United States Patent [19]

Barr, IV et al.

[11] **Patent Number: 4,641,086**

[45] **Date of Patent: Feb. 3, 1987**

[54] **VECTOR NETWORK ANALYZER WITH INTEGRAL PROCESSOR**

[75] Inventors: **John T. Barr, IV; Michael J. Neering; Douglas E. Fullmer; Roger P. Oblad, all of Santa Rosa; Wayne C. Cannon, Forestville; Glenn E. Elmore, Santa Rosa, all of Calif.**

[73] Assignee: **Hewlett-Packard Company, Palo Alto, Calif.**

[21] Appl. No.: **568,990**

[22] Filed: **Jan. 9, 1984**

[51] Int. Cl.[4] **G01R 23/16**

[52] U.S. Cl. ..... **324/77 R; 324/77 B; 364/485**

[58] Field of Search ..... 324/77 R, 77 B, 77 C, 324/77 CS, 76 R, 73 R, 73 AT, 57 R, 57 N, 57 SS, 57 H; 371/20; 364/481, 484, 485, 550, 551

[56] References Cited

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Theory and Application of Digital Signal Processing, by Lawrence R. Rabiner and Bernard Gold, pp. 393–398, 1975.

Automatic Network Analyzer 8542, Section IV Fundamentals, Hewlett-Packard Operating and Service Manual, Oct. 1969.

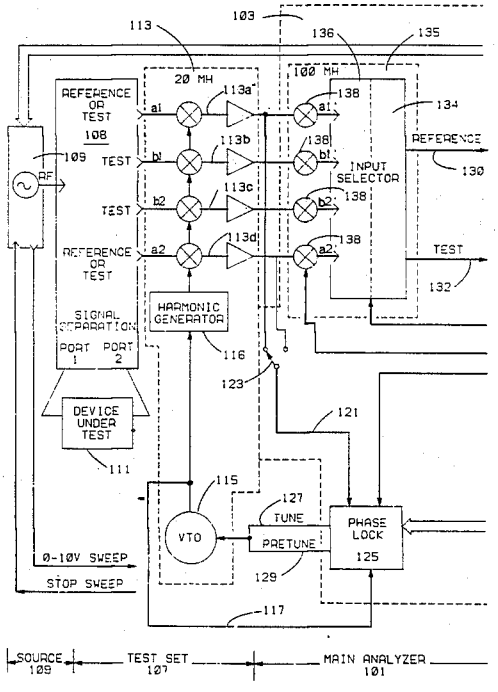
Primary Examiner—Michael J. Tokar

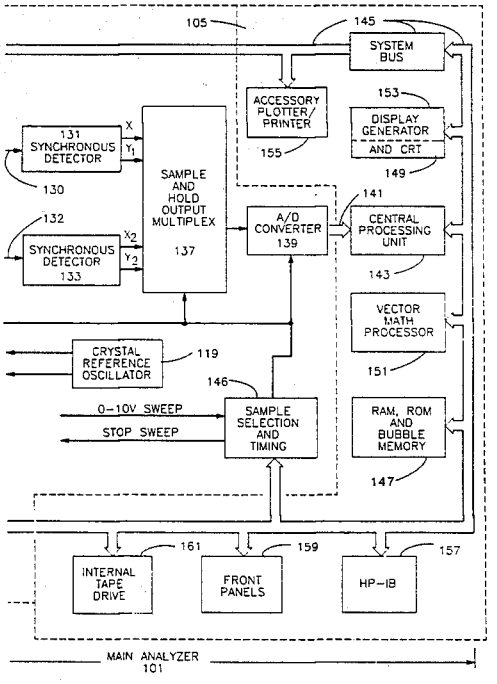
Attorney, Agent, or Firm—Jeffery B. Fromm; Joseph M. Smith

[57] ABSTRACT

A precision vector network analyzer which is suitable for a wide range of applications including both laboratory and automated production measurements and testing is disclosed. New measurement capabilities, greater ease of use, and nearly complete automation are provided. Contributions include fully corrdinated communications between subsystem modules; real time, two channel, precision vector measurements with complete, internal error correction; wide frequency capability from RF to millimeter bands; combined time and frequency domain analysis and display; measurements either in the swept or step frequency modes; and user definable test functions and calibration device sets.

4 Claims, 410 Drawing Figures





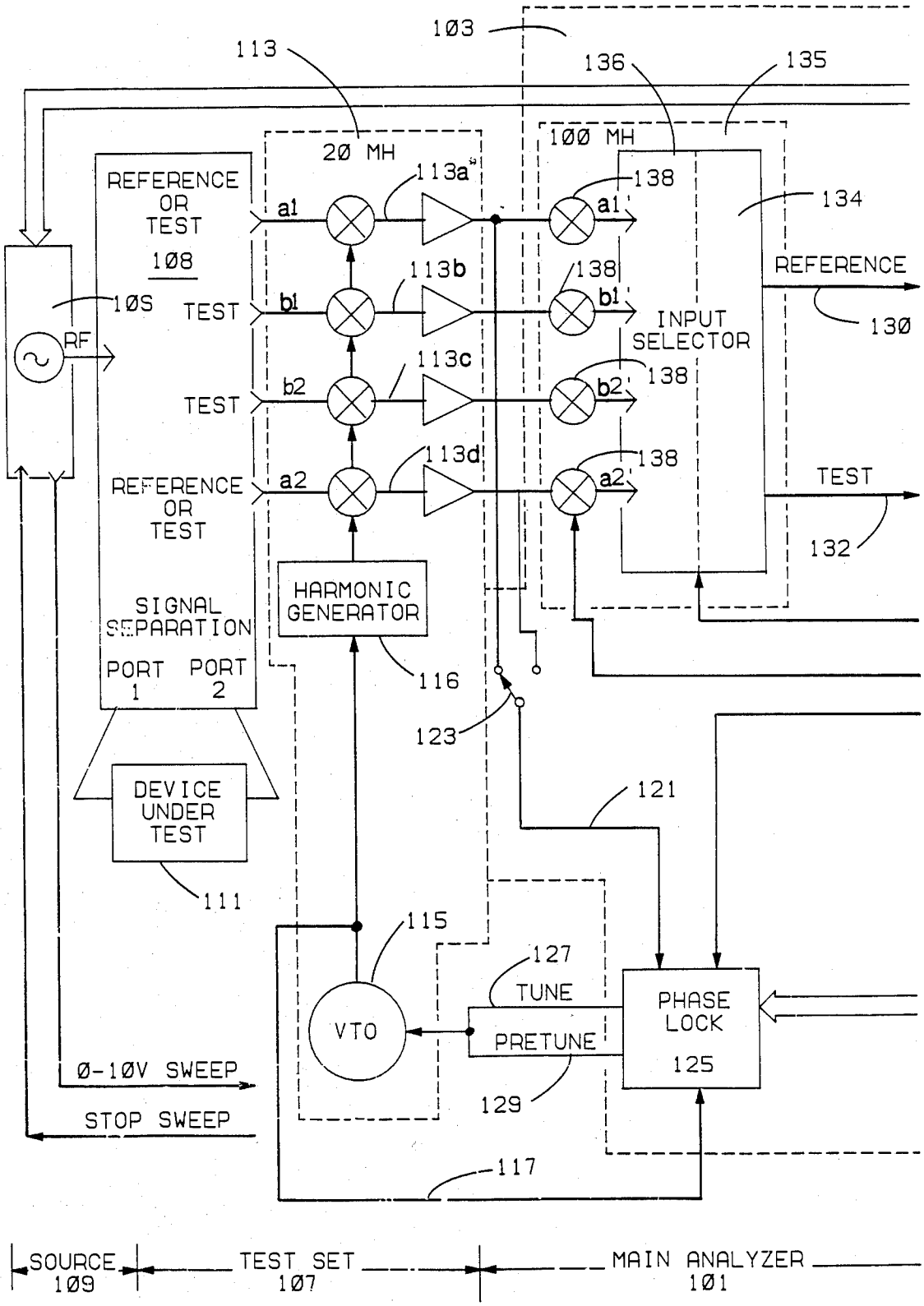

103
113
136
135
20 MH
100 MH
REFERENCE OR TEST
108
a1
113a
138
134
REFERENCE
130
105
TEST
b1
113b
INPUT SELECTOR
RF
TEST
b2
113c
REFERENCE OR TEST
a2
113d
TEST
132
HARMONIC GENERATOR
116
SIGNAL SEPARATION
PORT 1
PORT 2
123
121
DEVICE UNDER TEST
111
115
127
TUNE
VTO
PRETUNE
PHASE LOCK
125
129
0-10V SWEEP
STOP SWEEP
117
SOURCE 109
TEST SET 107
MAIN ANALYZER 101

FIG 1A

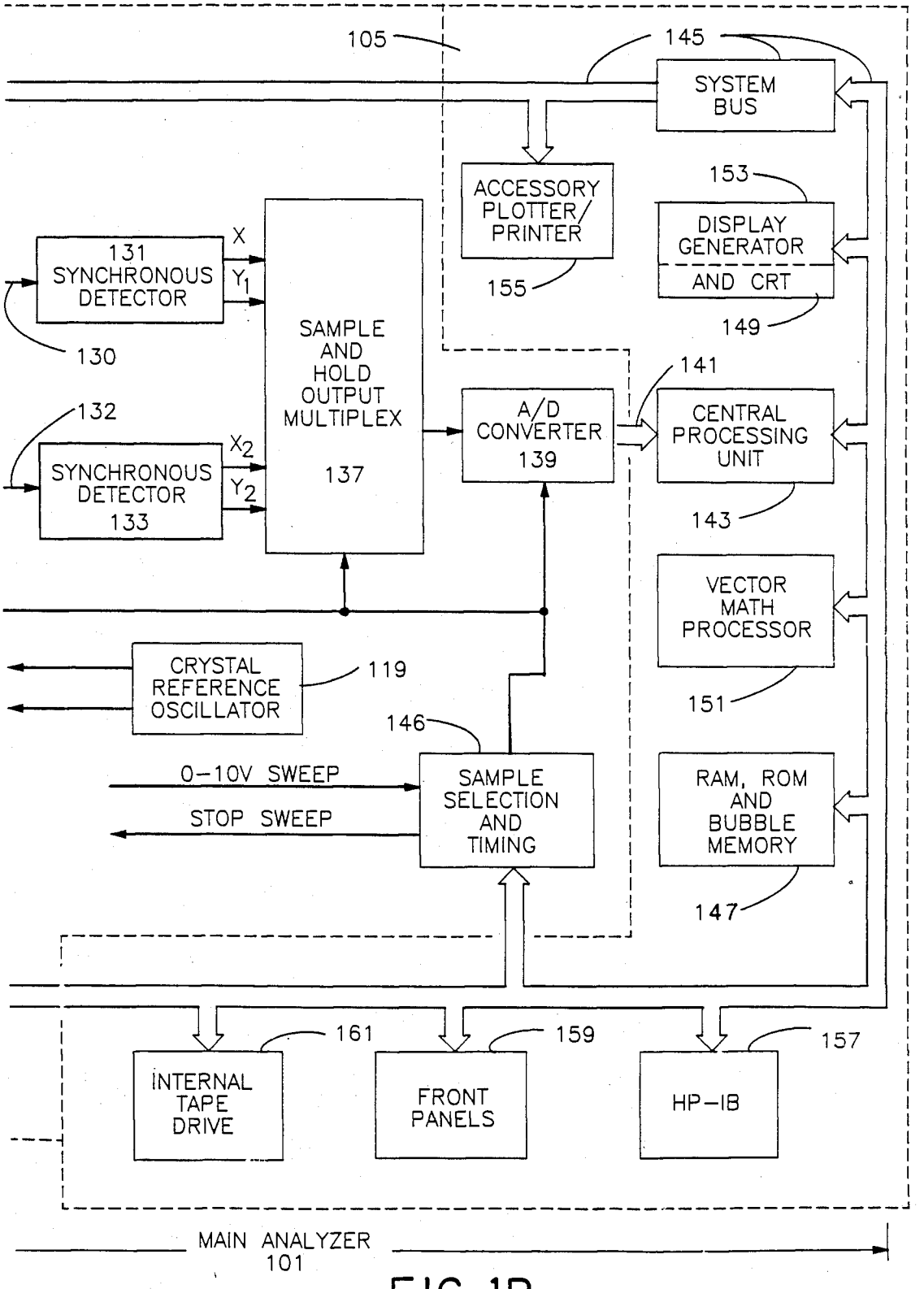

105
145
SYSTEM BUS
ACCESSORY PLOTTER/ PRINTER
155
153
DISPLAY GENERATOR AND CRT
149
131 SYNCHRONOUS DETECTOR
X
Y1
130
SAMPLE AND HOLD OUTPUT MULTIPLEX
137
132
SYNCHRONOUS DETECTOR 133
X2
Y2
A/D CONVERTER 139
141
CENTRAL PROCESSING UNIT
143
VECTOR MATH PROCESSOR
151
CRYSTAL REFERENCE OSCILLATOR
119
146
0–10V SWEEP
STOP SWEEP
SAMPLE SELECTION AND TIMING
RAM, ROM AND BUBBLE MEMORY
147
161
159
157
INTERNAL TAPE DRIVE
FRONT PANELS
HP–IB
MAIN ANALYZER 101

FIG 1B

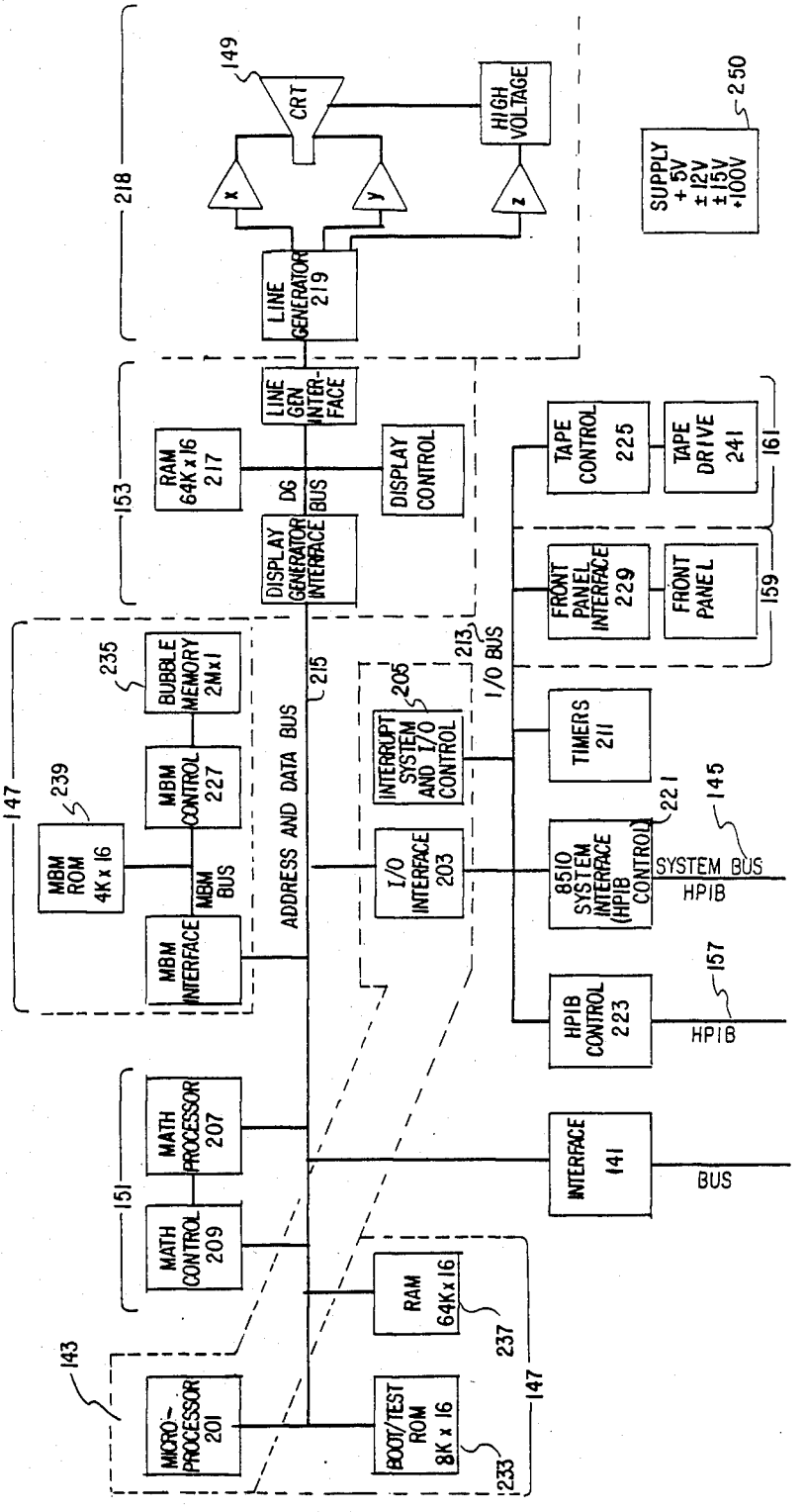

149
CRT
HIGH VOLTAGE
SUPPLY +5V ±12V ±15V +100V
250
218
x
y
z
LINE GENERATOR 219
LINE GEN INTER-FACE
RAM 64K x 16 217
DISPLAY CONTROL
153
DG BUS
DISPLAY GENERATOR INTERFACE
TAPE CONTROL 225
TAPE DRIVE 241
161
FRONT PANEL INTERFACE 229
FRONT PANEL
159
213
I/O BUS
235
BUBBLE MEMORY 2M x 1
215
ADDRESS AND DATA BUS
205
INTERRUPT SYSTEM AND I/O CONTROL
TIMERS 211
147
239
MBM ROM 4K x 16
MBM CONTROL 227
MBM BUS
MBM INTERFACE
I/O INTERFACE 203
8510 SYSTEM INTERFACE (HPIB CONTROL)
221
145
SYSTEM BUS
HPIB
157
HPIB CONTROL 223
HPIB
MATH PROCESSOR 207
151
MATH CONTROL 209
INTERFACE 141
BUS
143
MICRO-PROCESSOR 201
RAM 64K x 16
237
BOOT/TEST ROM 8K x 16
233
147

FIG 2

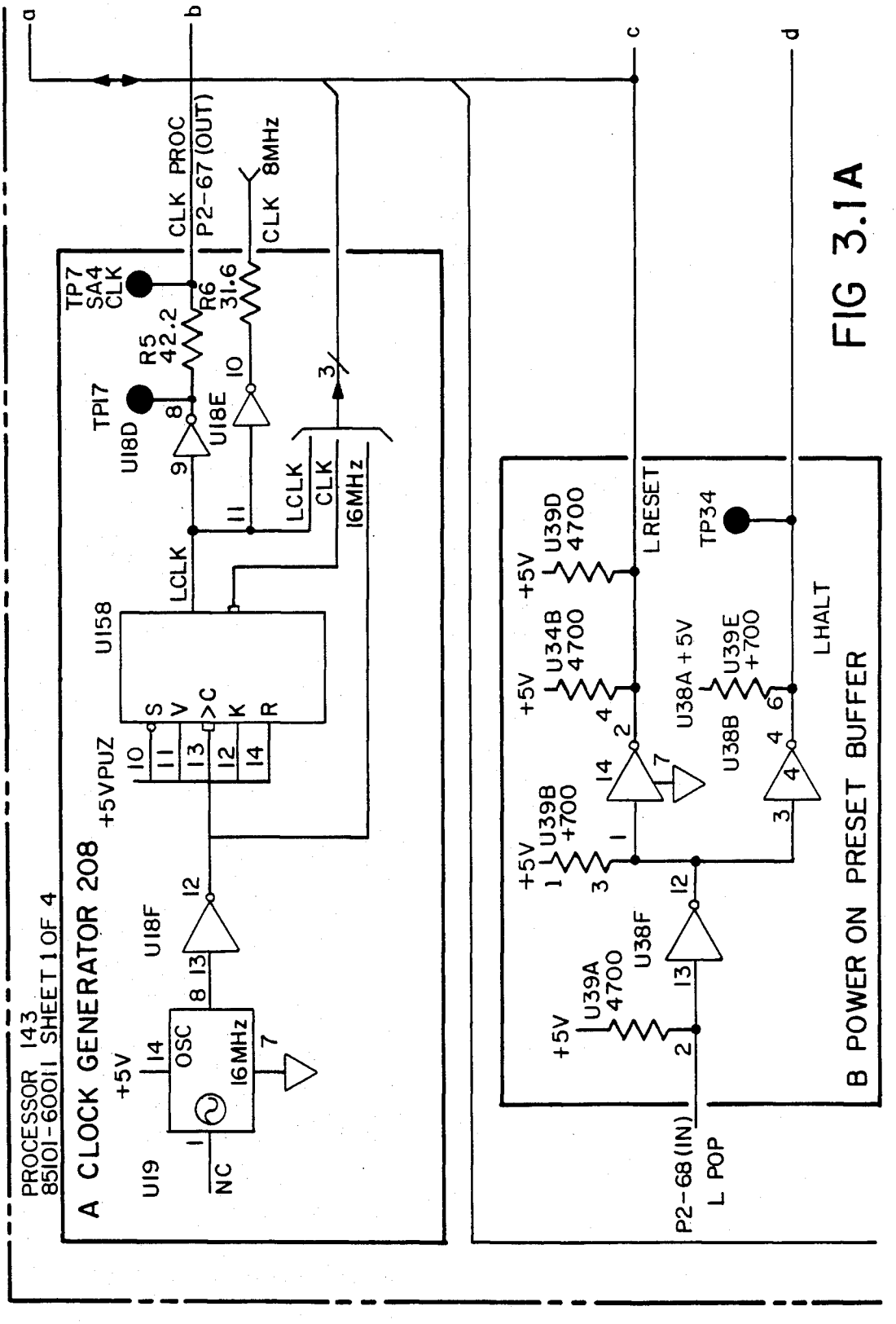

PROCESSOR 143
85101-60011 SHEET 1 OF 4
A CLOCK GENERATOR 208
B POWER ON PRESET BUFFER
U19
U158
U18D
U18E
U18F
U38B
U38F
U39A 4700
U39B +700
U34B 4700
U39D 4700
U39E +700
+5V
+5VPUZ
OSC
16MHz
NC
CLK PROC
P2-67 (OUT)
CLK 8MHz
TP7 SA4 CLK
TP17
TP34
R5 42.2
R6 31.6
LCLK
CLK
LRESET
LHALT
P2-68 (IN)
L POP

FIG 3.1A

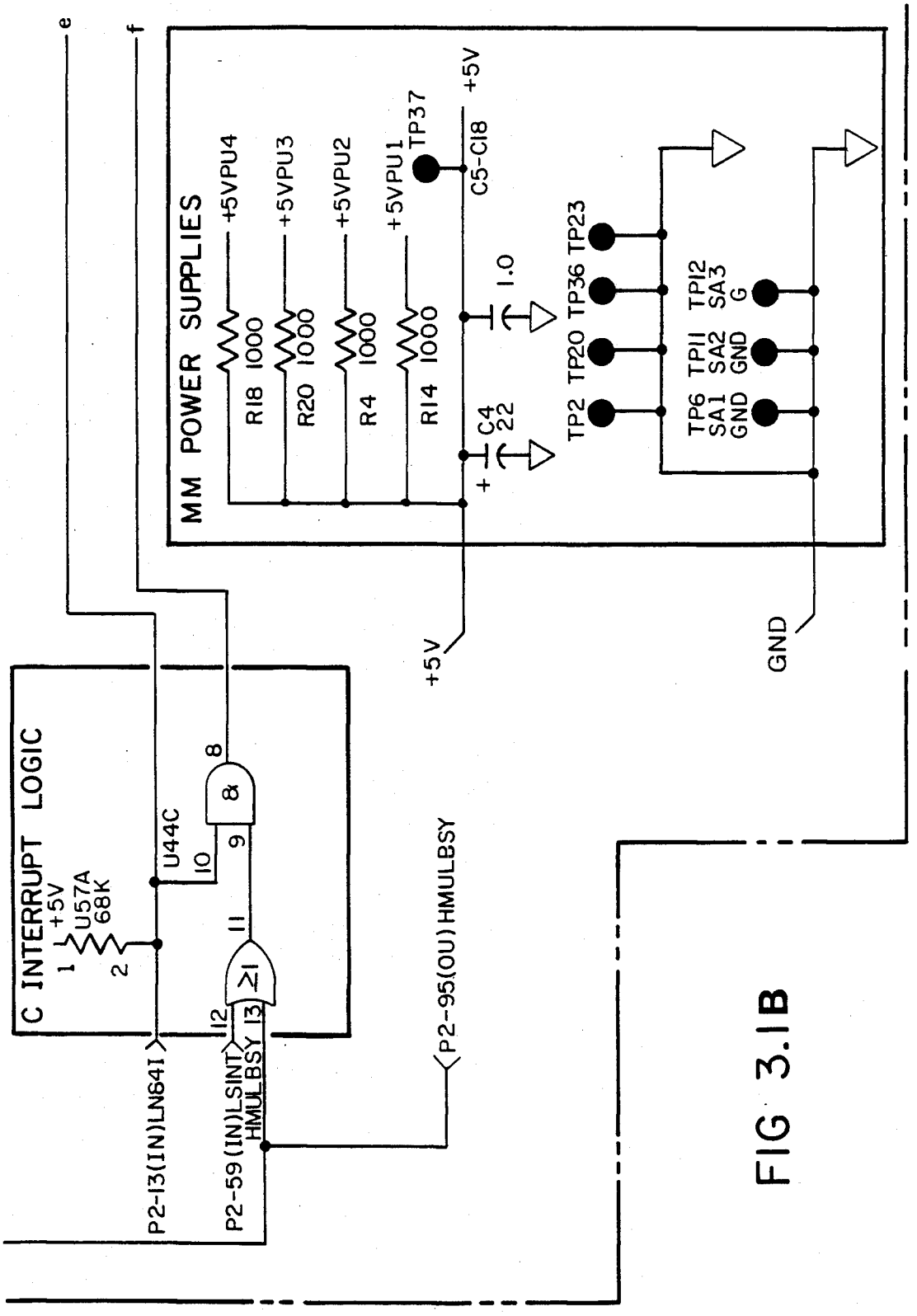

C INTERRUPT LOGIC
+5V
U57A
68K
1
2
U44C
10
8
9
11
12
13
≥1
P2-13(IN)LN641
P2-59(IN)LSINT
HMULBSY
P2-95(OU)HMULBSY
MM POWER SUPPLIES
+5VPU4
+5VPU3
+5VPU2
+5VPU1
TP37
+5V
R18 1000
R20 1000
R4 1000
R14 1000
C5-C18
1.0
C4
22
+
TP2 TP20 TP36 TP23
TP6 TP11 TP12
SA1 SA2 SA3
GND GND G
+5V
GND
e
f

FIG 3.1B

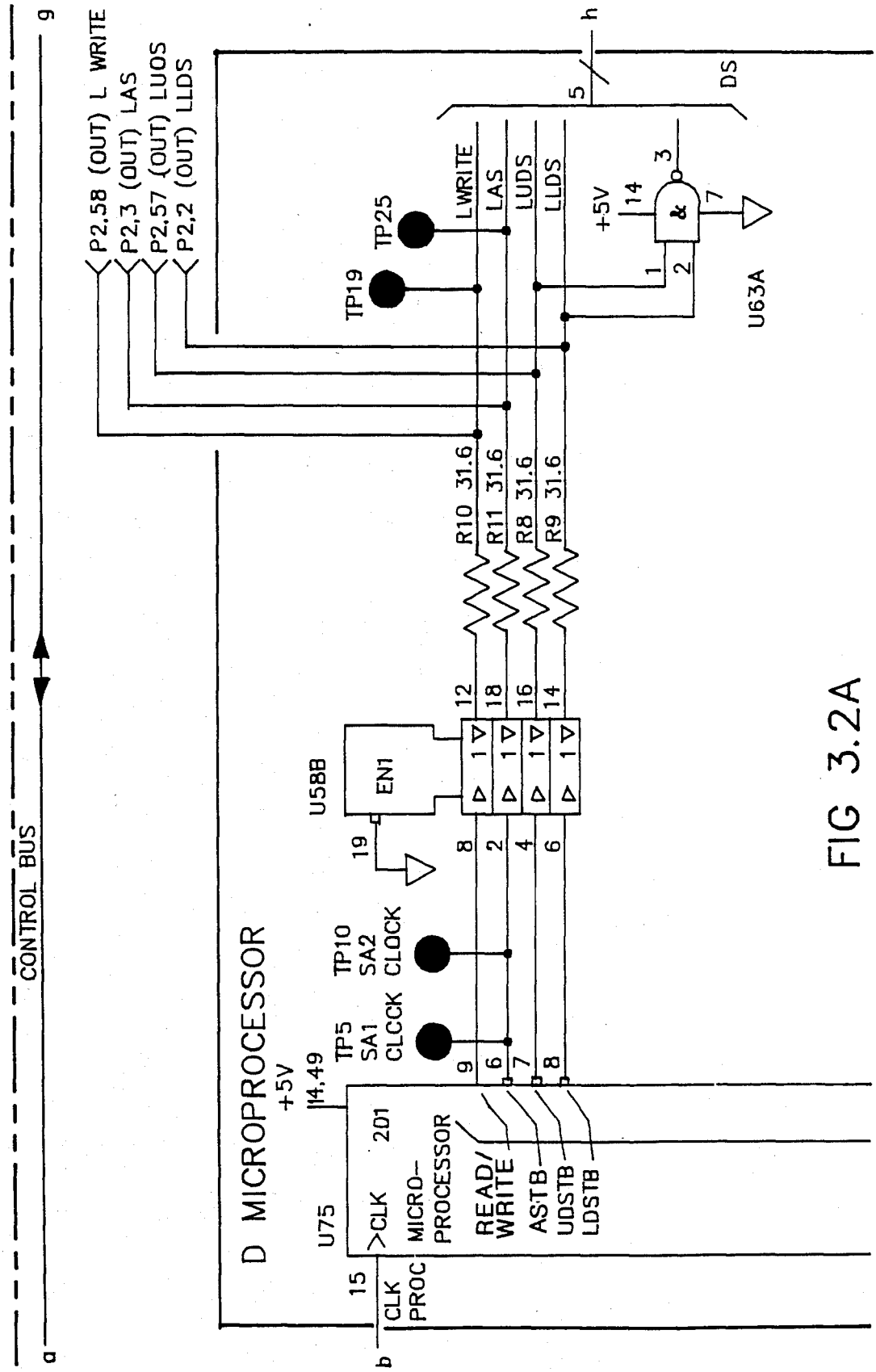

CONTROL BUS
g
a
P2,58 (OUT) L WRITE
P2,3 (OUT) LAS
P2,57 (OUT) LUOS
P2,2 (OUT) LLDS
h
5
DS
TP25
TP19
LWRITE
LAS
LUDS
LLDS
+5V
14
3
&
1
2
7
U63A
R10 31.6
R11 31.6
R8 31.6
R9 31.6
12
18
16
14
U58B
EN1
19
8
2
4
6
TP10
SA2
CLOCK
TP5
SA1
CLCCK
9
6
7
8
+5V
14,49
D MICROPROCESSOR
U75
201
>CLK
MICRO-
PROCESSOR
15
CLK
PROC
b
READ/
WRITE
ASTB
UDSTB
LDSTB

FIG 3.2A

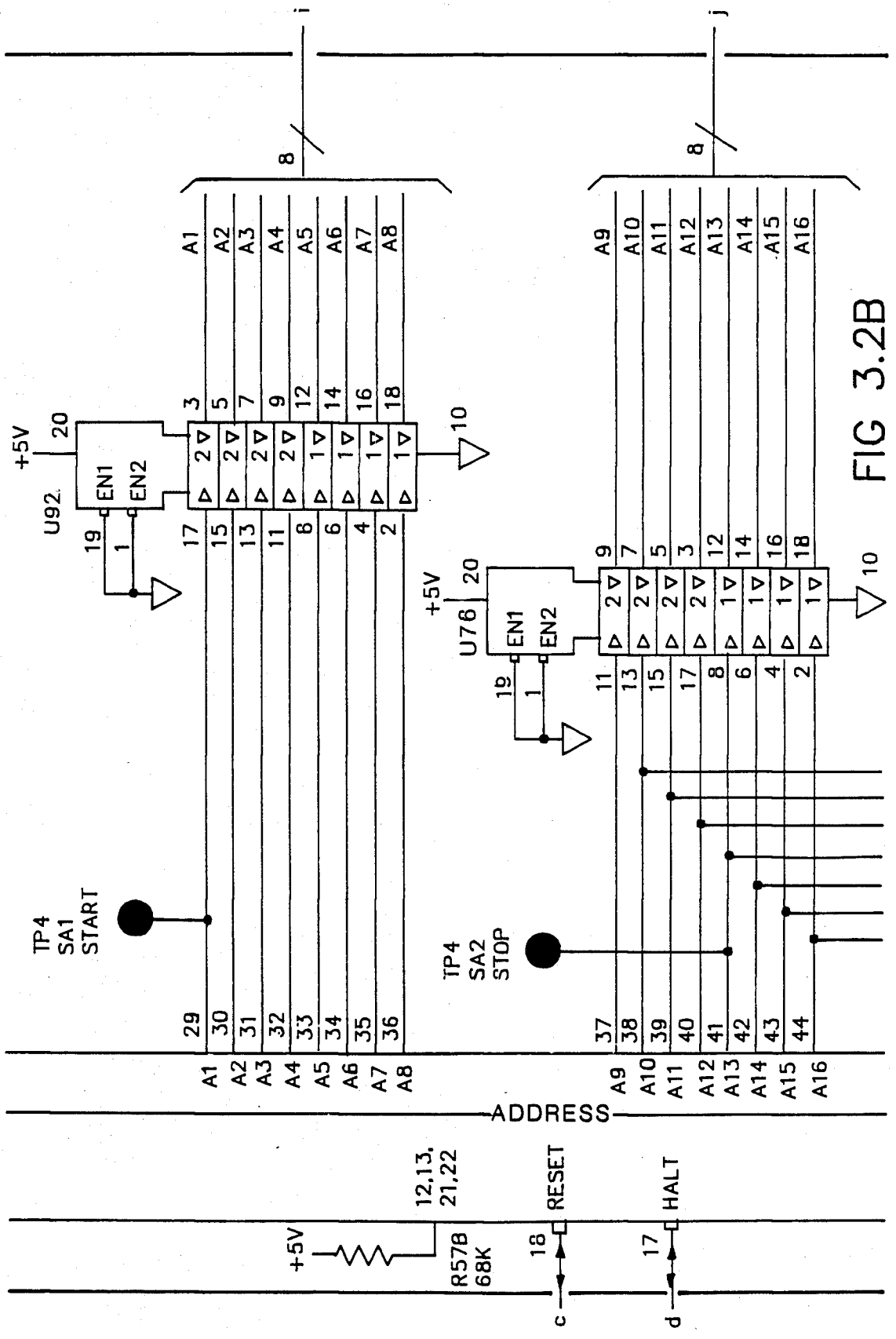

i
j
8
8
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
+5V
20
U92
EN1
EN2
19
1
3
5
7
9
12
14
16
18
17
15
13
11
8
6
4
2
10
+5V
20
U76
EN1
EN2
19
1
9
7
5
3
12
14
16
18
11
13
15
17
8
6
4
2
10
TP4
SA1
START
TP4
SA2
STOP
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
ADDRESS
12,13,
21,22
+5V
R578
68K
RESET
18
HALT
17
c
d

FIG 3.2B

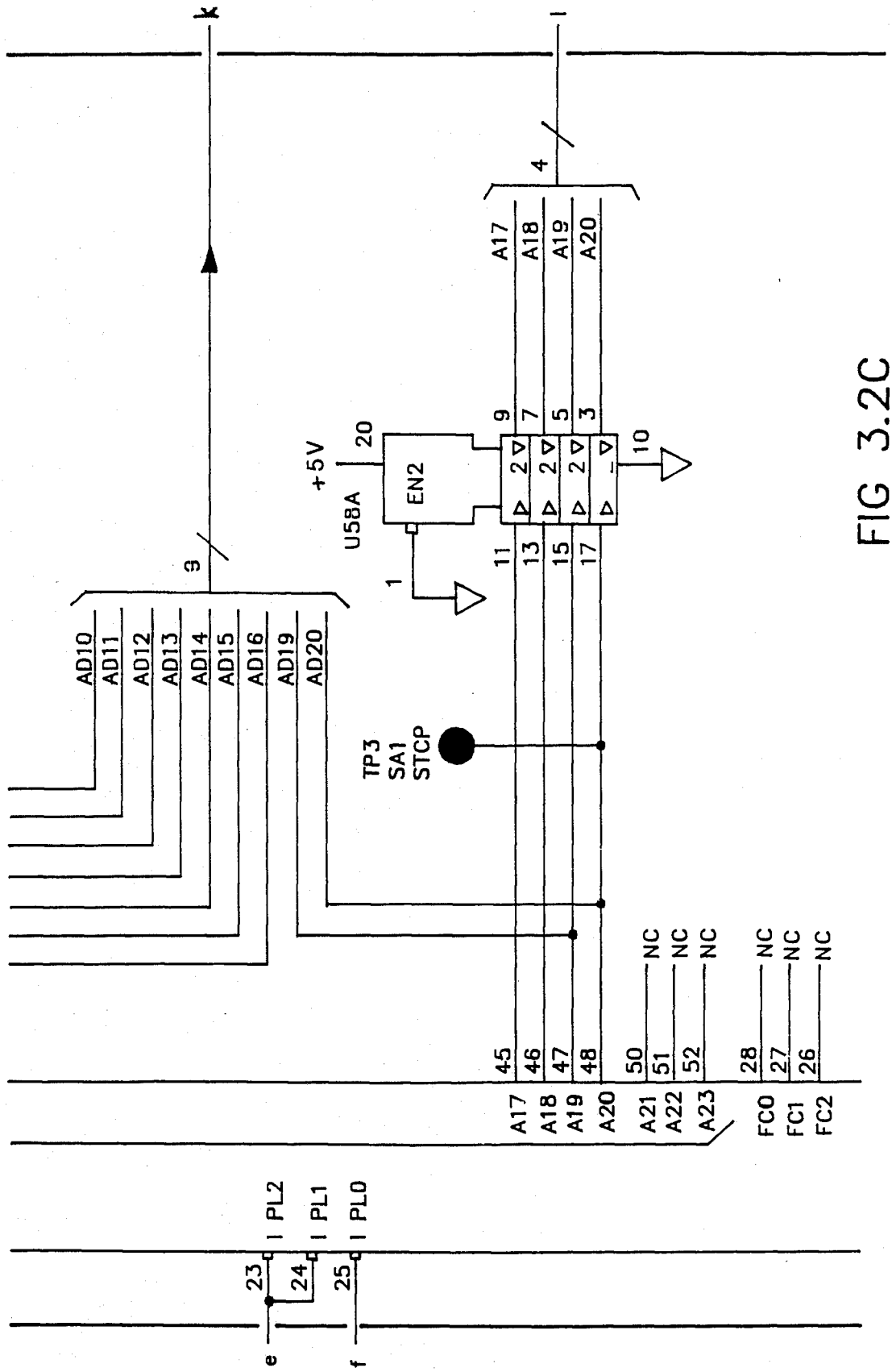

k
l
3
4
AD10
AD11
AD12
AD13
AD14
AD15
AD16
AD19
AD20
A17
A18
A19
A20
+5V
20
U58A
EN2
1
9
7
5
3
10
11
13
15
17
TP3
SA1
STCP
45
46
47
48
50
51
52
28
27
26
NC
A17
A18
A19
A20
A21
A22
A23
FC0
FC1
FC2
PL2
PL1
PL0
23
24
25
e
f

FIG 3.2C

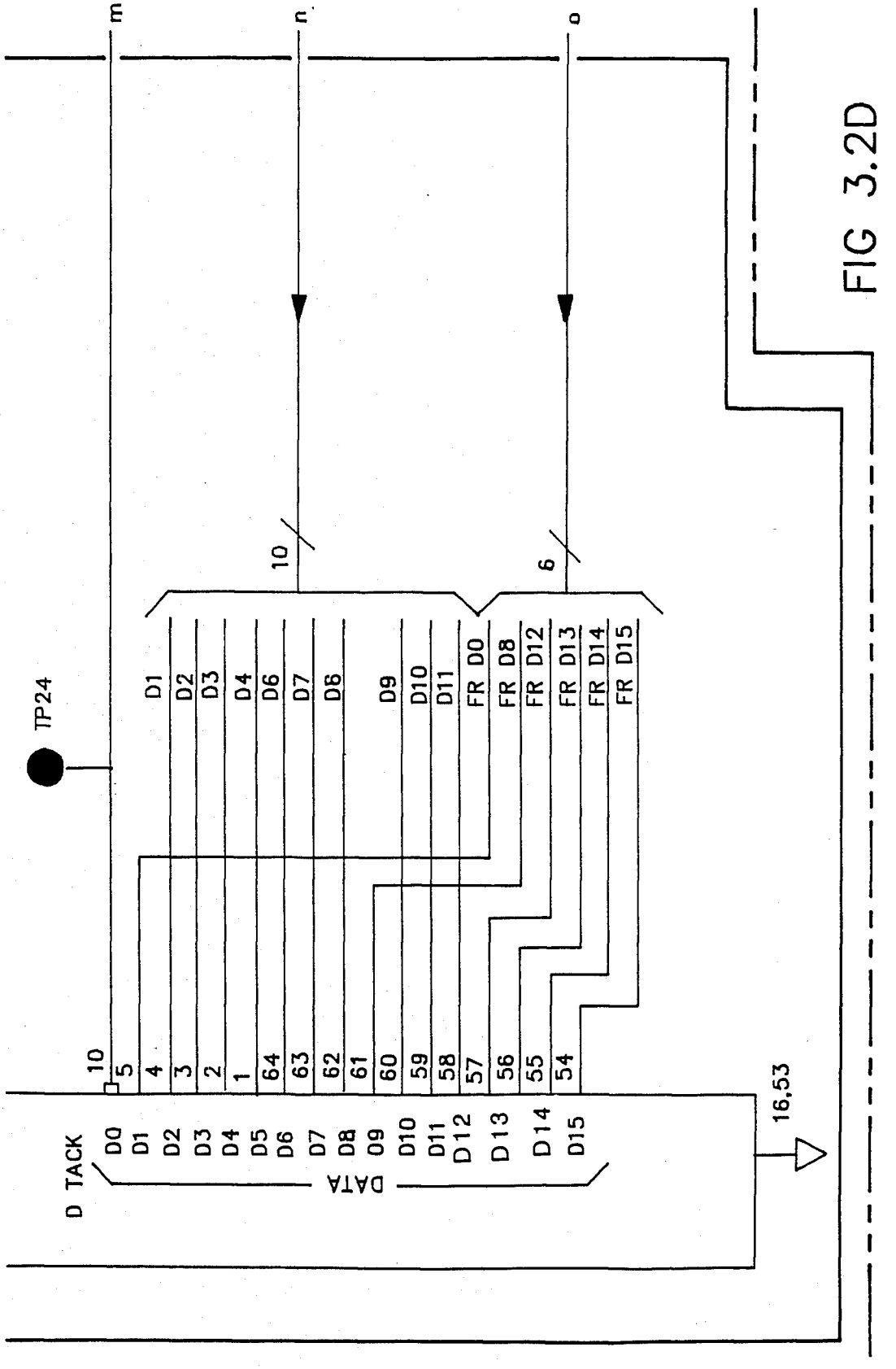

m
n
o
10
6
TP24
D1
D2
D3
D4
D6
D7
D8
D9
D10
D11
FR D0
FR D8
FR D12
FR D13
FR D14
FR D15
10
5
4
3
2
1
64
63
62
61
60
59
58
57
56
55
54
16,53
D TACK
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
DATA

FIG 3.2D

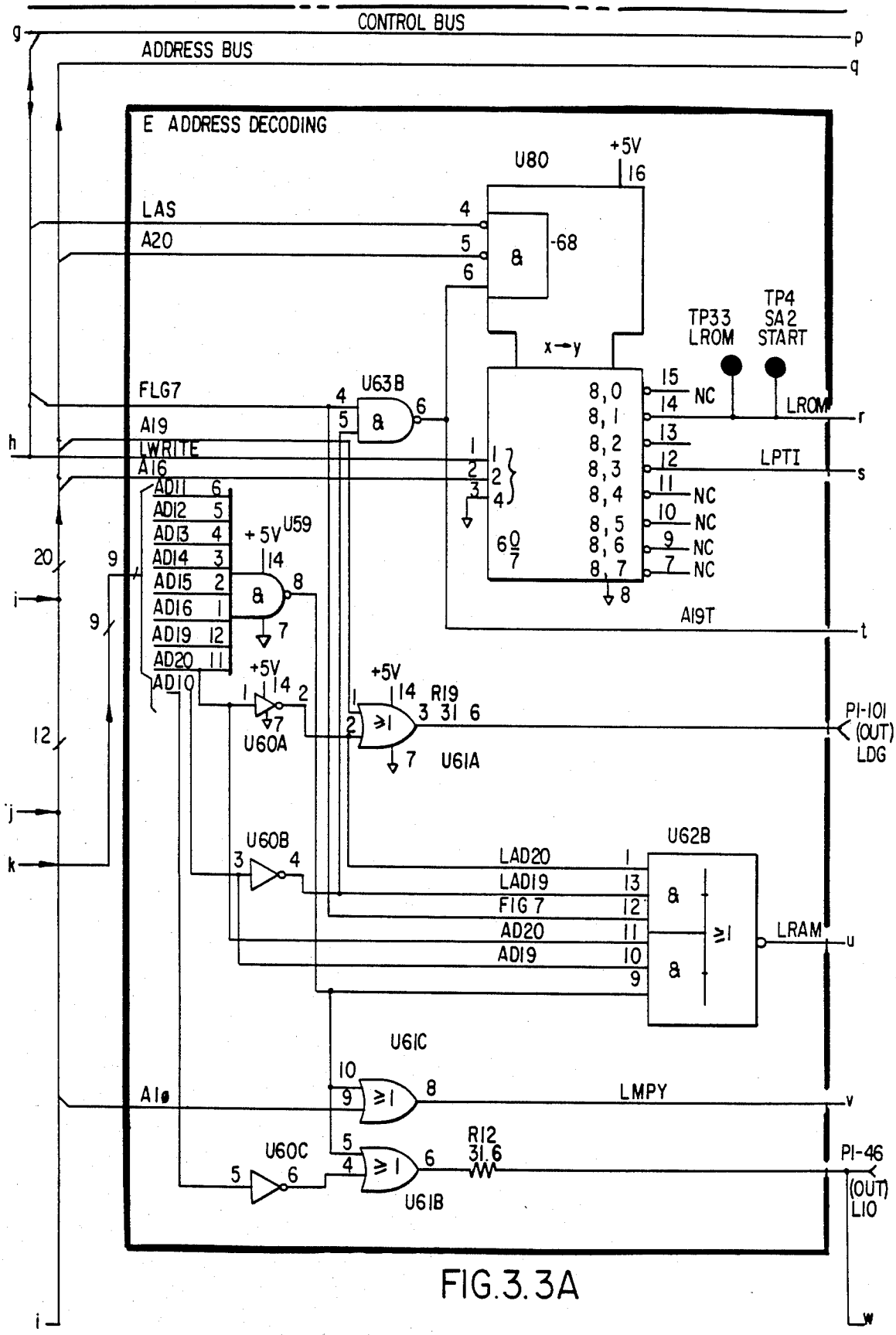

CONTROL BUS
ADDRESS BUS
E ADDRESS DECODING
U80
+5V
16
LAS
A20
4
5
6
&
-68
x→y
TP33
LROM
TP4
SA2
START
FLG7
A19
LWRITE
A16
U63B
8,0
8,1
8,2
8,3
8,4
8,5
8,6
8,7
15
14
13
12
11
10
9
7
NC
LROM
LPTI
AD11
AD12
AD13
AD14
AD15
AD16
AD19
AD20
AD10
U59
+5V
A19T
U60A
U61A
R19
PI-101
(OUT)
LDG
U60B
U62B
LAD20
LAD19
FIG 7
AD20
AD19
≥1
LRAM
U61C
A10
LMPY
U60C
R12
31.6
PI-46
(OUT)
LIO
U61B
20
12
9
h
i
j
k
r
s
t
u
v
w

FIG.3.3A

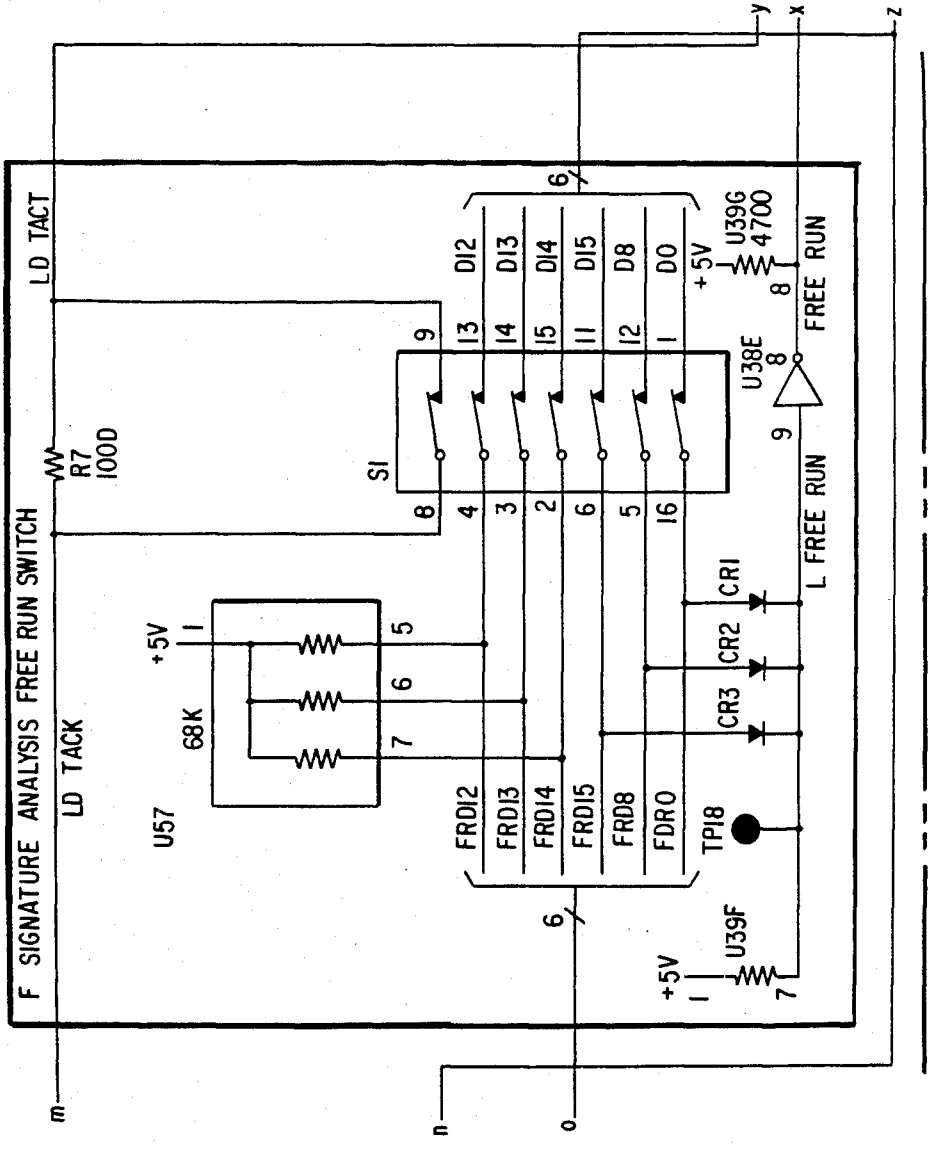

F SIGNATURE ANALYSIS FREE RUN SWITCH
LD TACT
LD TACK
R7
100D
S1
U57
68K
+5V
U39G
470Ω
U38E
FREE RUN
L FREE RUN
CR1
CR2
CR3
TP18
U39F
DI2
DI3
DI4
DI5
D8
D0
FRDI2
FRDI3
FRDI4
FRDI5
FRD8
FDR0
x
y
z
m
n
o

FIG. 33B

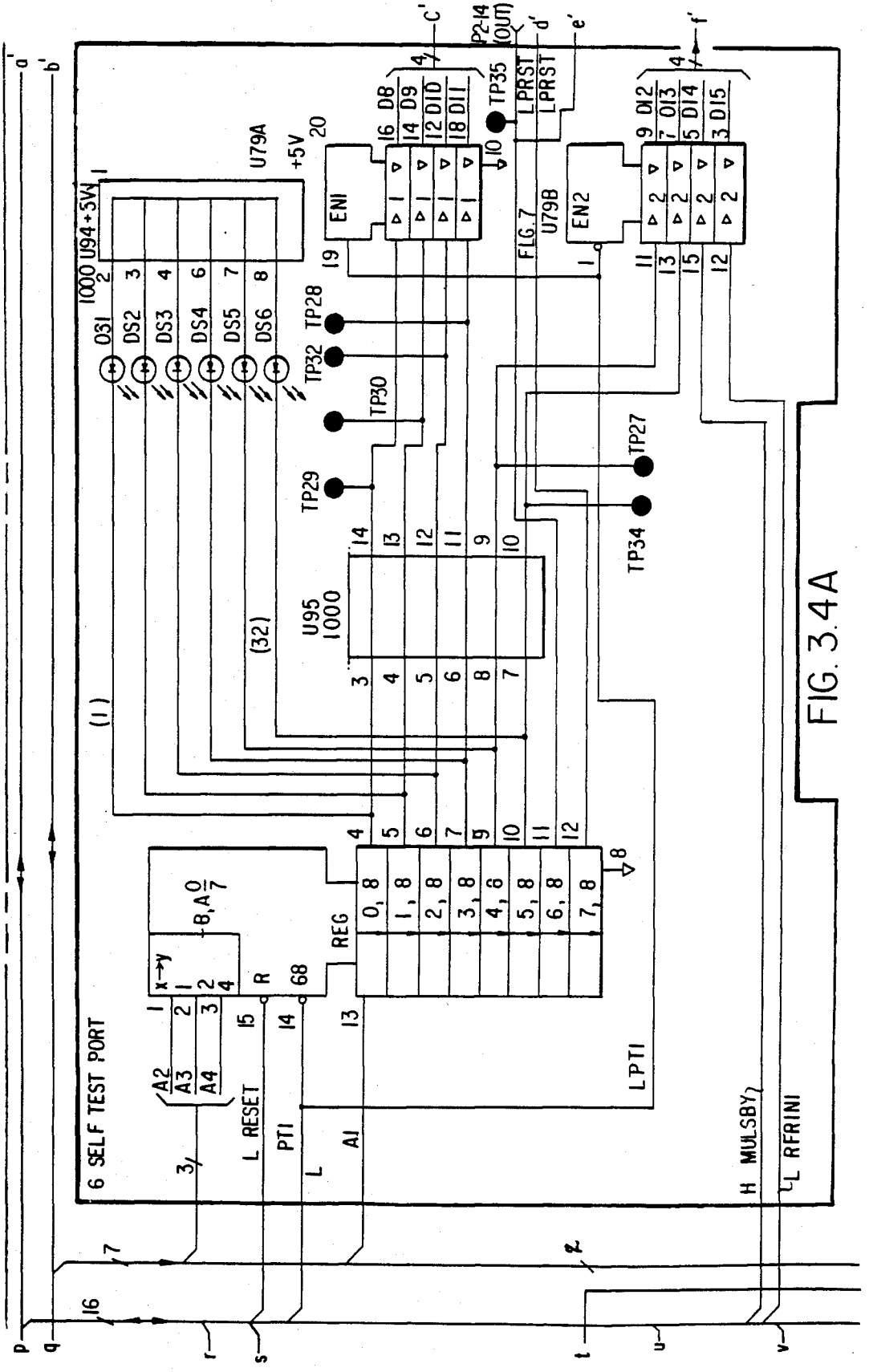

6 SELF TEST PORT
L RESET
PTI
L
AI
LPTI
H MULSBY
L RFRINI
U79A
U79B
ENI
EN2
U94 +5V
U95
1000
REG
TP28
TP32
TP30
TP29
TP27
TP34
TP35
LPRST
P2-14 (OUT)
DS1
DS2
DS3
DS4
DS5
DS6
FIG. 7

FIG. 3.4A

FIG. 3.4B

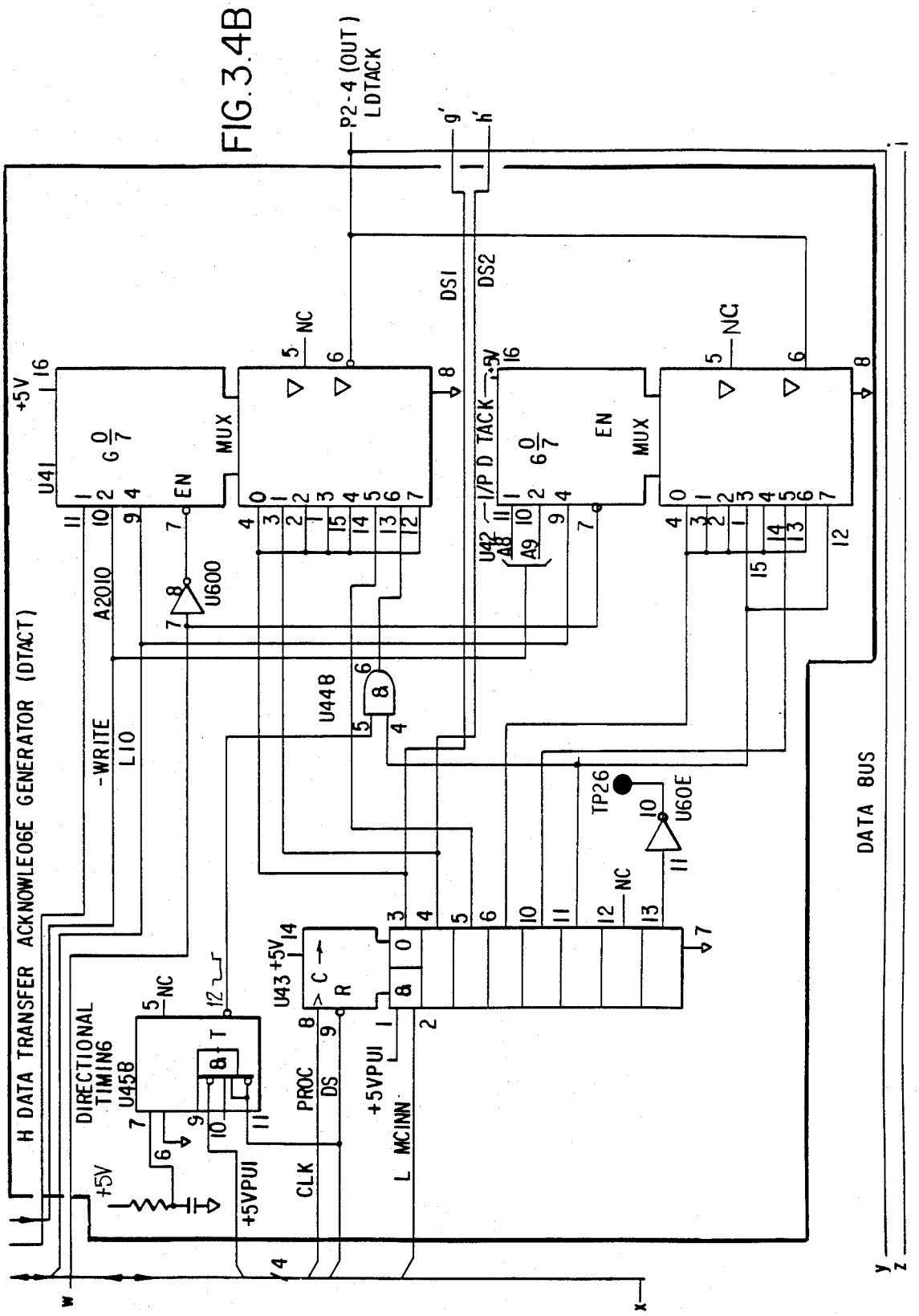
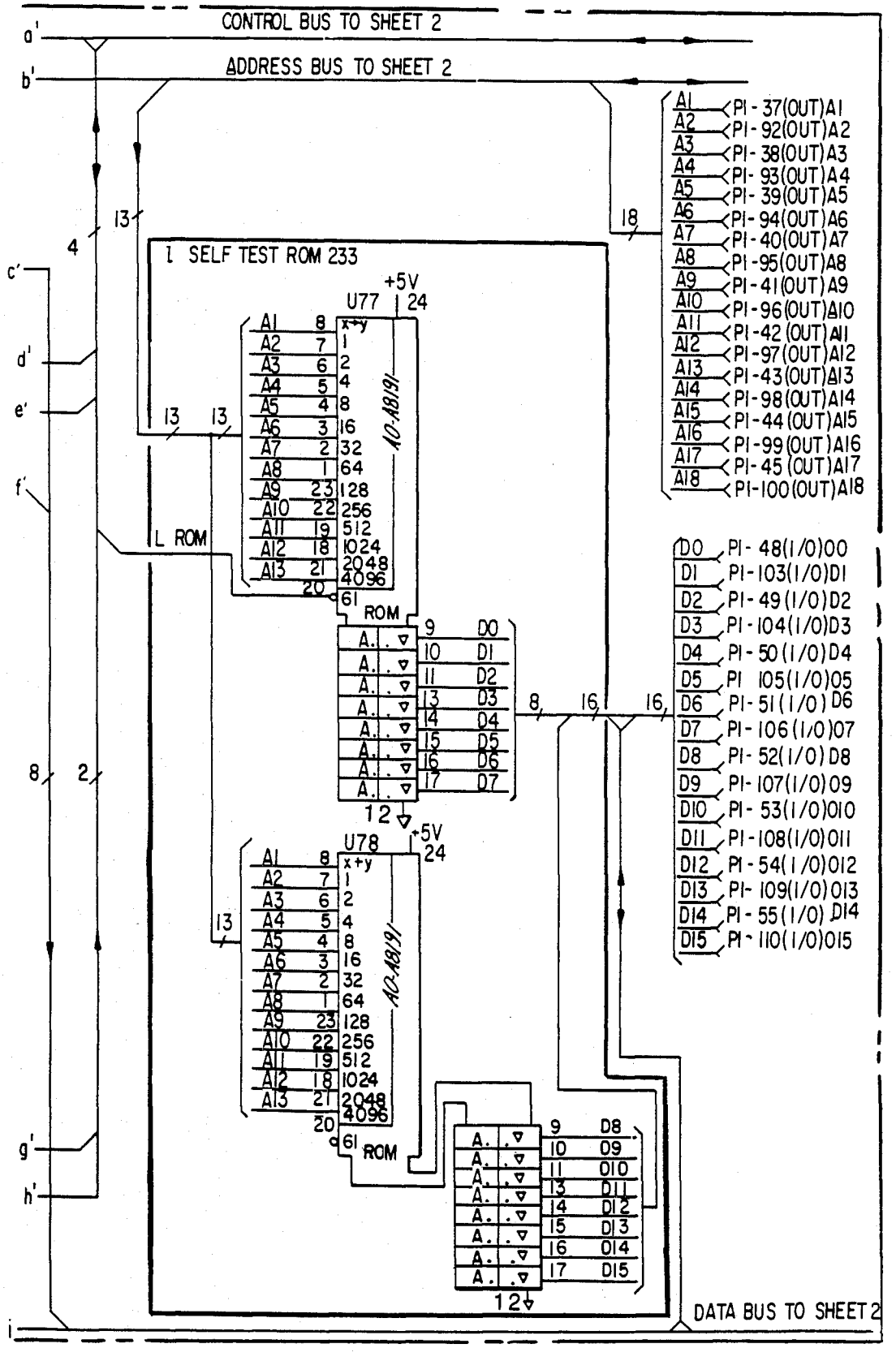

H DATA TRANSFER ACKNOWLEDGE GENERATOR (DTACT)
DIRECTIONAL TIMING
U45B
U41
U42
U43
U44B
U60E
U600
MUX
EN
NC
+5V
+5VPUI
CLK
PROC
DS
L MCINN
-WRITE
L10
A2010
I/P D TACK
P2-4 (OUT) LDTACK
DS1
DS2
TP26
DATA BUS

FIG. 3.5


CONTROL BUS TO SHEET 2
ADDRESS BUS TO SHEET 2
1 SELF TEST ROM 233
L ROM
U77
U78
+5V
ROM
A0-A8/9/1
DATA BUS TO SHEET 2
PI-37(OUT)A1
PI-92(OUT)A2
PI-38(OUT)A3
PI-93(OUT)A4
PI-39(OUT)A5
PI-94(OUT)A6
PI-40(OUT)A7
PI-95(OUT)A8
PI-41(OUT)A9
PI-96(OUT)A10
PI-42(OUT)A11
PI-97(OUT)A12
PI-43(OUT)A13
PI-98(OUT)A14
PI-44(OUT)A15
PI-99(OUT)A16
PI-45(OUT)A17
PI-100(OUT)A18
PI-48(I/O)D0
PI-103(I/O)D1
PI-49(I/O)D2
PI-104(I/O)D3
PI-50(I/O)D4
PI-105(I/O)D5
PI-51(I/O)D6
PI-106(I/O)D7
PI-52(I/O)D8
PI-107(I/O)D9
PI-53(I/O)D10
PI-108(I/O)D11
PI-54(I/O)D12
PI-109(I/O)D13
PI-55(I/O)D14
PI-110(I/O)D15

UNLESS OTHERWISE INDICATED,:
RESISTANCE VALUES SHOWN ARE IN OHMS,
CAPACITANCE IN MICROFARADS,
AND INDUCTANCE IN MICROHENRIES.
SIGNALS ENTER AT LEFT SIDE AND EXIT AT
RIGHT SIDE OF FUNCITON BLOCKS.

ROMS SUPPLIED IN MATCHED SETS
U10,12,13, REPLACED AS A SET.
U77 AND U78 REPLACED AS A SET

ACTIVE COMPONENTS APRTS LISTS (U's and Q's)

REFERENCE DESIGNATORS	PART NUMBER	MANUFACTURER'S PART NUMBER
U1-8,20-27	1818-3005	RAM 64KX1
U9	1820-2076	I 3242
U10 NOTE 3	85010-80001	PROM 512X8
U11,31,32	1820-1858	74LS377
U12 NOTE 3	85101-80002	PROM 512X8
U12 NOTE 3	85101-80003	PROM 512X8
U14,33	1820-1432	74LS163
U15,49	1820-0629	74S112
U16,29,30,80	1820-1216	74LS138
U17,18,48	1820-0683	74S04
U19	1813-0130	16 MHz OSC
U28,52,61	1820-1449	74S32
U34	1820-0681	74S00
U35	1820-1440	74LS279
U36	1820-0648	74S20
U37	1820-1191	74S175
U38	1820-1200	74LS05
U39	1810-0205	RES 4.7K OHM
U40	NOT USED	
U41,42	1820-1298	74LS251
U43	1820-1433	74LS164
U44	1820-1201	74LS08
U45	1820-1423	74LS123
U46	NOT USED	
U47,54,55,96	1820-1367	74S08
U50,63	1820-1197	74LS00
U51	1820-1322	74LS02
U53,56,74,97	1820-0998	74S153
U57	1810-0208	RES 68K OHM
U58,75,79,92	1820-2024	74LS244
U59	1820-1207	74LS30
U60	1820-1199	74LS04
U52	1820-1210	74LS51
U64,81	1820-2075	74LS245
U65-68,82-85	1820-2120	25LS14
U69-72,86084	1820-2906	25LS299
U73,90	1820-3217	74ALS569
U75	1820-2505	63000
U77 NOTE 3	55101-80004	PROM 8KX 8
U78	35101-80005	PROM 8KX 8
U91	1820-2220	74LS385
U93	1820-1729	74LS259
U94	1810-0204	RES 1K ohm
U95	1810-0037	RES 1K ohm
U98	1820-0694	74S86

FIG 3.6

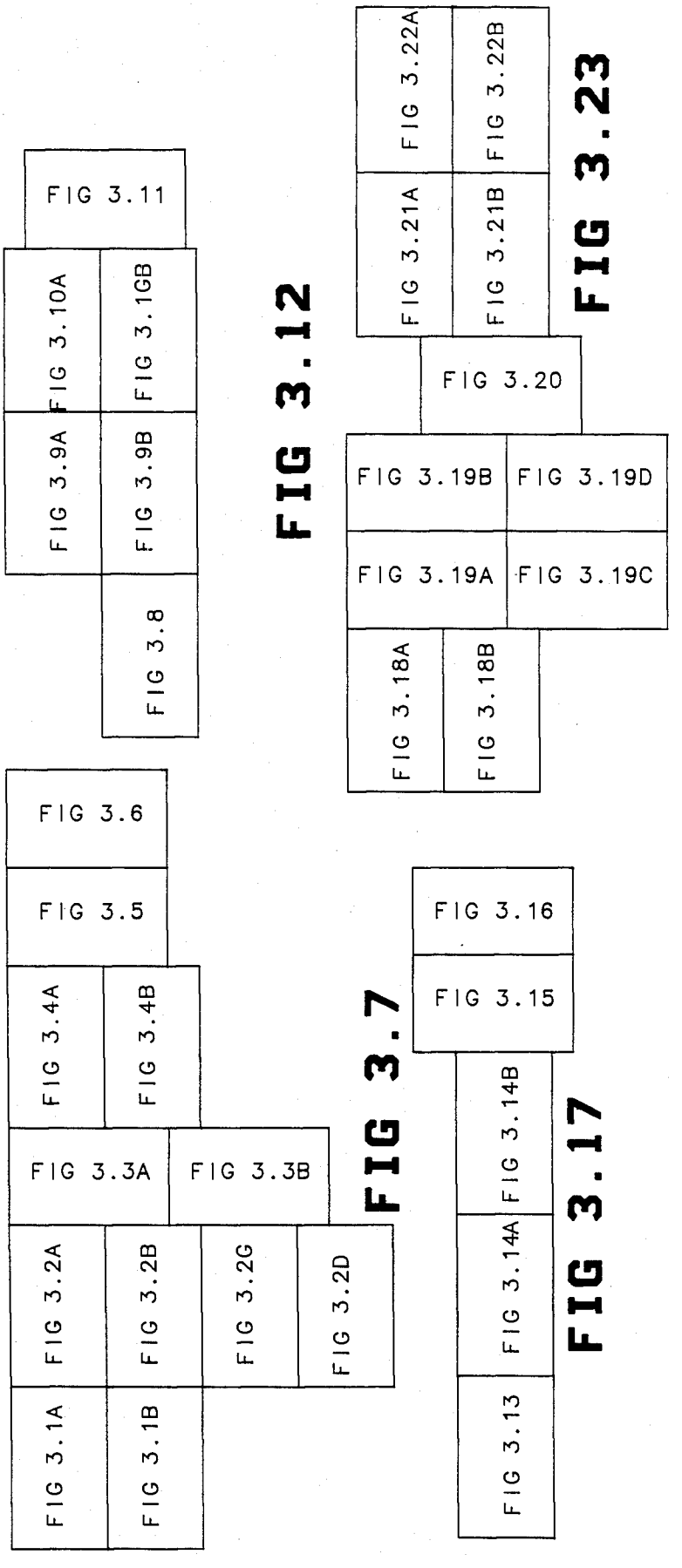


FIG 3.11
FIG 3.10A
FIG 3.1GB
FIG 3.9A
FIG 3.9B
FIG 3.8
FIG 3.12
FIG 3.22A
FIG 3.22B
FIG 3.21A
FIG 3.21B
FIG 3.20
FIG 3.19B
FIG 3.19D
FIG 3.19A
FIG 3.19C
FIG 3.18A
FIG 3.18B
FIG 3.23
FIG 3.6
FIG 3.5
FIG 3.4A
FIG 3.4B
FIG 3.3A
FIG 3.3B
FIG 3.2A
FIG 3.2B
FIG 3.2G
FIG 3.2D
FIG 3.1A
FIG 3.1B
FIG 3.7
FIG 3.16
FIG 3.15
FIG 3.14B
FIG 3.14A
FIG 3.13
FIG 3.17

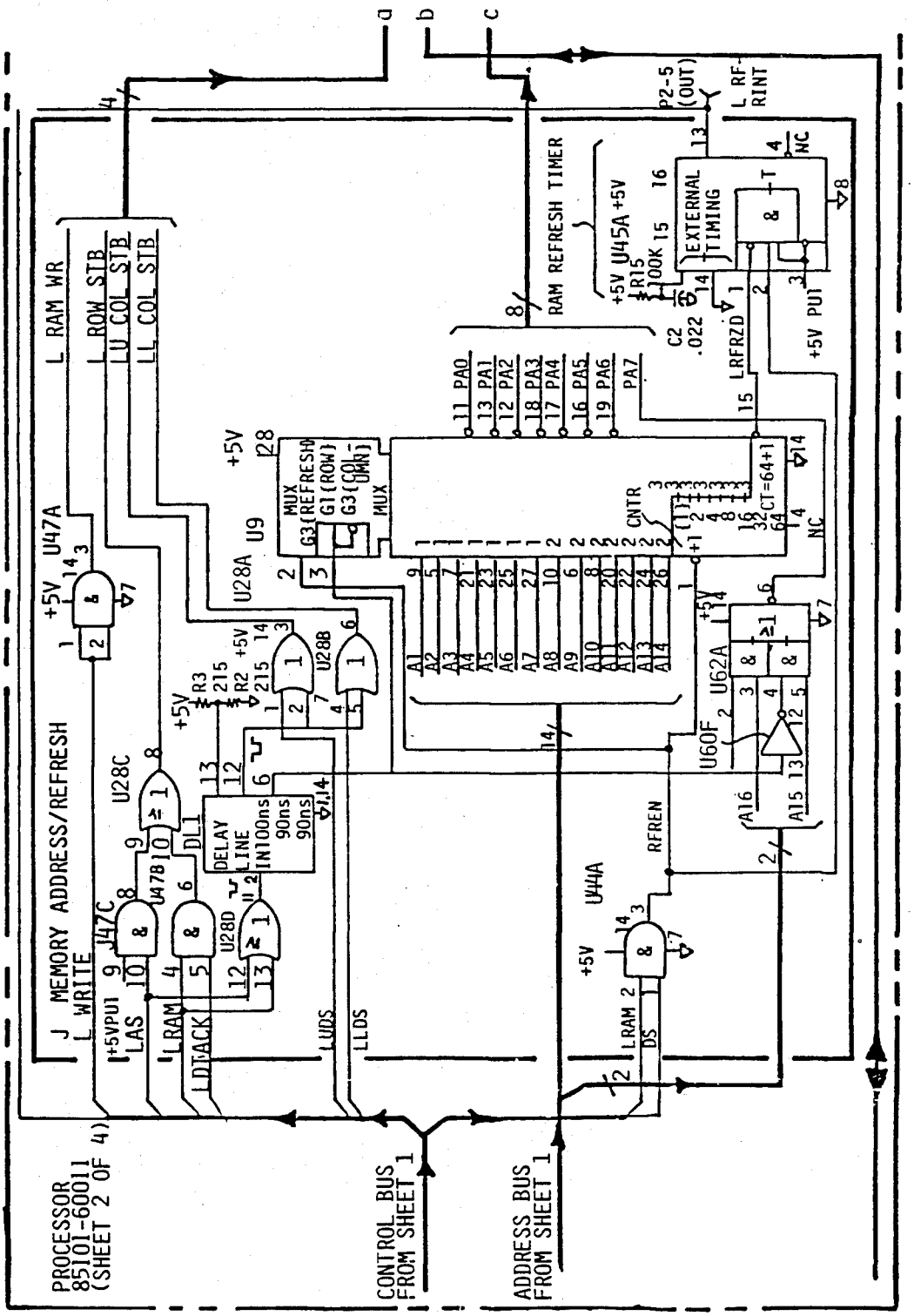
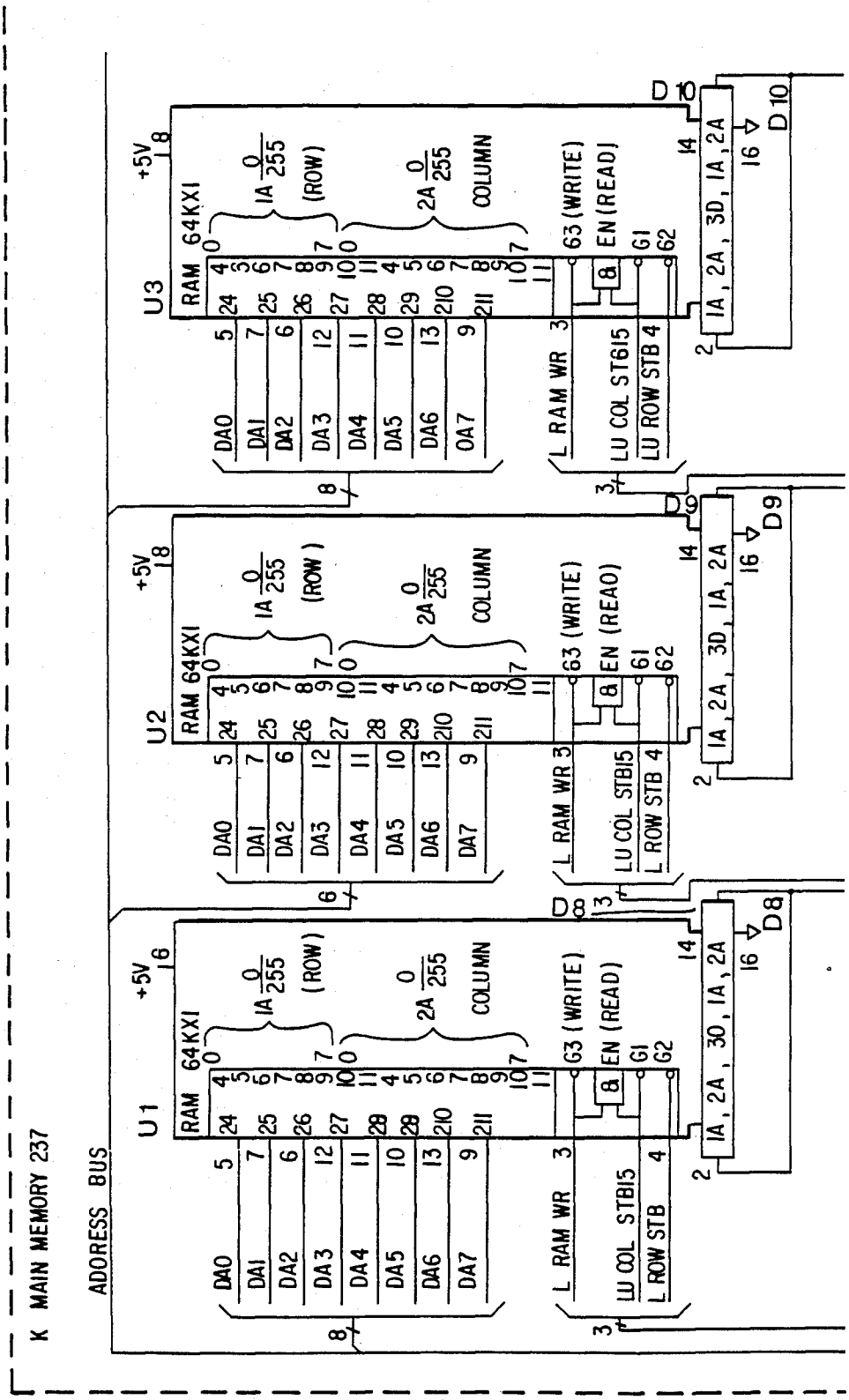

PROCESSOR
85101-60011
(SHEET 2 OF 4)
CONTROL BUS
FROM SHEET 1
ADDRESS BUS
FROM SHEET 1
J MEMORY ADDRESS/REFRESH
L WRITE
L RAM WR
L ROW STB
LU COL STB
LL COL STB
U47A
U47B
U47C
U28A
U28B
U28C
U28D
U9
U44A
U45A
U62A
U60F
DELAY LINE
100ns
90ns
90ns
DL1
LUDS
LLDS
LDTACK
LRAM
LAS
+5VPU1
RAM REFRESH TIMER
EXTERNAL TIMING
P2-5 (OUT)
L RF-RINT
LRFRZD
+5V PU1
RFREN
LRAM 2
DS
MUX
CNTR
CT=64+1
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
R15
100K
C2
.022
R2
215
R3
215
+5V

FIG 3.8

FIG. 3.9A


K MAIN MEMORY 237
ADDRESS BUS
U1
U2
U3
RAM 64KX1
+5V
(ROW)
COLUMN
(WRITE)
(READ)
L RAM WR
LU COL STBI5
L ROW STB
LU COL ST615
LU ROW STB
1A, 2A, 3D, 1A, 2A
1A, 2A, 3D, 1A, 2A
1A, 2A, 3D, 1A, 2A
D8
D9
D10

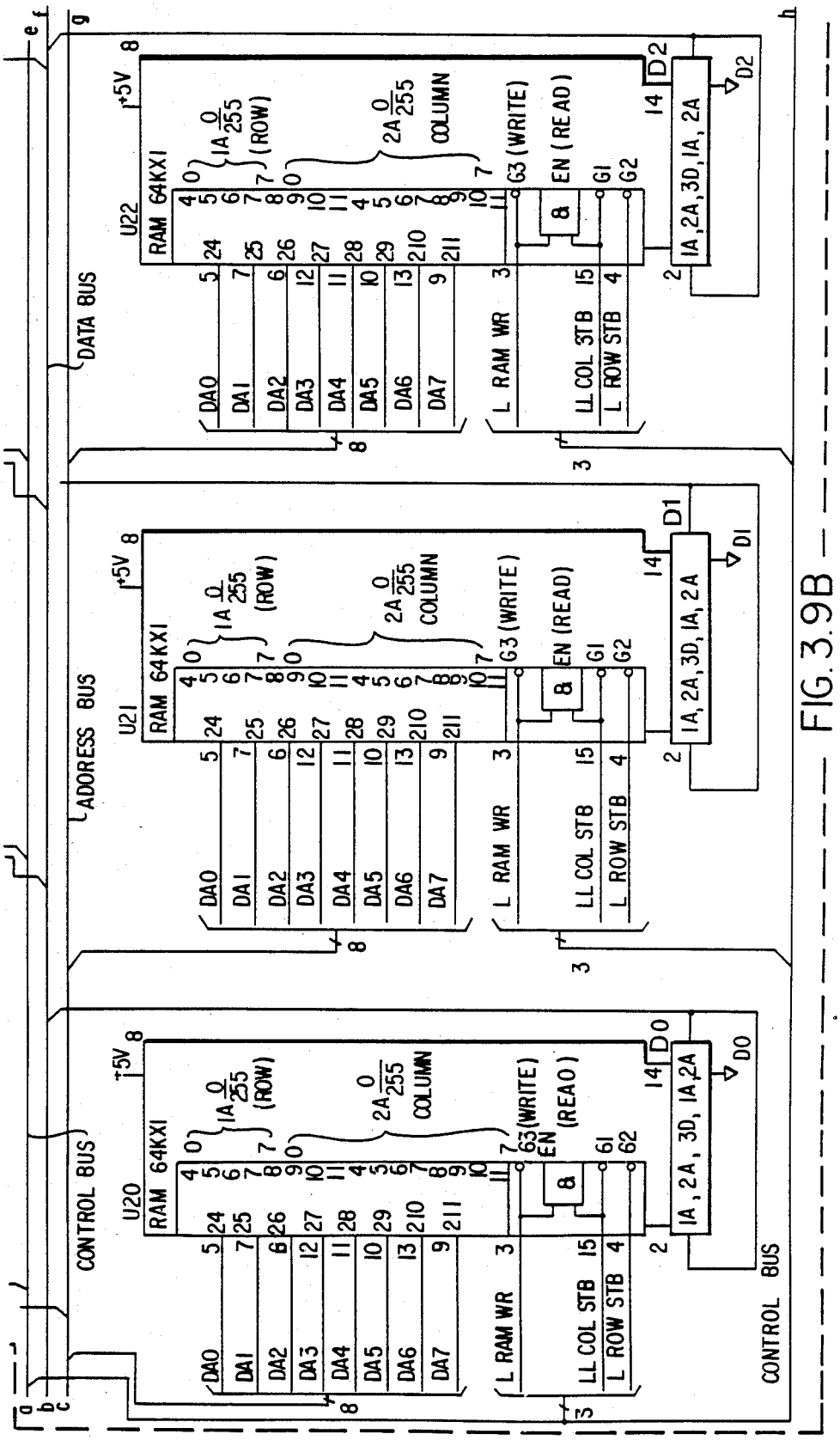

U22
U21
U20
RAM 64KX1
+5V
DATA BUS
ADDRESS BUS
CONTROL BUS
1A 0/255 (ROW)
2A 0/255 COLUMN
G3 (WRITE)
EN (READ)
G1
G2
L RAM WR
LL COL STB
L ROW STB
D2
D1
D0
1A, 2A, 3D, 1A, 2A

FIG. 3.9B

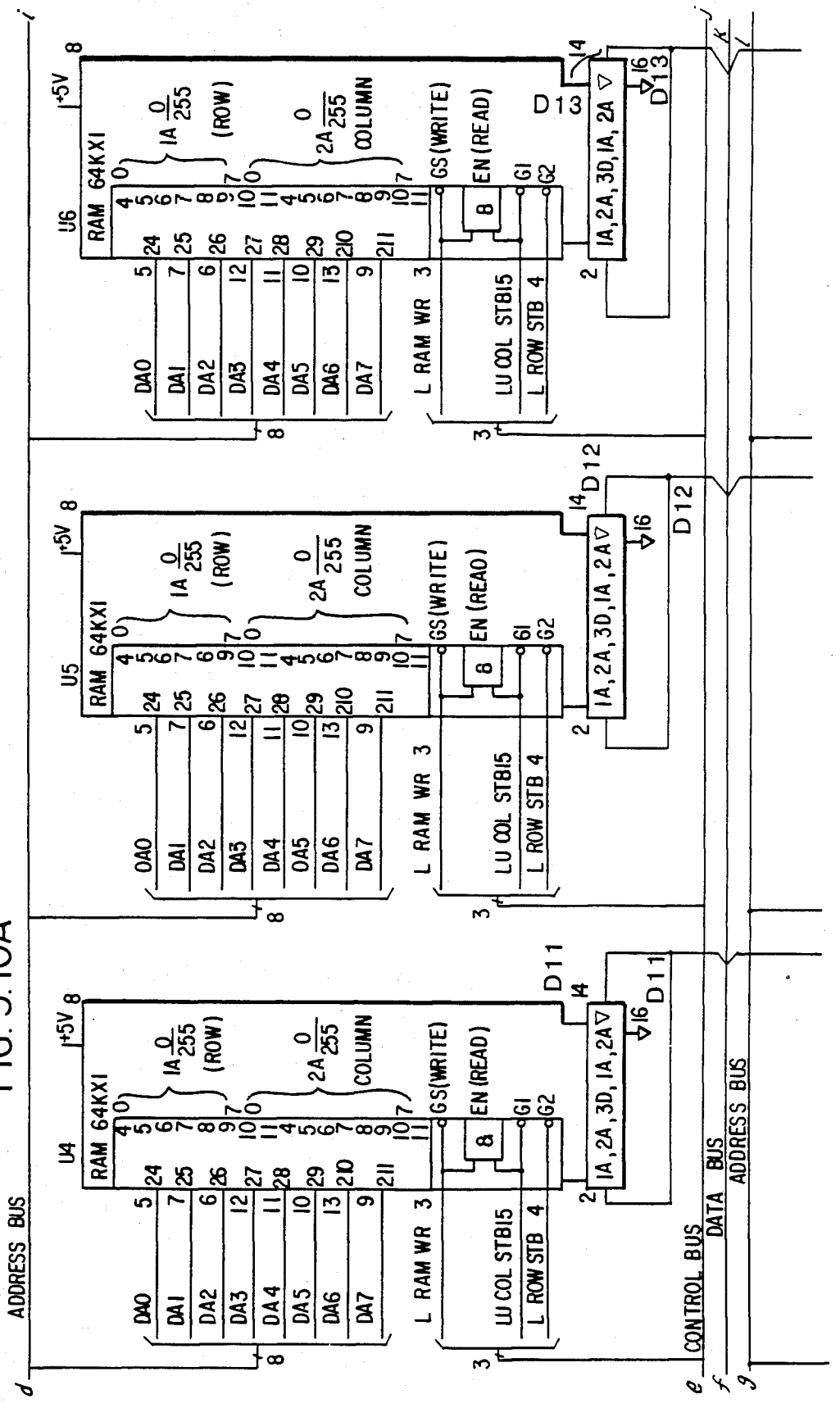

ADDRESS BUS
CONTROL BUS
DATA BUS
ADDRESS BUS
U4
U5
U6
RAM 64KX1
+5V
IA 0/255 (ROW)
2A 0/255 COLUMN
GS (WRITE)
EN (READ)
L RAM WR
LU COL STB
L ROW STB
IA, 2A, 3D, IA, 2A
D11
D12
D13

FIG. 3.10A

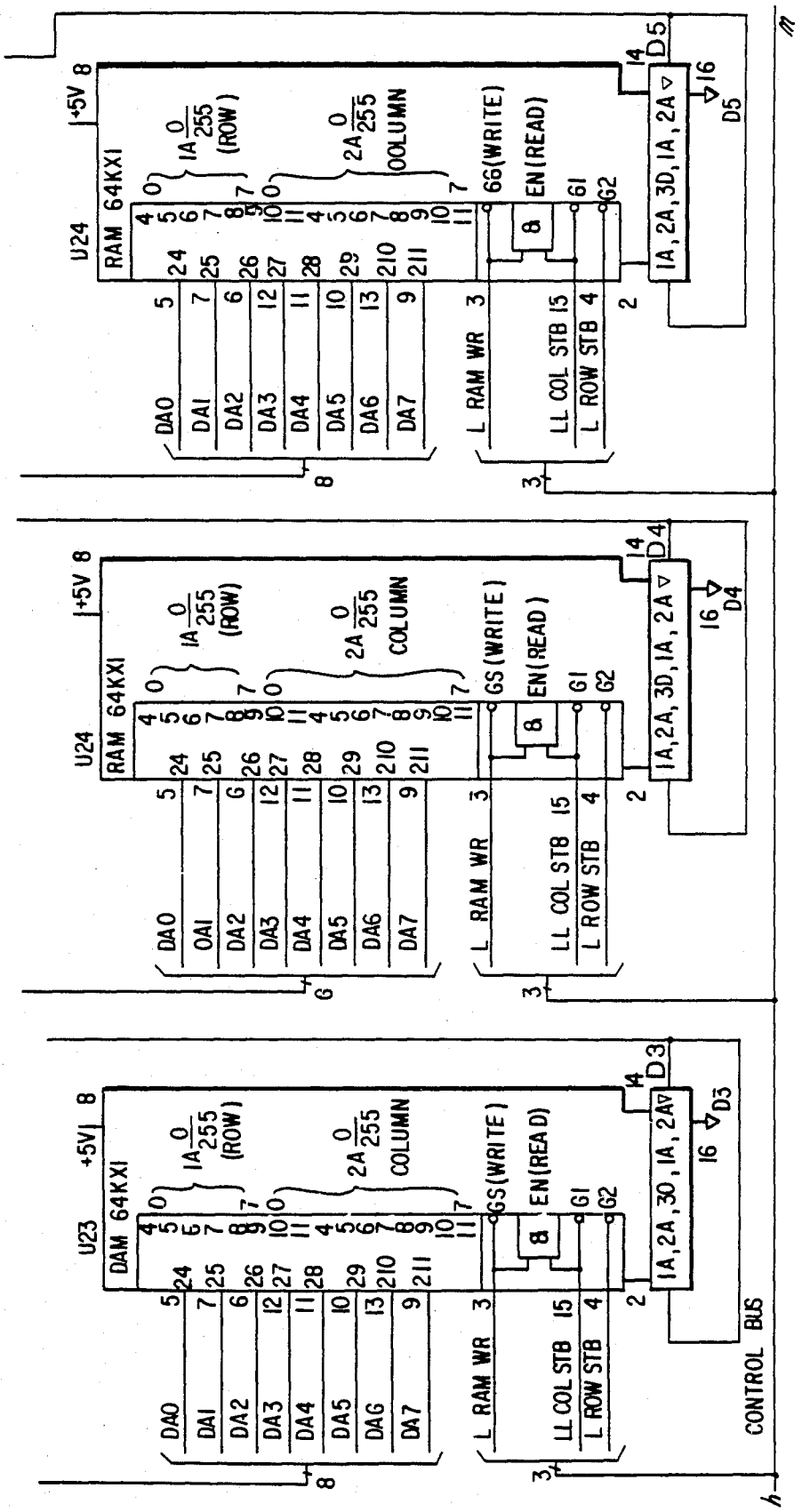
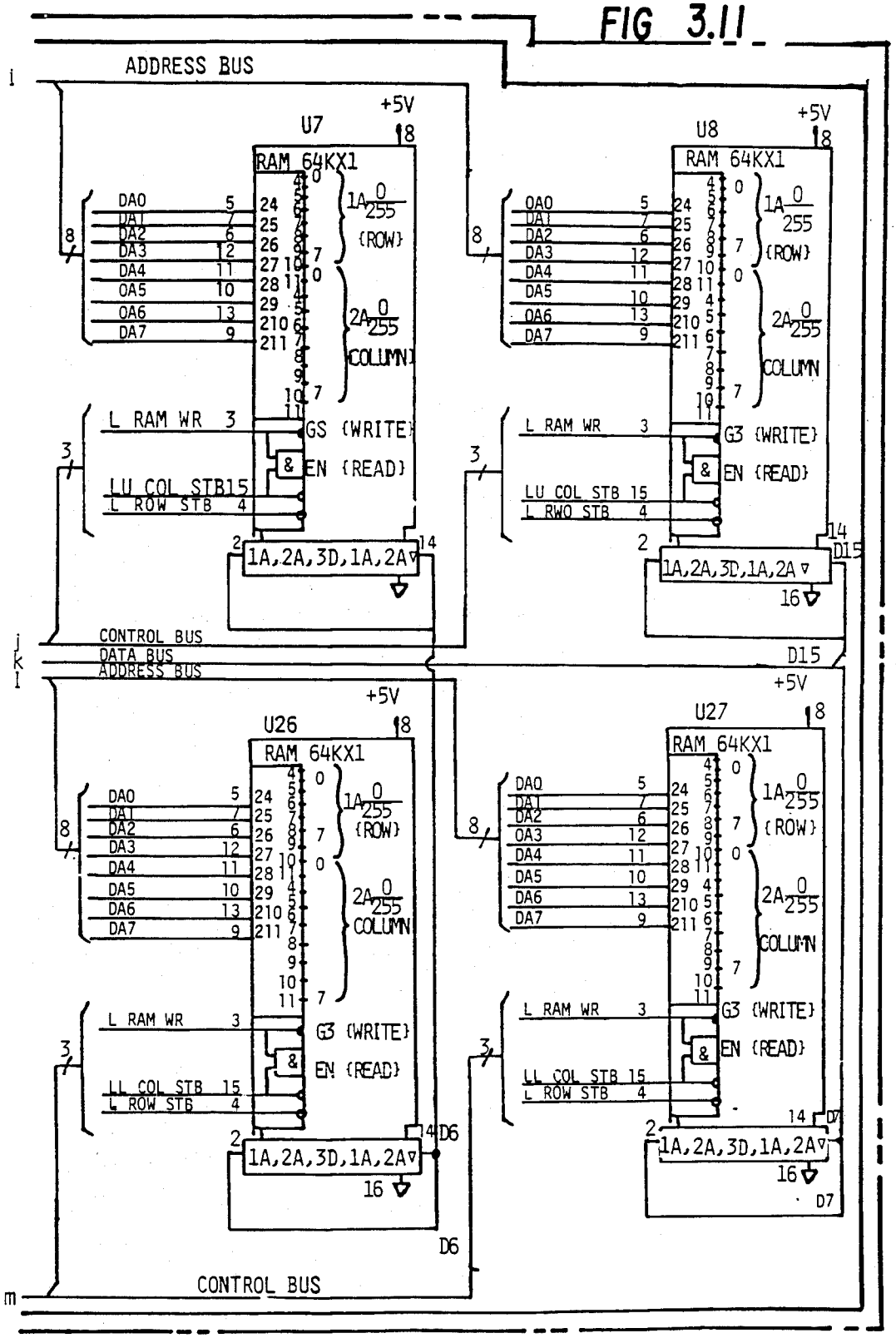

U24
RAM 64KX1
+5V
DA0
DA1
DA2
DA3
DA4
DA5
DA6
DA7
1A 0/255 (ROW)
2A 0/255 COLUMN
66(WRITE)
EN(READ)
L RAM WR
LL COL STB
L ROW STB
1A, 2A, 3D, 1A, 2A
D5
U24
RAM 64KX1
+5V
1A 0/255 (ROW)
2A 0/255 COLUMN
GS(WRITE)
EN(READ)
1A, 2A, 3D, 1A, 2A
D4
U23
DAM 64KX1
+5V
1A 0/255 (ROW)
2A 0/255 COLUMN
GS(WRITE)
EN(READ)
1A, 2A, 3D, 1A, 2A
D3
CONTROL BUS

FIG. 3.10B

FIG 3.11


ADDRESS BUS
U7
U8
U26
U27
RAM 64KX1
+5V
DA0
DA1
DA2
DA3
DA4
DA5
DA6
DA7
OA0
OA1
OA2
OA3
OA4
OA5
OA6
OA7
1A 0/255 (ROW)
2A 0/255 COLUMN
L RAM WR
GS (WRITE)
G3 (WRITE)
EN (READ)
LU COL STB15
L ROW STB
LL COL STB 15
L RWO STB
1A,2A,3D,1A,2A
CONTROL BUS
DATA BUS
ADDRESS BUS
D15
D6
D7

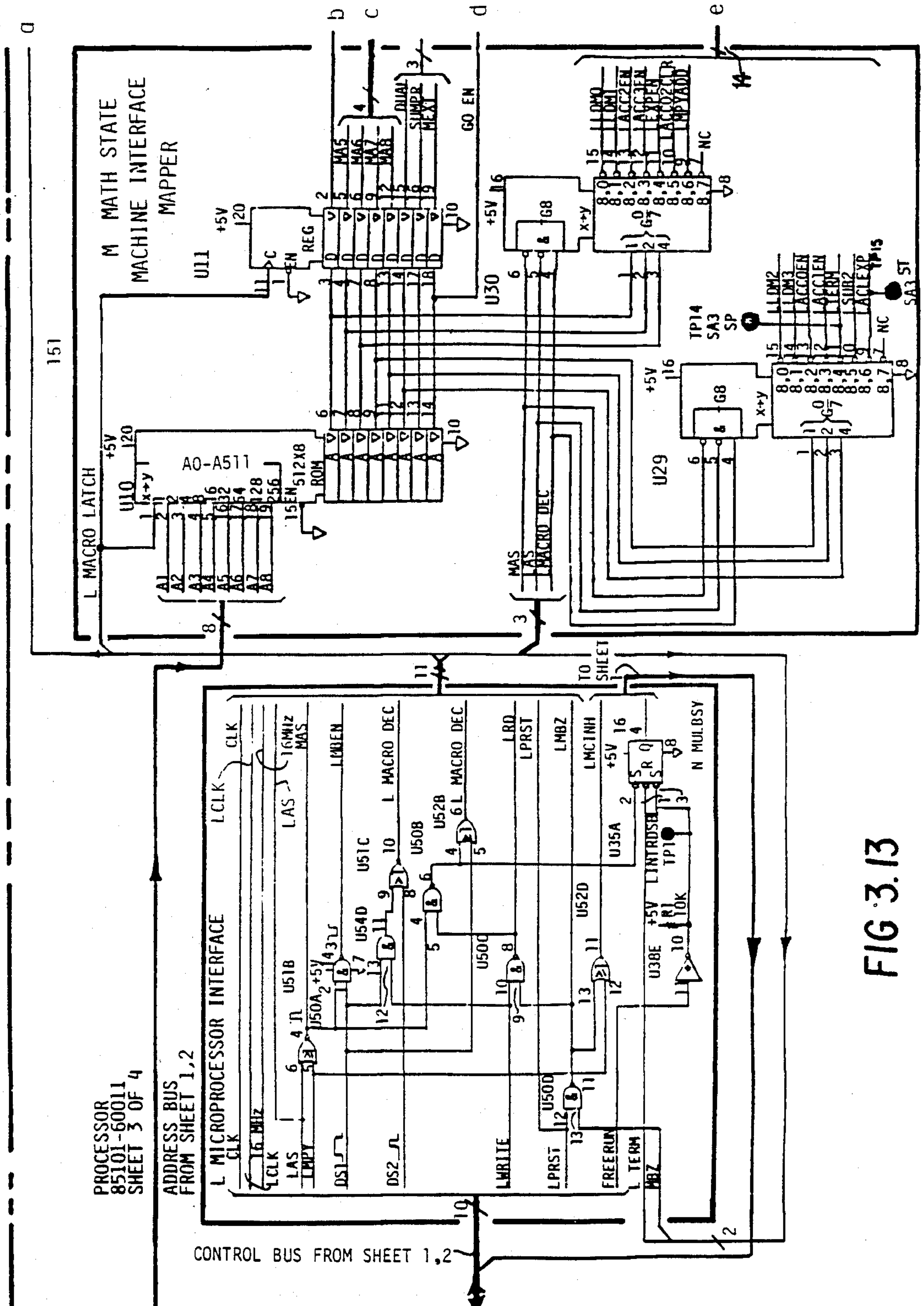

M MATH STATE
MACHINE INTERFACE
MAPPER
L MACRO LATCH
L MICROPROCESSOR INTERFACE
ADDRESS BUS
FROM SHEET 1,2
PROCESSOR
85101-60011
SHEET 3 OF 4
CONTROL BUS FROM SHEET 1,2

FIG 3.13

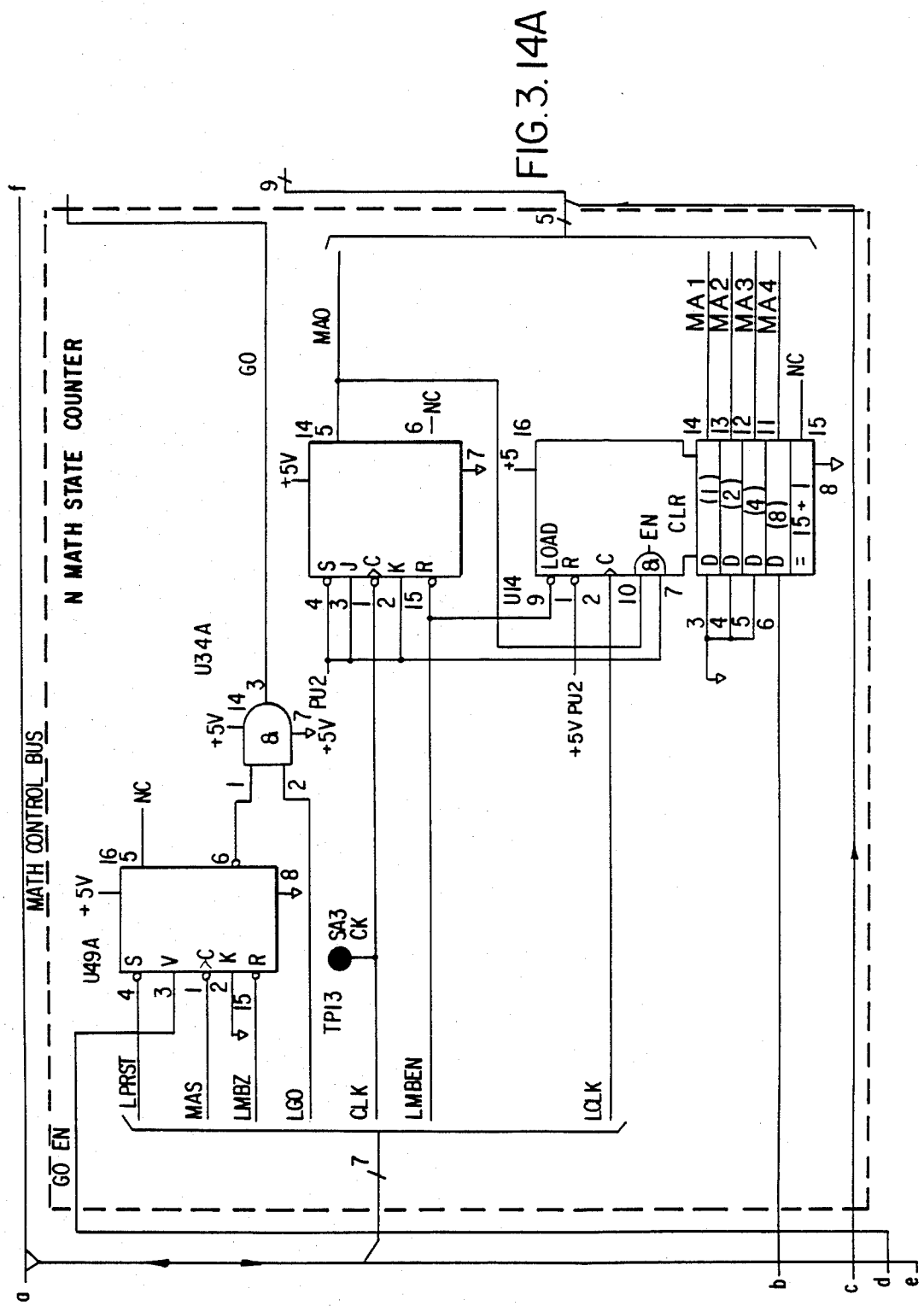

N MATH STATE COUNTER
MATH CONTROL BUS
GO
MA0
MA1
MA2
MA3
MA4
NC
+5V
+5V PU2
U34A
U49A
U14
LOAD
EN
CLR
SA3 CK
TP13
LPRST
MAS
LMBZ
LGO
CLK
LMBEN
LCLK
GO EN
a
b
c
d
e
f

FIG. 3.14A

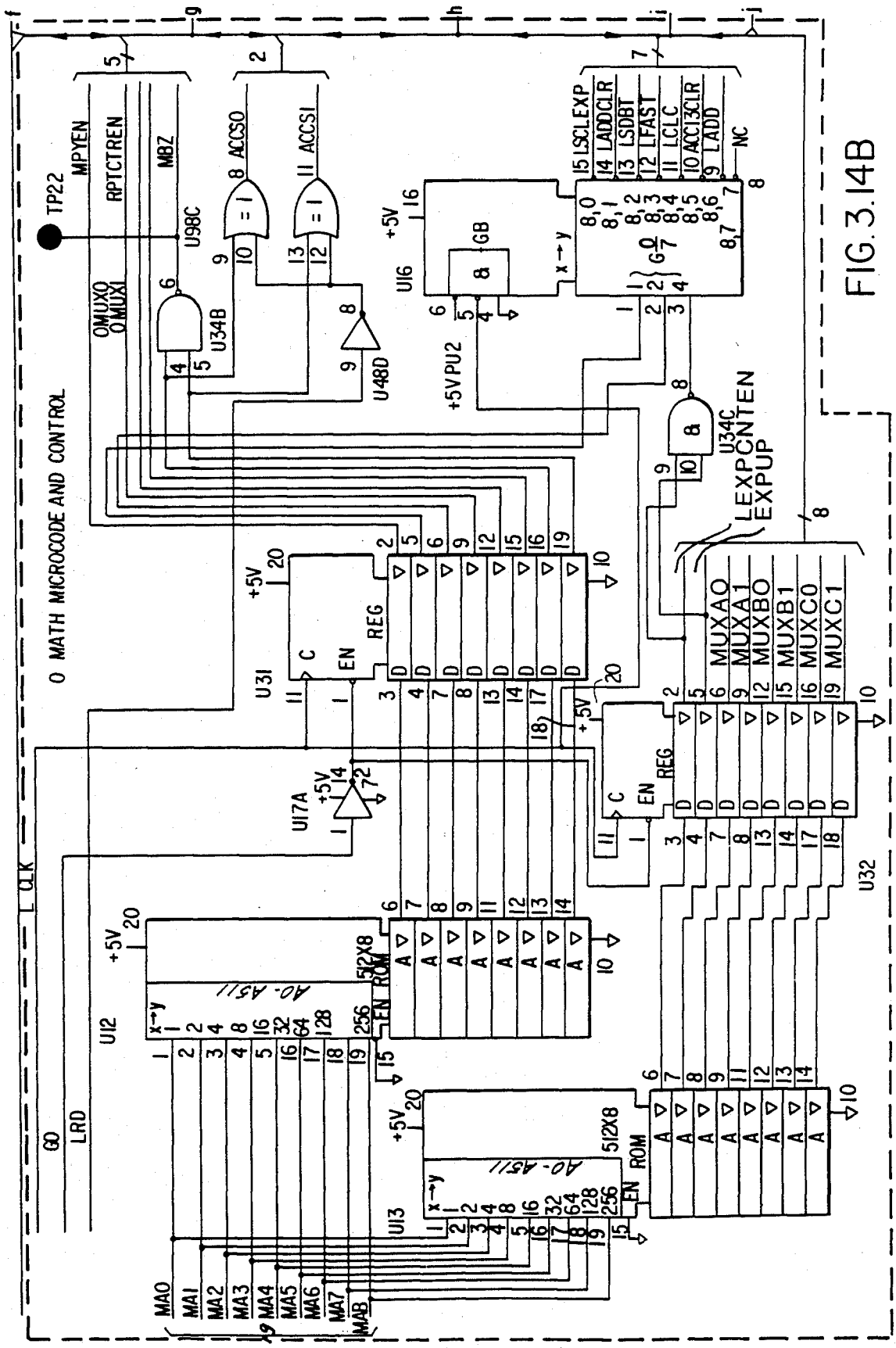

0 MATH MICROCODE AND CONTROL
TP22
MPYEN
RPTCTREN
MBZ
U98C
OMUXO
OMUX1
U34B
ACCSO
ACCS1
U48D
+5VPU2
U16
GB
LSCLEXP
LADDCLR
LSDBT
LFAST
LCLC
ACC13CLR
LADD
NC
U34C
LEXPCNTEN
LEXPUP
U31
REG
MUXAO
MUXA1
MUXBO
MUXB1
MUXCO
MUXC1
U32
U17A
CLK
GO
LRD
U12
U13
512X8
ROM
EN
MA0
MA1
MA2
MA3
MA4
MA5
MA6
MA7
MA8

FIG. 3.14B

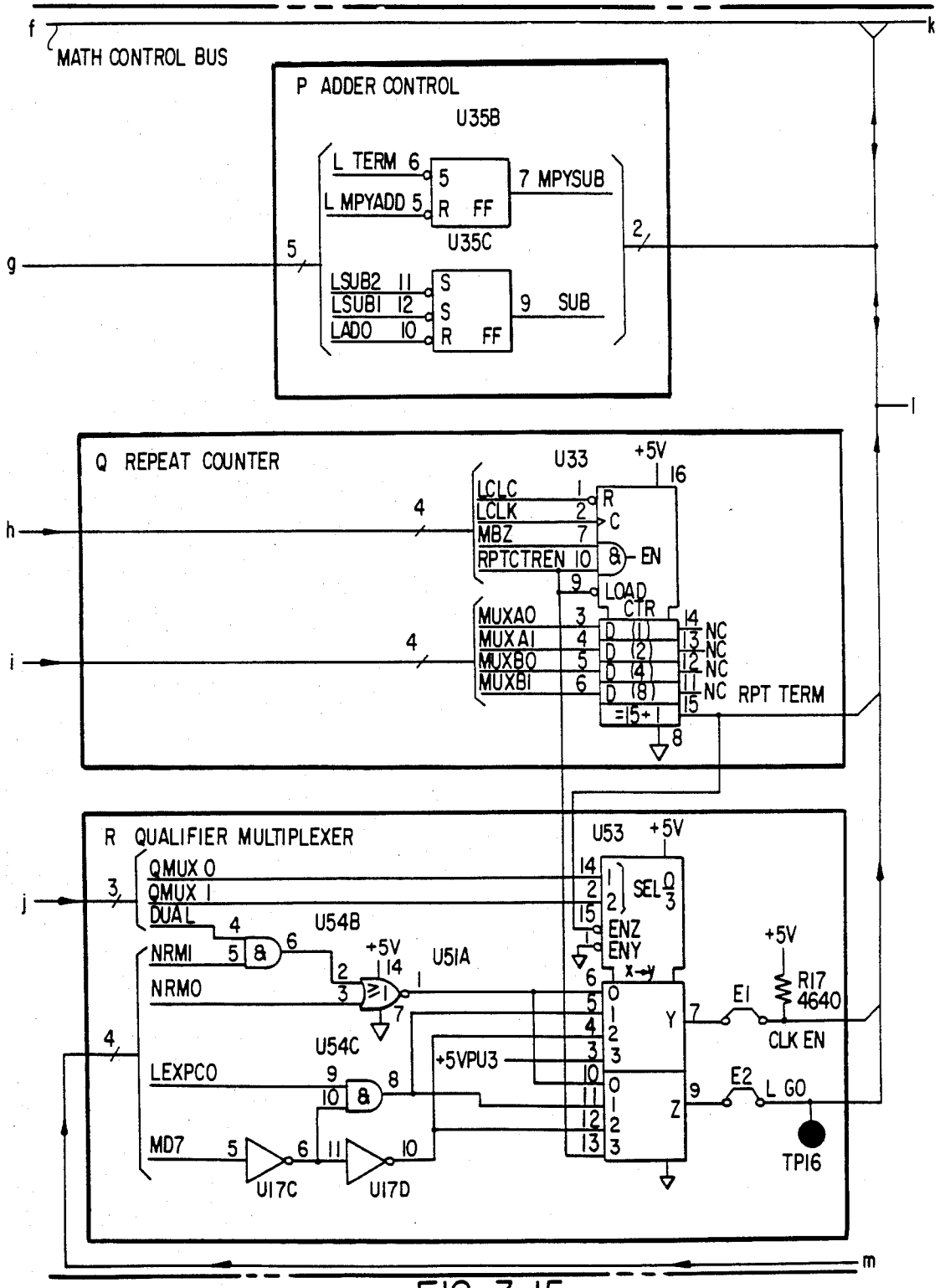

f
MATH CONTROL BUS
k
P ADDER CONTROL
U35B
L TERM 6
L MPYADD 5
5
R FF
7 MPYSUB
U35C
g
5
2
LSUB2 11
LSUBI 12
LADO 10
S
S
R FF
9 SUB
l
Q REPEAT COUNTER
U33
+5V
16
h
4
LCLC 1
LCLK 2
MBZ 7
RPTCTREN 10
R
C
8 EN
9 LOAD
CTR
i
4
MUXAO 3
MUXAI 4
MUXBO 5
MUXBI 6
D (1)
D (2)
D (4)
D (8)
=15+1
14 NC
13 NC
12 NC
11 NC
15 RPT TERM
8
R QUALIFIER MULTIPLEXER
U53
+5V
j
3
QMUX 0
QMUX 1
DUAL
4
U54B
NRMI 5
6
+5V
14
U51A
NRMO
2
3
1
7
SEL
Q
3
14
2
15
ENZ
ENY
x→y
6
+5V
R17
4640
E1
CLK EN
4
U54C
LEXPCO
9
10
8
+5VPU3
MD7
5
6
11
10
U17C
U17D
E2
L GO
TPI6
m

FIG. 3.15

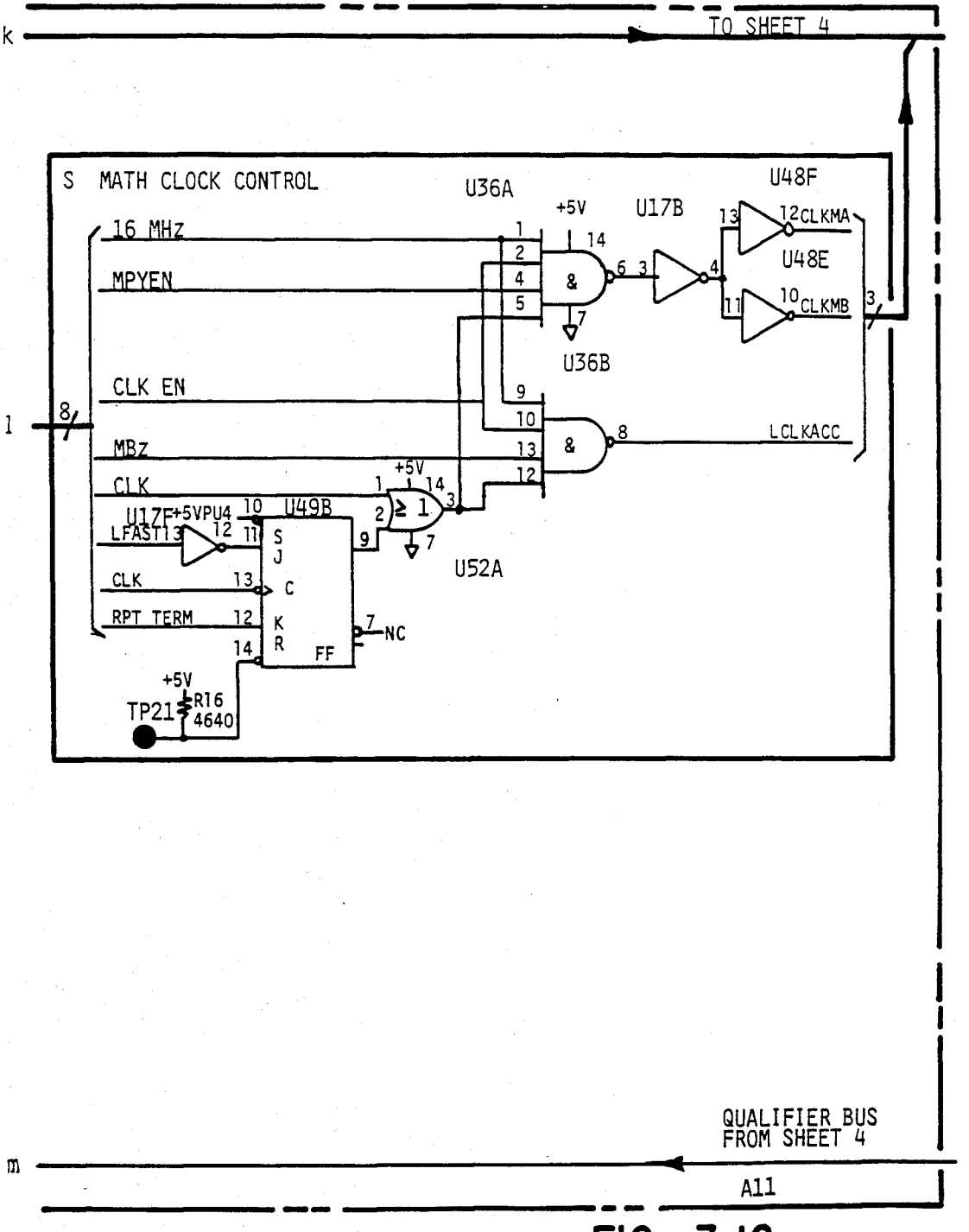

k
TO SHEET 4
S MATH CLOCK CONTROL
16 MHz
MPYEN
CLK EN
MBz
CLK
LFAST13
CLK
RPT TERM
U36A
+5V
U17B
U48F
U48E
CLKMA
CLKMB
U36B
LCLKACC
U49B
U52A
U17F
+5VPU4
NC
FF
TP21
R16
4640
l
8
m
QUALIFIER BUS
FROM SHEET 4
A11

FIG 3.16

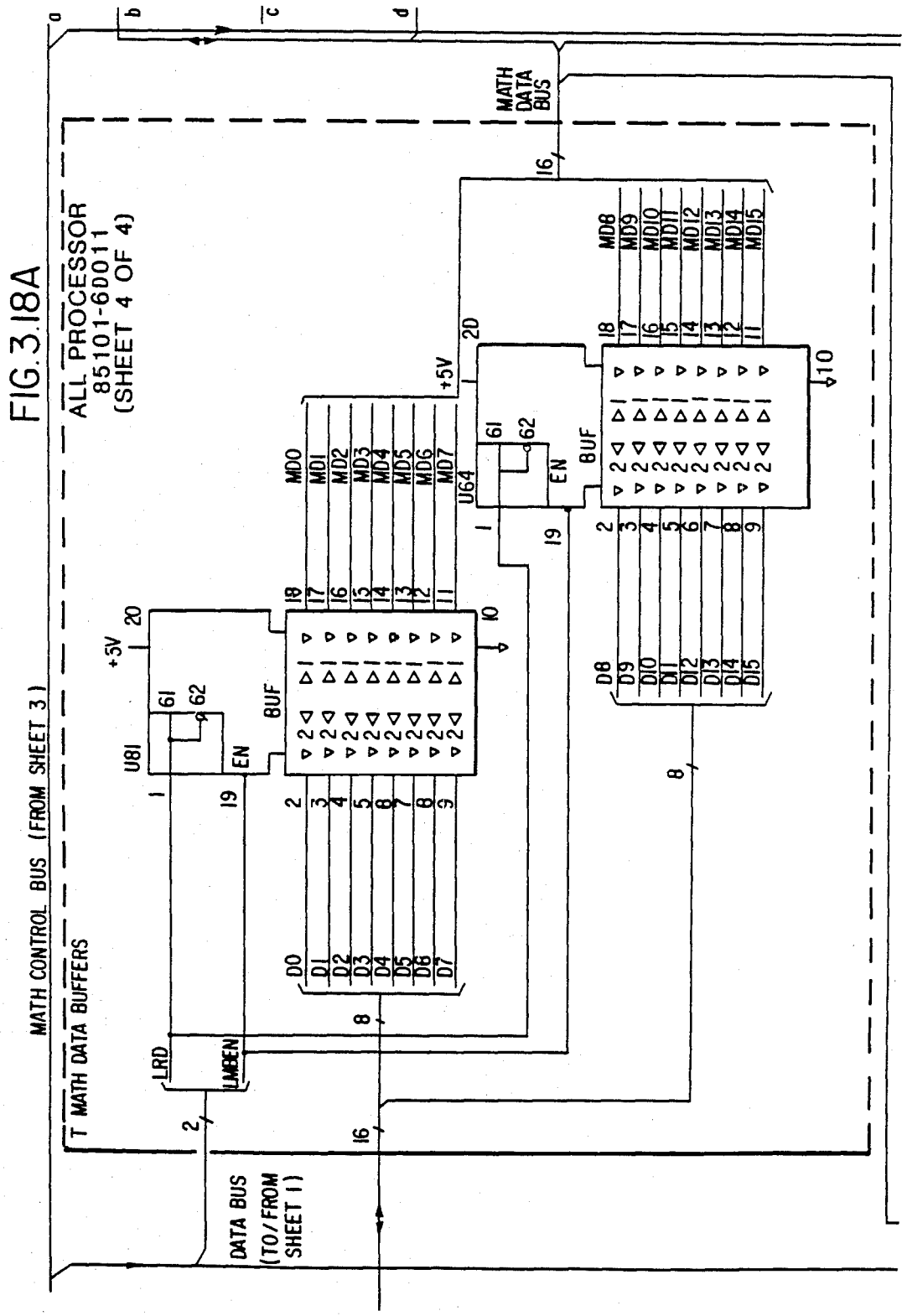
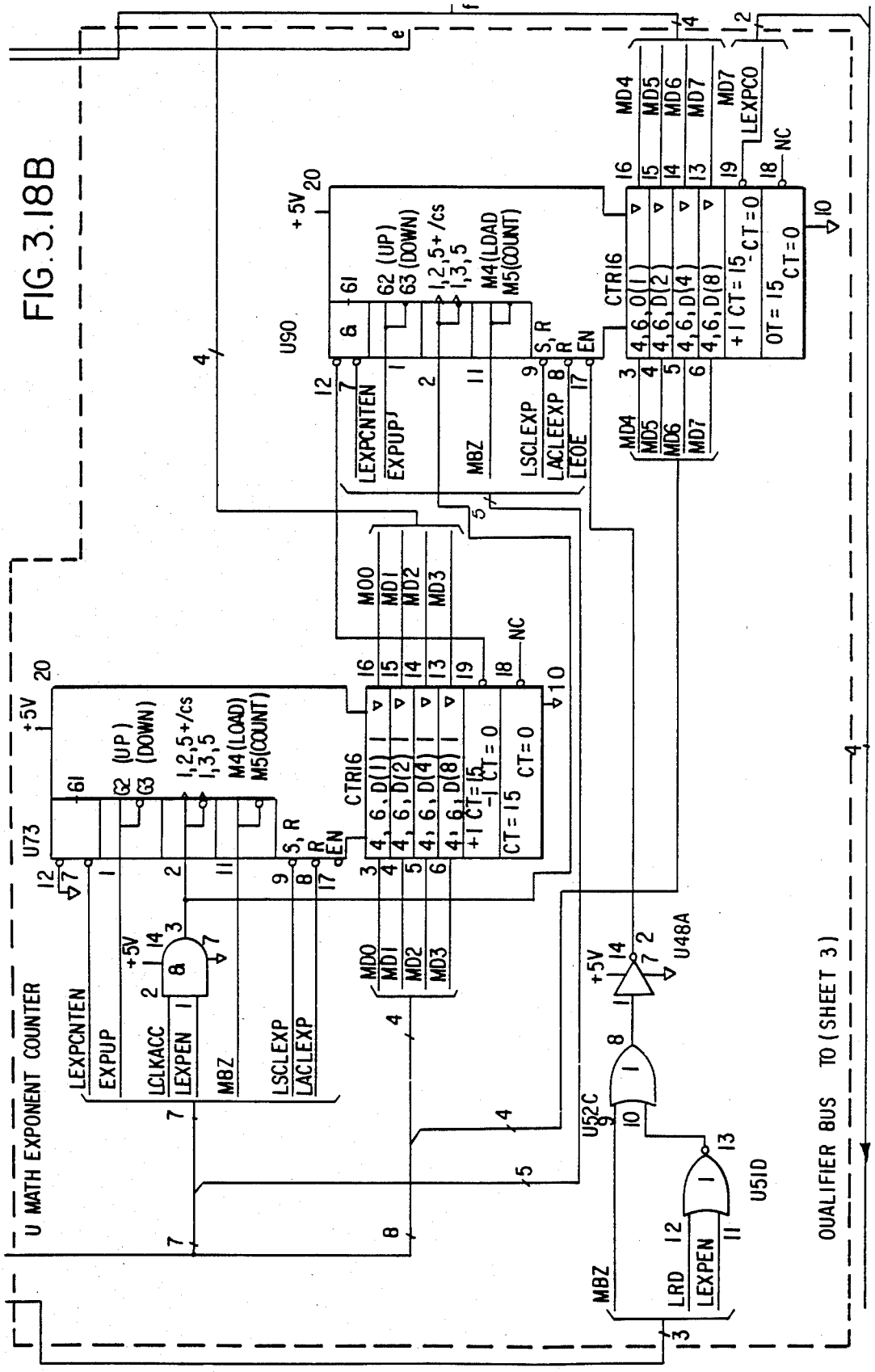

ALL PROCESSOR
85101-60011
(SHEET 4 OF 4)
MATH DATA BUS
MATH CONTROL BUS (FROM SHEET 3)
MATH DATA BUFFERS
DATA BUS
(TO/FROM SHEET 1)
U81
U64
BUF
EN
+5V
LRD
LWEN
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
MD8
MD9
MD10
MD11
MD12
MD13
MD14
MD15
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15

FIG. 3.18A

FIG. 3.18B


U MATH EXPONENT COUNTER
QUALIFIER BUS TO (SHEET 3)
U73
U90
U48A
U52C
U51D
CTR16
LEXPCNTEN
EXPUP
LCLKACC
LEXPEN
MBZ
LSCLEXP
LACLEXP
LRD
LACLEEXP
LEOE
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
LEXPCO
NC
+5V
(UP)
(DOWN)
M4(LOAD)
M5(COUNT)
CT=0
CT=15

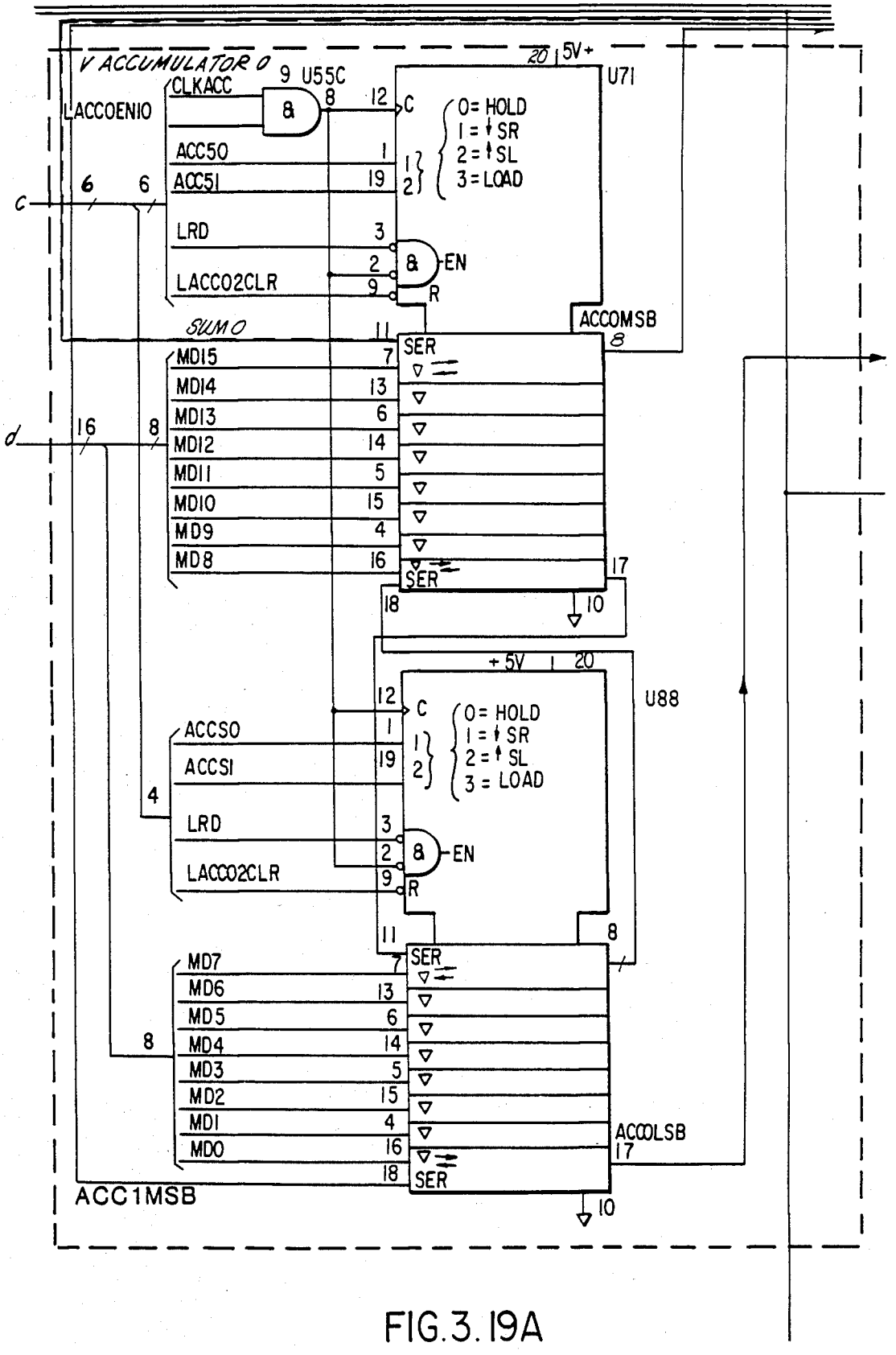

V ACCUMULATOR 0
CLKACC
LACCOENIO
U55C
9
8
12
C
0= HOLD
1 = SR
2 = SL
3 = LOAD
ACC50
ACC51
1
19
6
6
c
LRD
3
LACCO2CLR
2
9
EN
R
SUM 0
11
ACCOMSB
8
SER
MDI5
MDI4
MDI3
MDI2
MDI1
MDI0
MD9
MD8
7
13
6
14
5
15
4
16
16
8
d
17
18
10
+5V
20
U88
ACCSO
ACCSI
LRD
LACCO2CLR
4
MD7
MD6
MD5
MD4
MD3
MD2
MDI
MDO
8
ACCOLSB
ACC1MSB

FIG. 3. 19A

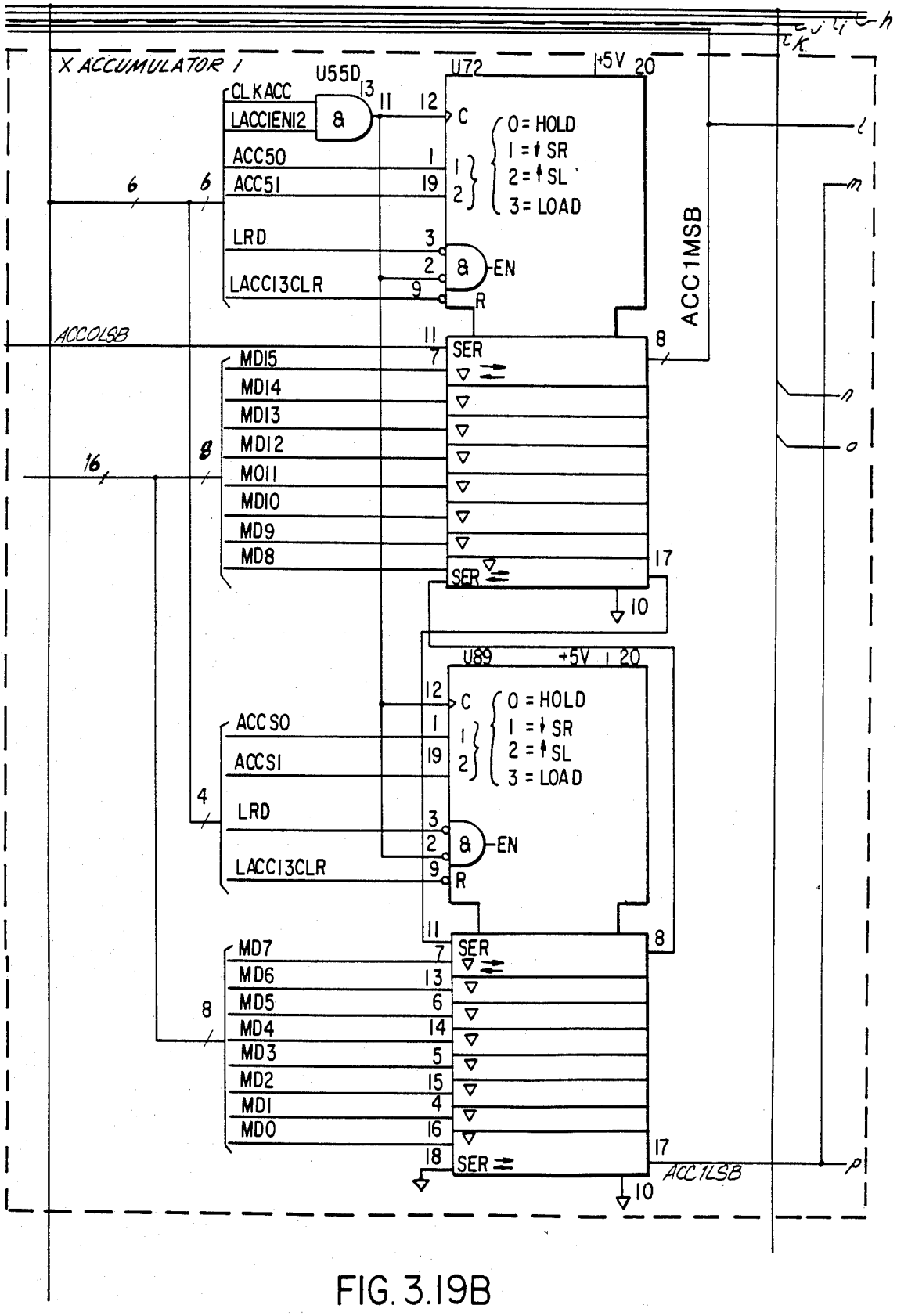

X ACCUMULATOR 1
U55D
CLKACC
LACCIENI2
ACC50
ACC51
LRD
LACC13CLR
U72
+5V
0 = HOLD
1 = SR
2 = SL
3 = LOAD
EN
R
SER
ACC1MSB
ACC0LSB
MDI5
MDI4
MDI3
MDI2
MDI1
MDI0
MD9
MD8
U89
ACCS0
ACCS1
MD7
MD6
MD5
MD4
MD3
MD2
MD1
MD0
ACC1LSB

FIG. 3.19B

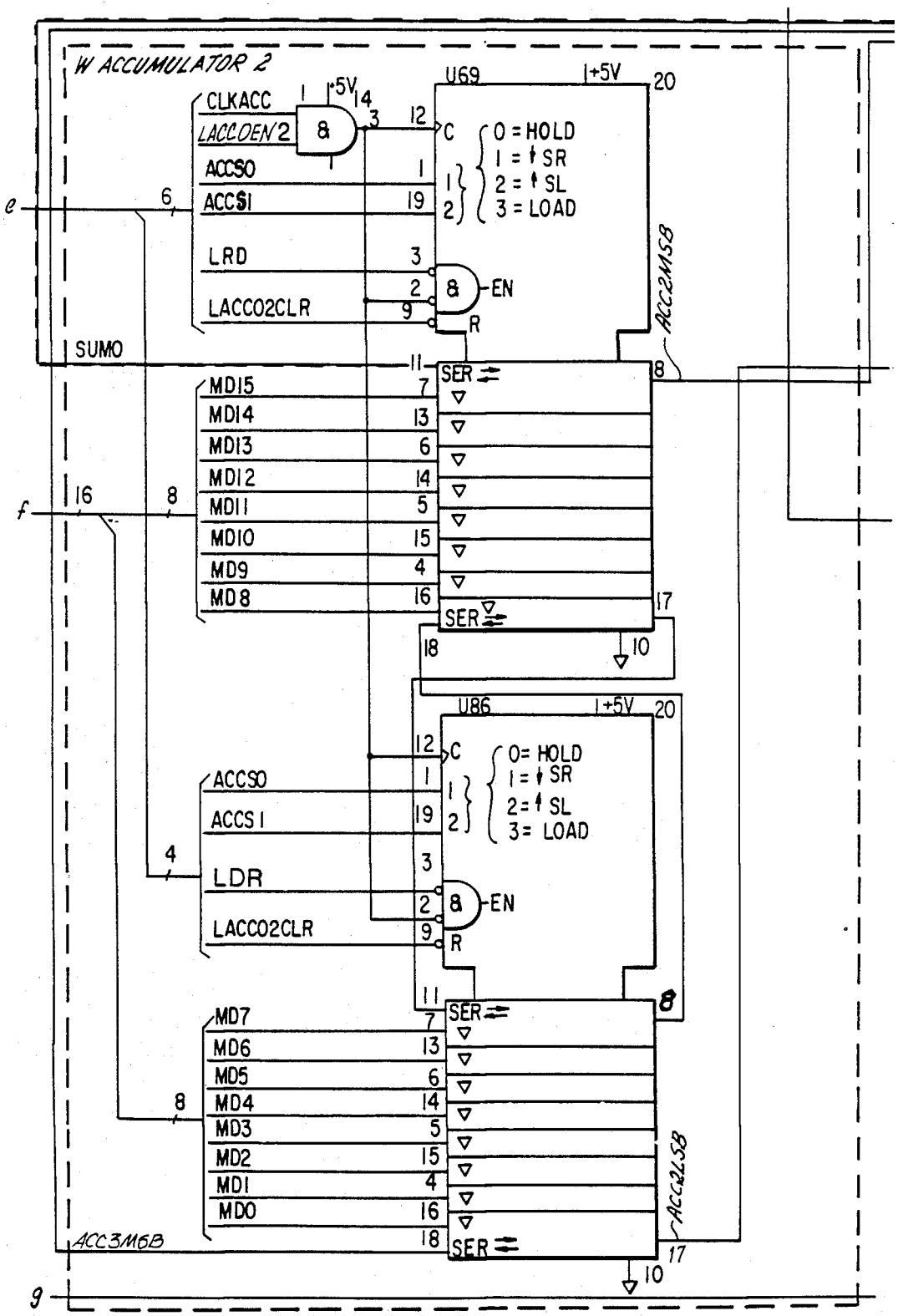

W ACCUMULATOR 2
U69
U86
+5V
CLKACC
LACCOEN/2
ACCSO
ACCSI
LRD
LACCO2CLR
SUMO
LDR
MD15
MD14
MD13
MD12
MD11
MD10
MD9
MD8
MD7
MD6
MD5
MD4
MD3
MD2
MD1
MD0
0 = HOLD
1 = SR
2 = SL
3 = LOAD
EN
SER
ACC2M5B
ACC2L5B
ACC3M6B

FIG. 3.19C

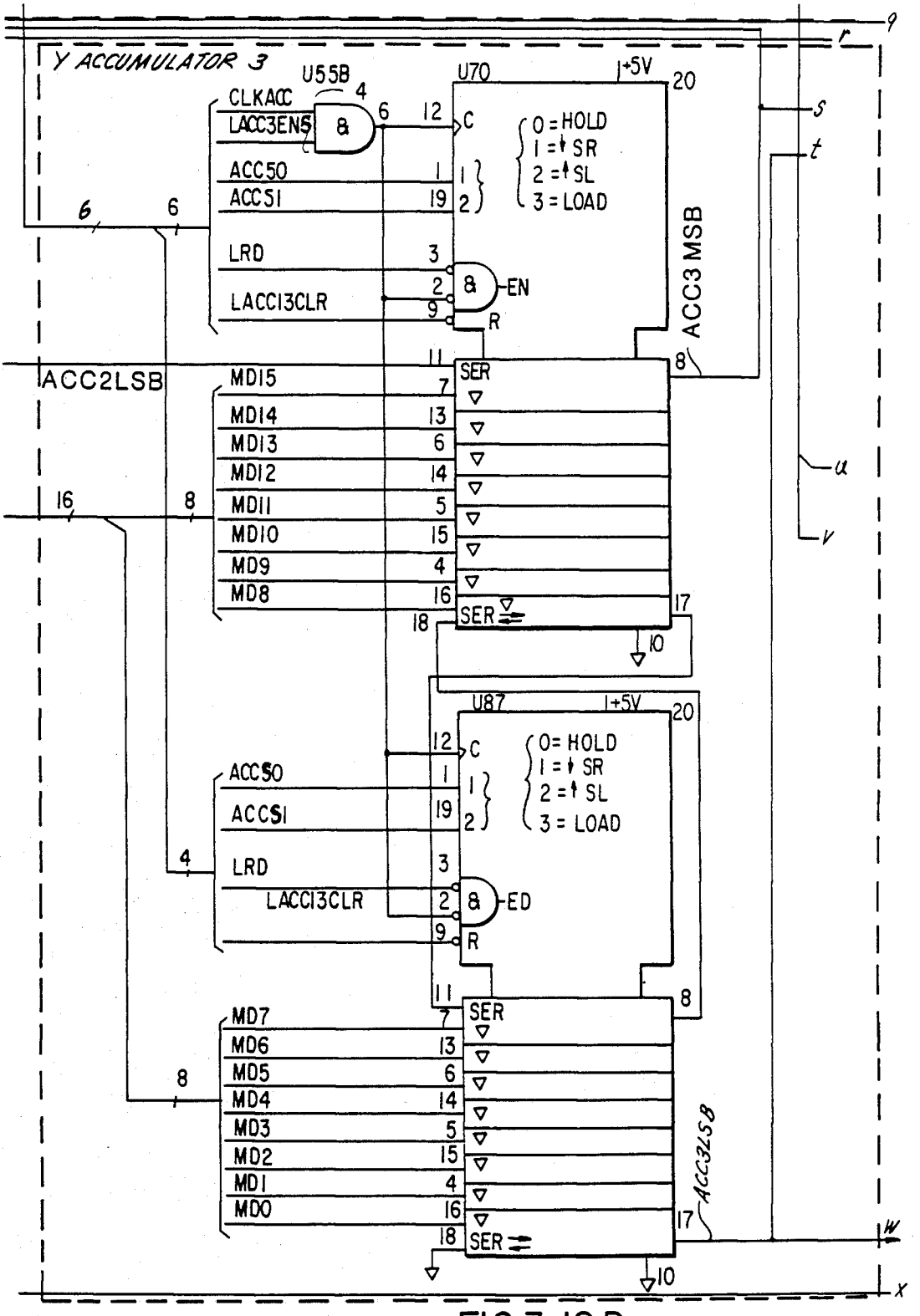

Y ACCUMULATOR 3
U55B
U70
+5V
CLKACC
LACC3EN5
ACC50
ACC51
0 = HOLD
1 = SR
2 = SL
3 = LOAD
LRD
LACC13CLR
EN
R
SER
ACC3 MSB
ACC2LSB
MD15
MD14
MD13
MD12
MD11
MD10
MD9
MD8
U87
MD7
MD6
MD5
MD4
MD3
MD2
MD1
MD0
ED
ACC3LSB

FIG.3.19D

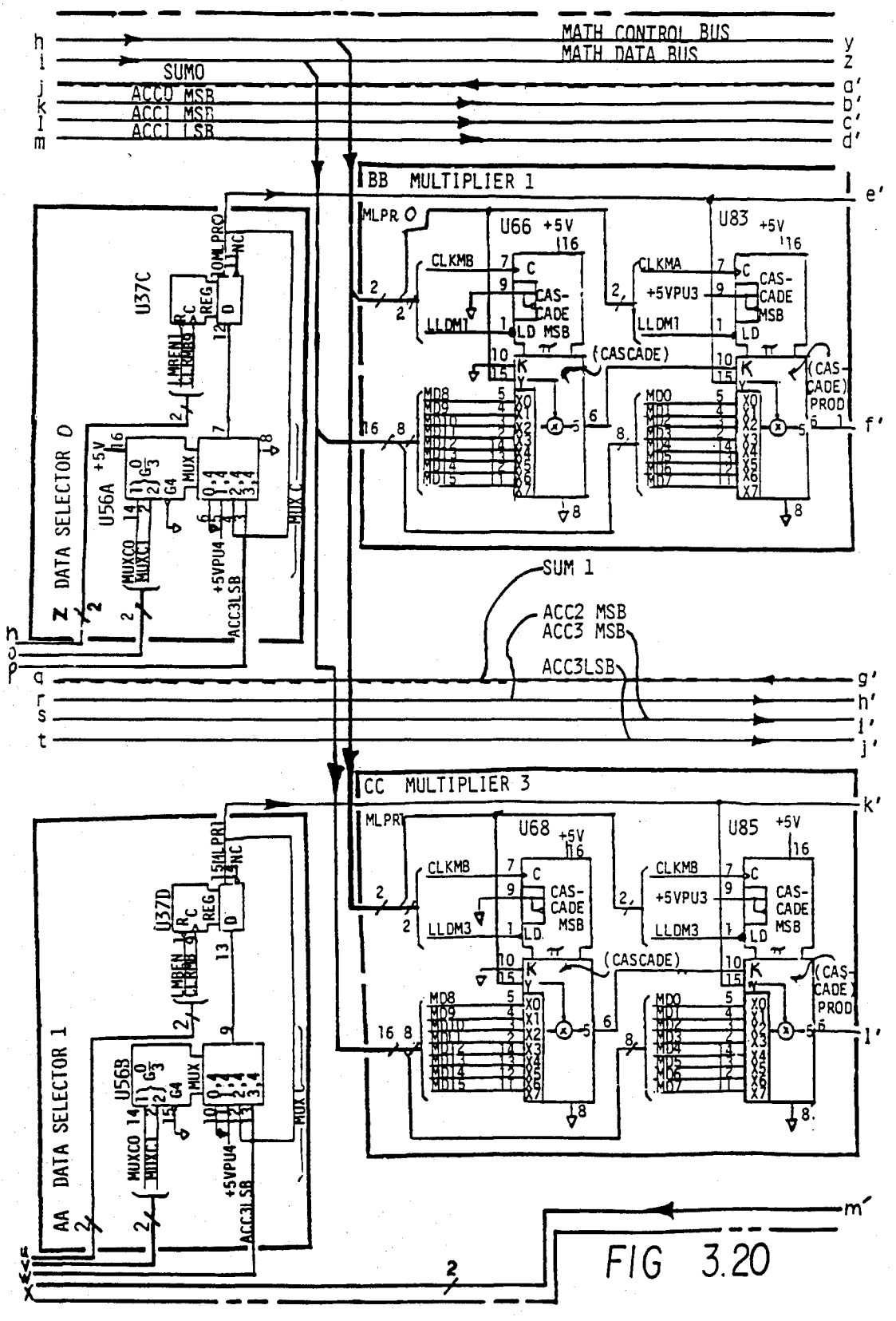

MATH CONTROL BUS
MATH DATA BUS
SUMO
ACCO MSB
ACC1 MSB
ACC1 LSB
BB MULTIPLIER 1
MLPR 0
U66 +5V
U83 +5V
CLKMB
CLKMA
+5VPU3
LLDM1
CAS-CADE MSB
LD MSB
(CASCADE)
(CAS-CADE) PROD
MD8
MD0
U37C
U56A
Z DATA SELECTOR 0
MUXCO
MUXC1
+5VPU4
ACC3LSB
SUM 1
ACC2 MSB
ACC3 MSB
ACC3LSB
CC MULTIPLIER 3
MLPR1
U68 +5V
U85 +5V
LLDM3
U37D
U56B
AA DATA SELECTOR 1

FIG 3.20

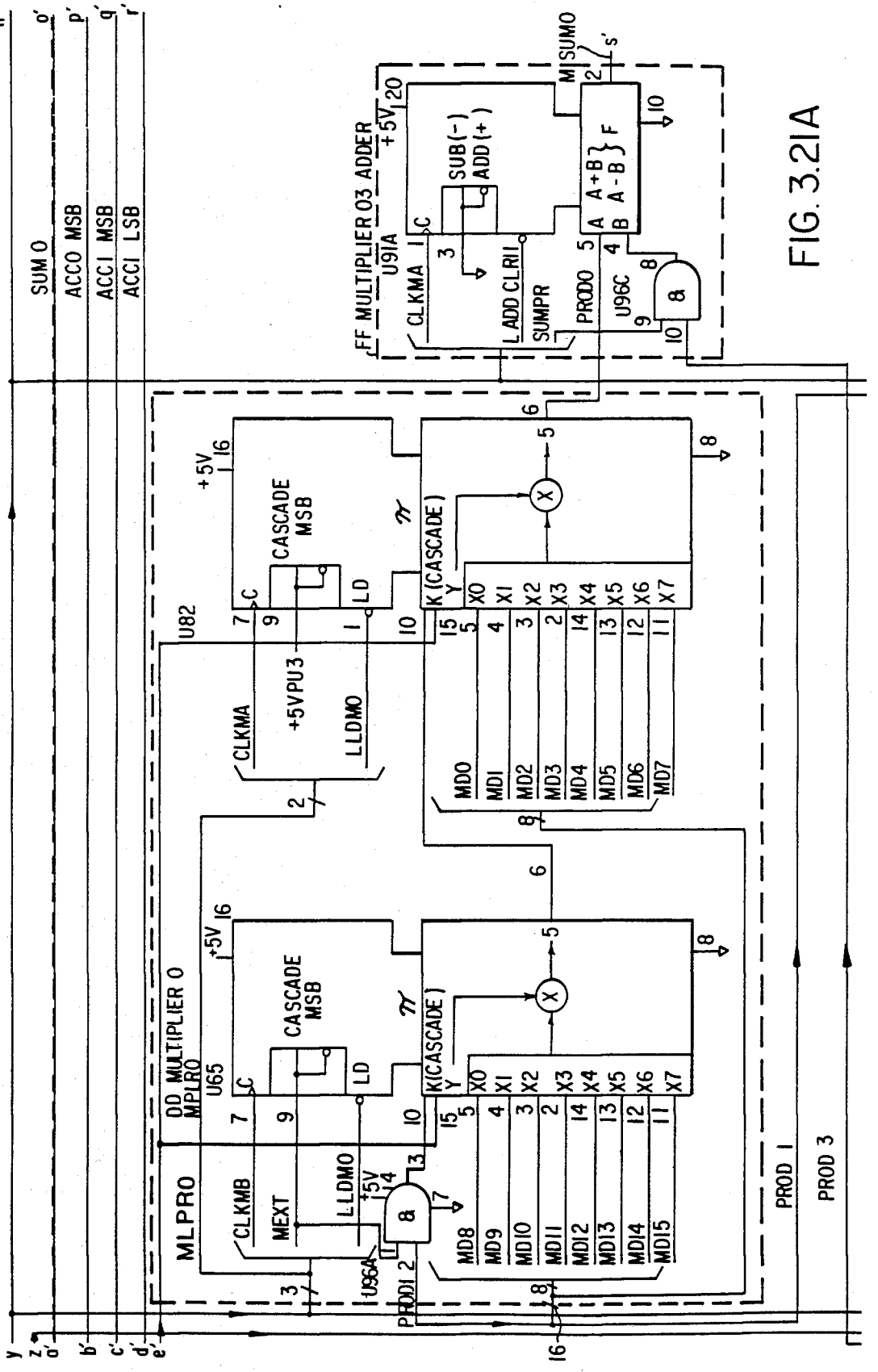

SUM 0
ACC0 MSB
ACC1 MSB
ACC1 LSB
FF MULTIPLIER 03 ADDER
U91A
CLKMA
LADD CLR11
SUMPR
SUB(-)
ADD(+)
A+B
A-B
F
PROD0
U96C
M|SUMO
+5V
CASCADE MSB
K (CASCADE)
U82
+5VPU3
LLDMO
CLKMA
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
OD MULTIPLIER 0
MPLR0
U65
MLPR0
CLKMB
MEXT
U96A
PROD1 2
MD8
MD9
MD10
MD11
MD12
MD13
MD14
MD15
PROD 1
PROD 3

FIG. 3.21A

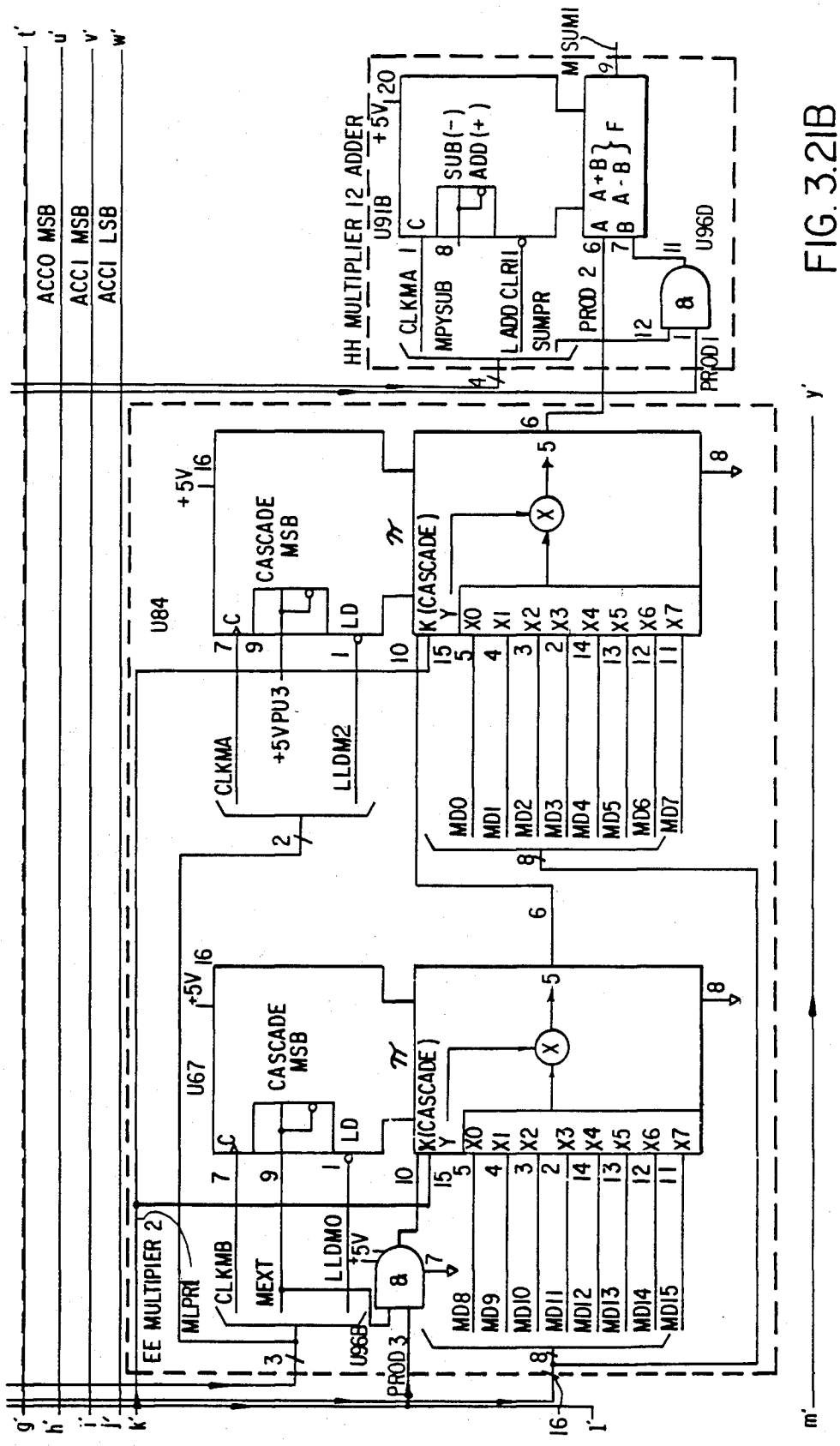
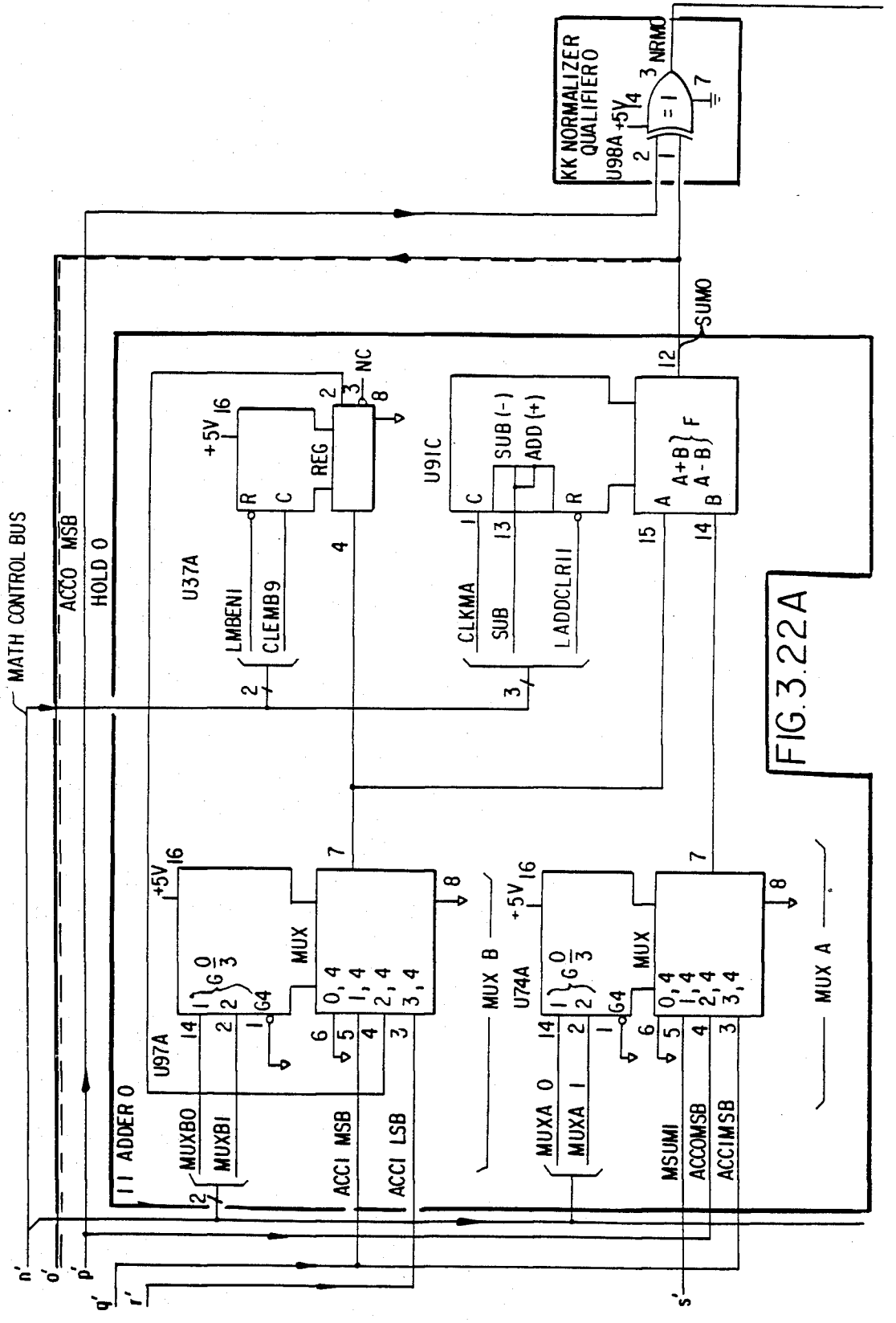

ACC0 MSB
ACC1 MSB
ACC1 LSB
HH MULTIPLIER 12 ADDER
U91B
+5V
20
SUB(-)
ADD(+)
A+B
A-B
F
M1SUMI
CLKMA
MPYSUB
LADD CLR1
SUMPR
PROD 2
PROD 1
U96D
U84
CASCADE MSB
K(CASCADE)
+5VPU3
LLDM2
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
U67
EE MULTIPIER 2
MLPR1
CLKMB
MEXT
LLDM0
U96B
PROD 3
MD8
MD9
MD10
MD11
MD12
MD13
MD14
MD15

FIG. 3.21B


KK NORMALIZER QUALIFIER 0
U98A
+5V
NRM0
SUM0
MATH CONTROL BUS
ACC0 MSB
HOLD 0
U37A
+5V
REG
NC
LMBEN1
CLEMB9
U91C
SUB (-)
ADD (+)
A+B
A-B
CLKMA
SUB
LADDCLR11
11 ADDER 0
U97A
MUX
MUXB0
MUXB1
ACC1 MSB
ACC1 LSB
MUX B
U74A
MUXA 0
MUXA 1
MSUM1
ACC0MSB
ACC1MSB
MUX A
FIG.3.22A

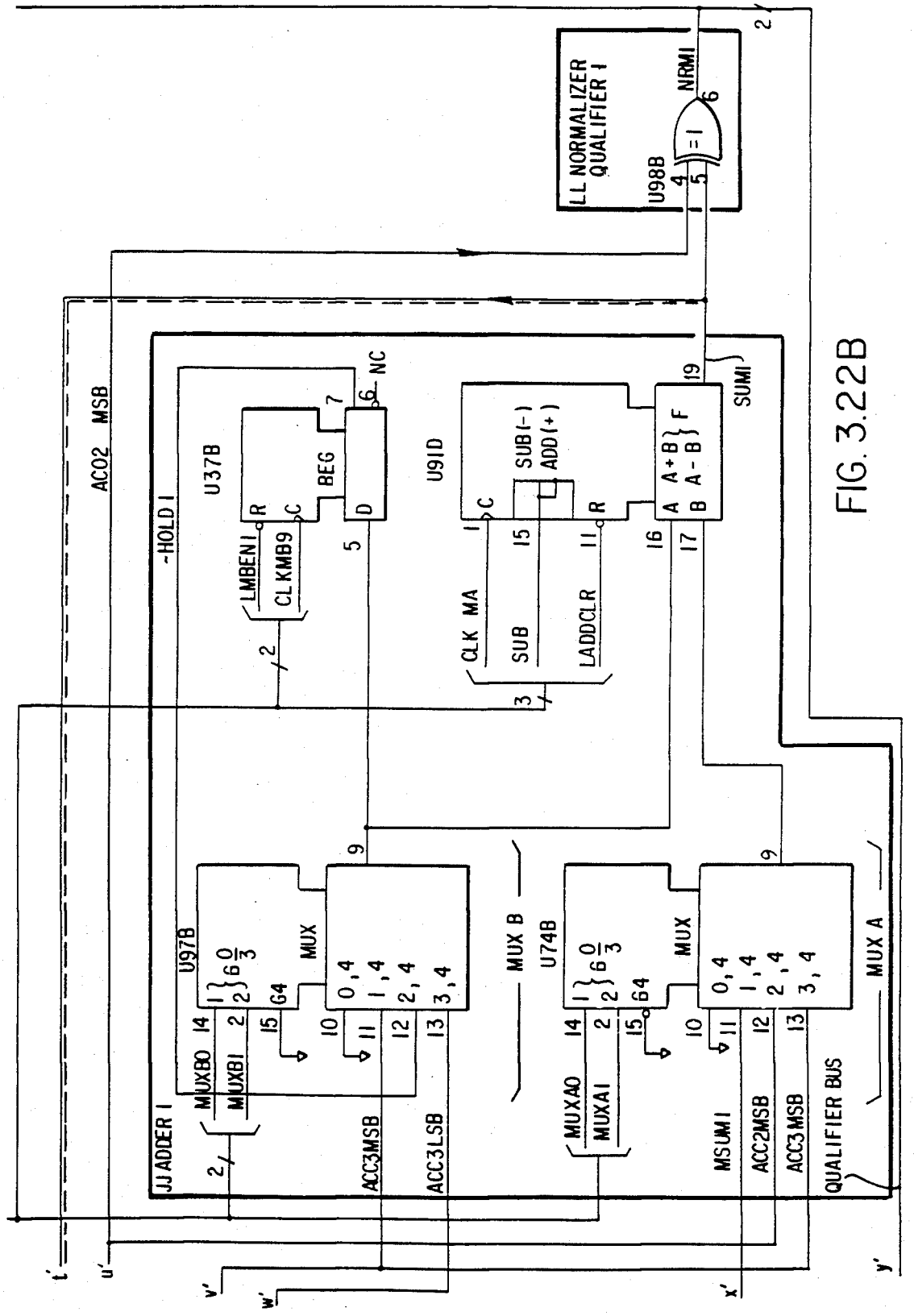

LL NORMALIZER QUALIFIER I
U98B
NRMI
SUMI
ACO2 MSB
-HOLD I
U37B
LMBEN I
CLKMB9
BEG
NC
U91D
SUB(-)
ADD(+)
CLK MA
SUB
LADDCLR
A A+B F
B A-B
JJ ADDER I
U97B
MUXBO
MUXBI
MUX
ACC3MSB
ACC3LSB
MUX B
U74B
MUXAO
MUXAI
MSUMI
ACC2MSB
ACC3MSB
QUALIFIER BUS
MUX A
t'
u'
v'
w'
x'
y'

FIG. 3.22B

A13 BUBBLE MEMORY 147
08510-60013

ACTIVE COMPONENTS PARTS LISTS (U's and Q's)

Reference Designators	Part Number	Manufacturer's Part Number
Q1	1SS40477	2N2222A
Q2, Q3	1855-0423	
U2,4,23,25	1858-0081	17254
U1	1820-2520	75453
U3,24	1820-2815	17250
U5, 19	1820-2817	17242
U7, 17	1820-2807	BUBBLE 1MX1
U8, 16	1820-2818	17230
U9	1820-1197	74LS00
U10	1820-2806	17220
U11	1820-2024	74LS244
U12	1820-1730	74LS273
U13	1820-2075	74LS245
U14	1820-1112	74LS74
U15	1820-1216	74LS138
U20, 21 NOTE 3	1818-0850	PROM4KXS D2732
U22	1820-1144	74LS02

FIG 3.24

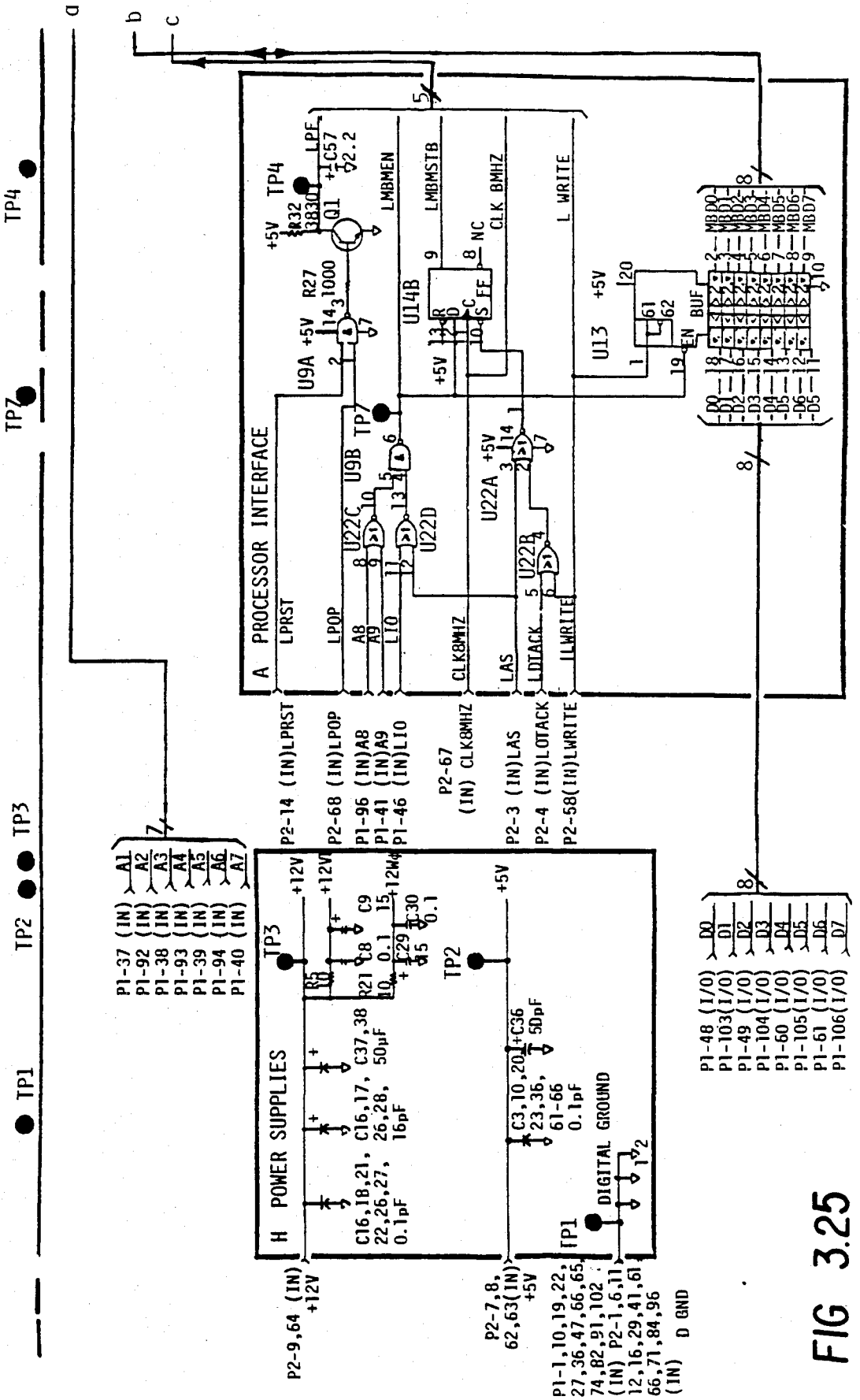

A PROCESSOR INTERFACE
H POWER SUPPLIES
DIGITAL GROUND
LPRST
LPOP
A8
A9
LIO
CLK8MHZ
LAS
LDTACK
LLWRITE
L WRITE
LMBMEN
LMBMSTB
CLK 8MHZ
NC
U9A
U9B
U14B
U22A
U22B
U22C
U22D
U13
BUF
EN
LPF
R27
Q1
TP1
TP2
TP3
TP4
TP7
P1-37 (IN)
P1-92 (IN)
P1-38 (IN)
P1-93 (IN)
P1-39 (IN)
P1-94 (IN)
P1-40 (IN)
P2-14 (IN)LPRST
P2-68 (IN)LPOP
P1-96 (IN)A8
P1-41 (IN)A9
P1-46 (IN)LIO
P2-67 (IN) CLK8MHZ
P2-3 (IN)LAS
P2-4 (IN)LDTACK
P2-58(IN)LWRITE
P2-9,64 (IN) +12V
P2-7,8, 62,63(IN) +5V
P1-1,10,19,22, 27,36,47,66,65, 74,82,91,102 (IN) P2-1,6,11, 12,16,29,41,61, 66,71,84,96 (IN) D GND
P1-48 (I/O)
P1-103(I/O)
P1-49 (I/O)
P1-104(I/O)
P1-60 (I/O)
P1-105(I/O)
P1-61 (I/O)
P1-106(I/O)
MBD0
MBD1
MBD2
MBD3
MBD4
MBD5
MBD6
MBD7

FIG 3.25

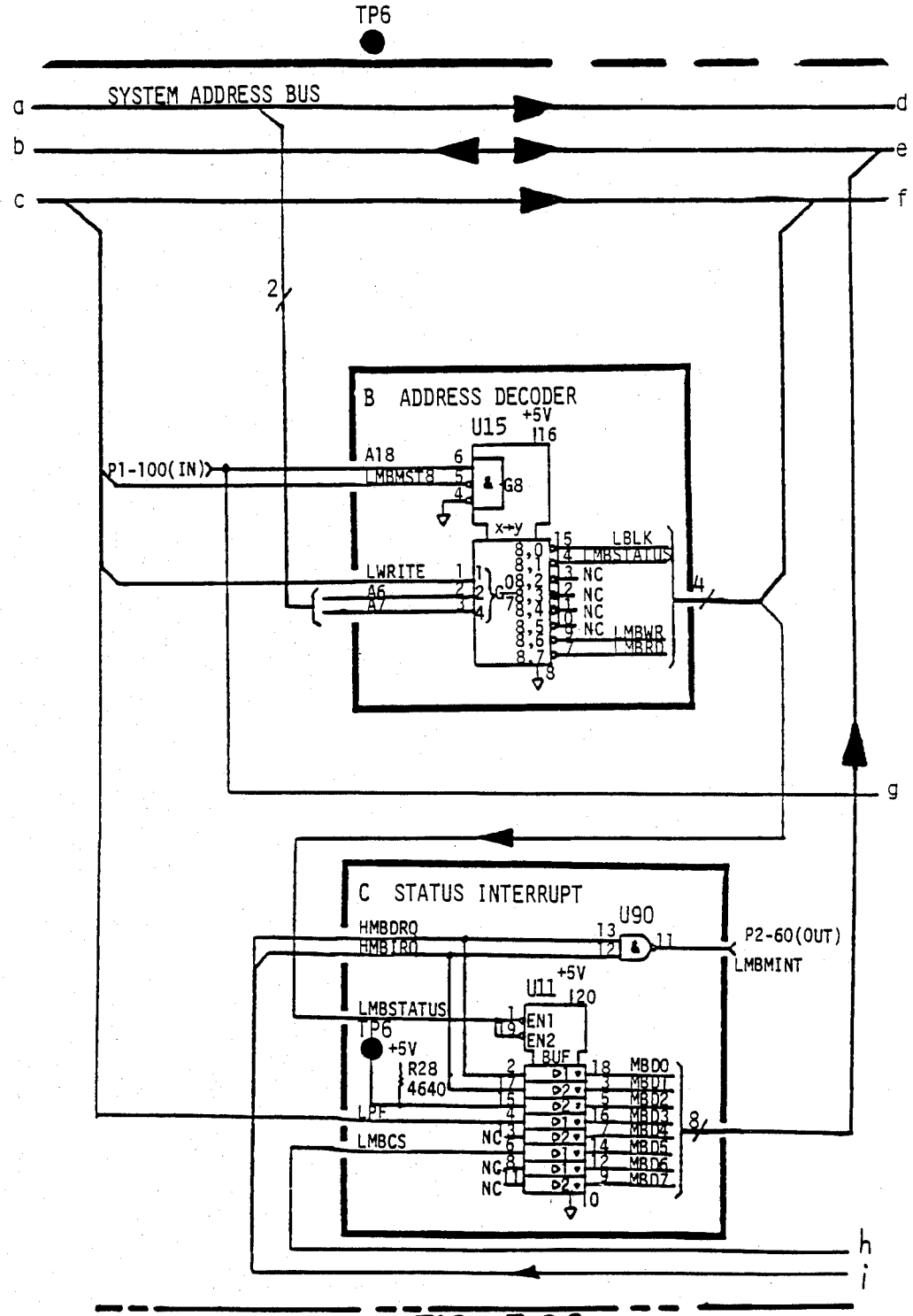

TP6
SYSTEM ADDRESS BUS
a
b
c
d
e
f
g
h
i
2
B ADDRESS DECODER
U15
+5V
16
A18
6
P1-100(IN)
LMBMST8
5
4
G8
x→y
15
LBLK
14
LMBSTATUS
LWRITE
1
1
A6
2
2
A7
3
4
G
8,0
8,1
8,2
8,3
8,4
8,5
8,6
8,7
13
NC
12
NC
11
NC
10
NC
9
LMBWR
7
LMBRD
8
4
C STATUS INTERRUPT
U90
HMBDRQ
HMBIRQ
13
12
11
P2-60(OUT)
LMBMINT
+5V
U11
20
LMBSTATUS
1
19
EN1
EN2
BUF
TP6
+5V
R28
4640
LPF
LMBCS
2
17
5
4
7
6
8
11
NC
NC
18
MBD0
3
MBD1
5
MBD2
16
MBD3
7
MBD4
14
MBD5
12
MBD6
9
MBD7
10
8

FIG 3.26

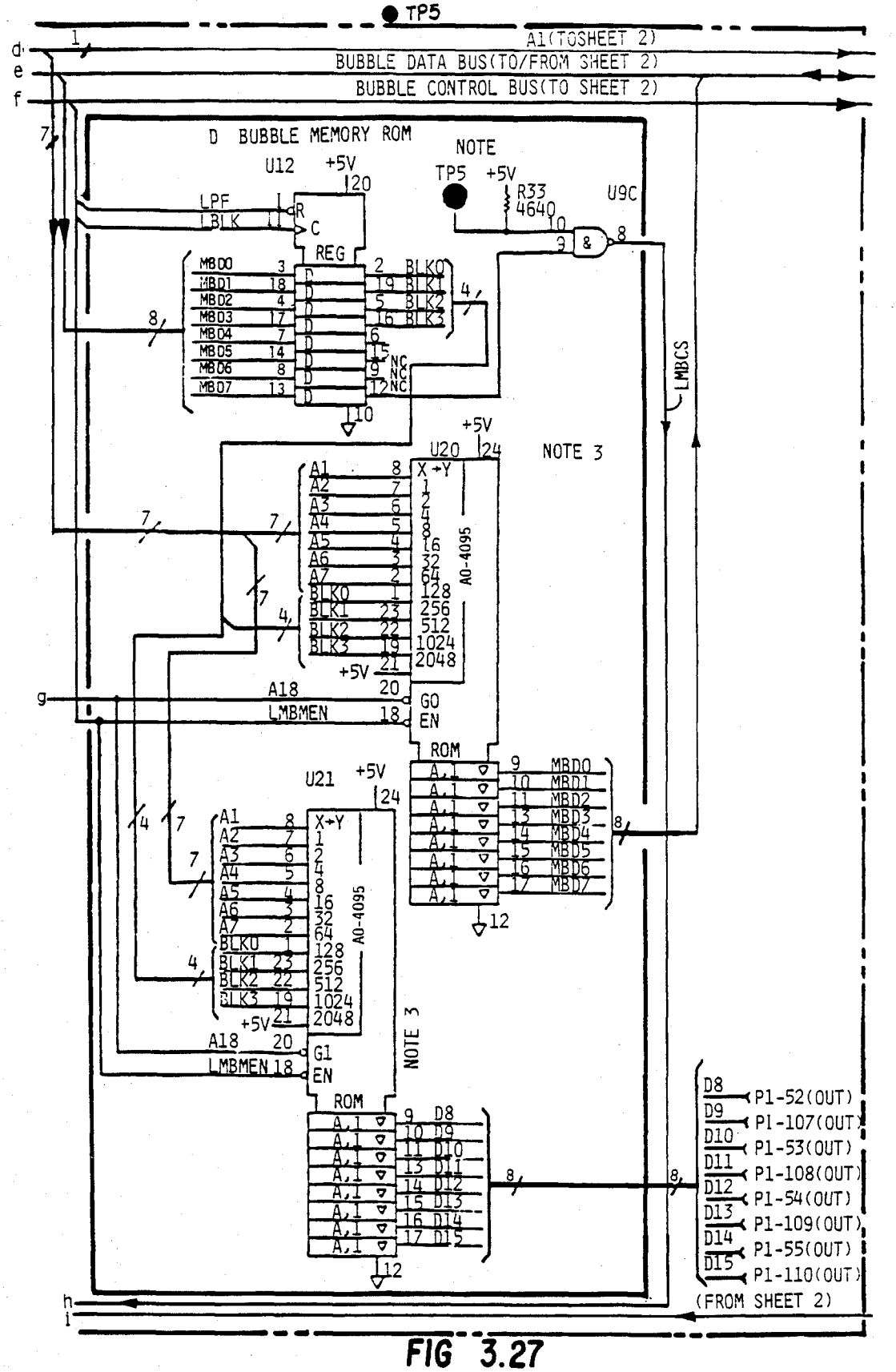

TP5
A1(TOSHEET 2)
BUBBLE DATA BUS(TO/FROM SHEET 2)
BUBBLE CONTROL BUS(TO SHEET 2)
D BUBBLE MEMORY ROM
NOTE
U12 +5V
TP5 +5V
R33 4640
U9C
LPF
BLK
REG
MBD0
MBD1
MBD2
MBD3
MBD4
MBD5
MBD6
MBD7
BLK0
BLK1
BLK2
BLK3
NC
LMBCS
U20
NOTE 3
A1
A2
A3
A4
A5
A6
A7
X→Y
A0-4095
A18
LMBMEN
GO
EN
ROM
MBD0
MBD1
MBD2
MBD3
MBD4
MBD5
MBD6
MBD7
U21
G1
D8
D9
D10
D11
D12
D13
D14
D15
P1-52(OUT)
P1-107(OUT)
P1-53(OUT)
P1-108(OUT)
P1-54(OUT)
P1-109(OUT)
P1-55(OUT)
P1-110(OUT)
(FROM SHEET 2)

FIG 3.27

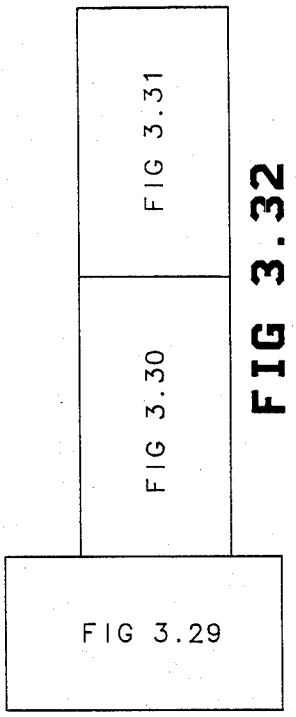


FIG 3.32

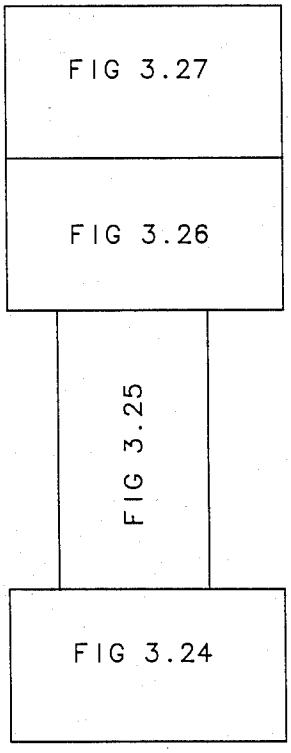


FIG 3.28

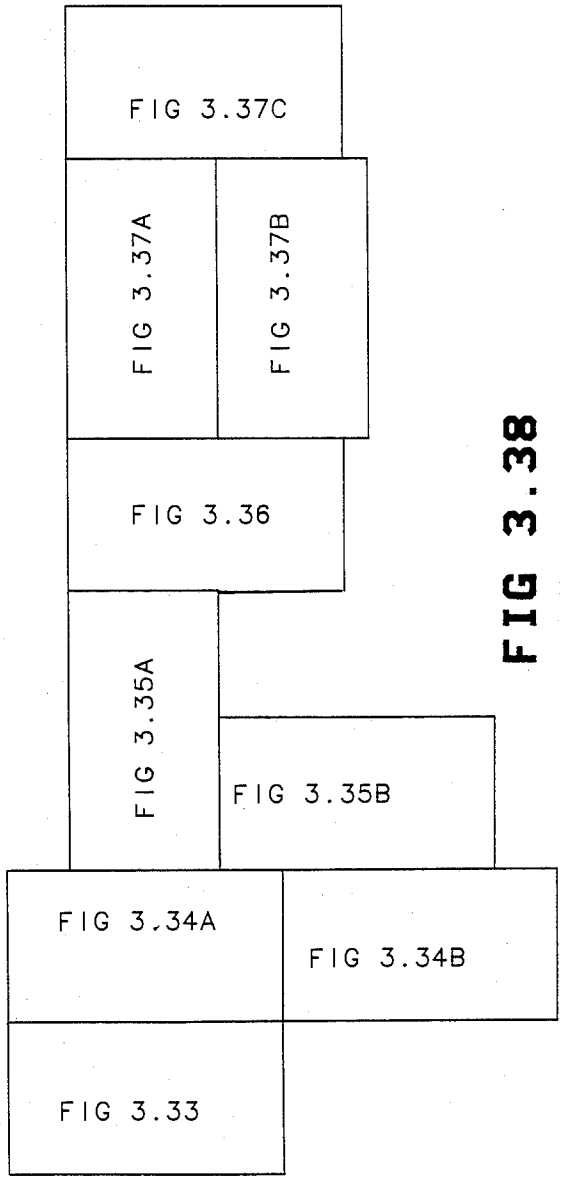


FIG 3.38

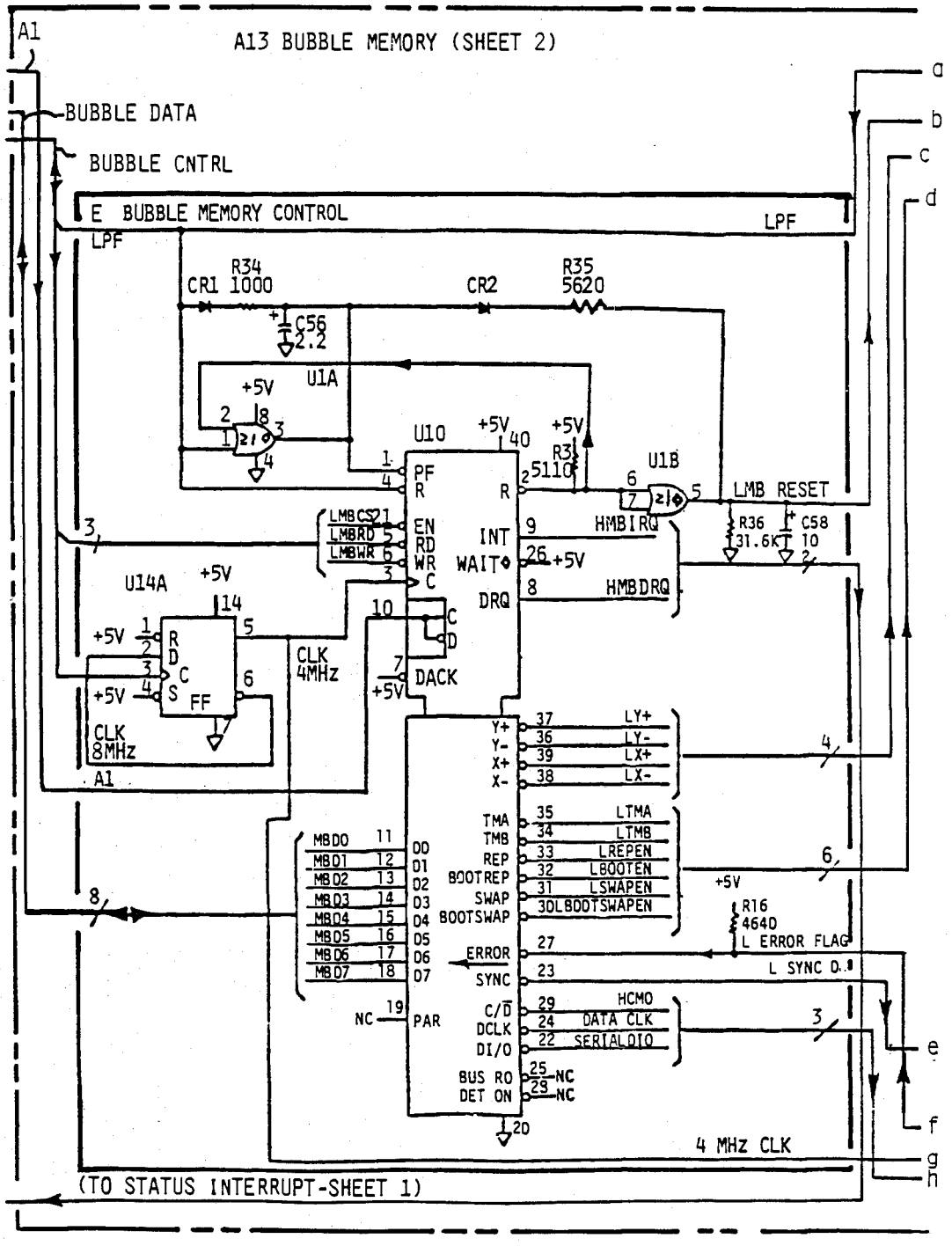

A13 BUBBLE MEMORY (SHEET 2)
A1
BUBBLE DATA
BUBBLE CNTRL
E BUBBLE MEMORY CONTROL
LPF
R34
CR1 1000
CR2
R35
5620
C56
2.2
U1A
+5V
U10
U1B
R3
5110
LMB RESET
HMBIRQ
HMBDRQ
R36
31.6K
C58
10
LMBCS
LMBRD
LMBWR
EN
RD
WR
INT
WAIT
DRQ
DACK
U14A
FF
CLK
4MHz
CLK
8MHz
MBD0
MBD1
MBD2
MBD3
MBD4
MBD5
MBD6
MBD7
DD
D1
D2
D3
D4
D5
D6
D7
NC
PAR
Y+
Y-
X+
X-
LY+
LY-
LX+
LX-
TMA
TMB
REP
BOOTREP
SWAP
BOOTSWAP
LTMA
LTMB
LREPEN
LBOOTEN
LSWAPEN
3DLBOOTSWAPEN
R16
4640
L ERROR FLAG
ERROR
SYNC
L SYNC D.
C/D
DCLK
DI/O
HCMO
DATA CLK
SERIALDIO
BUS RQ
DET ON
4 MHz CLK
(TO STATUS INTERRUPT-SHEET 1)

FIG 3.29

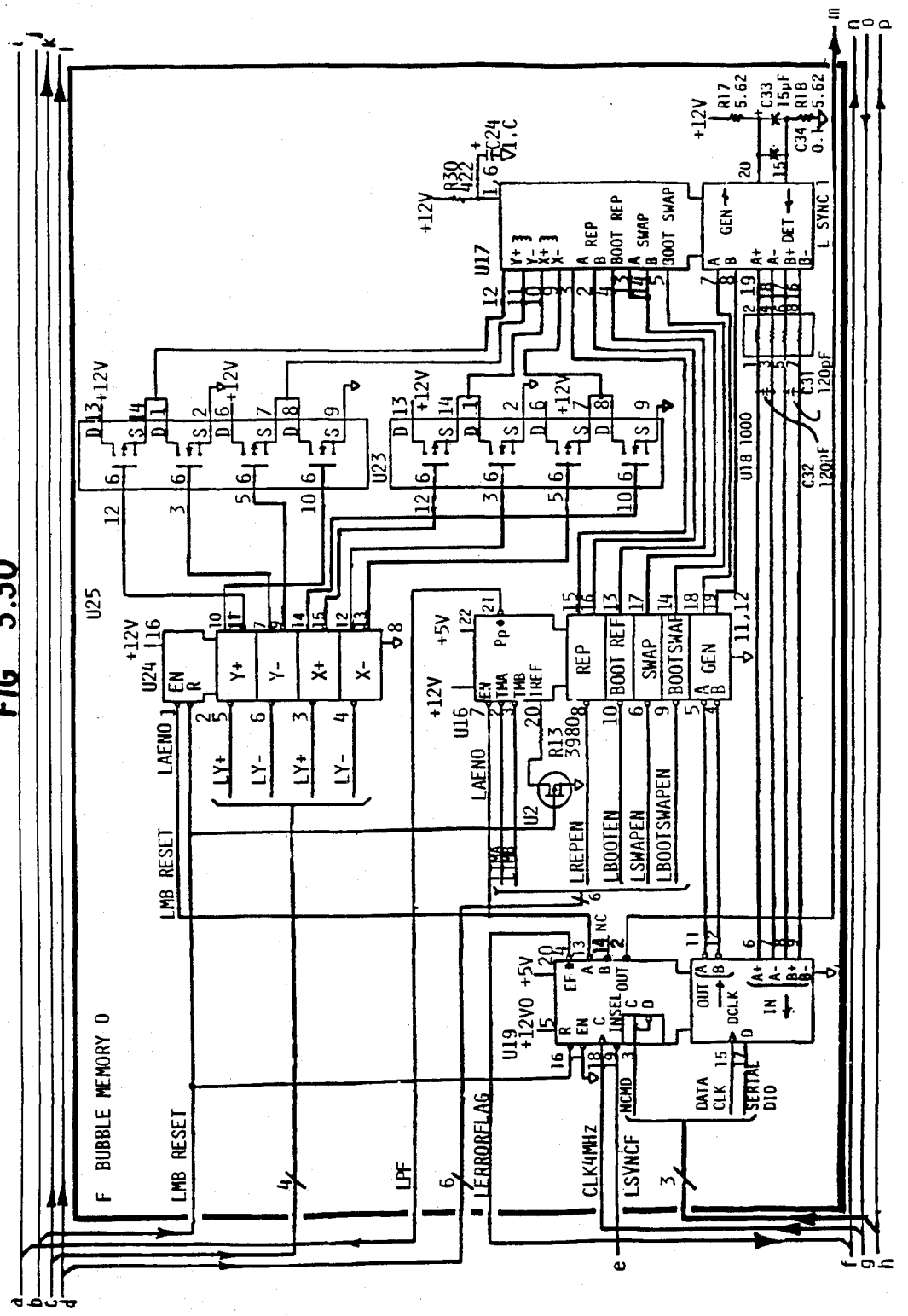
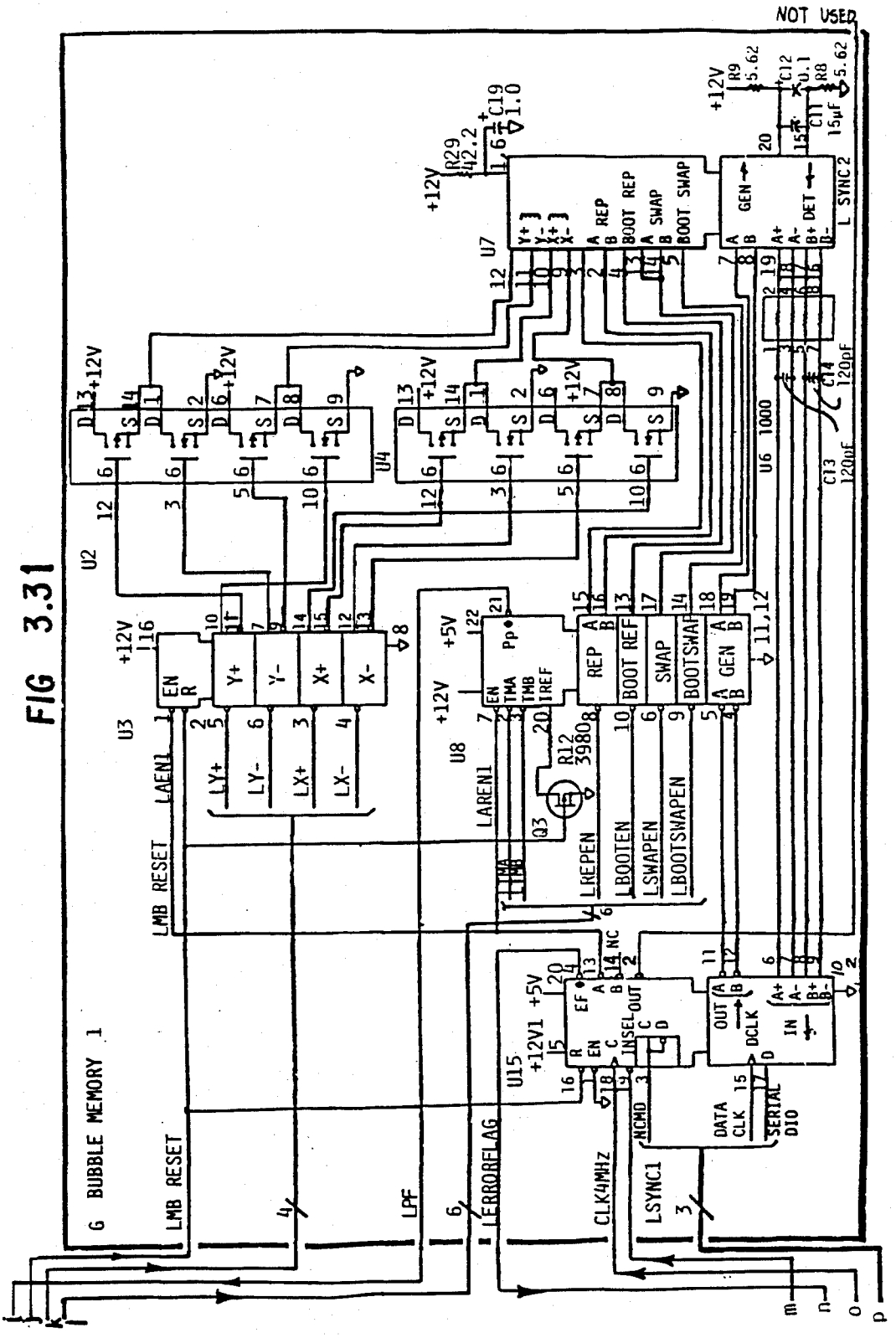

F BUBBLE MEMORY 0
LMB RESET
LPF
LERRORFLAG
CLK4MHz
LSYNCF
SERIAL
DATA
CLK
DIO
U25
U24
U23
U16
U17
U18 1000
U19
+12V
+5V
LAENO
LREPEN
LBOOTEN
LSWAPEN
LBOOTSWAPEN
R13 3980
R30 422
R17 5.62
R18 5.62
C24 1.C
C33 15μF
C34 0.1
C31 120pF
C32 120nF
REP
BOOT REF
SWAP
BOOTSWAP
GEN
L SYNC
BOOT REP
A SWAP
B SWAP
Y+
Y-
X+
X-
LY+
LY-

FIG 3.30


NOT USED
+12V
R29
42.2
C19
1.0
U7
Y+
Y-
X+
X-
A REP
B REP
BOOT REP
A SWAP
B SWAP
BOOT SWAP
GEN
DET
L SYNC2
R9
5.62
C12
0.1
R8
5.62
C11
15μF
U6
1000
C14
120pF
C13
120uF
U4
U2
U3
EN
R
Y+
Y-
X+
X-
LY+
LY-
LX+
LX-
LAEN1
LMB RESET
U8
+5V
EN
TMA
TMB
TREF
REP
BOOT REF
SWAP
BOOTSWAP
A GEN
B GEN
11,12
R12
3980
Q3
LAREN1
LREPEN
LBOOTEN
LSWAPEN
LBOOTSWAPEN
U15
+12V1
R
EN
C
INSEL
EF
NC
OUT
IN
DCLK
A+
A-
B+
B-
NCMD
DATA
CLK
SERIAL
DIO
LSYNC1
CLK4MHz
LERRORFLAG
LPF
6 BUBBLE MEMORY 1
LMB RESET
FIG 3.31

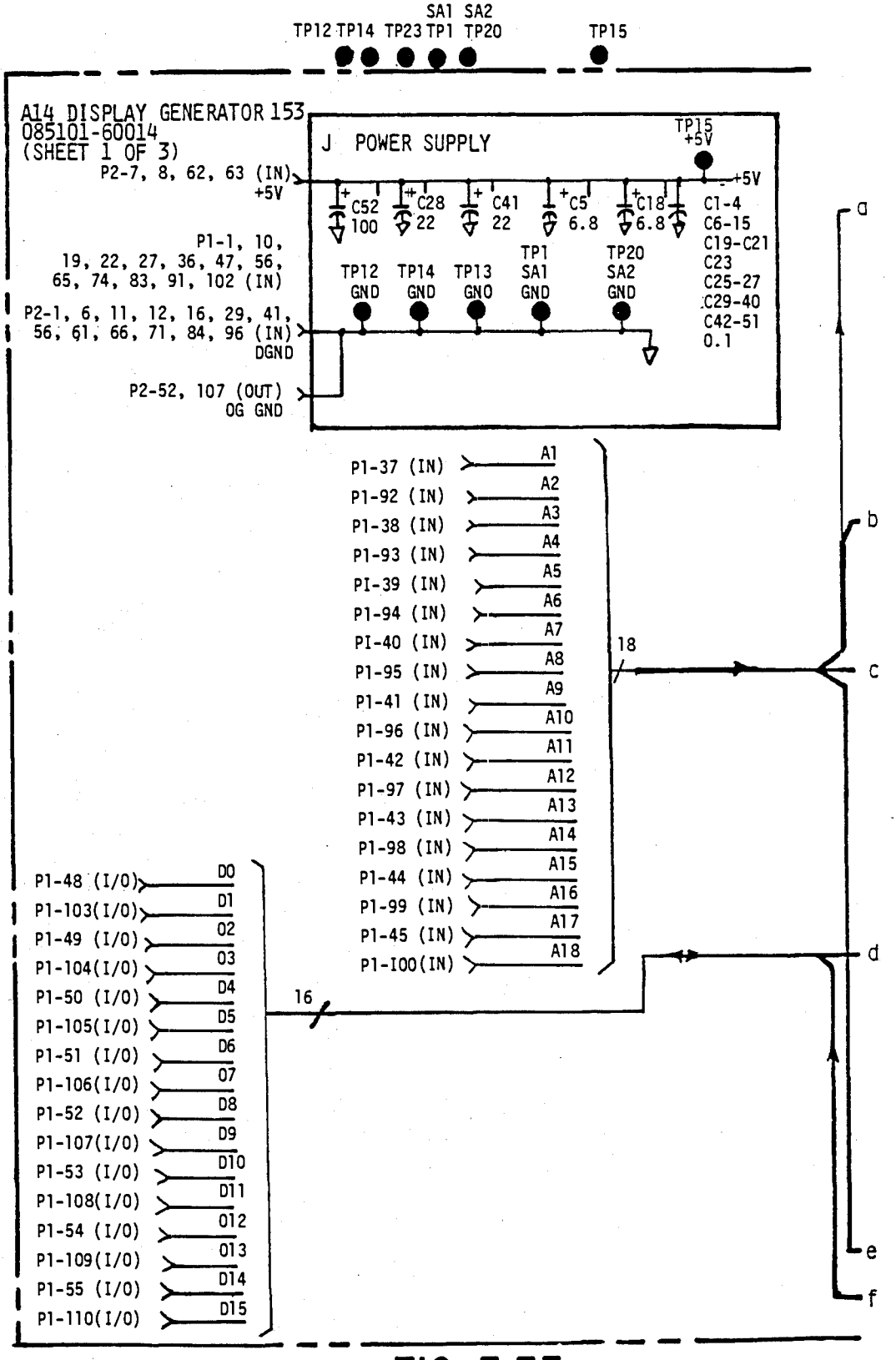
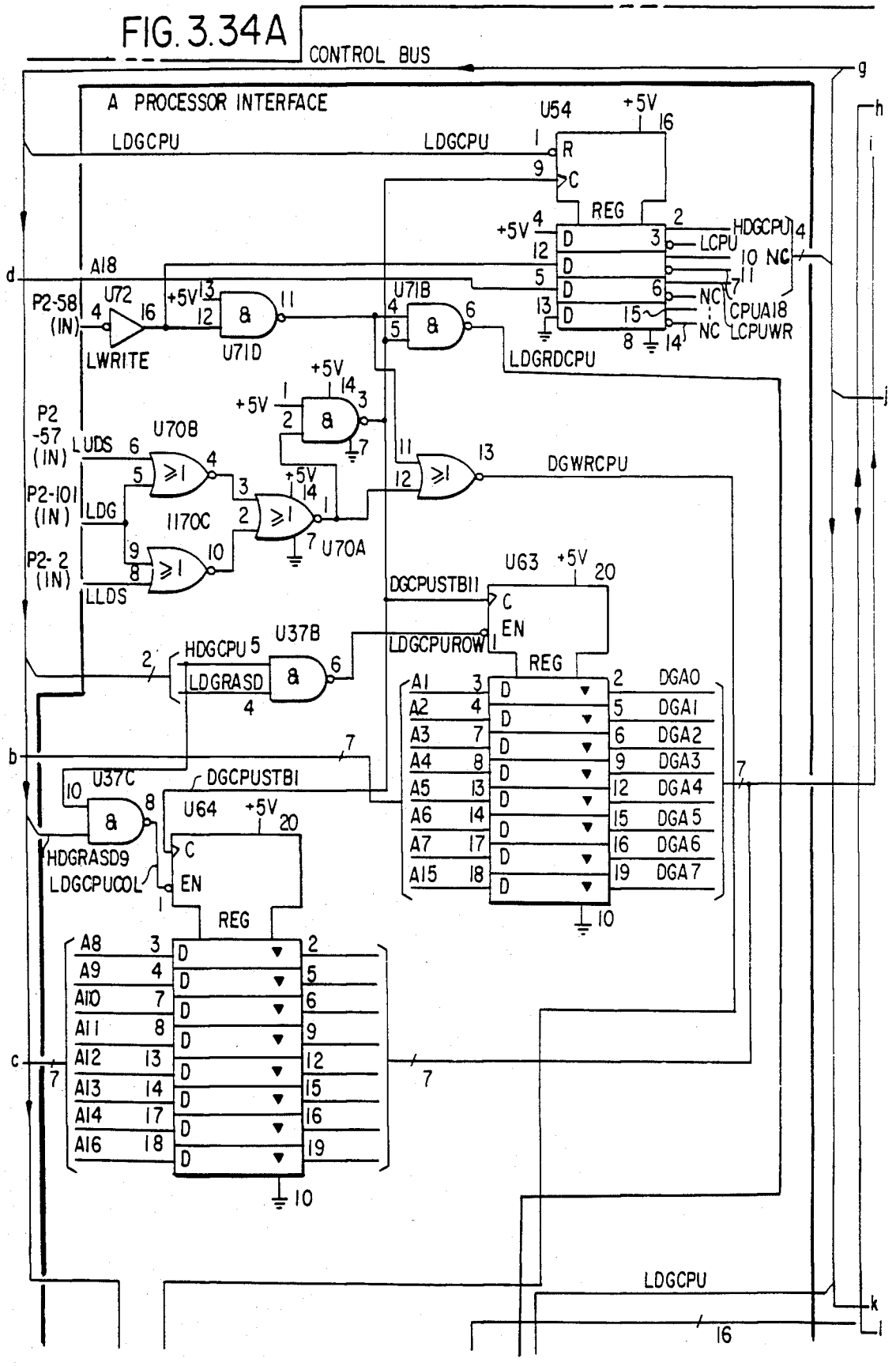

SA1 SA2
TP12 TP14 TP23 TP1 TP20
TP15
A14 DISPLAY GENERATOR 153
085101-60014
(SHEET 1 OF 3)
J POWER SUPPLY
TP15
+5V
P2-7, 8, 62, 63 (IN)
+5V
C52 100
C28 22
C41 22
C5 6.8
C18 6.8
C1-4
C6-15
C19-C21
C23
C25-27
C29-40
C42-51
0.1
P1-1, 10, 19, 22, 27, 36, 47, 56, 65, 74, 83, 91, 102 (IN)
TP12 GND
TP14 GND
TP13 GND
TP1 SA1 GND
TP20 SA2 GND
P2-1, 6, 11, 12, 16, 29, 41, 56, 61, 66, 71, 84, 96 (IN)
DGND
P2-52, 107 (OUT)
OG GND
P1-37 (IN) A1
P1-92 (IN) A2
P1-38 (IN) A3
P1-93 (IN) A4
PI-39 (IN) A5
P1-94 (IN) A6
PI-40 (IN) A7
P1-95 (IN) A8
P1-41 (IN) A9
P1-96 (IN) A10
P1-42 (IN) A11
P1-97 (IN) A12
P1-43 (IN) A13
P1-98 (IN) A14
P1-44 (IN) A15
P1-99 (IN) A16
P1-45 (IN) A17
P1-I00(IN) A18
18
P1-48 (I/0) D0
P1-103(I/0) D1
P1-49 (I/0) 02
P1-104(I/0) 03
P1-50 (I/0) D4
P1-105(I/0) D5
P1-51 (I/0) D6
P1-106(I/0) 07
P1-52 (I/0) D8
P1-107(I/0) D9
P1-53 (I/0) D10
P1-108(I/0) D11
P1-54 (I/0) 012
P1-109(I/0) 013
P1-55 (I/0) D14
P1-110(I/0) D15
16
a
b
c
d
e
f

FIG 3.33

FIG. 3.34A


CONTROL BUS
A PROCESSOR INTERFACE
LDGCPU
LDGCPU
U54
+5V
REG
HDGCPU
LCPU
NC
CPUA18
LCPUWR
A18
P2-58 (IN)
U72
LWRITE
U71D
U71B
LDGRDCPU
P2 -57 (IN)
LUDS
U70B
P2-101 (IN)
LDG
1170C
U70A
P2-2 (IN)
LLDS
DGWRCPU
U63
DGCPUSTBII
LDGCPUROW
HDGCPU
U37B
LDGRASD
DGA0
DGA1
DGA2
DGA3
DGA4
DGA5
DGA6
DGA7
U37C
DGCPUSTBI
U64
HDGRASD9
LDGCPUCOL
A8
A9
A10
A11
A12
A13
A14
A16
A15
A1
A2
A3
A4
A5
A6
A7

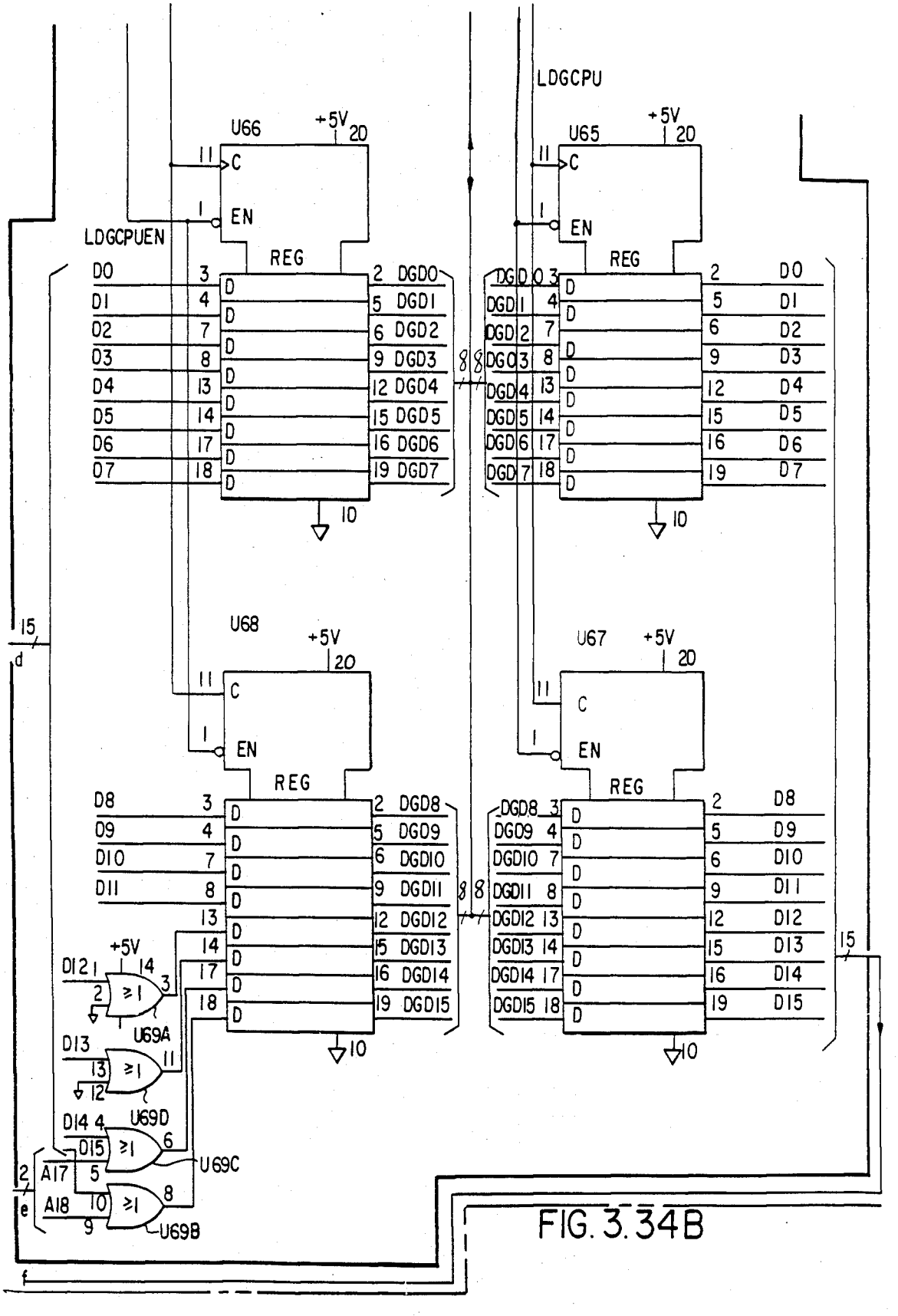

LDGCPU
U66
U65
U68
U67
+5V
20
C
EN
LDGCPUEN
REG
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
A17
A18
DGD0
DGD1
DGD2
DGD3
DGD4
DGD5
DGD6
DGD7
DGD8
DGD9
DGD10
DGD11
DGD12
DGD13
DGD14
DGD15
10
15
U69A
U69B
U69C
U69D
≥1

FIG. 3.34B

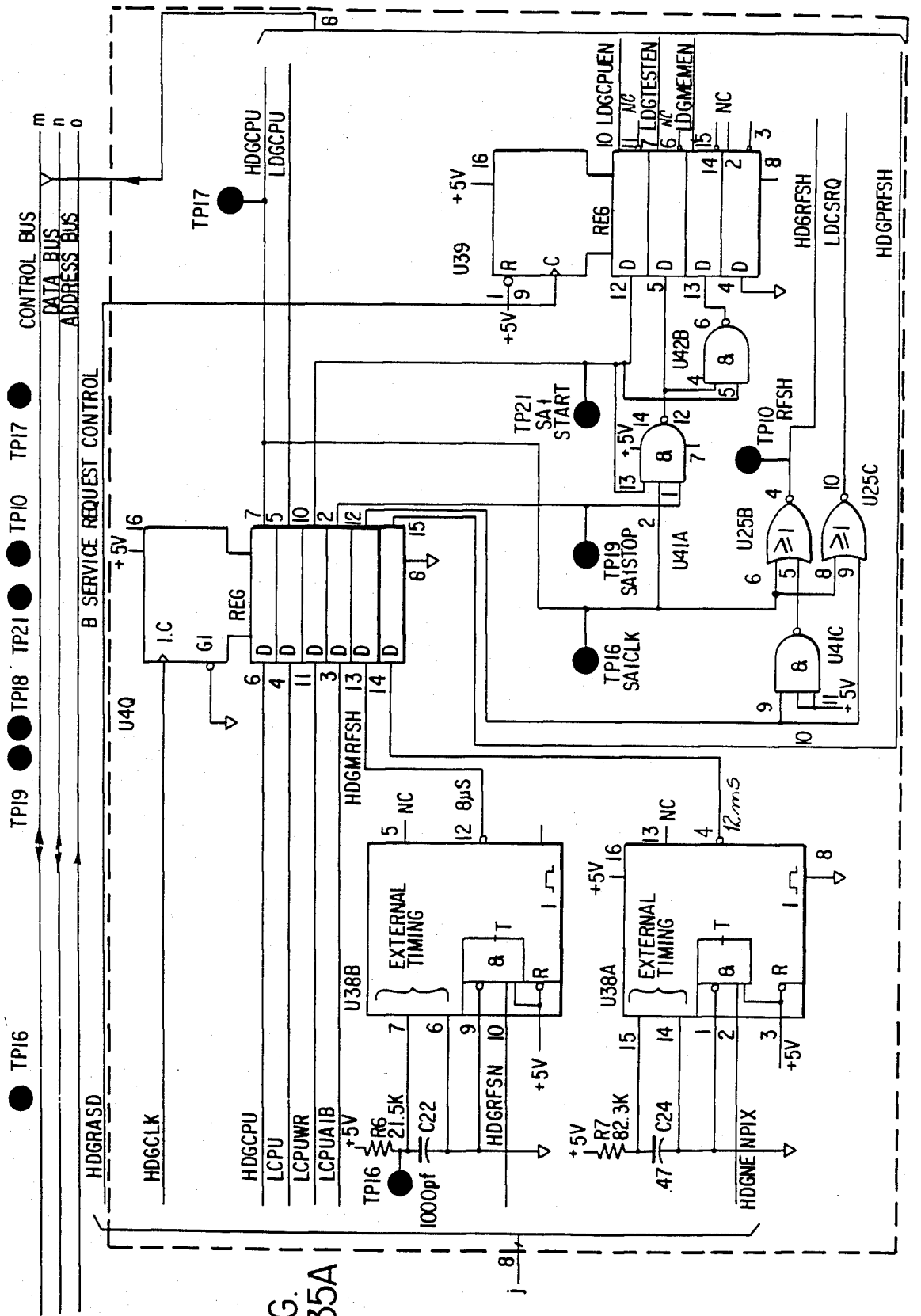

TP16
TP19
TP18
TP21
TP10
TP17
CONTROL BUS
DATA BUS
ADDRESS BUS
B SERVICE REQUEST CONTROL
HDGRASD
HDGCLK
HDGCPU
LCPU
LCPUWR
LCPUAIB
HDGMRFSH
HDGRFSN
HDGNE
NPIX
HDGPRFSH
LDCSRQ
HDGRFSH
LDGCPU
LDGCPUEN
LDGTESTEN
LDGMEMEN
RFSH
TP21 SA1 START
TP19 SA1STOP
TP16 SA1CLK
U38B
U38A
U39
U40
U41A
U41C
U42B
U25B
U25C
EXTERNAL TIMING
REG
R6 21.5K
R7 82.3K
C22
C24
1000pf
.47
8µS
12ms
+5V

FIG. 335A

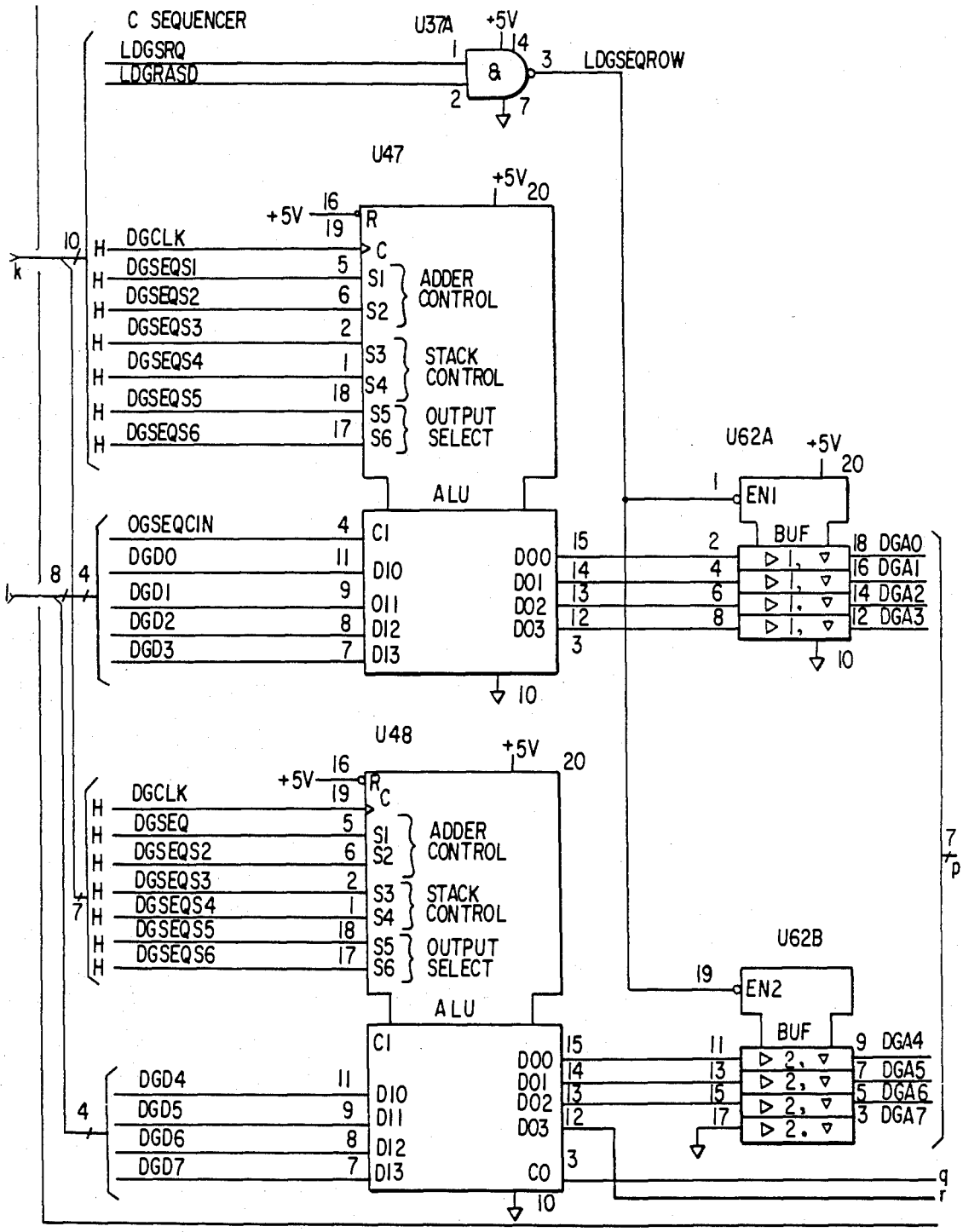

C SEQUENCER
LDGSRQ
LDGRASD
U37A
+5V
LDGSEQROW
U47
DGCLK
DGSEQSI
DGSEQS2
DGSEQS3
DGSEQS4
DGSEQS5
DGSEQS6
ADDER CONTROL
STACK CONTROL
OUTPUT SELECT
ALU
OGSEQCIN
DGD0
DGD1
DGD2
DGD3
U62A
BUF
DGA0
DGA1
DGA2
DGA3
U48
DGSEQ
DGD4
DGD5
DGD6
DGD7
U62B
DGA4
DGA5
DGA6
DGA7

FIG. 3.35B

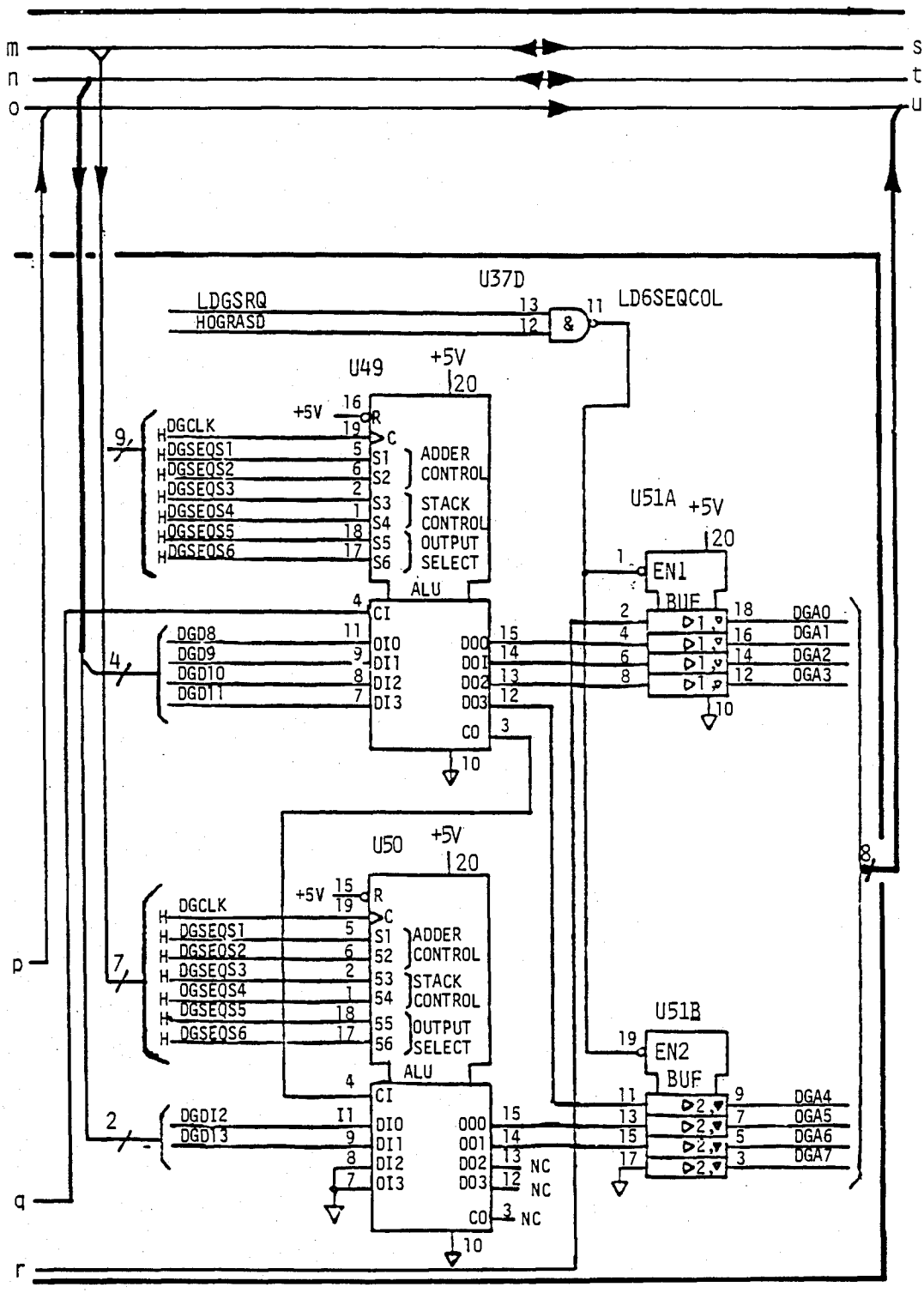

m
n
o
s
t
u
U37D
LDGSRQ
HOGRASD
LD6SEQCOL
U49
+5V
DGCLK
DGSEQS1
DGSEQS2
DGSEQS3
DGSEQS4
DGSEQS5
DGSEQS6
ADDER CONTROL
STACK CONTROL
OUTPUT SELECT
ALU
DGD8
DGD9
DGD10
DGD11
U51A
EN1
BUF
DGA0
DGA1
DGA2
DGA3
U50
DGDI2
DGDI3
U51B
EN2
DGA4
DGA5
DGA6
DGA7
NC
p
q
r

FIG 3.36

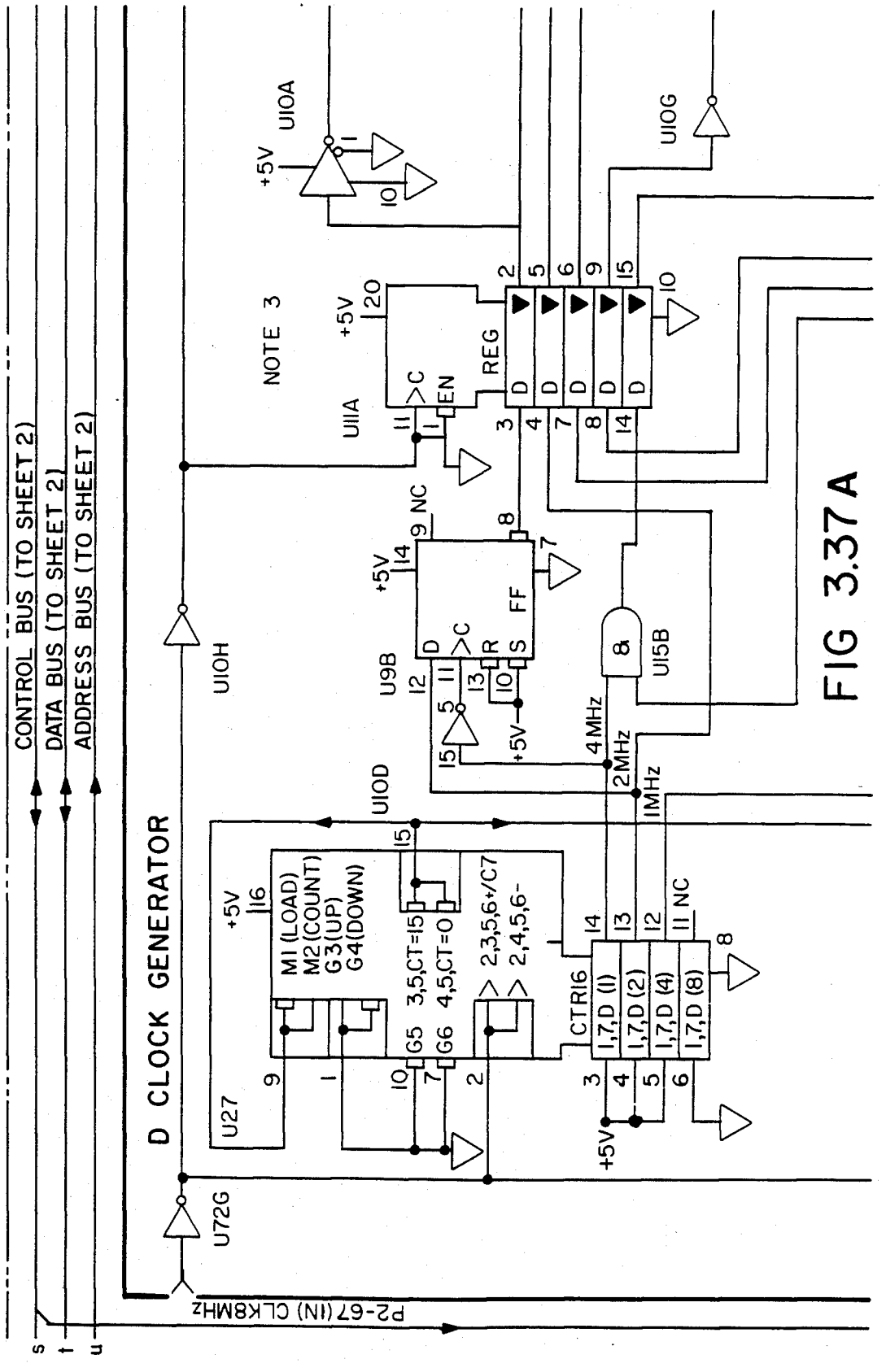

CONTROL BUS (TO SHEET 2)
DATA BUS (TO SHEET 2)
ADDRESS BUS (TO SHEET 2)
D CLOCK GENERATOR
U72G
P2-67(IN) CLK8MHz
U27
M1(LOAD)
M2(COUNT)
G3(UP)
G4(DOWN)
3,5,CT=15
4,5,CT=0
2,3,5,6+/C7
2,4,5,6-
CTR16
1,7,D(1)
1,7,D(2)
1,7,D(4)
1,7,D(8)
U10H
U9B
D
C
R
S
FF
NC
U15B
4MHz
2MHz
1MHz
U10D
U11A
EN
REG
NOTE 3
U10A
U10G
+5V

FIG 3.37A

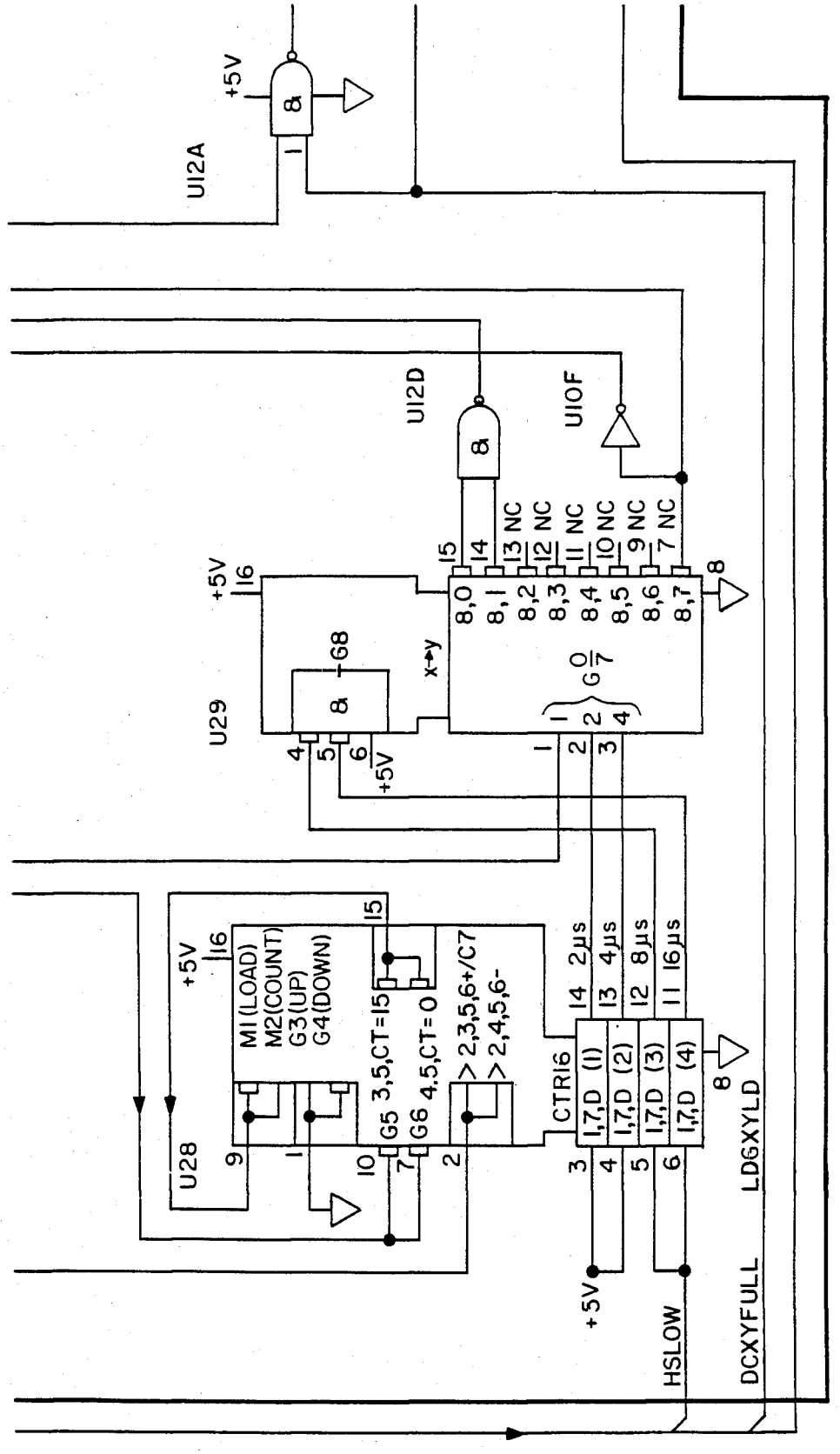

U12A
+5V
U12D
U10F
U29
U28
8,0
8,1
8,2
8,3
8,4
8,5
8,6
8,7
M1(LOAD)
M2(COUNT)
G3(UP)
G4(DOWN)
3,5,CT=15
4,5,CT=0
> 2,3,5,6+/C7
> 2,4,5,6-
CTR16
2µs
4µs
8µs
16µs
HSLOW
DCXYFULL
LDGXYLD

FIG 3.37B

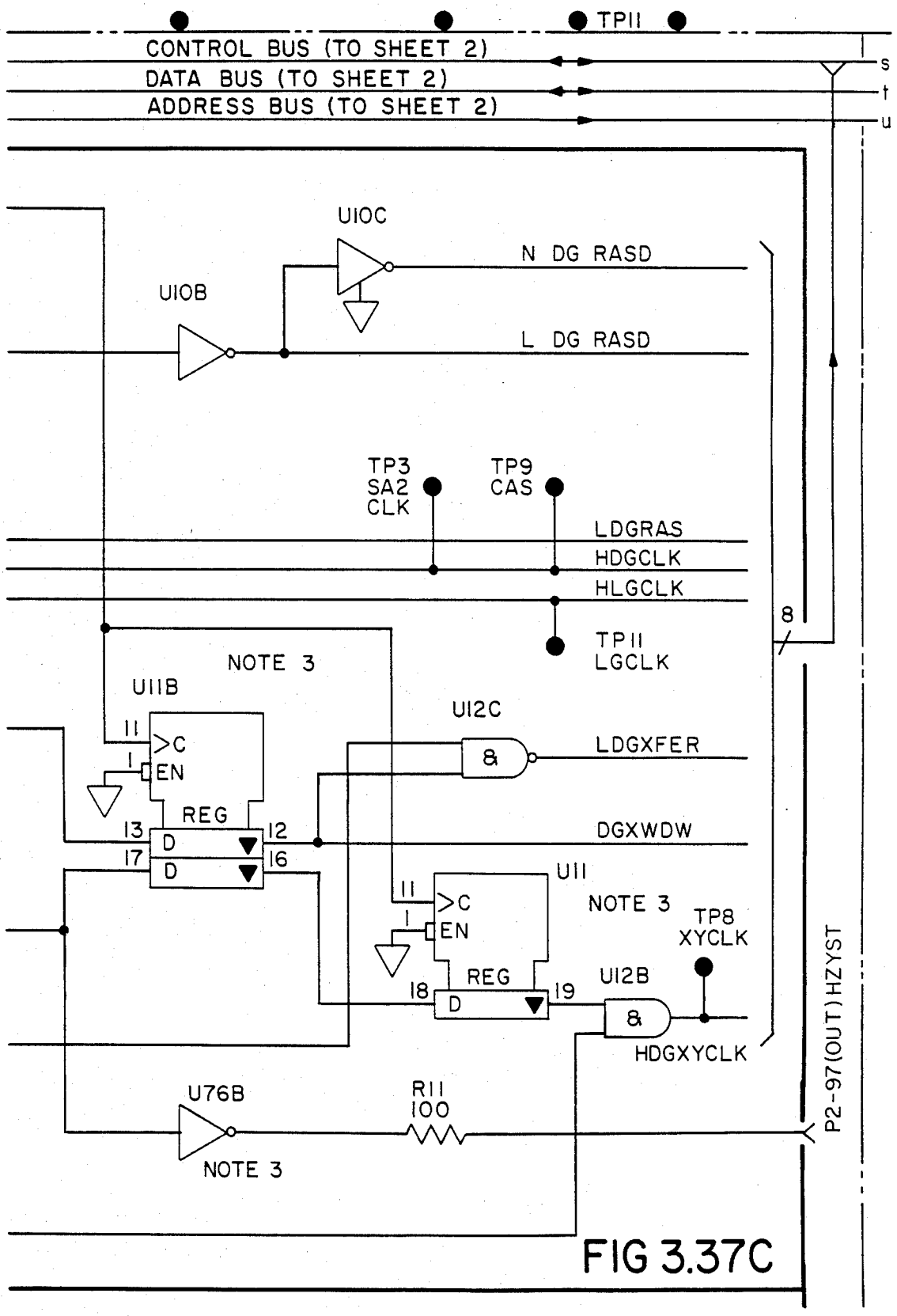

TP11
CONTROL BUS (TO SHEET 2)
DATA BUS (TO SHEET 2)
ADDRESS BUS (TO SHEET 2)
s
t
u
U10C
N DG RASD
U10B
L DG RASD
TP3
SA2
CLK
TP9
CAS
LDGRAS
HDGCLK
HLGCLK
TP11
LGCLK
8
NOTE 3
U11B
11
>C
1
EN
REG
13
D
12
17
D
16
U12C
&
LDGXFER
DGXWDW
U11
NOTE 3
11
>C
1
EN
REG
18
D
19
TP8
XYCLK
U12B
&
HDGXYCLK
U76B
NOTE 3
R11
100
P2-97(OUT)HZYST

FIG 3.37C

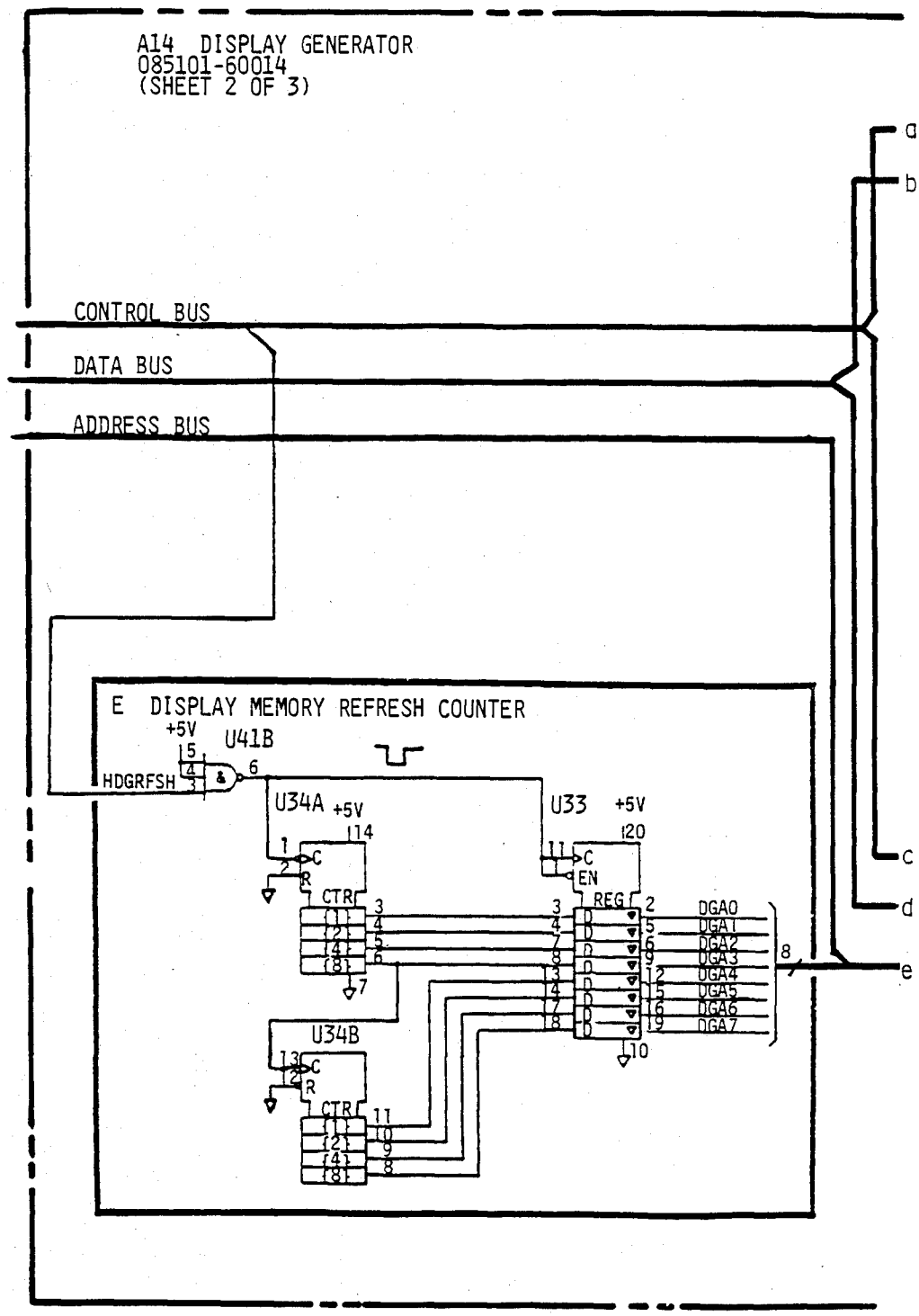

A14 DISPLAY GENERATOR
085101-60014
(SHEET 2 OF 3)
a
b
CONTROL BUS
DATA BUS
ADDRESS BUS
E DISPLAY MEMORY REFRESH COUNTER
+5V
U41B
HDGRFSH
U34A +5V
U33 +5V
CTR
REG
U34B
DGA0
DGA1
DGA2
DGA3
DGA4
DGA5
DGA6
DGA7
c
d
e

FIG 3.39

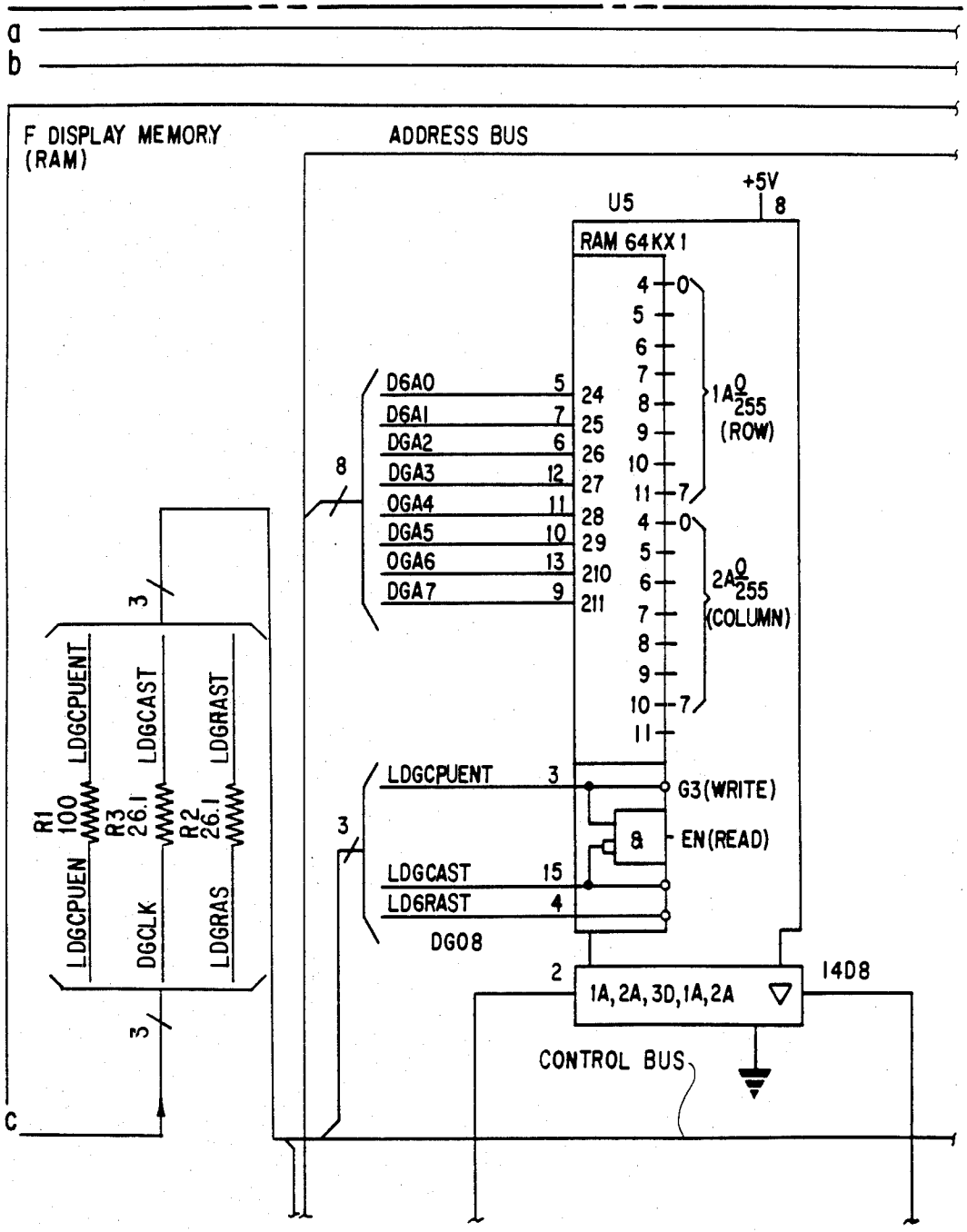

a
b
F DISPLAY MEMORY (RAM)
ADDRESS BUS
U5
+5V
8
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0 255 (ROW)
2A 0 255 (COLUMN)
D6A0
D6A1
DGA2
DGA3
OGA4
DGA5
OGA6
DGA7
5
7
6
12
11
10
13
9
24
25
26
27
28
29
210
211
8
3
LDGCPUENT
LDGCAST
LDGRAST
R1 100
R3 26.1
R2 26.1
LDGCPUEN
DGCLK
LDGRAS
G3(WRITE)
EN(READ)
LDGCAST
LD6RAST
15
4
DG08
2
1A, 2A, 3D, 1A, 2A
14D8
CONTROL BUS
c

FIG. 3.40A

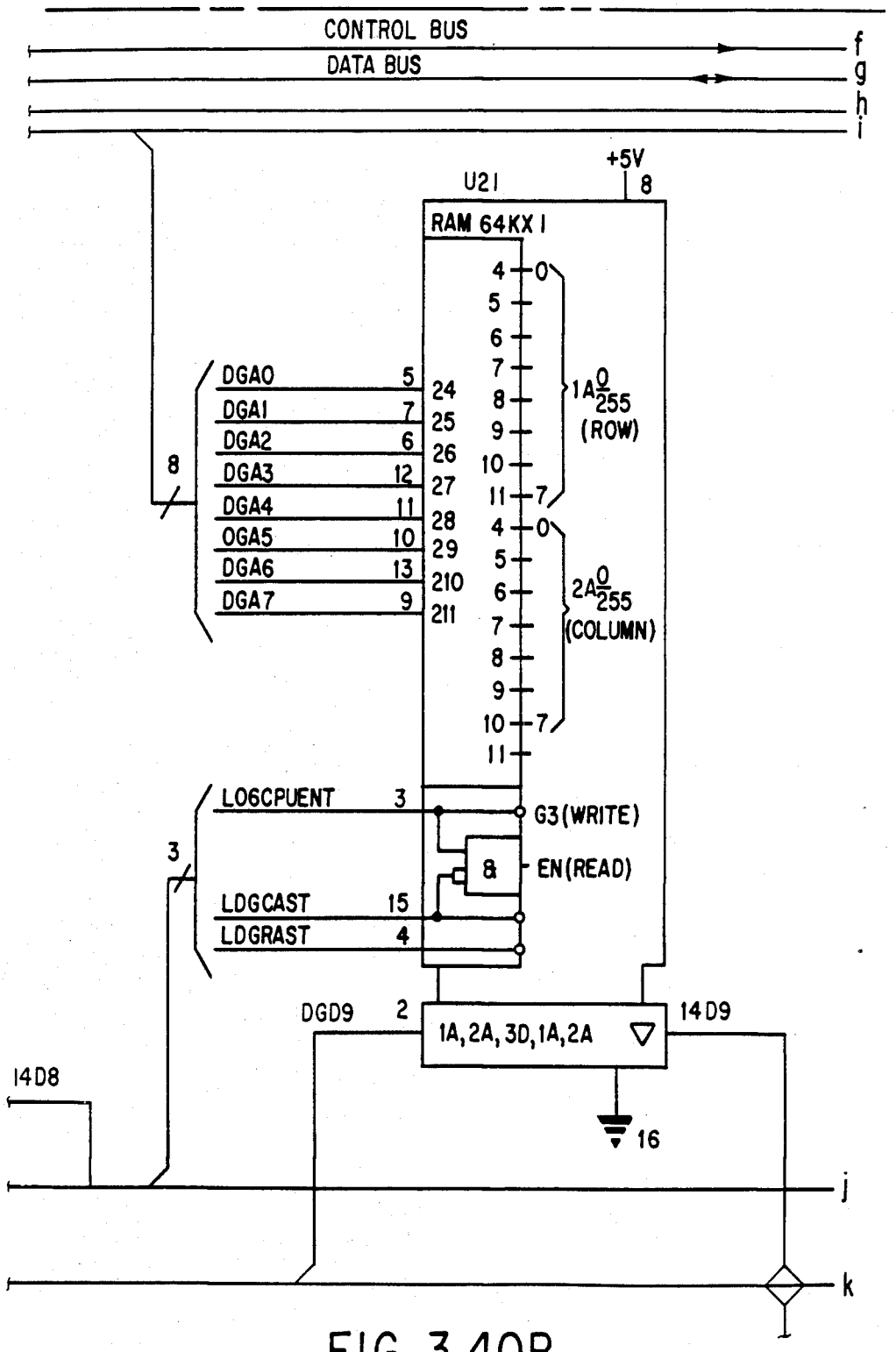

CONTROL BUS
DATA BUS
f
g
h
i
+5V
8
U21
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255 (COLUMN)
DGA0 5 24
DGA1 7 25
DGA2 6 26
DGA3 12 27
DGA4 11 28
OGA5 10 29
DGA6 13 210
DGA7 9 211
8
LO6CPUENT 3
G3(WRITE)
&
EN(READ)
3
LDGCAST 15
LDGRAST 4
DGD9 2
1A,2A,3D,1A,2A
14D9
14D8
16
j
k

FIG. 3.40B

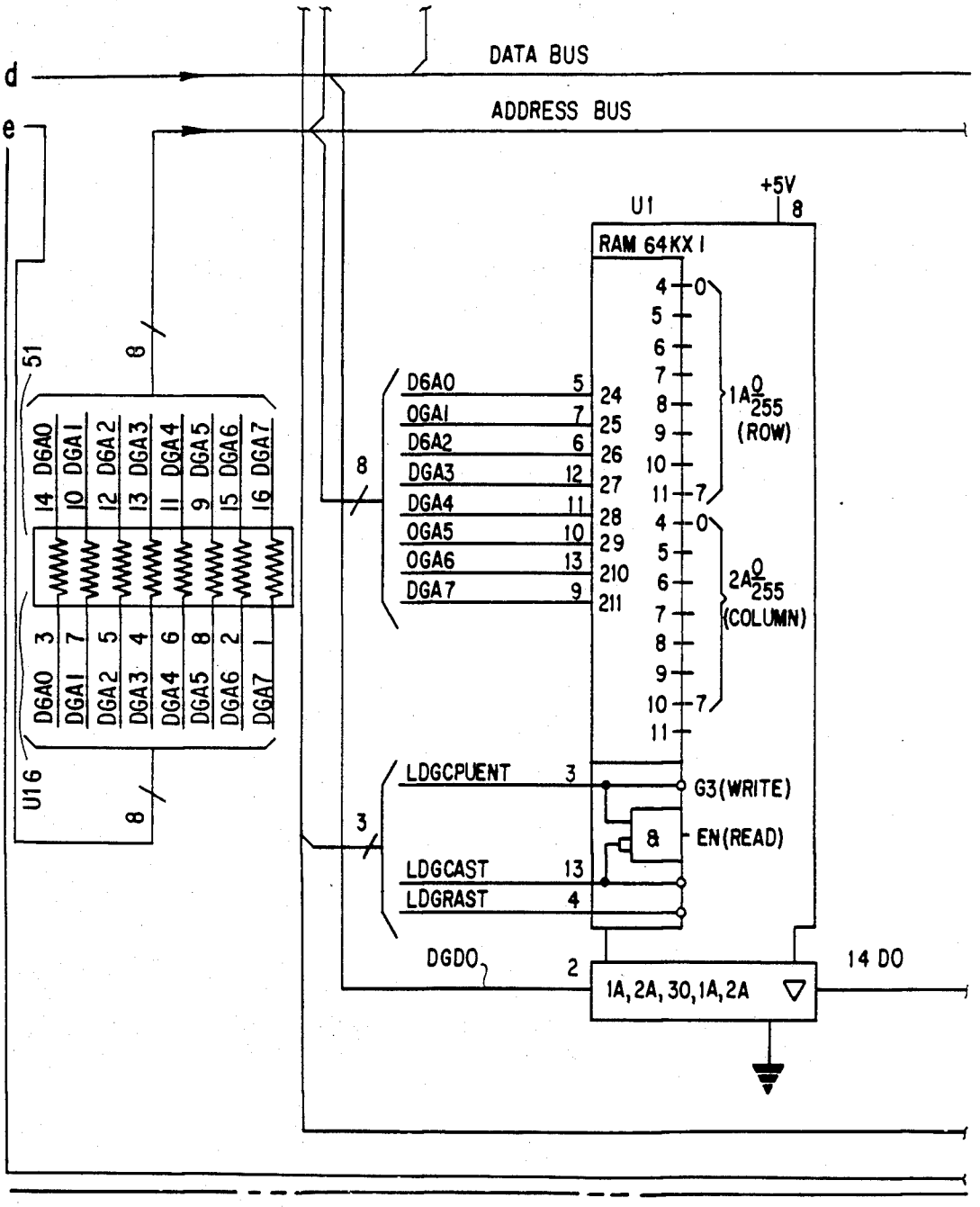

DATA BUS
ADDRESS BUS
d
e
U1
+5V
8
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
2A 0/255 (COLUMN)
D6A0
OGA1
D6A2
DGA3
DGA4
OGA5
OGA6
DGA7
5
7
6
12
11
10
13
9
24
25
26
27
28
29
210
211
8
51
U16
LDGCPUENT
LDGCAST
LDGRAST
3
13
4
G3(WRITE)
EN(READ)
&
DGDO
2
1A,2A,30,1A,2A
14 DO

FIG. 3.40C

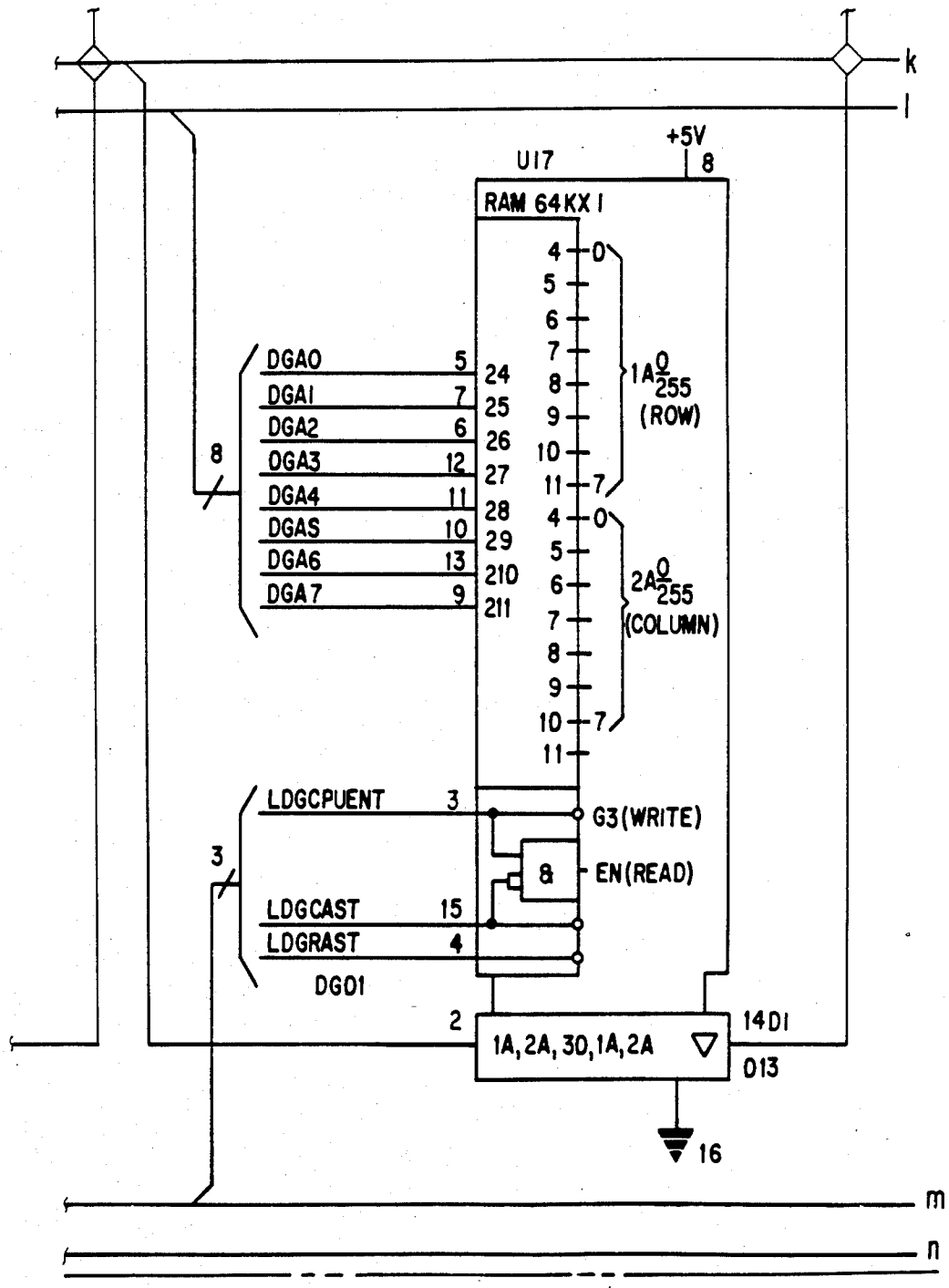

k
l
+5V
U17
8
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255 (COLUMN)
DGA0
DGA1
DGA2
DGA3
DGA4
DGA5
DGA6
DGA7
5
7
6
12
11
10
13
9
24
25
26
27
28
29
210
211
8
LDGCPUENT
3
G3(WRITE)
3
8
EN(READ)
LDGCAST
15
LDGRAST
4
DG01
2
1A, 2A, 30, 1A, 2A
14D1
013
16
m
n

FIG. 3.40D

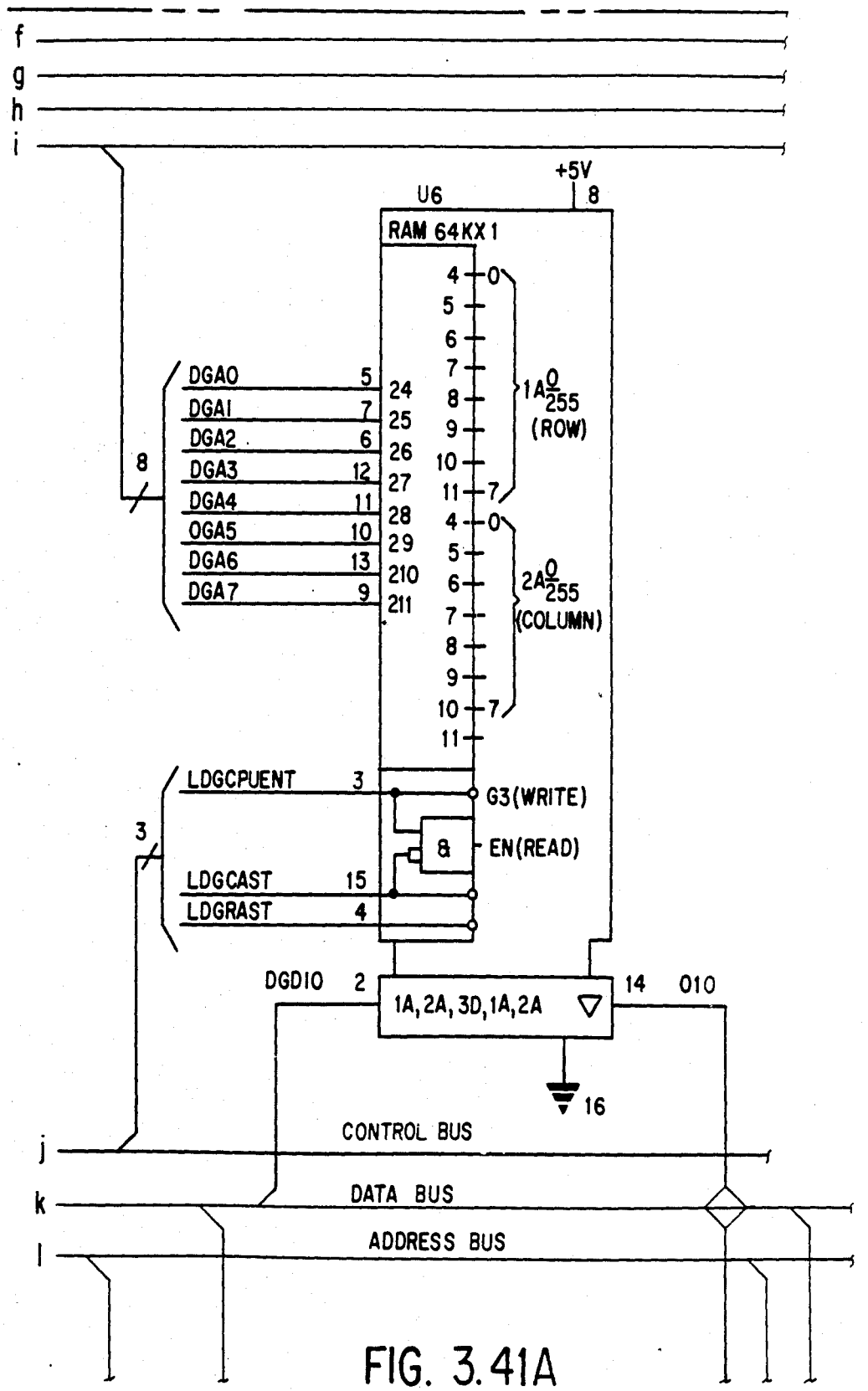

f
g
h
i
+5V
U6
8
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255 (COLUMN)
DGA0 5
DGA1 7
DGA2 6
DGA3 12
DGA4 11
OGA5 10
DGA6 13
DGA7 9
24
25
26
27
28
29
210
211
8
LDGCPUENT 3
G3(WRITE)
8
EN(READ)
3
LDGCAST 15
LDGRAST 4
DGDIO 2
1A, 2A, 3D, 1A, 2A
14
010
16
CONTROL BUS
DATA BUS
ADDRESS BUS
j
k
l

FIG. 3.41A

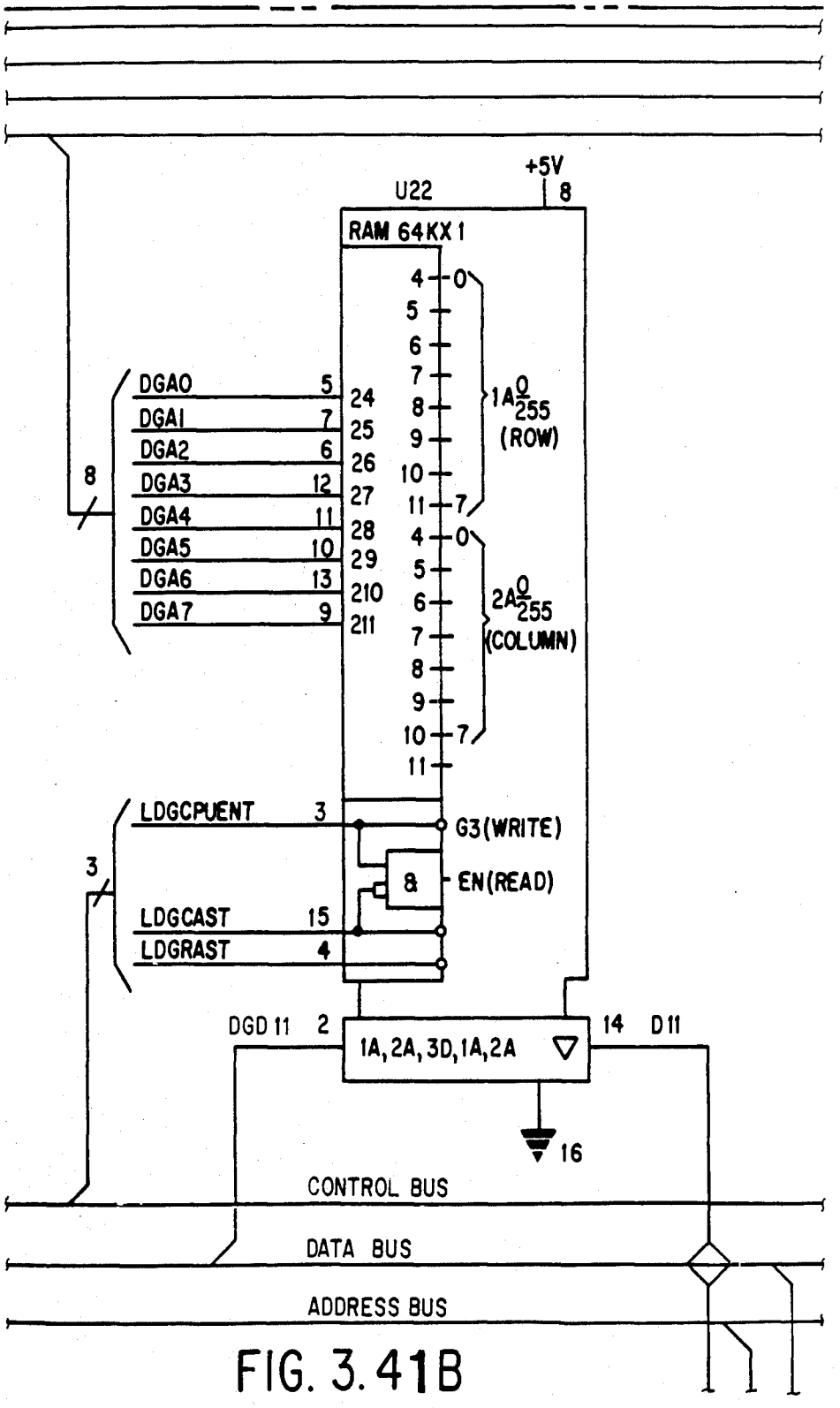

+5V
U22
8
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255 (COLUMN)
DGA0 5 24
DGA1 7 25
DGA2 6 26
DGA3 12 27
DGA4 11 28
DGA5 10 29
DGA6 13 210
DGA7 9 211
8
LDGCPUENT 3
G3(WRITE)
8
EN(READ)
3
LDGCAST 15
LDGRAST 4
DGD 11 2
1A, 2A, 3D, 1A, 2A
14 D11
16
CONTROL BUS
DATA BUS
ADDRESS BUS

FIG. 3.41B

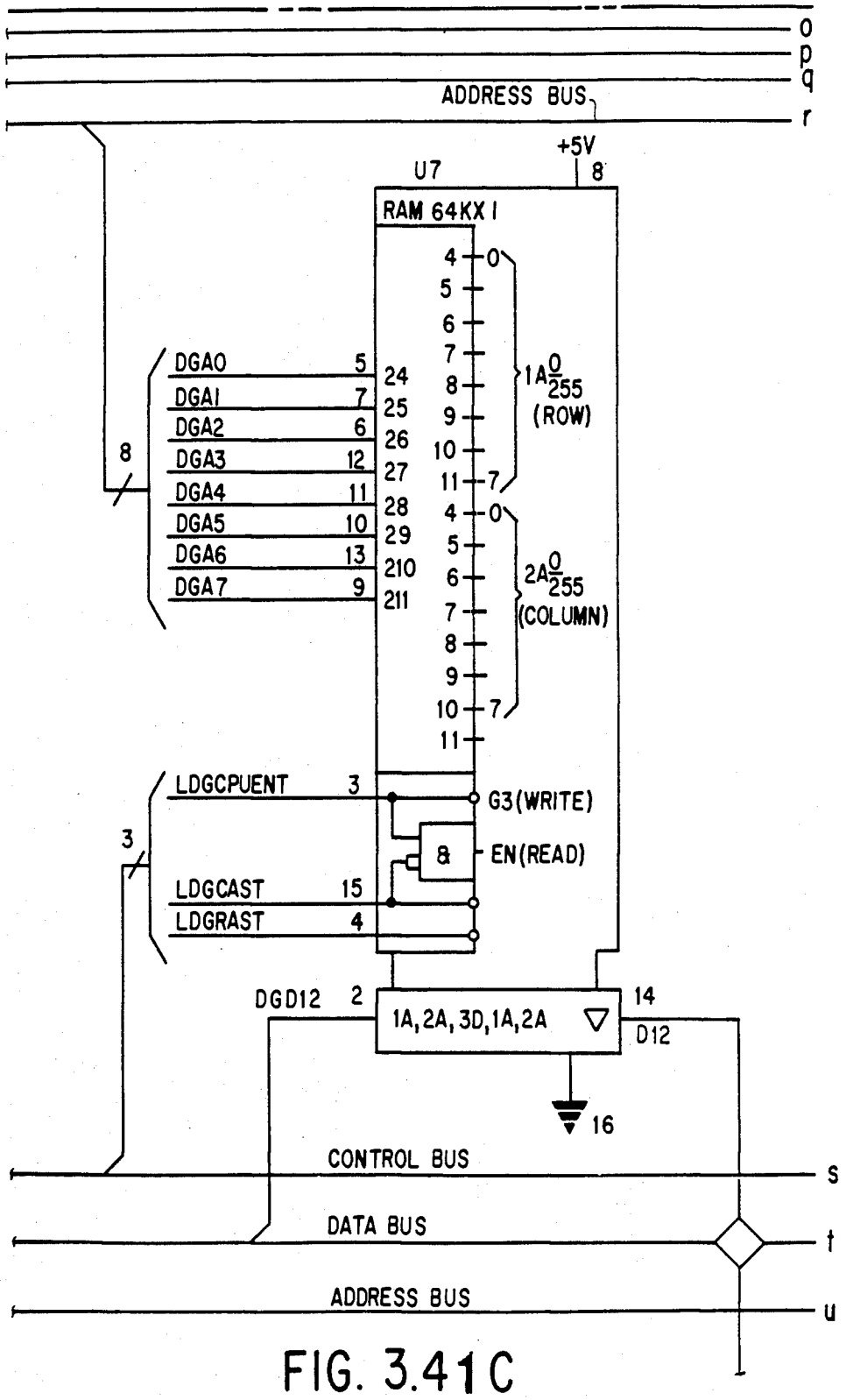

o
p
q
ADDRESS BUS
r
+5V
U7
8
RAM 64KX I
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255 (COLUMN)
DGA0 5 24
DGA1 7 25
DGA2 6 26
DGA3 12 27
DGA4 11 28
DGA5 10 29
DGA6 13 210
DGA7 9 211
8
LDGCPUENT 3
G3(WRITE)
&
EN(READ)
3
LDGCAST 15
LDGRAST 4
DGD12 2
1A,2A,3D,1A,2A
14
D12
16
CONTROL BUS
s
DATA BUS
t
ADDRESS BUS
u

FIG. 3.41C

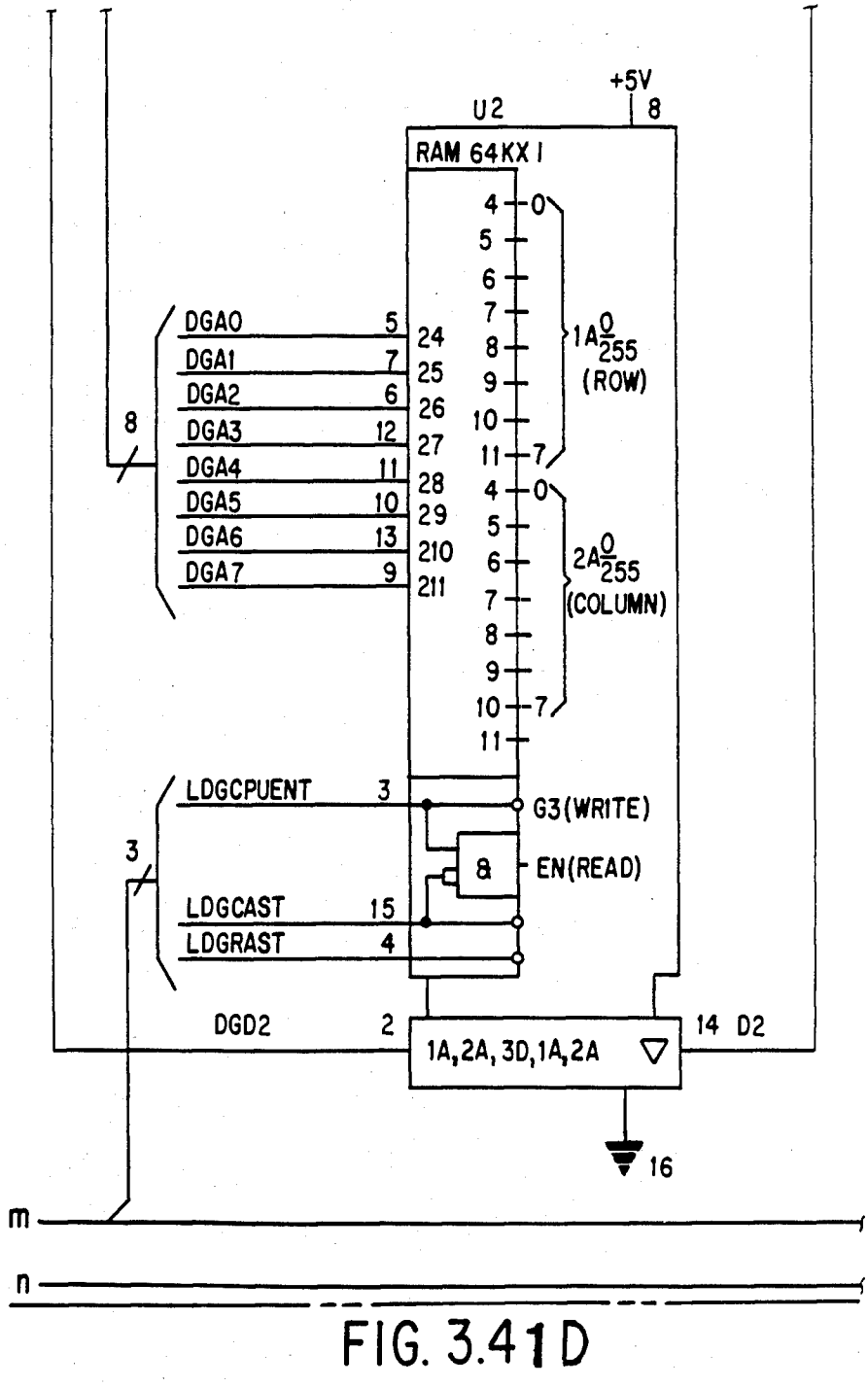

U2
+5V
8
RAM 64KX I
DGA0
DGA1
DGA2
DGA3
DGA4
DGA5
DGA6
DGA7
5
7
6
12
11
10
13
9
24
25
26
27
28
29
210
211
8
1A 0/255 (ROW)
2A 0/255 (COLUMN)
LDGCPUENT
3
G3(WRITE)
EN(READ)
LDGCAST
15
LDGRAST
4
DGD2
2
1A,2A,3D,1A,2A
14 D2
16
m
n

FIG. 3.41D

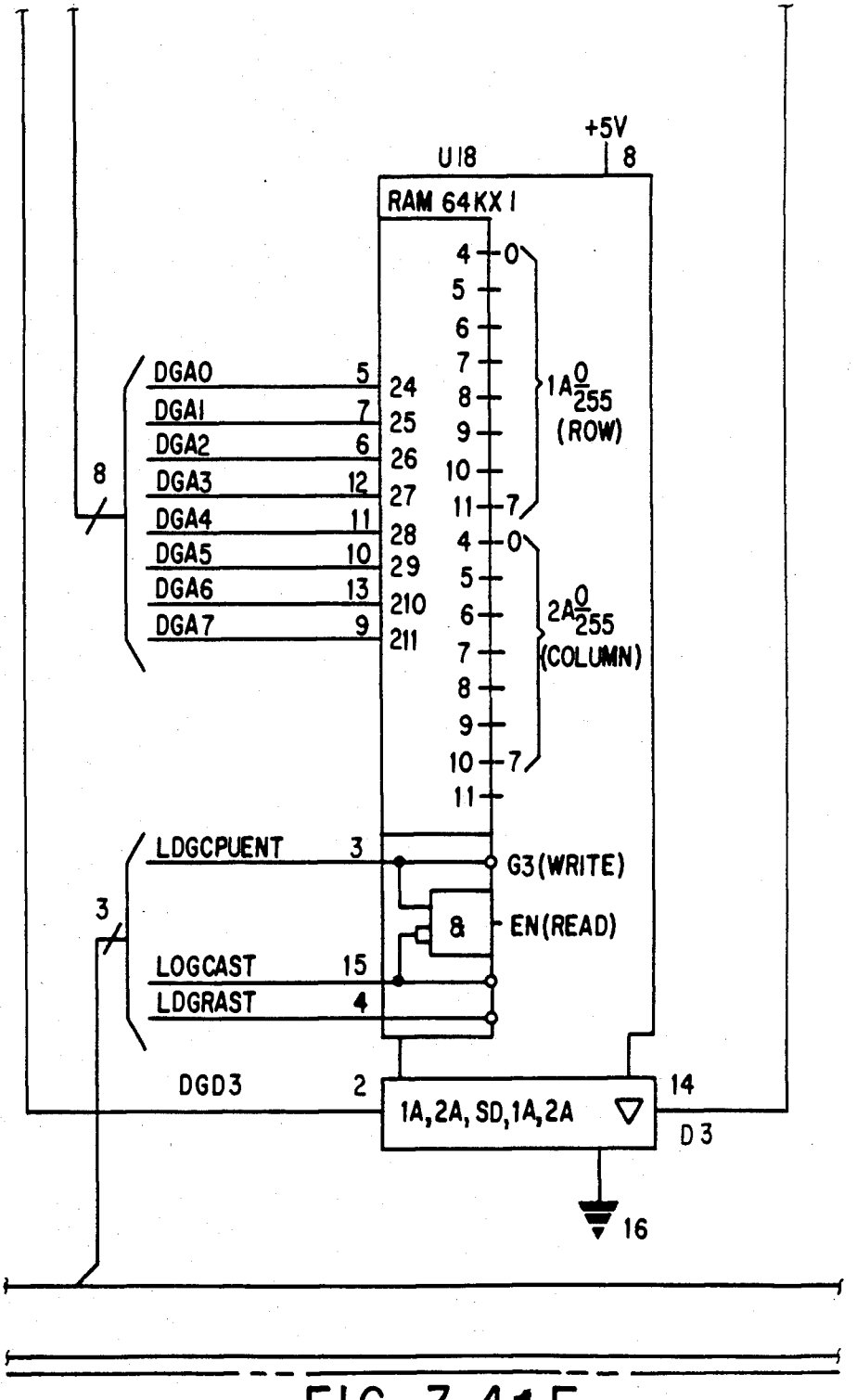

+5V
8
U18
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255 (COLUMN)
DGA0 5 24
DGA1 7 25
DGA2 6 26
DGA3 12 27
DGA4 11 28
DGA5 10 29
DGA6 13 210
DGA7 9 211
8
LDGCPUENT 3
G3(WRITE)
8
EN(READ)
3
LOGCAST 15
LDGRAST 4
DGD3 2
1A,2A,SD,1A,2A
14
D3
16

FIG. 3.41E

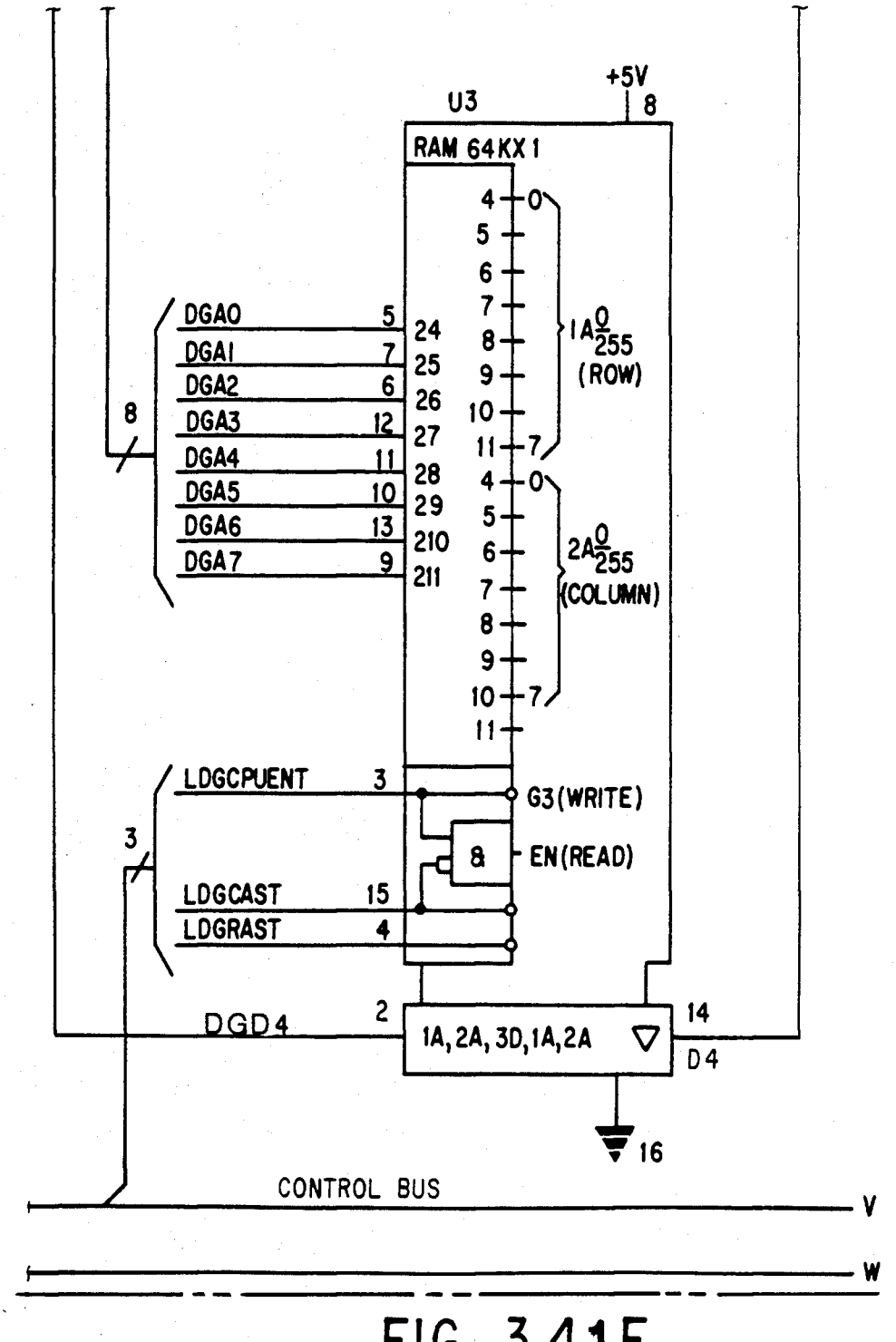

U3
+5V
8
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255
(ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255
(COLUMN)
DGA0
DGA1
DGA2
DGA3
DGA4
DGA5
DGA6
DGA7
5
7
6
12
11
10
13
9
24
25
26
27
28
29
210
211
8
LDGCPUENT
3
G3(WRITE)
8
EN(READ)
3
LDGCAST
15
LDGRAST
4
DGD4
2
1A, 2A, 3D, 1A, 2A
14
D4
16
CONTROL BUS
V
W

FIG. 3.41F

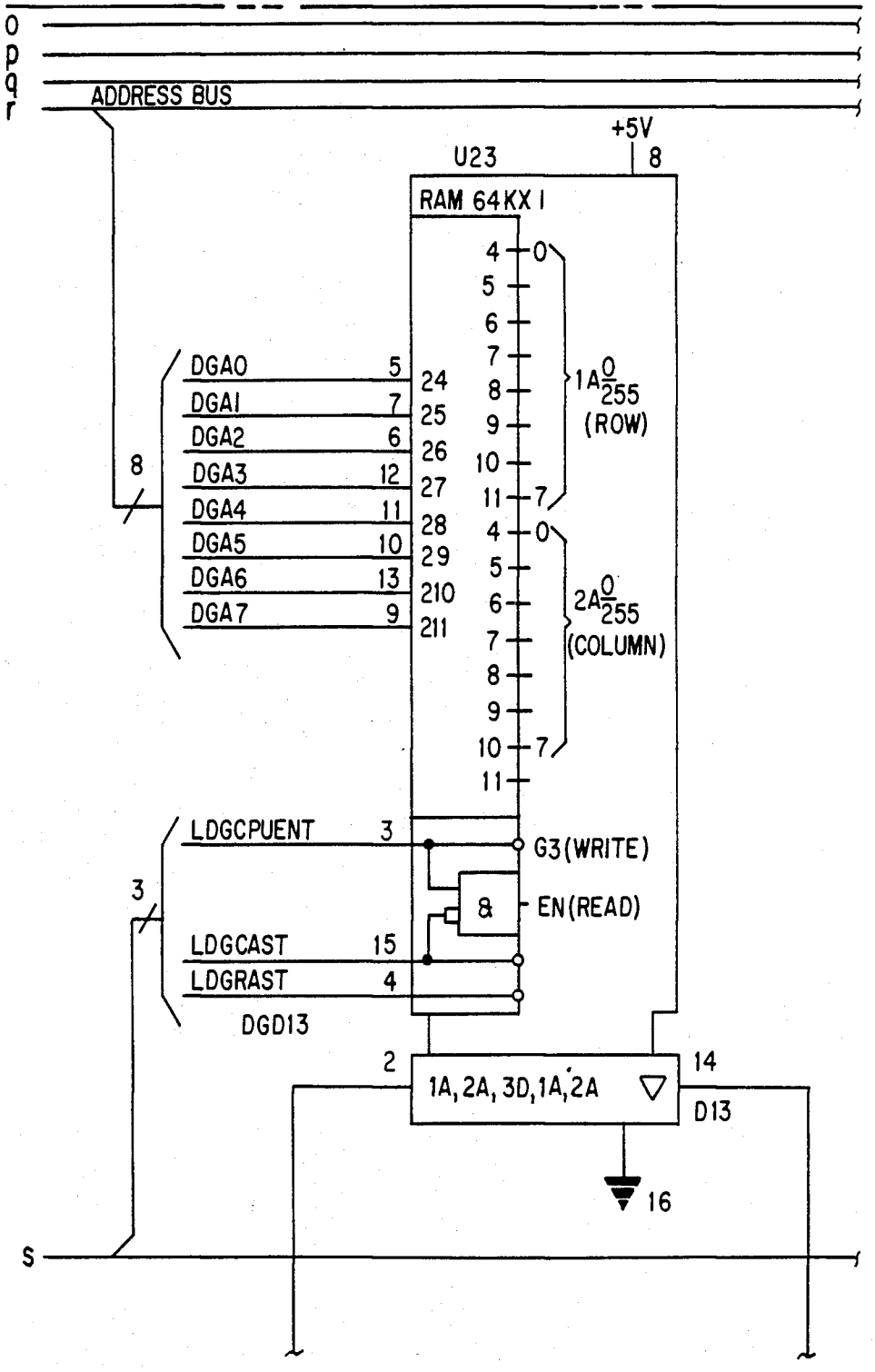

o
p
q
r
ADDRESS BUS
+5V
U23
8
RAM 64KX I
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
2A 0/255 (COLUMN)
DGA0
DGA1
DGA2
DGA3
DGA4
DGA5
DGA6
DGA7
5
7
6
12
11
10
13
9
24
25
26
27
28
29
210
211
8
LDGCPUENT
3
G3(WRITE)
&
EN(READ)
LDGCAST
15
LDGRAST
4
DGD13
3
2
1A, 2A, 3D, 1A, 2A
14
D13
16
S

FIG. 3.42A

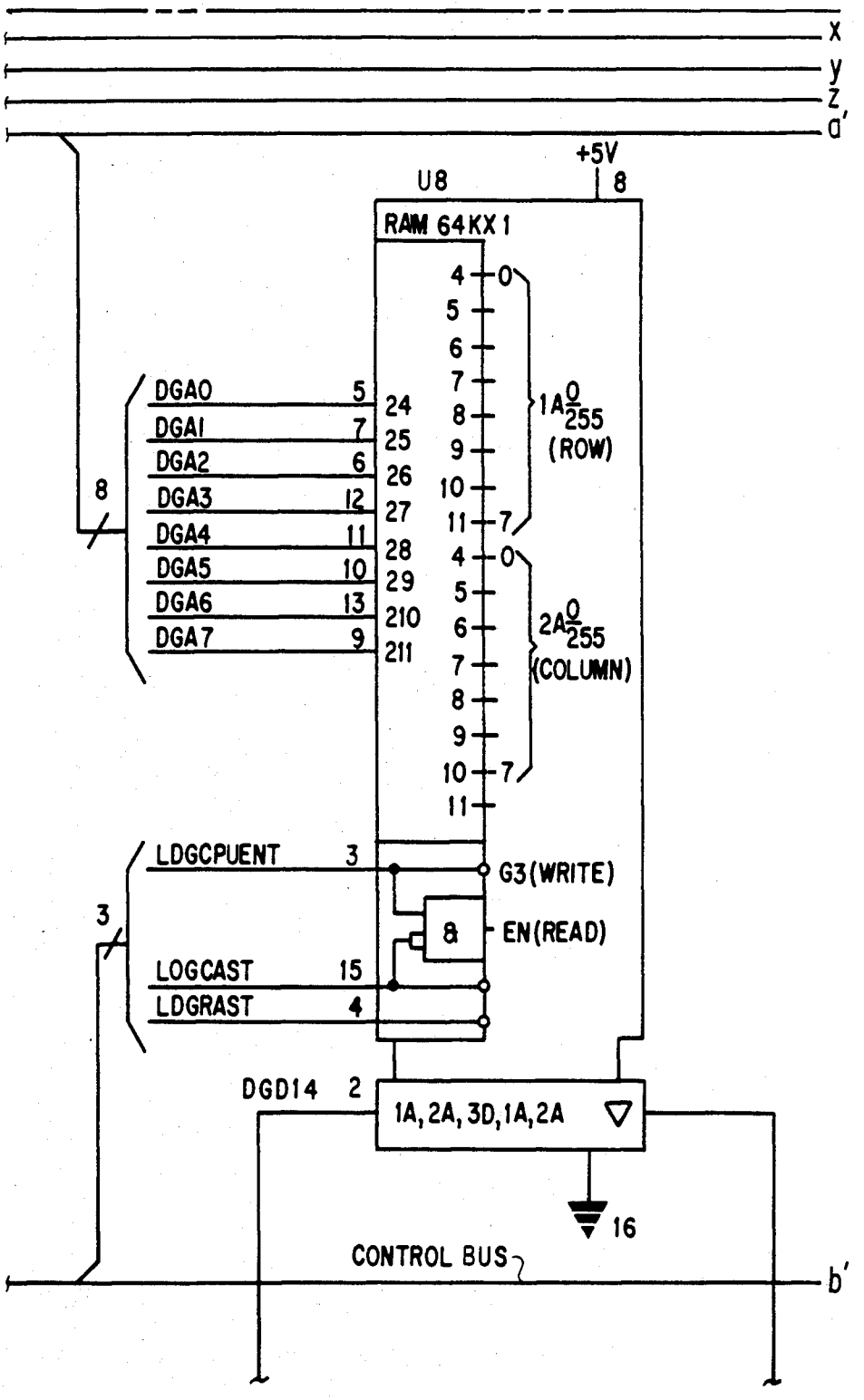

x
y
z
a'
+5V
U8
8
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255 (COLUMN)
DGA0 5 24
DGA1 7 25
DGA2 6 26
DGA3 12 27
DGA4 11 28
DGA5 10 29
DGA6 13 210
DGA7 9 211
8
LDGCPUENT 3
G3(WRITE)
8
EN(READ)
3
LOGCAST 15
LDGRAST 4
DGD14 2
1A, 2A, 3D, 1A, 2A
16
CONTROL BUS
b'

FIG. 3.42B

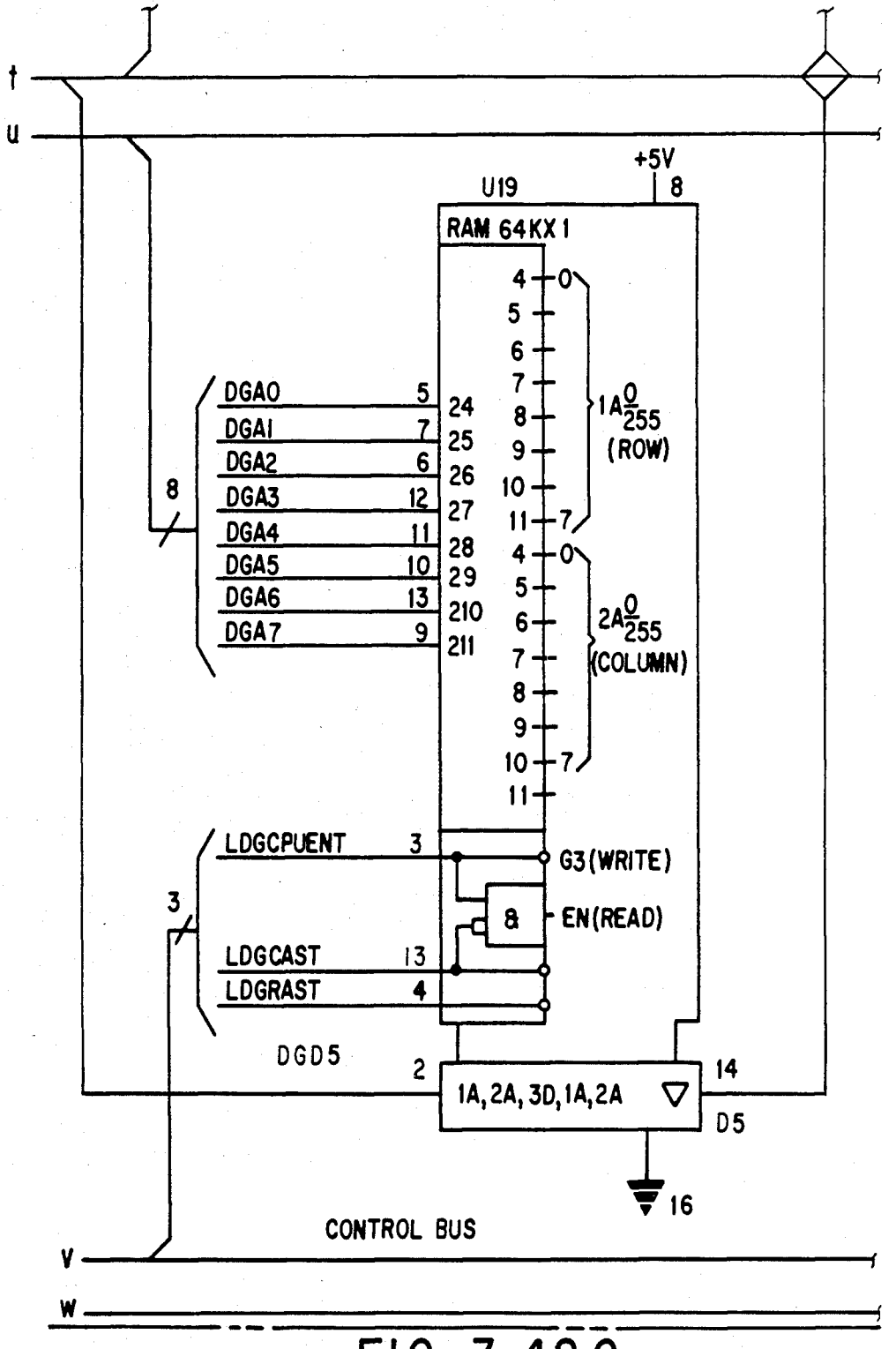

t
u
+5V
U19
8
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255 (ROW)
4
5
6
7
8
9
10
11
0
7
2A 0/255 (COLUMN)
DGA0 5 24
DGA1 7 25
DGA2 6 26
DGA3 12 27
DGA4 11 28
DGA5 10 29
DGA6 13 210
DGA7 9 211
8
LDGCPUENT 3
G3(WRITE)
8
EN(READ)
3
LDGCAST 13
LDGRAST 4
DGD5
2
1A, 2A, 3D, 1A, 2A
14
D5
16
CONTROL BUS
V
W

FIG. 3.42C

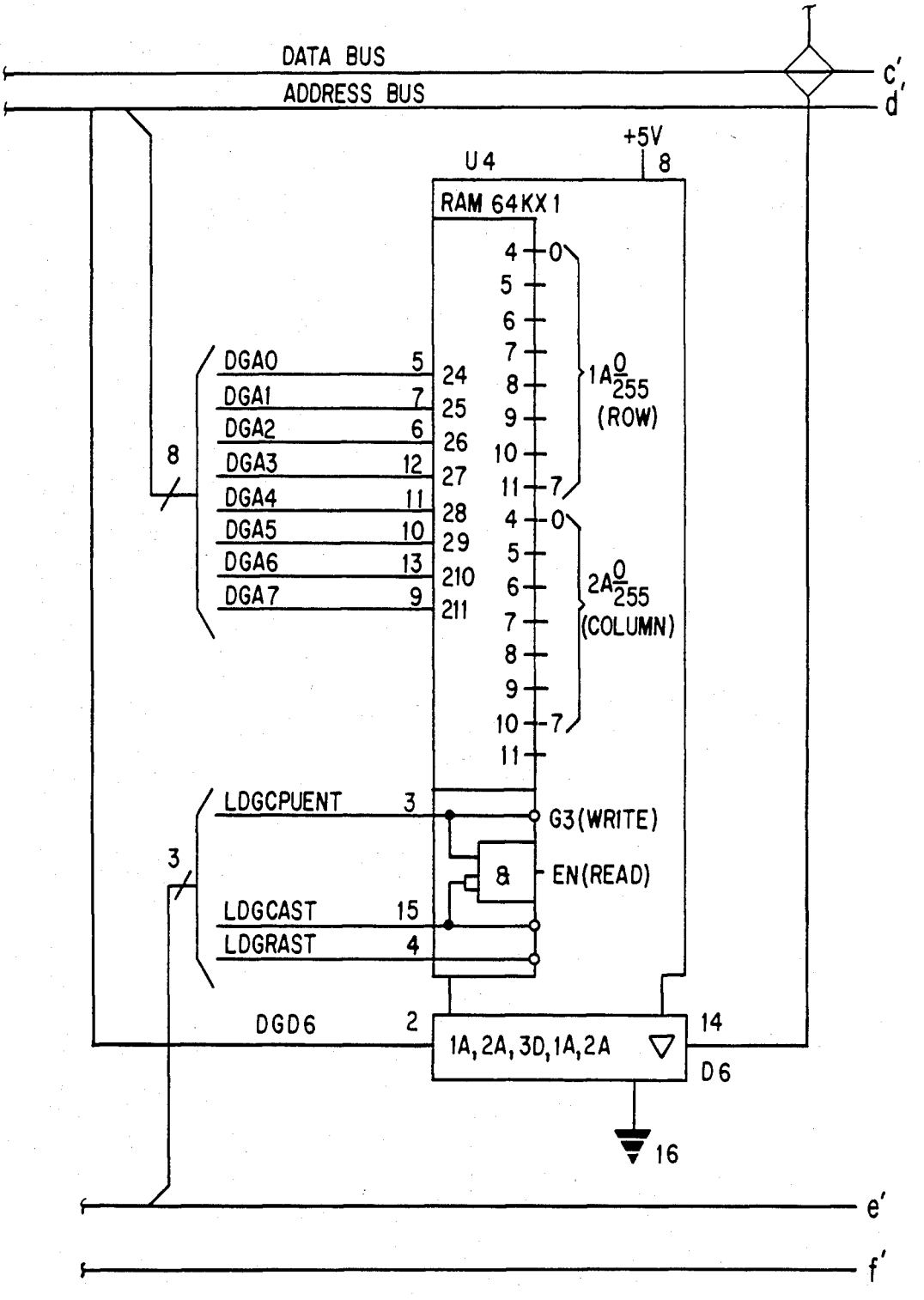

DATA BUS
ADDRESS BUS
c'
d'
+5V
8
U4
RAM 64KX1
4
5
6
7
8
9
10
11
0
7
1A 0/255
(ROW)
2A 0/255
(COLUMN)
DGA0
DGA1
DGA2
DGA3
DGA4
DGA5
DGA6
DGA7
5
7
6
12
11
10
13
9
24
25
26
27
28
29
210
211
LDGCPUENT
3
G3(WRITE)
&
EN(READ)
LDGCAST
15
LDGRAST
4
DGD6
2
1A, 2A, 3D, 1A, 2A
14
D6
16
e'
f'

FIG. 3.42D

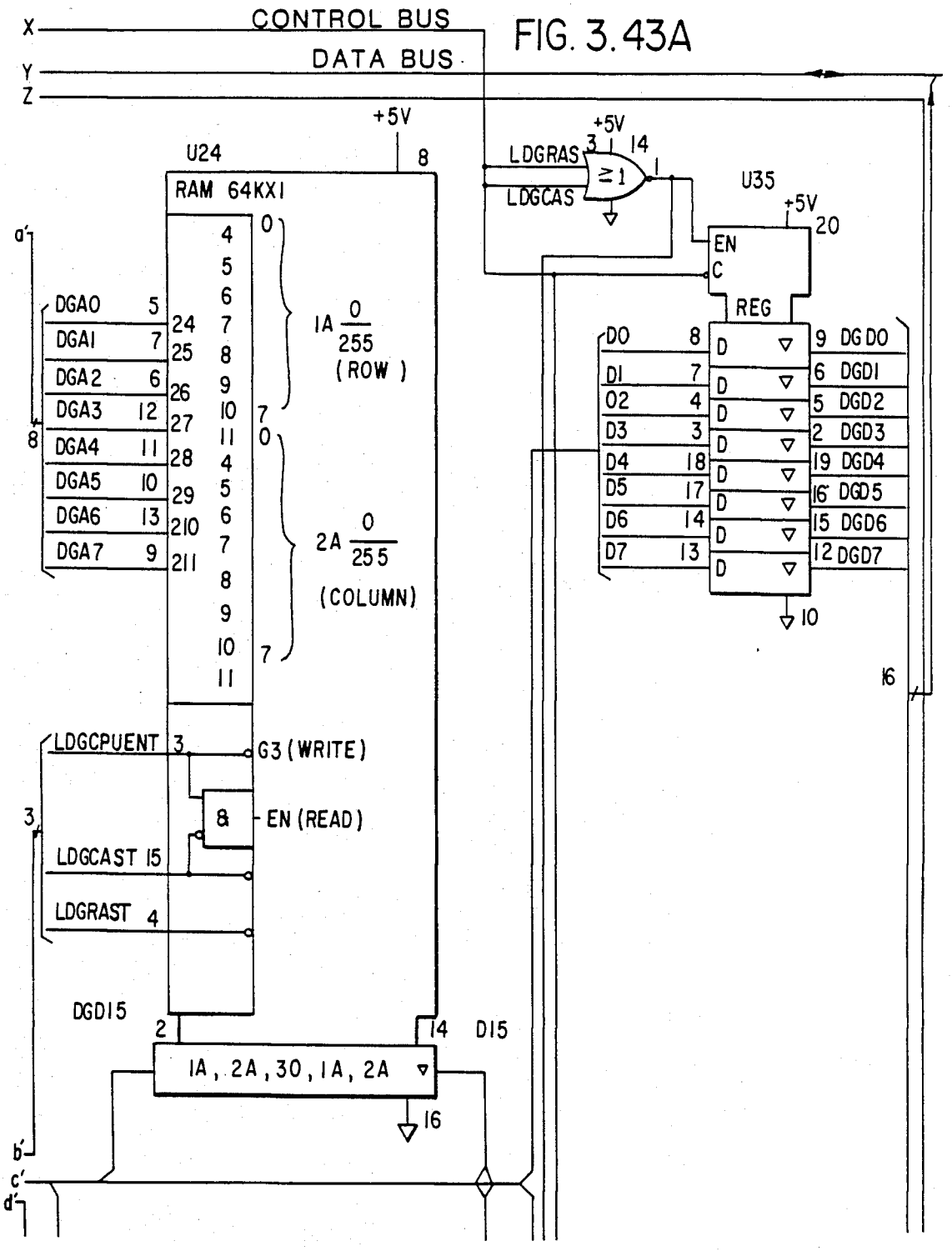

X
Y
Z
CONTROL BUS
DATA BUS
+5V
U24
RAM 64KX1
DGA0
DGA1
DGA2
DGA3
DGA4
DGA5
DGA6
DGA7
IA 0/255 (ROW)
2A 0/255 (COLUMN)
LDGCPUENT
G3 (WRITE)
EN (READ)
LDGCAST
LDGRAST
DGD15
IA, 2A, 30, 1A, 2A
D15
LDGRAS
LDGCAS
≥1
U35
EN
C
REG
DO
DI
D2
D3
D4
D5
D6
D7
DG DO
DGD1
DGD2
DGD3
DGD4
DGD5
DGD6
DGD7

FIG. 3.43A

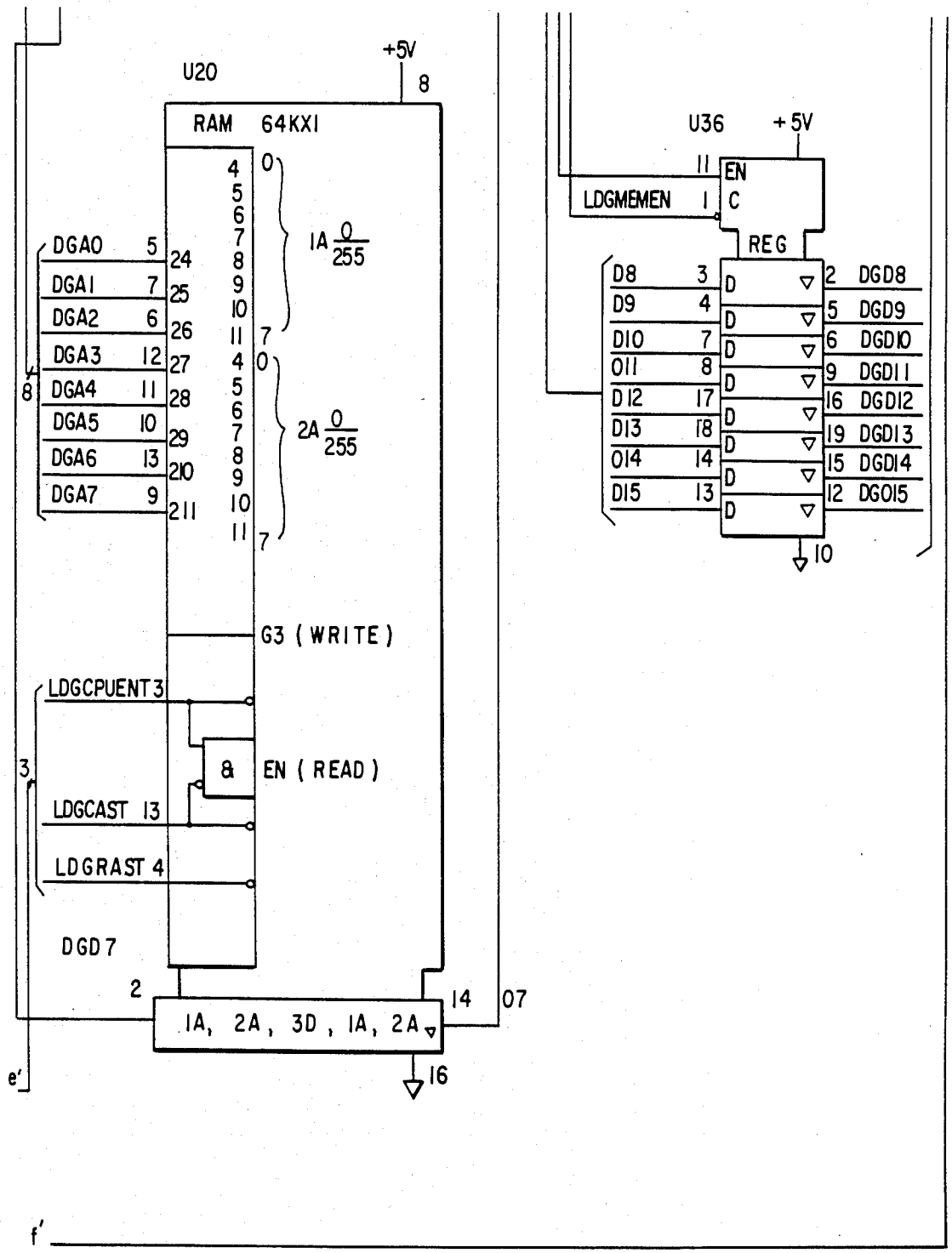

U20
+5V
8
RAM 64KX1
DGA0 5
DGA1 7
DGA2 6
DGA3 12
DGA4 11
DGA5 10
DGA6 13
DGA7 9
24
25
26
27
28
29
210
211
8
IA 0/255
2A 0/255
G3 (WRITE)
LDGCPUENT 3
3
&
EN (READ)
LDGCAST 13
LDGRAST 4
DGD7
2
14
07
1A, 2A, 3D, 1A, 2A
16
e'
f'
U36
+5V
11
EN
LDGMEMEN 1
C
REG
D8 3
D9 4
D10 7
D11 8
D12 17
D13 18
D14 14
D15 13
D
2 DGD8
5 DGD9
6 DGD10
9 DGD11
16 DGD12
19 DGD13
15 DGD14
12 DGD15
10

FIG. 3.43B

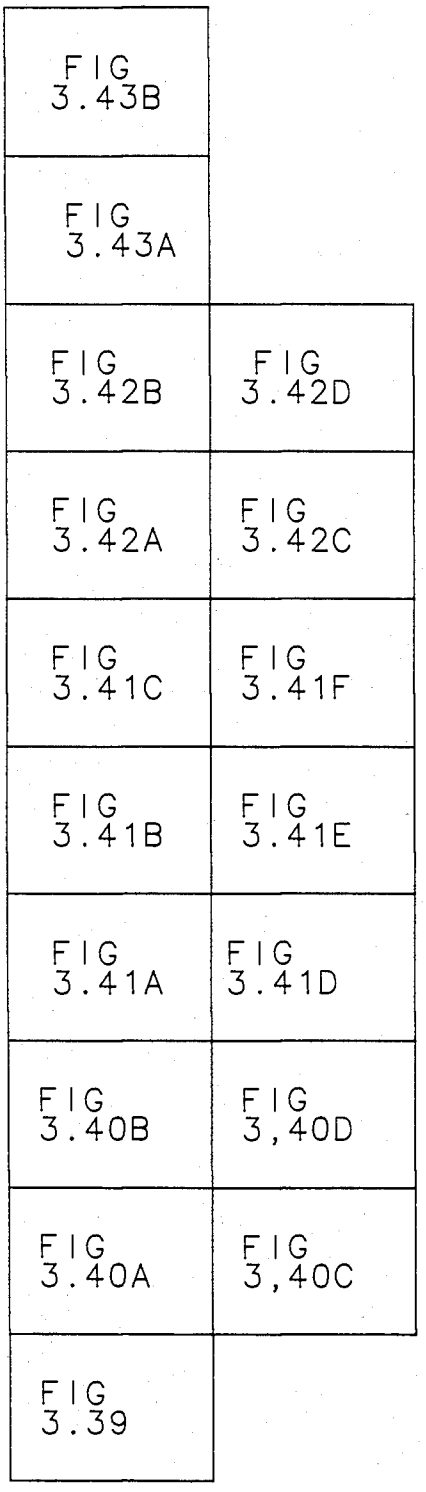


FIG 3.44

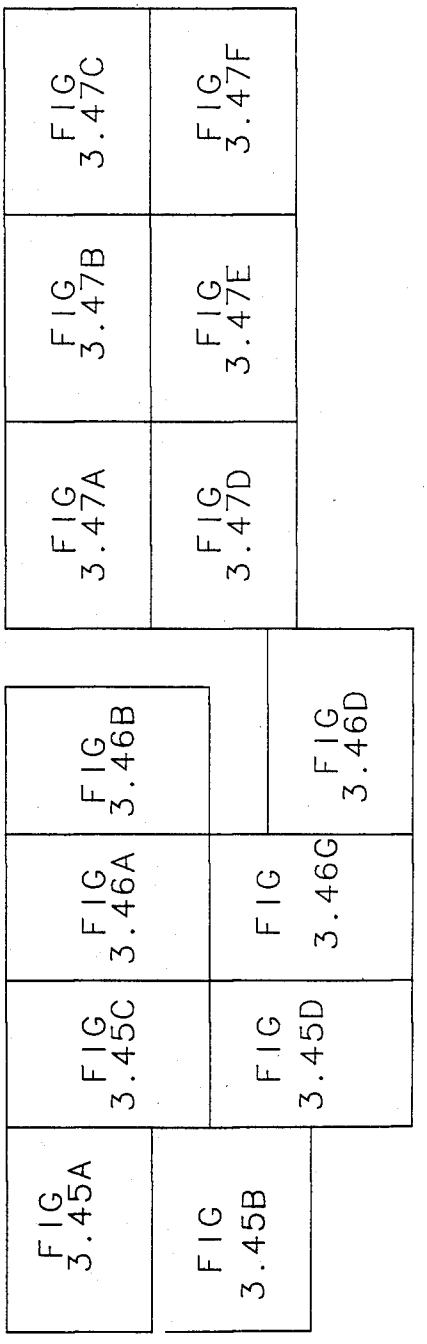


FIG 3.48

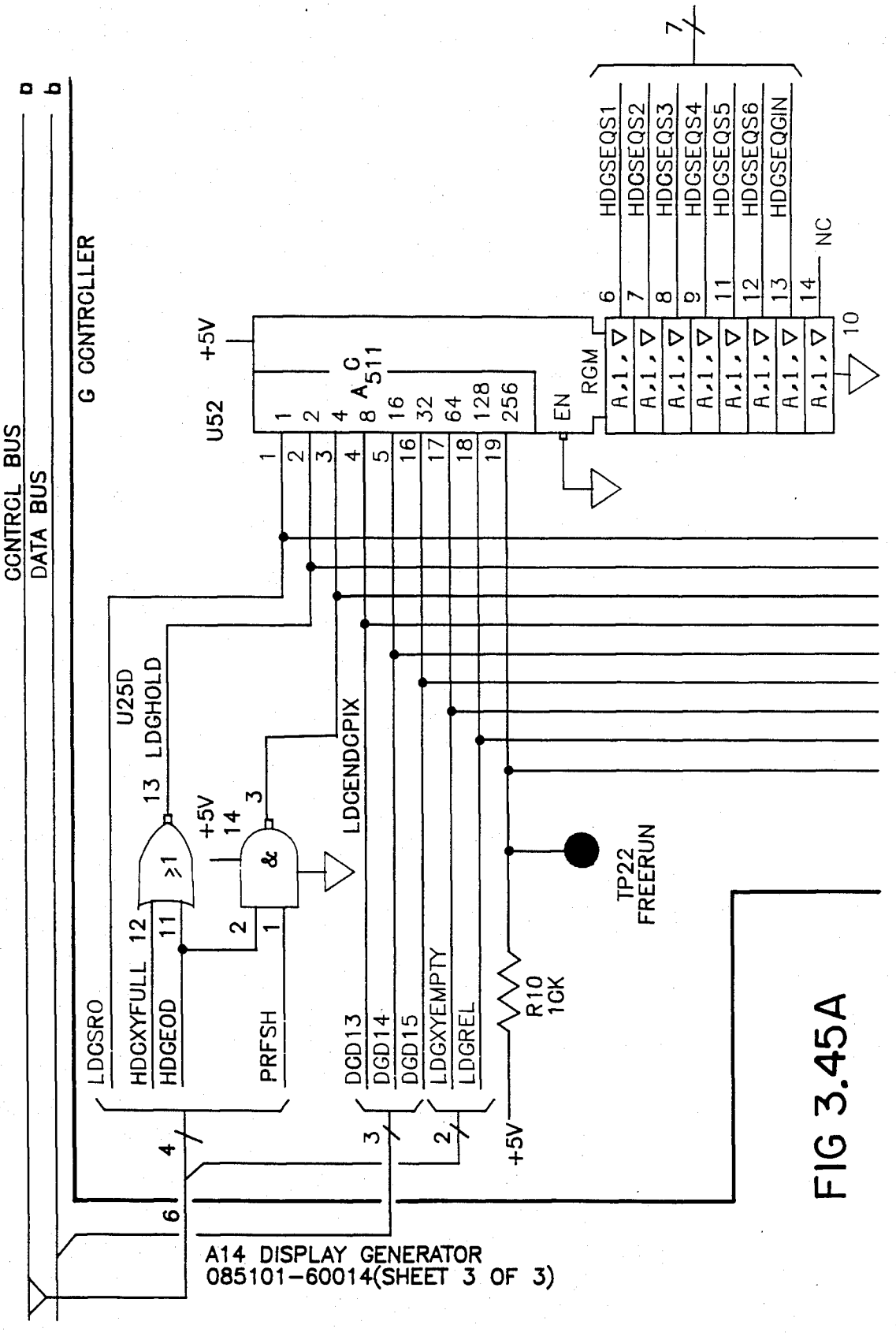

CONTRCL BUS
DATA BUS
G CONTRCLLER
U52
+5V
A C
511
1 2 4 8 16 32 64 128 256
EN
RGM
HDGSEQS1
HDGSEQS2
HDGSEQS3
HDGSEQS4
HDGSEQS5
HDGSEQS6
HDGSEQGIN
NC
U25D
LDGHOLD
LDGENDGPIX
HDGXYFULL
HDGEOD
PRFSH
LDGSRO
DGD13
DGD14
DGD15
LDGXYEMPTY
LDGREL
R10
1GK
TP22
FREERUN
A14 DISPLAY GENERATOR
085101-60014(SHEET 3 OF 3)

FIG 3.45A

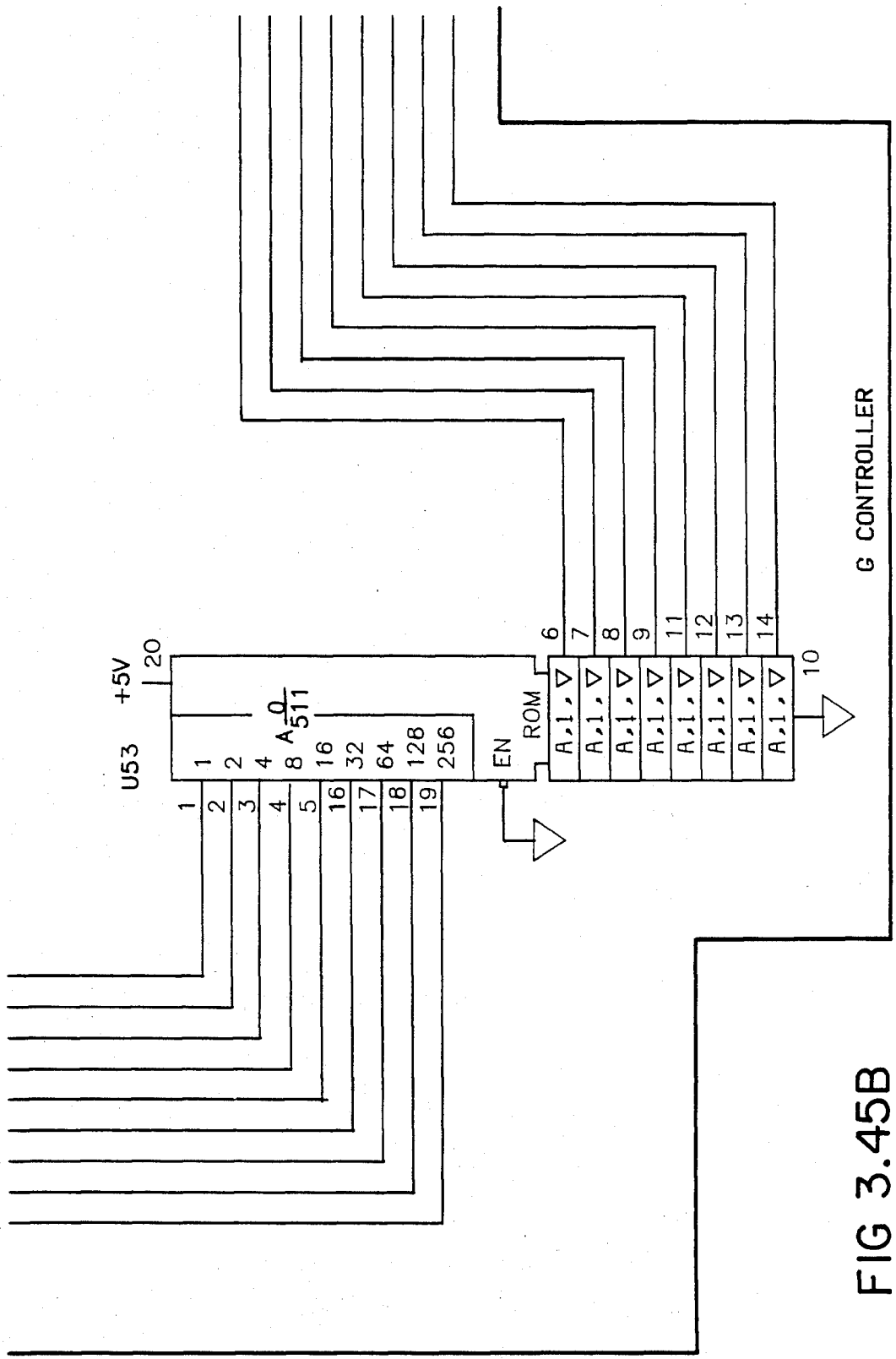

G CONTROLLER
U53
+5V
20
A0
A511
1
2
4
8
16
32
64
128
256
EN
ROM
A,1,▽
6
7
8
9
11
12
13
14
10
1
2
3
4
5
16
17
18
19

FIG 3.45B

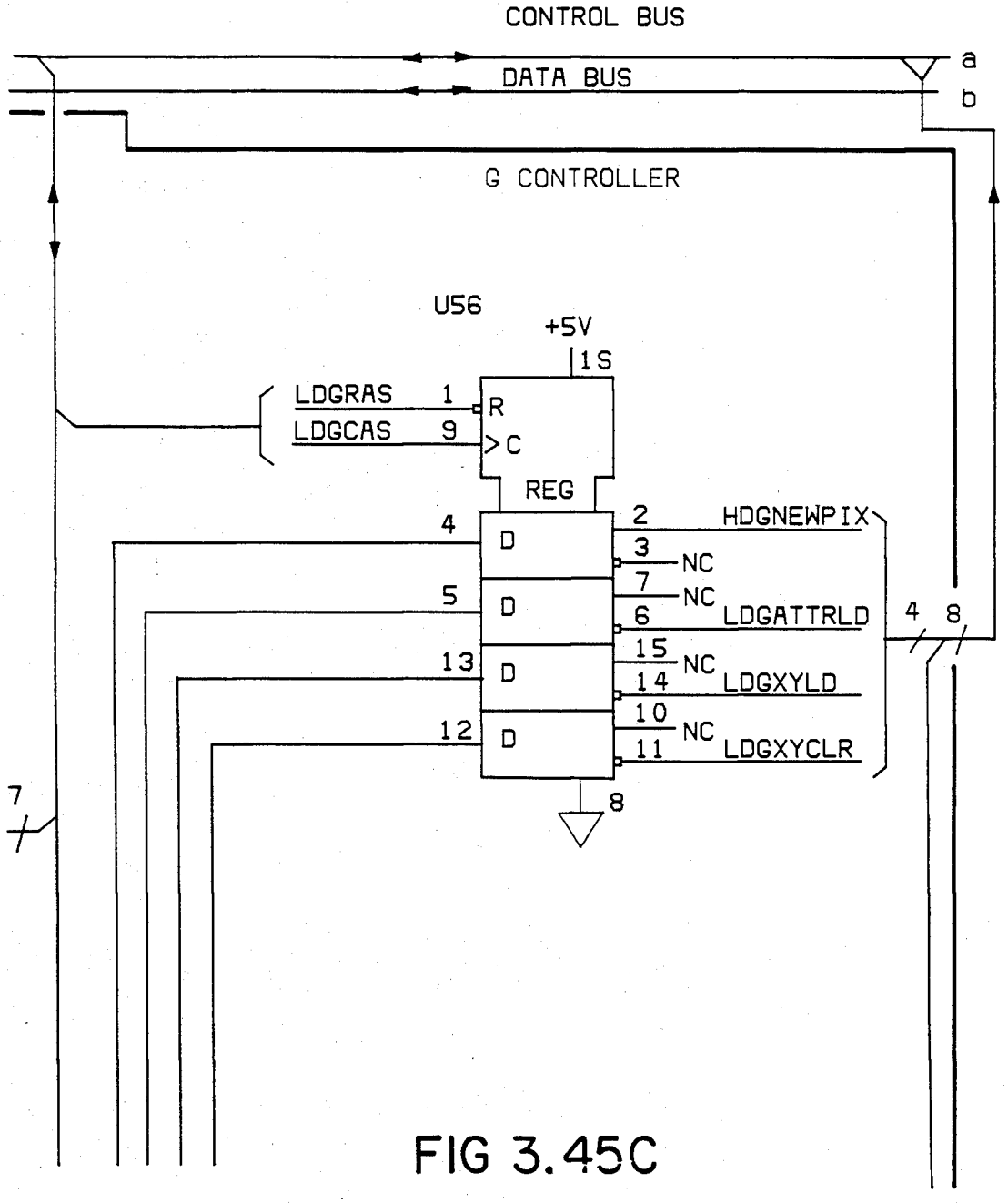

CONTROL BUS
DATA BUS
a
b
G CONTROLLER
U56
+5V
1S
LDGRAS
1
R
LDGCAS
9
C
REG
4
D
2
HDGNEWPIX
3
NC
5
D
7
NC
6
LDGATTRLD
13
D
15
NC
14
LDGXYLD
12
D
10
NC
11
LDGXYCLR
4
8
7
8

FIG 3.45C

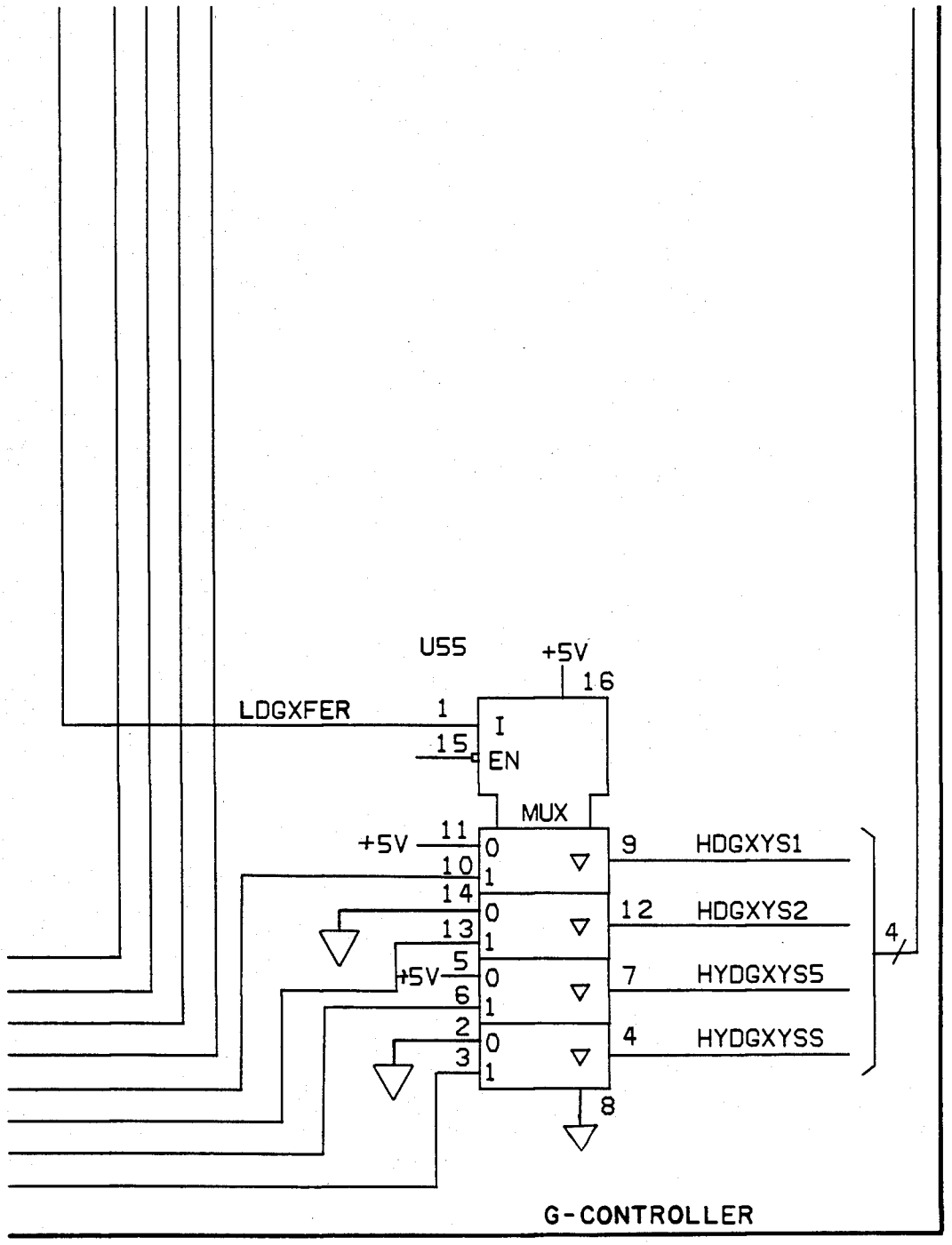

U55
+5V
16
LDGXFER
1
I
15
EN
MUX
+5V
11
0
10
1
9
HDGXYS1
14
0
13
1
12
HDGXYS2
4
5
+5V
0
6
1
7
HYDGXYS5
2
0
3
1
4
HYDGXYSS
8
G-CONTROLLER

FIG 3.45D

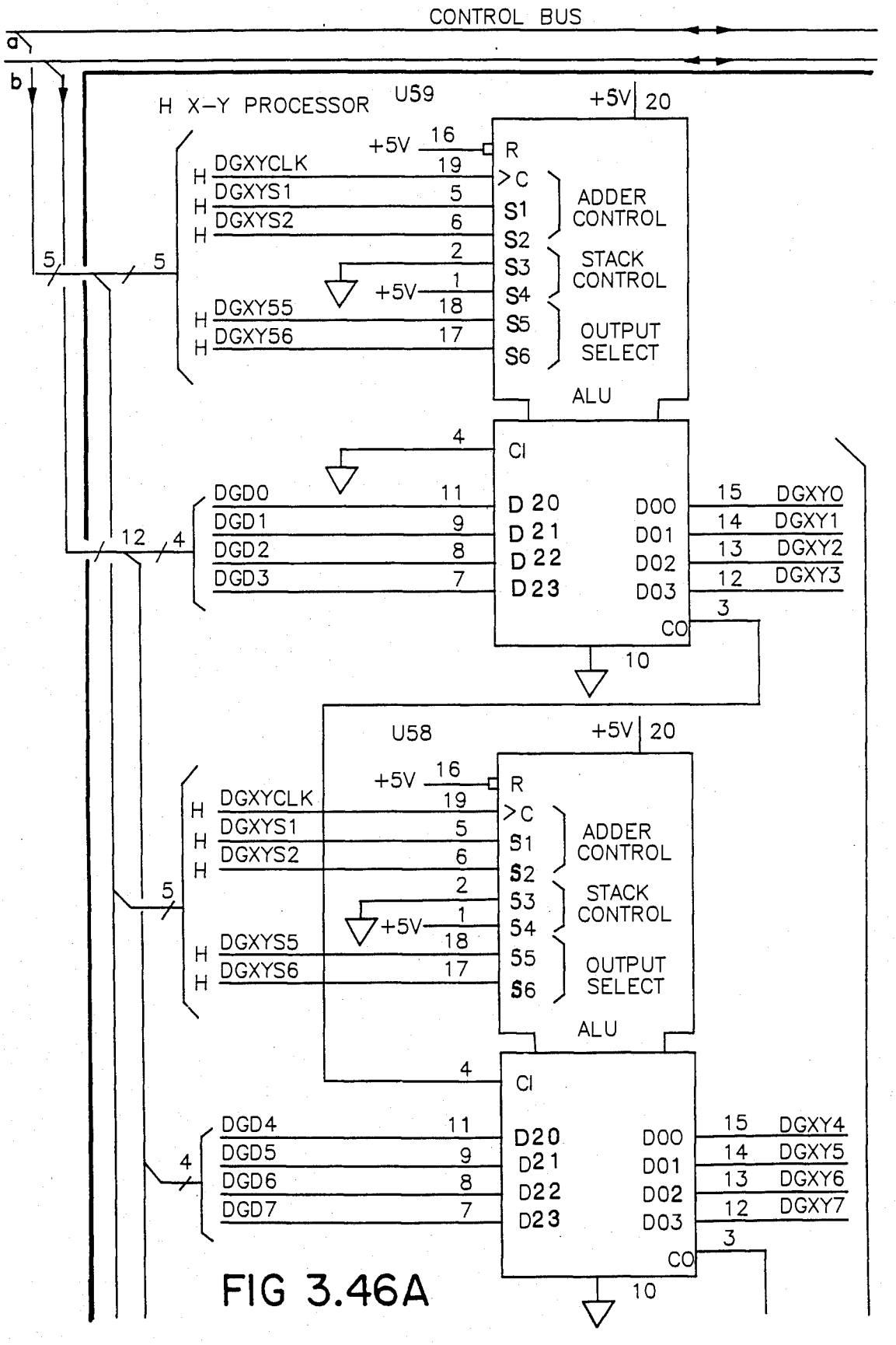

CONTROL BUS
a
b
H X-Y PROCESSOR U59
+5V 20
+5V 16
R
DGXYCLK 19
>C
DGXYS1 5
S1
DGXYS2 6
S2
ADDER CONTROL
2
S3
STACK CONTROL
+5V 1
S4
DGXY55 18
S5
DGXY56 17
S6
OUTPUT SELECT
ALU
5
5
4
CI
DGD0 11
D 20
DGD1 9
D 21
DGD2 8
D 22
DGD3 7
D 23
D00 15 DGXY0
D01 14 DGXY1
D02 13 DGXY2
D03 12 DGXY3
12
4
3
CO
10
U58
+5V 20
+5V 16
R
DGXYCLK 19
>C
DGXYS1 5
S1
DGXYS2 6
S2
ADDER CONTROL
2
S3
STACK CONTROL
+5V 1
S4
DGXYS5 18
S5
DGXYS6 17
S6
OUTPUT SELECT
ALU
5
4
CI
DGD4 11
D20
DGD5 9
D21
DGD6 8
D22
DGD7 7
D23
D00 15 DGXY4
D01 14 DGXY5
D02 13 DGXY6
D03 12 DGXY7
4
3
CO
10

FIG 3.46A

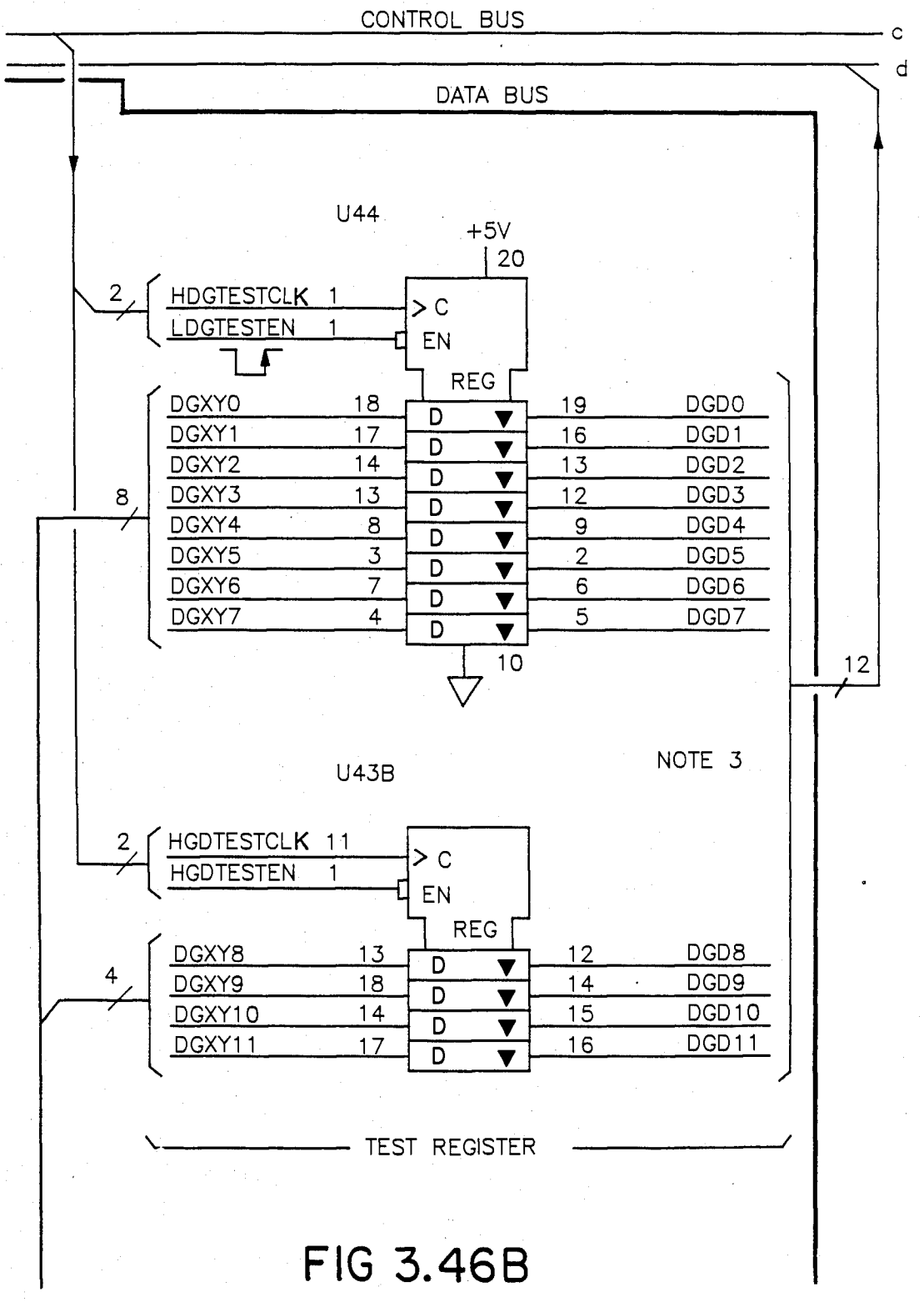

CONTROL BUS
c
d
DATA BUS
U44
+5V
20
2
HDGTESTCLK 1
LDGTESTEN 1
> C
EN
REG
DGXY0 18
DGXY1 17
DGXY2 14
DGXY3 13
DGXY4 8
DGXY5 3
DGXY6 7
DGXY7 4
D
19 DGD0
16 DGD1
13 DGD2
12 DGD3
9 DGD4
2 DGD5
6 DGD6
5 DGD7
8
10
12
NOTE 3
U43B
2
HGDTESTCLK 11
HGDTESTEN 1
> C
EN
REG
DGXY8 13
DGXY9 18
DGXY10 14
DGXY11 17
12 DGD8
14 DGD9
15 DGD10
16 DGD11
4
TEST REGISTER

FIG 3.46B

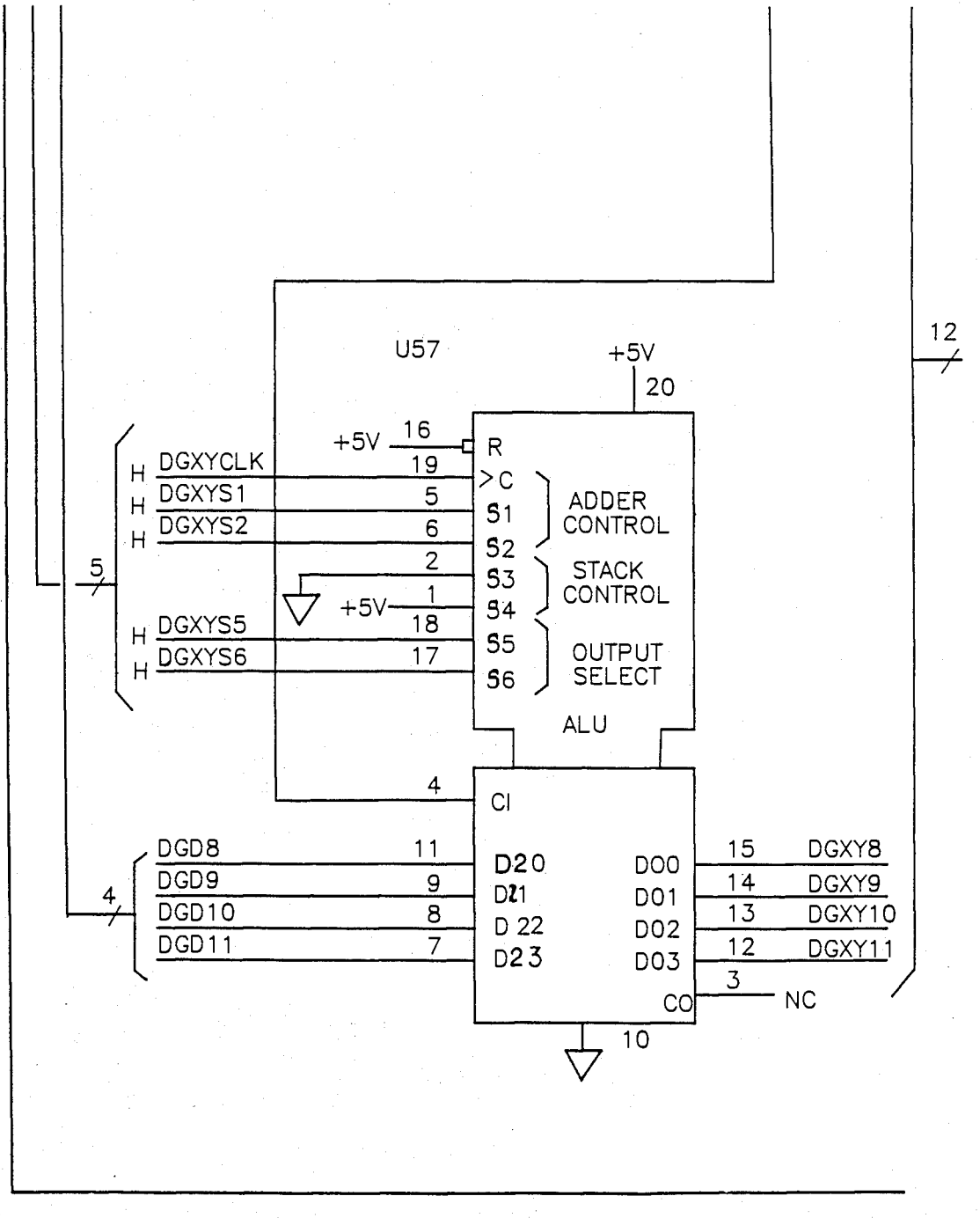

U57
+5V
20
12
+5V
16
R
DGXYCLK
19
>C
DGXYS1
5
S1
DGXYS2
6
S2
ADDER CONTROL
2
S3
+5V
1
S4
STACK CONTROL
5
DGXYS5
18
S5
DGXYS6
17
S6
OUTPUT SELECT
ALU
4
CI
DGD8
11
D20
DGD9
9
D21
DGD10
8
D 22
DGD11
7
D23
4
DO0
15
DGXY8
DO1
14
DGXY9
DO2
13
DGXY10
DO3
12
DGXY11
3
CO
NC
10

FIG 3.46C

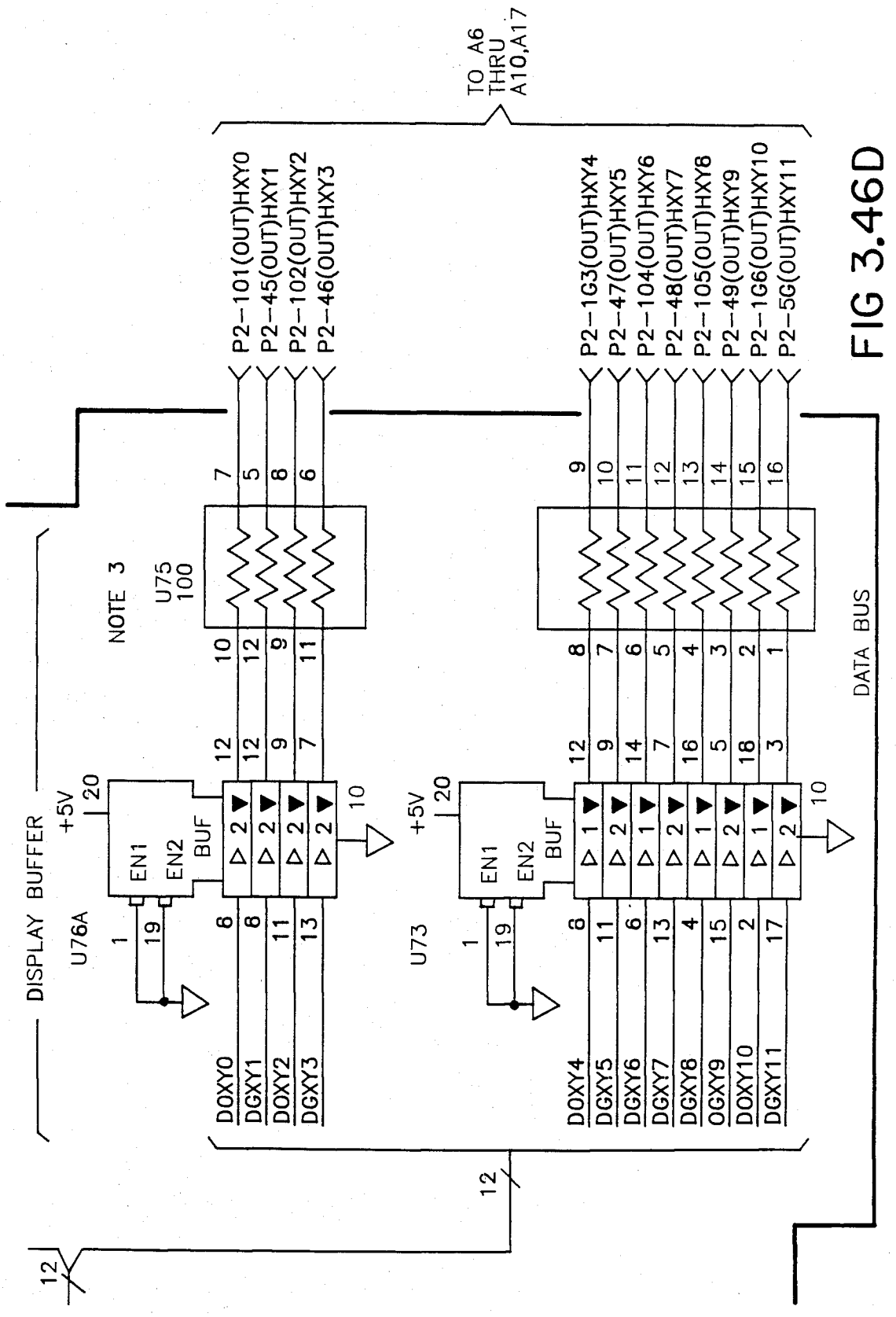

TO A6 THRU A10,A17
P2-101(OUT)HXY0
P2-45(OUT)HXY1
P2-102(OUT)HXY2
P2-46(OUT)HXY3
P2-1G3(OUT)HXY4
P2-47(OUT)HXY5
P2-104(OUT)HXY6
P2-48(OUT)HXY7
P2-105(OUT)HXY8
P2-49(OUT)HXY9
P2-1G6(OUT)HXY10
P2-5G(OUT)HXY11
DISPLAY BUFFER
DATA BUS
NOTE 3
U75 100
U76A
U73
+5V
EN1
EN2
BUF
DOXY0
DGXY1
DOXY2
DGXY3
DOXY4
DGXY5
DGXY6
DGXY7
DGXY8
OGXY9
DOXY10
DGXY11
12

FIG 3.46D

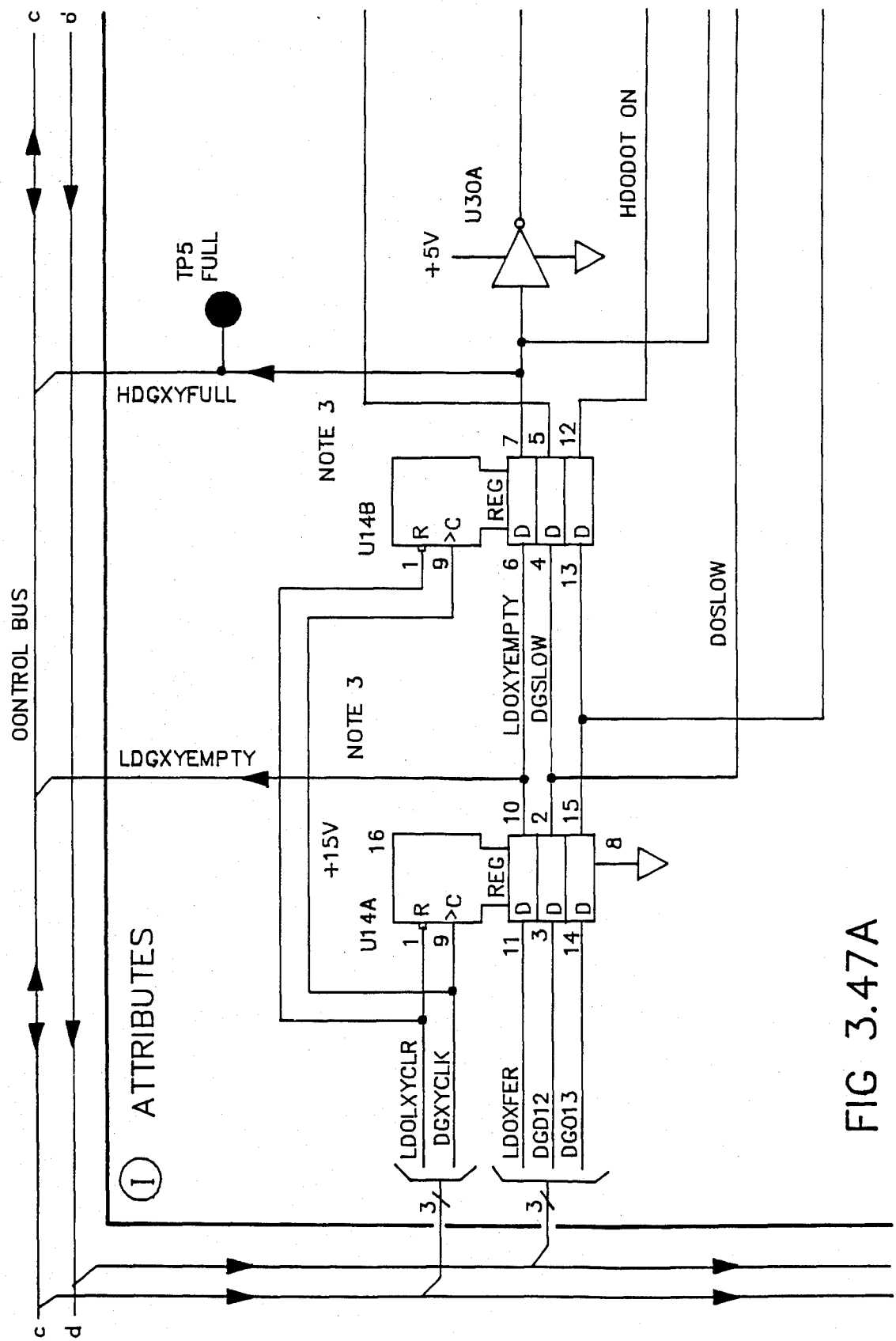

c
d
OONTROL BUS
TP5
FULL
HDGXYFULL
+5V
U30A
HDODOT ON
NOTE 3
U14B
R
>C
REG
D
7
5
12
1
9
6
4
13
LDOXYEMPTY
DGSLOW
DOSLOW
LDGXYEMPTY
NOTE 3
+15V
16
U14A
10
2
15
8
11
3
14
LDOLXYCLR
DGXYCLK
LDOXFER
DGD12
DGO13
3
ATTRIBUTES
1

FIG 3.47A

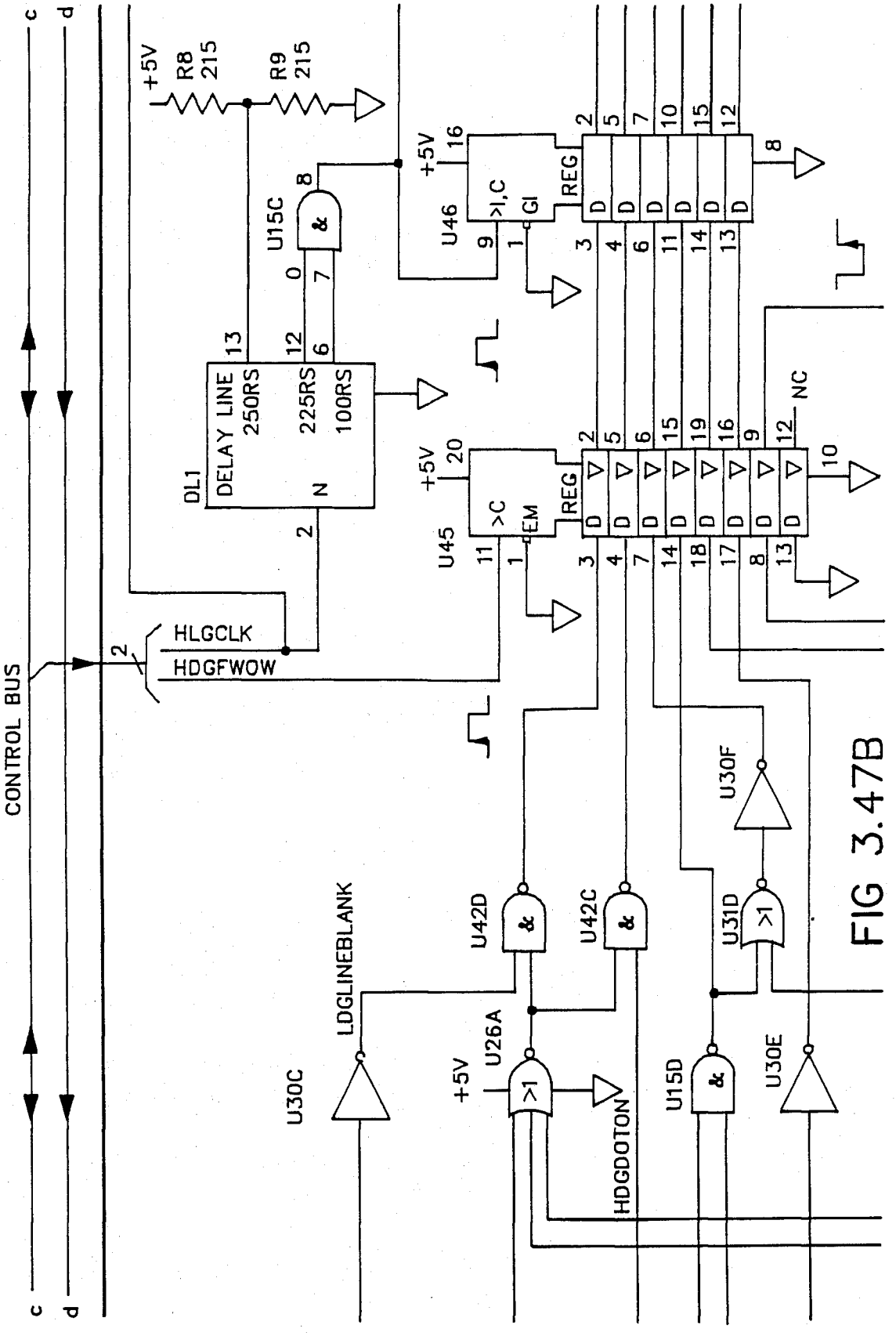

c
d
+5V
R8
215
R9
215
U15C
DL1
DELAY LINE
250RS
225RS
100RS
N
U46
>1,C
G1
REG
U45
>C
EM
NC
HLGCLK
HDGFWOW
CONTROL BUS
U30C
LDGLINEBLANK
U42D
U42C
U26A
HDGDOTON
U15D
U30E
U30F
U31D

FIG 3.47B

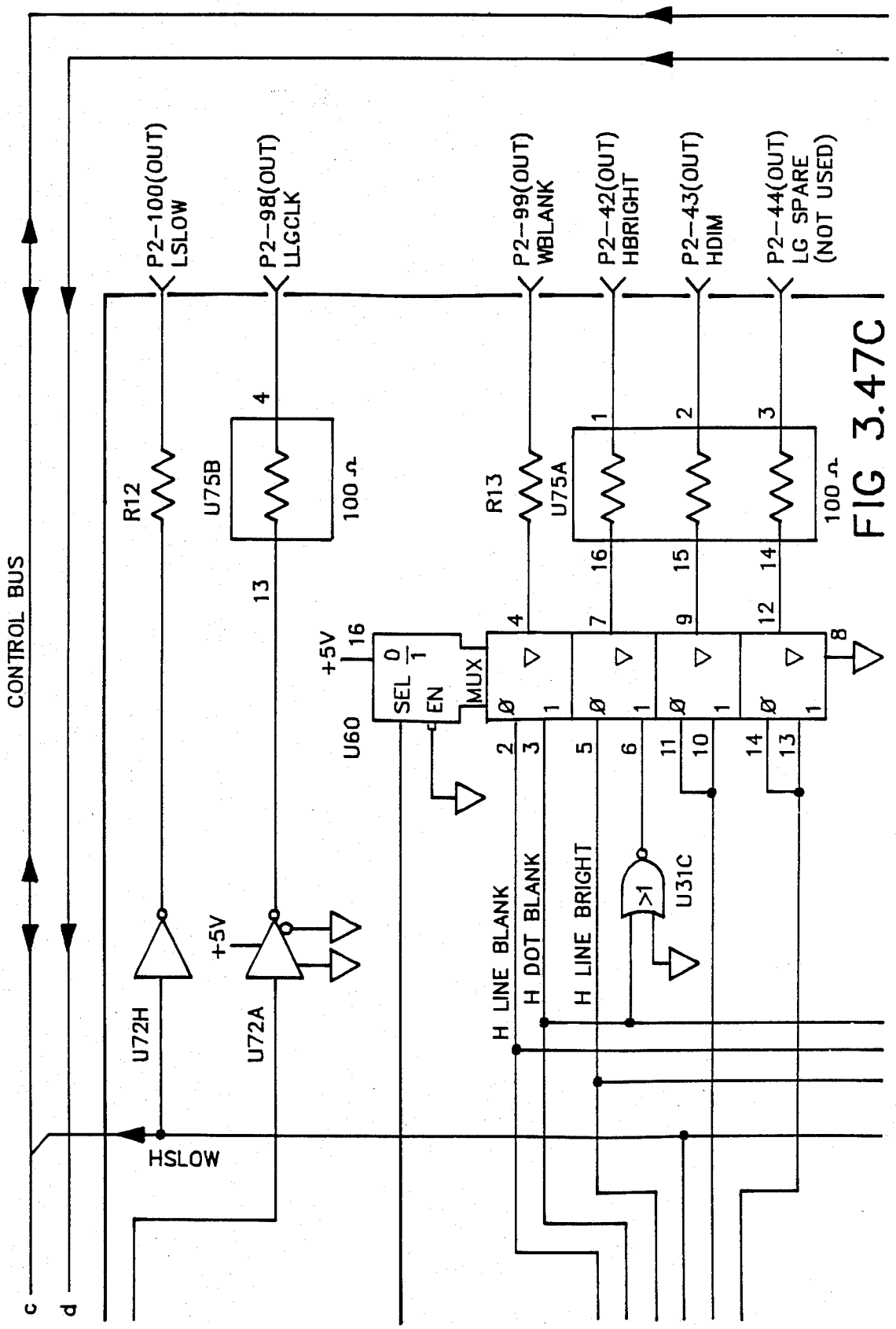

CONTROL BUS
c
d
P2-100(OUT)
LSLOW
P2-98(OUT)
LLGCLK
P2-99(OUT)
WBLANK
P2-42(OUT)
HBRIGHT
P2-43(OUT)
HDIM
P2-44(OUT)
LG SPARE
(NOT USED)
R12
U75B
100 Ω
R13
U75A
100 Ω
+5V
U60
SEL
EN
MUX
U72H
U72A
HSLOW
H LINE BLANK
H DOT BLANK
H LINE BRIGHT
U31C
>1

FIG 3.47C

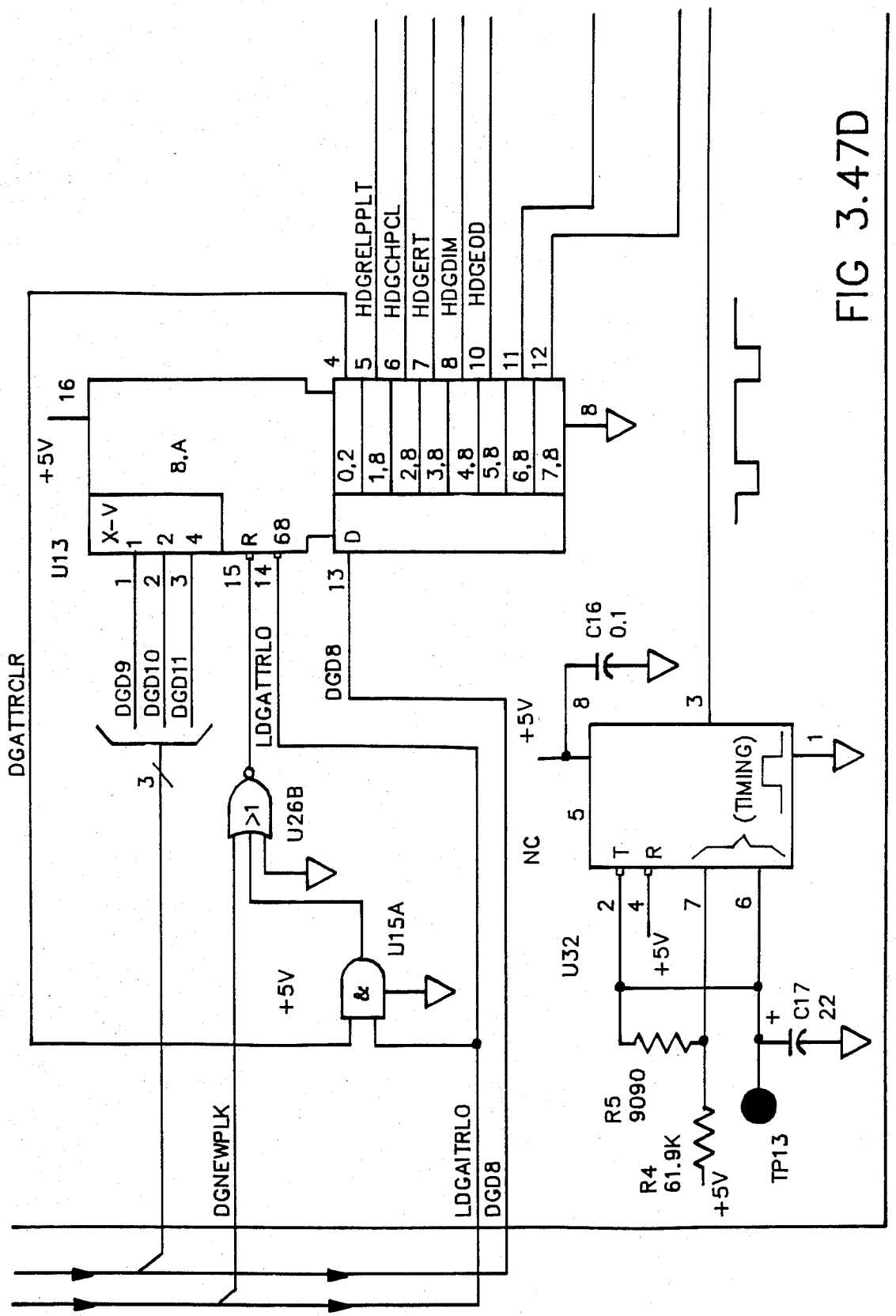

DGATTRCLR
+5V
U13
X-V
8,A
16
1
2
4
15
R
14
68
13
D
4
5
6
7
8
10
11
12
HDGRELPPLT
HDGCHPCL
HDGERT
HDGDIM
HDGEOD
0,2
1,8
2,8
3,8
4,8
5,8
6,8
7,8
8
DGD9
DGD10
DGD11
3
LDGATTRLO
DGD8
C16
0.1
+5V
8
3
NC
5
T
R
(TIMING)
1
U26B
>1
U15A
&
+5V
U32
2
4
+5V
7
6
C17
22
R5
9090
R4
61.9K
+5V
TP13
DGNEWPLK
LDGAITRLO
DGD8

FIG 3.47D

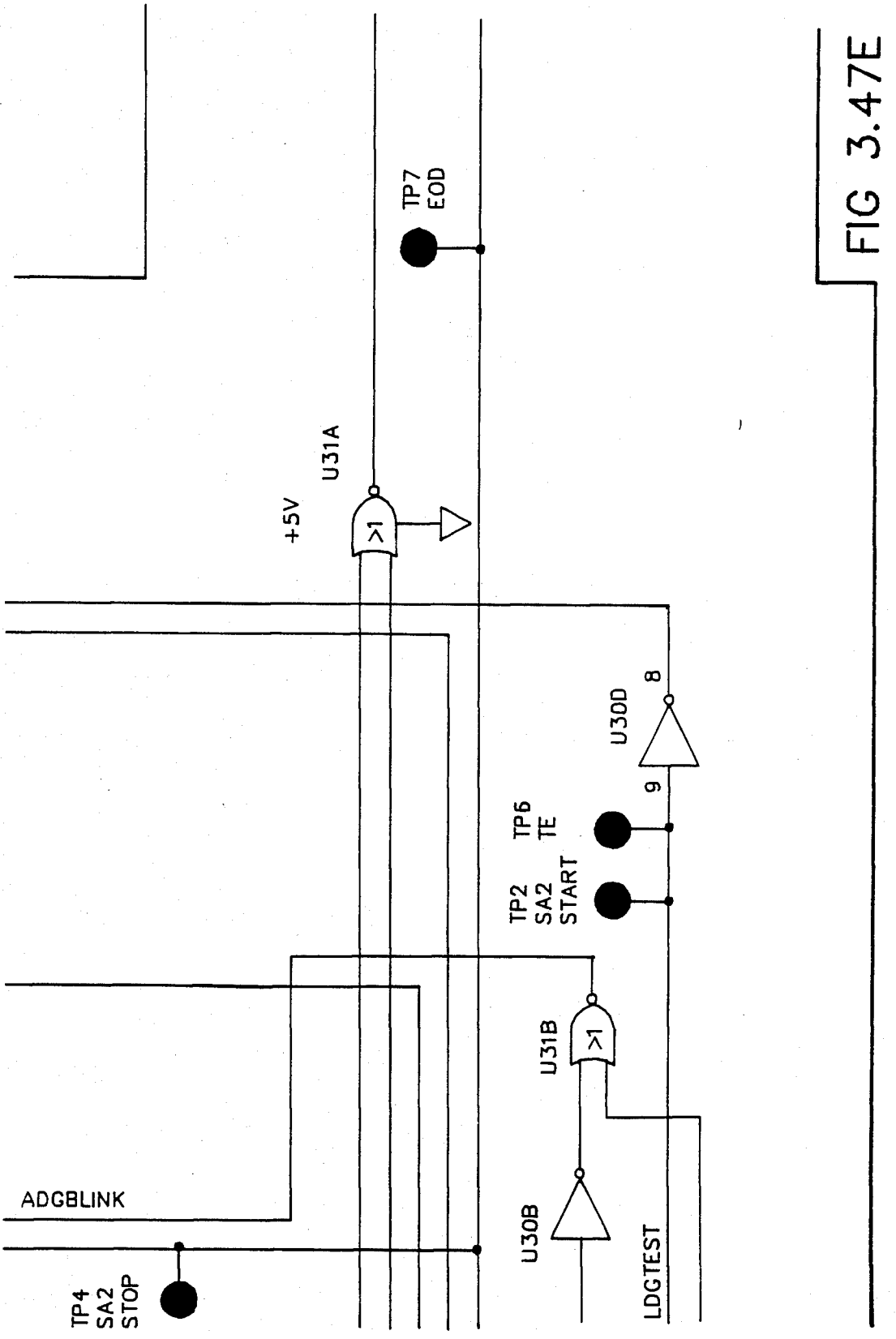

TP7
EOD
U31A
+5V
>1
U30D
8
9
TP6
TE
TP2
SA2
START
U31B
>1
ADGBLINK
U30B
TP4
SA2
STOP
LDGTEST

FIG 3.47E

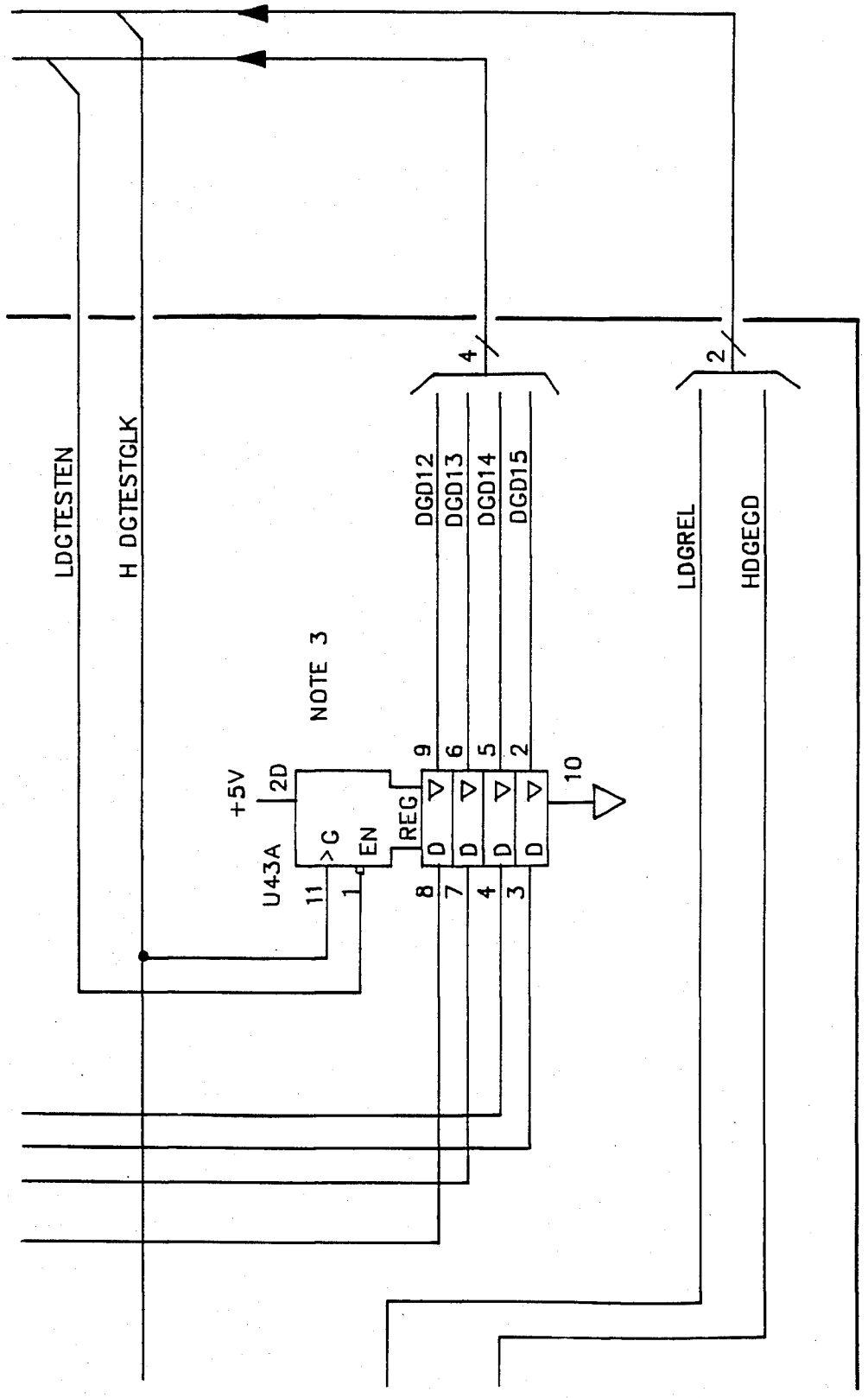

LDGTESTEN
H DGTESTGLK
NOTE 3
+5V
U43A
2D
>C
EN
REG
11
1
9
6
5
2
8
7
4
3
10
DGD12
DGD13
DGD14
DGD15
4
2
LDGREL
HDGEGD

FIG 3.47F

AI5 I.O BOARD
085101-60015
(SHEET 1 OF 2)

FIG. 3.49

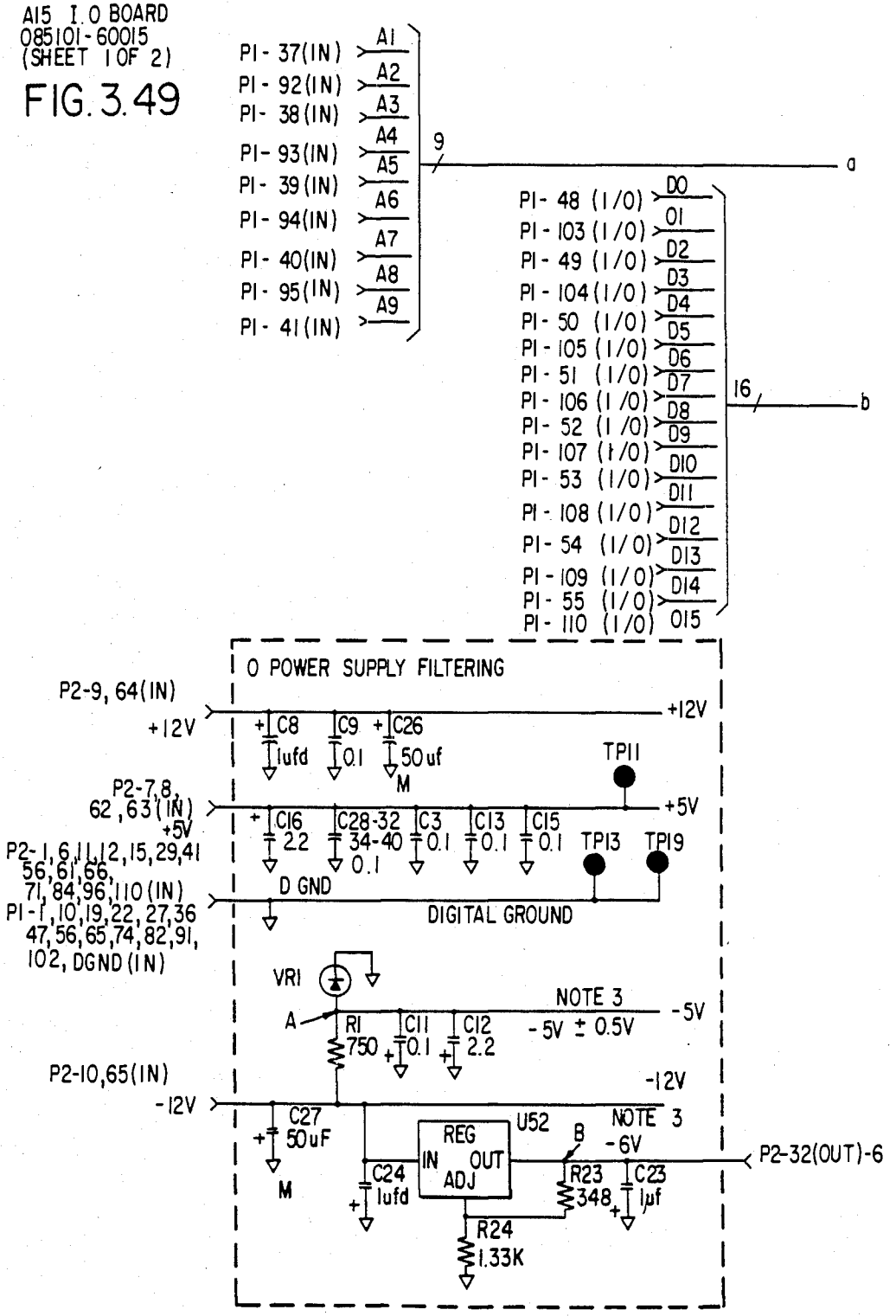


FIG 3.50A

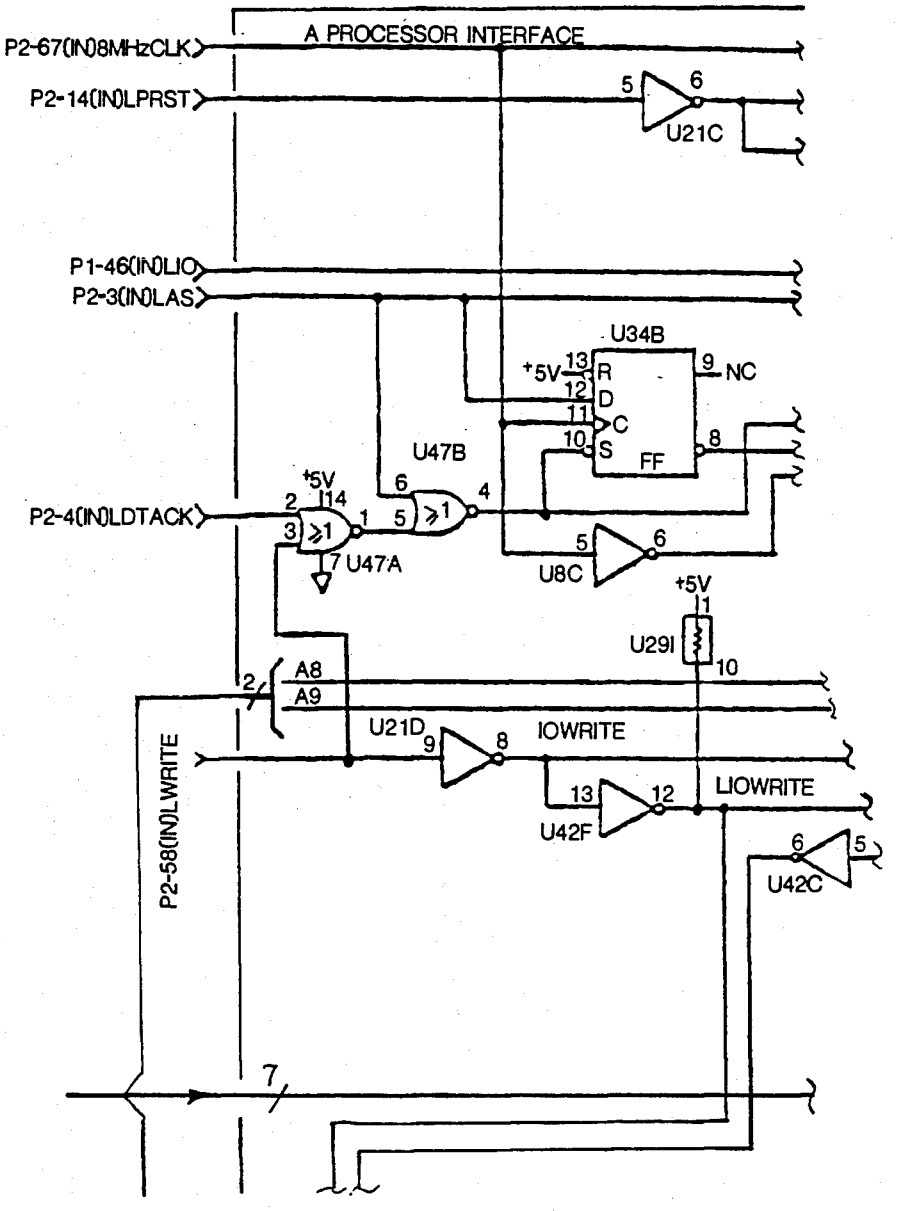
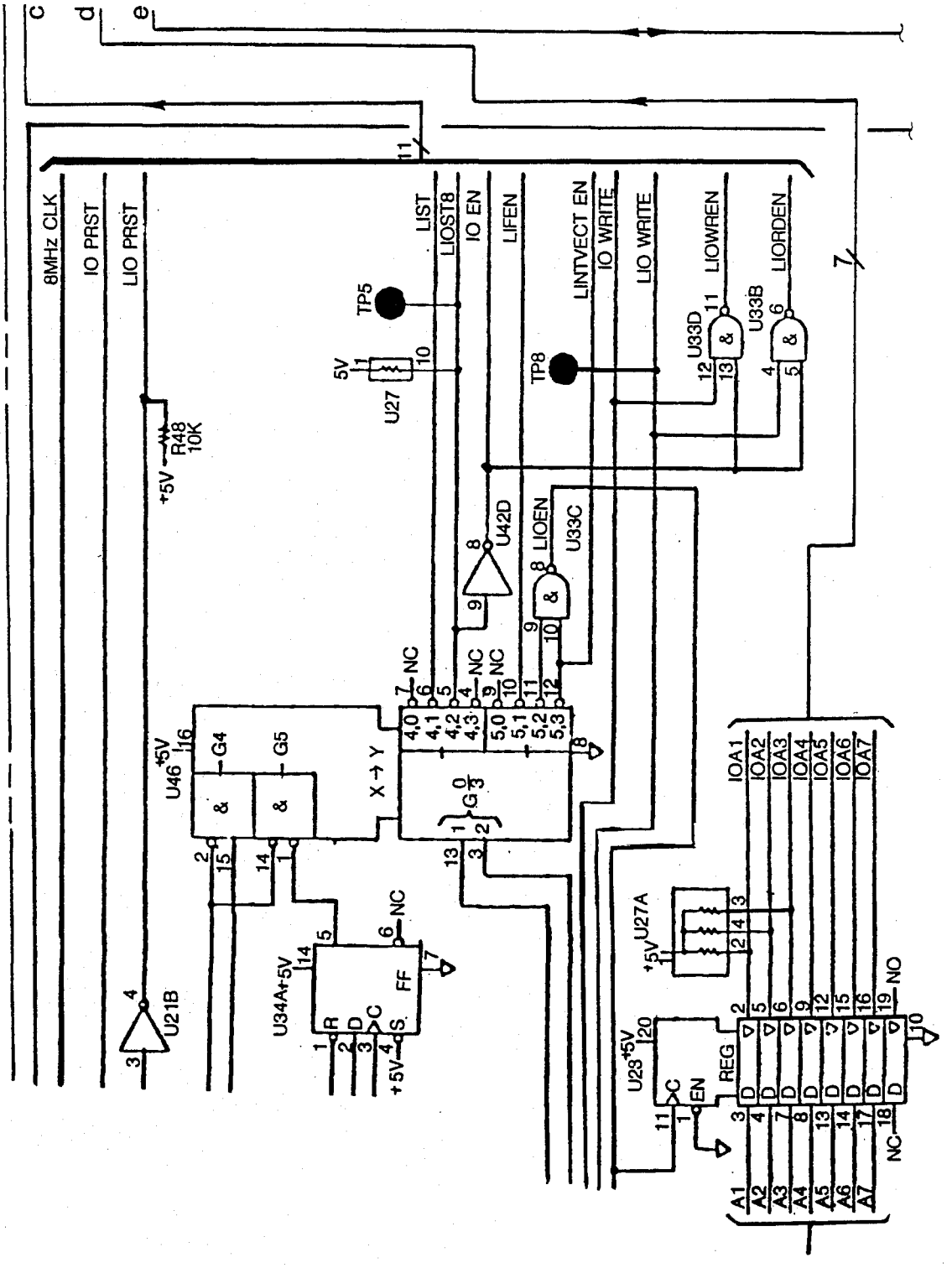

A PROCESSOR INTERFACE
P2-67(IN)8MHzCLK
P2-14(IN)LPRST
U21C
P1-46(IN)LIO
P2-3(IN)LAS
U34B
+5V
NC
FF
U47B
P2-4(IN)LDTACK
U47A
U8C
U29I
A8
A9
U21D
IOWRITE
LIOWRITE
U42F
U42C
P2-58(IN)LWRITE

FIG 3.50B


8MHz CLK
IO PRST
LIO PRST
LIST
LIOST8
IO EN
LIFEN
LINTVECT EN
IO WRITE
LIO WRITE
LIOWREN
LIORDEN
TP5
TP8
U27
R48 10K
U33D
U33B
U42D
LIOEN
U33C
U46
G4
G5
X → Y
U34A
FF
U21B
U27A
U23
REG
EN
IOA1
IOA2
IOA3
IOA4
IOA5
IOA6
IOA7
A1
A2
A3
A4
A5
A6
A7
NC
NO

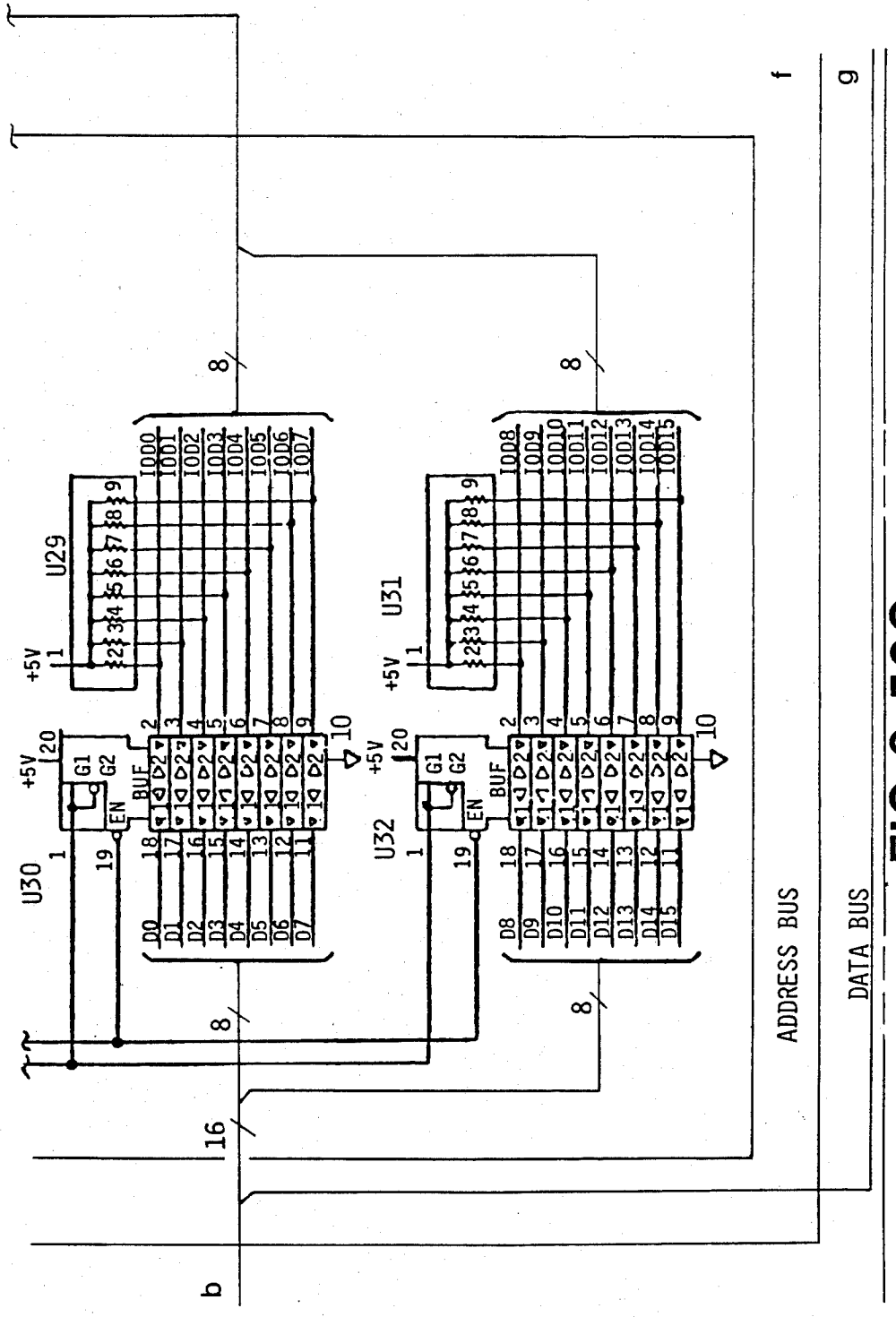


FIG 3.50G

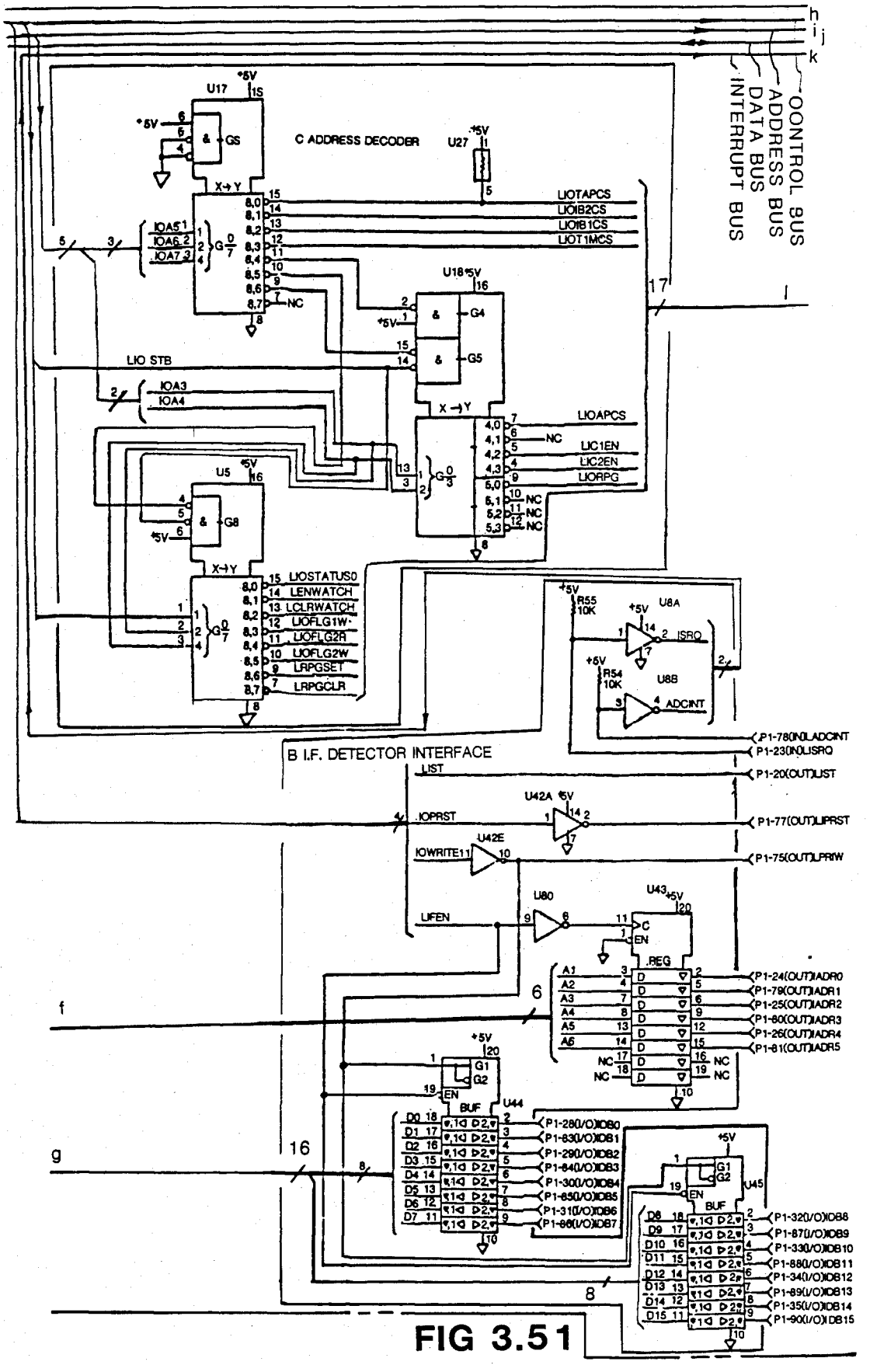

CONTROL BUS
ADDRESS BUS
DATA BUS
INTERRUPT BUS
C ADDRESS DECODER
U17
U27
U18
U5
U8A
U8B
LIOTAPCS
LIOIB2CS
LIOIB1CS
LIOT1MCS
LIO STB
IOA3
IOA4
LIOAPCS
LIC1EN
LIC2EN
LIORPG
LIOSTATUS0
LENWATCH
LCLRWATCH
LIOFLG1W
LIOFLG2R
LIOFLG2W
LRPGSET
LRPGCLR
ISRQ
ADCINT
B I.F. DETECTOR INTERFACE
LIST
IOPRST
IOWRITE
LIFEN
U42A
U42E
U80
U43
REG
U44
U45
BUF
P1-78(IN)LADCINT
P1-23(IN)LISRQ
P1-20(OUT)LIST
P1-77(OUT)LIPRST
P1-75(OUT)LPRW
P1-24(OUT)ADR0
P1-79(OUT)ADR1
P1-25(OUT)ADR2
P1-80(OUT)ADR3
P1-26(OUT)ADR4
P1-81(OUT)ADR5
P1-28(I/O)DB0
P1-83(I/O)DB1
P1-29(I/O)DB2
P1-84(I/O)DB3
P1-30(I/O)DB4
P1-85(I/O)DB5
P1-31(I/O)DB6
P1-86(I/O)DB7
P1-32(I/O)DB8
P1-87(I/O)DB9
P1-33(I/O)DB10
P1-88(I/O)DB11
P1-34(I/O)DB12
P1-89(I/O)DB13
P1-35(I/O)DB14
P1-90(I/O)DB15

FIG 3.51

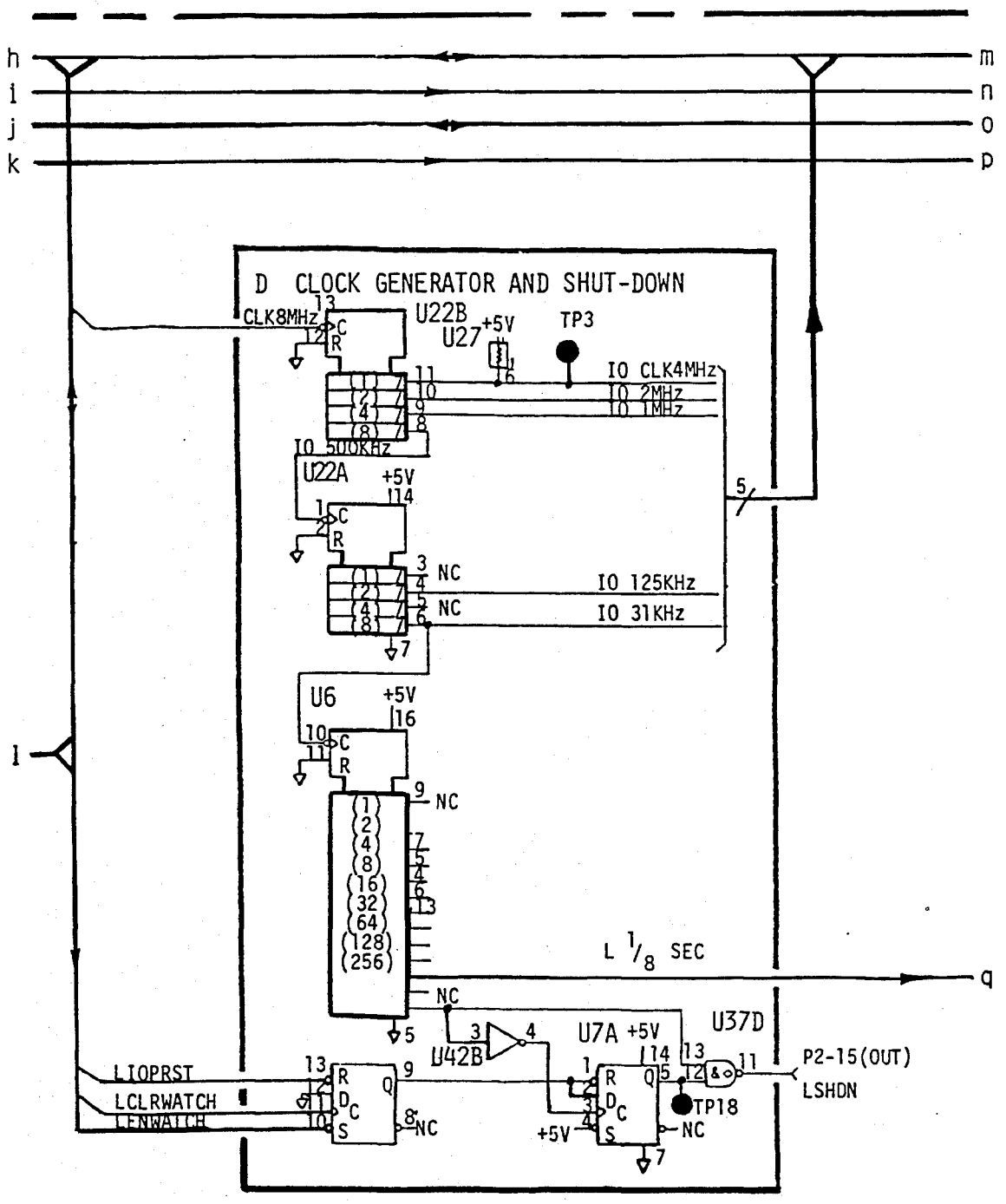

h
i
j
k
m
n
o
p
l
q
D CLOCK GENERATOR AND SHUT-DOWN
CLK8MHz
U22B
U27
+5V
TP3
IO CLK4MHz
IO 2MHz
IO 1MHz
IO 500KHz
U22A
IO 125KHz
IO 31KHz
NC
U6
L 1/8 SEC
U42B
U7A
U37D
P2-15(OUT)
LSHDN
TP18
LIOPRST
LCLRWATCH
LENWATCH

FIG 3.52

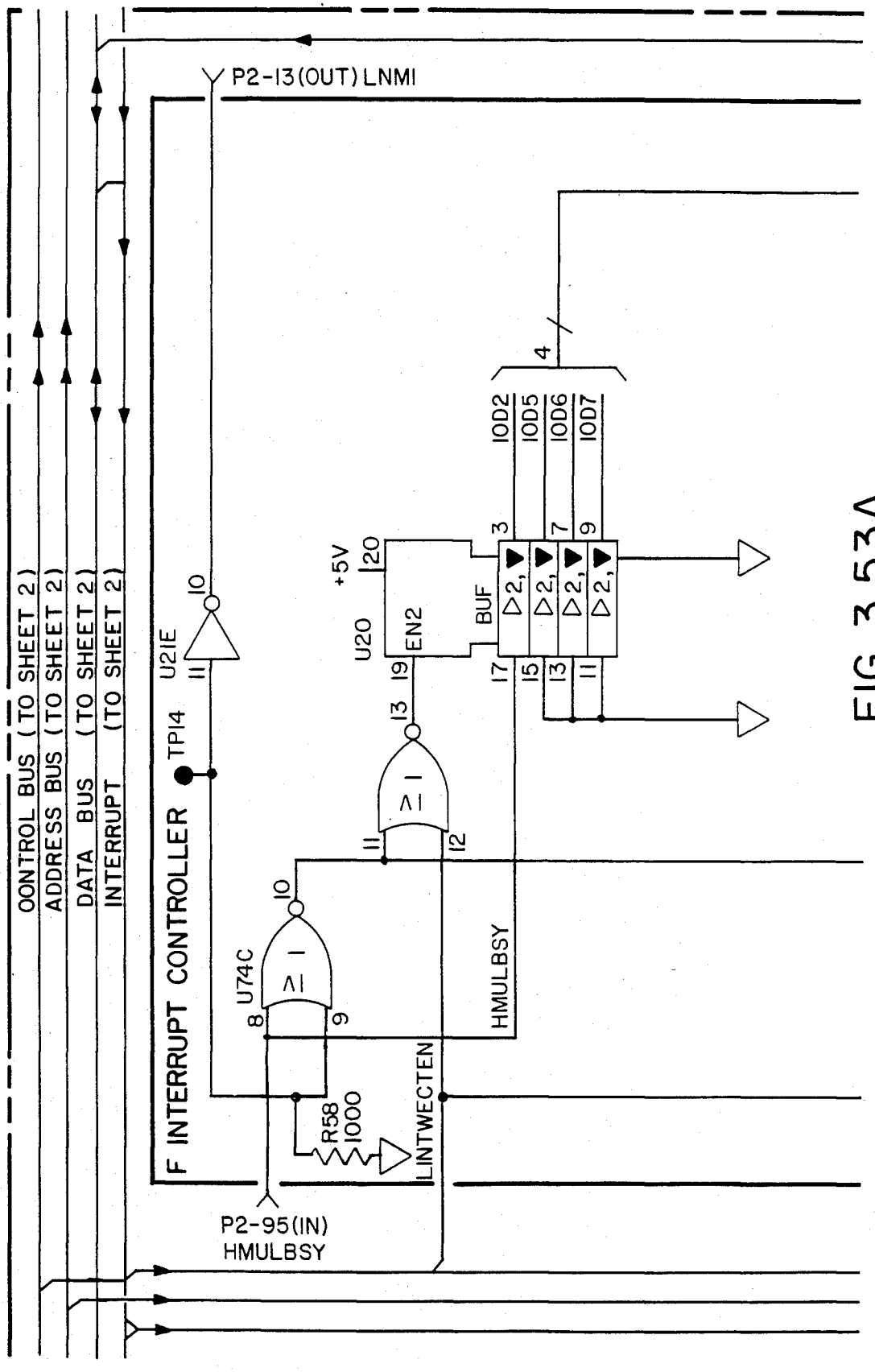

OONTROL BUS (TO SHEET 2)
ADDRESS BUS (TO SHEET 2)
DATA BUS (TO SHEET 2)
INTERRUPT (TO SHEET 2)
F INTERRUPT CONTROLLER
P2-13(OUT) LNMI
P2-95(IN) HMULBSY
TP14
U21E
U74C
U20
BUF
EN2
+5V
R58 1000
HMULBSY
LINTWECTEN
IOD2
IOD5
IOD6
IOD7

FIG 3.53A

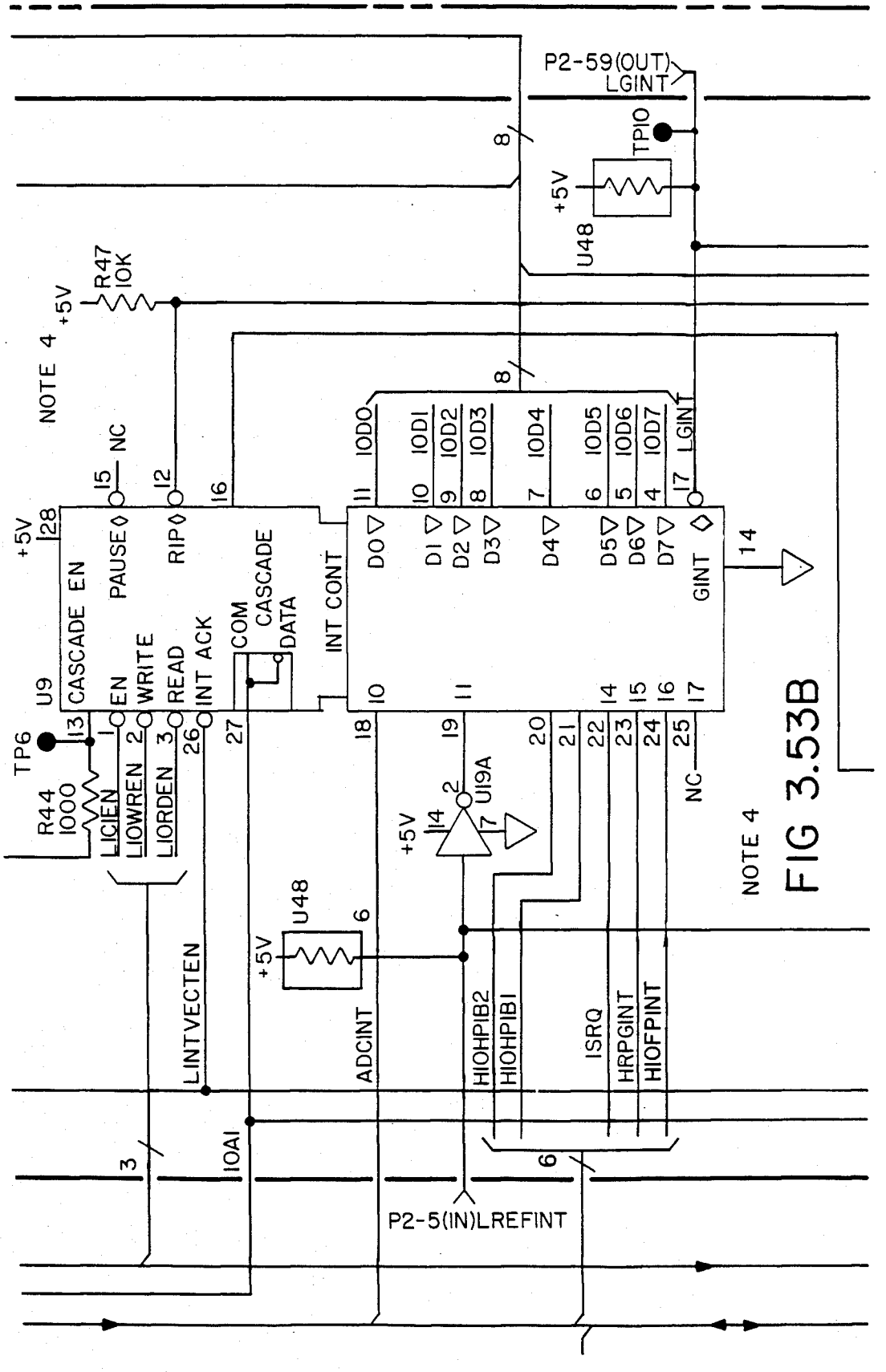

P2-59(OUT)
LGINT
TP10
+5V
U48
R47
10K
NOTE 4
NC
PAUSE
RIP
CASCADE EN
U9
EN
WRITE
READ
INT ACK
COM
CASCADE
DATA
INT CONT
10D0
10D1
10D2
10D3
10D4
10D5
10D6
10D7
LGINT
D0
D1
D2
D3
D4
D5
D6
D7
GINT
TP6
R44
1000
LIOEN
LIOWREN
LIORDEN
U19A
LINTVECTEN
ADCINT
HIOHPIB2
HIOHPIB1
ISRQ
HRPGINT
HIOFPINT
IOAI
P2-5(IN)LREFINT

FIG 3.53B

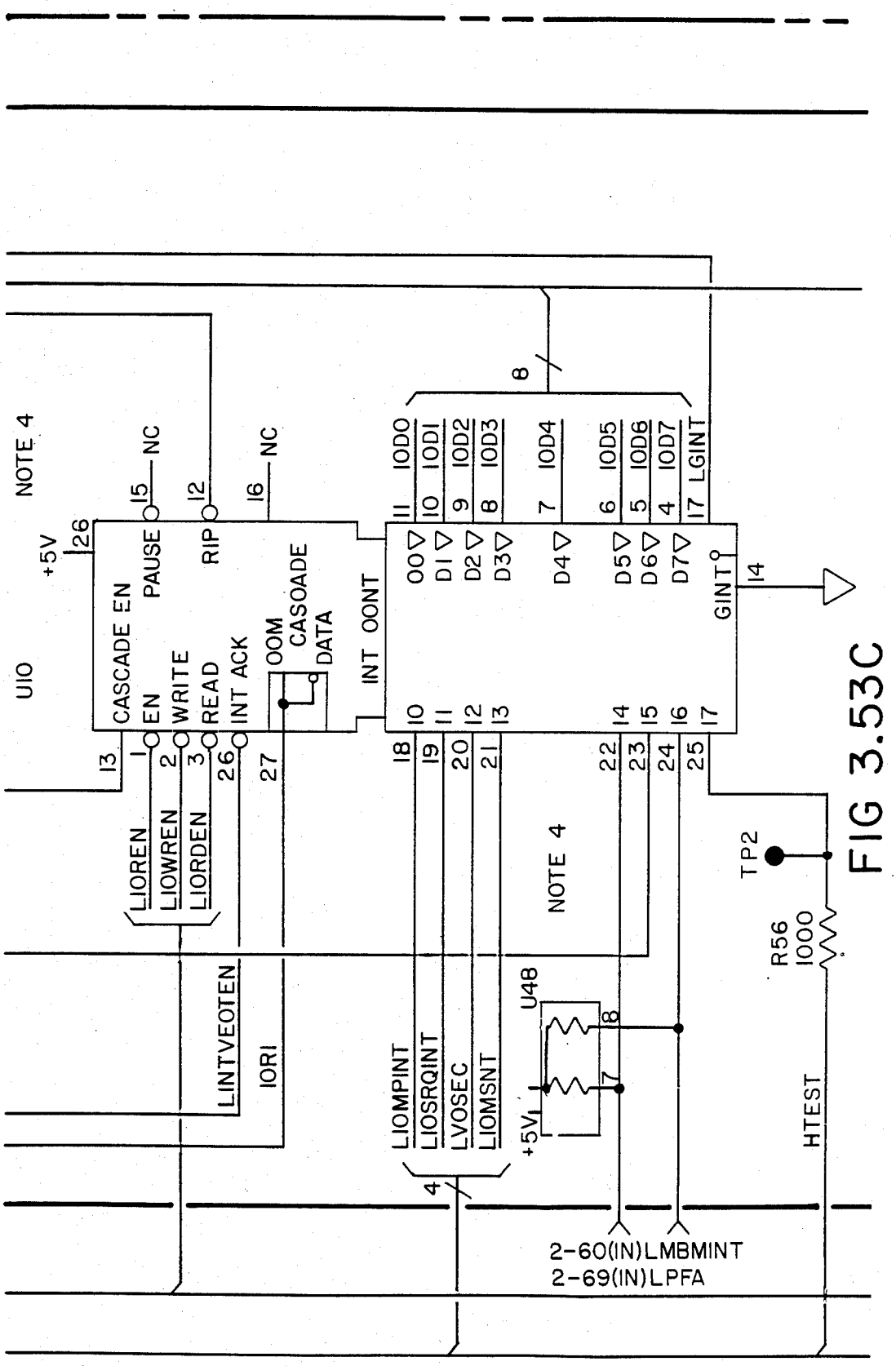

NOTE 4
+5V
26
15
NC
12
16
NC
8
10D0
10D1
10D2
10D3
10D4
10D5
10D6
10D7
LGINT
11
10
9
8
7
6
5
4
17
U10
CASCADE EN
EN
WRITE
READ
INT ACK
PAUSE
RIP
OOM
CASOADE
DATA
INT OONT
D0
D1
D2
D3
D4
D5
D6
D7
GINT
14
13
1
2
3
26
27
10
11
12
13
14
15
16
17
LIOREN
LIOWREN
LIORDEN
18
19
20
21
22
23
24
25
NOTE 4
TP2
R56
1000
U48
8
7
+5V
LIOMPINT
LIOSRQINT
LVOSEC
LIOMSNT
LINTVEOTEN
IORI
HTEST
4
2-60(IN)LMBMINT
2-69(IN)LPFA

FIG 3.53C

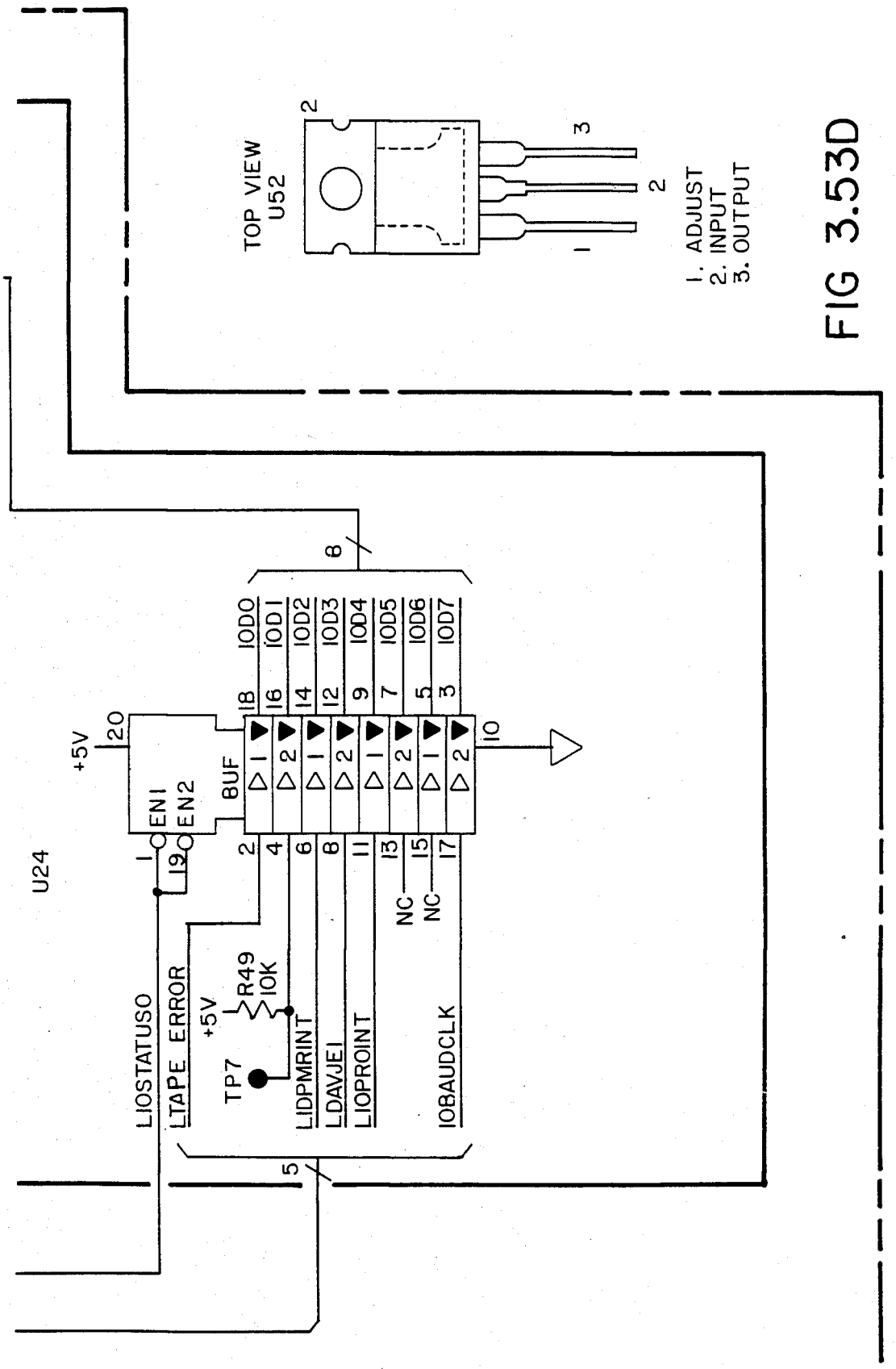

TOP VIEW
U52
1. ADJUST
2. INPUT
3. OUTPUT
U24
+5V
EN1
EN2
BUF
IOD0
IOD1
IOD2
IOD3
IOD4
IOD5
IOD6
IOD7
NC
NC
LIOSTATUSO
LTAPE ERROR
R49
10K
TP7
LIDPMRINT
LDAVJEI
LIOPROINT
IOBAUDCLK

FIG 3.53D

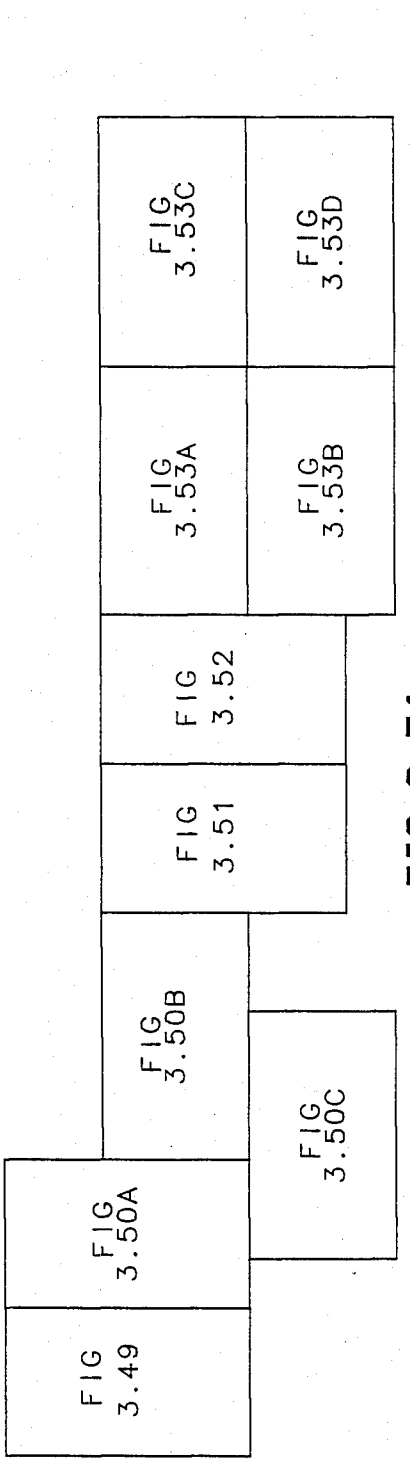


FIG 3.54

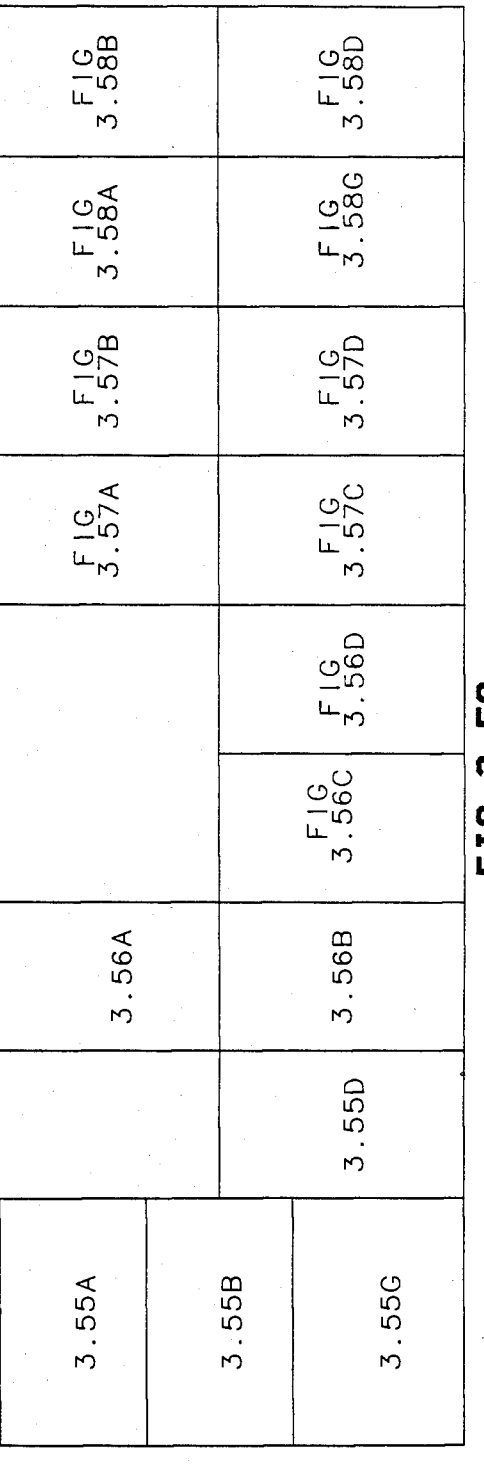


FIG 3.59

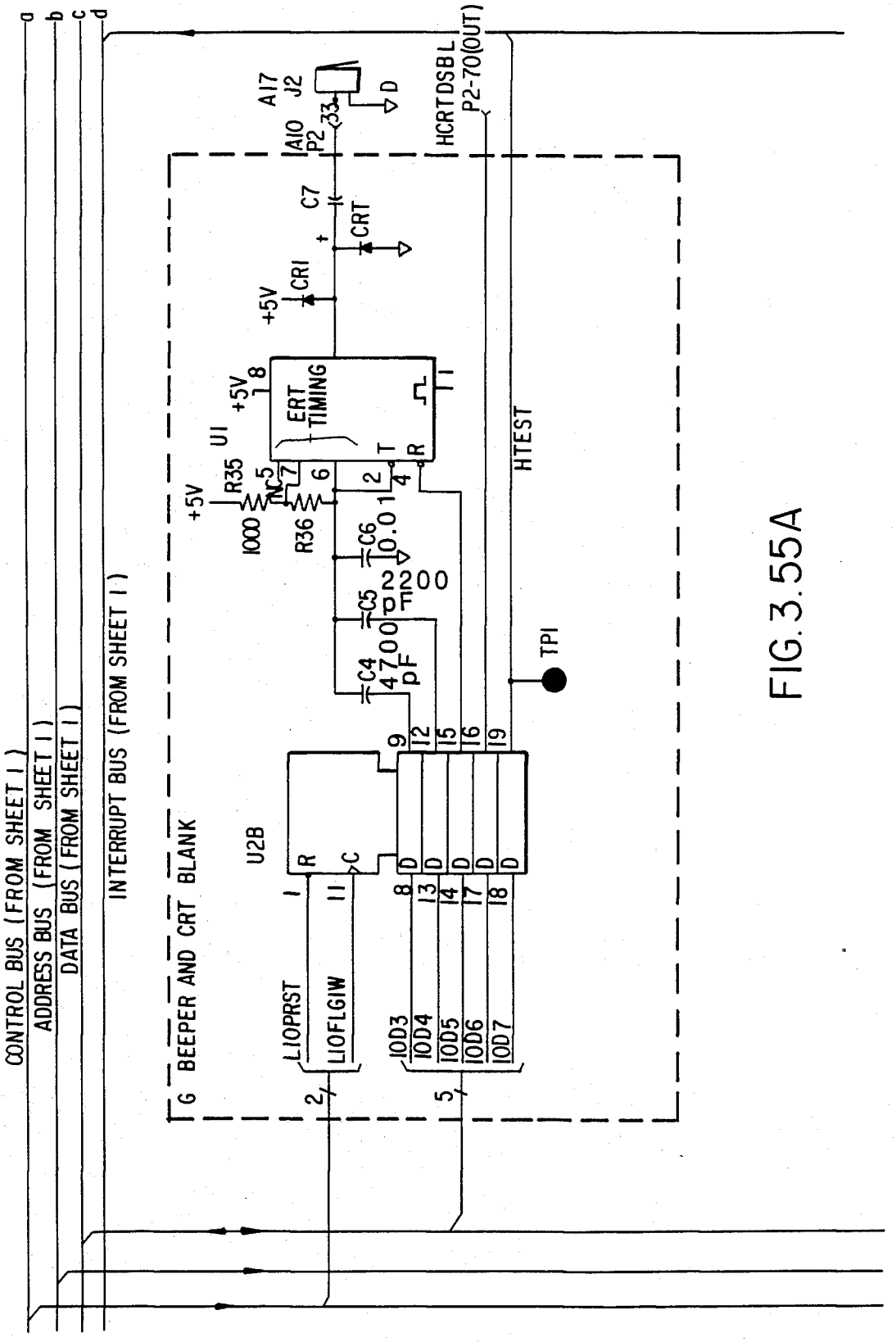

CONTROL BUS (FROM SHEET 1)
ADDRESS BUS (FROM SHEET 1)
DATA BUS (FROM SHEET 1)
INTERRUPT BUS (FROM SHEET 1)
HCRTDSBL
P2-70(OUT)
A17
J2
A10
P2
33
D
C7
CRT
CR1
+5V
U1
ERT TIMING
R35
100Ω
R36
C6
0.01
C5
2200 pF
C4
4700 pF
TP1
HTEST
U2B
LIOPRST
LIOFLGIW
IOD3
IOD4
IOD5
IOD6
IOD7
BEEPER AND CRT BLANK

FIG. 3.55A

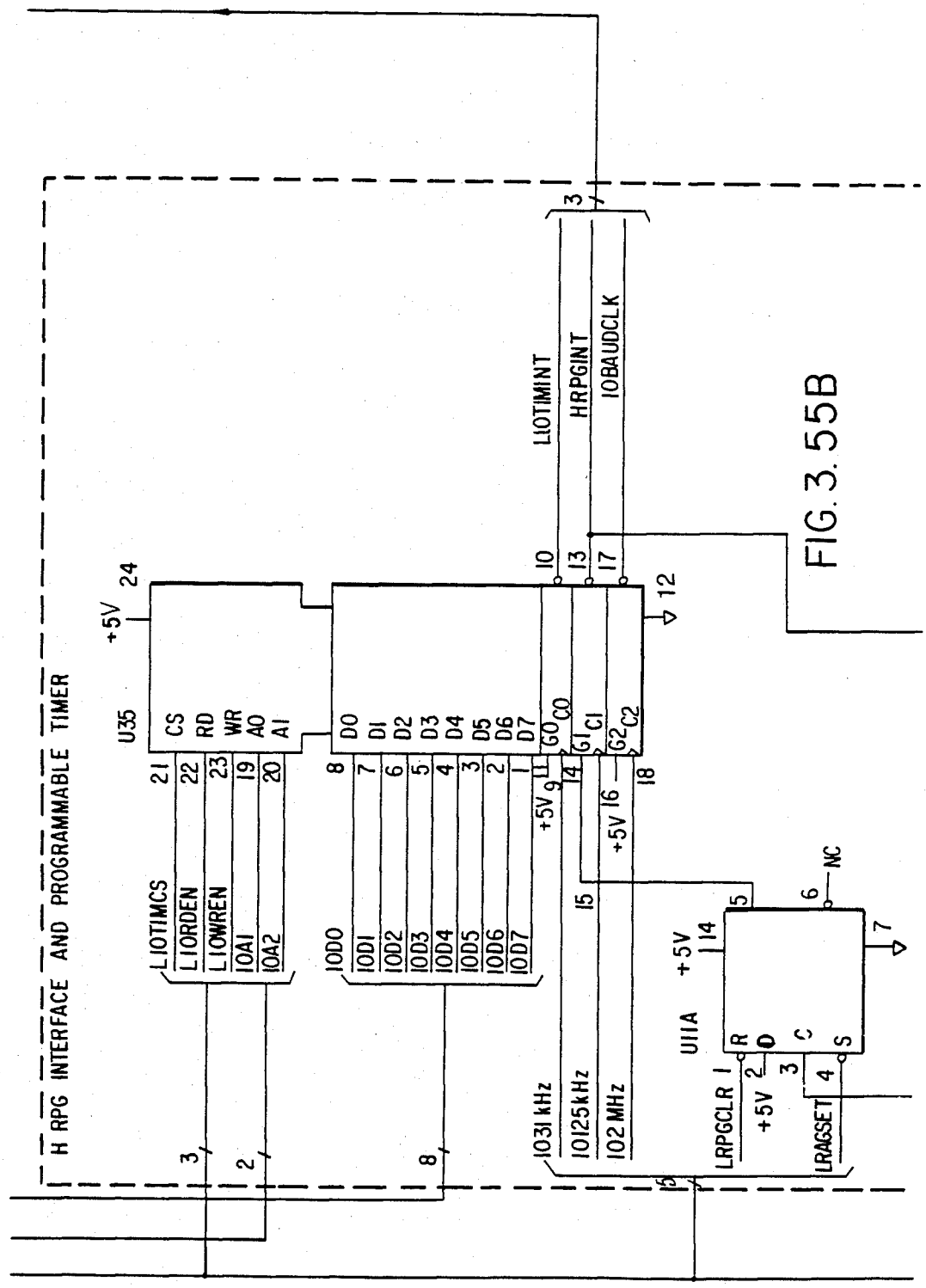

H RPG INTERFACE AND PROGRAMMABLE TIMER
U35
+5V
24
CS
RD
WR
A0
A1
21
22
23
19
20
L1OTIMCS
L1ORDEN
L1OWREN
1OA1
1OA2
D0
D1
D2
D3
D4
D5
D6
D7
8
7
6
5
4
3
2
1
1OD0
1OD1
1OD2
1OD3
1OD4
1OD5
1OD6
1OD7
G0
C0
G1
C1
G2
C2
11
14
18
+5V
9
+5V
16
10
13
17
12
L1OTIMINT
HRPGINT
1OBAUDCLK
3
1031 kHz
10125kHz
102 MHz
15
U11A
+5V
14
5
6
NC
7
R
D
C
S
1
2
3
4
LRPGCLR 1
+5V
LRAGSET

FIG. 3.55B

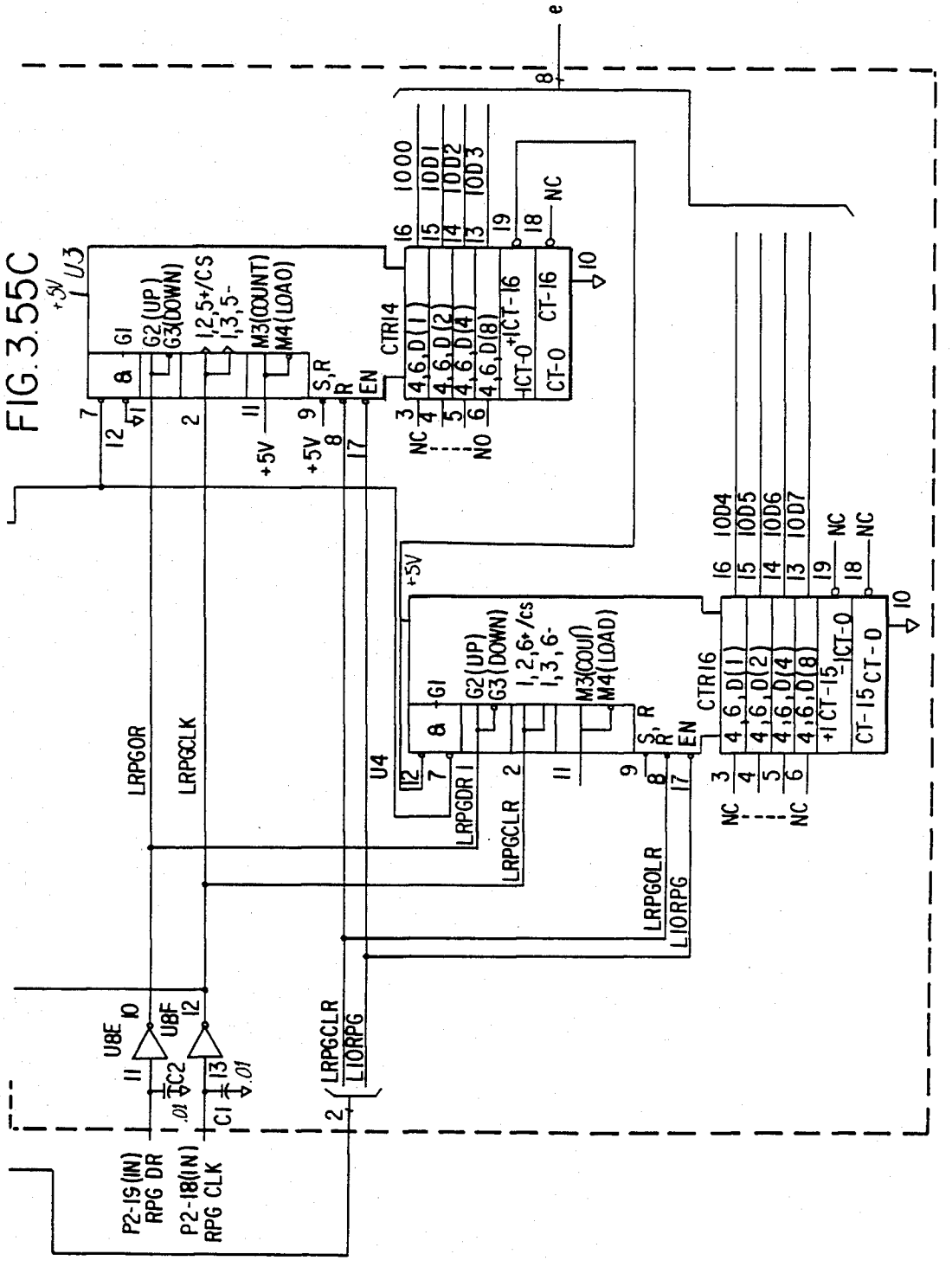


FIG. 3.55C
U3
U4
CTR14
CTR16
G1
G2(UP)
G3(DOWN)
M3(COUNT)
M4(LOAD)
CT-0
CT-16
CT-15
LRPGOR
LRPGCLK
LRPGDR I
LRPGCLR
LRPGOLR
LIORPG
U8E
U8F
C1
C2
.01
+5V
P2-19(IN) RPG DR
P2-18(IN) RPG CLK

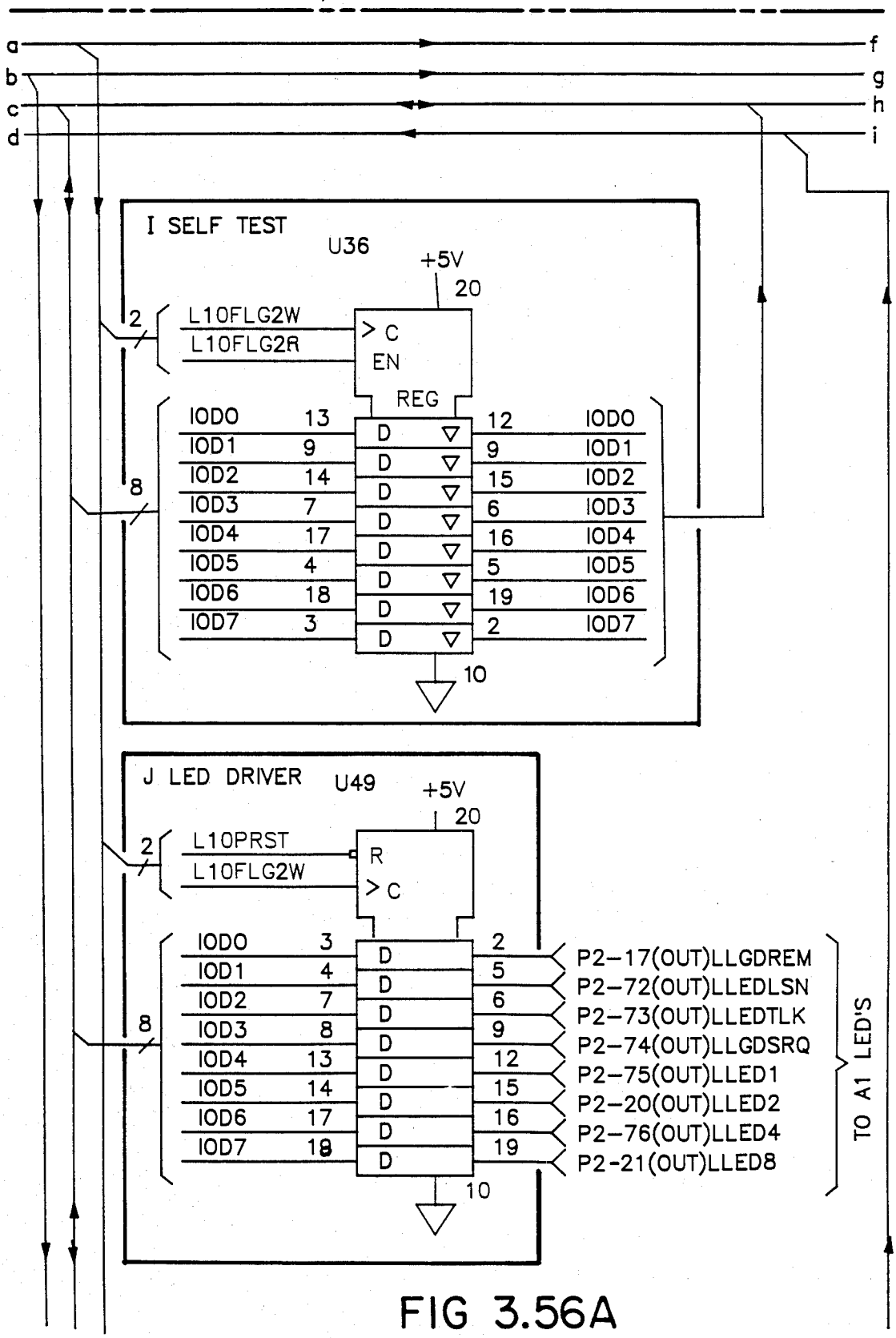

a
b
c
d
f
g
h
i
I SELF TEST
U36
+5V
20
2
L10FLG2W
L10FLG2R
> C
EN
REG
8
IOD0 13 12 IOD0
IOD1 9 9 IOD1
IOD2 14 15 IOD2
IOD3 7 6 IOD3
IOD4 17 16 IOD4
IOD5 4 5 IOD5
IOD6 18 19 IOD6
IOD7 3 2 IOD7
D
10
J LED DRIVER U49
+5V
20
2
L10PRST
L10FLG2W
R
> C
8
IOD0 3 2
IOD1 4 5
IOD2 7 6
IOD3 8 9
IOD4 13 12
IOD5 14 15
IOD6 17 16
IOD7 18 19
P2-17(OUT)LLGDREM
P2-72(OUT)LLEDLSN
P2-73(OUT)LLEDTLK
P2-74(OUT)LLGDSRQ
P2-75(OUT)LLED1
P2-20(OUT)LLED2
P2-76(OUT)LLED4
P2-21(OUT)LLED8
TO A1 LED'S
10

FIG 3.56A

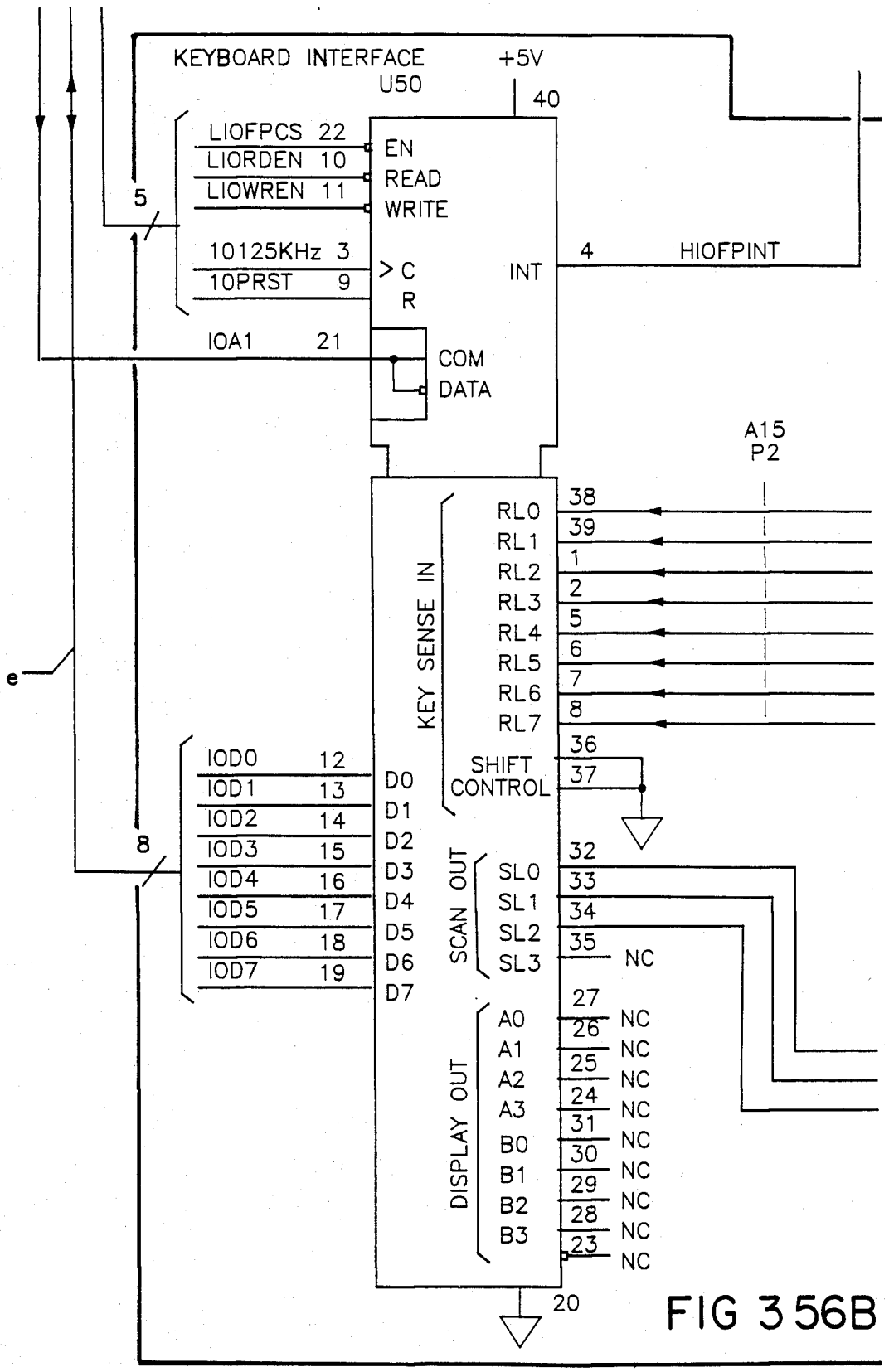

KEYBOARD INTERFACE
U50
+5V
40
LIOFPCS 22
LIORDEN 10
LIOWREN 11
EN
READ
WRITE
5
10125KHz 3
10PRST 9
> C
R
INT
4
HIOFPINT
IOA1 21
COM
DATA
A15
P2
KEY SENSE IN
RL0 38
RL1 39
RL2 1
RL3 2
RL4 5
RL5 6
RL6 7
RL7 8
SHIFT CONTROL 36 37
e
IOD0 12
IOD1 13
IOD2 14
IOD3 15
IOD4 16
IOD5 17
IOD6 18
IOD7 19
D0
D1
D2
D3
D4
D5
D6
D7
8
SCAN OUT
SL0 32
SL1 33
SL2 34
SL3 35 NC
DISPLAY OUT
A0 27
A1 26 NC
A2 25 NC
A3 24 NC
B0 31 NC
B1 30 NC
B2 29 NC
B3 28 NC
23 NC
20

FIG 356B

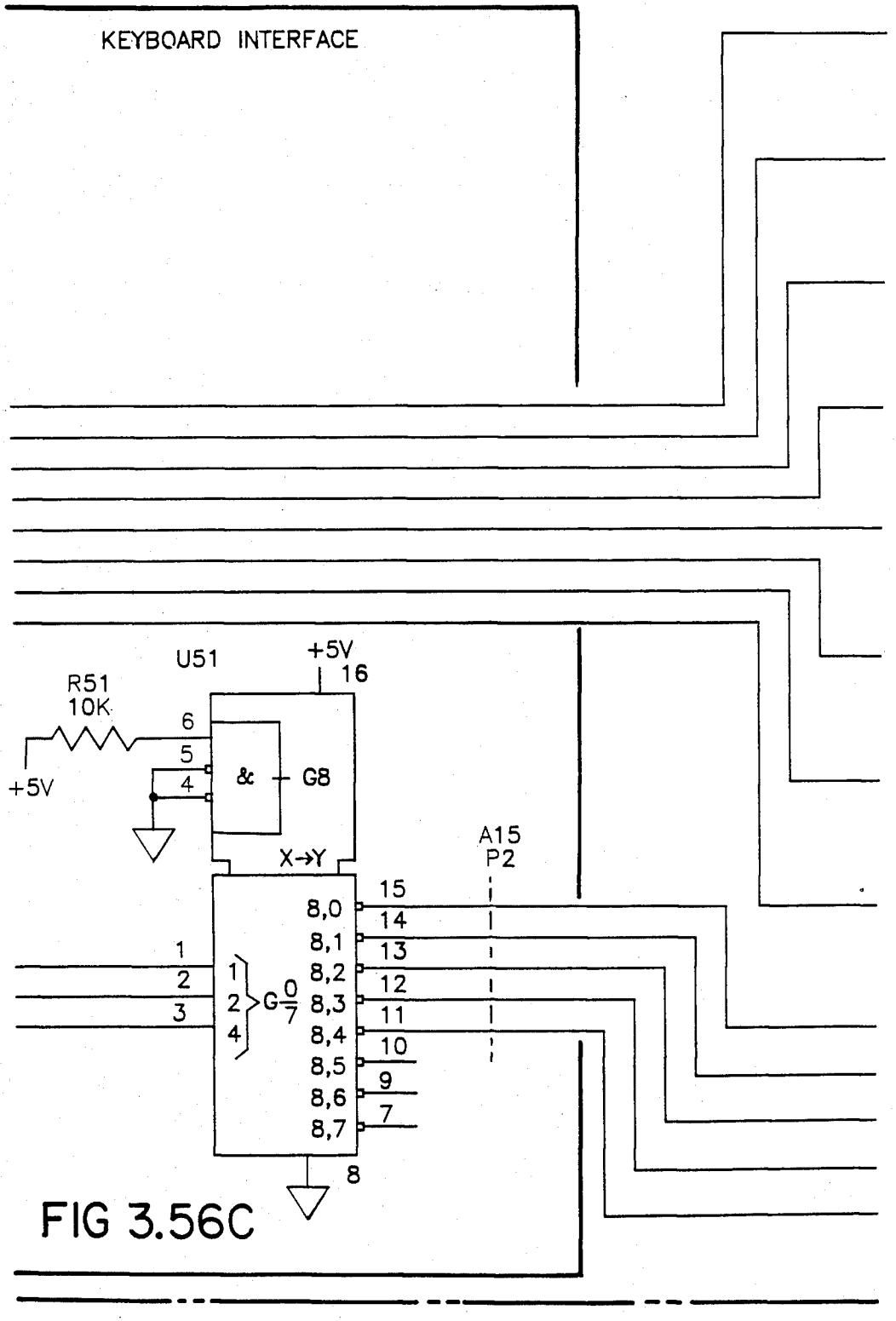

KEYBOARD INTERFACE
U51
+5V
16
R51
10K
6
5
4
&
G8
+5V
X→Y
A15
P2
15
14
13
12
11
10
9
7
8
8,0
8,1
8,2
8,3
8,4
8,5
8,6
8,7
1
2
3
1
2
4
G 0/7

FIG 3.56C

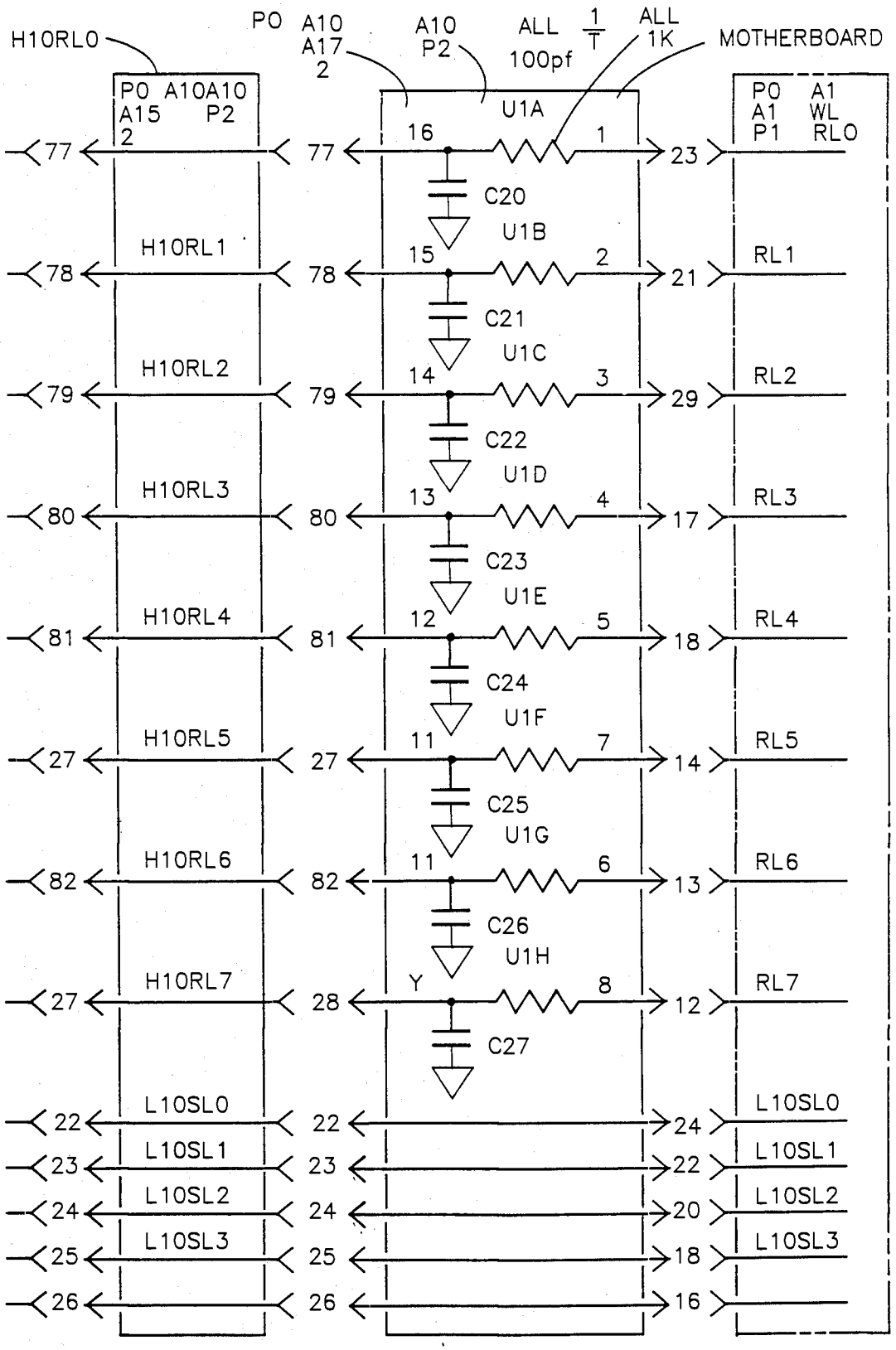

H10RL0
P0 A10A10
A15 P2
2
P0
A10
A17
2
A10
P2
ALL
100pf
1
T
ALL
1K
MOTHERBOARD
U1A
P0 A1
A1 WL
P1 RLO
77
16
1
23
C20
U1B
H10RL1
78
15
2
21
RL1
C21
U1C
H10RL2
79
14
3
29
RL2
C22
U1D
H10RL3
80
13
4
17
RL3
C23
U1E
H10RL4
81
12
5
18
RL4
C24
U1F
H10RL5
27
11
7
14
RL5
C25
U1G
H10RL6
82
11
6
13
RL6
C26
U1H
H10RL7
27
Y
28
8
12
RL7
C27
L10SL0
22
22
24
L10SL0
L10SL1
23
23
22
L10SL1
L10SL2
24
24
20
L10SL2
L10SL3
25
25
18
L10SL3
26
26
16

FIG 3.56D

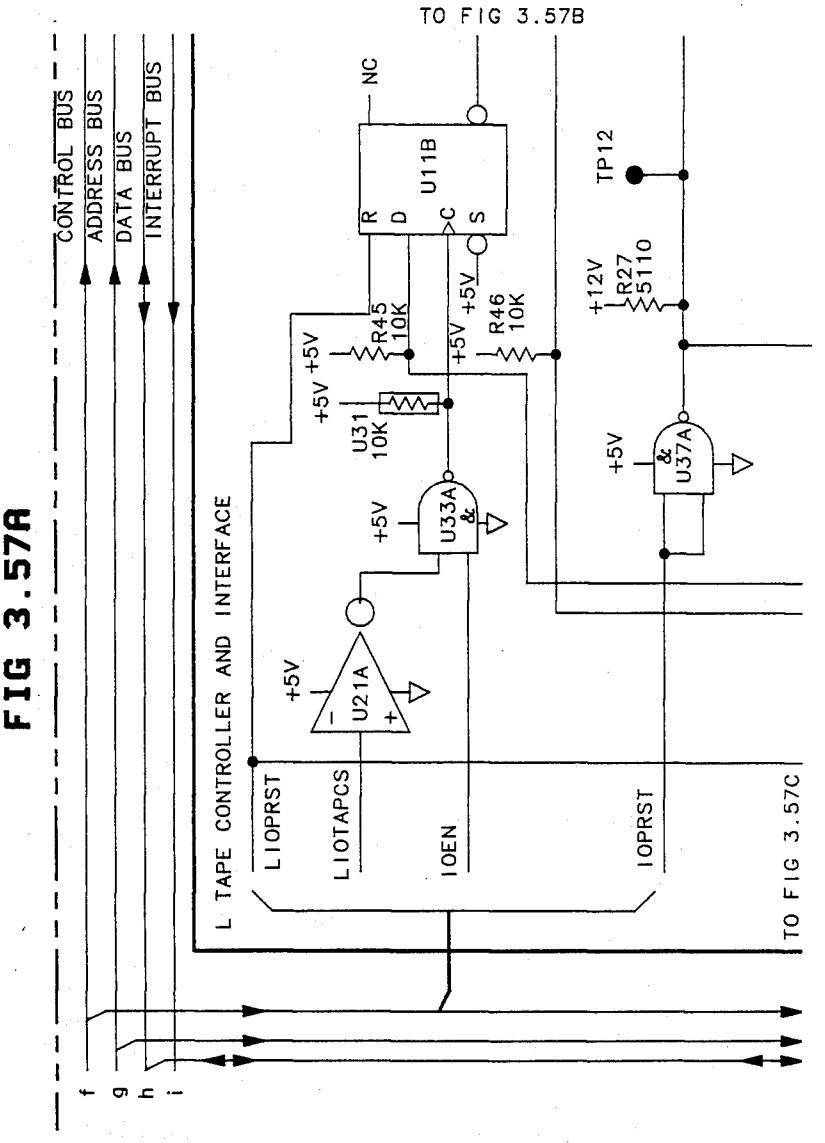

TO FIG 3.57B
CONTROL BUS
ADDRESS BUS
DATA BUS
INTERRUPT BUS
L TAPE CONTROLLER AND INTERFACE
NC
U11B
R
D
C
S
TP12
+12V
R27
5110
R45
10K
R46
10K
+5V
U31
10K
U33A
U37A
U21A
LIOPRST
LIOTAPCS
IOEN
IOPRST
TO FIG 3.57C
f
g
h
i

FIG 3.57A

FIG 3.57B

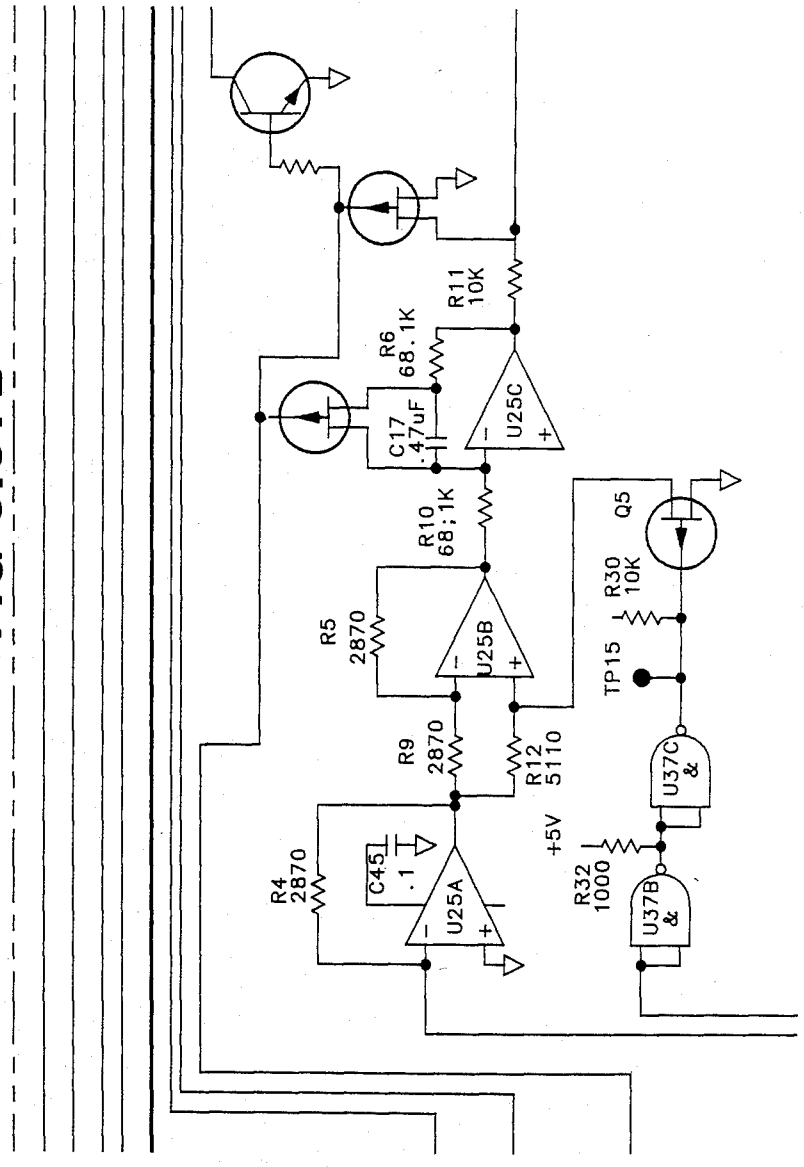
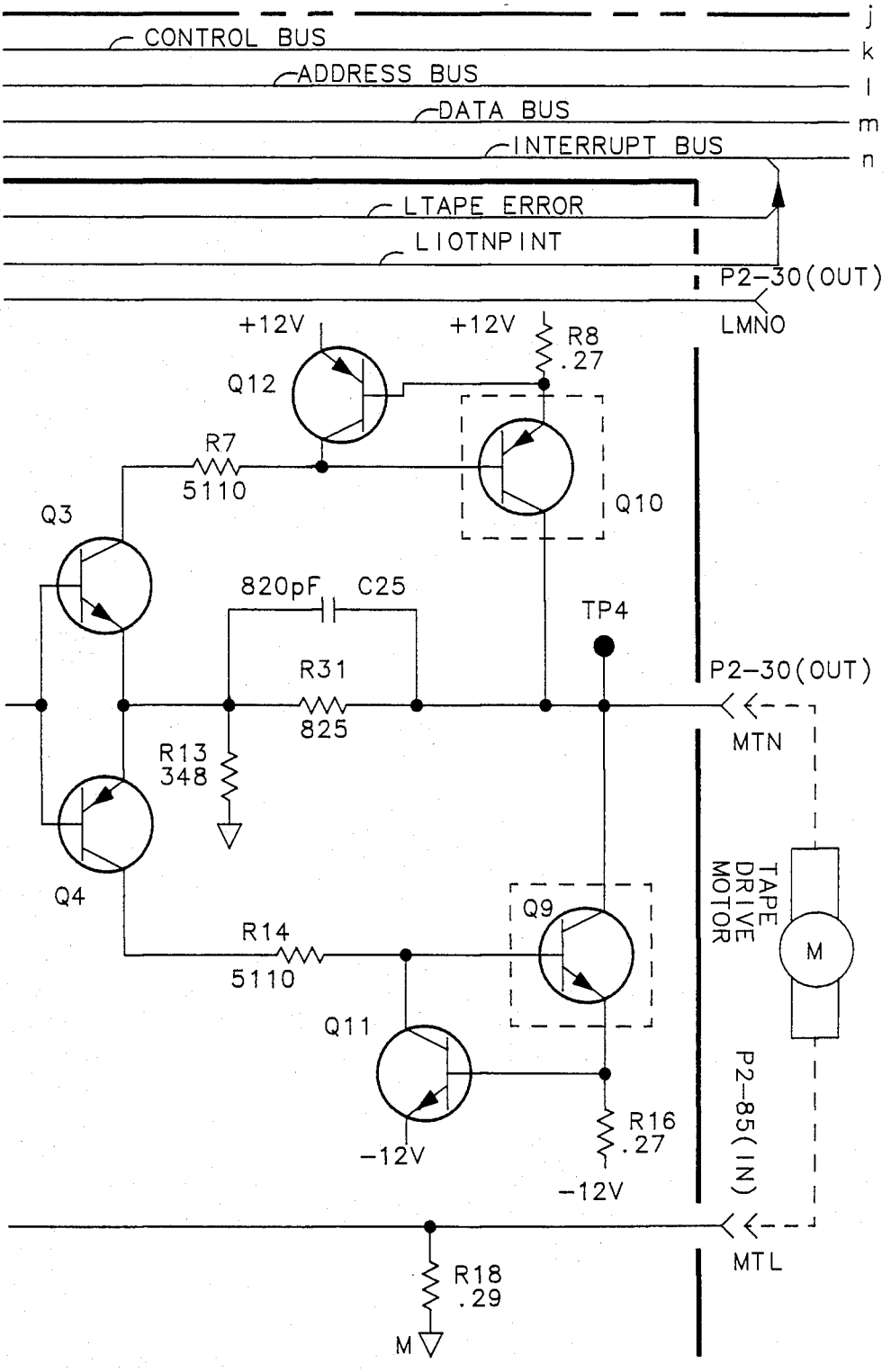

R11
10K
R6
68.1K
C17
.47uF
U25C
R10
68;1K
Q5
R30
10K
R5
2870
U25B
TP15
R9
2870
R12
5110
U37C
&
+5V
R4
2870
C45
.1
U25A
R32
1000
U37B
&

FIG 3.57C


CONTROL BUS
ADDRESS BUS
DATA BUS
INTERRUPT BUS
LTAPE ERROR
LIOTNPINT
P2-30(OUT)
LMNO
j
k
l
m
n
+12V
+12V
R8
.27
Q12
R7
5110
Q10
Q3
820pF
C25
TP4
R31
825
P2-30(OUT)
MTN
R13
348
Q4
Q9
R14
5110
TAPE DRIVE MOTOR
M
Q11
R16
.27
-12V
-12V
P2-85(IN)
MTL
R18
.29
M

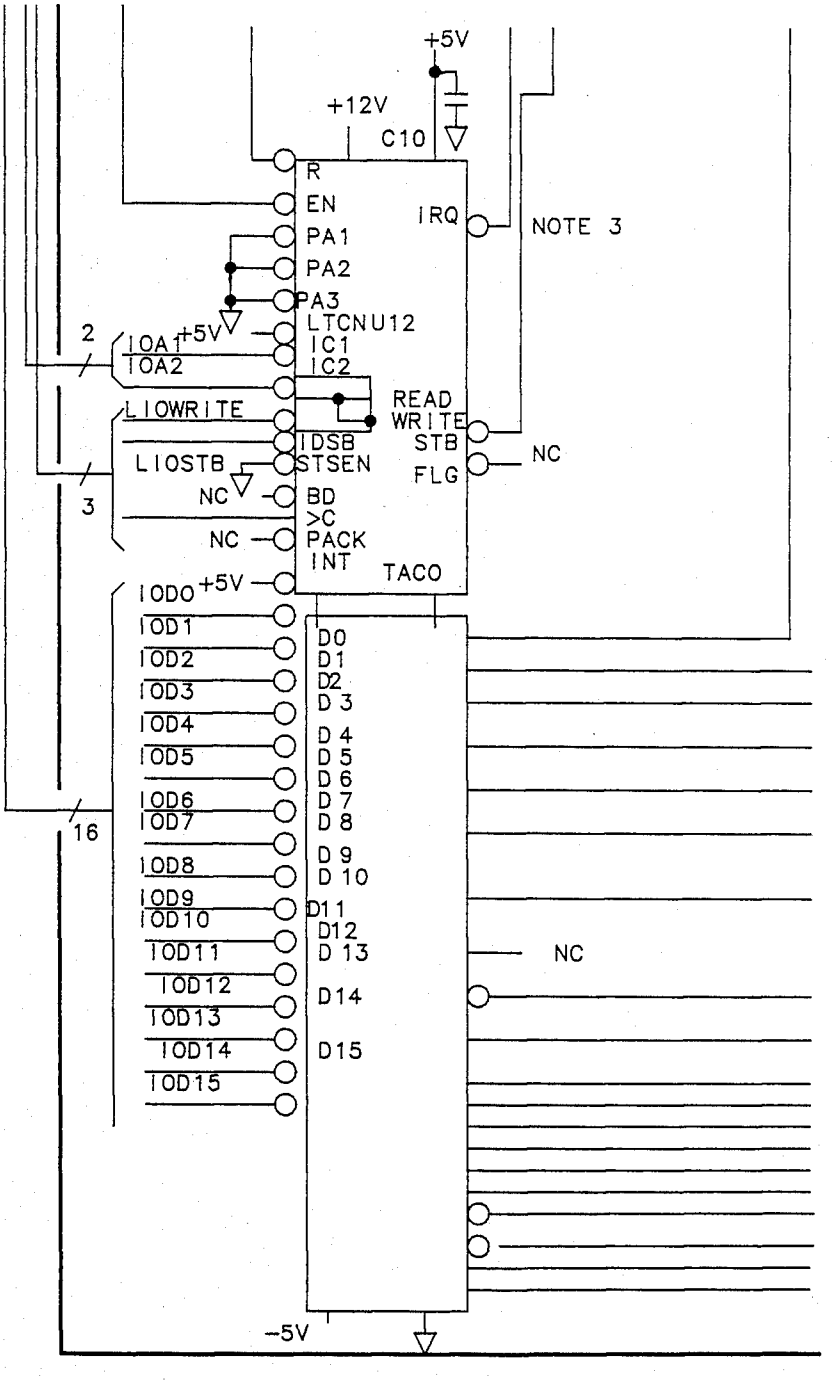

+5V
+12V
C10
R
EN
IRQ
NOTE 3
PA1
PA2
PA3
LTCNU12
IC1
IC2
READ
WRITE
STB
NC
FLG
IDSB
STSEN
BD
>C
PACK
INT
TACO
IOA1
IOA2
LIOWRITE
LIOSTB
IOD0
IOD1
IOD2
IOD3
IOD4
IOD5
IOD6
IOD7
IOD8
IOD9
IOD10
IOD11
IOD12
IOD13
IOD14
IOD15
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
2
3
16
-5V

FIG 3.57D

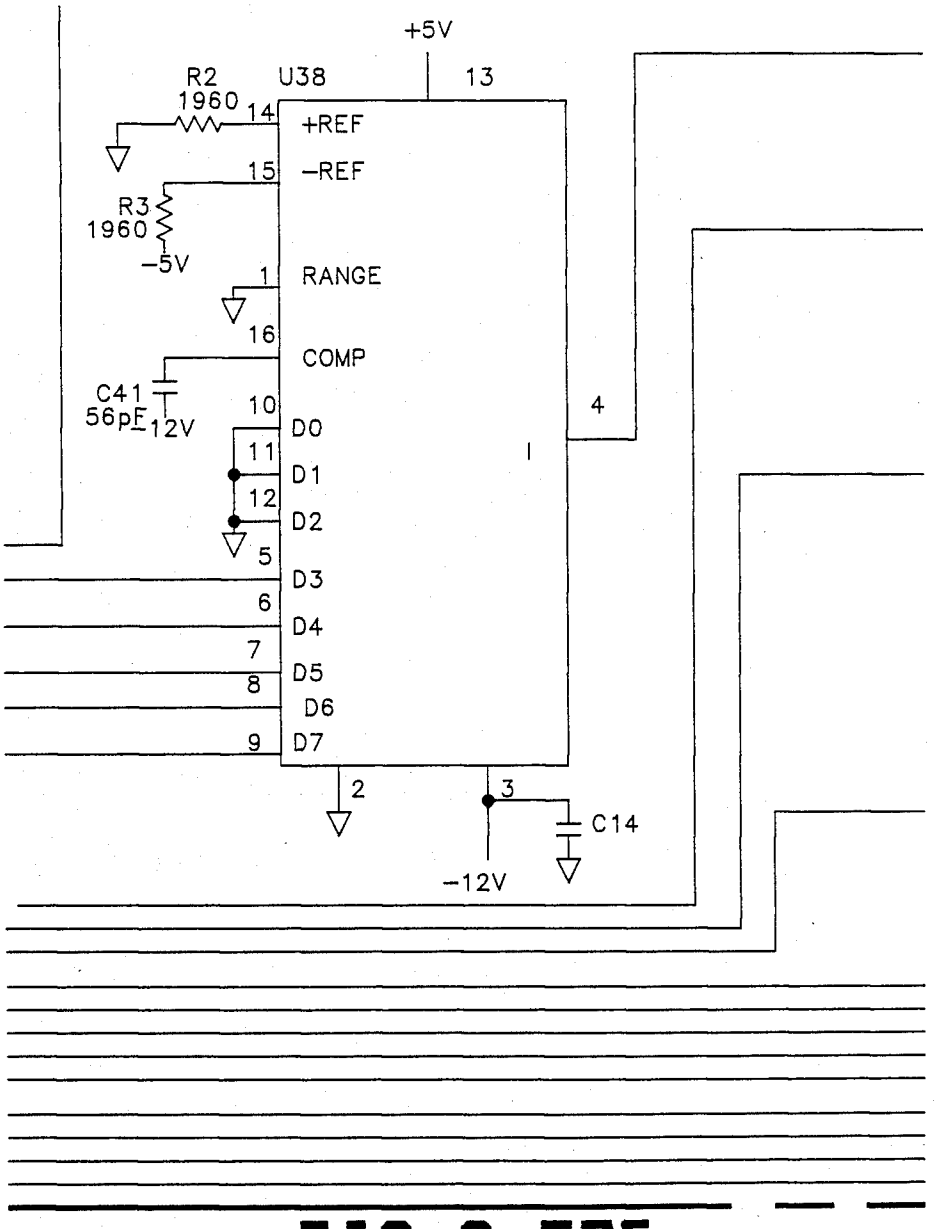

+5V
R2
1960
U38
13
14
+REF
15
-REF
R3
1960
-5V
1
RANGE
16
COMP
C41
56pF
12V
10
D0
4
11
D1
1
12
D2
5
D3
6
D4
7
D5
8
D6
9
D7
2
3
C14
-12V

FIG 3.57E

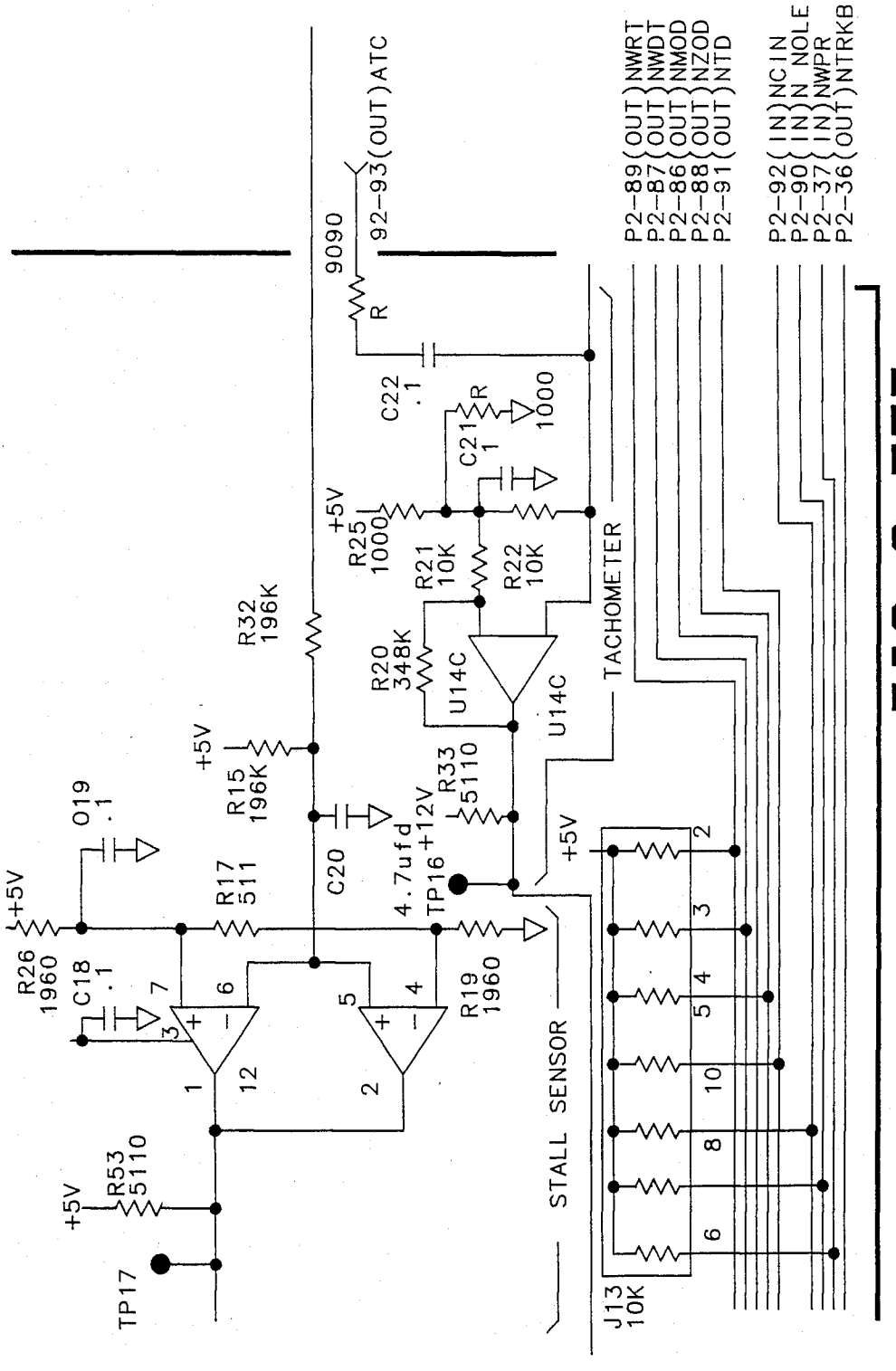

9090
R
92-93(OUT)ATC
C22
.1
C21
1
R
1000
+5V
R25
1000
R21
10K
R22
10K
R32
196K
R20
348K
U14C
U14C
U14C
TACHOMETER
P2-89(OUT)NWRT
P2-87(OUT)NWDT
P2-86(OUT)NMOD
P2-88(OUT)NZOD
P2-91(OUT)NTD
P2-92(IN)NC IN
P2-90(IN)N_NOLE
P2-37(IN)NWPR
P2-36(OUT)NTRKB
+5V
R15
196K
C19
.1
+5V
R17
511
C20
4.7ufd
TP16
+12V
R33
5110
+5V
+5V
R26
1960
C18
.1
R19
1960
STALL SENSOR
+5V
R53
5110
TP17
J13
10K

FIG 3.57F

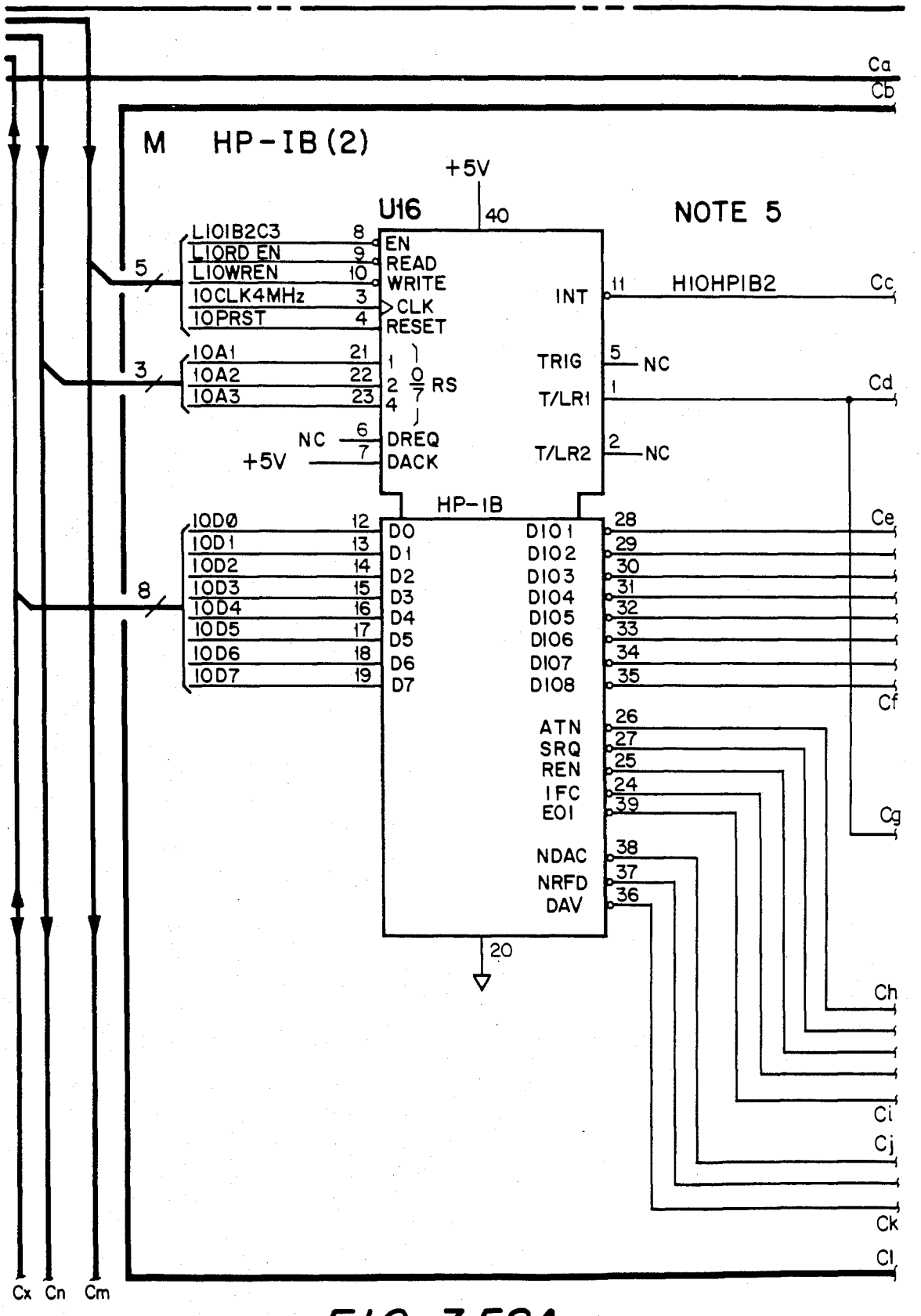

M HP-IB (2)
+5V
U16
40
NOTE 5
LIOIB2C3
LIORD EN
LIOWREN
IOCLK4MHz
IOPRST
IOA1
IOA2
IOA3
NC
+5V
EN
READ
WRITE
CLK
RESET
RS
DREQ
DACK
INT
TRIG
T/LR1
T/LR2
HIOHPIB2
NC
NC
HP-IB
IOD0
IOD1
IOD2
IOD3
IOD4
IOD5
IOD6
IOD7
D0
D1
D2
D3
D4
D5
D6
D7
DIO1
DIO2
DIO3
DIO4
DIO5
DIO6
DIO7
DIO8
ATN
SRQ
REN
IFC
EOI
NDAC
NRFD
DAV
20
Ca
Cb
Cc
Cd
Ce
Cf
Cg
Ch
Ci
Cj
Ck
Cl
Cx
Cn
Cm

FIG 3.58A

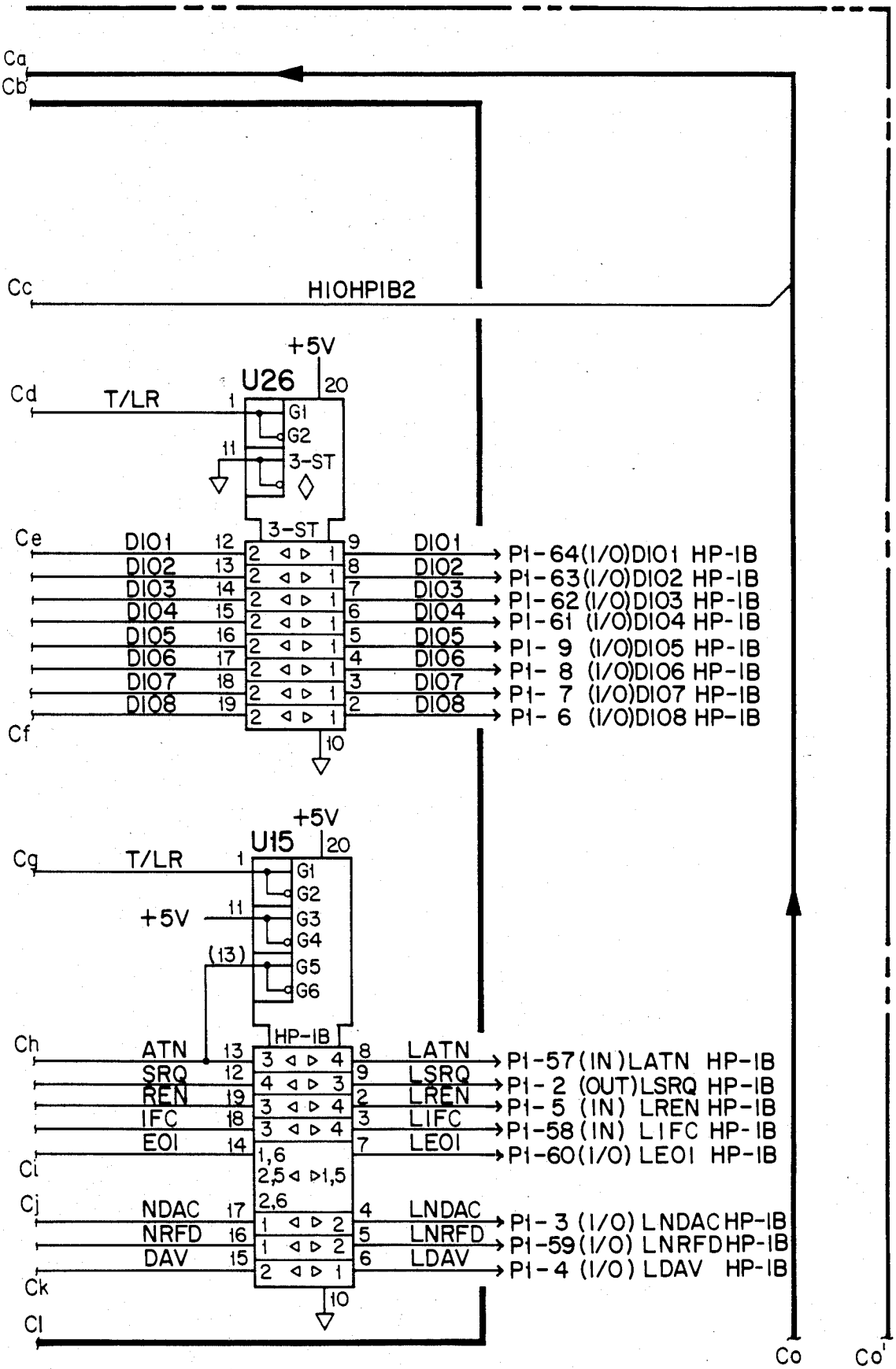

Ca
Cb
Cc
HIOHPIB2
+5V
U26
20
Cd
T/LR
1
G1
G2
11
3-ST
3-ST
Ce
DIO1 12 9 DIO1 → P1-64(I/O)DIO1 HP-IB
DIO2 13 8 DIO2 → P1-63(I/O)DIO2 HP-IB
DIO3 14 7 DIO3 → P1-62(I/O)DIO3 HP-IB
DIO4 15 6 DIO4 → P1-61 (I/O)DIO4 HP-IB
DIO5 16 5 DIO5 → P1- 9 (I/O)DIO5 HP-IB
DIO6 17 4 DIO6 → P1- 8 (I/O)DIO6 HP-IB
DIO7 18 3 DIO7 → P1- 7 (I/O)DIO7 HP-IB
DIO8 19 2 DIO8 → P1- 6 (I/O)DIO8 HP-IB
Cf
10
+5V
U15
20
Cg
T/LR
1
G1
G2
+5V
11
G3
G4
(13)
G5
G6
HP-IB
Ch
ATN 13 8 LATN → P1-57(IN)LATN HP-IB
SRQ 12 9 LSRQ → P1- 2 (OUT)LSRQ HP-IB
REN 19 2 LREN → P1- 5 (IN) LREN HP-IB
IFC 18 3 LIFC → P1-58(IN) LIFC HP-IB
EOI 14 7 LEOI → P1-60(I/O) LEOI HP-IB
Ci
1,6
2,5 1,5
Cj
2,6
NDAC 17 4 LNDAC → P1- 3 (I/O) LNDAC HP-IB
NRFD 16 5 LNRFD → P1-59(I/O) LNRFD HP-IB
DAV 15 6 LDAV → P1- 4 (I/O) LDAV HP-IB
Ck
10
Cl
Co
Co'

FIG 3.58B

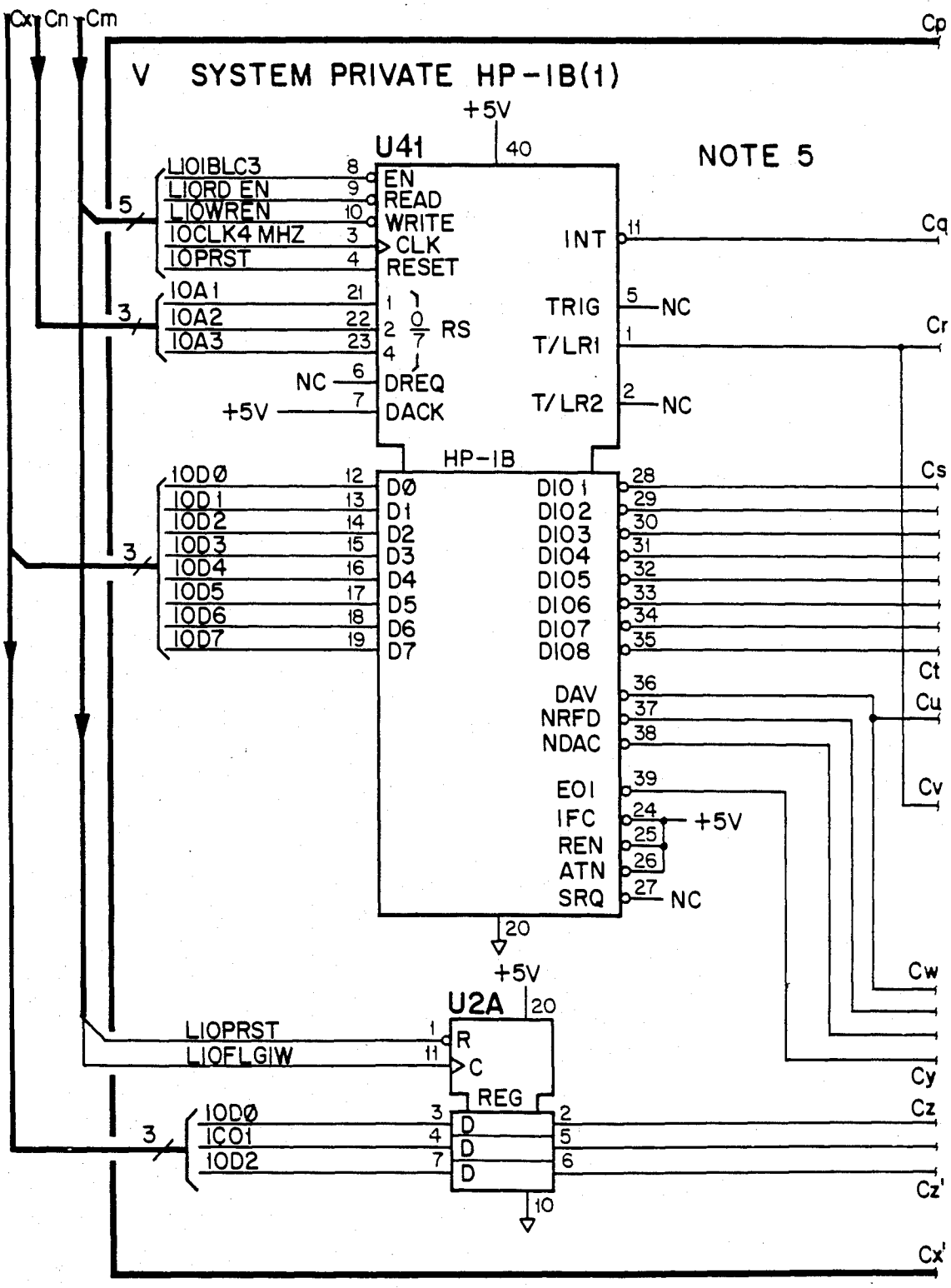

Cx
Cn
Cm
Cp
V SYSTEM PRIVATE HP-IB(1)
+5V
U41
40
NOTE 5
LIOIBLC3
LIORD EN
LIOWREN
IOCLK4 MHZ
IOPRST
EN
READ
WRITE
CLK
RESET
INT
Cq
IOA1
IOA2
IOA3
RS
TRIG
NC
T/LR1
Cr
NC
DREQ
+5V
DACK
T/LR2
NC
HP-IB
IOD0
IOD1
IOD2
IOD3
IOD4
IOD5
IOD6
IOD7
D0
D1
D2
D3
D4
D5
D6
D7
DIO1
DIO2
DIO3
DIO4
DIO5
DIO6
DIO7
DIO8
Cs
Ct
DAV
NRFD
NDAC
Cu
EOI
IFC
REN
ATN
SRQ
+5V
NC
Cv
Cw
Cy
U2A
20
LIOPRST
LIOFLGIW
R
C
REG
IOD0
IOC01
IOD2
D
Cz
Cz'
Cx'

FIG 3.58C

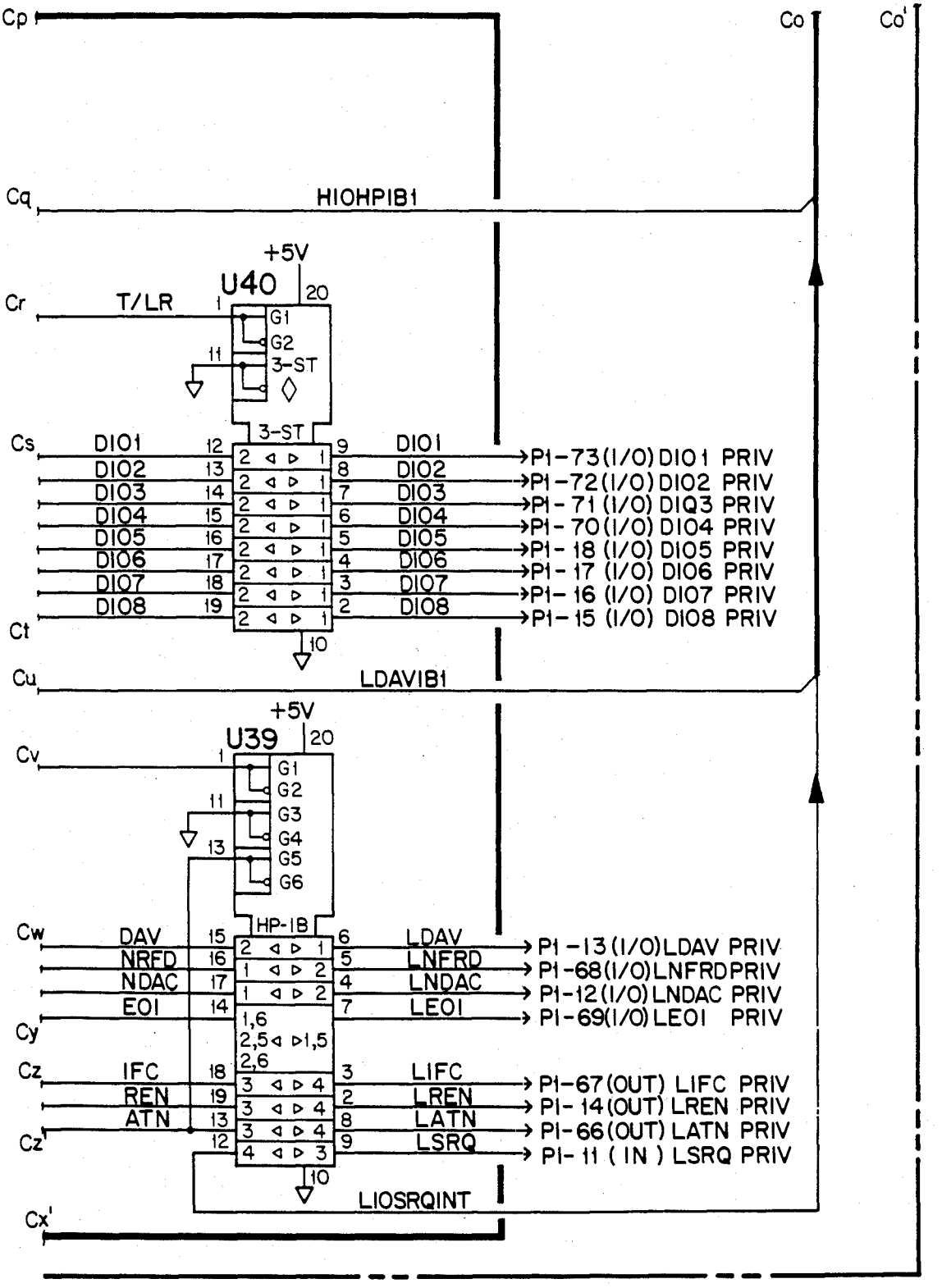

Cp
Co
Co'
Cq
HIOHPIB1
+5V
U40
20
Cr
T/LR
1
G1
G2
11
3-ST
3-ST
Cs
DIO1
12
9
DIO1
→P1-73(I/O) DIO1 PRIV
DIO2
13
8
DIO2
→P1-72(I/O) DIO2 PRIV
DIO3
14
7
DIO3
→P1-71(I/O) DIO3 PRIV
DIO4
15
6
DIO4
→P1-70(I/O) DIO4 PRIV
DIO5
16
5
DIO5
→P1-18(I/O) DIO5 PRIV
DIO6
17
4
DIO6
→P1-17(I/O) DIO6 PRIV
DIO7
18
3
DIO7
→P1-16(I/O) DIO7 PRIV
DIO8
19
2
DIO8
→P1-15(I/O) DIO8 PRIV
Ct
10
Cu
LDAVIB1
+5V
U39
20
Cv
1
G1
G2
11
G3
G4
13
G5
G6
HP-IB
Cw
DAV
15
6
LDAV
→P1-13(I/O) LDAV PRIV
NRFD
16
5
LNFRD
→P1-68(I/O) LNFRD PRIV
NDAC
17
4
LNDAC
→P1-12(I/O) LNDAC PRIV
EOI
14
7
LEOI
→P1-69(I/O) LEOI PRIV
Cy
1,6
2,5 1,5
2,6
Cz
IFC
18
3
LIFC
→P1-67(OUT) LIFC PRIV
REN
19
2
LREN
→P1-14(OUT) LREN PRIV
ATN
13
8
LATN
→P1-66(OUT) LATN PRIV
Cz'
12
9
LSRQ
→P1-11 (IN) LSRQ PRIV
10
LIOSRQINT
Cx'

FIG 3.58D

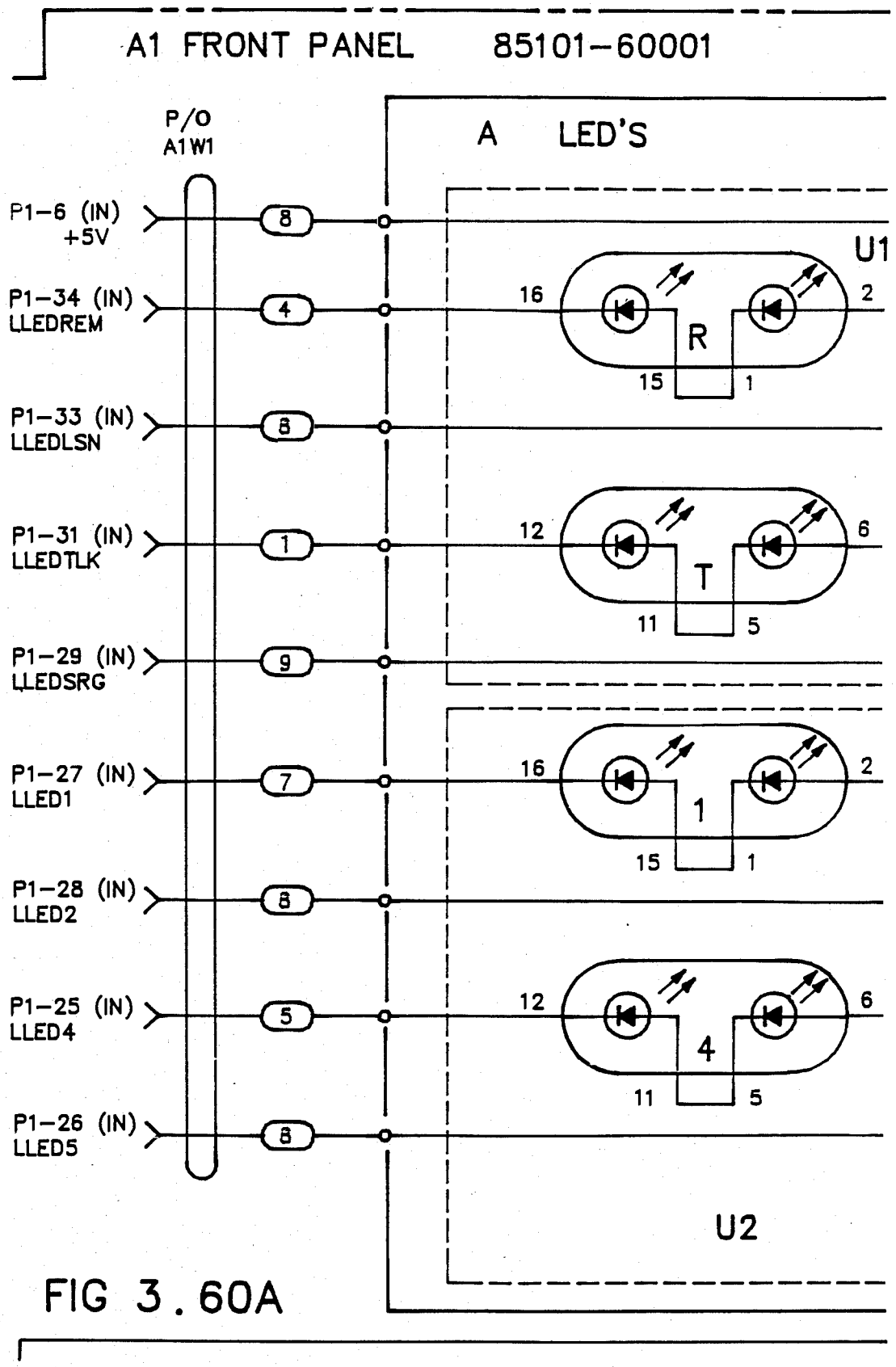

A1 FRONT PANEL 85101-60001
P/O A1W1
A LED'S
P1-6 (IN) +5V
P1-34 (IN) LLEDREM
P1-33 (IN) LLEDLSN
P1-31 (IN) LLEDTLK
P1-29 (IN) LLEDSRG
P1-27 (IN) LLED1
P1-28 (IN) LLED2
P1-25 (IN) LLED4
P1-26 (IN) LLED5
8
4
8
1
9
7
8
5
8
U1
16
2
R
15
1
12
6
T
11
5
16
2
1
15
1
12
6
4
11
5
U2

FIG 3.60A

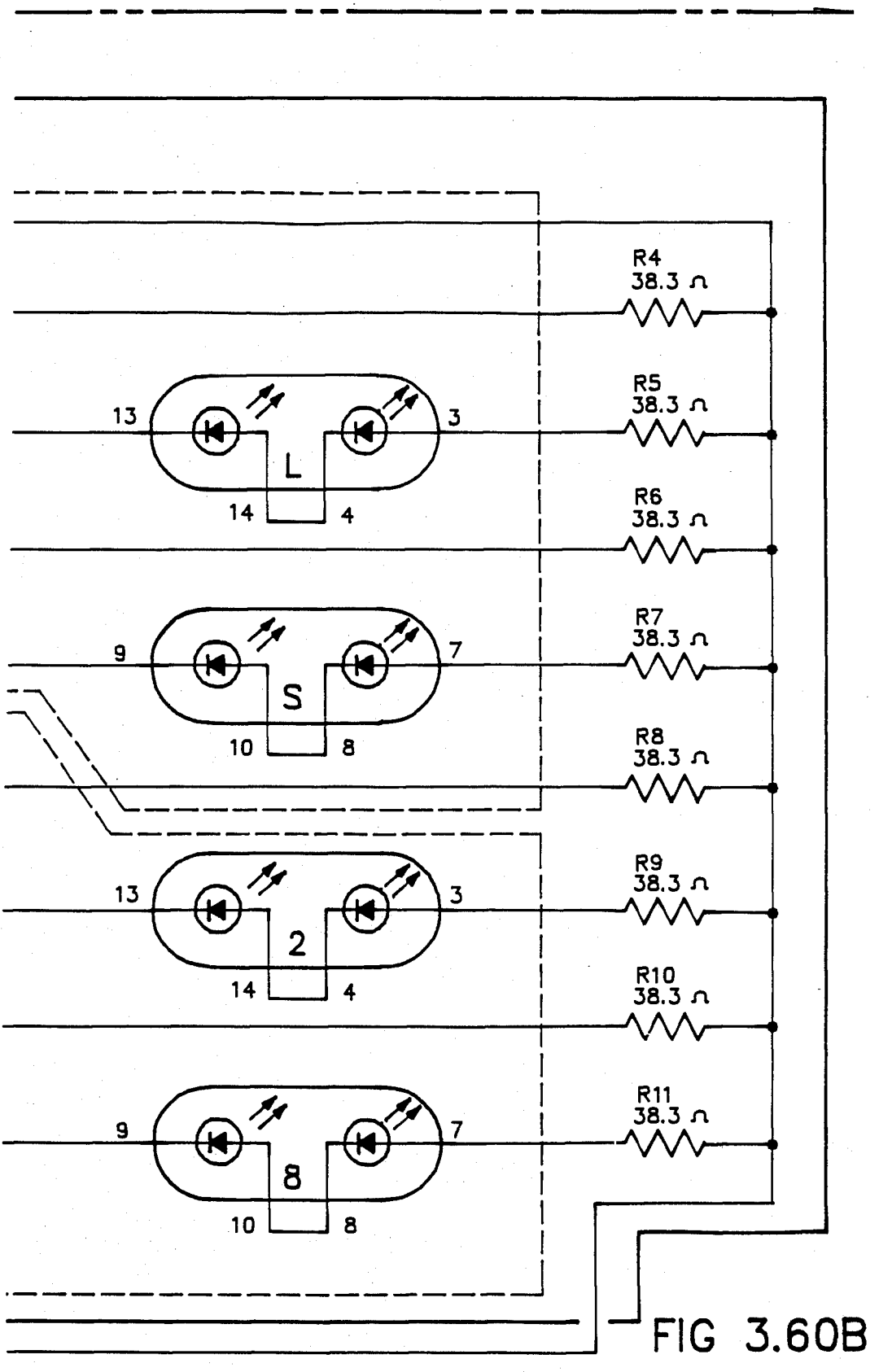

R4
38.3 Ω
R5
38.3 Ω
R6
38.3 Ω
R7
38.3 Ω
R8
38.3 Ω
R9
38.3 Ω
R10
38.3 Ω
R11
38.3 Ω
13
3
L
14
4
9
7
S
10
8
13
3
2
14
4
9
7
8
10
8

FIG 3.60B

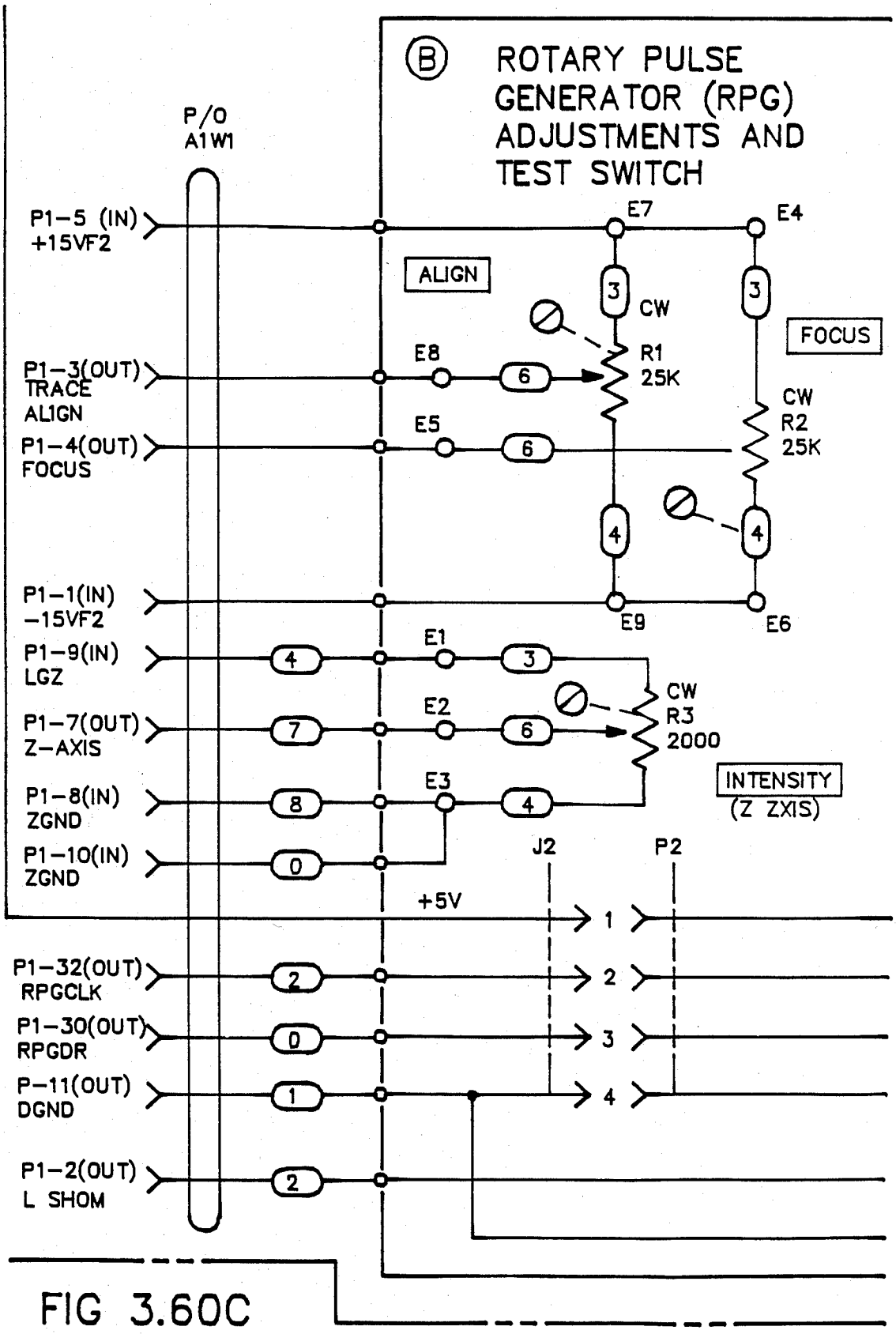

B
ROTARY PULSE GENERATOR (RPG) ADJUSTMENTS AND TEST SWITCH
P/O A1W1
P1-5 (IN) +15VF2
P1-3(OUT) TRACE ALIGN
P1-4(OUT) FOCUS
P1-1(IN) -15VF2
P1-9(IN) LGZ
P1-7(OUT) Z-AXIS
P1-8(IN) ZGND
P1-10(IN) ZGND
P1-32(OUT) RPGCLK
P1-30(OUT) RPGDR
P-11(OUT) DGND
P1-2(OUT) L SHOM
ALIGN
FOCUS
E7
E4
E8
E5
E9
E6
E1
E2
E3
CW
R1 25K
CW R2 25K
CW R3 2000
INTENSITY (Z ZXIS)
+5V
J2
P2

FIG 3.60C

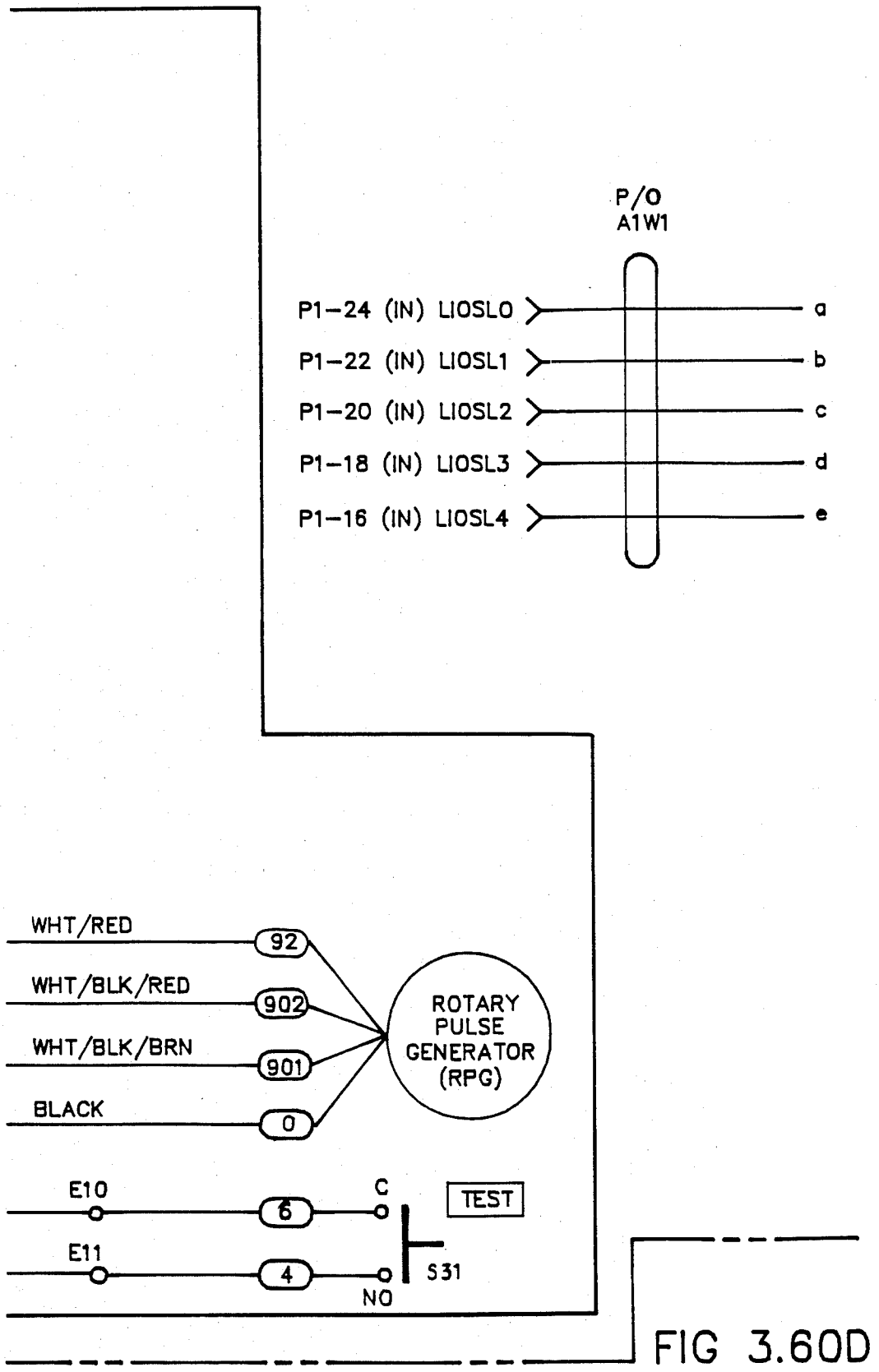

P/O
A1W1
P1-24 (IN) LIOSL0
P1-22 (IN) LIOSL1
P1-20 (IN) LIOSL2
P1-18 (IN) LIOSL3
P1-16 (IN) LIOSL4
a
b
c
d
e
WHT/RED
92
WHT/BLK/RED
902
WHT/BLK/BRN
901
BLACK
0
ROTARY
PULSE
GENERATOR
(RPG)
E10
6
C
TEST
E11
4
NO
S31

FIG 3.60D

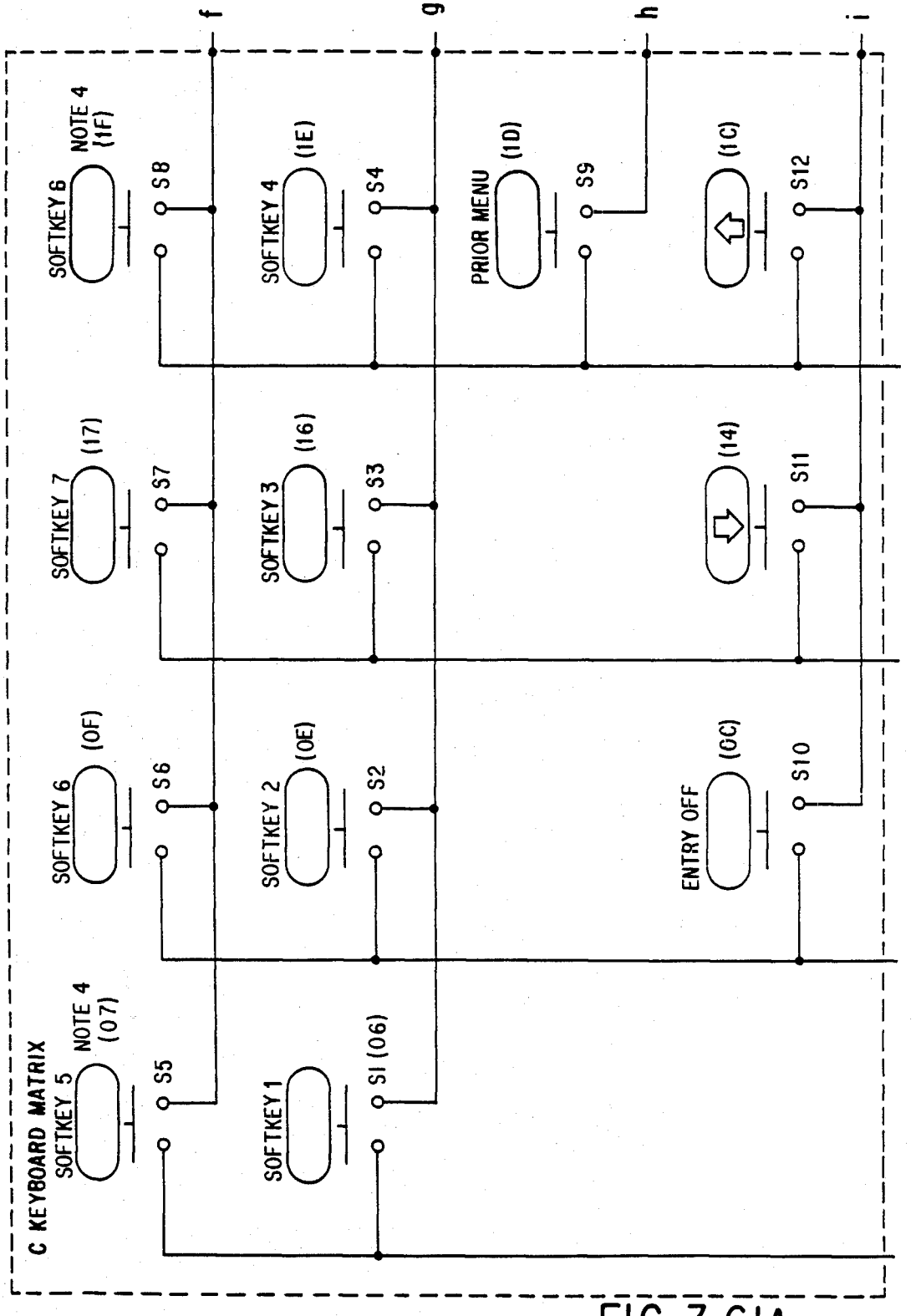

C KEYBOARD MATRIX
f
g
h
i
SOFTKEY 5
NOTE 4
(07)
S5
SOFTKEY 1
S1 (06)
SOFTKEY 6
(0F)
S6
SOFTKEY 2
(0E)
S2
SOFTKEY 7
(17)
S7
SOFTKEY 3
(16)
S3
SOFTKEY 6
NOTE 4
(1F)
S8
SOFTKEY 4
(1E)
S4
PRIOR MENU
(1D)
S9
ENTRY OFF
(0C)
S10
(14)
S11
(1C)
S12

FIG. 3.61A

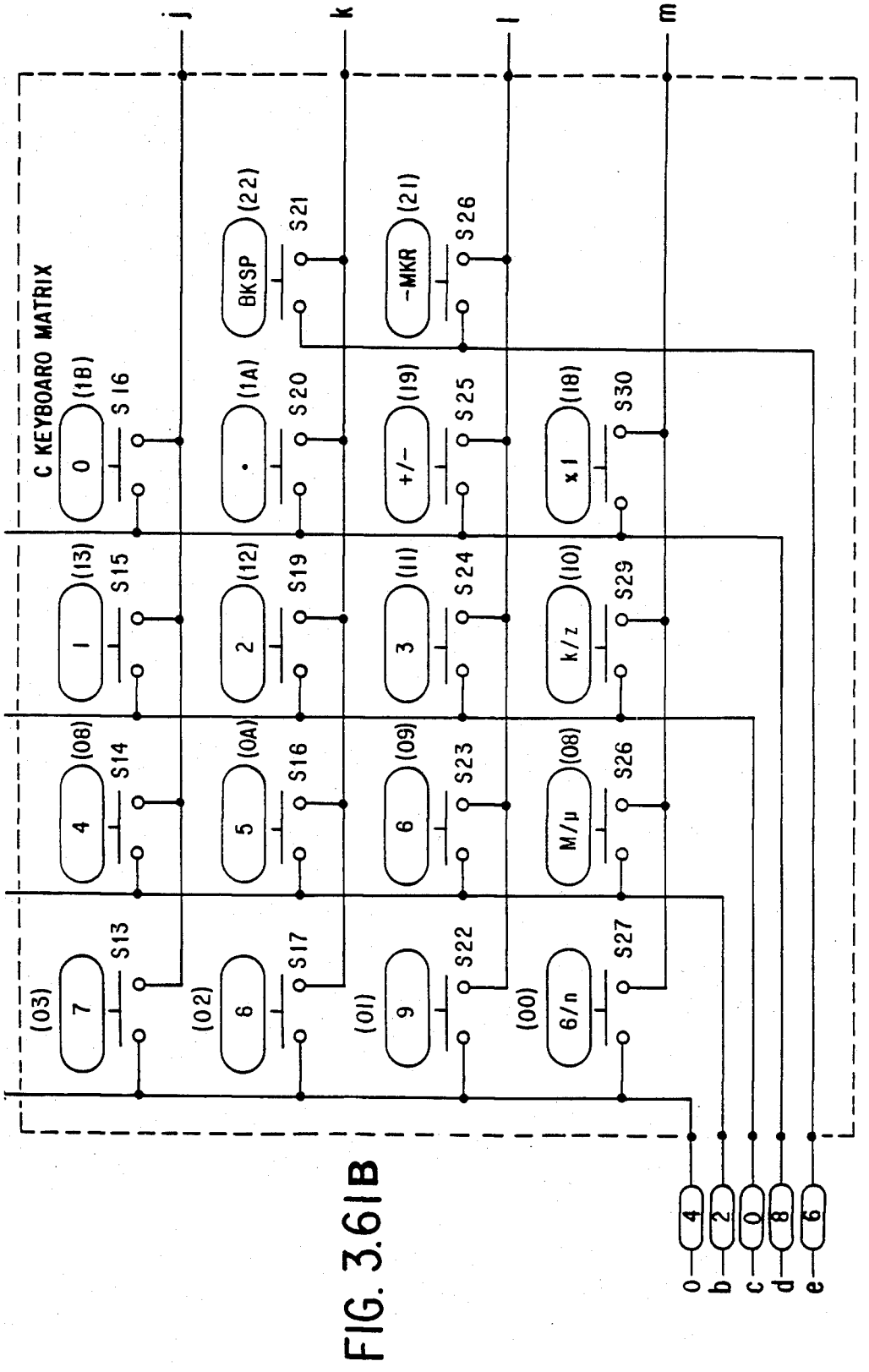

C KEYBOARD MATRIX
j
k
l
m
(03)
(02)
(01)
(00)
7
8
9
6/n
4
5
6
M/μ
1
2
3
k/z
0
.
+/-
x1
BKSP
-MKR
S13
S17
S22
S27
S14
S16
S23
S26
S15
S19
S24
S29
S16
S20
S25
S30
S21
S26
(08)
(0A)
(09)
(13)
(12)
(11)
(10)
(1B)
(1A)
(19)
(18)
(22)
(21)
a
b
c
d
e

FIG. 3.61B

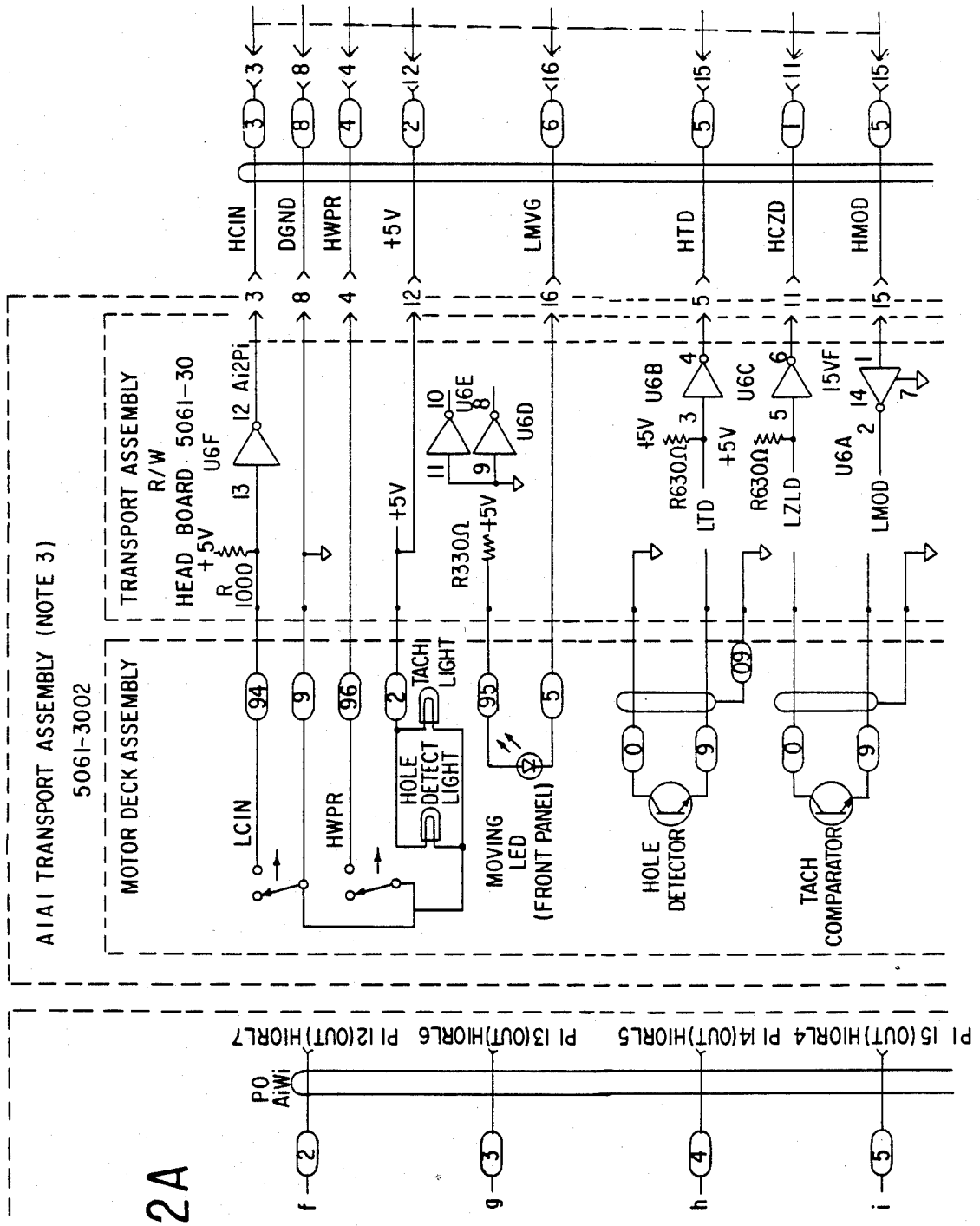

A1A1 TRANSPORT ASSEMBLY (NOTE 3)
5061-3002
MOTOR DECK ASSEMBLY
TRANSPORT ASSEMBLY
R/W
HEAD BOARD 5061-30
HCIN
DGND
HWPR
+5V
LMVG
HTD
HCZD
HMOD
LCIN
HWPR
HOLE DETECT LIGHT
TACH LIGHT
MOVING LED (FRONT PANEL)
HOLE DETECTOR
TACH COMPARATOR
LTD
LZLD
LMOD
R330Ω
R630Ω
R1000
U6A
U6B
U6C
U6D
U6E
U6F
15VF
Ai2Pi
P0 AiWi
Pl 12(OUT)HIORL7
Pl 13(OUT)HIORL6
Pl 14(OUT)HIORL5
Pl 15(OUT)HIORL4

FIG. 3.62A

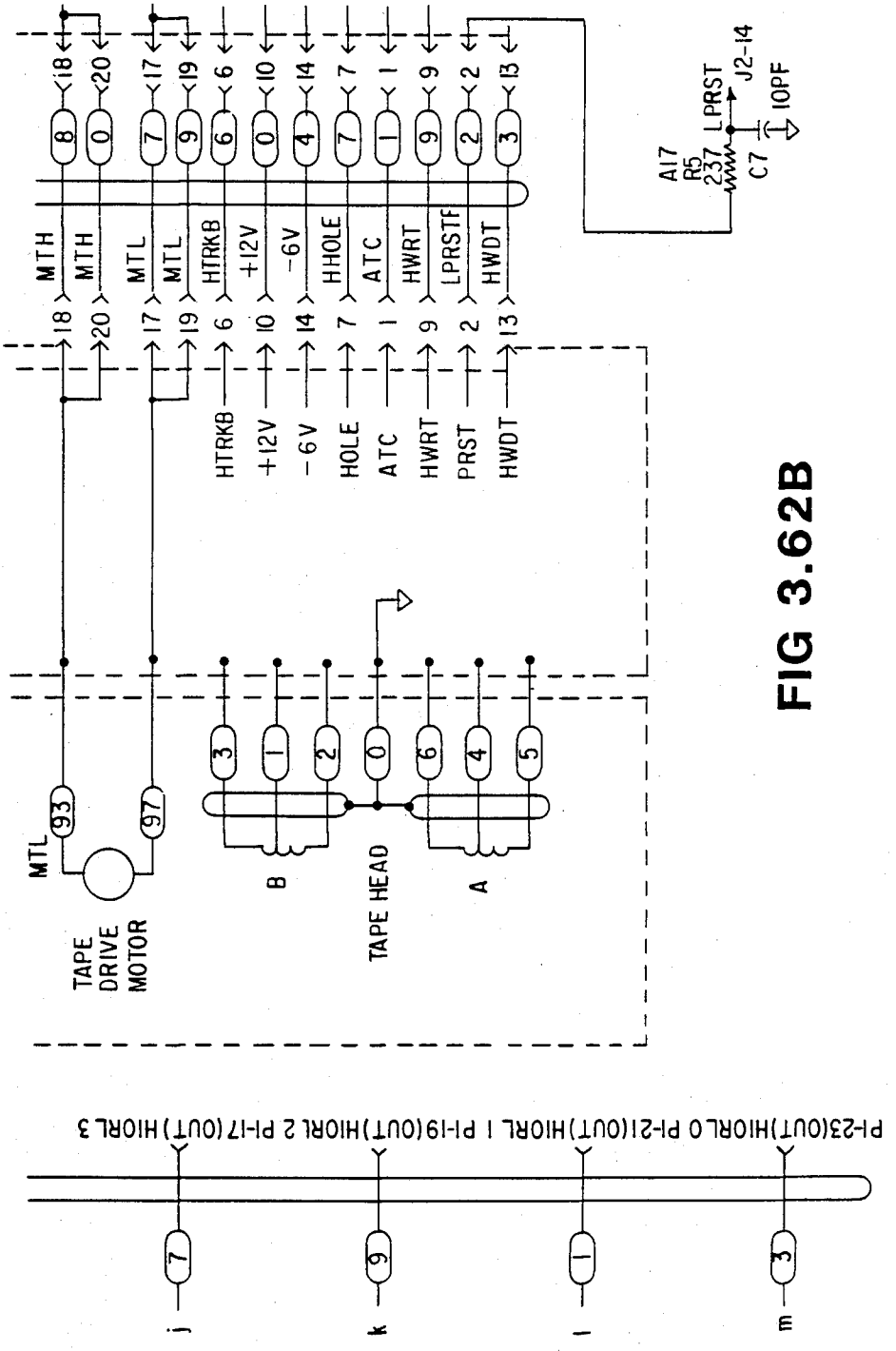

MTH
MTH
MTL
MTL
HTRKB
+12V
-6V
HHOLE
ATC
HWRT
LPRSTF
HWDT
HTRKB
+12V
-6V
HOLE
ATC
HWRT
PRST
HWDT
A17
R5
237
C7
10PF
LPRST
J2-14
MTL
TAPE DRIVE MOTOR
B
TAPE HEAD
A
PI-23(OUT)HIORL 0 PI-21(OUT)HIORL 1 PI-19(OUT)HIORL 2 PI-17(OUT)HIORL 3
j
k
l
m

FIG 3.62B

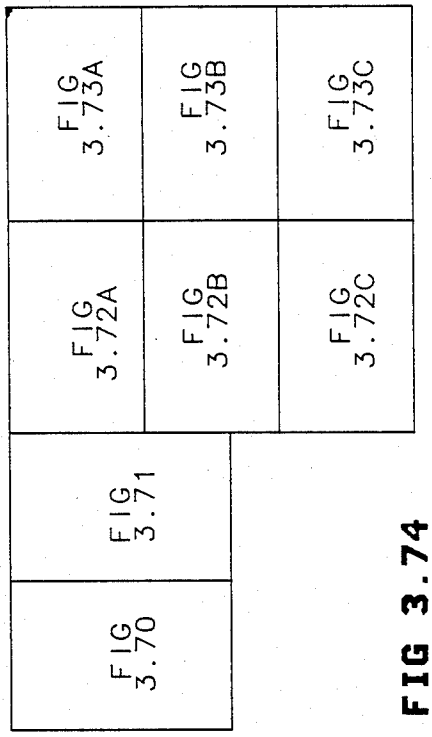


FIG 3.74

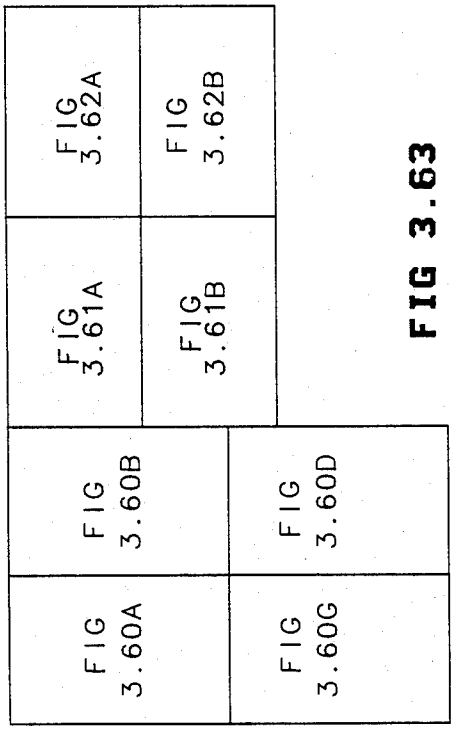


FIG 3.63

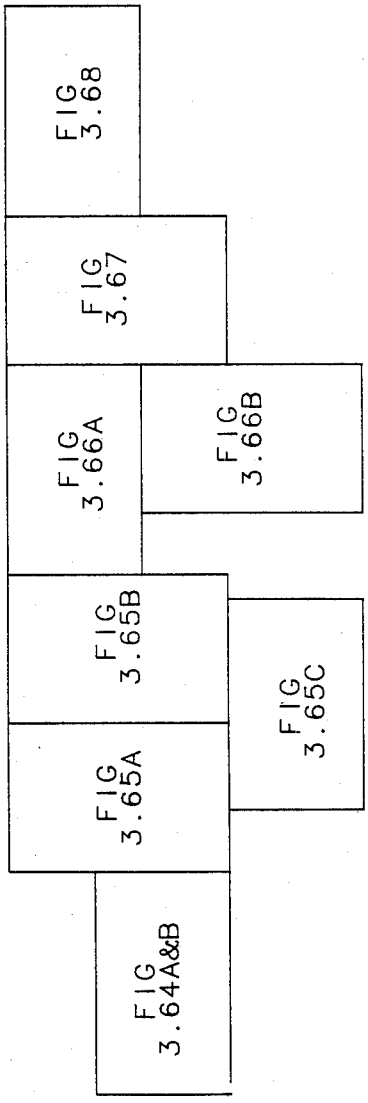


FIG 3.69

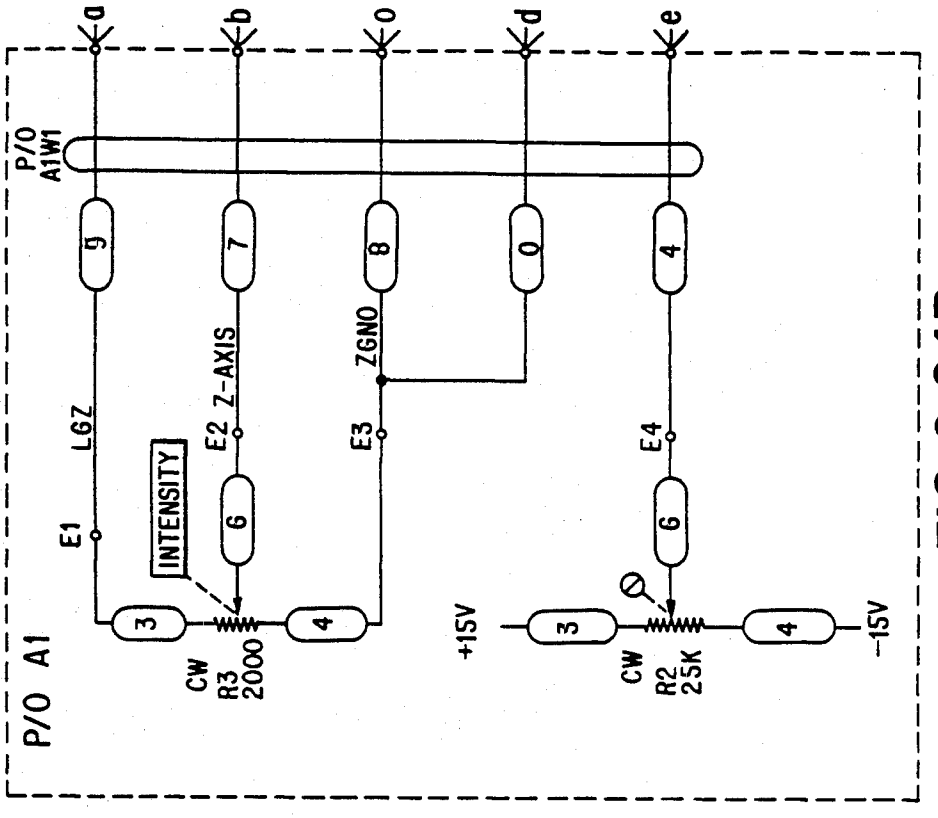


FIG 3.64B

MNEMONIC	DESCRIPTION
AOC	WRITE GUN ACCELERATOR
ASTIG	ASTIGMATISM
CONTROL GATE	BLANKING AND INTENSITY CONTROL
FOCUS	FOCUS CONTROL INPUT
HF GAIN	HIGH FREQUENCY GAIN
HF TRIM	HIGH FREQUENCY COMPENSATION
INT GAIN	INTENSITY GAIN
INTLIMIT	INTENSITY LIMIT
LBLANKO	LO-BLANK DELAYED
LGZ	LINE GENERATOR Z-AXIS OUTPUT
MESH	EXPANSION MESH
ORTHO	ORTHOGONAL
PATT	PATTERN
Z-AXIS	INTENSITY SIGNAL
ZGND	Z-AXIS GROUND RETURN

FIG 3.64A

FIG. 3.65A

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 16	ORTHO ZGND	VI AI7CI-NEG	E,G F
2 17	FOCUS GATE CONTROL GATE	A3 A3	D C
3 18	PATTERN INTENSITY LIMIT	VI A3	E,G E
4 19	ASTIG ZGND	VI AI7CI-NEG	E,G F
5 20	MESH ZGND	VI AI7CI-NEG	E,G F
6 21	ACC LBLANKD	VI A6	E,G B
7 22	-15V NC	AB.AI7	F
8 23	ZGND ZGND	AI7CI-NEG	F F
9 24	+15V FOCUS	AI7. A8 AI	F D
10 25	TRACE ALIGN NC	AI	G
11 26	ZGND ZGND	AI7CI-NEG	F F
12 27	+100V ZGND	AB AI7CI-NEG	F F
13 28	ZGND ZGND	AI7CI-NEG	F F
14 29	ZGND Z-AXIS	AI7CI-NEG AI	F A
15 30	ZGND ZGND	AI7CI-NEG	F F

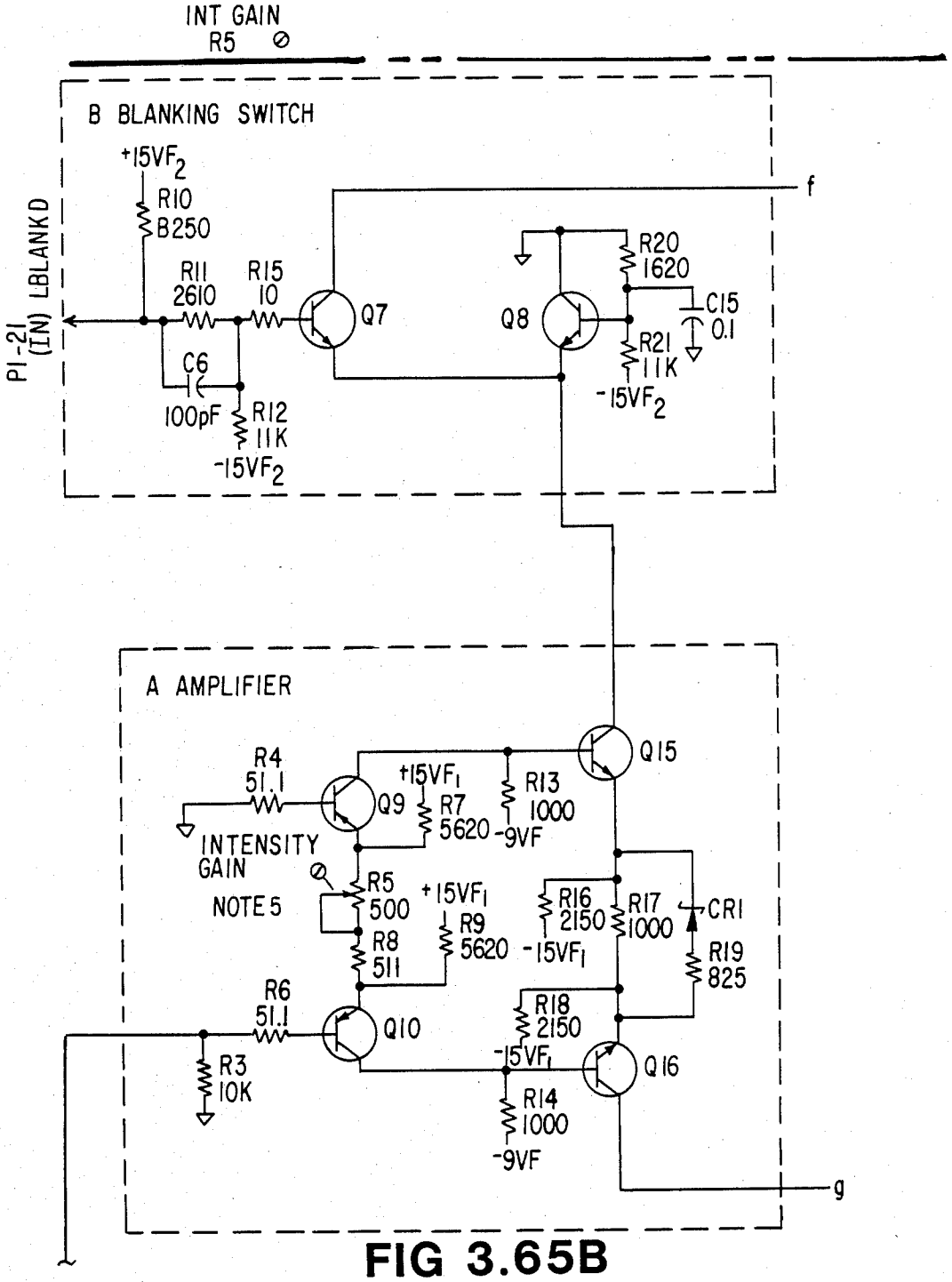

INT GAIN
R5
B BLANKING SWITCH
+15VF2
R10
B250
R11
2610
R15
10
Q7
Q8
R20
1620
C15
0.1
R21
11K
-15VF2
C6
100pF
R12
11K
-15VF2
P1-21
(IN) LBLANKD
f
A AMPLIFIER
R4
51.1
Q9
+15VF1
R7
5620
R13
1000
-9VF
Q15
INTENSITY
GAIN
NOTE 5
R5
500
R8
511
R9
5620
+15VF1
R16
2150
R17
1000
CR1
R19
825
-15VF1
R6
51.1
Q10
R3
10K
R18
2150
-15VF1
Q16
R14
1000
-9VF
g

FIG 3.65B

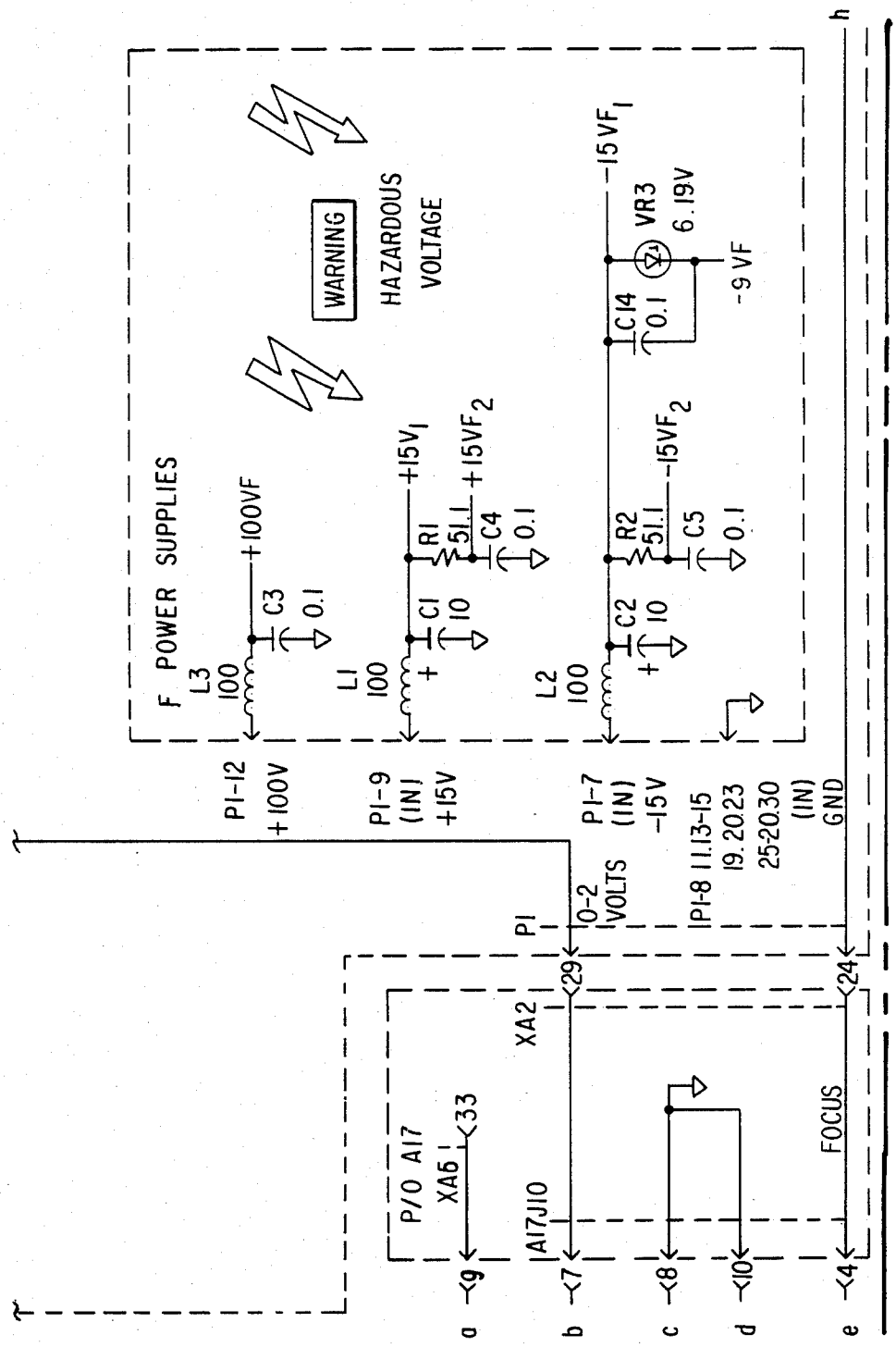

F POWER SUPPLIES
WARNING
HAZARDOUS VOLTAGE
L3 100
L1 100
L2 100
C3 0.1
C1 10
C4 0.1
C2 10
C5 0.1
C14 0.1
R1 51.1
R2 51.1
+100VF
+15V1
+15VF2
-15VF2
-15VF1
VR3 6.19V
-9 VF
P1-12 +100V
P1-9 (IN) +15V
P1-7 (IN) -15V
P1-8 11.13-15 19.20.23 25-20.30 (IN) GND
P1
0-2 VOLTS
XA2
P/O A17 XA6
A17J10
FOCUS
a
b
c
d
e
h

FIG 3.65C

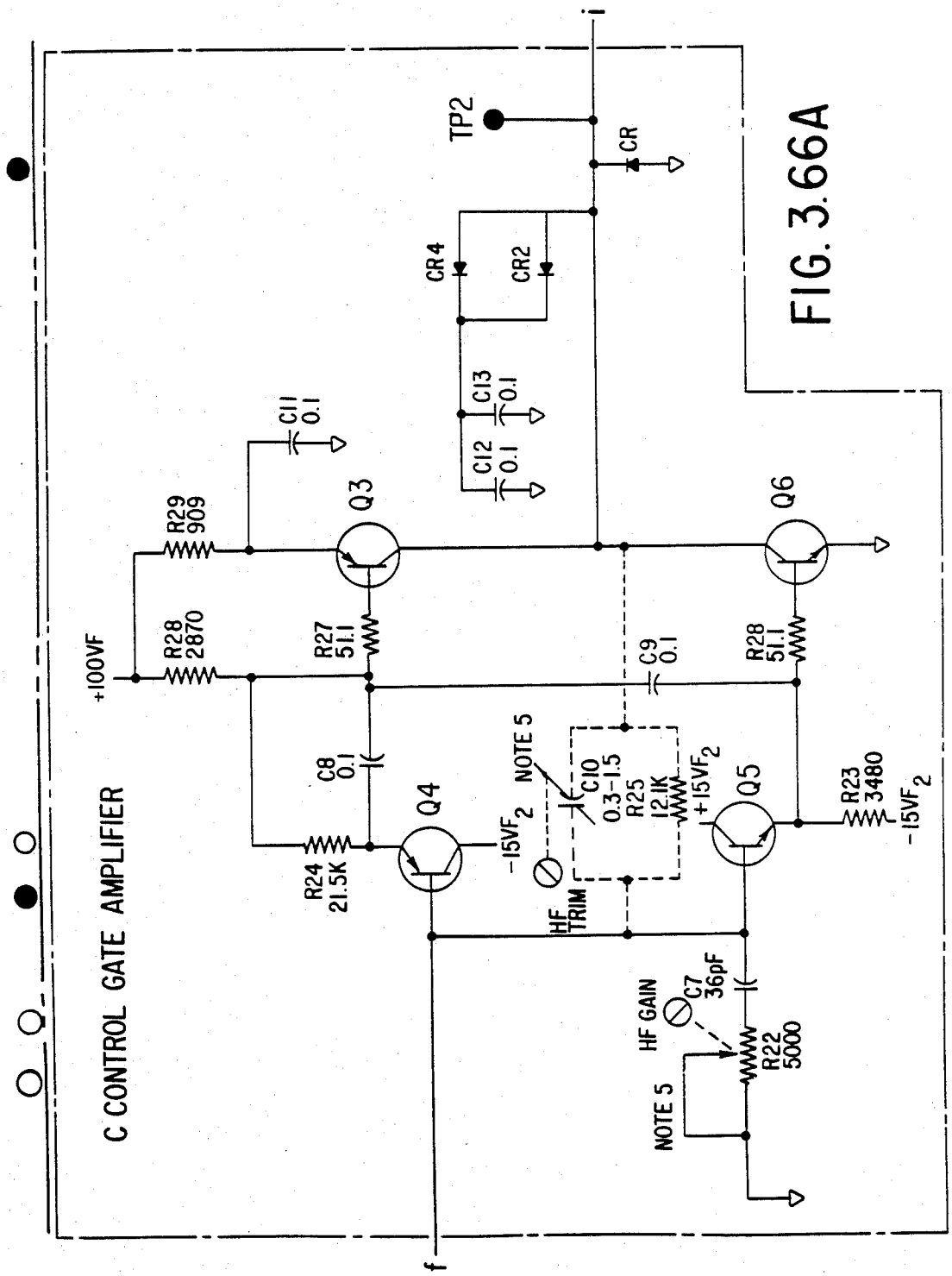

C CONTROL GATE AMPLIFIER
+100VF
R28 2870
R29 909
C11 0.1
Q3
R27 51.1
C8 0.1
Q4
R24 21.5K
TP2
CR
CR4
CR2
C13 0.1
C12 0.1
C9 0.1
Q6
R28 51.1
NOTE 5
C10 0.3-1.5
R25 12.1K
-15VF2
+15VF2
HF TRIM
Q5
R23 3480
-15VF2
HF GAIN
C7 36pF
R22 5000
NOTE 5
i
f

FIG. 3.66A

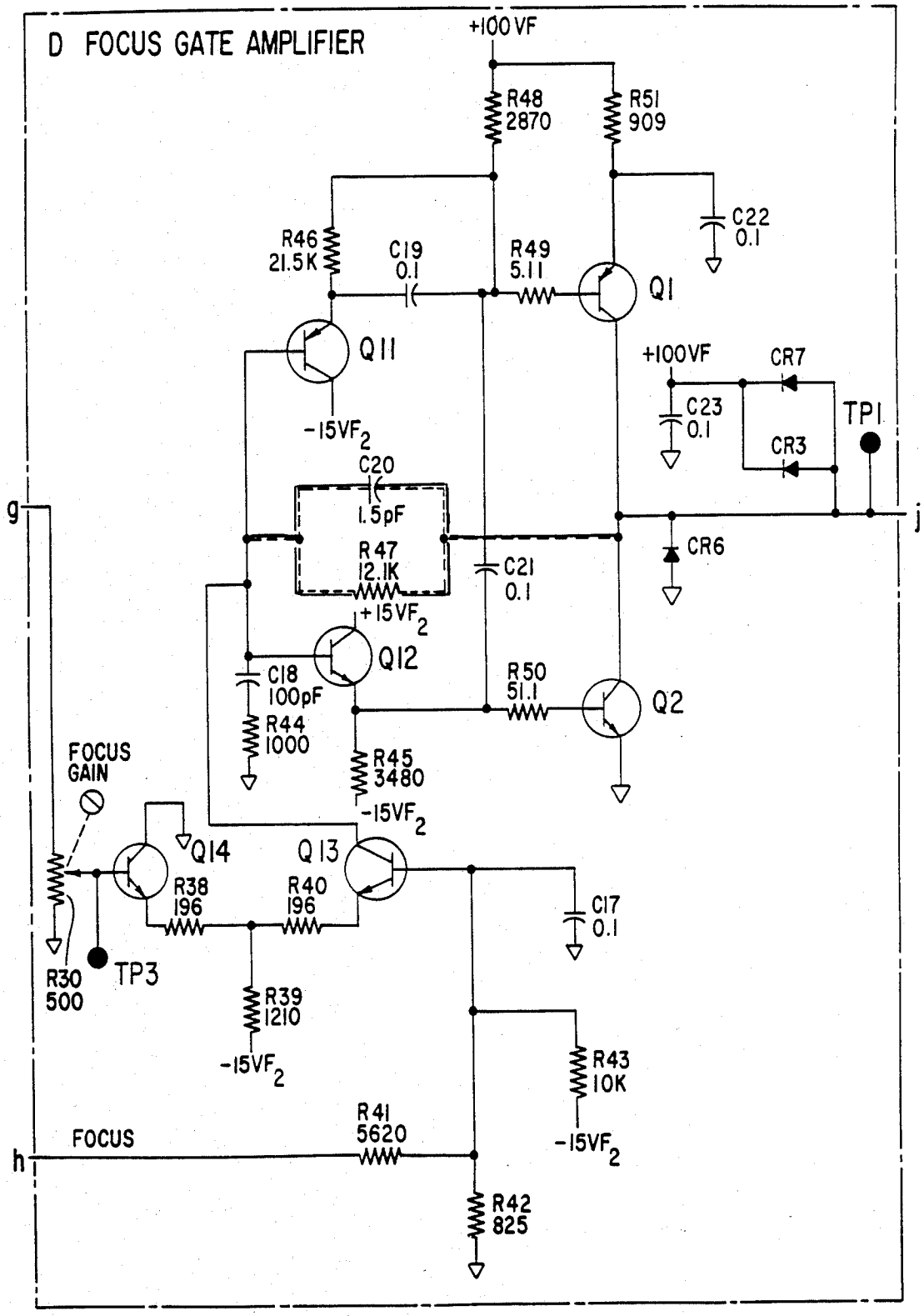

D FOCUS GATE AMPLIFIER
+100 VF
R48 2870
R51 909
C22 0.1
R46 21.5K
C19 0.1
R49 5.11
Q1
Q11
-15VF2
+100VF
CR7
C23 0.1
CR3
TP1
C20 1.5pF
R47 12.1K
g
j
CR6
C21 0.1
+15VF2
Q12
C18 100pF
R44 1000
R50 51.1
Q2
R45 3480
-15VF2
FOCUS GAIN
Q14
Q13
R38 196
R40 196
C17 0.1
R30 500
TP3
R39 1210
-15VF2
R43 10K
-15VF2
R41 5620
FOCUS
h
R42 825

FIG. 3.66B

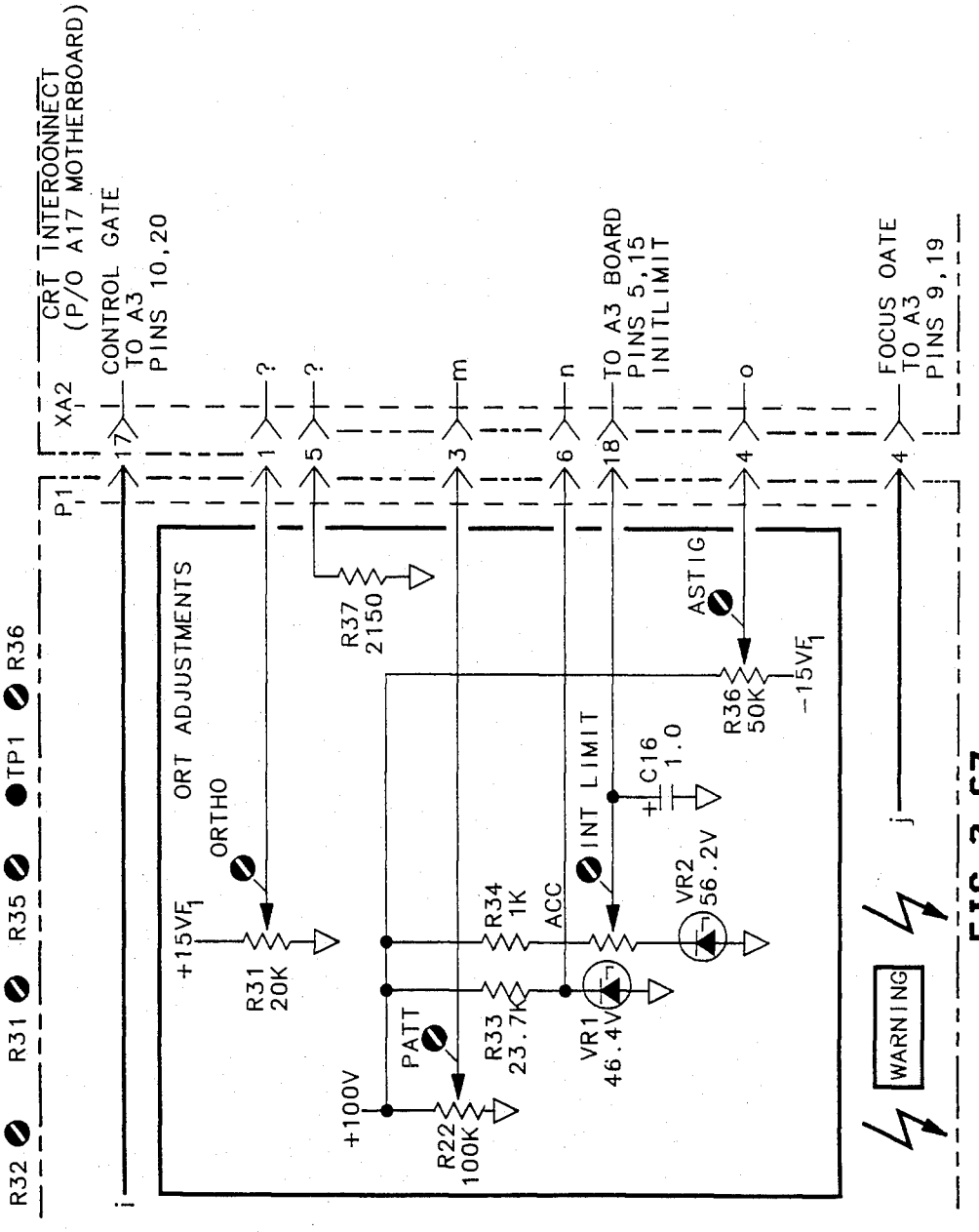

CRT INTERCONNECT
(P/O A17 MOTHERBOARD)
P1
XA2
CONTROL GATE
TO A3
PINS 10,20
TO A3 BOARD
PINS 5,15
INITLIMIT
FOCUS OATE
TO A3
PINS 9,19
17
1
5
3
6
18
4
4
?
?
m
n
o
i
j
R32
R31
R35
TP1
R36
ORT ADJUSTMENTS
ORTHO
+15VF1
R31
20K
R37
2150
R34
1K
ACC
INT LIMIT
PATT
+100V
R22
100K
R33
23.7K
VR1
46.4V
C16
1.0
VR2
56.2V
ASTIG
R36
50K
-15VF1
WARNING

FIG 3.67

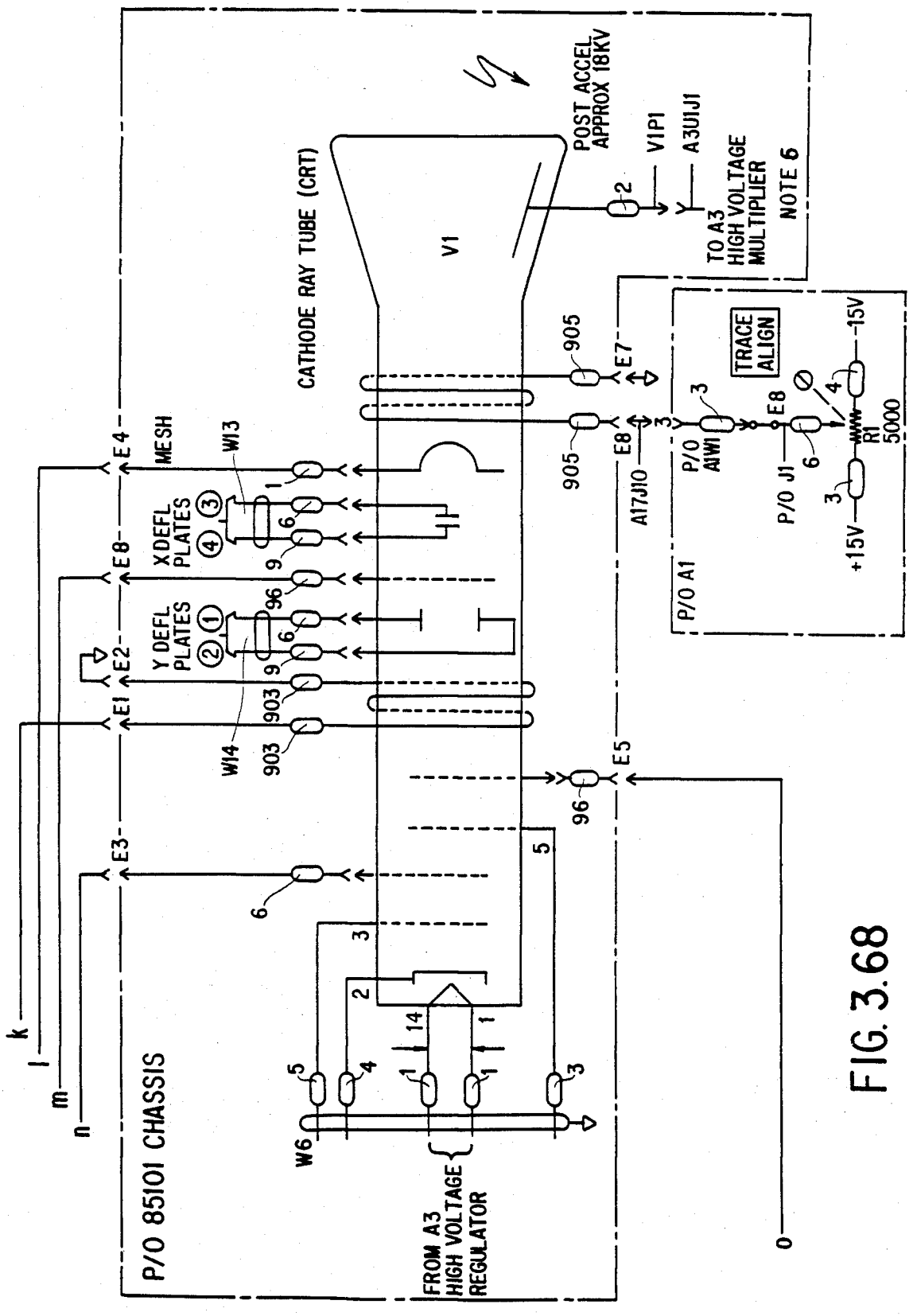

CATHODE RAY TUBE (CRT)
V1
POST ACCEL APPROX 18KV
V1P1
A3U1J1
TO A3 HIGH VOLTAGE MULTIPLIER
NOTE 6
MESH
XDEFL PLATES
Y DEFL PLATES
W13
W14
W6
E1
E2
E3
E4
E5
E7
E8
905
903
96
TRACE ALIGN
P/O A1
P/O A1W1
P/O J1
A17J10
+15V
-15V
R1
5000
P/O 85101 CHASSIS
FROM A3 HIGH VOLTAGE REGULATOR
k
l
m
n
o

FIG. 3.68

MNEMONIC TABLE

MNEMONIC	DESCRIPTION	SOURCE
ACC	WRITE GUNACCELERATOR	A2
ASTIG	ASTIGMATISM	A2
BASE	Q4 BASE DRIVE	A3
COLL	Q4 COLLECTOR OUTPUT	Q4 CHASSIS
CONTROL GATE	CONTROL INPUT FOR INTENSITY	A2
DGND	DIGITAL GROUND	AI7 CI-NEG
FOCUS GATE	DYNAMIC FOCUS INPUT	A2
HV FEEDBACK	HV CONTROL FEEDBACK	A3
INT LIMIT	INTENSITY LIMIT	A2
OSCILLATOR DRIVE	HV REGULATOR OUTPUT	A8
+20V RAW	+20V UNREGULATED	A17

A3 HIGH VOLTAGE REGULATOR
85101-60003

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 11	COLL	A8	A
2 12	BASE	A8	A
3 13	OSCILLATOR DRIVE	A8	A
4 14	+20 RAW	A8	A
5 15	INT LIMIT	A2	C
5 15	GND GND		A A
7 17	HV FEEDBACK	A8	B
8 18	GND GND		A A
9 19	FOCUS GATE	A2	D
10 20	CONTROL GATE	A2	C

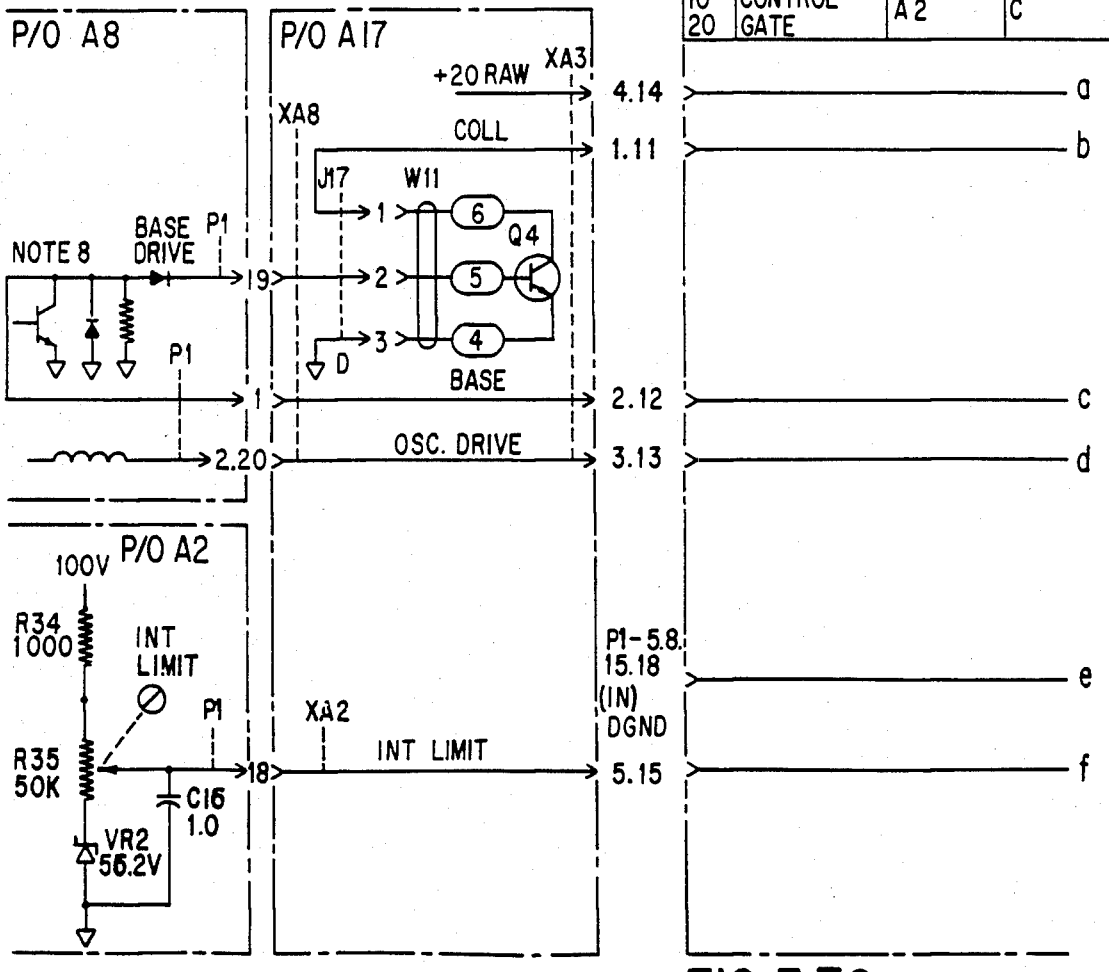


FIG. 3.70

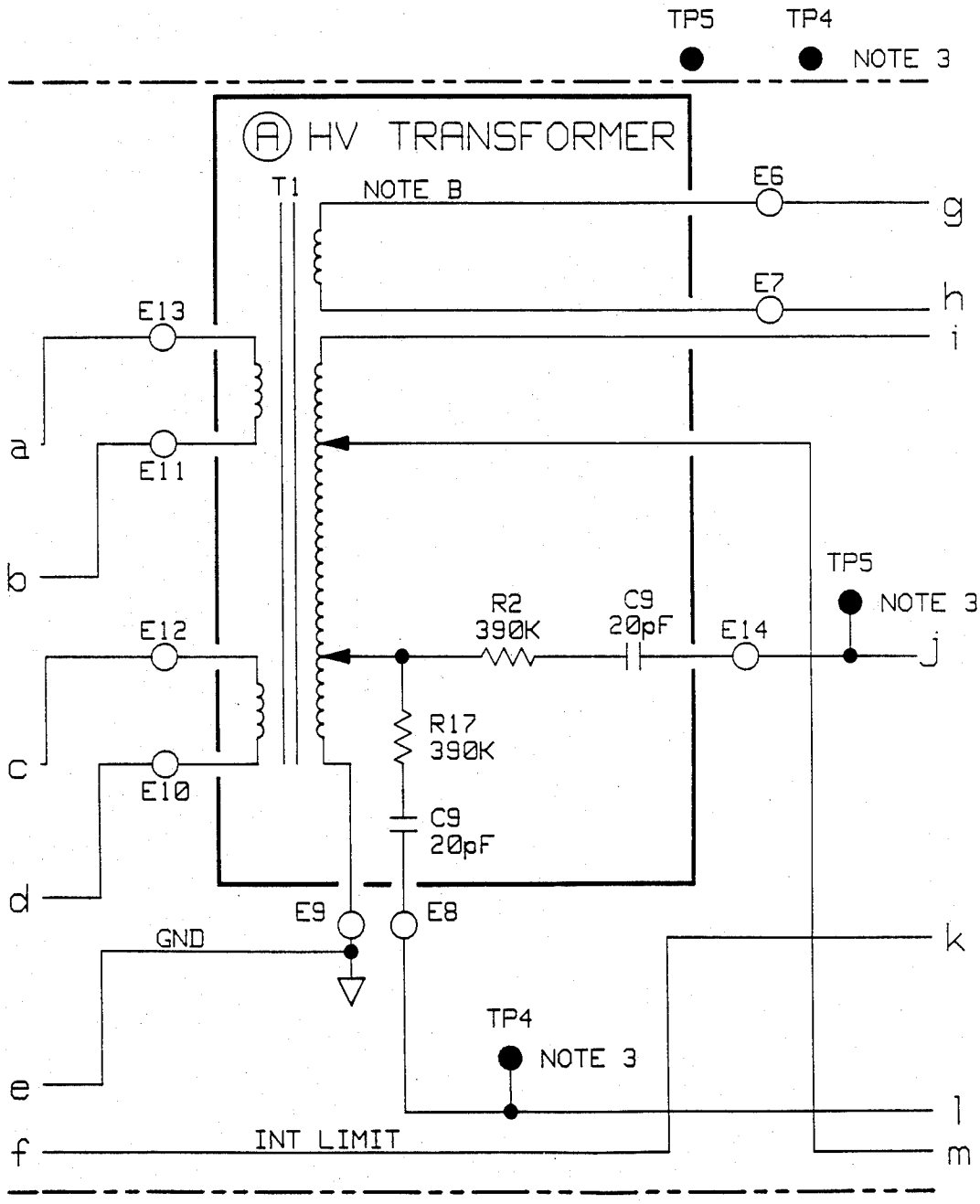

TP5
TP4
NOTE 3
A HV TRANSFORMER
T1
NOTE B
E6
g
E7
h
E13
i
a
E11
b
TP5
NOTE 3
R2
390K
C9
20pF
E14
j
E12
R17
390K
c
E10
C9
20pF
d
E9
E8
GND
k
TP4
NOTE 3
e
l
f
INT LIMIT
m

FIG 3.71

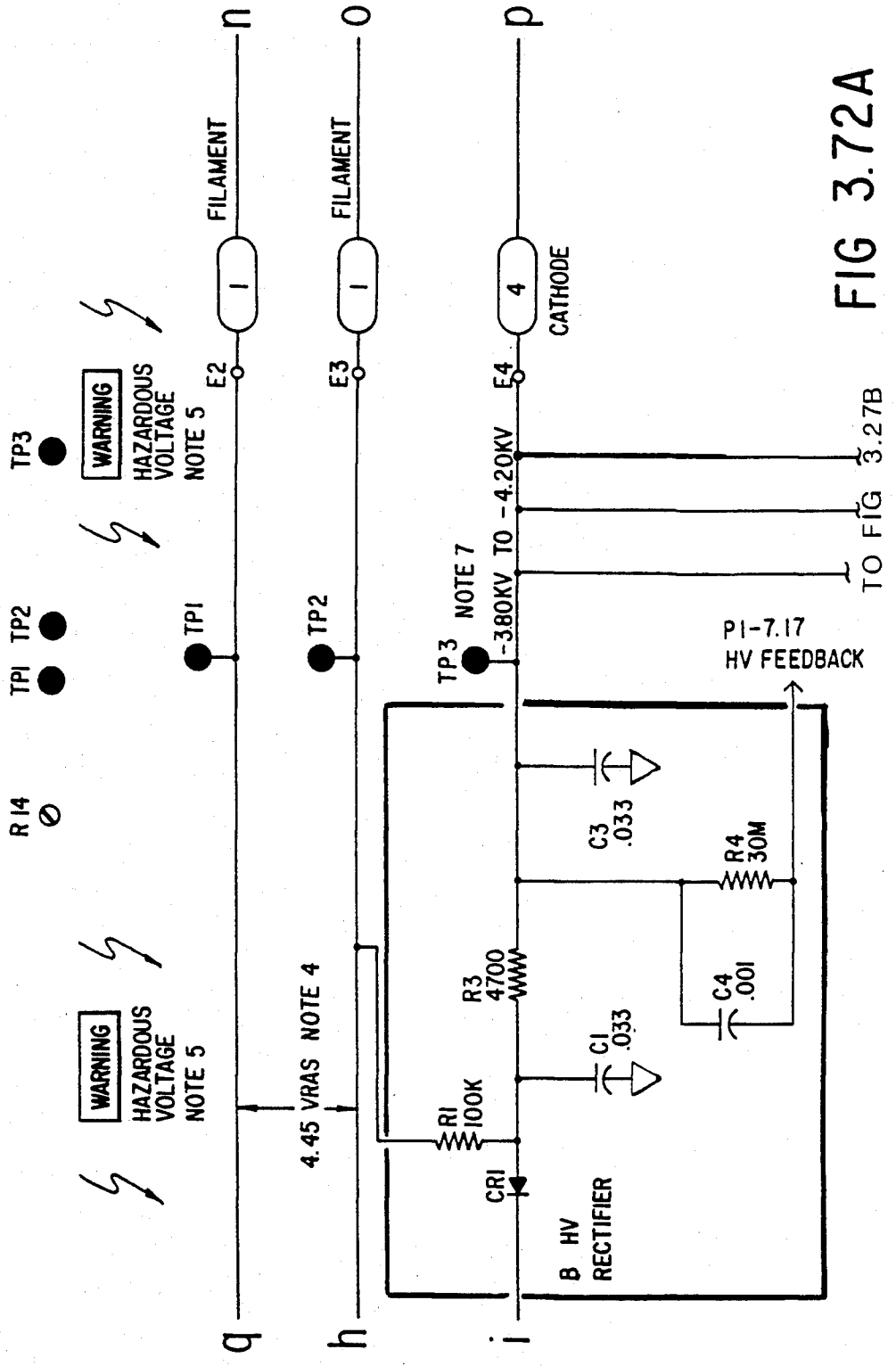

TP3
WARNING
HAZARDOUS VOLTAGE NOTE 5
TP1 TP2
R14
TP1
TP2
FILAMENT
FILAMENT
CATHODE
E2
E3
E4
n
o
p
q
h
i
-4.20KV
-380KV
NOTE 7
TO FIG 3.27B
P1-7.17
HV FEEDBACK
C3 .033
R4 30M
C4 .001
R3 4700
C1 .033
R1 100K
CR1
4.45 VRAS NOTE 4
B HV RECTIFIER

FIG 3.72A

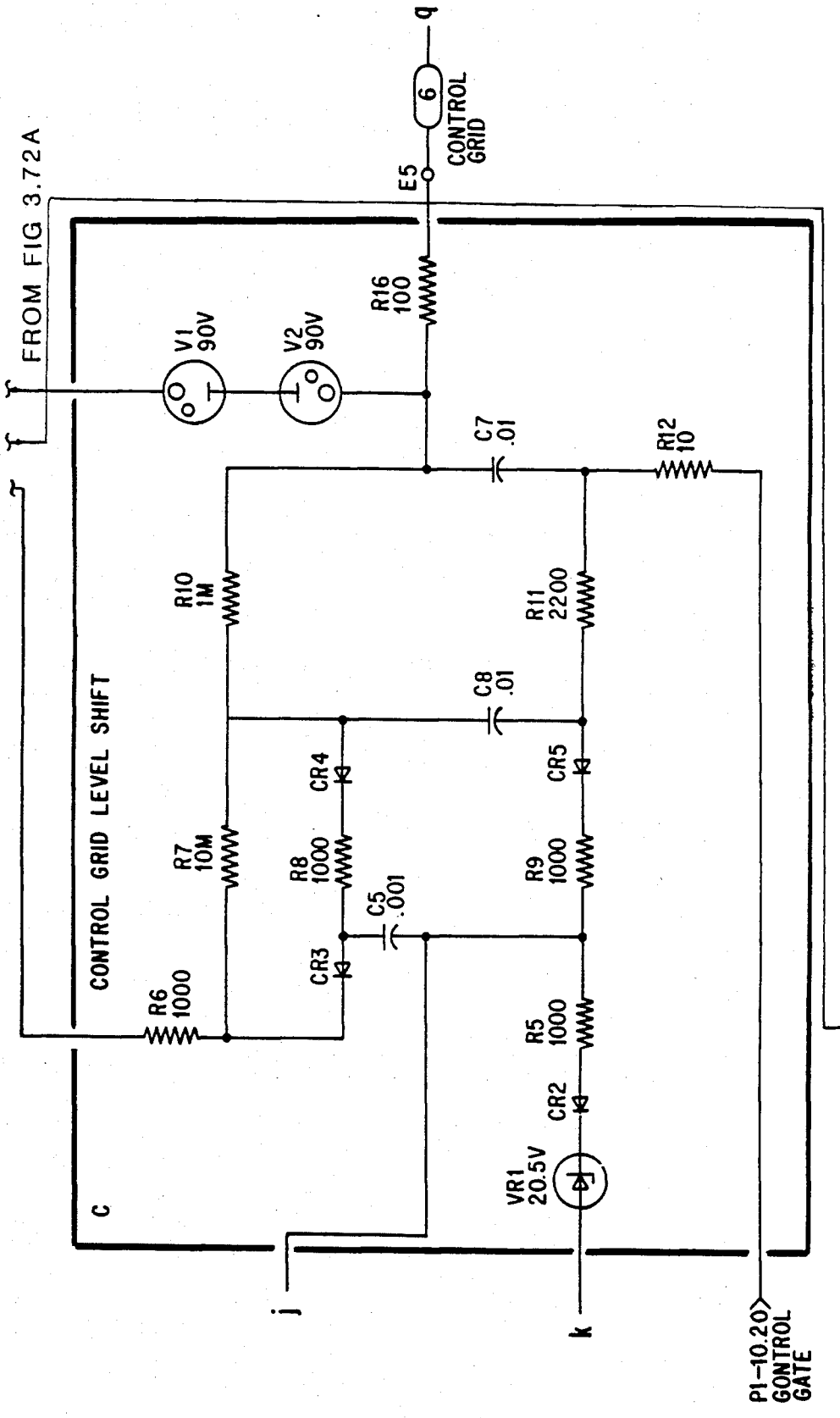

FROM FIG 3.72A
CONTROL GRID LEVEL SHIFT
E5
6
CONTROL GRID
V1 90V
V2 90V
R16 100
C7 .01
R12 10
R10 1M
R11 2200
C8 .01
CR4
CR5
R7 10M
R8 1000
R9 1000
C5 .001
CR3
R6 1000
R5 1000
CR2
VR1 20.5V
TO FIG 3.72C
P1-10.20 CONTROL GATE

FIG. 3.72B

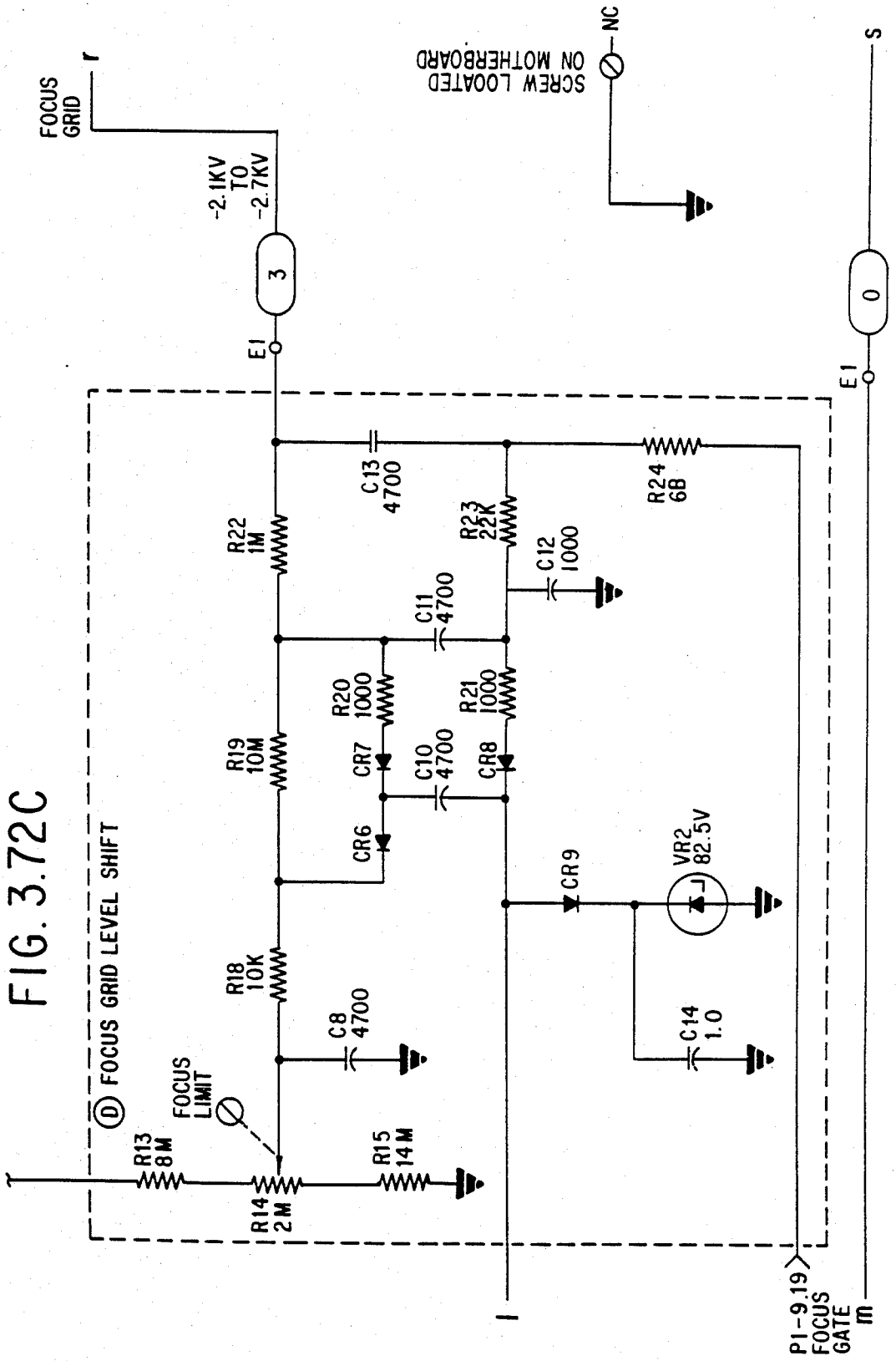

FOCUS GRID
r
-2.1KV TO -2.7KV
3
E1
SCREW LOCATED ON MOTHERBOARD
NC
S
0
E1
C13 4700
R24 68
R22 1M
R23 22K
C12 1000
C11 4700
R20 1000
R21 1000
R19 10M
CR7
CR8
C10 4700
CR6
CR9
VR2 82.5V
R18 10K
C8 4700
C14 1.0
FOCUS LIMIT
D FOCUS GRID LEVEL SHIFT
R13 8M
R15 14M
R14 2M
P1-9.19 FOCUS GATE
m

FIG. 3.72C

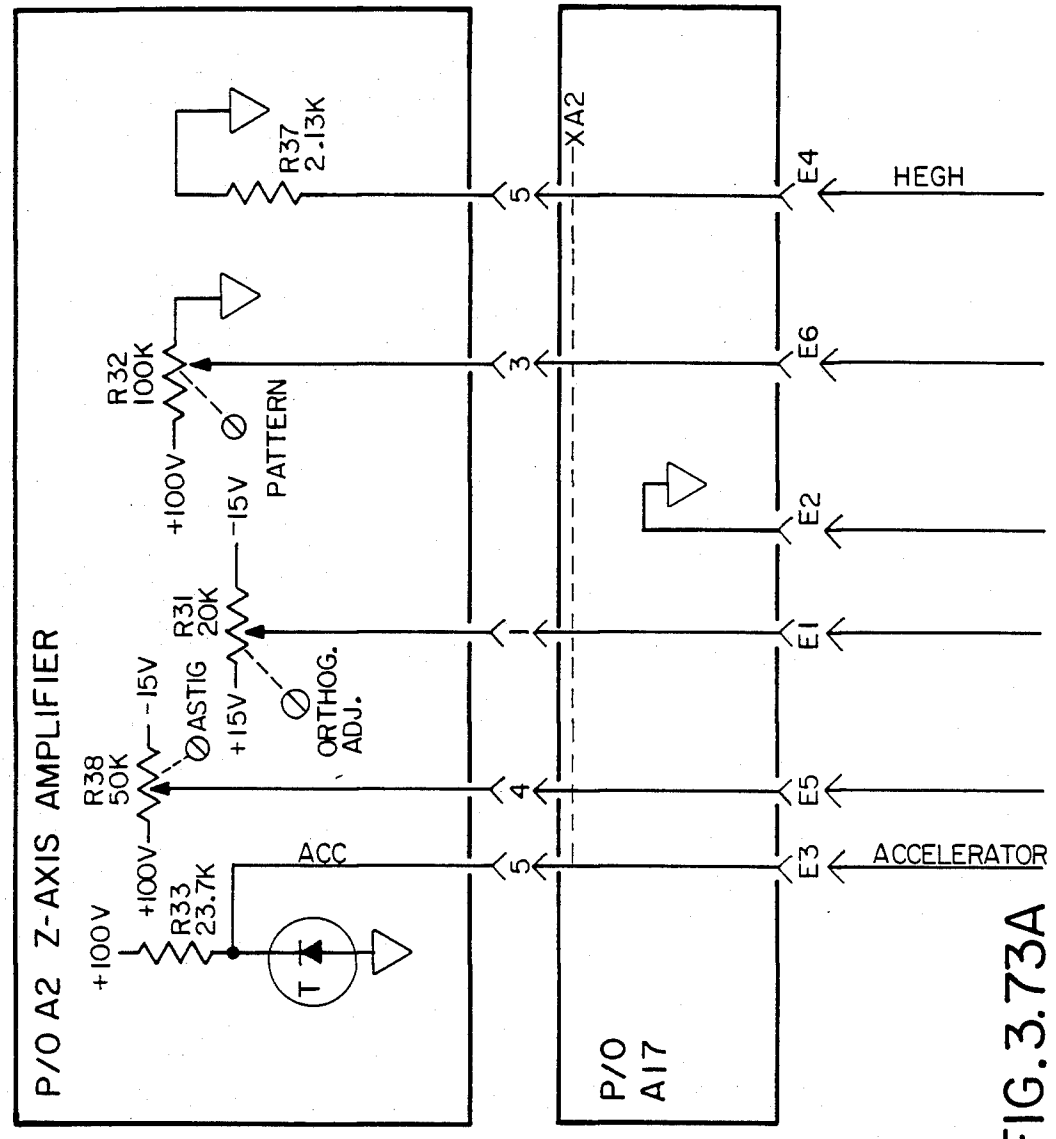
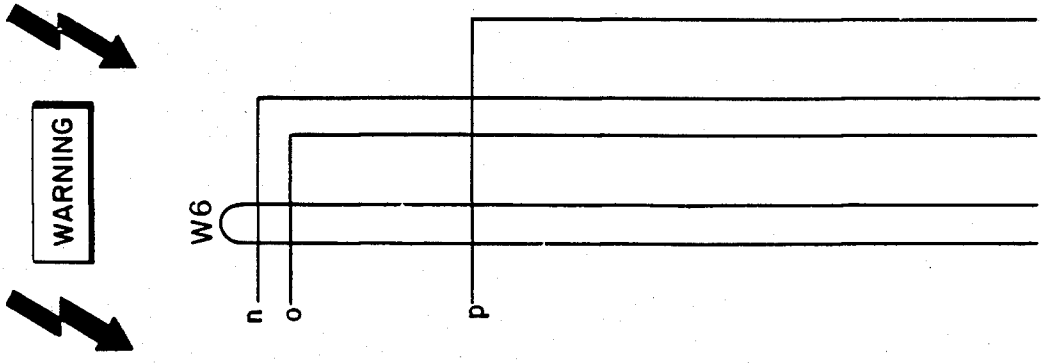

P/O A2 Z-AXIS AMPLIFIER
R37 2.13K
R32 100K
+100V
PATTERN
-15V
R31 20K
ASTIG
+15V
ORTHOG. ADJ.
R38 50K
-15V
+100V
ACC
R33 23.7K
+100V
T
XA2
5
3
4
5
E4
HEGH
E6
E2
E1
E5
E3
ACCELERATOR
P/O A17

FIG. 3.73A


WARNING
W6
n
o
p

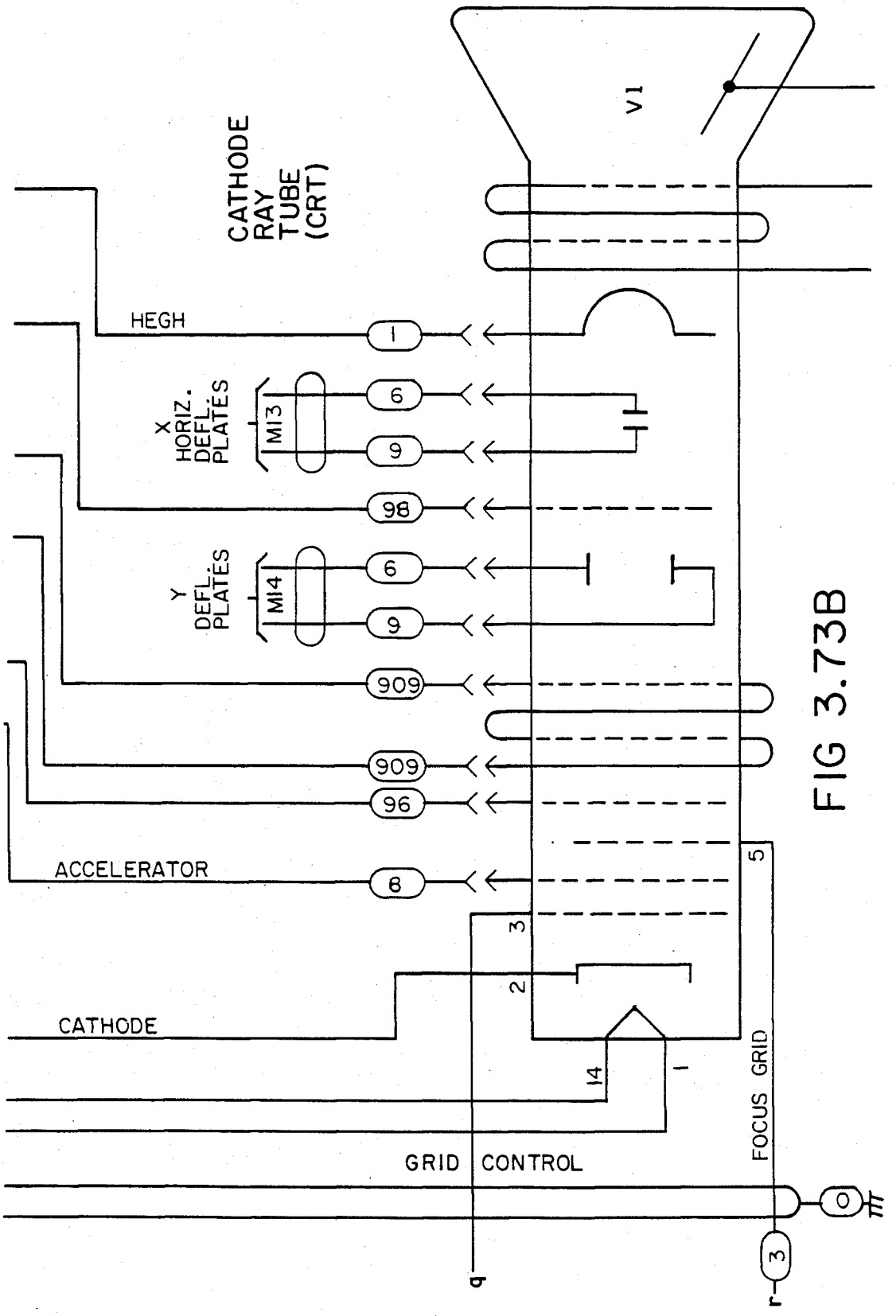

V1
CATHODE RAY TUBE (CRT)
HEGH
1
X HORIZ. DEFL. PLATES
M13
6
9
98
Y DEFL. PLATES
M14
6
9
909
909
96
ACCELERATOR
8
5
3
2
CATHODE
14
1
FOCUS GRID
GRID CONTROL
q
r
3
0

FIG 3.73B

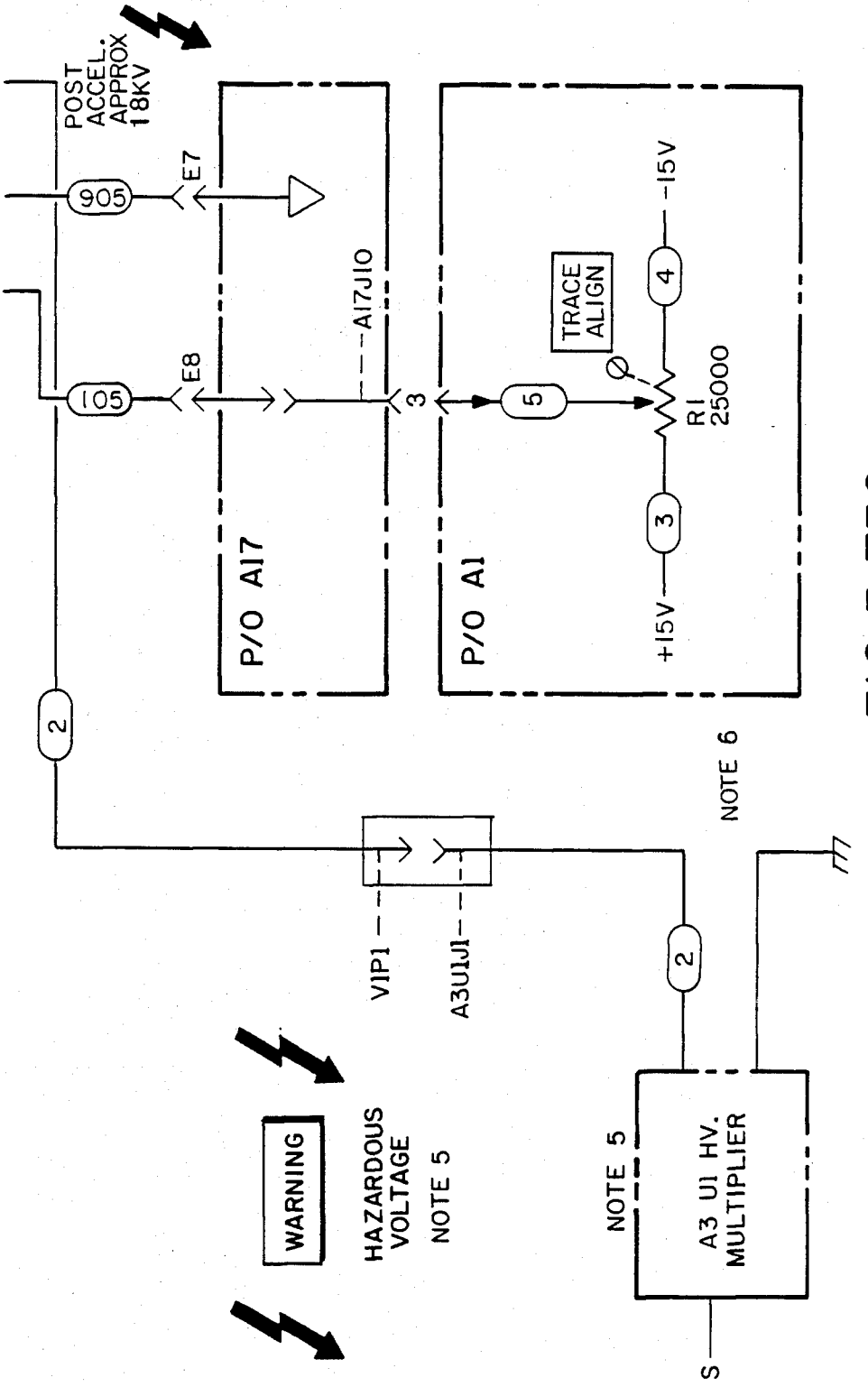

POST ACCEL. APPROX 18KV
905
E7
105
E8
A17J10
3
P/O A17
5
P/O A1
TRACE ALIGN
4
-15V
R1 25000
3
+15V
2
NOTE 6
VIP1
A3U1J1
2
WARNING
HAZARDOUS VOLTAGE
NOTE 5
NOTE 5
A3 U1 HV. MULTIPLIER
S

FIG 3.73C

A4 X DEFLECTION AMPLIFIER
A5 Y DEFLECTION AMPLIFIER

P1 85101-60004

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 16	LGX/LGY INPUT	A5 P1-5/7	A
2 17	AGND AGND	A17 CI-NEG	F
3 18	NC NC		
4 19	NC NC		
5 20	AUX-X/AUX-Y	REAR PANEL AUX OUT	B
6 21	NC NC		
7 22	-15VF1 -15VF1	A17L5.L8	F
8 23	AGND AGND	A17 CI-NEG	F
9 24	+15VF1 +15VF1	A17L4.L7	F
10 25	NC NC		
11 26	NC NC		
12 27	+100VF +100VF	A17L3	F
13 28	NC NC		
14 29	AGND AGND	A17 CI-NEG	F
15 30	NC NC		

FIG 3.75A

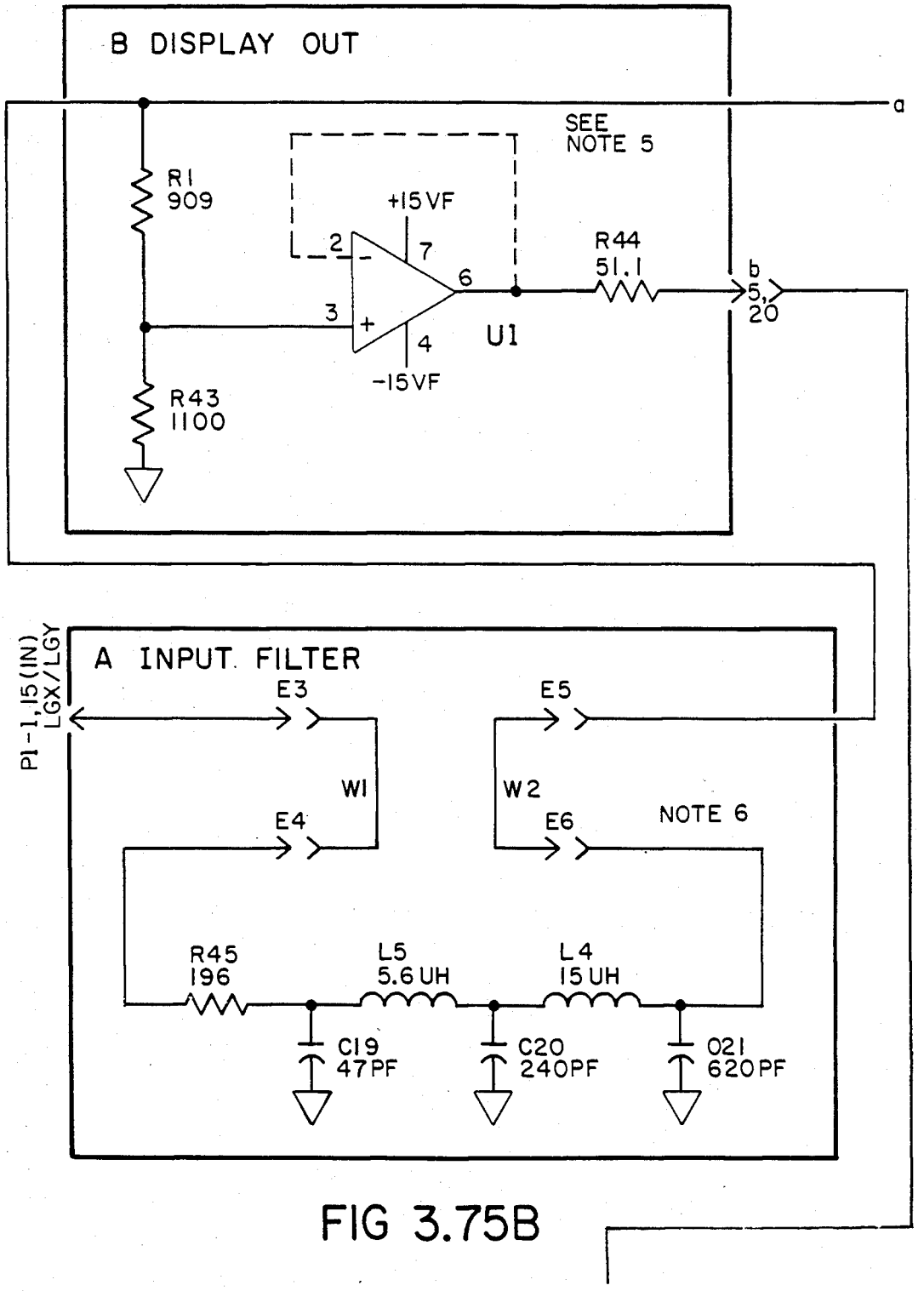

B DISPLAY OUT
a
SEE
NOTE 5
R1
909
+15VF
2
7
6
R44
51.1
b
5,
20
3
+
4
U1
-15VF
R43
1100
P1-1,15(IN)
LGX/LGY
A INPUT FILTER
E3
E5
W1
W2
E4
E6
NOTE 6
R45
196
L5
5.6 UH
L4
15 UH
C19
47PF
C20
240PF
021
620PF

FIG 3.75B

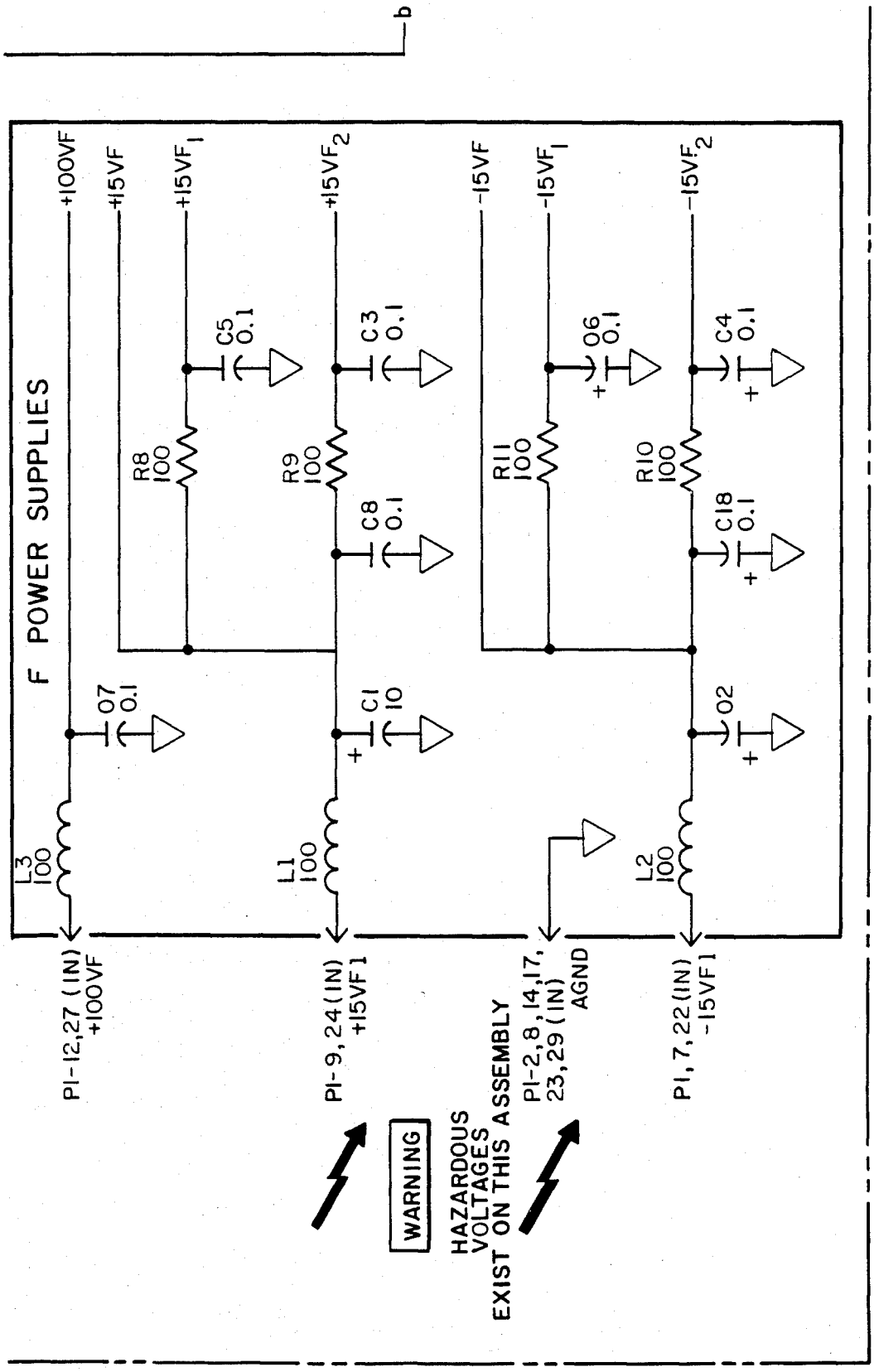

b
F POWER SUPPLIES
+100VF
+15VF
+15VF1
+15VF2
-15VF
-15VF1
-15VF2
C5 0.1
C3 0.1
C6 0.1
C4 0.1
R8 100
R9 100
R11 100
R10 100
C8 0.1
C18 0.1
C7 0.1
C1 10
C2
L3 100
L1 100
L2 100
P1-12,27 (IN) +100VF
P1-9,24(IN) +15VF1
P1-2,8,14,17, 23,29 (IN) AGND
P1,7,22(IN) -15VF1
WARNING
HAZARDOUS VOLTAGES EXIST ON THIS ASSEMBLY

FIG 3.75C

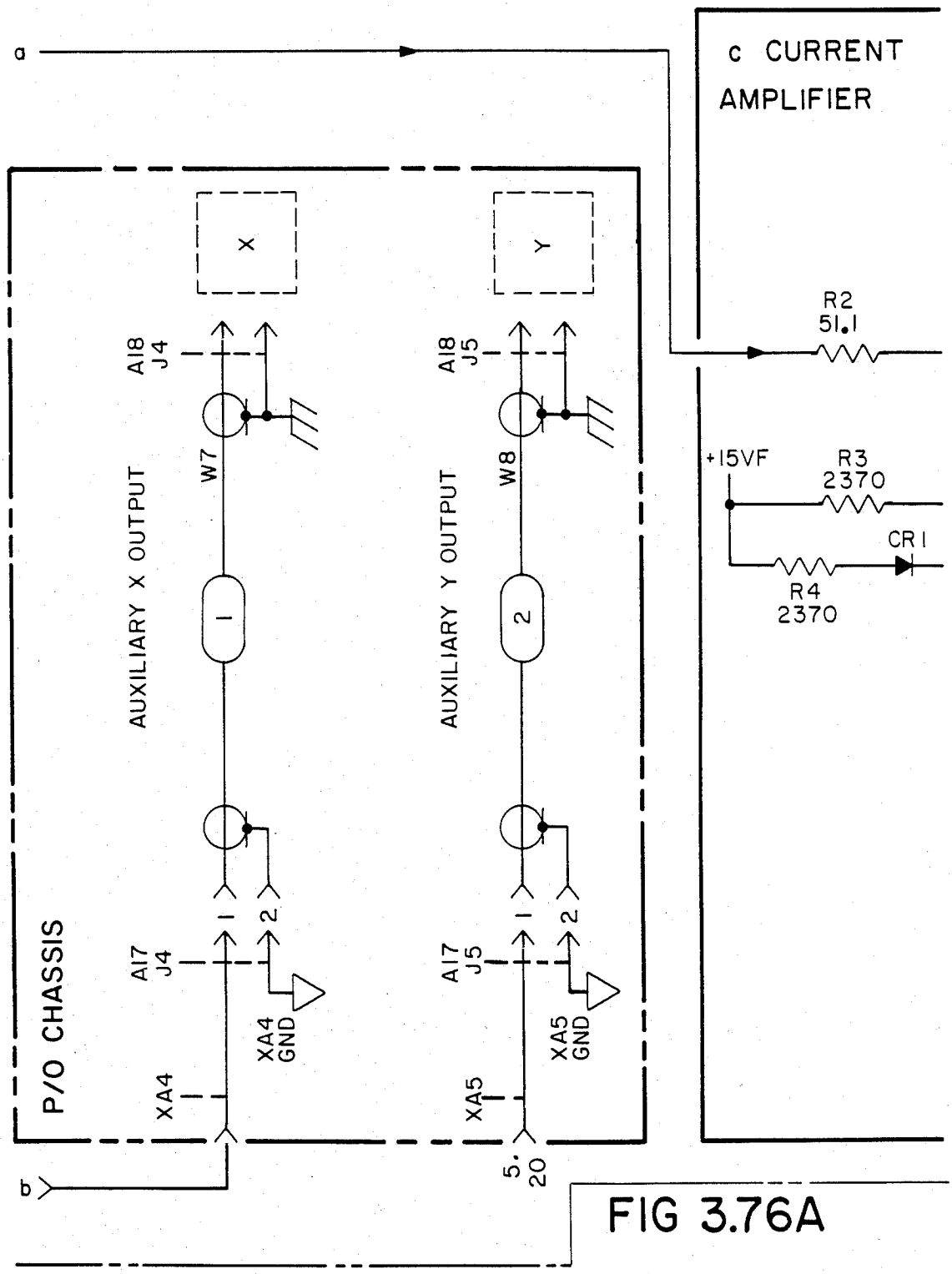

a
c CURRENT AMPLIFIER
X
Y
R2
51.1
A18 J4
A18 J5
W7
W8
AUXILIARY X OUTPUT
AUXILIARY Y OUTPUT
+15VF
R3
2370
CR1
R4
2370
1
2
A17 J4
A17 J5
XA4 GND
XA5 GND
XA4
XA5
P/O CHASSIS
5.
20
b

FIG 3.76A

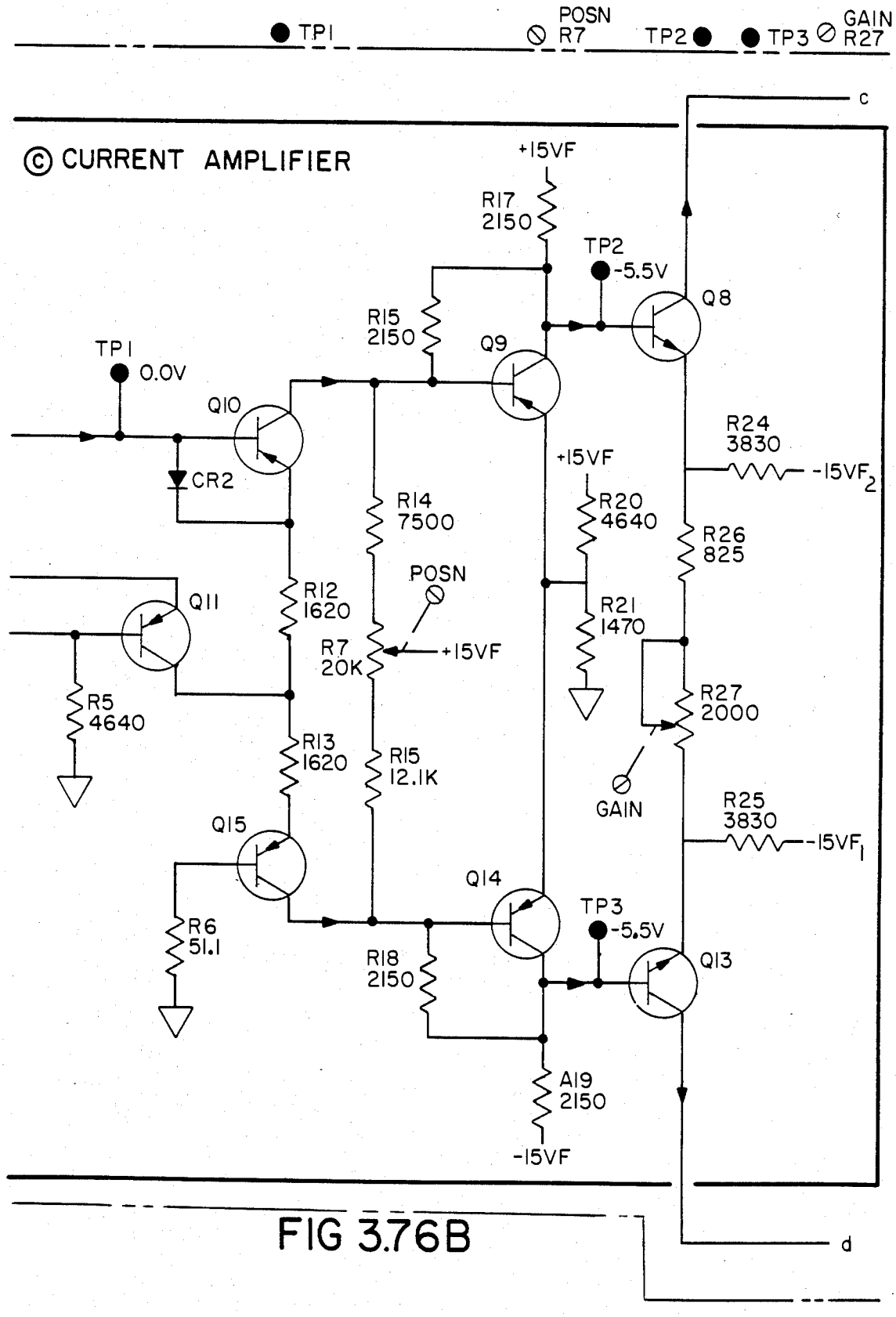

TP1
POSN R7
TP2
TP3
GAIN R27
c
© CURRENT AMPLIFIER
+15VF
R17 2150
TP2 -5.5V
Q8
R15 2150
Q9
TP1 0.0V
Q10
R24 3830
-15VF2
+15VF
CR2
R14 7500
R20 4640
R26 825
POSN
Q11
R12 1620
R21 1470
R7 20K
+15VF
R5 4640
R27 2000
R13 1620
R15 12.1K
GAIN
R25 3830
-15VF1
Q15
Q14
TP3 -5.5V
R6 51.1
R18 2150
Q13
A19 2150
-15VF
d

FIG 3.76B

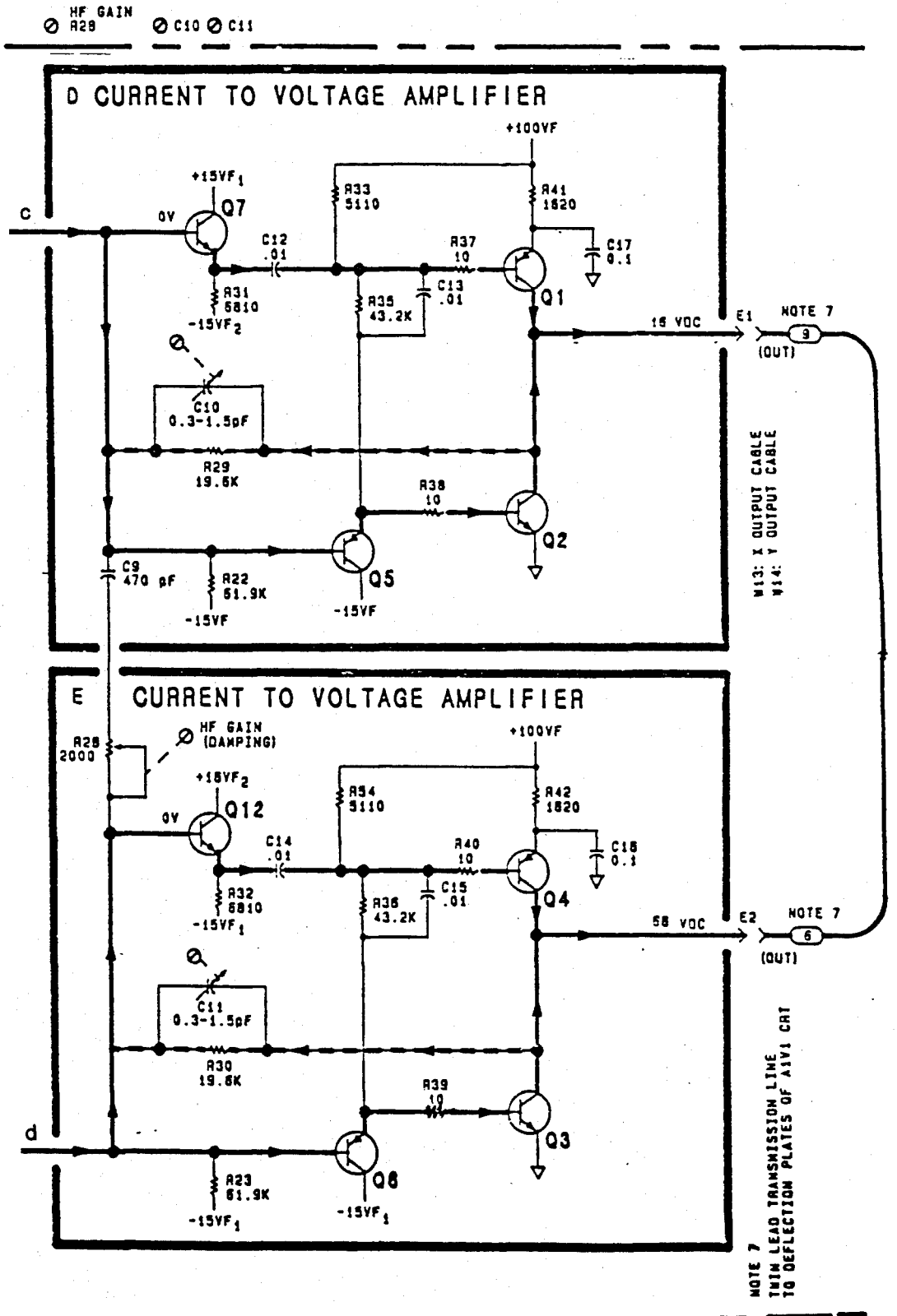

HF GAIN
R28
C10
C11
D CURRENT TO VOLTAGE AMPLIFIER
+100VF
+15VF1
Q7
0V
C
R33
5110
R41
1820
C12
.01
R37
10
C17
0.1
R31
5810
-15VF2
R35
43.2K
C13
.01
Q1
16 VDC
E1
NOTE 7
9
(OUT)
C10
0.3-1.5pF
R29
19.6K
R38
10
Q2
C9
470 pF
R22
51.9K
-15VF
Q5
-15VF
W13: X OUTPUT CABLE
W14: Y OUTPUT CABLE
E
CURRENT TO VOLTAGE AMPLIFIER
R28
2000
HF GAIN
(DAMPING)
+100VF
+15VF2
Q12
0V
R54
5110
R42
1820
C14
.01
R40
10
C18
0.1
R32
5810
-15VF1
R36
43.2K
C15
.01
Q4
58 VDC
E2
NOTE 7
6
(OUT)
C11
0.3-1.5pF
R30
19.6K
R39
10
Q3
d
R23
51.9K
-15VF1
Q6
-15VF1
NOTE 7
TWIN LEAD TRANSMISSION LINE
TO DEFLECTION PLATES OF A1V1 CRT

FIG 3.77

FIG 3.78

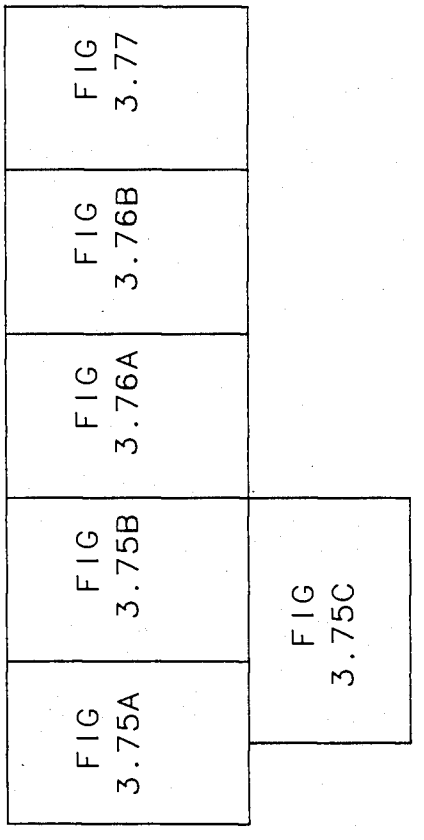
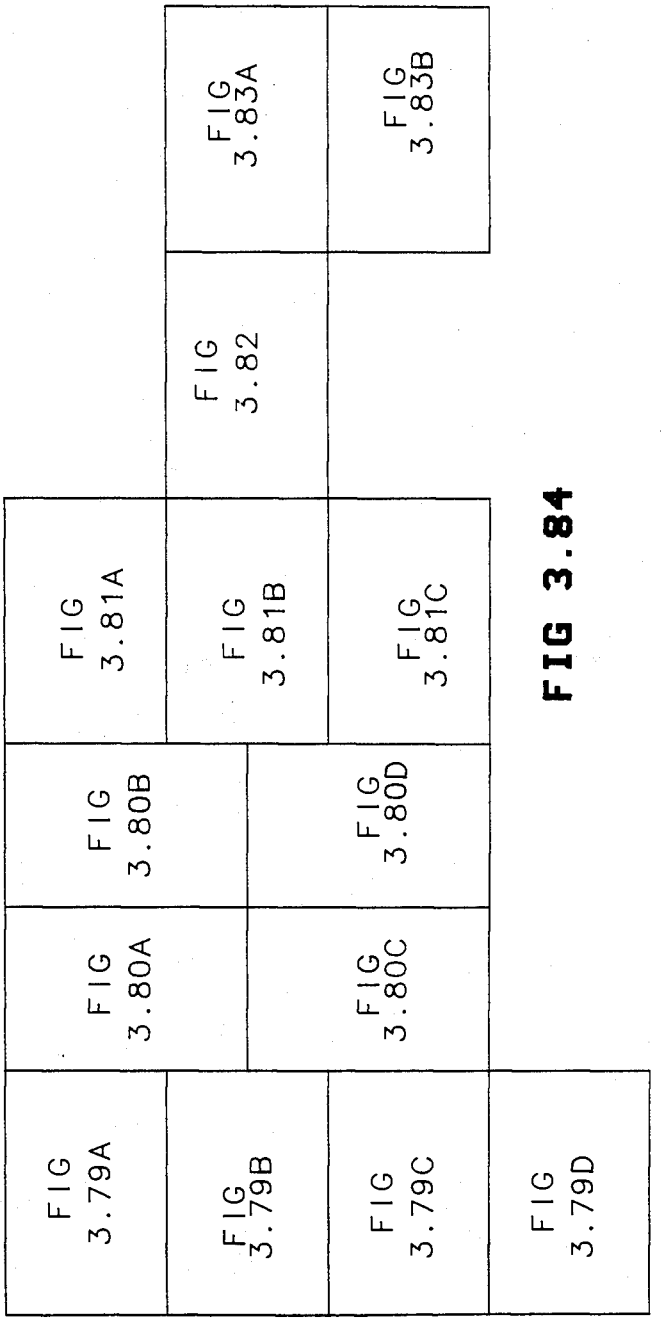


FIG 3.84



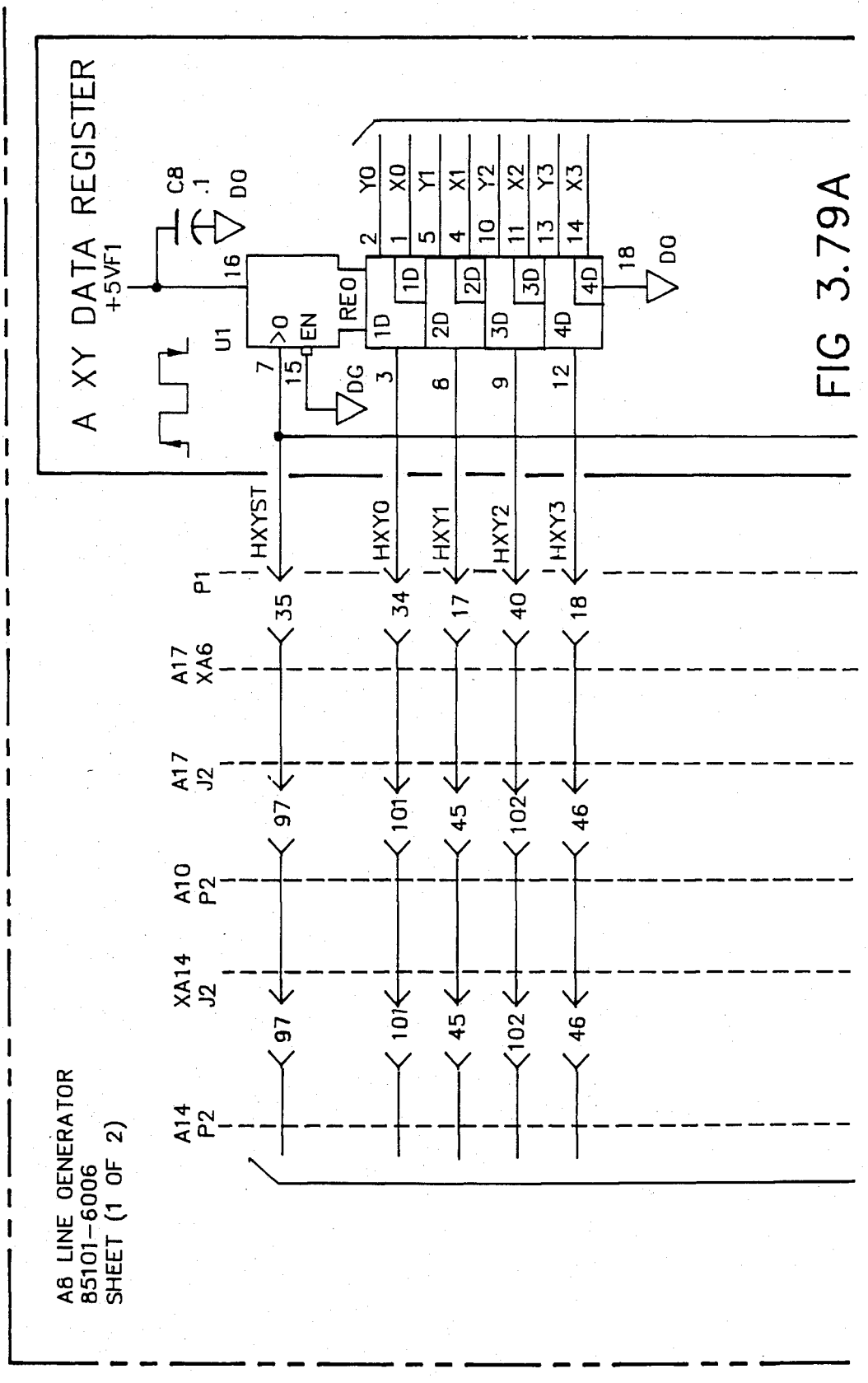

A XY DATA REGISTER
+5VF1
C8
.1
DO
U1
16
7
15
3
8
9
12
>O
EN
DG
REO
1D
2D
3D
4D
2
1
5
4
10
11
13
14
Y0
X0
Y1
X1
Y2
X2
Y3
X3
18
DO
HXYST
HXY0
HXY1
HXY2
HXY3
P1
A17
XA6
A17
J2
A10
P2
XA14
J2
A14
P2
35
34
17
40
18
97
101
45
102
46
TP1 GROUND
A8 LINE GENERATOR
85101-6006
SHEET (1 OF 2)

FIG 3.79A

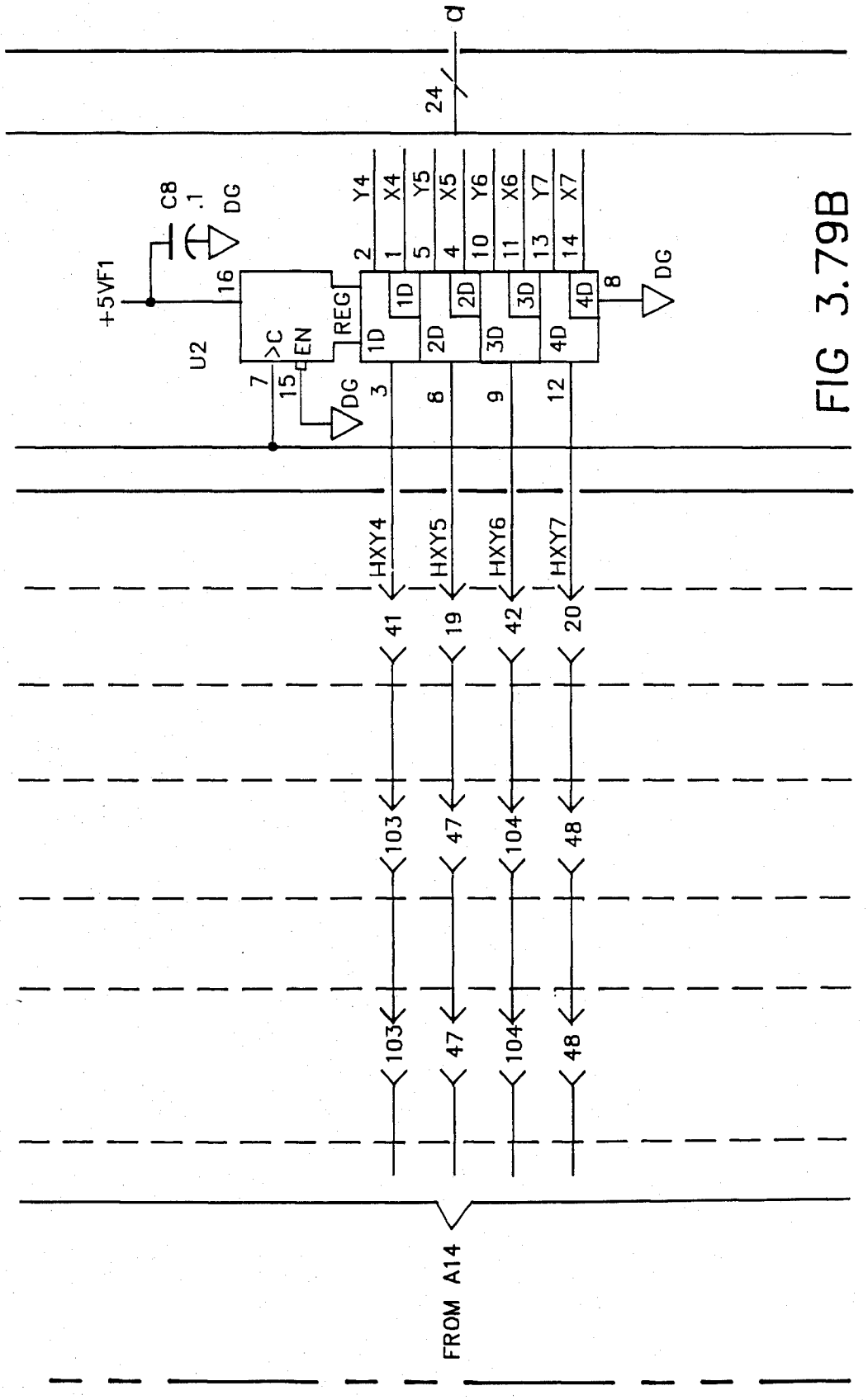

CI
24
C8
.1
DG
+5VF1
16
U2
>C
EN
REG
7
15
DG
1D
2D
3D
4D
Y4
X4
Y5
X5
Y6
X6
Y7
X7
2
1
5
4
10
11
13
14
8
DG
3
6
9
12
HXY4
HXY5
HXY6
HXY7
41
19
42
20
103
47
104
48
103
47
104
48
FROM A14

FIG 3.79B

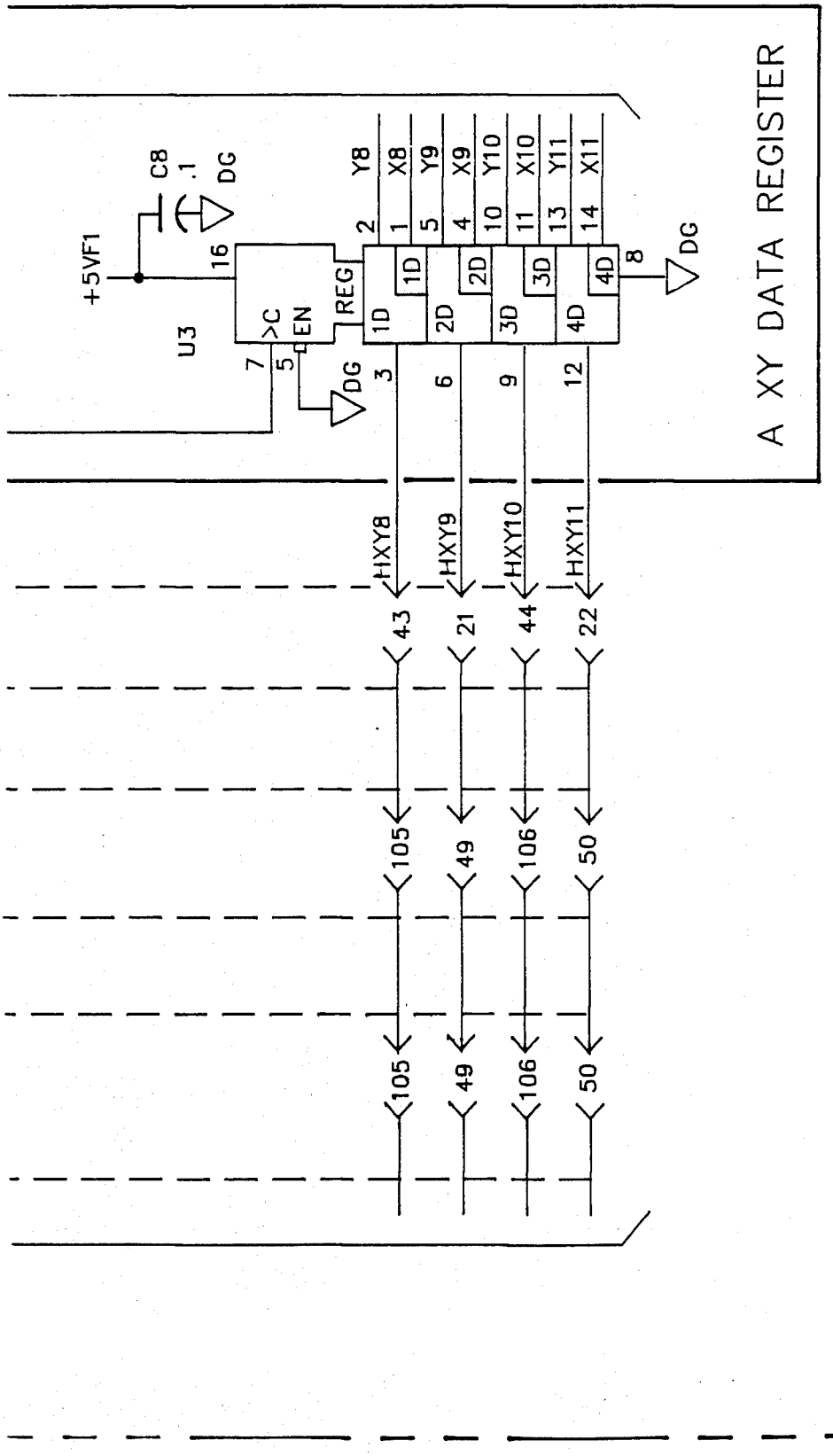

A XY DATA REGISTER
+5VF1
C8
.1
DG
U3
REG
EN
1D
2D
3D
4D
Y8
X8
Y9
X9
Y10
X10
Y11
X11
HXY8
HXY9
HXY10
HXY11
43
21
44
22
105
49
106
50

FIG 3.79C

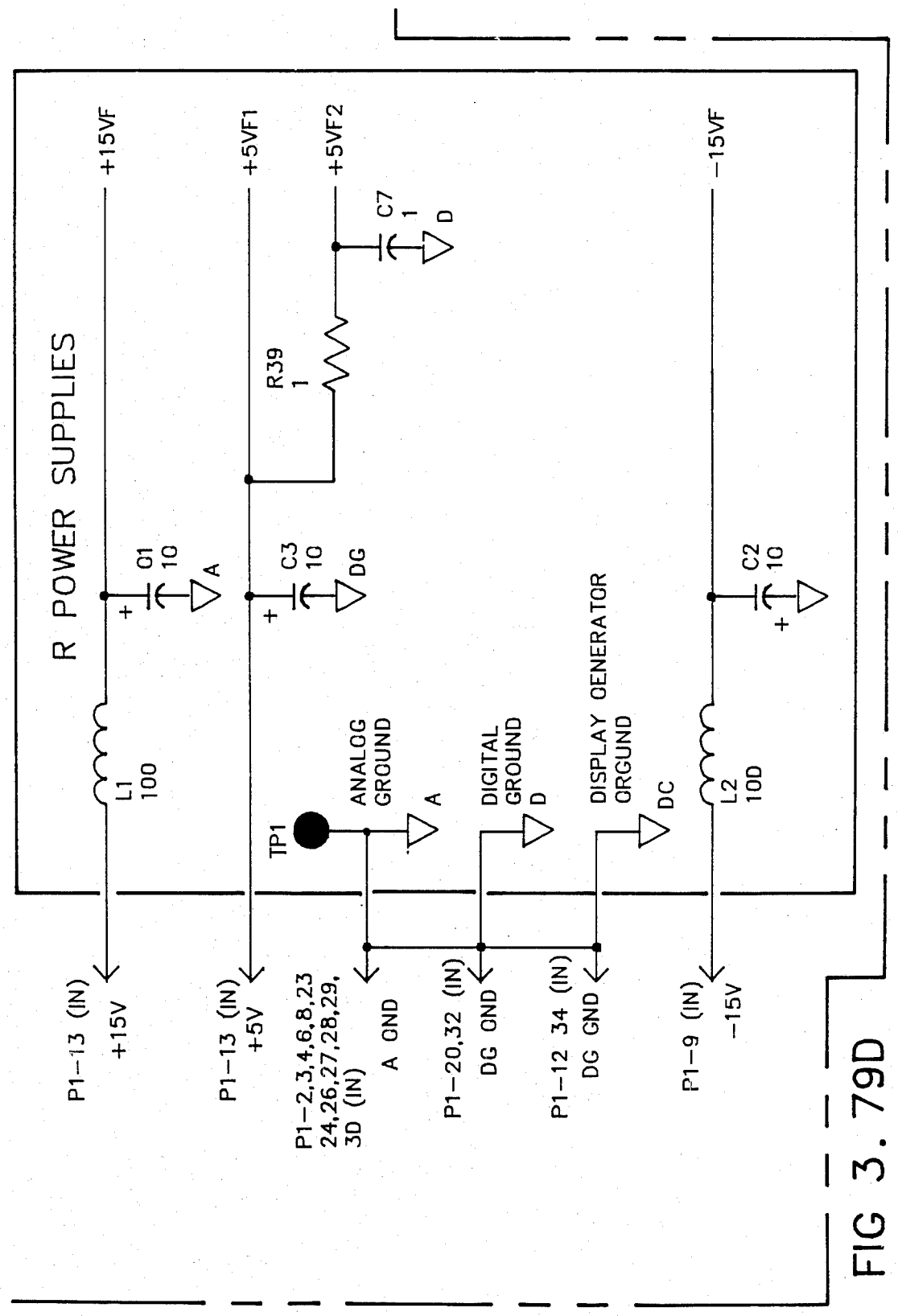

R POWER SUPPLIES
+15VF
+5VF1
+5VF2
-15VF
C7
1
D
R39
1
C1
10
A
C3
10
DG
C2
10
L1
100
L2
10D
TP1
ANALOG
GROUND
A
DIGITAL
GROUND
D
DISPLAY GENERATOR
ORGUND
DC
P1-13 (IN)
+15V
P1-13 (IN)
+5V
P1-2,3,4,6,8,23
24,26,27,28,29,
3D (IN)
A OND
P1-20,32 (IN)
DG OND
P1-12 34 (IN)
DG GND
P1-9 (IN)
-15V

FIG 3. 79D

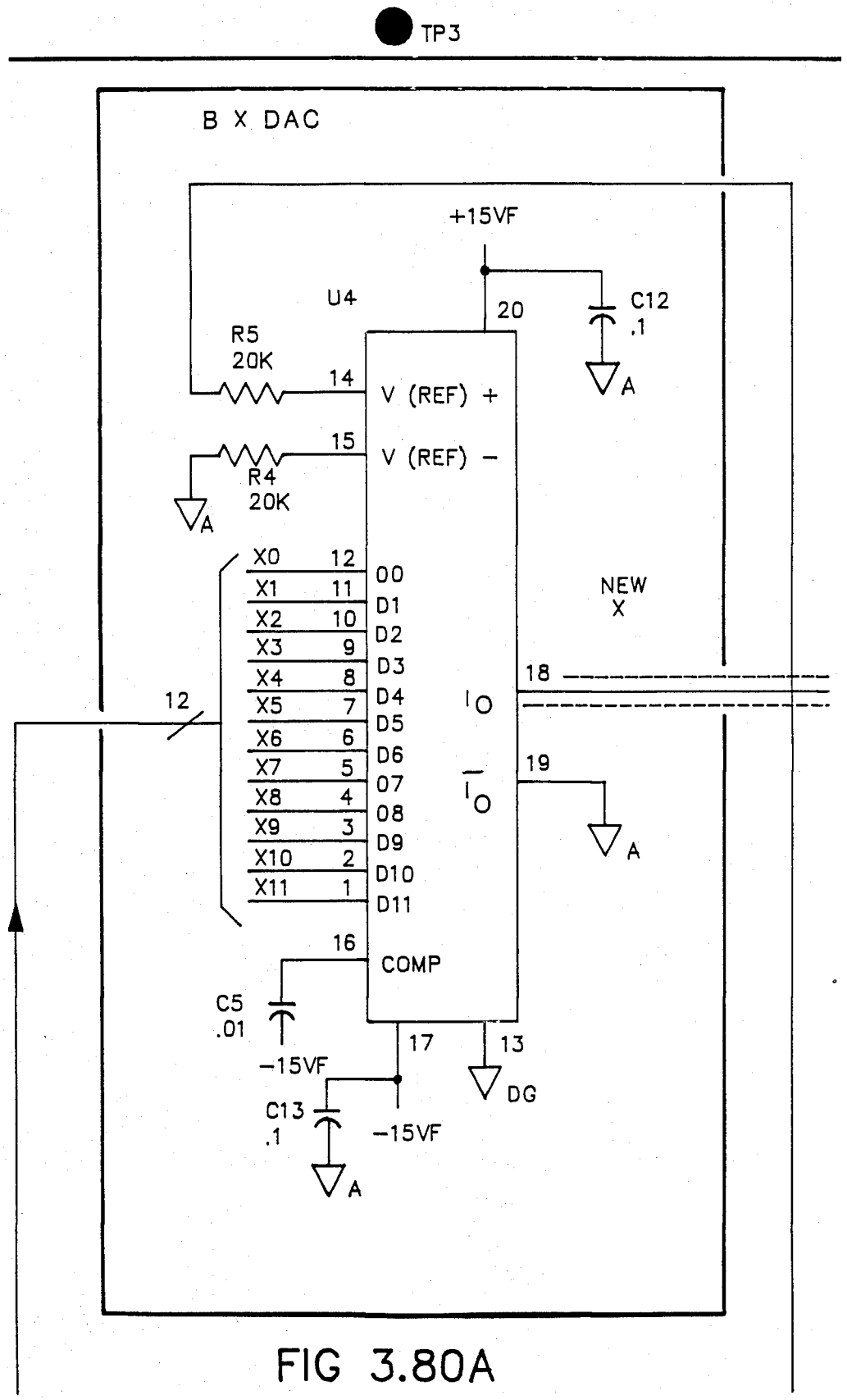

TP3
B X DAC
+15VF
U4
20
C12
.1
R5
20K
14
V (REF) +
15
V (REF) −
R4
20K
X0 12
X1 11
X2 10
X3 9
X4 8
X5 7
X6 6
X7 5
X8 4
X9 3
X10 2
X11 1
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
NEW
X
18
12
IO
19
16
COMP
C5
.01
−15VF
17
13
DG
C13
.1
−15VF
A

FIG 3.80A

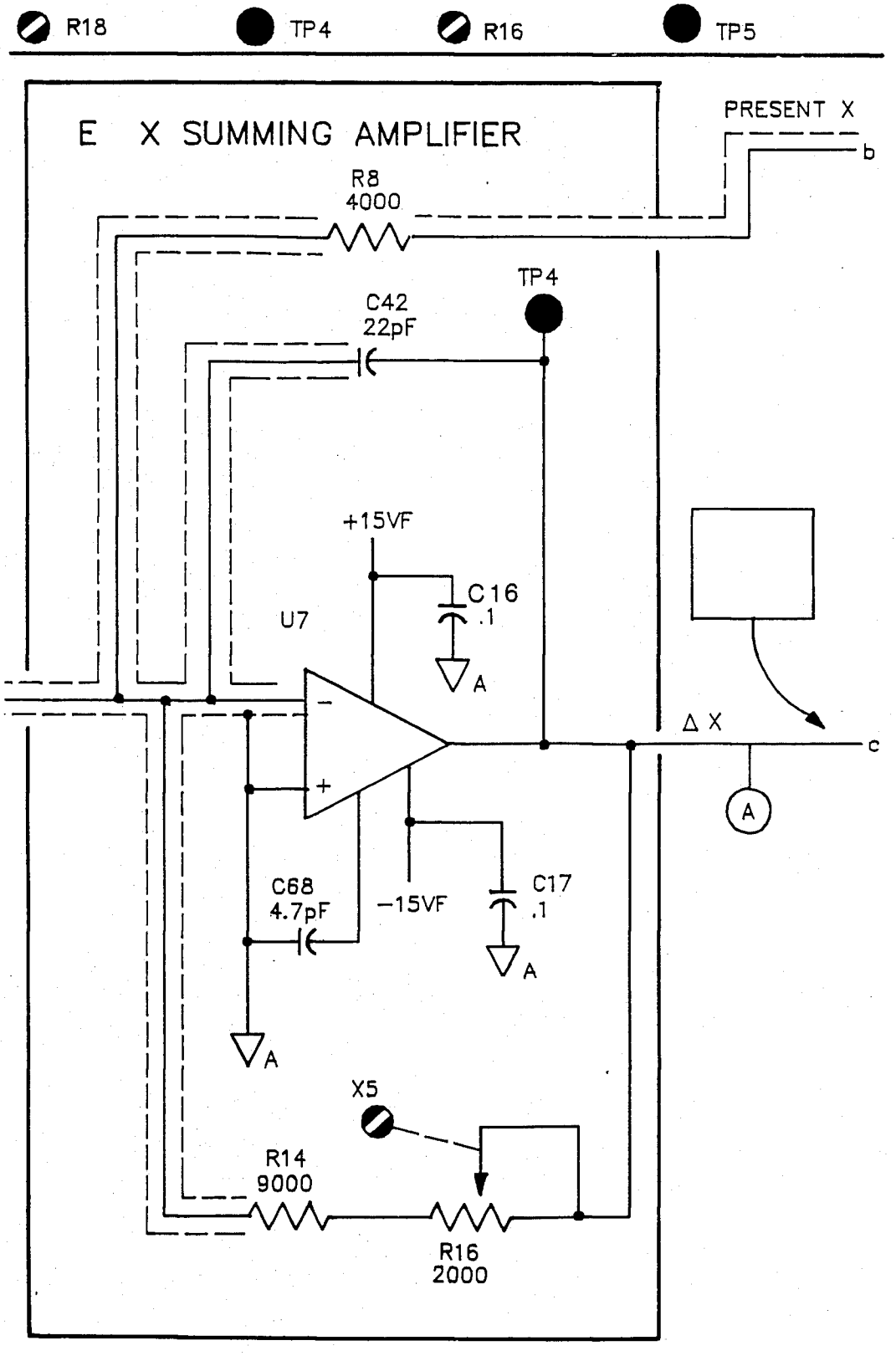

R18
TP4
R16
TP5
E X SUMMING AMPLIFIER
PRESENT X
b
R8
4000
TP4
C42
22pF
+15VF
C16
.1
U7
A
ΔX
c
A
C68
4.7pF
-15VF
C17
.1
A
A
X5
R14
9000
R16
2000

FIG 3.80B

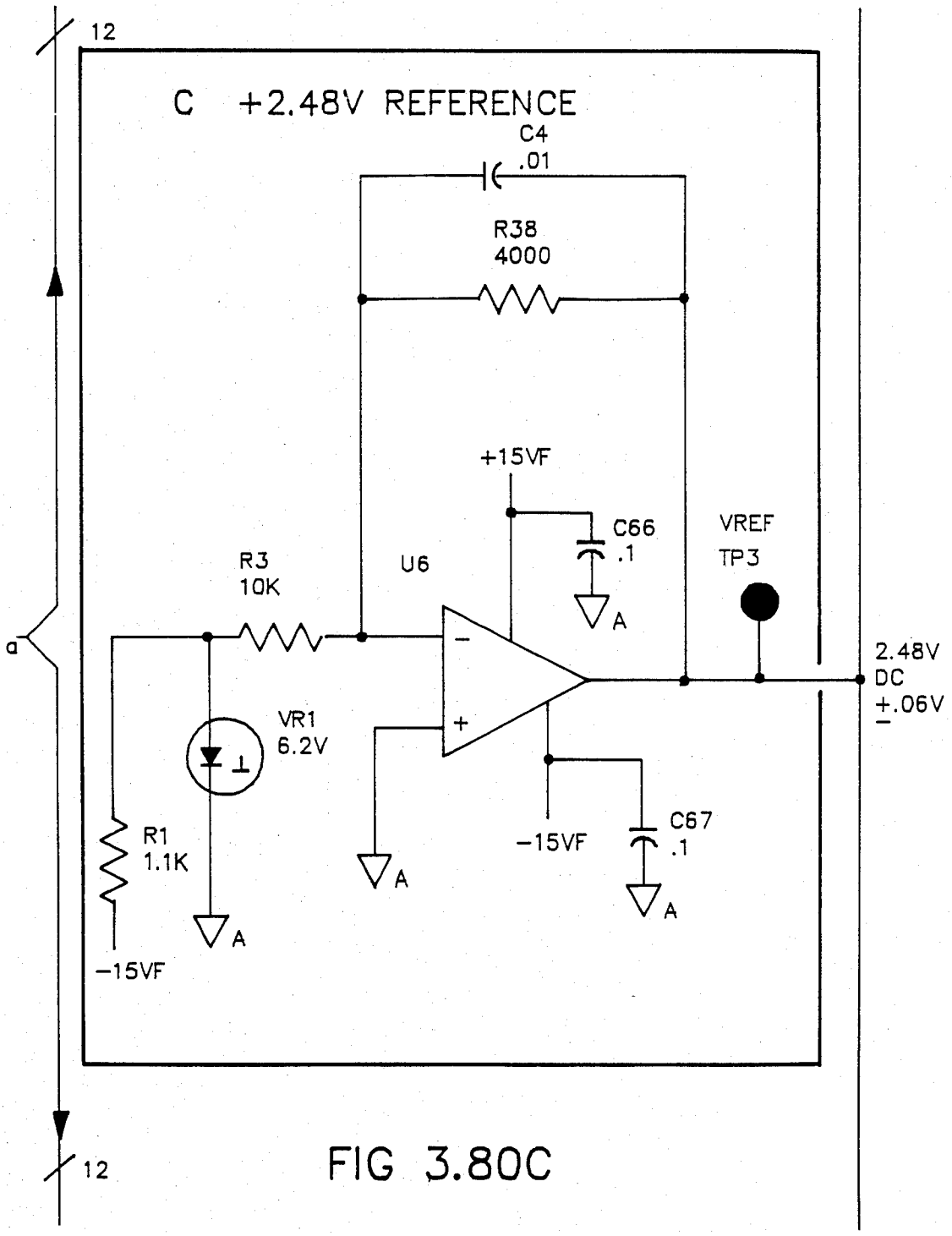

12
C +2.48V REFERENCE
C4
.01
R38
4000
+15VF
C66
.1
VREF
TP3
R3
10K
U6
A
2.48V
DC
+.06V
VR1
6.2V
R1
1.1K
A
A
−15VF
C67
.1
A
−15VF
12

FIG 3.80C

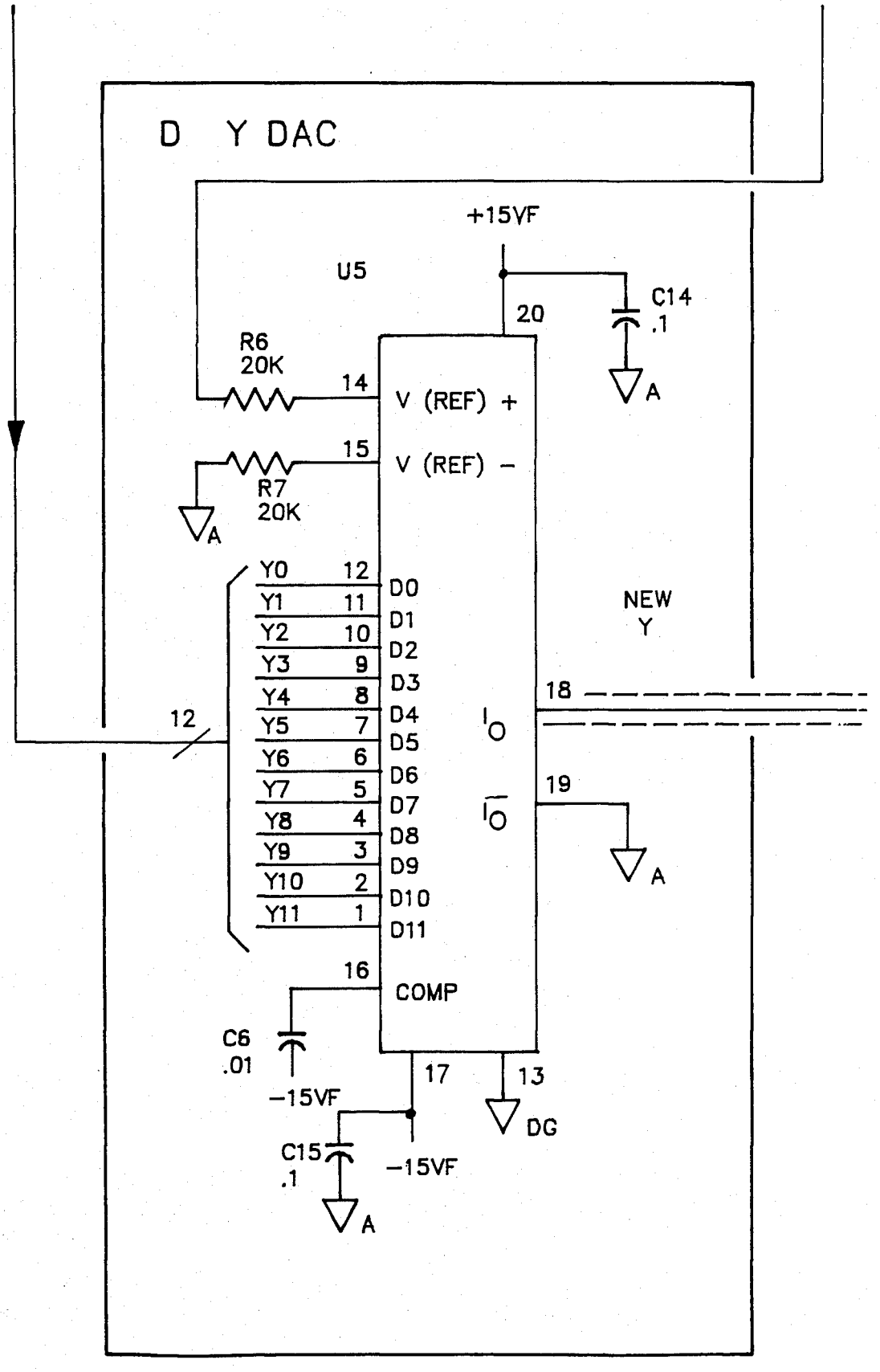

D Y DAC
+15VF
U5
20
C14
.1
A
R6
20K
14
V (REF) +
15
V (REF) −
R7
20K
A
Y0 12
Y1 11
Y2 10
Y3 9
Y4 8
Y5 7
Y6 6
Y7 5
Y8 4
Y9 3
Y10 2
Y11 1
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
NEW
Y
18
12
IO
IO
19
A
16
COMP
C6
.01
17
13
−15VF
DG
C15
.1
−15VF
A

FIG 3.80D

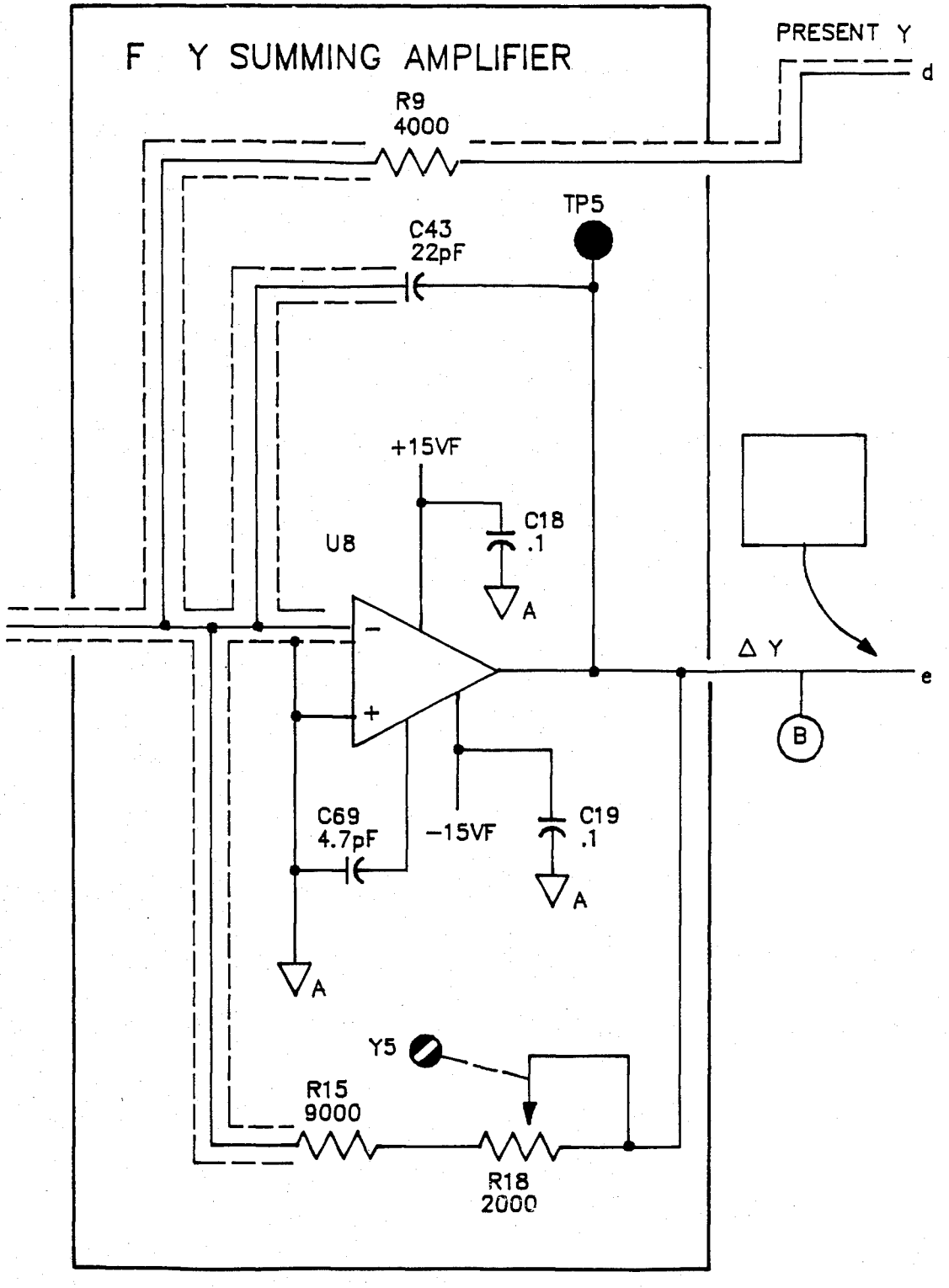

F Y SUMMING AMPLIFIER
PRESENT Y
d
R9
4000
TP5
C43
22pF
+15VF
C18
.1
U8
A
Δ Y
e
B
C69
4.7pF
−15VF
C19
.1
A
A
Y5
R15
9000
R18
2000

FIG 3.80E

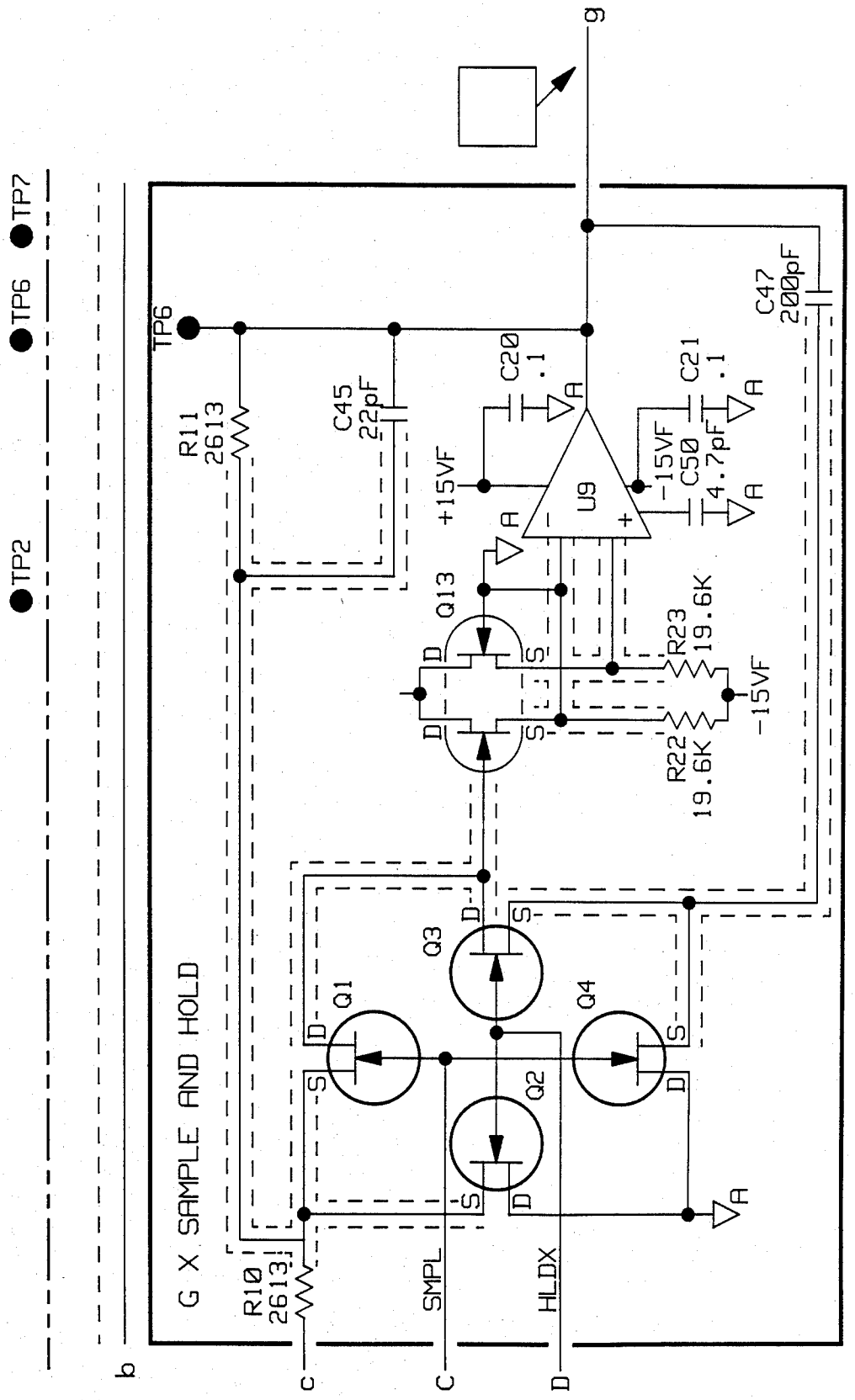

TP2
TP6
TP7
TP6
R11
2613
C45
22pF
C20
.1
C21
.1
C47
200pF
+15VF
-15VF
C50
4.7pF
U9
Q13
R23
19.6K
R22
19.6K
-15VF
Q3
Q1
Q4
Q2
G X SAMPLE AND HOLD
R10
2613
SMPL
HLDX
b
c
C
D
g

FIG 3.81A

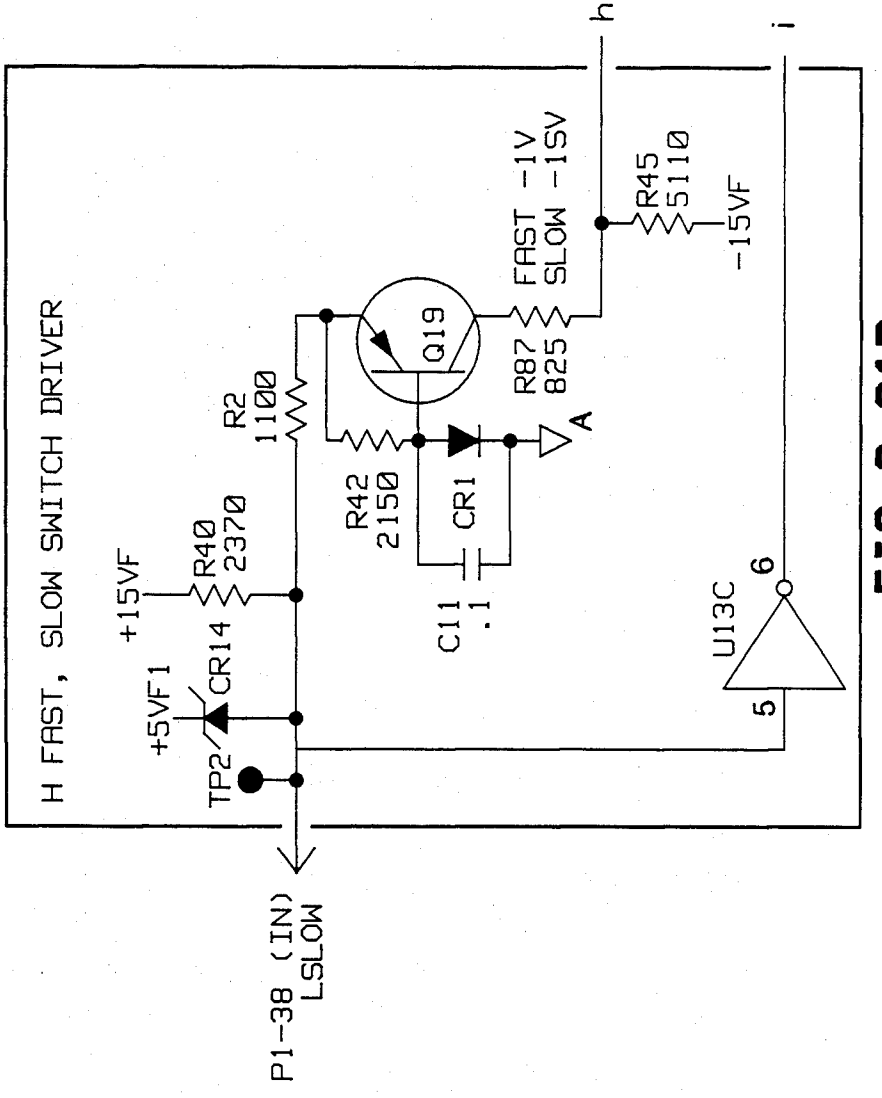

H FAST, SLOW SWITCH DRIVER
+15VF
R40
2370
+5VF1
CR14
TP2
R2
1100
R42
2150
CR1
C11
.1
Q19
A
R87
825
FAST -1V
SLOW -1SV
h
R45
5110
-15VF
i
U13C
6
5
P1-38 (IN)
LSLOW

FIG 3.81B

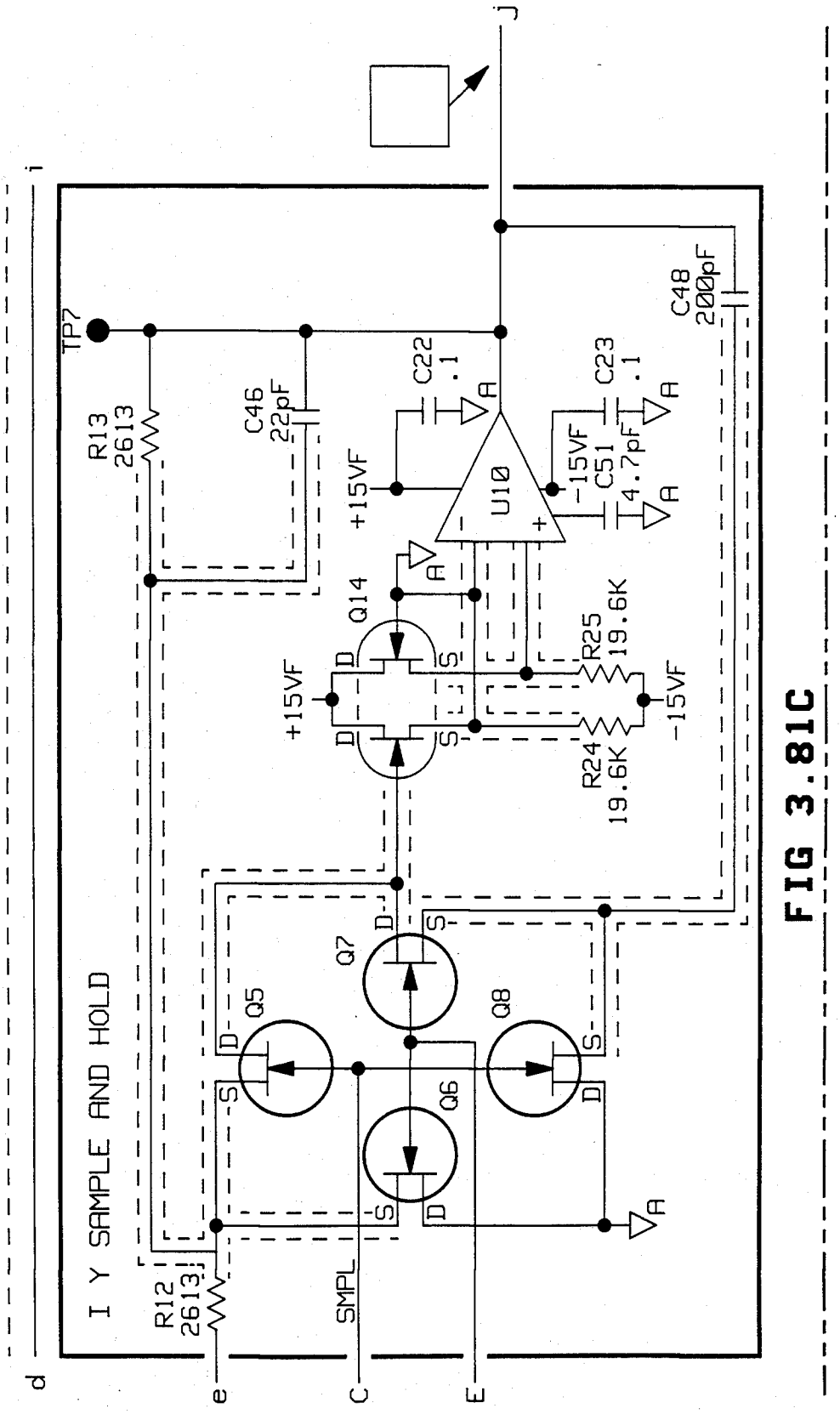

I Y SAMPLE AND HOLD
TP7
R13
2613
C46
22pF
C22
.1
C23
.1
C48
200pF
U10
+15VF
-15VF
C51
4.7pF
Q14
R25
19.6K
R24
19.6K
Q7
Q5
Q8
Q6
R12
2613
SMPL
d
i
j
e
C
E

FIG 3.81C

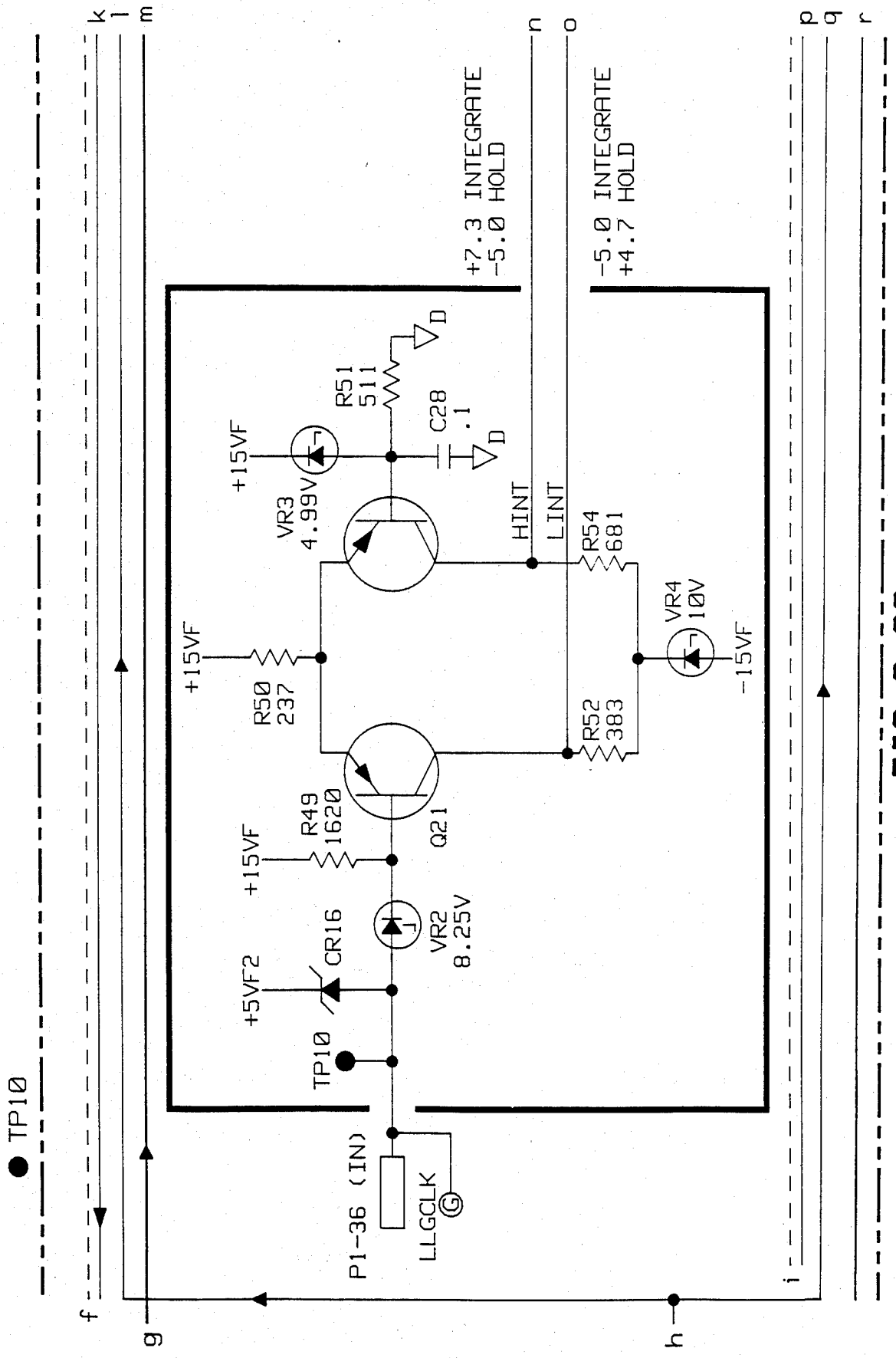

TP10
k
l
m
n
o
p
q
r
+7.3 INTEGRATE
-5.0 HOLD
-5.0 INTEGRATE
+4.7 HOLD
R51
511
C28
.1
+15VF
VR3
4.99V
HINT
LINT
R54
681
VR4
10V
-15VF
+15VF
R50
237
R52
383
R49
1620
Q21
+15VF
VR2
8.25V
CR16
+5VF2
TP10
P1-36 (IN)
LLGCLK
f
g
h
i

FIG 3.82

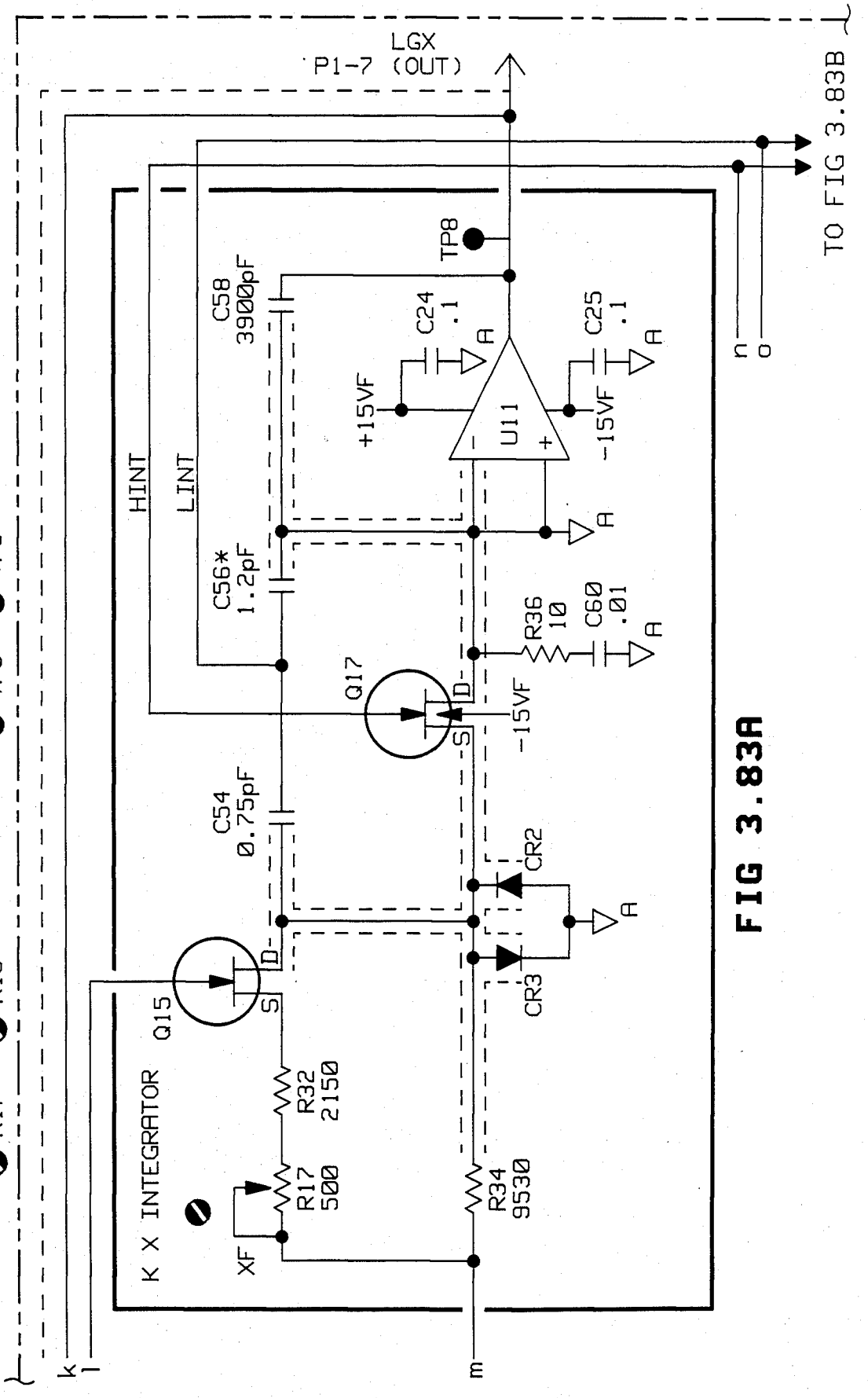

LGX
P1-7 (OUT)
TO FIG 3.83B
TP8
TP9
R19
R17
C58
3900pF
C24
.1
C25
.1
+15VF
-15VF
U11
HINT
LINT
C56*
1.2pF
R36
10
C60
.01
Q17
-15VF
C54
0.75pF
CR2
CR3
Q15
R32
2150
R17
500
R34
9530
K X INTEGRATOR
XF
k
l
m
n
o

FIG 3.83A

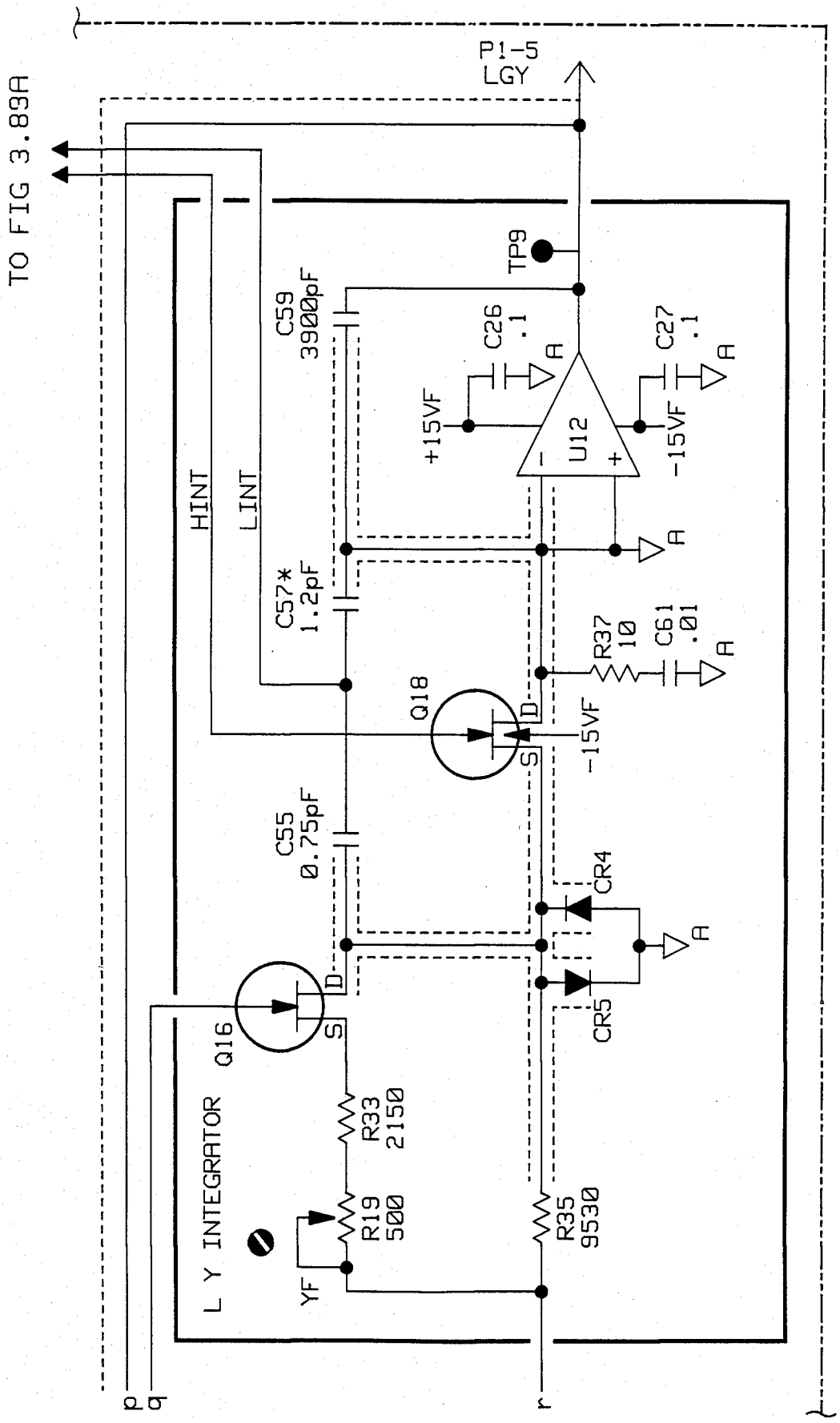
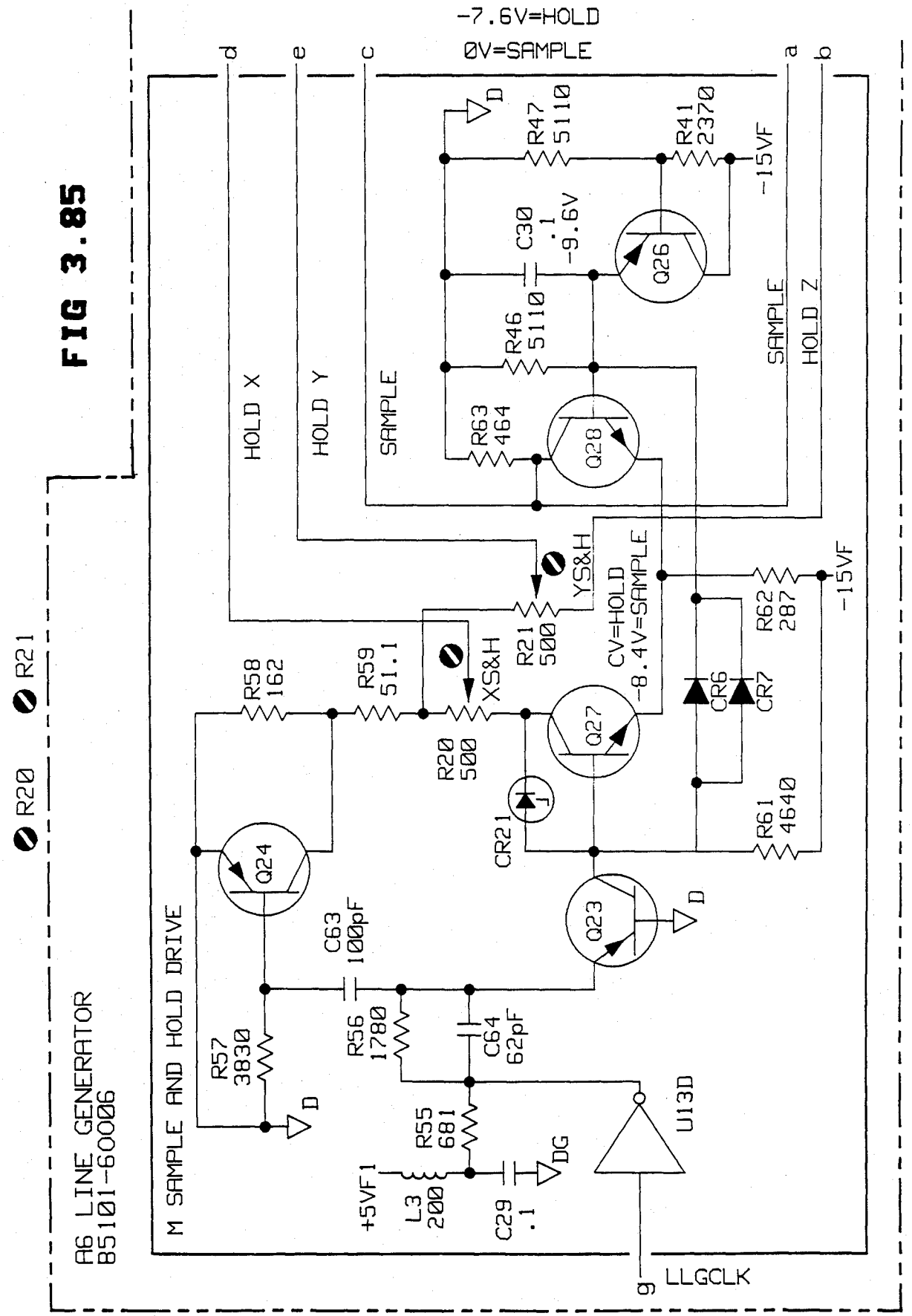

TO FIG 3.83A
P1-5
LGY
TP9
C59
3900pF
C26
.1
A
C27
.1
A
+15VF
U12
-15VF
HINT
LINT
C57*
1.2pF
A
R37
10
C61
.01
A
Q18
D
S
-15VF
C55
0.75pF
CR4
A
CR5
D
S
Q16
L Y INTEGRATOR
R33
2150
R19
500
YF
R35
9530
p
q
r

FIG 3.83B

FIG 3.85


A6 LINE GENERATOR
85101-60006
M SAMPLE AND HOLD DRIVE
R20
R21
-7.6V=HOLD
0V=SAMPLE
HOLD X
HOLD Y
SAMPLE
SAMPLE
HOLD Z
R47 5110
R41 2370
-15VF
C30 .1 -9.6V
Q26
R46 5110
R63 464
Q28
YS&H
R21 500
CV=HOLD -8.4V=SAMPLE
R62 287
-15VF
R58 162
R59 51.1
XS&H
R20 500
Q27
CR6
CR7
CR21
R61 4640
Q24
Q23
C63 100pF
R56 1780
C64 62pF
R57 3830
R55 681
+5VF1
L3 200
C29 .1
DG
U13D
LLGCLK

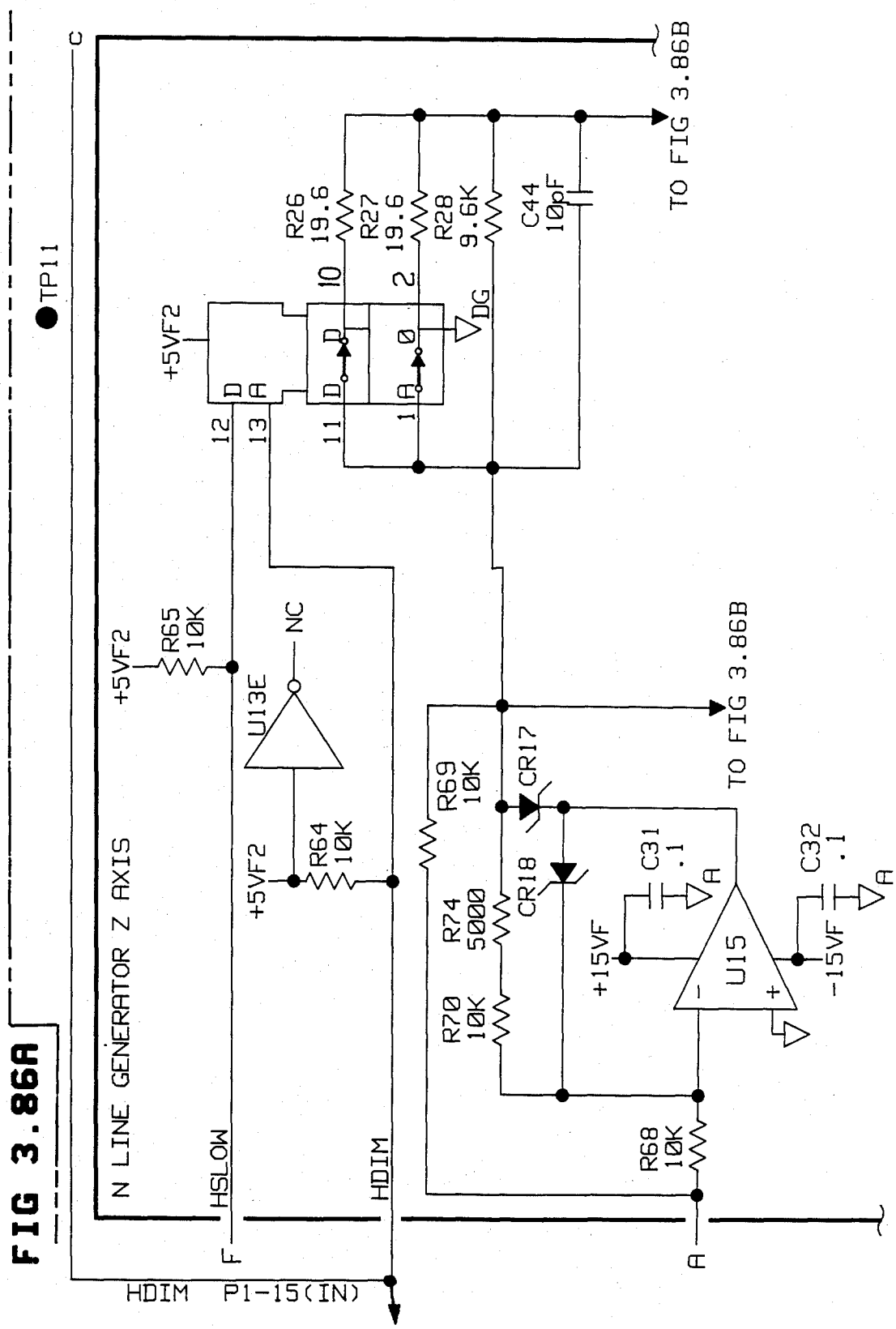

TO FIG 3.86B
TO FIG 3.86B
TP11
C
R26 19.6
R27 19.6
R28 9.6K
C44 10pF
+5VF2
DG
10
2
0
1
11
12
13
D
A
R65 10K
+5VF2
NC
U13E
R64 10K
+5VF2
R69 10K
CR17
CR18
R74 5000
R70 10K
C31 .1
C32 .1
+15VF
-15VF
U15
R68 10K
N LINE GENERATOR Z AXIS
HSLOW
HDIM
F
A
HDIM P1-15(IN)

FIG 3.86A

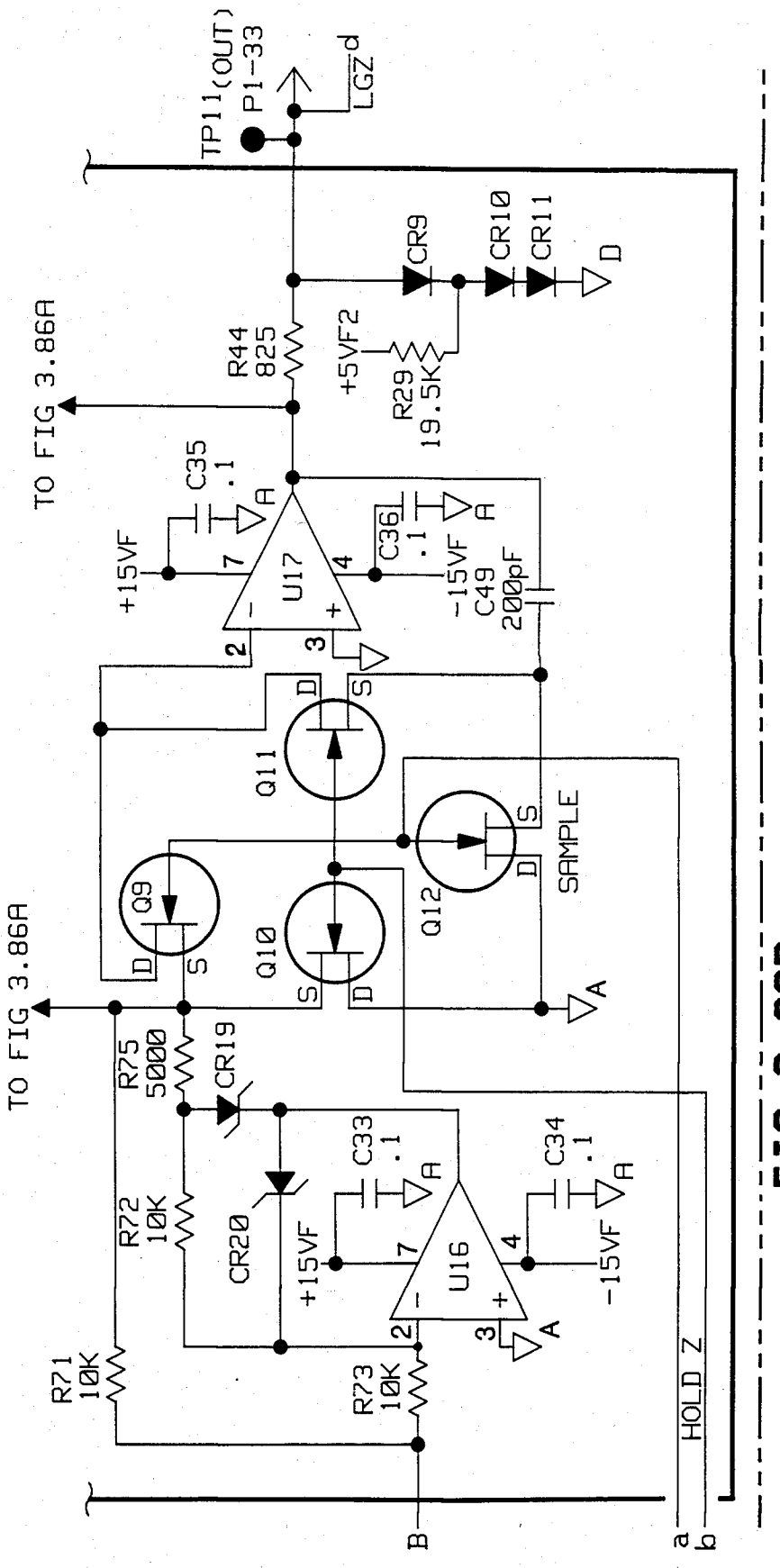

TP11(OUT)
P1-33
LGZd
CR9
CR10
CR11
D
R44
825
+5VF2
R29
19.5K
TO FIG 3.86A
C35
.1
A
C36
.1
A
+15VF
-15VF
C49
200pF
U17
7
4
2
3
Q11
Q9
Q10
Q12
D
S
SAMPLE
A
TO FIG 3.86A
R75
5000
CR19
C33
.1
A
C34
.1
A
R72
10K
CR20
+15VF
-15VF
U16
R71
10K
R73
10K
HOLD Z
B
a
b

FIG 3.86B

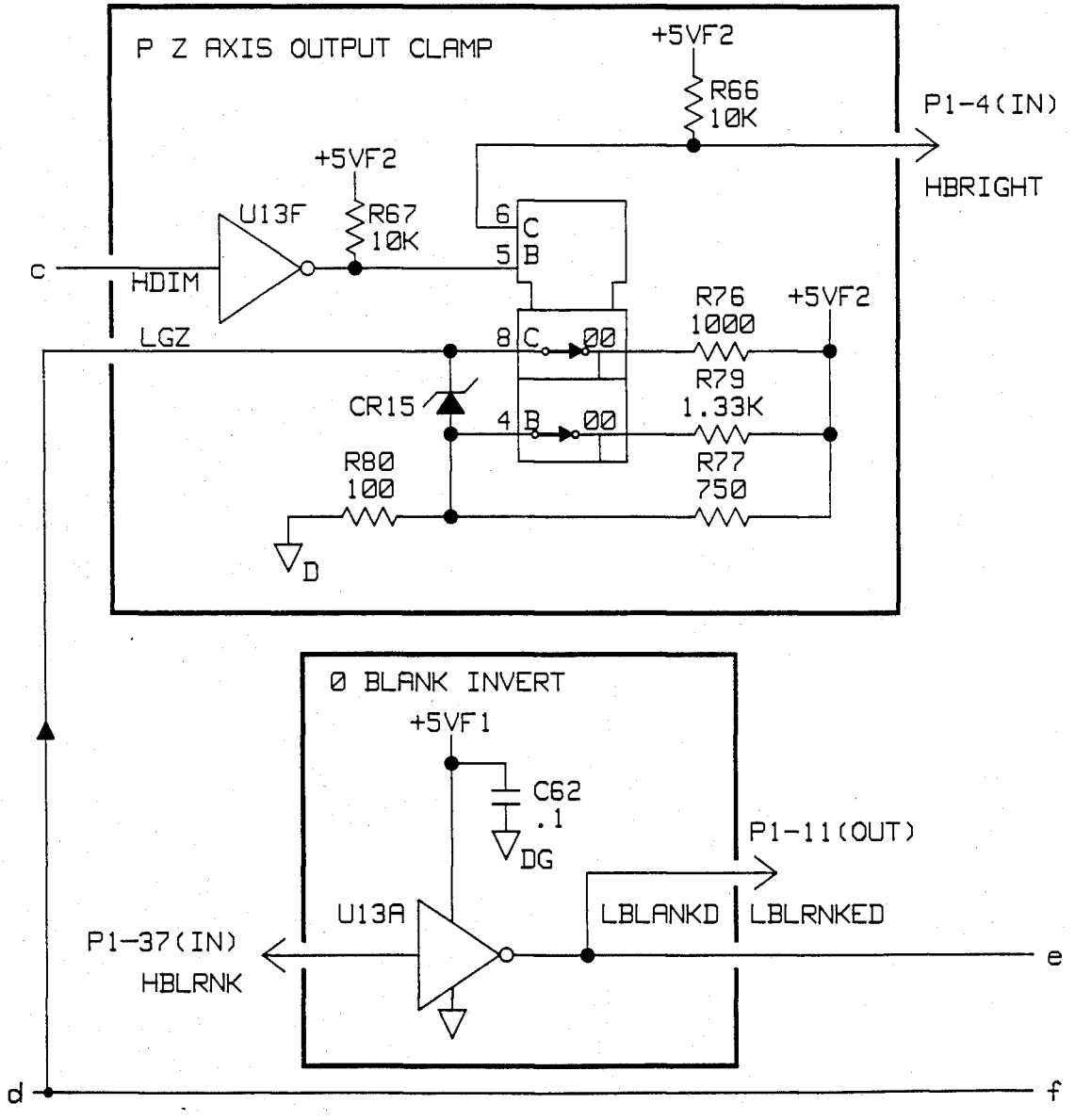

P Z AXIS OUTPUT CLAMP
+5VF2
R66
10K
P1-4(IN)
HBRIGHT
+5VF2
U13F
R67
10K
6
C
5
B
c
HDIM
LGZ
8 C 00
R76
1000
+5VF2
R79
1.33K
CR15
4 B 00
R80
100
R77
750
D
0 BLANK INVERT
+5VF1
C62
.1
DG
P1-11(OUT)
U13A
LBLANKD
LBLRNKED
P1-37(IN)
HBLRNK
e
d
f

FIG 3.87

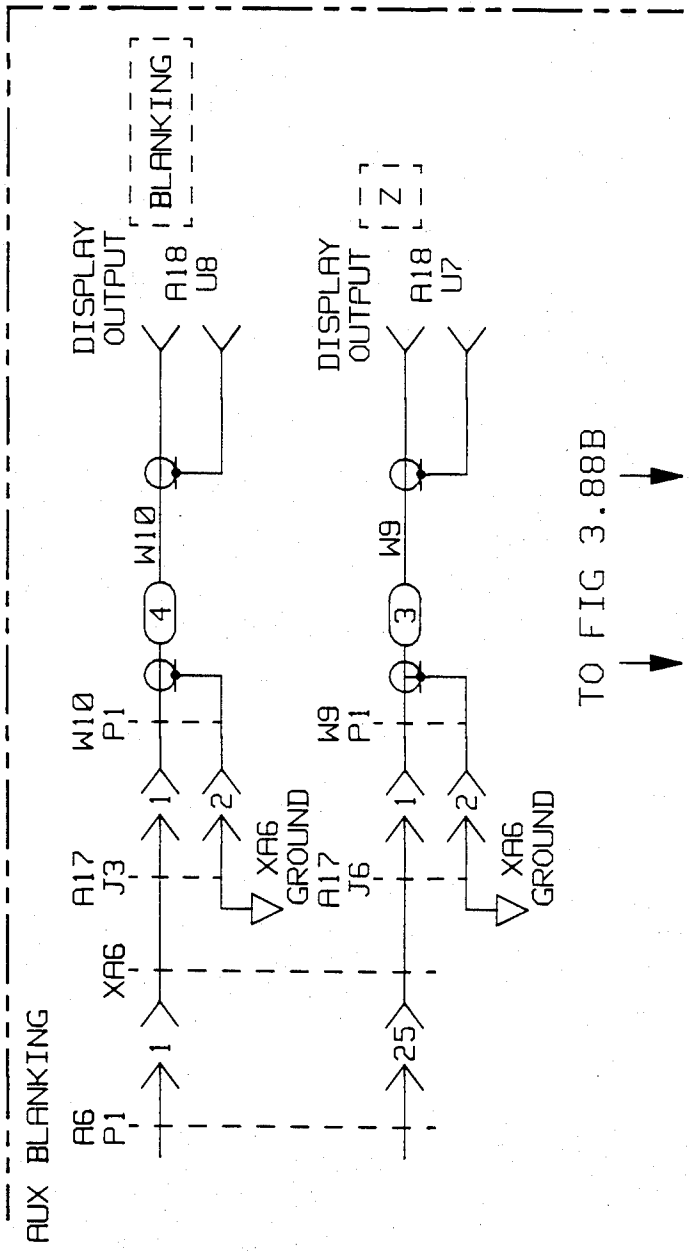

AUX BLANKING
A6
P1
1
XA6
A17
J3
1
2
XA6
GROUND
W10
P1
4
W10
DISPLAY
OUTPUT
A18
U8
BLANKING
A17
J6
25
1
2
XA6
GROUND
W9
P1
3
W9
DISPLAY
OUTPUT
A18
U7
Z
TO FIG 3.88B

FIG 3.88A

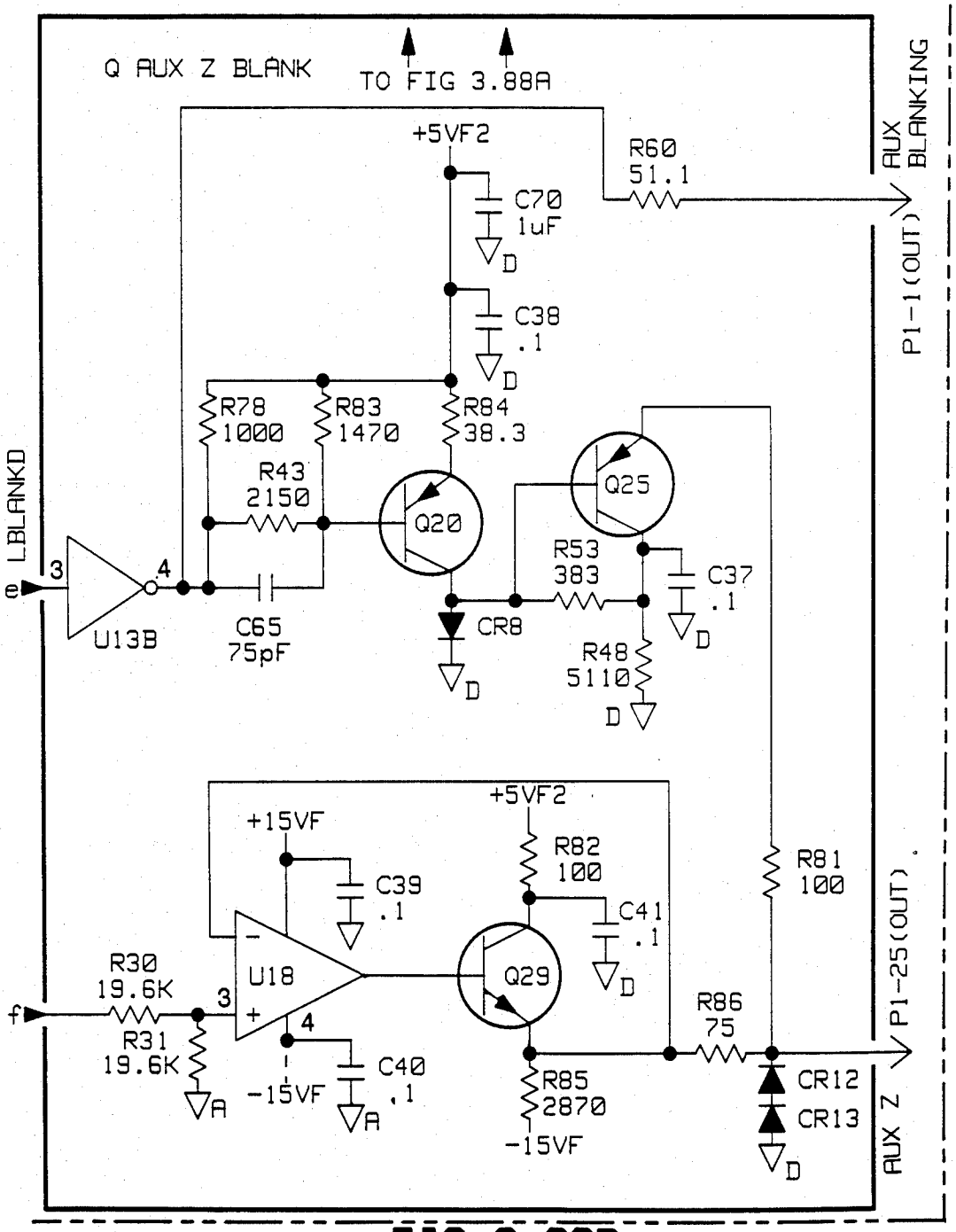

Q AUX Z BLANK
TO FIG 3.88A
+5VF2
R60
51.1
AUX
BLANKING
P1-1(OUT)
C70
1uF
D
C38
.1
D
R78
1000
R83
1470
R84
38.3
R43
2150
Q20
Q25
e LBLANKD
3
4
U13B
C65
75pF
R53
383
C37
.1
D
CR8
D
R48
5110
D
+5VF2
+15VF
R82
100
R81
100
C39
.1
C41
.1
D
U18
Q29
R30
19.6K
3
f
4
R31
19.6K
A
-15VF
C40
.1
A
R86
75
P1-25(OUT)
R85
2870
-15VF
CR12
CR13
D
AUX Z

FIG 3.88B

FAST LINES ARE DRAWN IN 3μS
SLOW LINES ARE DRRWN IN 15μS
SETUP TIME IS 1μS

ACTIVE COMPONENTS PARTS LISTS (U's AND Q's)

REFERENCE DESIGNRTORS	PART NUMBER	MANUFACTURERS PART NUMBER
U1-U3	1820-2026	74LS396
U4-U5	1826-0705	DAC6012
U6	1826-0371	LF256
U7,8,11,12	1826-0079	HA-2625
U9,U10	1826-0089	HA-2525
U13	1826-1199	74LS04
U14	1826-1548	MC14066
U15-U18	1826-0081	LM318
Q1-12	1855-0081	2N5245
Q13,Q14	1855-0050	
Q15,Q16	1855-0020	
Q17,Q18	1855-0241	
Q19,Q20	1853-0034	2N3251
Q21-Q26	1853-0007	2N3251
Q27-Q29	1854-0404	NPN

FIG 3.89

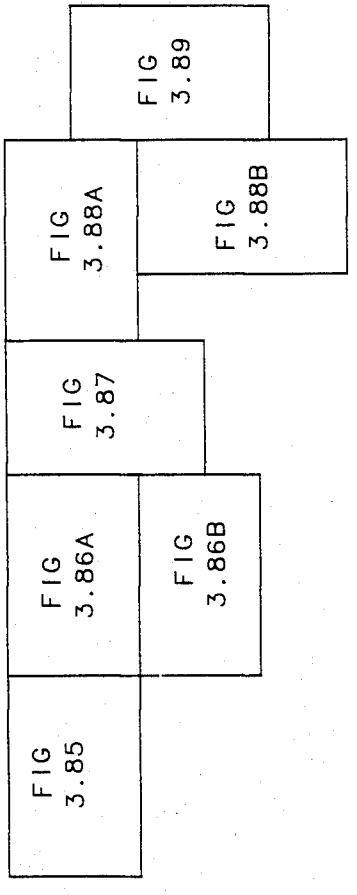


FIG 3.90

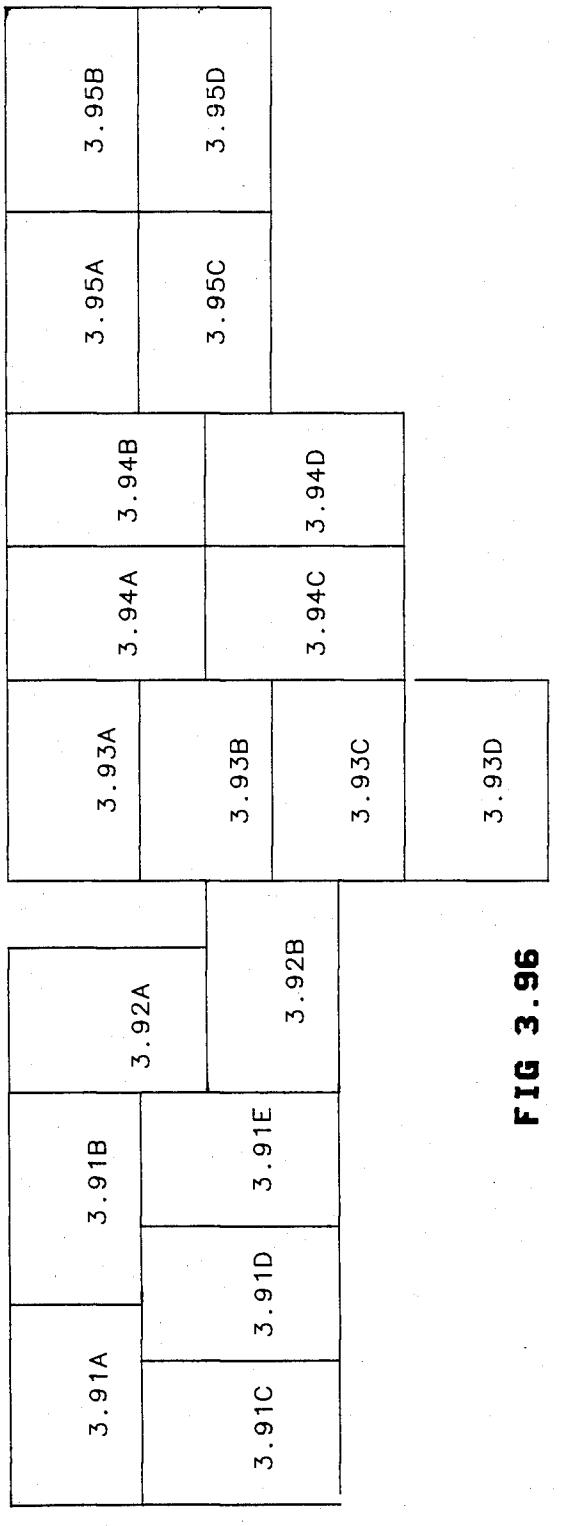
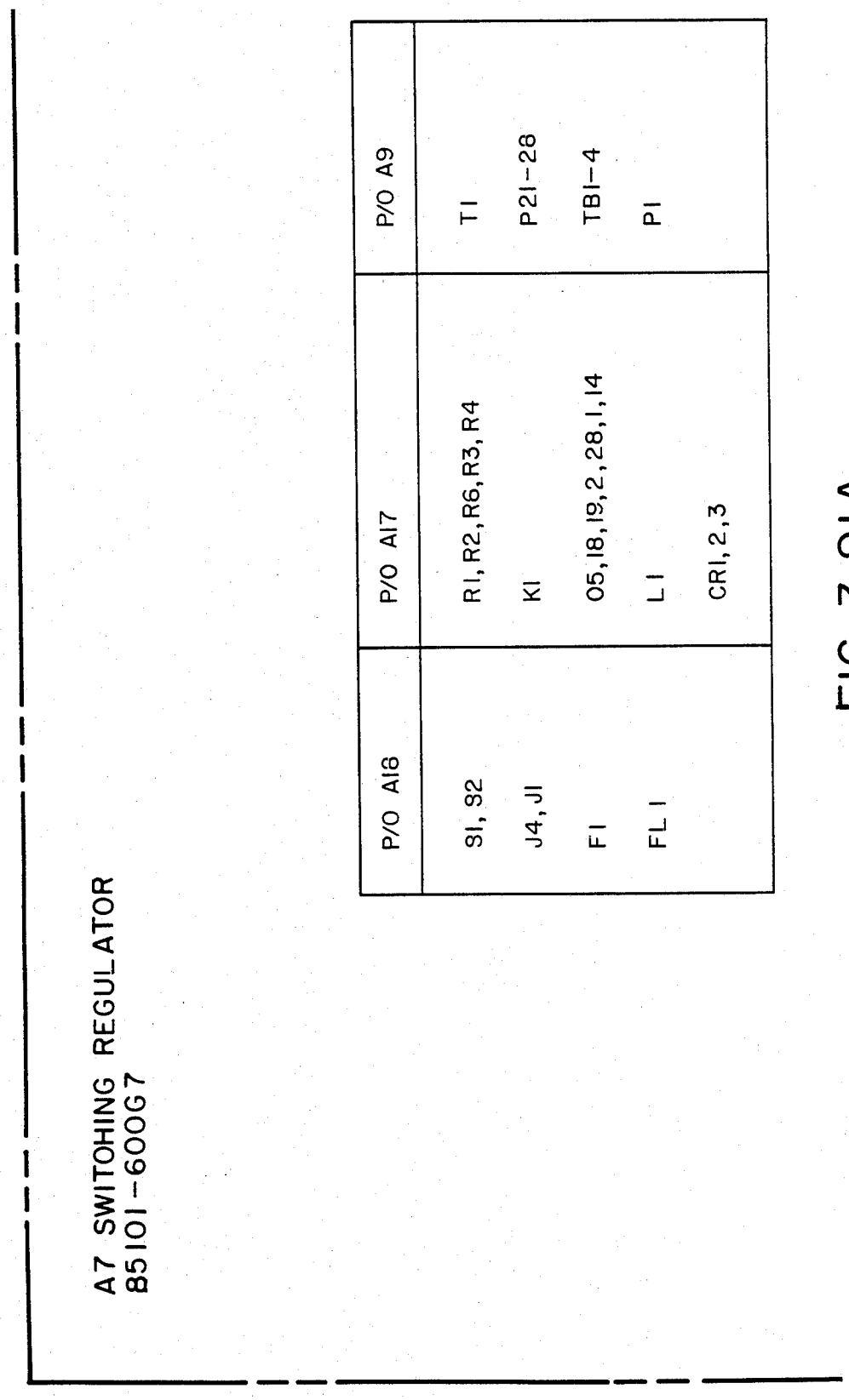


FIG 3.96



P/O A18	P/O A17	P/O A9
S1, S2	R1, R2, R6, R3, R4	T1
J4, J1	K1	P21-28
F1	05, 18, 19, 2, 28, 1, 14	TB1-4
FL1	L1	P1
	CR1, 2, 3	

FIG 3.91A

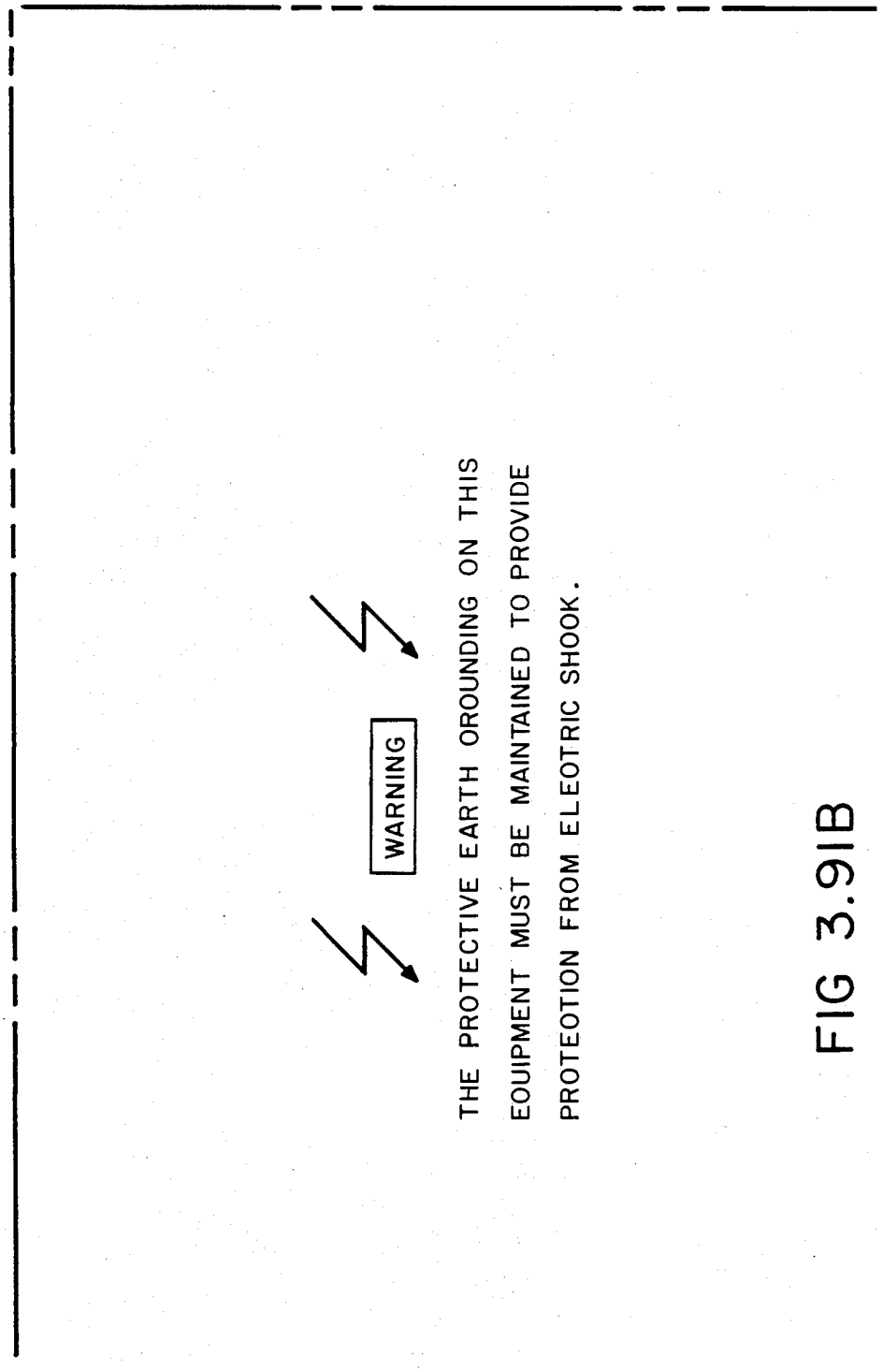

WARNING
THE PROTECTIVE EARTH OROUNDING ON THIS
EOUIPMENT MUST BE MAINTAINED TO PROVIDE
PROTEOTION FROM ELEOTRIC SHOOK.

FIG 3.91B

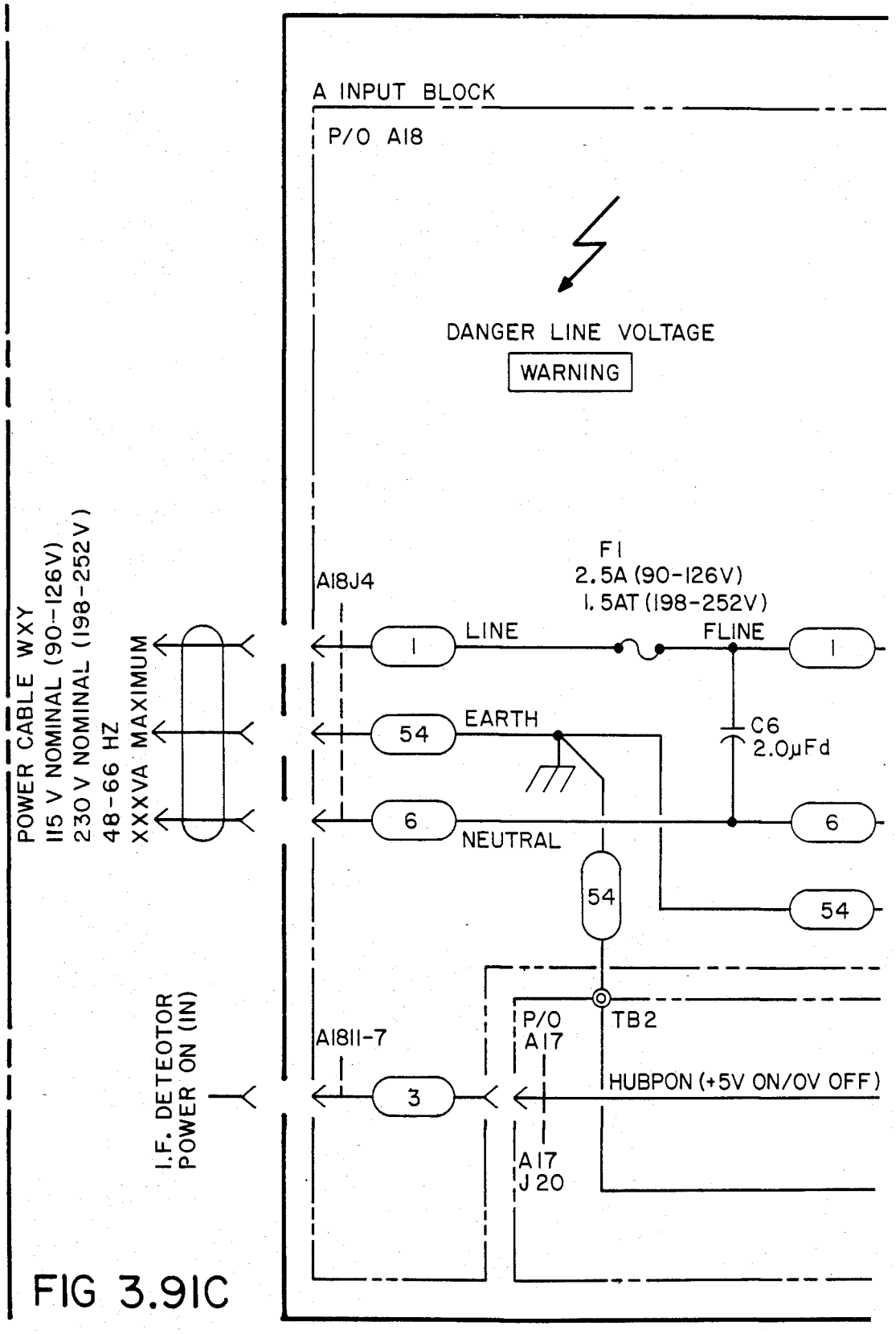

A INPUT BLOCK
P/O A18
DANGER LINE VOLTAGE
WARNING
POWER CABLE WXY
115 V NOMINAL (90-126V)
230 V NOMINAL (198-252V)
48-66 HZ
XXXVA MAXIMUM
A18J4
F1
2.5A (90-126V)
1.5AT (198-252V)
LINE
FLINE
1
1
54
EARTH
C6
2.0μFd
6
6
NEUTRAL
54
54
I.F. DETEOTOR
POWER ON (IN)
A1811-7
3
P/O
A17
TB2
HUBPON (+5V ON/OV OFF)
A17
J 20

FIG 3.91C

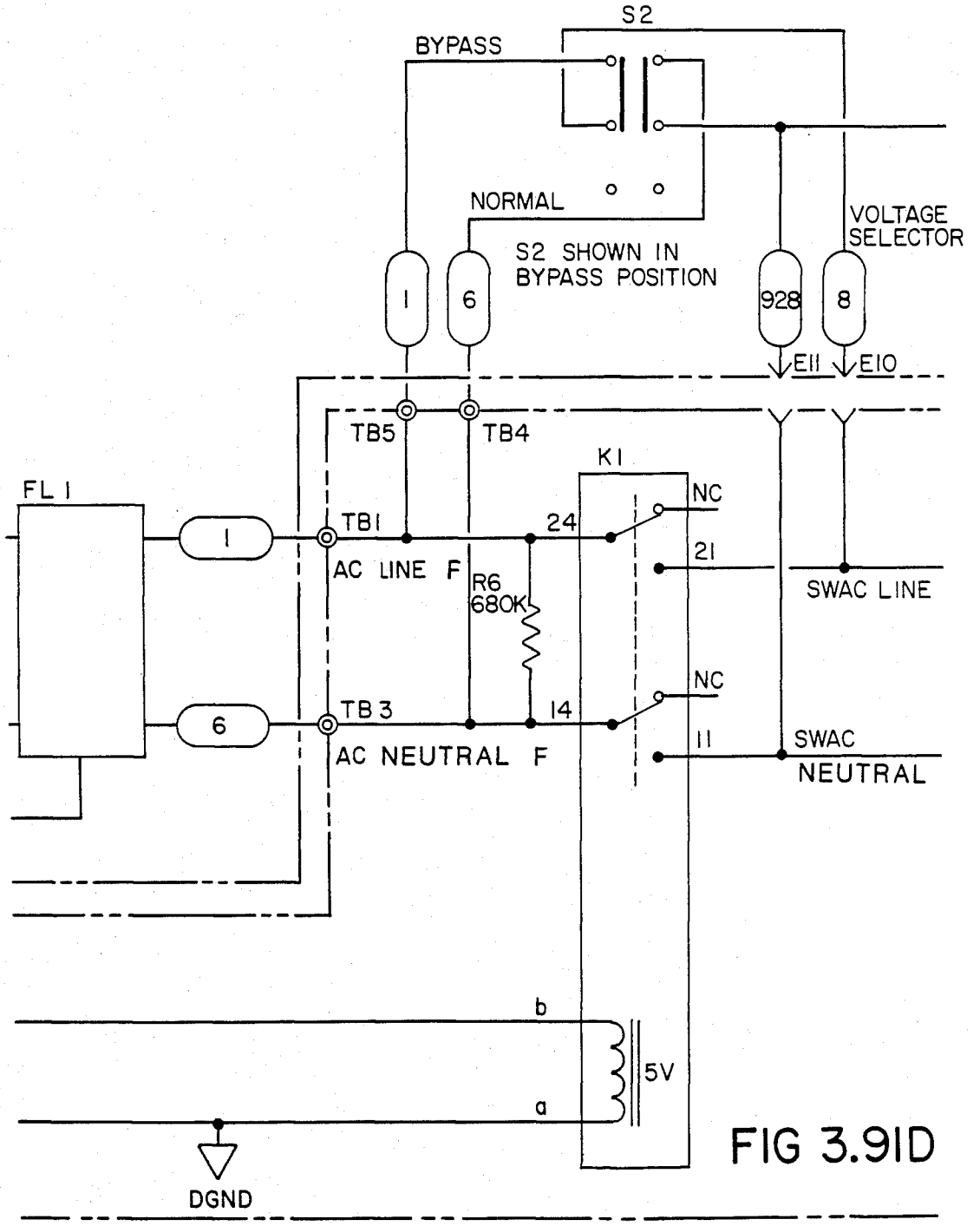
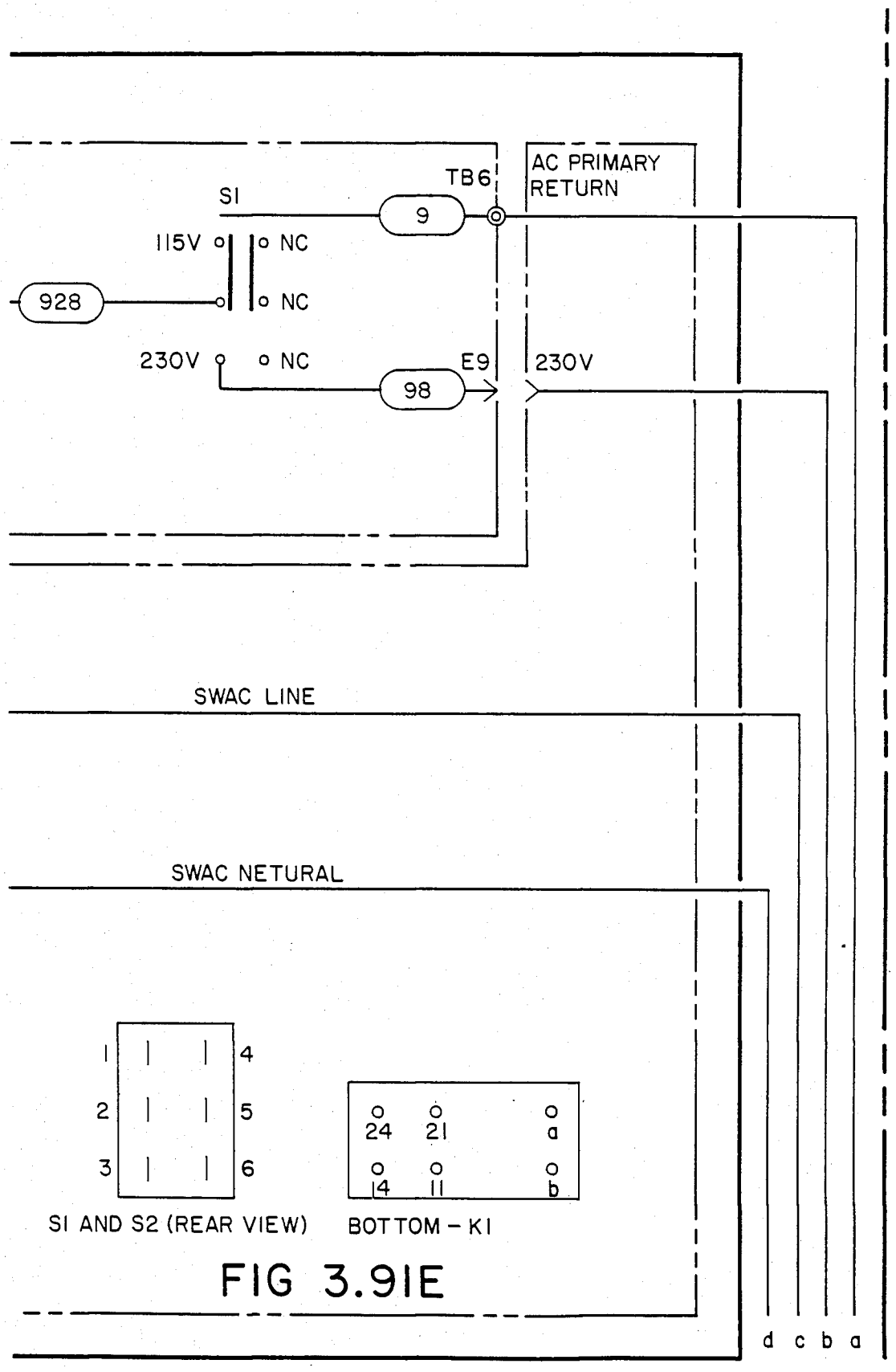

S2
BYPASS
NORMAL
S2 SHOWN IN
BYPASS POSITION
VOLTAGE
SELECTOR
1
6
928
8
E11
E10
TB5
TB4
K1
FL 1
TB1
24
NC
21
AC LINE F
R6
680K
SWAC LINE
TB 3
14
NC
11
SWAC
AC NEUTRAL F
NEUTRAL
b
5V
a
DGND

FIG 3.91D



S1 AND S2 (REAR VIEW) BOTTOM – K1

FIG 3.91E

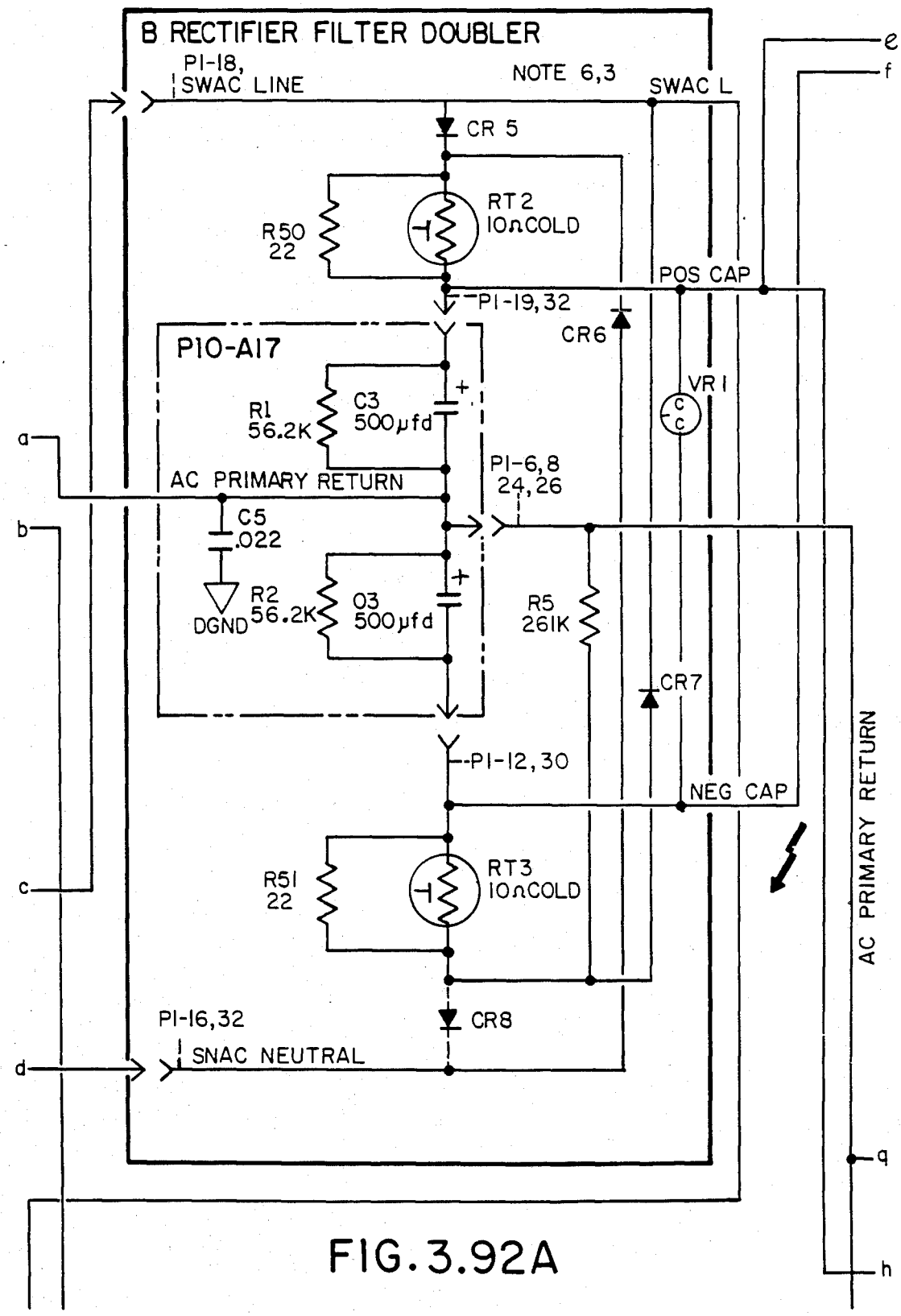

B RECTIFIER FILTER DOUBLER
P1-18,
SWAC LINE
NOTE 6,3
SWAC L
CR 5
RT2
10ΩCOLD
R50
22
POS CAP
P1-19,32
CR6
P10-A17
VR1
C3
500μfd
R1
56.2K
AC PRIMARY RETURN
P1-6,8
24,26
C5
.022
DGND
R2
56.2K
03
500μfd
R5
261K
CR7
P1-12,30
NEG CAP
RT3
10ΩCOLD
R51
22
P1-16,32
SNAC NEUTRAL
CR8
AC PRIMARY RETURN
a
b
c
d
e
f
q
h

FIG. 3.92A

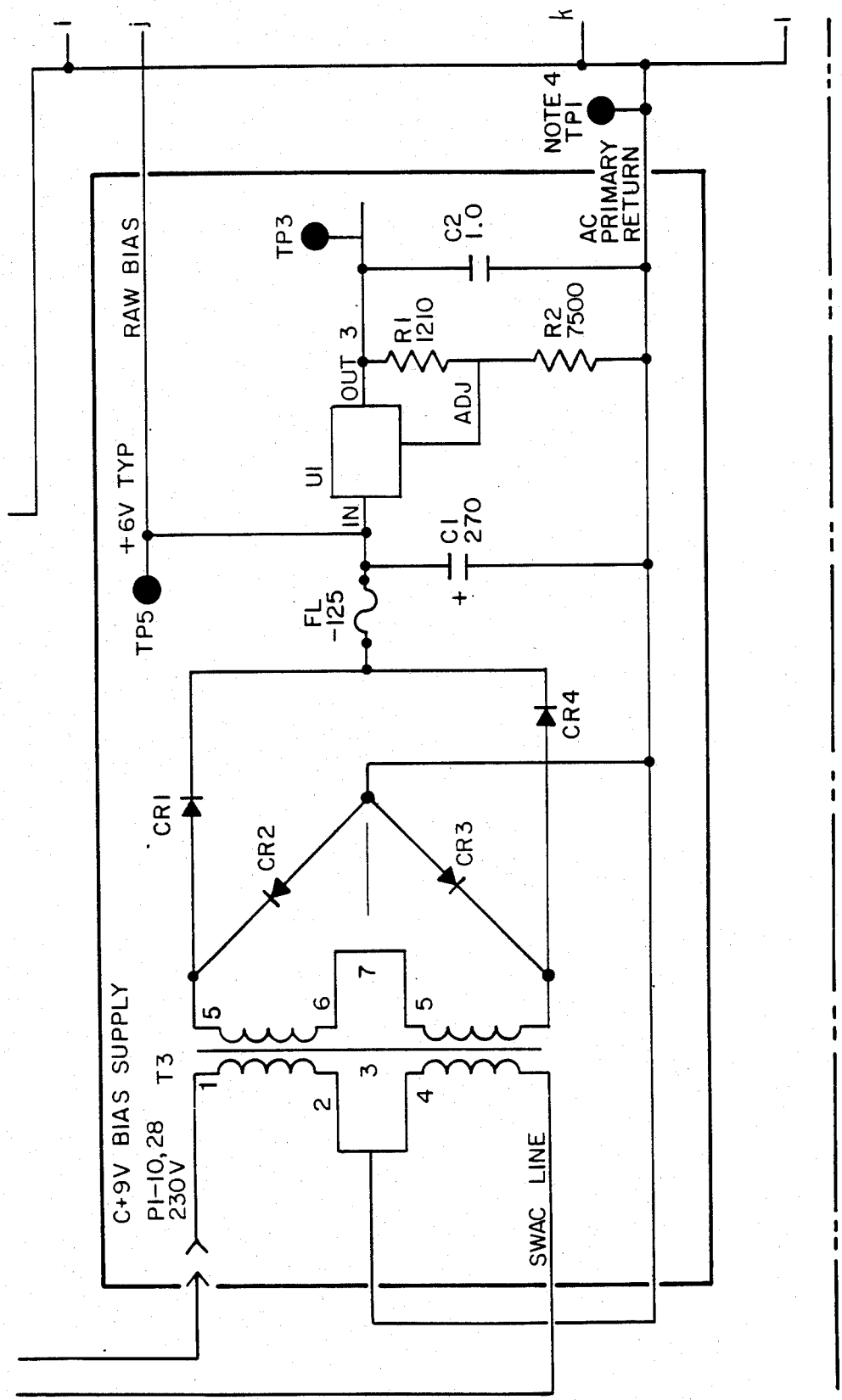

i
j
k
l
NOTE 4
TP1
AC PRIMARY RETURN
TP3
C2 1.0
RAW BIAS
R1 1210
R2 7500
OUT 3
ADJ
U1
IN
+6V TYP
C1 270
+
TP5
FL -125
CR4
CR1
CR2
CR3
7
5
6
5
C+9V BIAS SUPPLY
P1-10, 28 230V
T3
1
2
3
4
SWAC LINE

FIG 3.92B

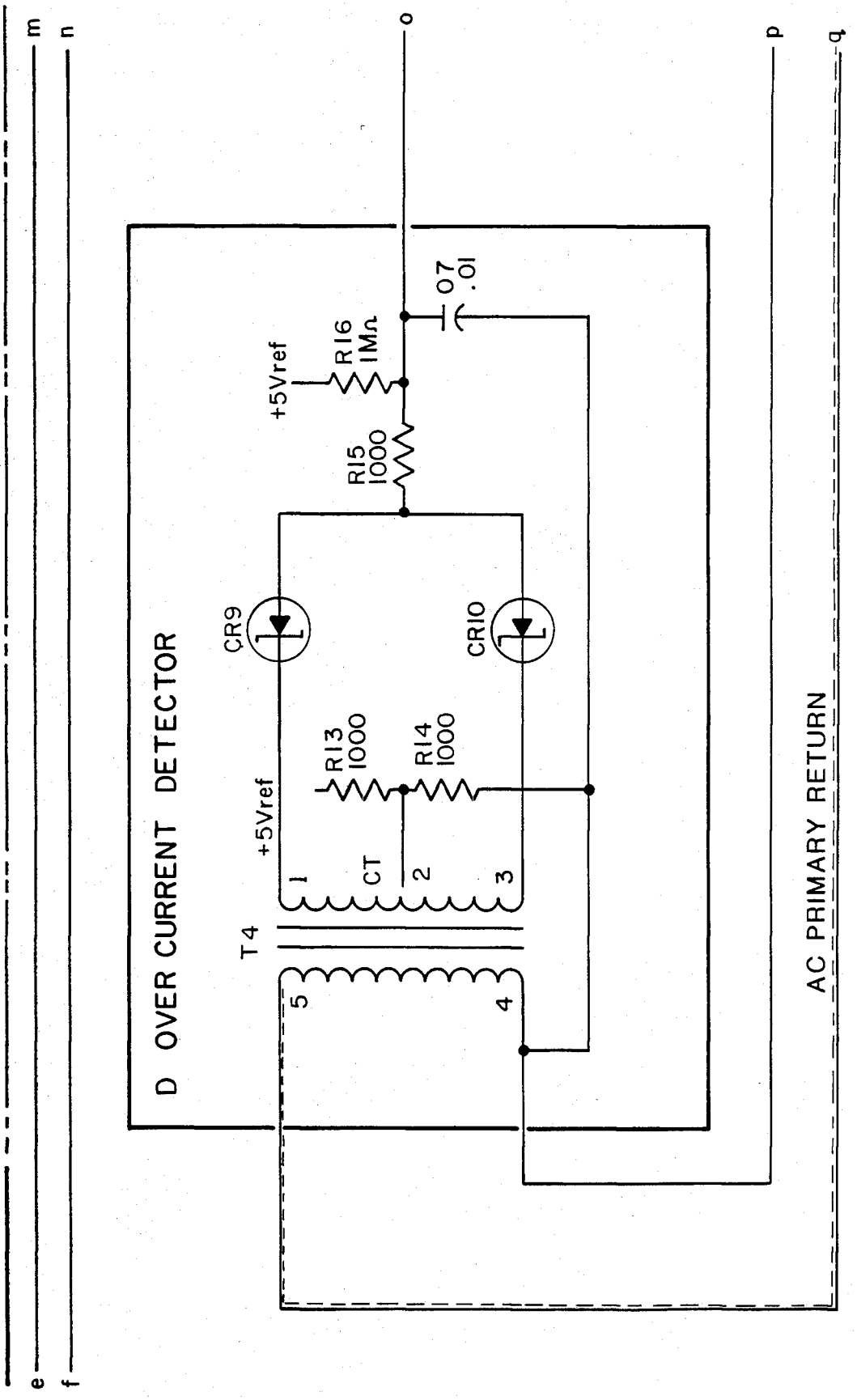

m
n
o
p
q
e
f
D OVER CURRENT DETECTOR
C7
.01
R16
1Mn
+5Vref
R15
1000
CR9
CR10
R13
1000
R14
1000
+5Vref
1
CT
2
3
T4
5
4
AC PRIMARY RETURN

FIG 3.93A

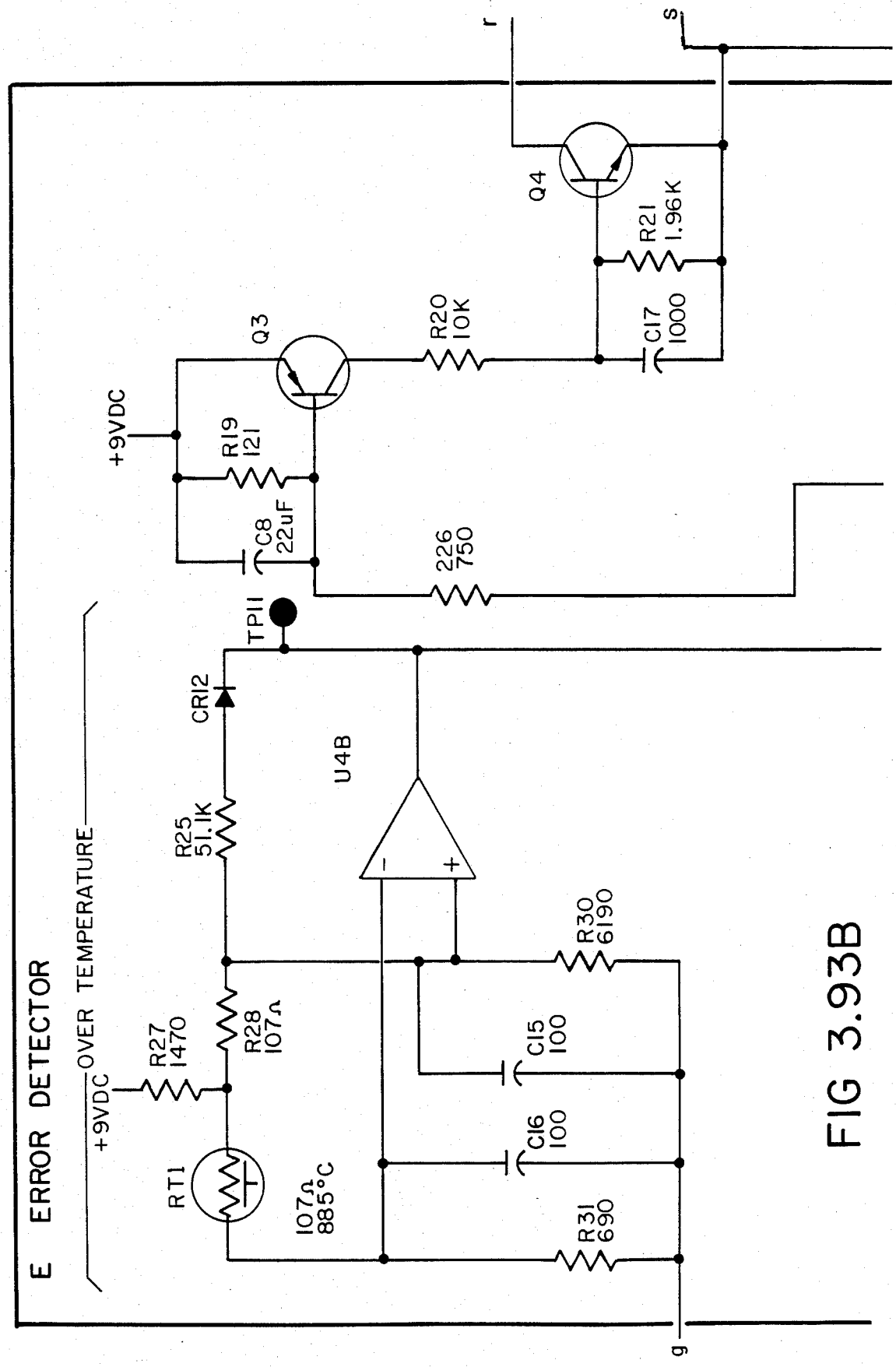

E ERROR DETECTOR
+9VDC OVER TEMPERATURE
R27 1470
R28 107Ω
RT1
107Ω 885°C
R25 51.1K
CR12
TP11
U4B
R30 6190
C15 100
C16 100
R31 690
226 750
+9VDC
R19 121
C8 22uF
Q3
R20 10K
C17 1000
R21 1.96K
Q4
r
s
g

FIG 3.93B

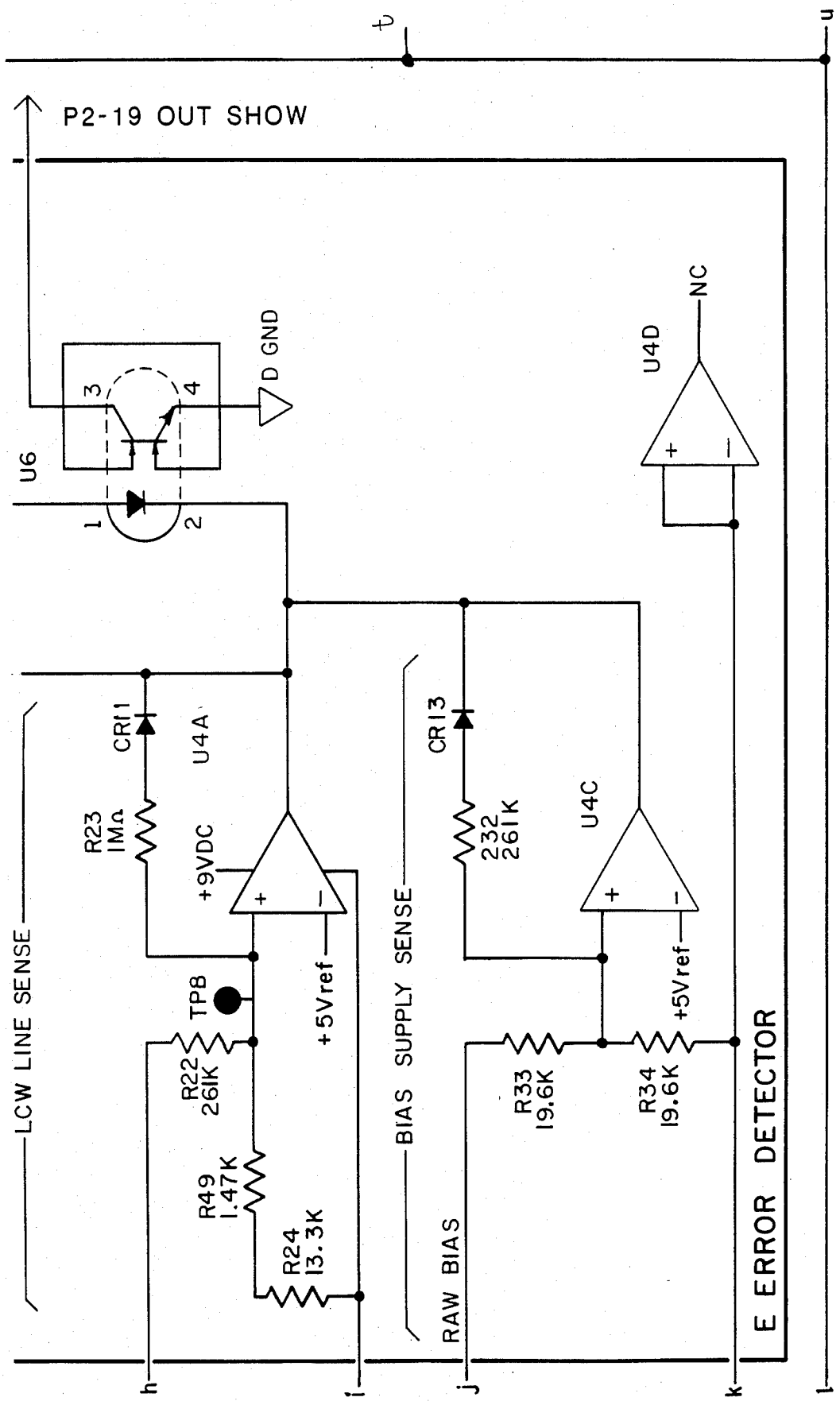

t
u
P2-19 OUT SHOW
i
U6
1
2
3
4
D GND
U4D
NC
+
−
CR11
U4A
R23
1MΩ
+9VDC
+
−
LCW LINE SENSE
TP8
R22
26IK
+5Vref
R49
1.47K
R24
13.3K
CR13
BIAS SUPPLY SENSE
232
261K
U4C
+
−
R33
19.6K
R34
19.6K
+5Vref
RAW BIAS
E ERROR DETECTOR
h
i
j
k
l

FIG 3.93C

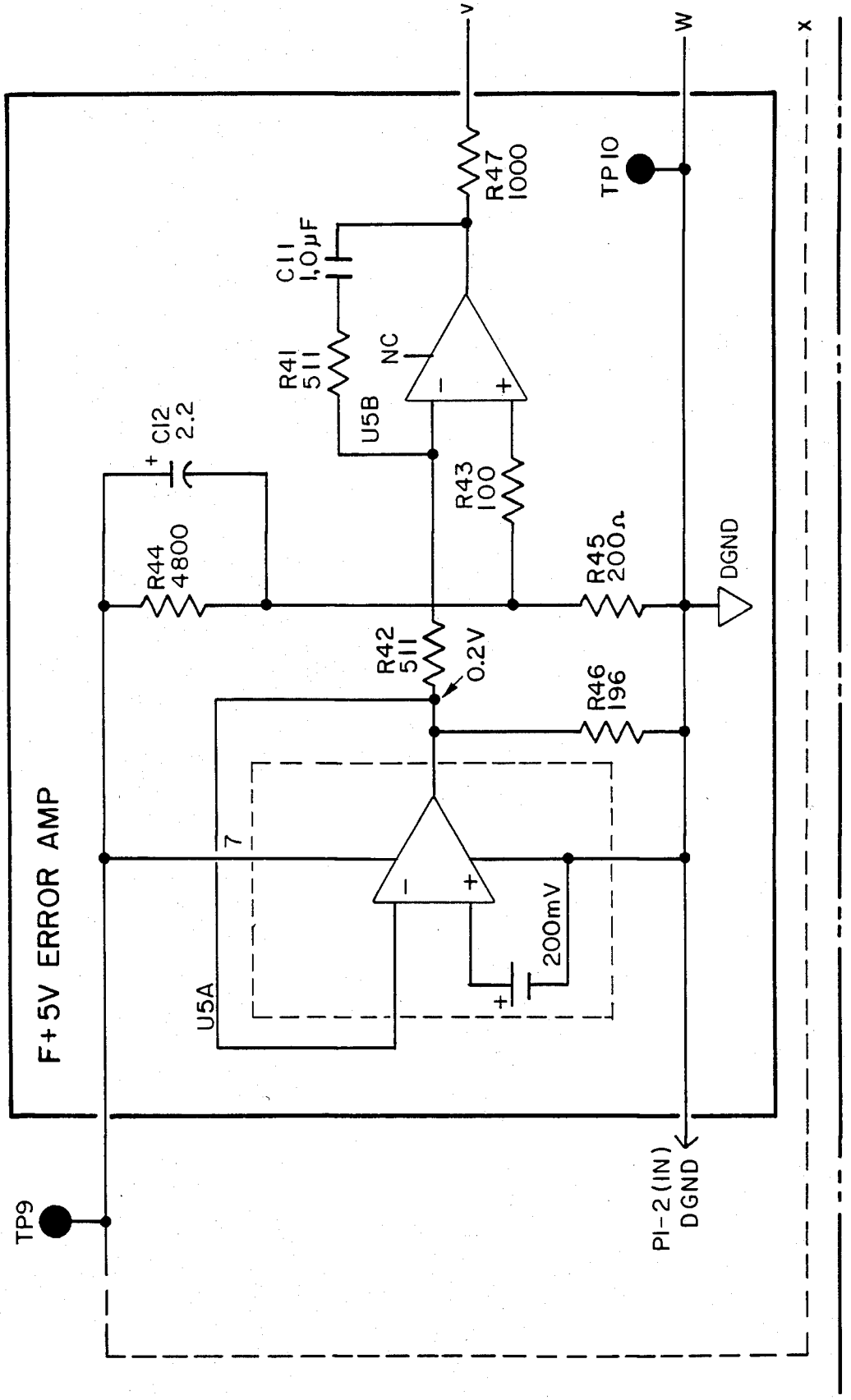

V
W
X
R47
1000
TP10
C11
1.0μF
R41
511
NC
U5B
C12
2.2
R43
100
R44
4800
R45
200Ω
DGND
R42
511
0.2V
R46
196
7
U5A
200mV
F+5V ERROR AMP
TP9
PI-2(IN)
DGND

FIG 3.93D

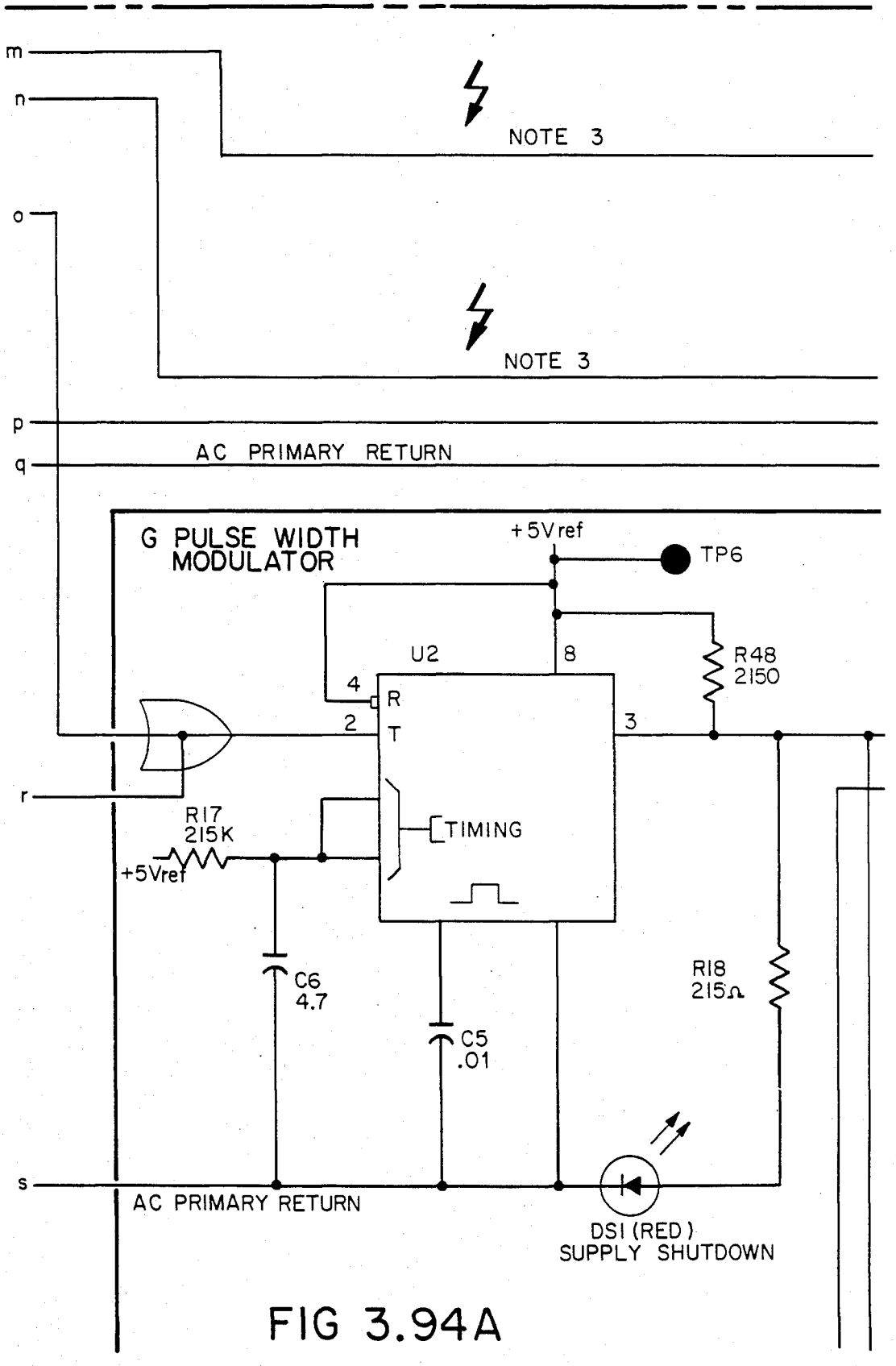

m
n
NOTE 3
o
NOTE 3
p
AC PRIMARY RETURN
q
G PULSE WIDTH MODULATOR
+5Vref
TP6
U2
8
R48
2150
4
R
2
T
3
r
R17
215K
+5Vref
TIMING
C6
4.7
C5
.01
R18
215Ω
s
AC PRIMARY RETURN
DS1 (RED)
SUPPLY SHUTDOWN

FIG 3.94A

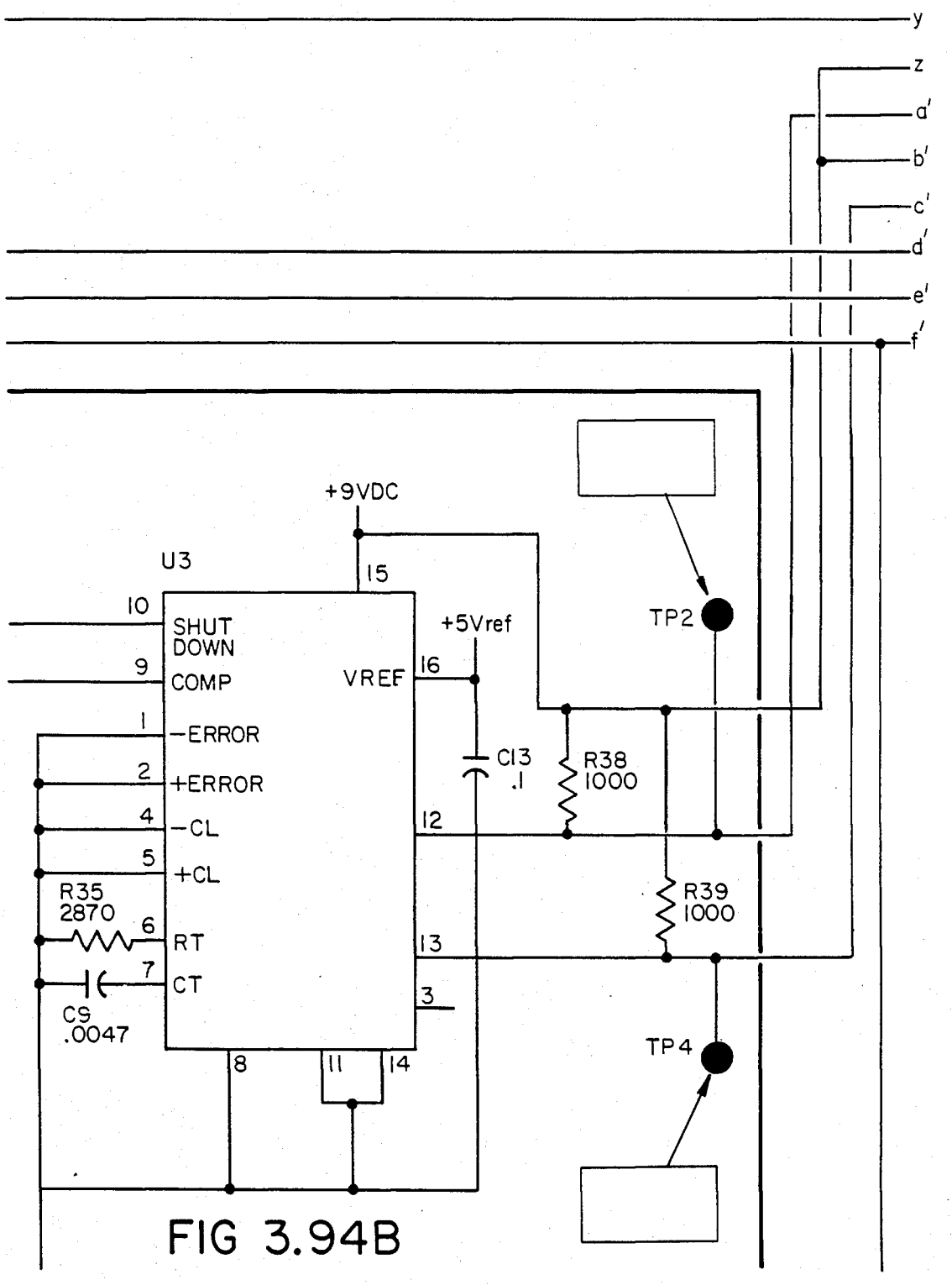

y
z
a'
b'
c'
d'
e'
f'
+9VDC
U3
15
10
SHUT DOWN
9
COMP
1
-ERROR
2
+ERROR
4
-CL
5
+CL
R35
2870
6
RT
7
CT
C9
.0047
8
11
14
3
13
12
VREF
16
+5Vref
C13
.1
R38
1000
R39
1000
TP2
TP4

FIG 3.94B

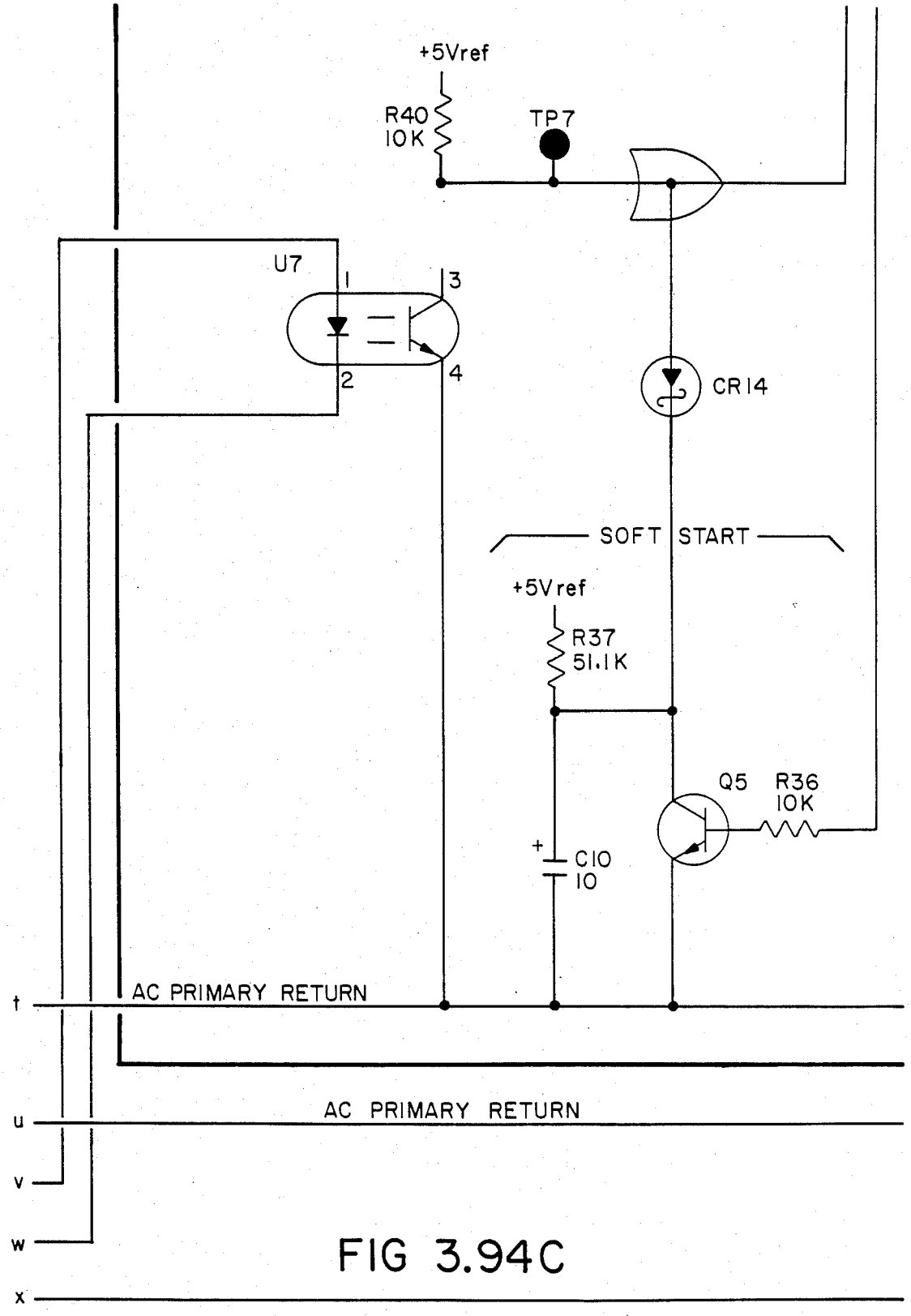

+5Vref
R40
10K
TP7
U7
1
3
2
4
CR14
SOFT START
+5Vref
R37
51.1K
Q5
R36
10K
+
C10
10
AC PRIMARY RETURN
AC PRIMARY RETURN
t
u
v
w
x

FIG 3.94C

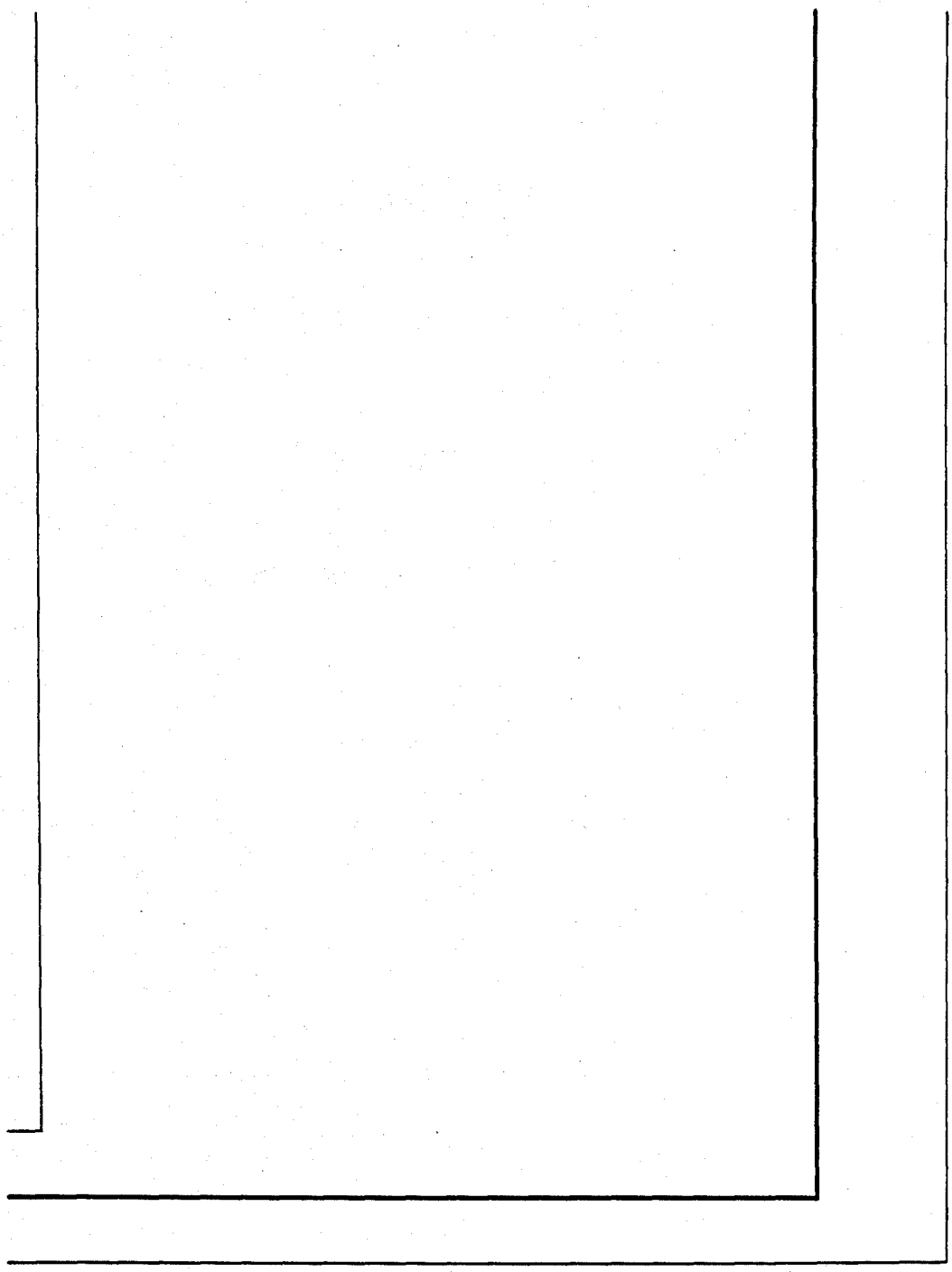
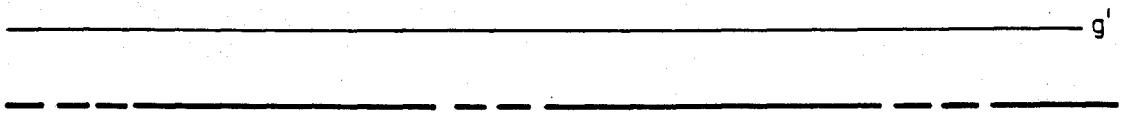


FIG 3.94D



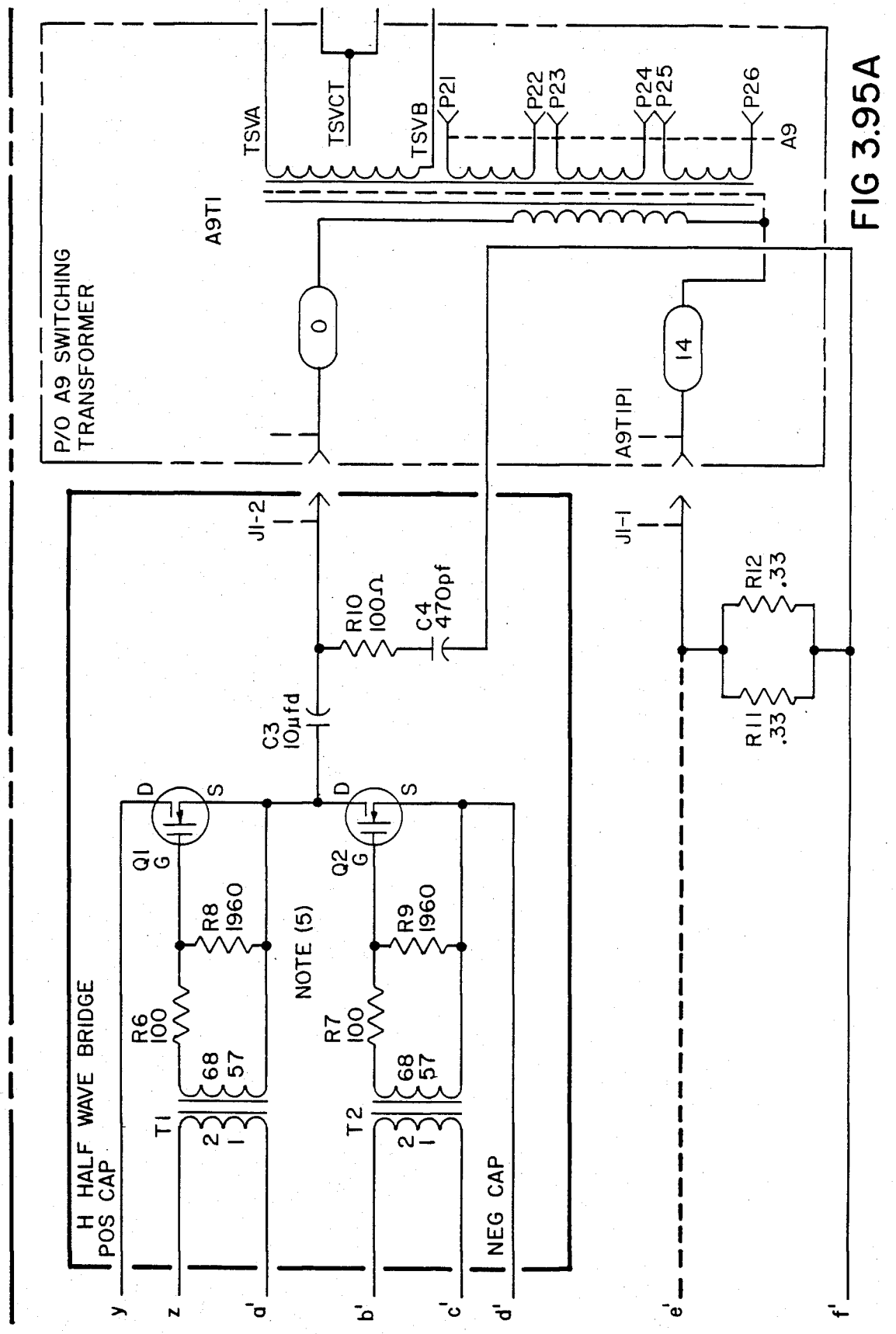

P/O A9 SWITCHING TRANSFORMER
A9T1
TSVA
TSVCT
TSVB
P21
P22
P23
P24
P25
P26
A9
0
14
A9T1P1
J1-2
J1-1
R10 100Ω
C4 470pf
C3 10μfd
R12 .33
R11 .33
H HALF WAVE BRIDGE
POS CAP
NEG CAP
Q1
Q2
D
S
G
R8 1960
R9 1960
R6 100
R7 100
68
57
T1
T2
2
1
NOTE (5)
y
z
a'
b'
c'
d'
e'
f'

FIG 3.95A

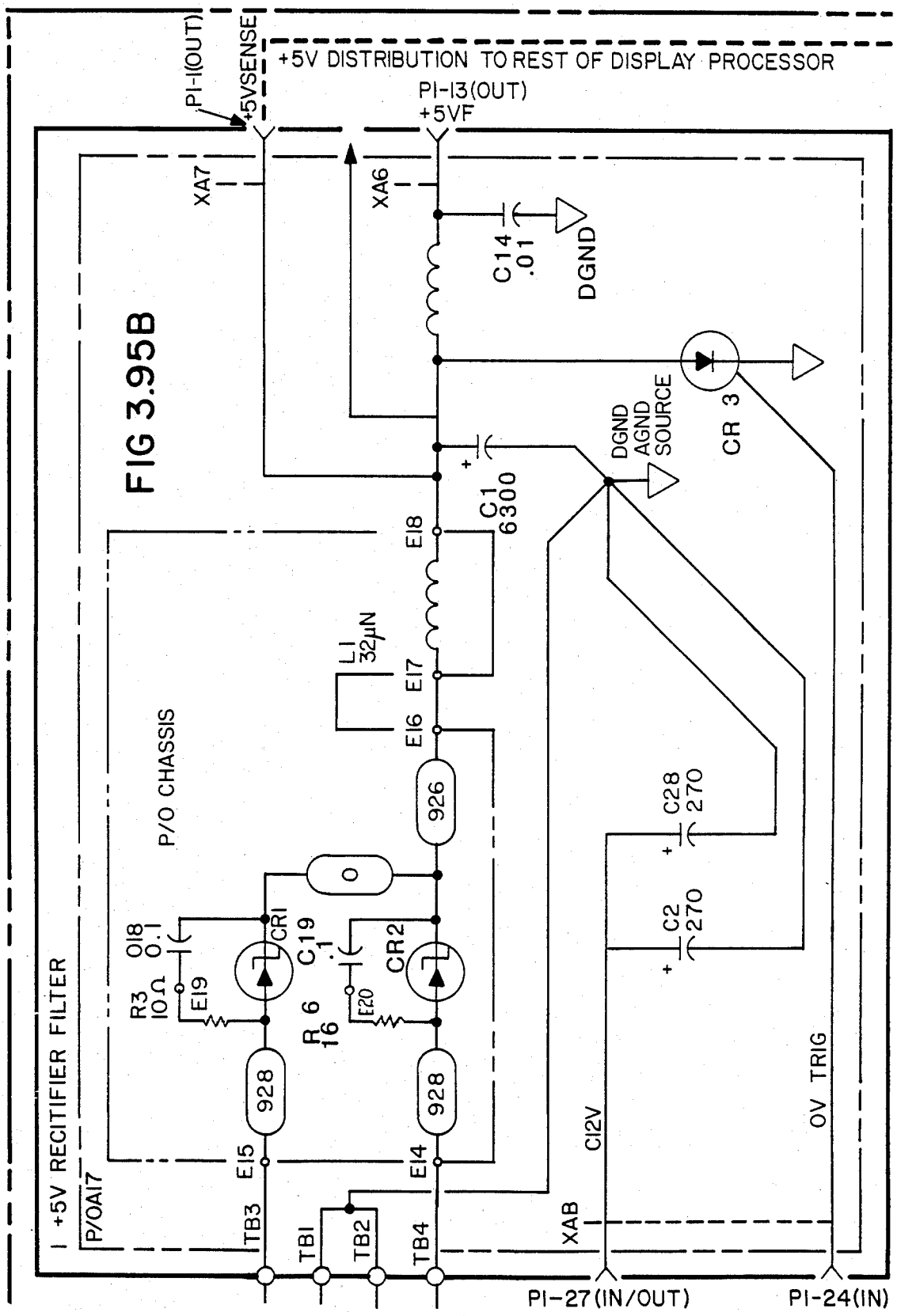

+5V DISTRIBUTION TO REST OF DISPLAY PROCESSOR
PI-1(OUT)
+5VSENSE
PI-13(OUT)
+5VF
XA7
XA6
C14
.01
DGND
DGND
AGND
SOURCE
CR 3
C1
6300
E18
L1
32μN
E17
E16
926
P/O CHASSIS
0
C28
270
C2
270
R3
10Ω
018
0.1
E19
CR1
C19
.1
CR2
R6
16
E20
928
928
E15
E14
C12V
OV TRIG
P/OAI7
1 +5V RECITIFIER FILTER
TB3
TB1
TB2
TB4
XAB
PI-27(IN/OUT)
PI-24(IN)

FIG 3.95B

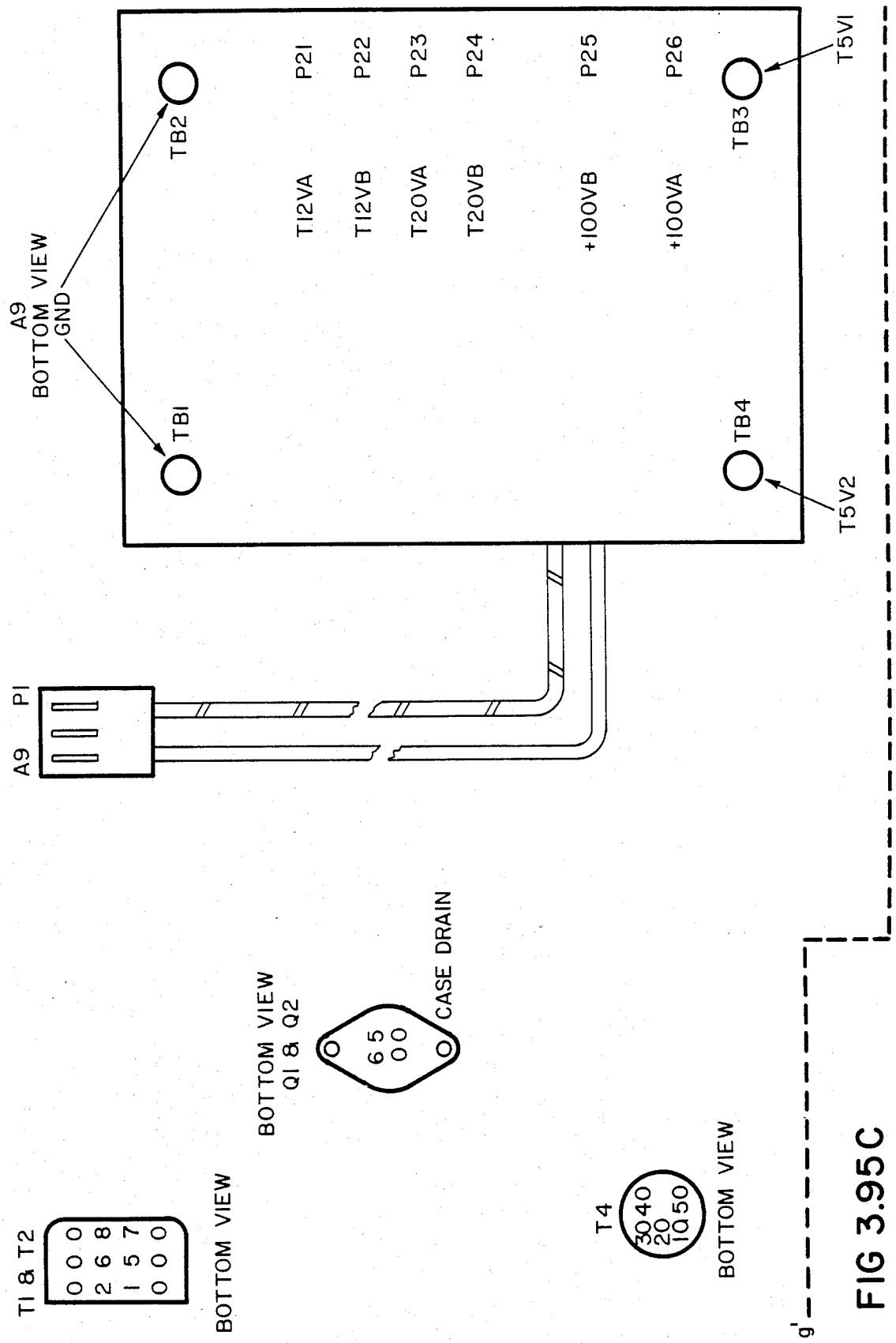

A9
BOTTOM VIEW
GND
TB2
TB1
P21
P22
P23
P24
P25
P26
T12VA
T12VB
T20VA
T20VB
+100VB
+100VA
TB3
TB4
T5V1
T5V2
A9 P1
T1 & T2
BOTTOM VIEW
BOTTOM VIEW
Q1 & Q2
CASE DRAIN
T4
BOTTOM VIEW
g'

FIG 3.95C

RESISTANCE VALUES SHOWN ARE IN DHMS, CAPACITANCE
IN MICROFARADS, AND INDUCTANCE IN MIOROHENRIES
UNLESS OTHERWISE NOTED.

PLUS AND MINUS 165 VOLTS DO ANO LINE VOLTAGE ARE
PRESENT WHENEVER THE POWER CABLE IS PLUGOED IN AND TURNED ON .

THERE IS NO OROUND TEST POINT ON THIS BOARD. OSOILLOSOOPE
MEASUREMENT SHDULD BE MADE USING "A-B" DIFFERENTIAL
MEASUREMENTS, "A" CHANNEL IS THE INPUT AND "B" CHANNEL IS
CONNECTED TO TP1 (AC PRIMARY RETURN).

THE CATES OF Q1 ANO Q2 CANNOUT BE MEASUREO WITH AN
OSCILLOSCOPE PROBE. MEASURE CATE DRIVE AT TP2 AND TP4.
REPLAOE Q1 ANO 02 AT THE SAME TIME .

FOR 115V LINE OPERATION CR6-CR7 ACT AS A VOLTAOE DOUBLER.
FOR 230V LINE OPERATION OR4-CR7 AOT AS A FULL WAVE RECTIFIER.

FIG 3.95D

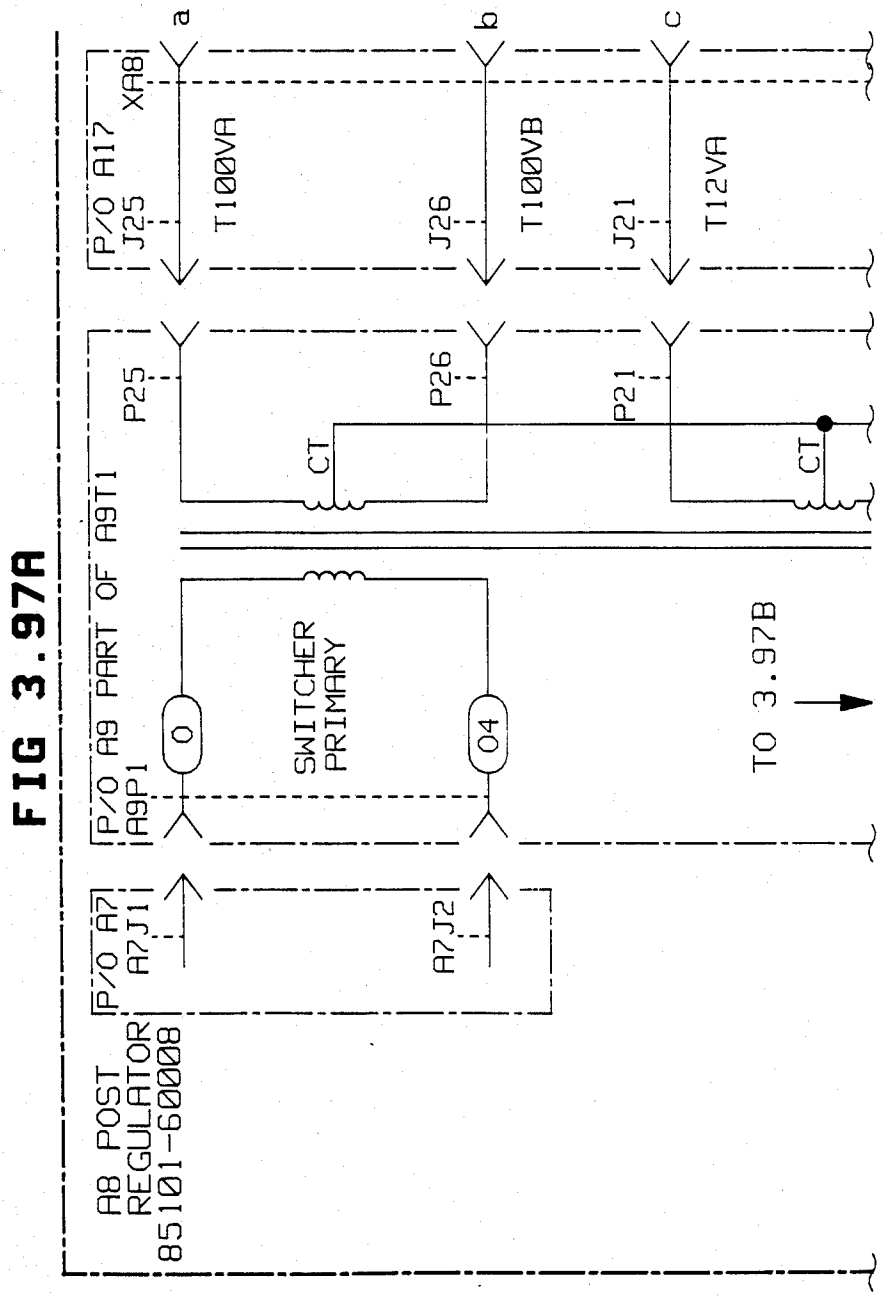

A8 POST REGULATOR 85101-60008
P/O A7 A7J1
A7J2
P/O A9 PART OF A9T1
A9P1
O
O4
SWITCHER PRIMARY
TO 3.97B
P25
P26
P21
CT
CT
P/O A17 XA8
J25
J26
J21
T100VA
T100VB
T12VA
a
b
c

FIG 3.97A

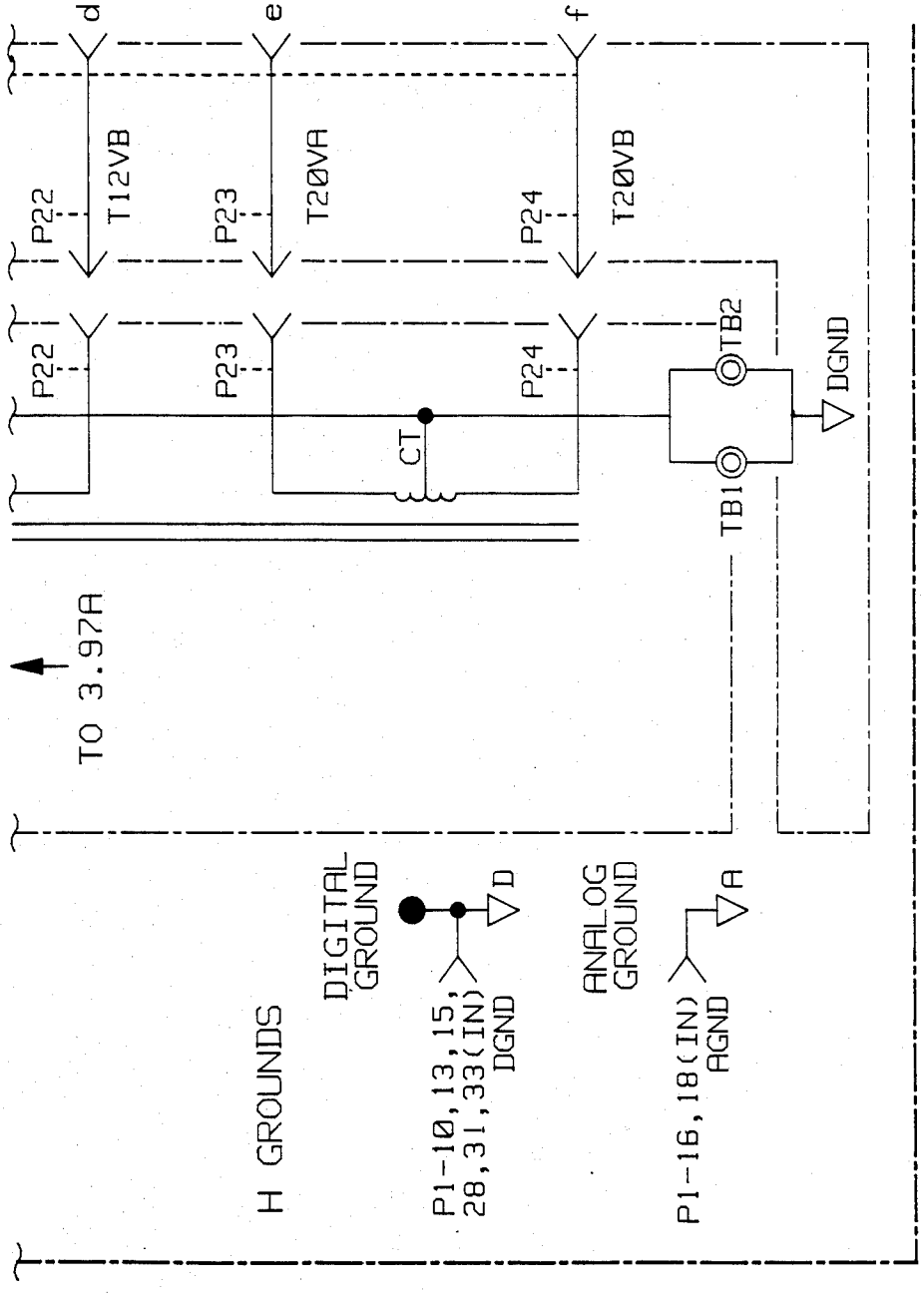

d
e
f
P22
T12VB
P23
T20VA
P24
T20VB
P22
P23
P24
TB2
DGND
CT
TB1
TO 3.97A
H GROUNDS
DIGITAL GROUND
P1-10,13,15, 28,31,33(IN) DGND
D
ANALOG GROUND
P1-16,18(IN) AGND
A

FIG 3.97B

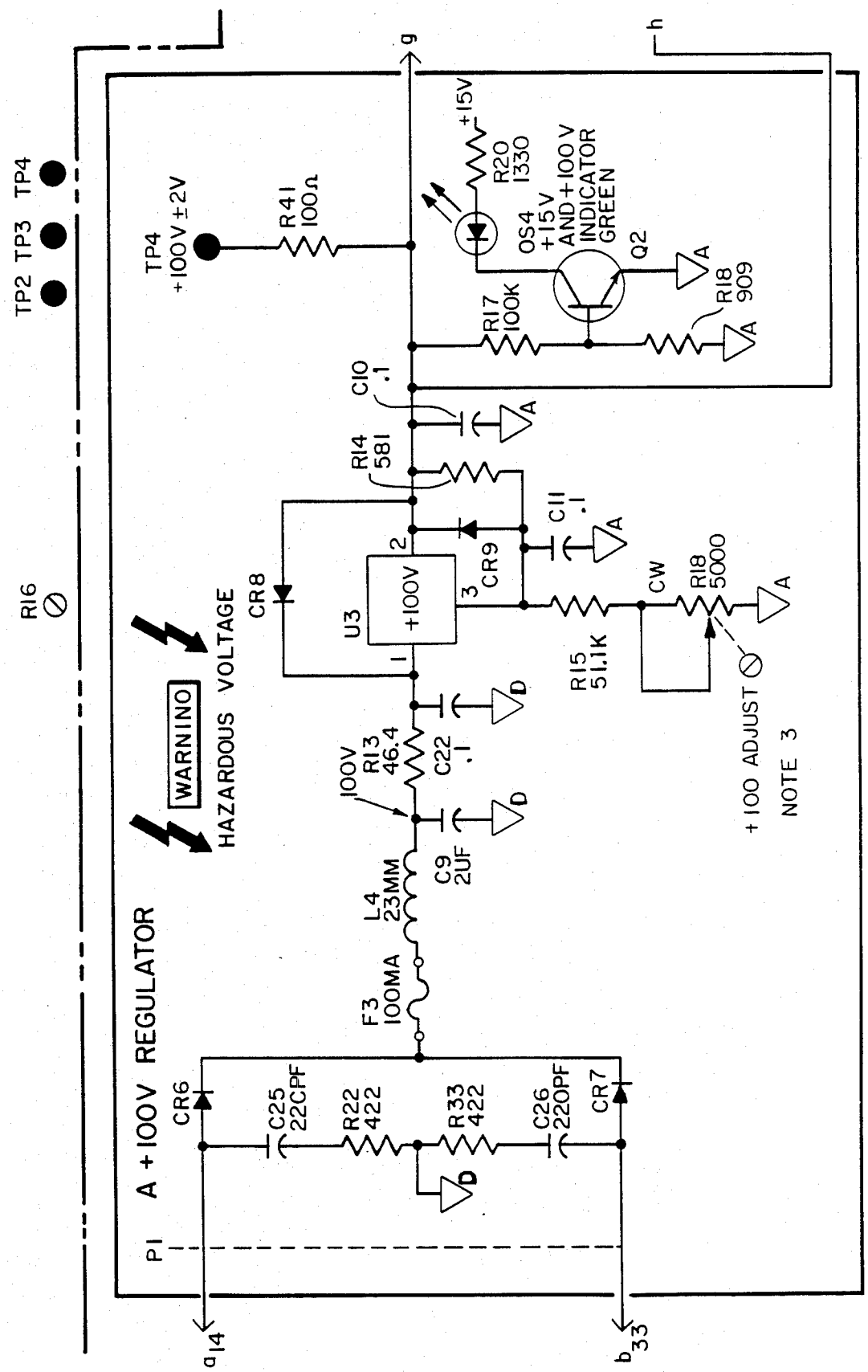

TP2 TP3 TP4
TP4 +100V ±2V
R41 100Ω
+15V
R20 1330
OS4 +15V AND +100V INDICATOR GREEN
Q2
R17 100K
R18 909
C10 .1
R14 581
C11 .1
CR8
CR9
U3
+100V
CW
R18 5000
R15 51.1K
+100 ADJUST
NOTE 3
R16
WARNING
HAZARDOUS VOLTAGE
100V
R13 46.4
C22 .1
C9 2UF
L4 23MM
F3 100MA
A +100V REGULATOR
CR6
C25 22CPF
R22 422
R33 422
C26 220PF
CR7
P1
g
h
a14
b33

FIG 3.98A

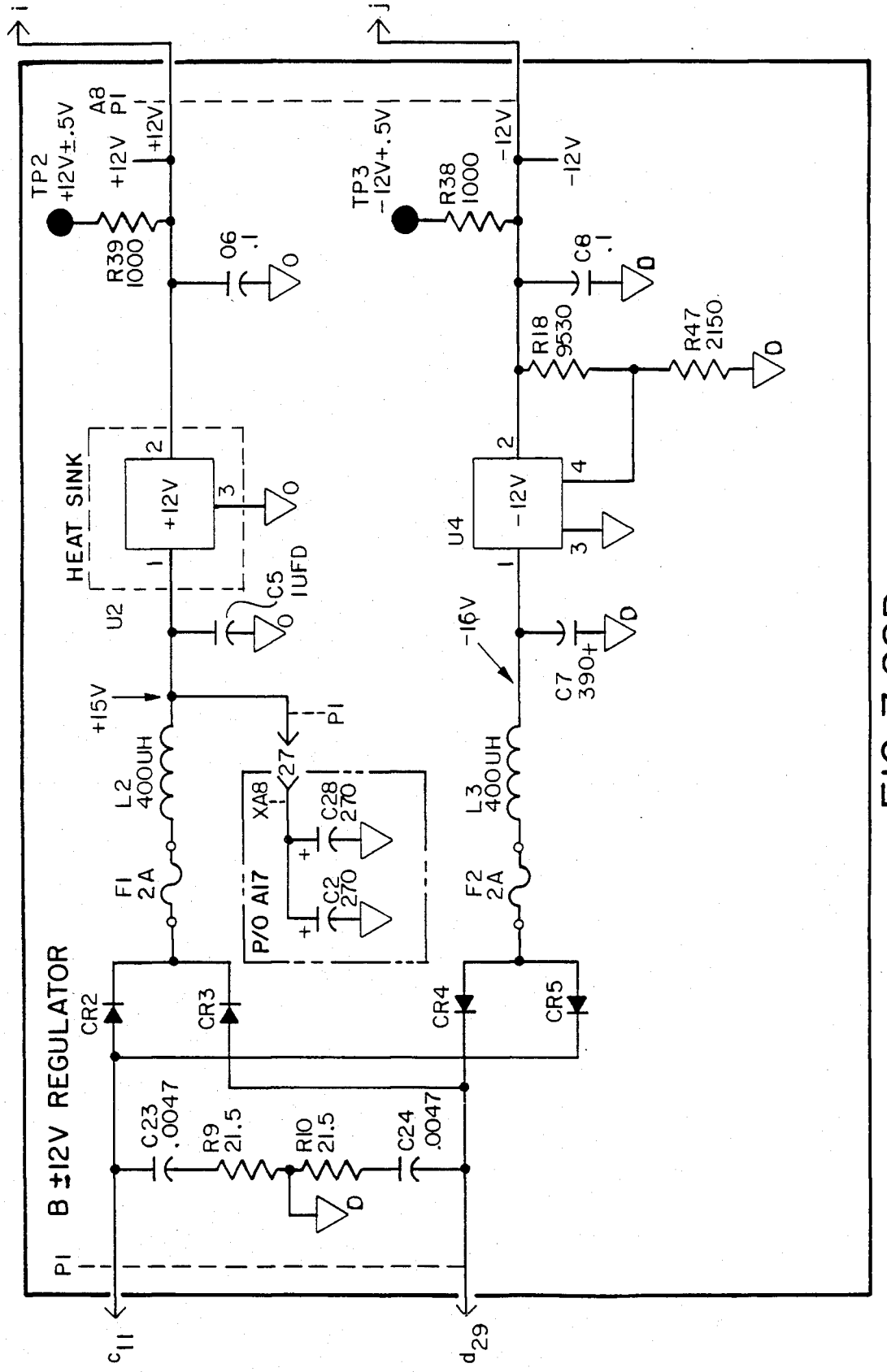

B ±12V REGULATOR
P1
A8 P1
+12V
+12V±.5V
TP2
R39 1000
C6 .1
HEAT SINK
U2
+12V
C5 1UFD
+15V
L2 400UH
F1 2A
CR2
CR3
C23 .0047
R9 21.5
R10 21.5
C24 .0047
P/O A17
XA8
C28 270
C2 270
-12V
-12V±.5V
TP3
R38 1000
C8 .1
R18 9530
R47 2150
U4
-16V
C7 390+
L3 400UH
F2 2A
CR4
CR5
i
j
c11
d29

FIG 3.98B

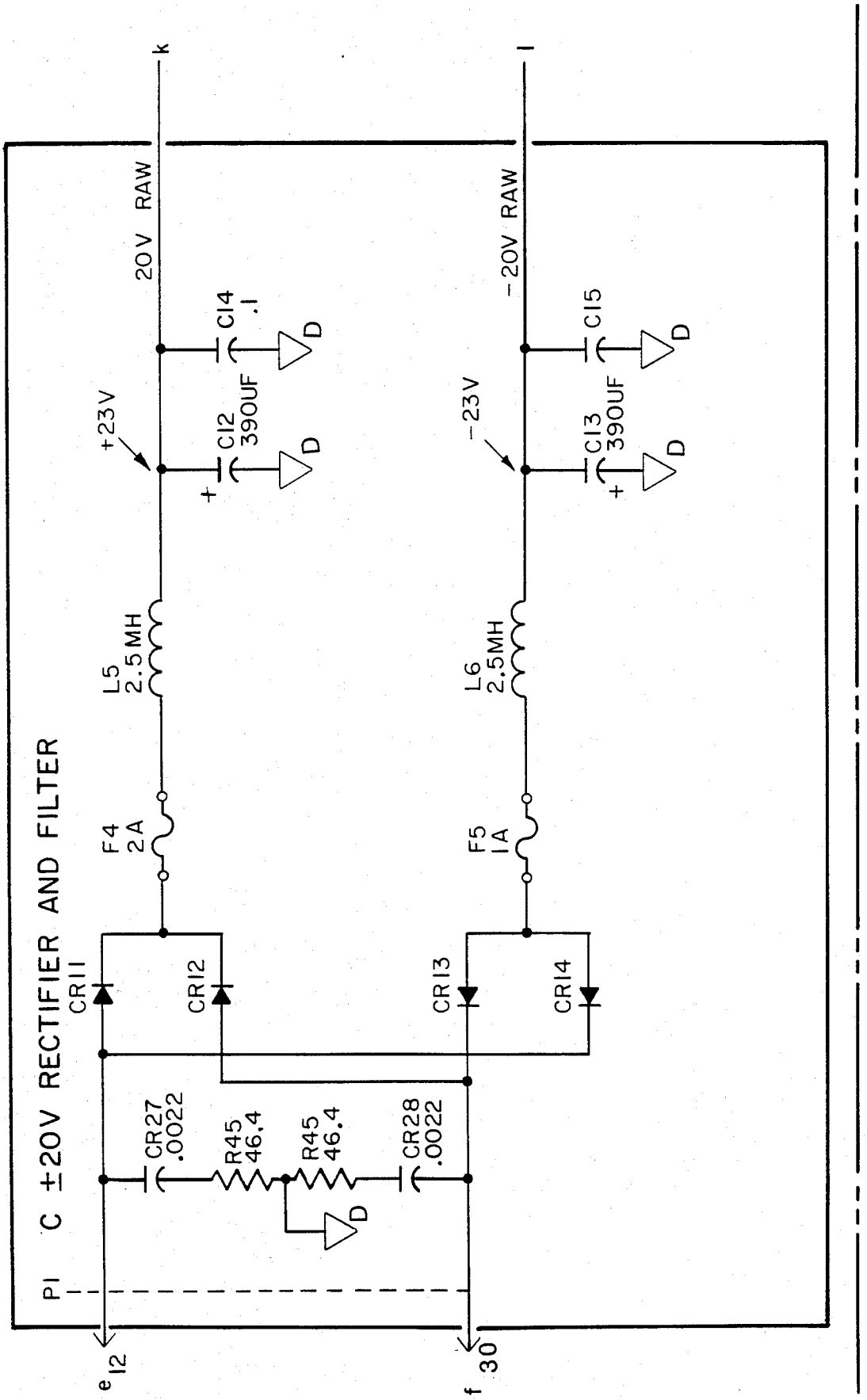

P1
C ±20V RECTIFIER AND FILTER
k
l
20V RAW
-20V RAW
+23V
-23V
C14 .1
C12 390UF
C15
C13 390UF
L5 2.5MH
L6 2.5MH
F4 2A
F5 1A
CR11
CR12
CR13
CR14
CR27 .0022
R45 46.4
R45 46.4
CR28 .0022
D
e 12
f 30

FIG 3.98C

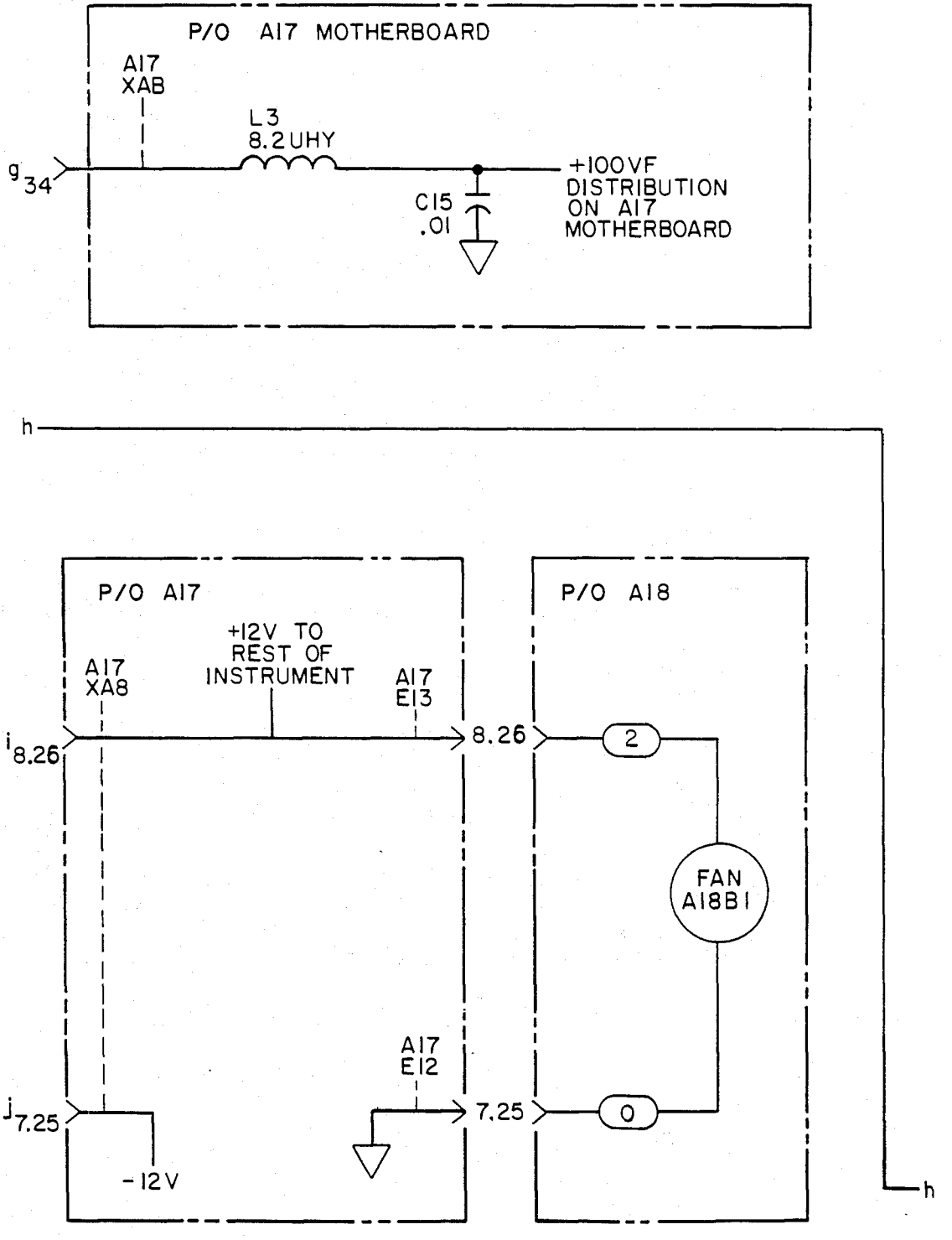

P/O A17 MOTHERBOARD
A17
XAB
L3
8.2UHY
g
34
+100VF
DISTRIBUTION
ON A17
MOTHERBOARD
C15
.01
h
P/O A17
P/O A18
+12V TO
REST OF
INSTRUMENT
A17
XA8
A17
E13
i
8.26
8.26
2
FAN
A18B1
A17
E12
j
7.25
7.25
0
-12V
h

FIG 3.99A

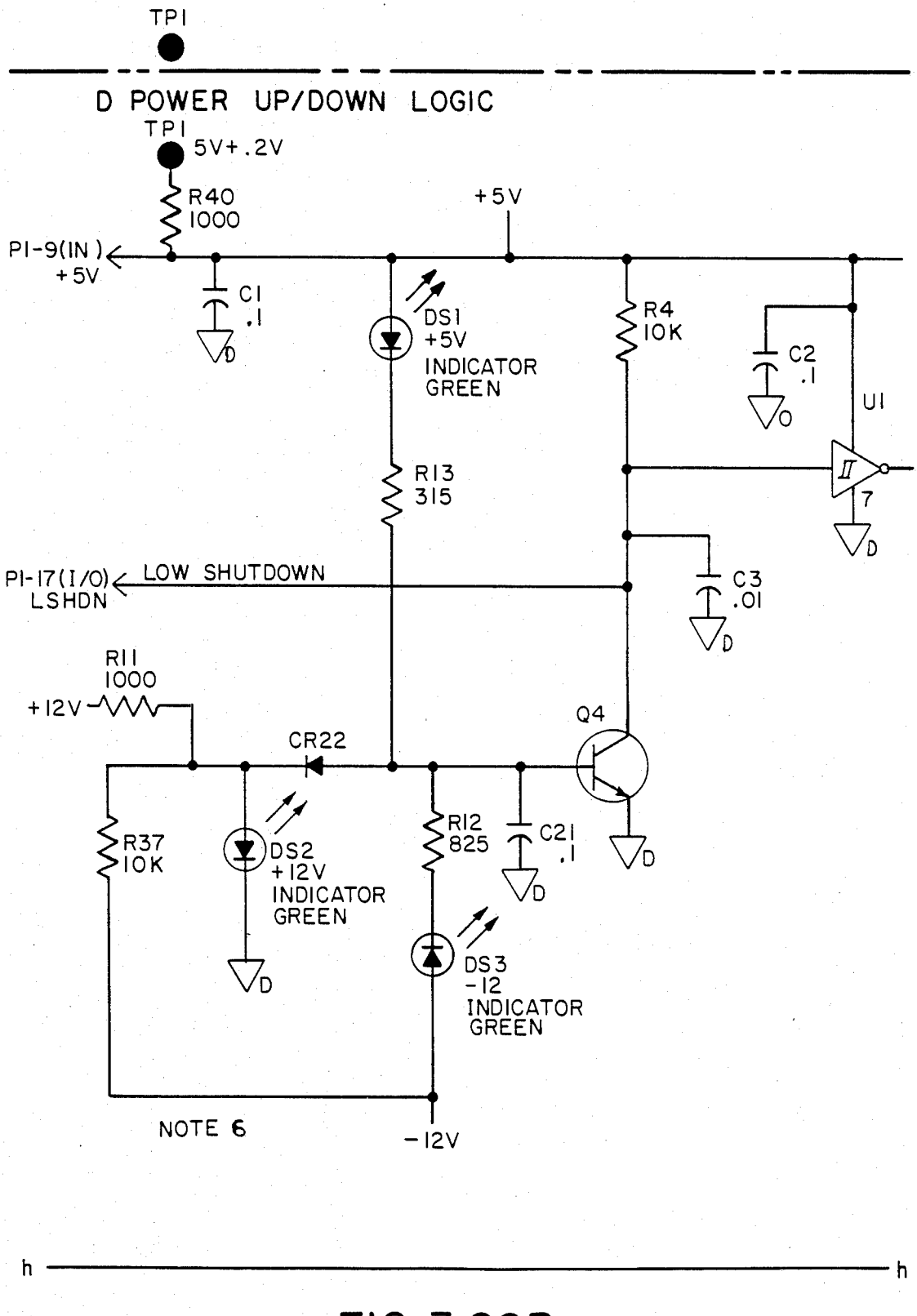

TP1
D POWER UP/DOWN LOGIC
TP1
5V+.2V
R40
1000
+5V
P1-9(IN)
+5V
C1
.1
D
DS1
+5V
INDICATOR
GREEN
R4
10K
C2
.1
U1
R13
315
P1-17(I/O)
LSHDN
LOW SHUTDOWN
C3
.01
R11
1000
+12V
Q4
CR22
R37
10K
DS2
+12V
INDICATOR
GREEN
R12
825
C21
.1
DS3
-12
INDICATOR
GREEN
NOTE 6
-12V
h
h

FIG 3.99B

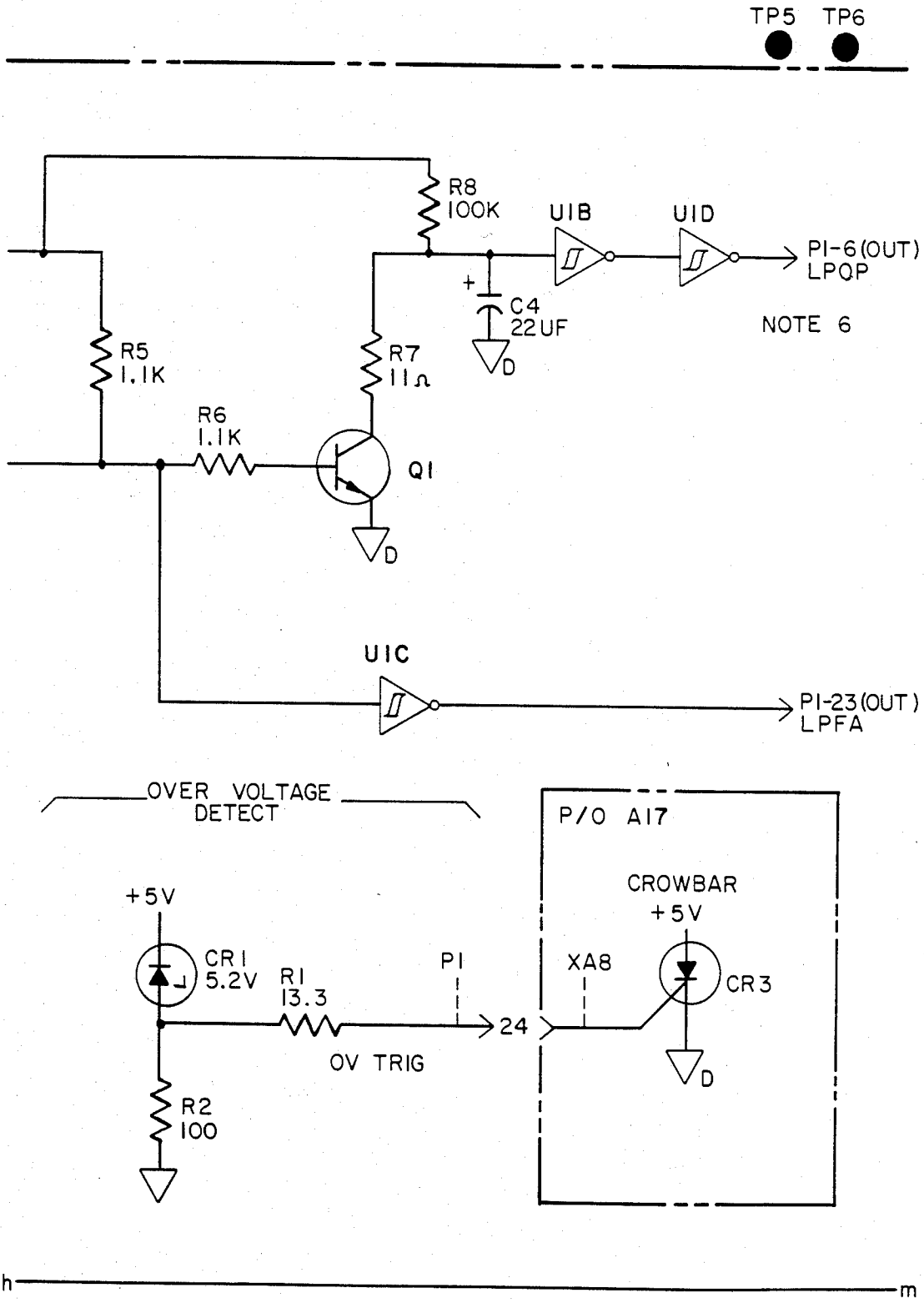

TP5
TP6
R8
100K
U1B
U1D
P1-6(OUT)
LPOP
NOTE 6
C4
22UF
R5
1.1K
R7
11Ω
R6
1.1K
Q1
U1C
P1-23(OUT)
LPFA
OVER VOLTAGE
DETECT
P/O A17
+5V
CR1
5.2V
R1
13.3
P1
XA8
CROWBAR
+5V
CR3
24
OV TRIG
R2
100
h
m

FIG 3.99C

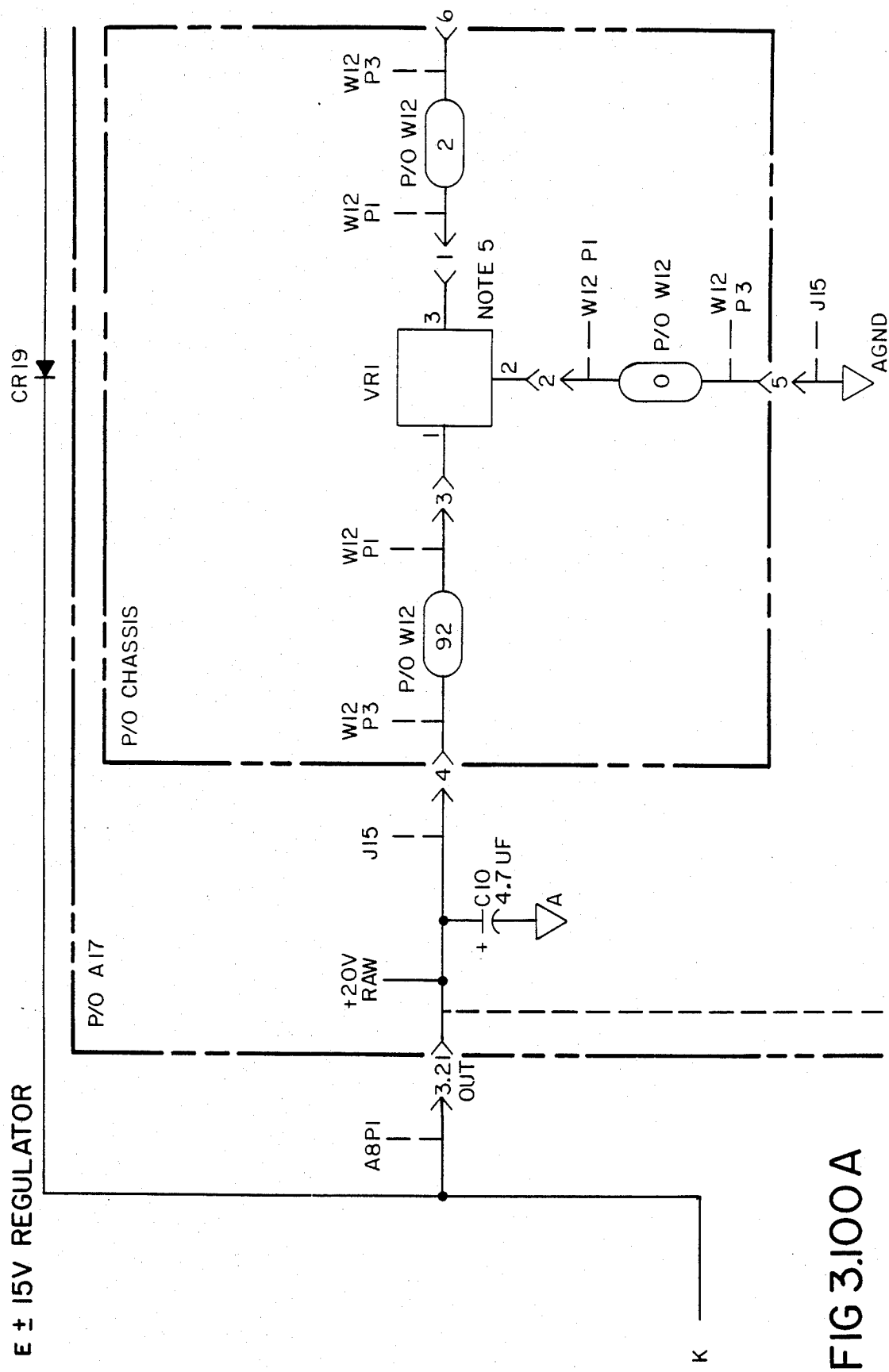

E ± 15V REGULATOR
CR19
P/O A17
P/O CHASSIS
+20V RAW
A8P1
3.21 OUT
J15
C10 4.7 UF
A
K
W12 P3
P/O W12
2
W12 P1
1
NOTE 5
3
VR1
2
W12 P1
P/O W12
0
W12 P3
5
J15
AGND
W12 P1
3
W12 P3
P/O W12
92
4
6

FIG 3.100A

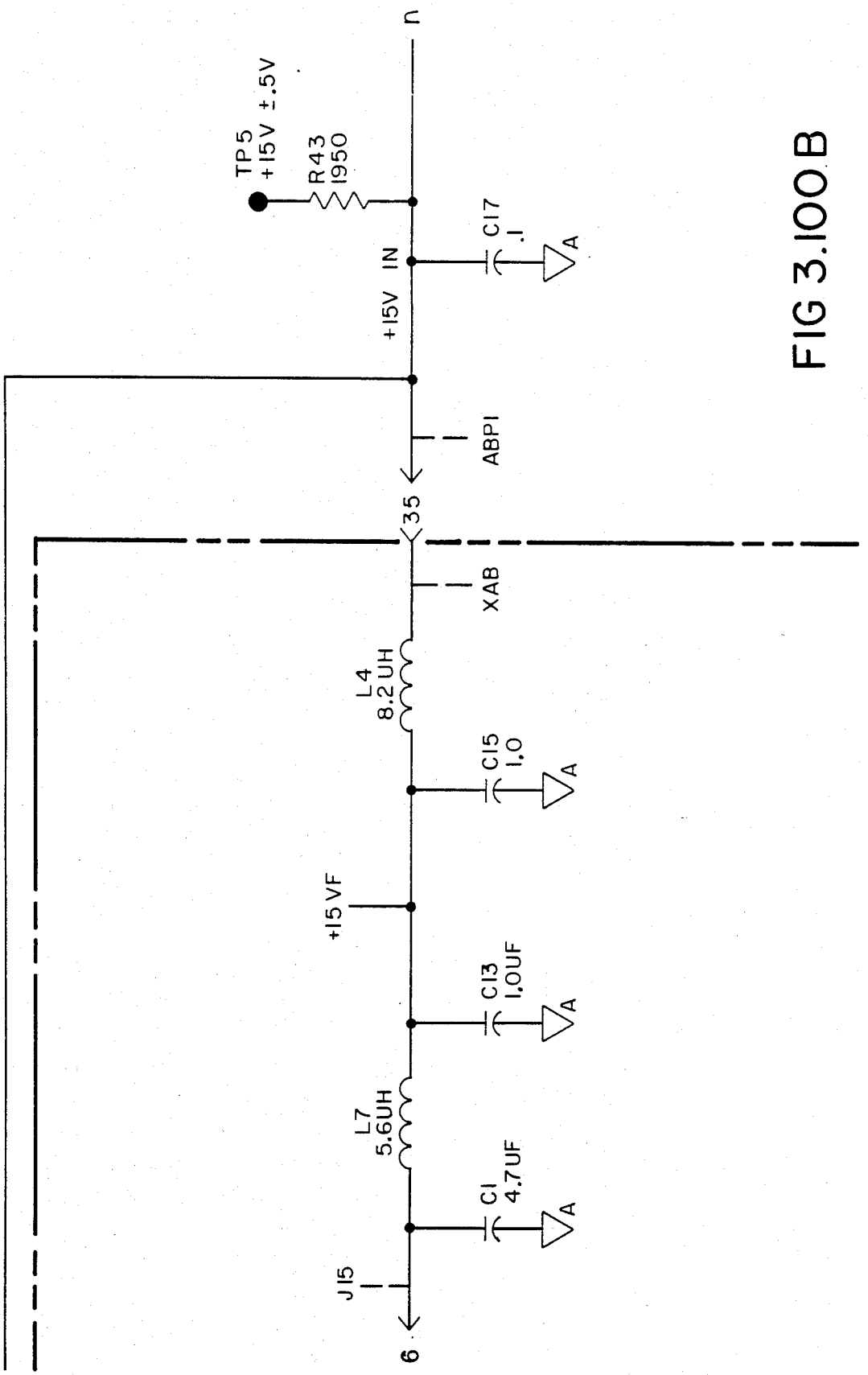

TP5
+15V ±.5V
R43
1950
C17
.1
A
+15V IN
ABPI
35
XAB
L4
8.2 UH
C15
1.0
A
+15 VF
C13
1.0UF
A
L7
5.6UH
C1
4.7UF
A
J15
6

FIG 3.100B

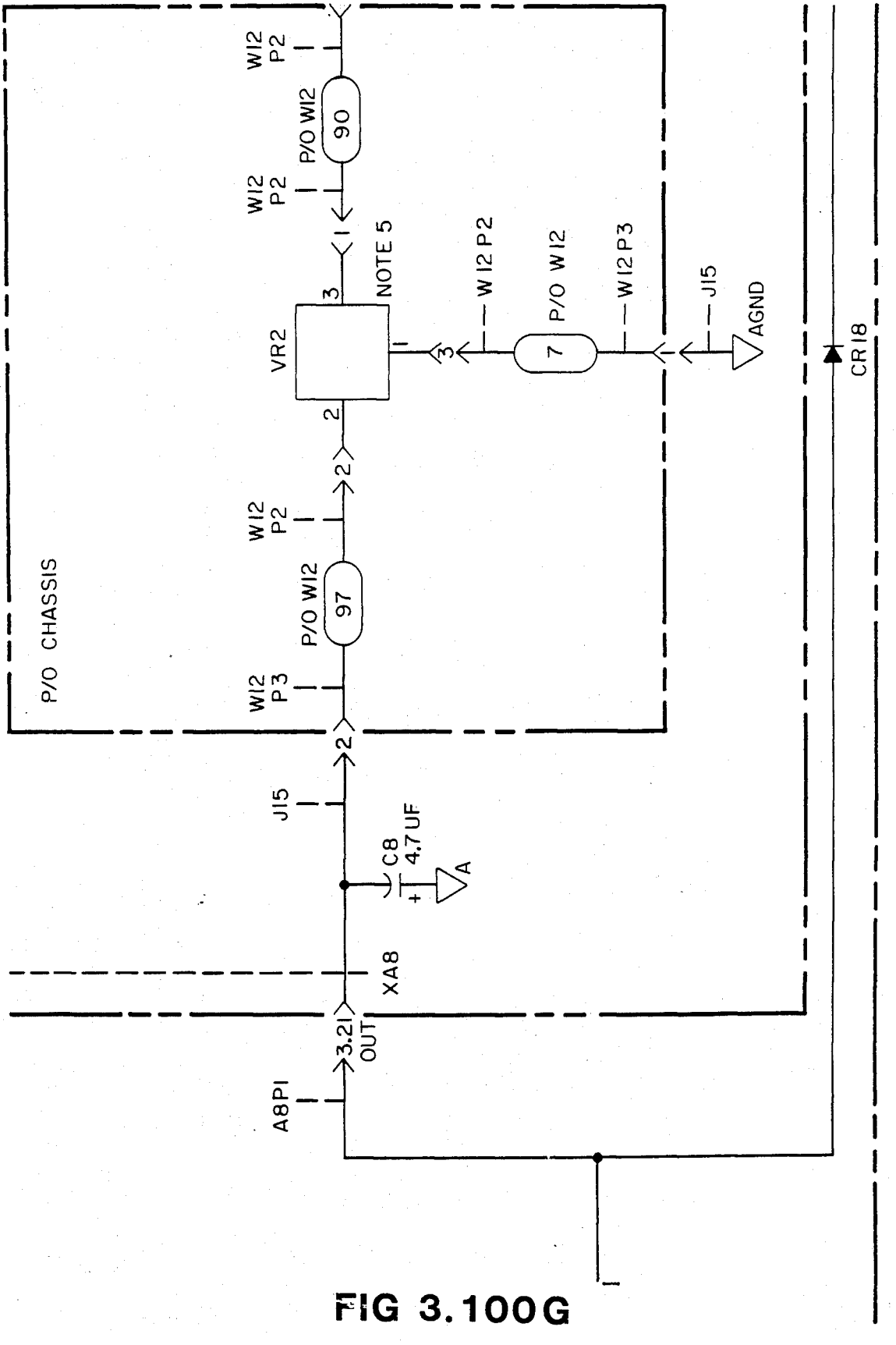

P/O CHASSIS
W12 P2
P/O W12 90
W12 P2
1
3
NOTE 5
VR2
1
2
2
W12 P2
P/O W12 97
W12 P3
2
J15
C8 4.7UF
A
XA8
3.21 OUT
A8P1
W12 P2
P/O W12
W12 P3
J15
AGND
CR18

FIG 3.100G

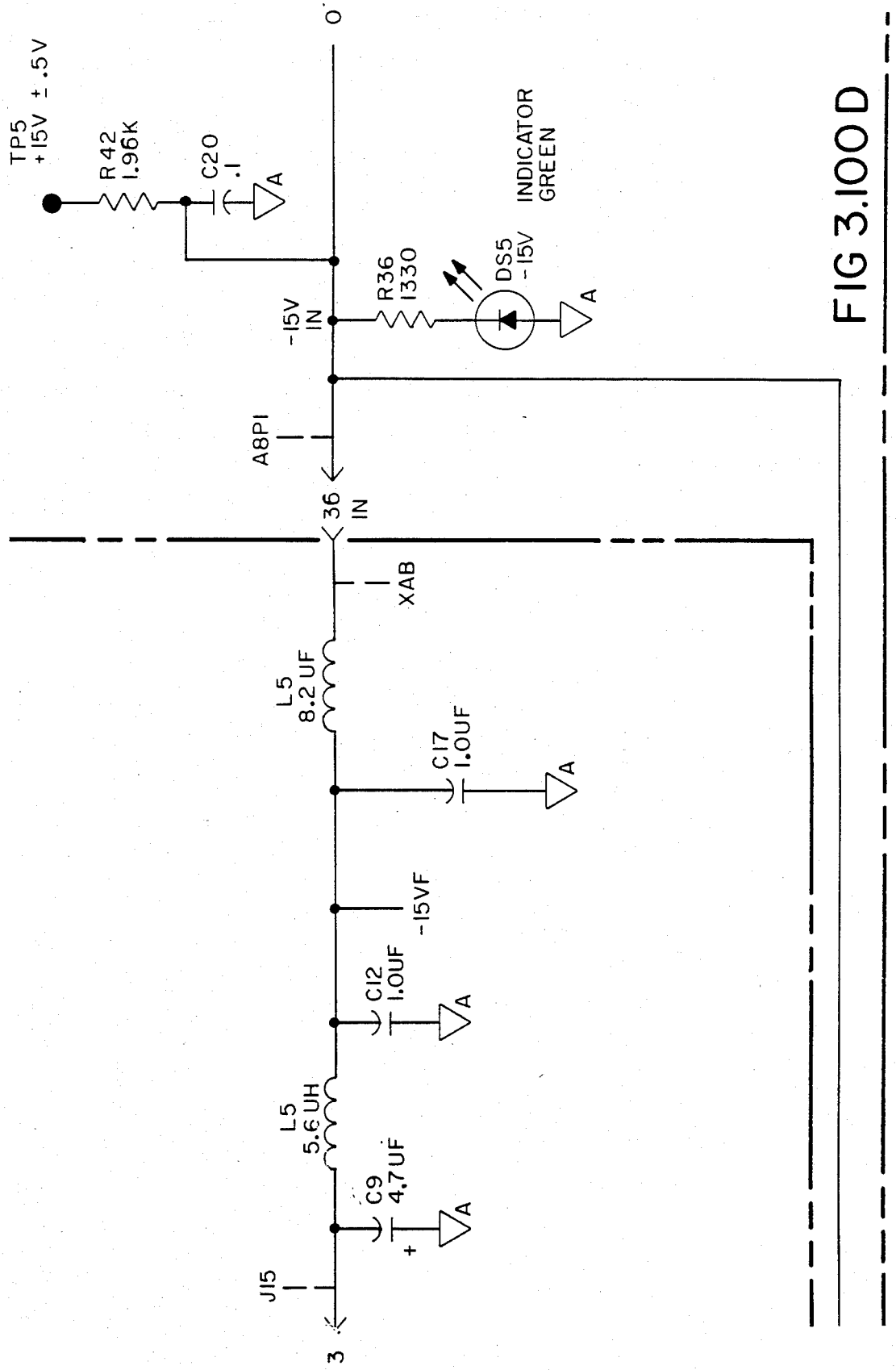

TP5
+15V ± .5V
R42
1.96K
C20
.1
A
0
INDICATOR
GREEN
DS5
-15V
R36
1330
-15V
IN
A8P1
36
IN
XAB
L5
8.2 UF
C17
1.0UF
-15VF
C12
1.0UF
L5
5.6 UH
C9
4.7UF
+
J15
3

FIG 3.100D

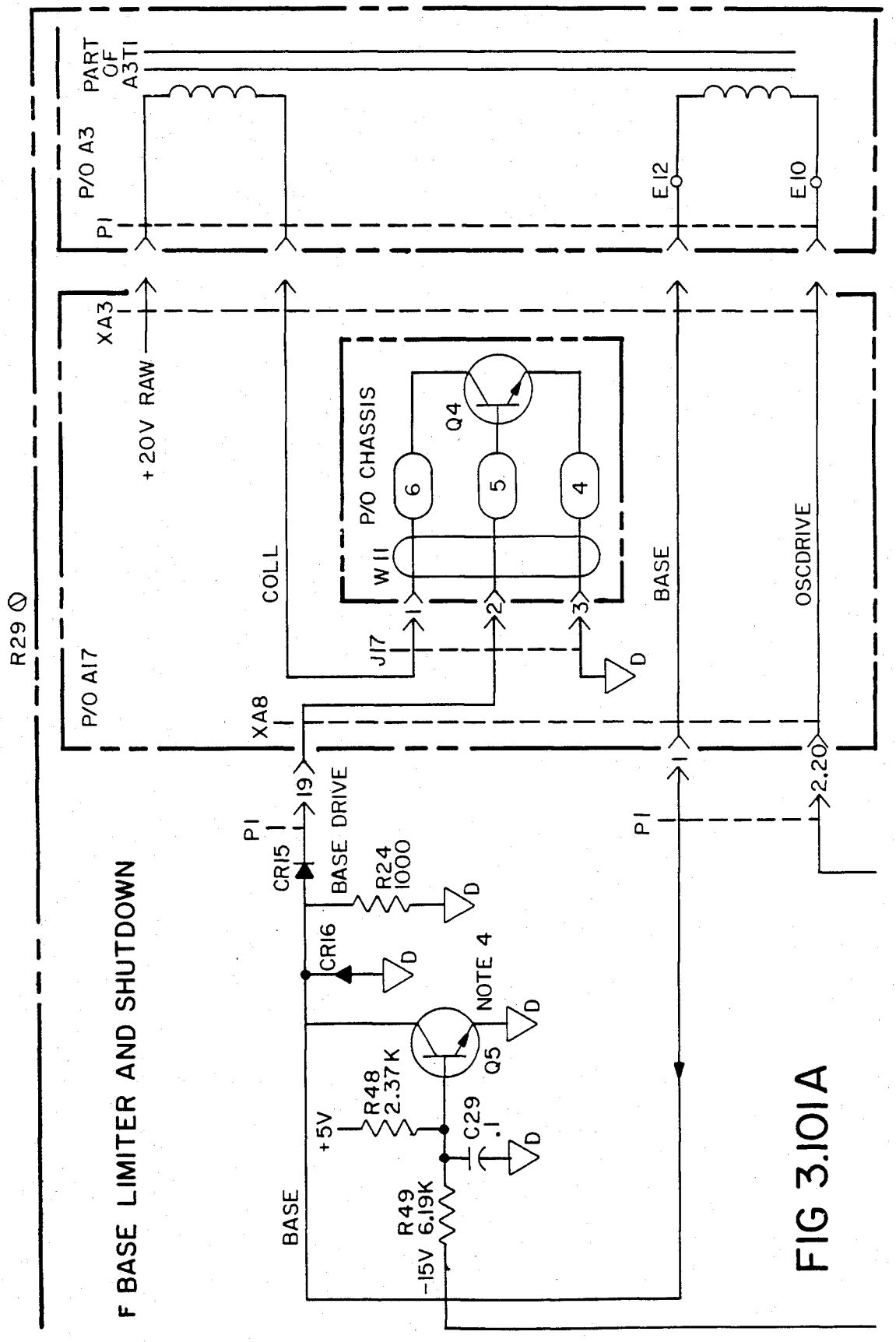

F BASE LIMITER AND SHUTDOWN
R29
P/O A17
P/O A3
PART OF A3T1
P1
XA3
+20V RAW
XA8
COLL
P/O CHASSIS
Q4
W11
J17
BASE
OSCDRIVE
E12
E10
2.20
CR15
BASE DRIVE
R24 1000
CR16
NOTE 4
Q5
R48 2.37K
+5V
C29 .1
R49 6.19K
-15V
BASE

FIG 3.101A

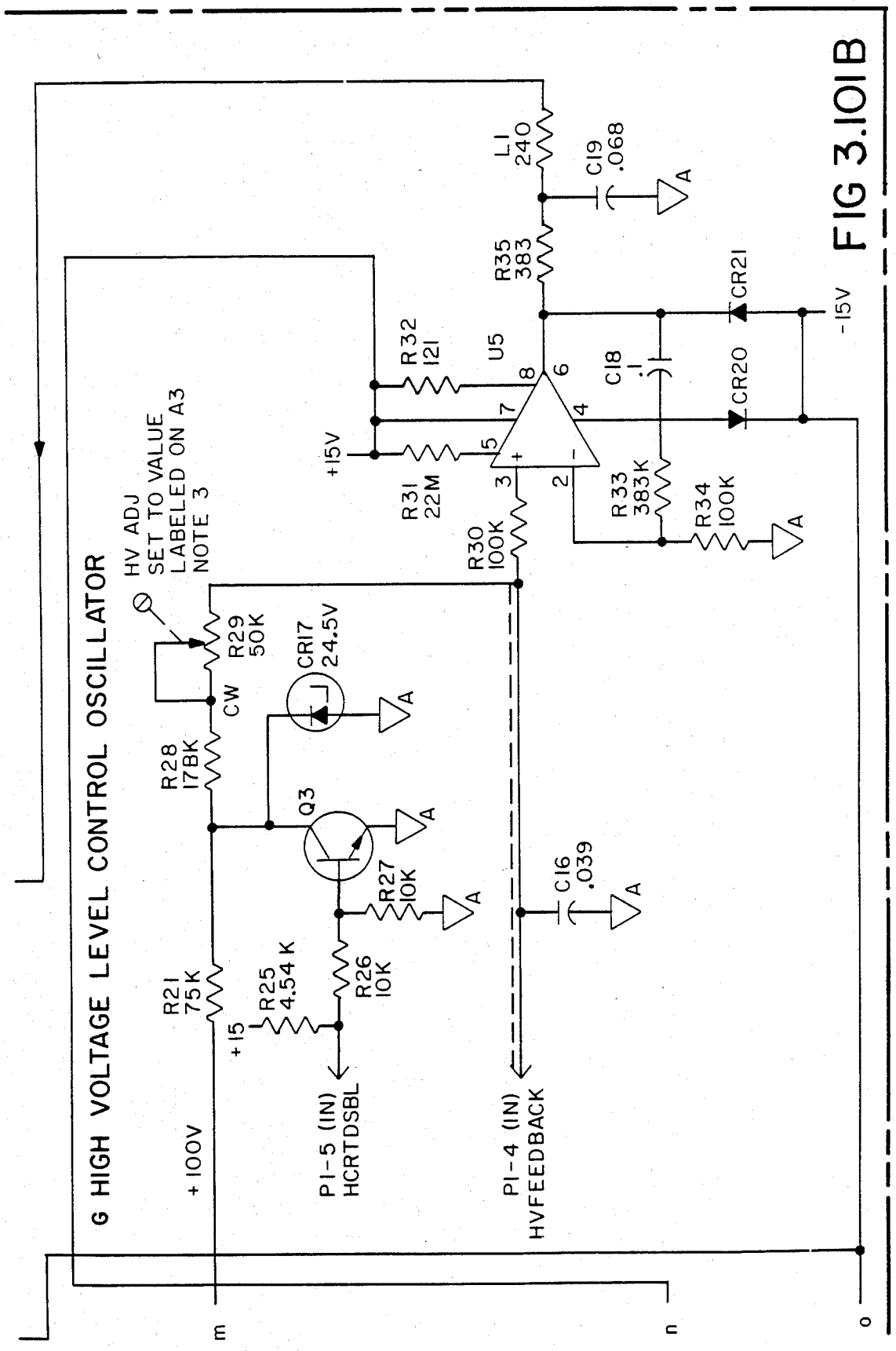

G HIGH VOLTAGE LEVEL CONTROL OSCILLATOR
HV ADJ
SET TO VALUE
LABELED ON A3
NOTE 3
R29
50K
CW
R28
178K
R21
75K
+100V
+15
R25
4.54 K
R26
10K
R27
10K
Q3
CR17
24.5V
P1-5 (IN)
HCRTDSBL
P1-4 (IN)
HVFEEDBACK
C16
.039
R30
100K
R31
22M
+15V
R32
121
U5
R33
383K
R34
100K
C18
.1
R35
383
L1
240
C19
.068
CR20
CR21
-15V
m
n
o

FIG 3.101B

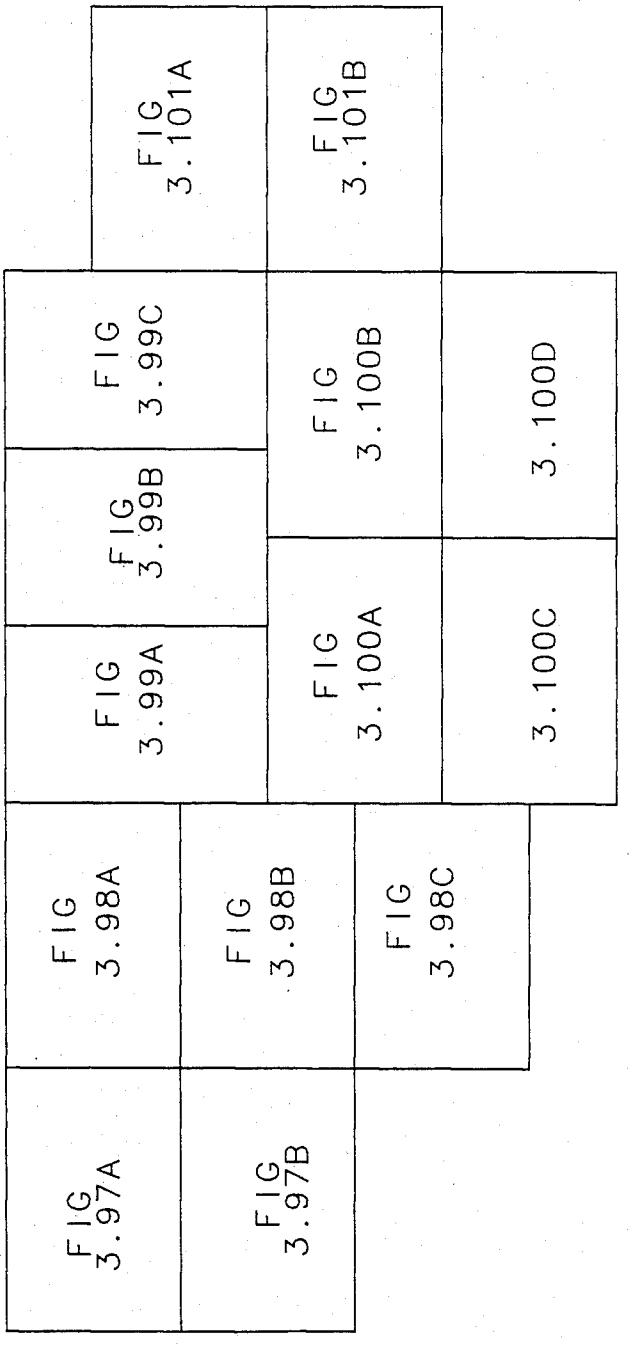


FIG 3.97A
FIG 3.97B
FIG 3.98A
FIG 3.98B
FIG 3.98C
FIG 3.99A
FIG 3.99B
FIG 3.99C
FIG 3.100A
FIG 3.100B
3.100C
3.100D
FIG 3.101A
FIG 3.101B

FIG 3.102

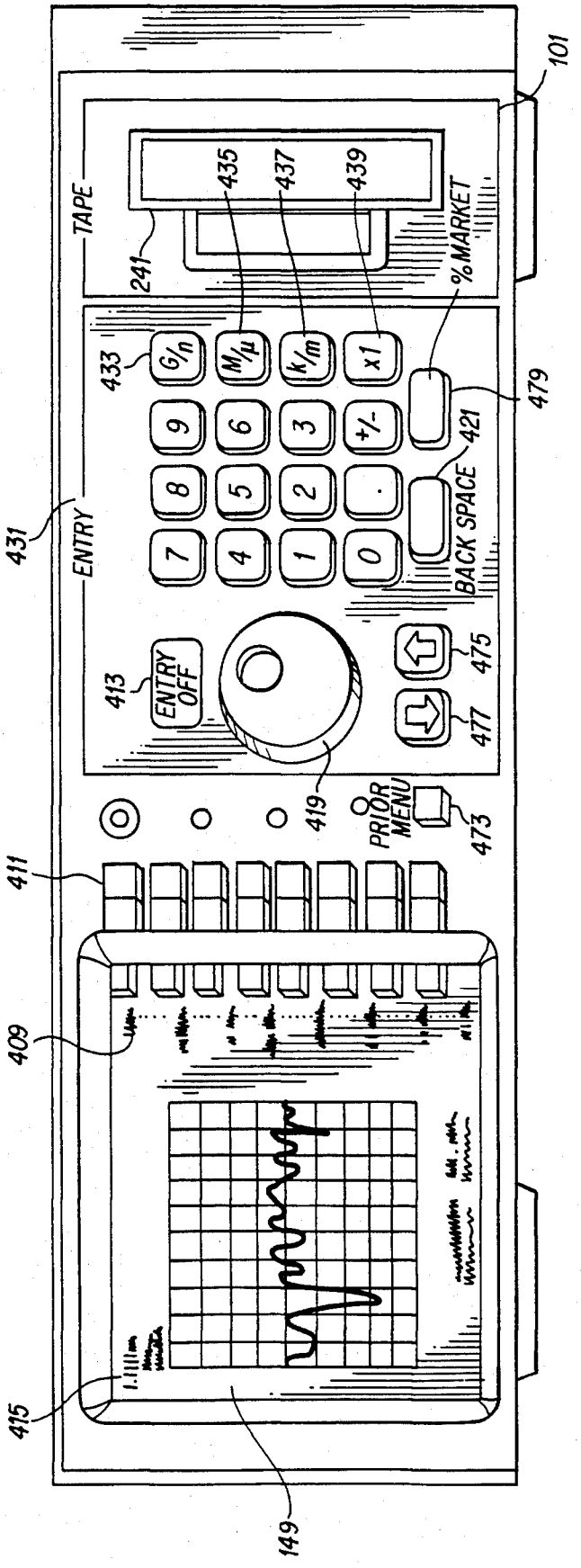

101
TAPE
241
435
437
439
%MARKET
433
G/n
M/μ
k/m
x1
479
9
6
3
+/-
421
8
5
2
.
BACK SPACE
431
ENTRY
7
4
1
0
413
ENTRY OFF
475
477
419
PRIOR MENU
473
411
409
415
149

FIG. 4A

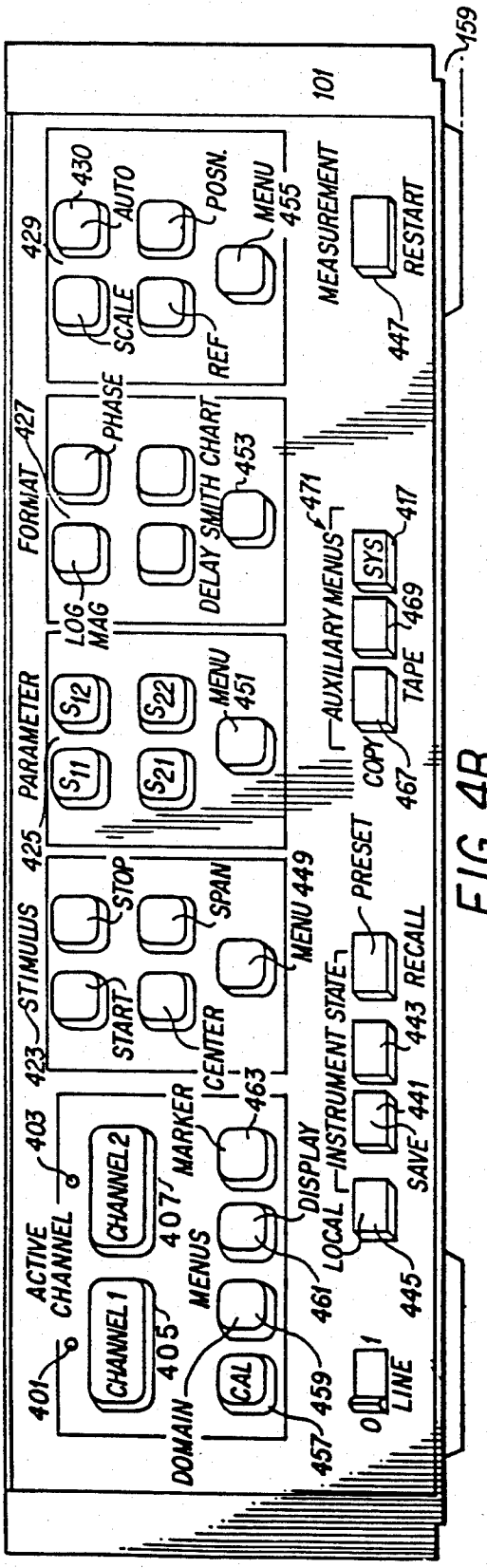

159
101
ACTIVE CHANNEL
403
STIMULUS
423
PARAMETER
425
FORMAT
427
429
401
CHANNEL 1
CHANNEL 2
START
STOP
S_{11}
S_{12}
S_{21}
S_{22}
LOG MAG
PHASE
SCALE
AUTO
407
405
MENUS
MARKER
CENTER
SPAN
MENU 451
DELAY
SMITH CHART
453
REF
POSN.
MENU 455
DOMAIN
CAL
DISPLAY
INSTRUMENT STATE
MENU 449
AUXILIARY MENUS
471
MEASUREMENT
457
459
461
PRESET
COPY
TAPE
SYS
467
469
417
447
RESTART
0
1
LINE
LOCAL
SAVE
RECALL
445
441
443

FIG. 4B

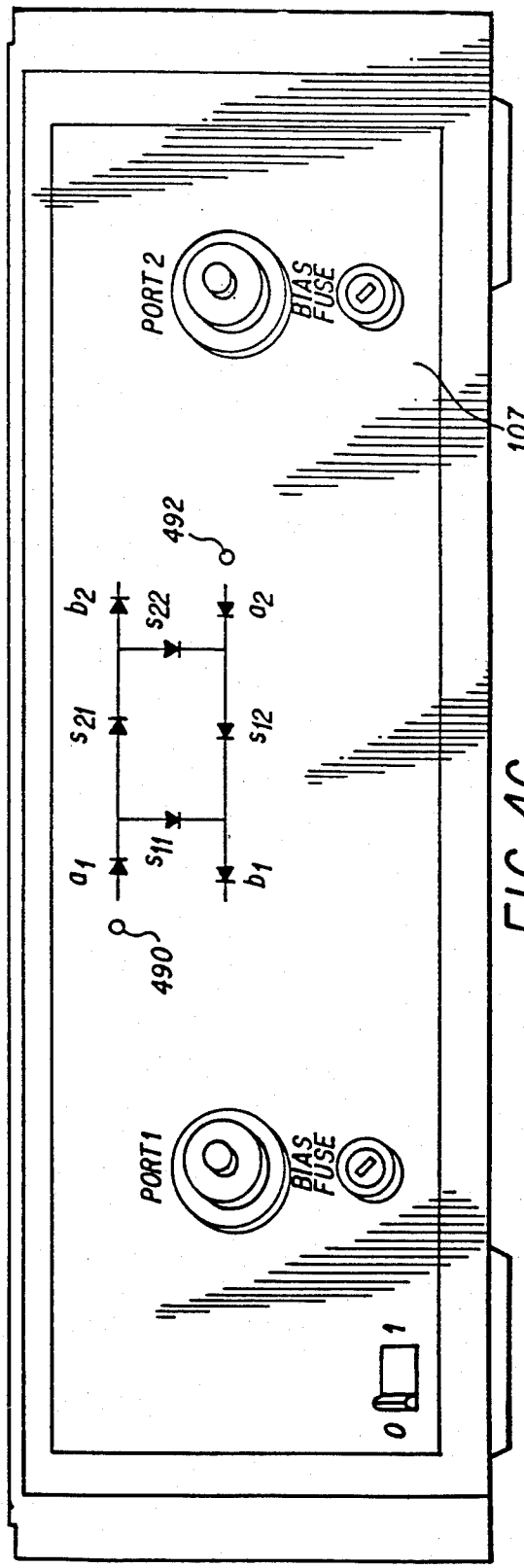

PORT 1
BIAS FUSE
PORT 2
BIAS FUSE
107
490
492
a_1
b_1
b_2
a_2
S_{11}
S_{21}
S_{12}
S_{22}
0
1

FIG. 4C

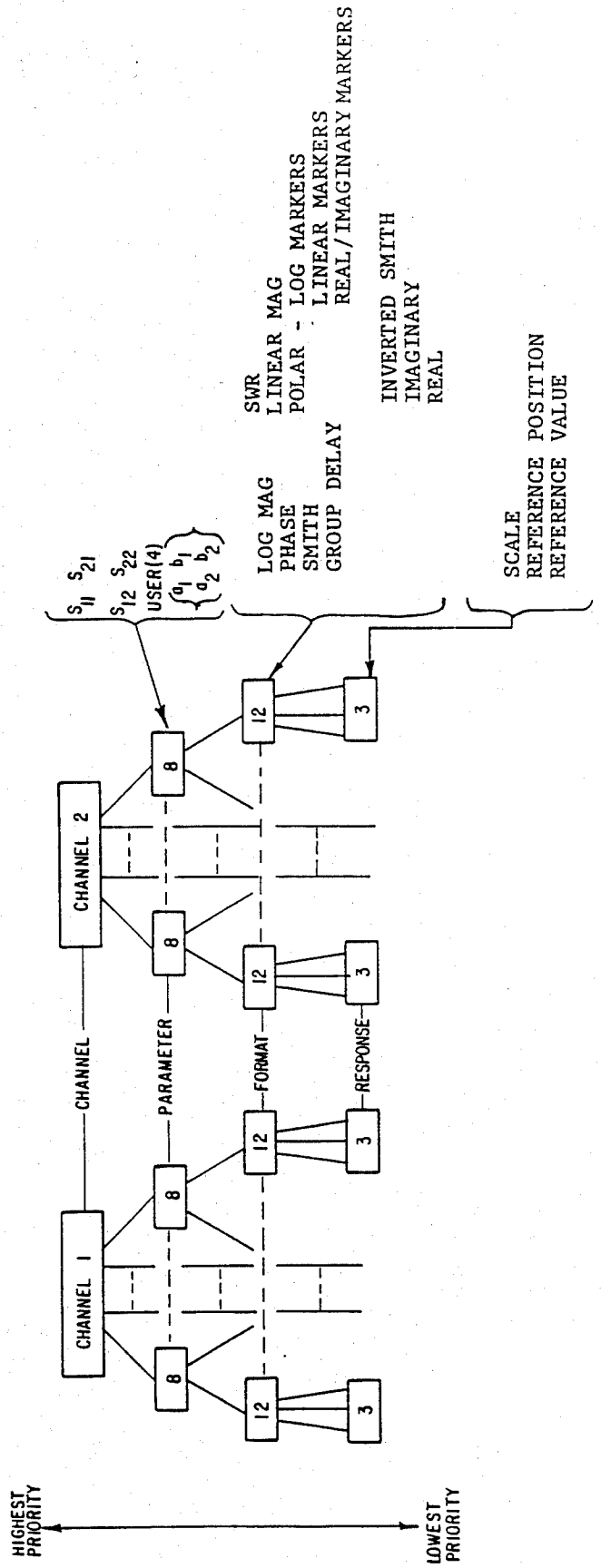

HIGHEST PRIORITY
LOWEST PRIORITY
CHANNEL
PARAMETER
FORMAT
RESPONSE
CHANNEL 1
CHANNEL 2
8
12
3
S_{11} S_{21}
S_{12} S_{22}
USER(4) a_1 b_1 a_2 b_2
LOG MAG
PHASE
SMITH
GROUP DELAY
SWR
LINEAR MAG
POLAR - LOG MARKERS
LINEAR MARKERS
REAL/IMAGINARY MARKERS
INVERTED SMITH
IMAGINARY
REAL
SCALE
REFERENCE POSITION
REFERENCE VALUE

FIG 5

FIG 6

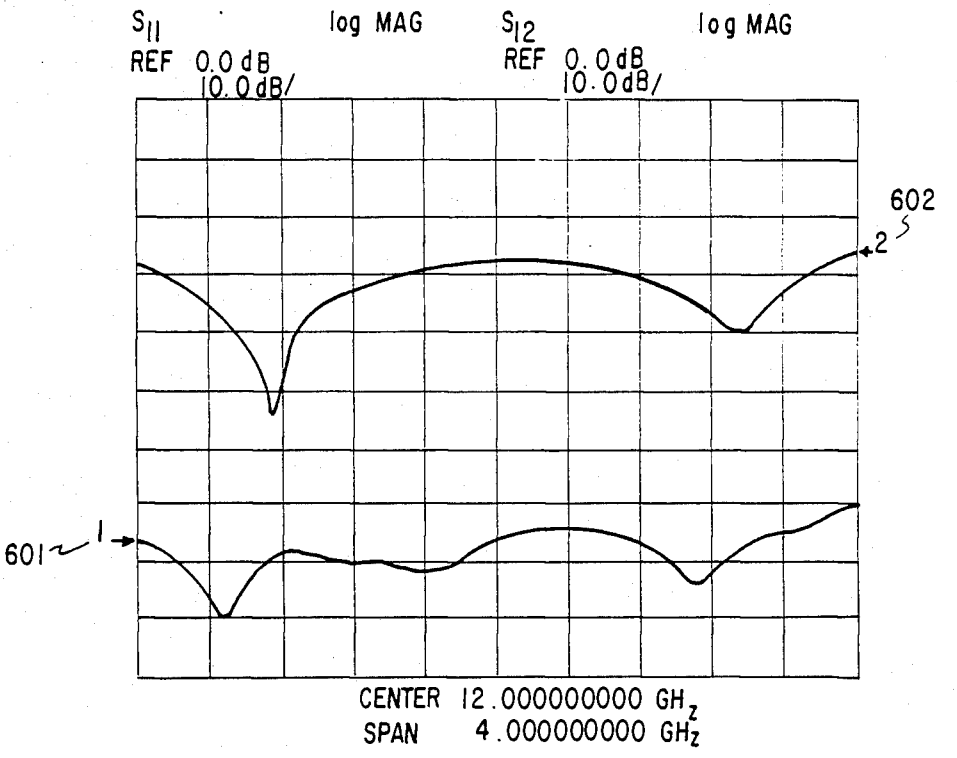
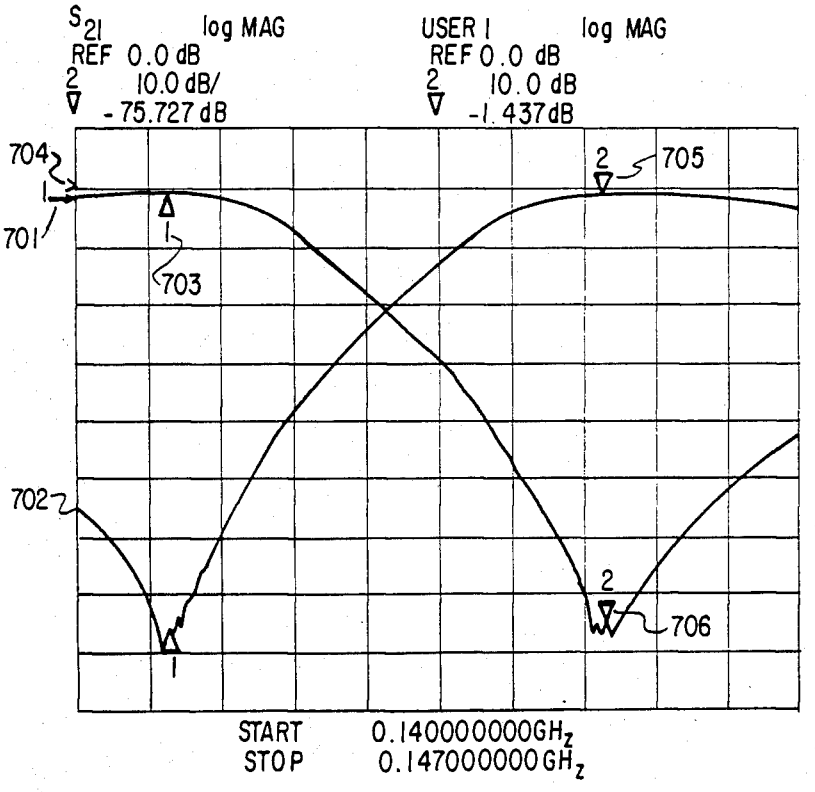

S11 log MAG
REF 0.0 dB
10.0 dB/
S12 log MAG
REF 0.0 dB
10.0 dB/
602
2
601
1
CENTER 12.000000000 GHz
SPAN 4.000000000 GHz

FIG 7


S21 log MAG
REF 0.0 dB
2 10.0 dB/
-75.727 dB
USER 1 log MAG
REF 0.0 dB
2 10.0 dB
-1.437 dB
704
1
701
703
2
705
702
2
706
START 0.140000000GHz
STOP 0.147000000GHz

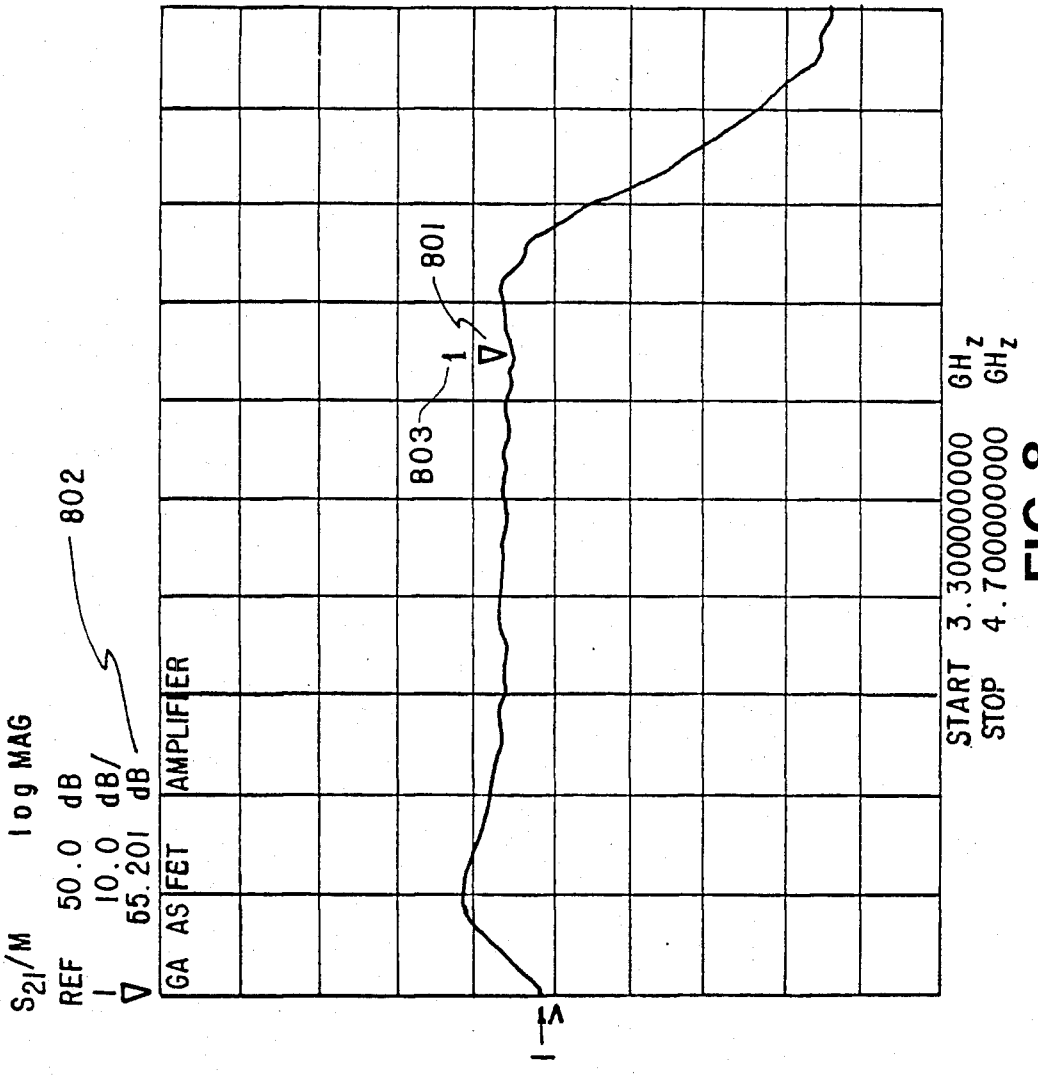

S21/M log MAG
REF 50.0 dB
10.0 dB/
65.201 dB
GA AS FET AMPLIFIER
802
801
803
1
START 3.300000000 GHz
STOP 4.700000000 GHz

FIG 8

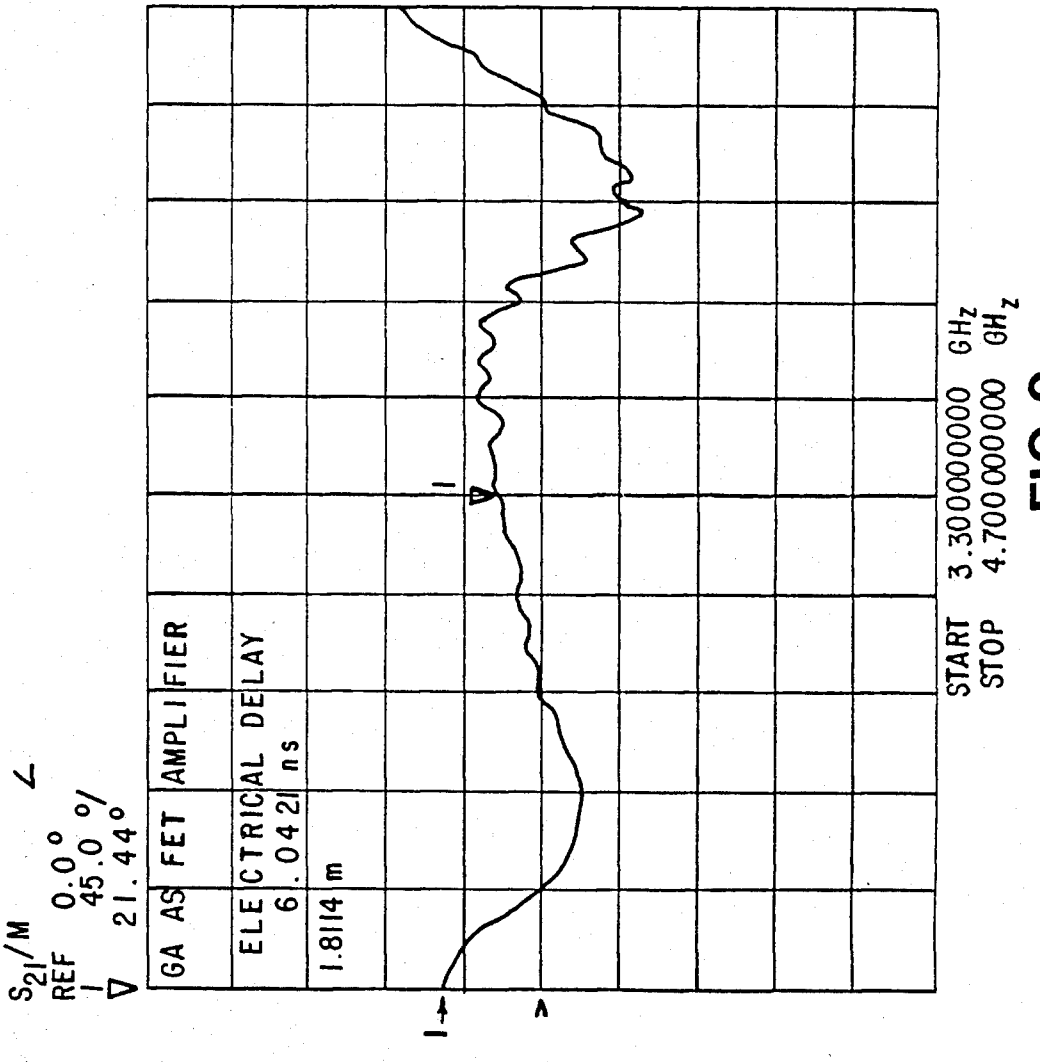

S21/M
REF 0.0°
45.0°/
V 21.44°
GA AS FET AMPLIFIER
ELECTRICAL DELAY
6.0421 ns
1.8114 m
START 3.300000000 GHz
STOP 4.700000000 GHz

FIG 9

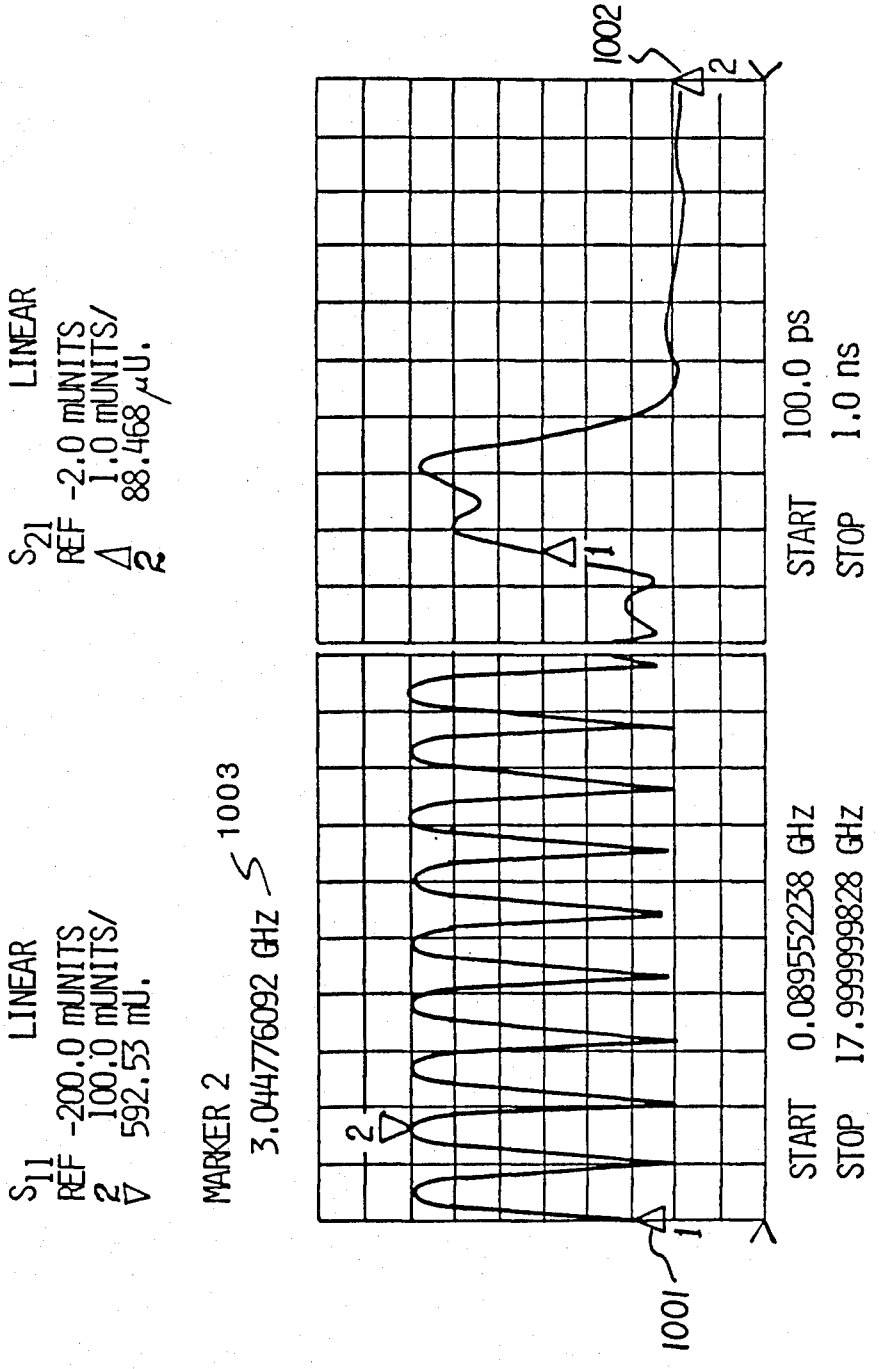

S11
LINEAR
REF -200.0 mUNITS
2 100.0 mUNITS/
▽ 592.53 mU.
MARKER 2
3.044776092 GHz
1003
S21
LINEAR
REF -2.0 mUNITS
Δ 1.0 mUNITS/
2 88.468 μU.
1002
1001
START 0.089552238 GHz
STOP 17.999999828 GHz
START 100.0 ps
STOP 1.0 ns

FIG 10

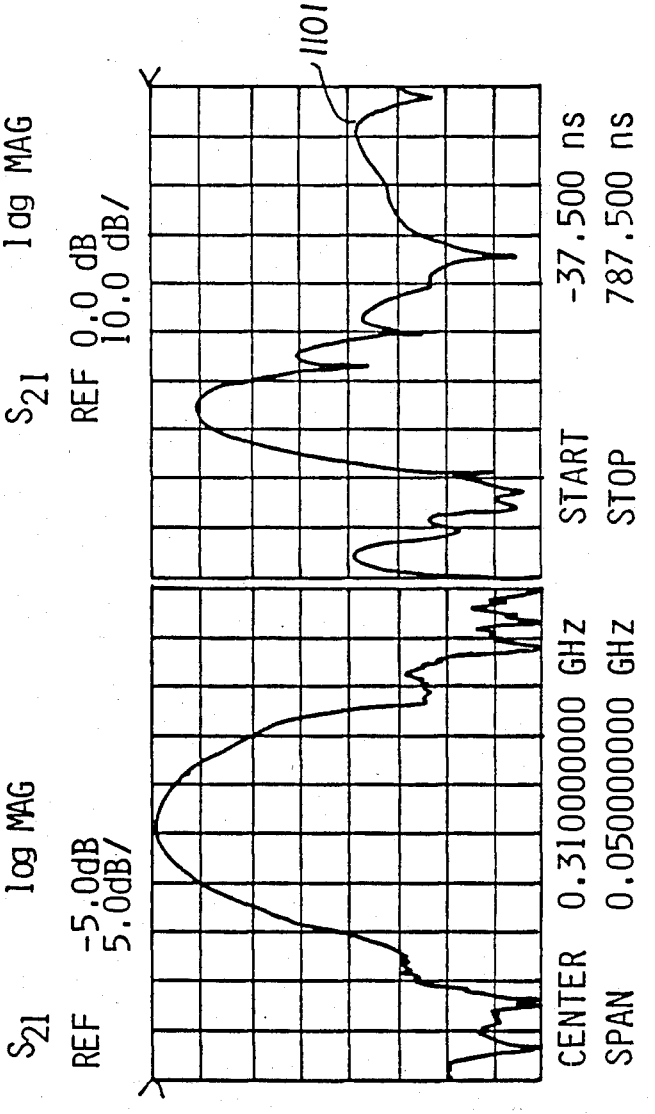

1101
S21
log MAG
REF 0.0 dB
10.0 dB/
S21
log MAG
REF -5.0dB
5.0dB/
CENTER 0.310000000 GHz
SPAN 0.050000000 GHz
START -37.500 ns
STOP 787.500 ns

FIG 11

FIG 12

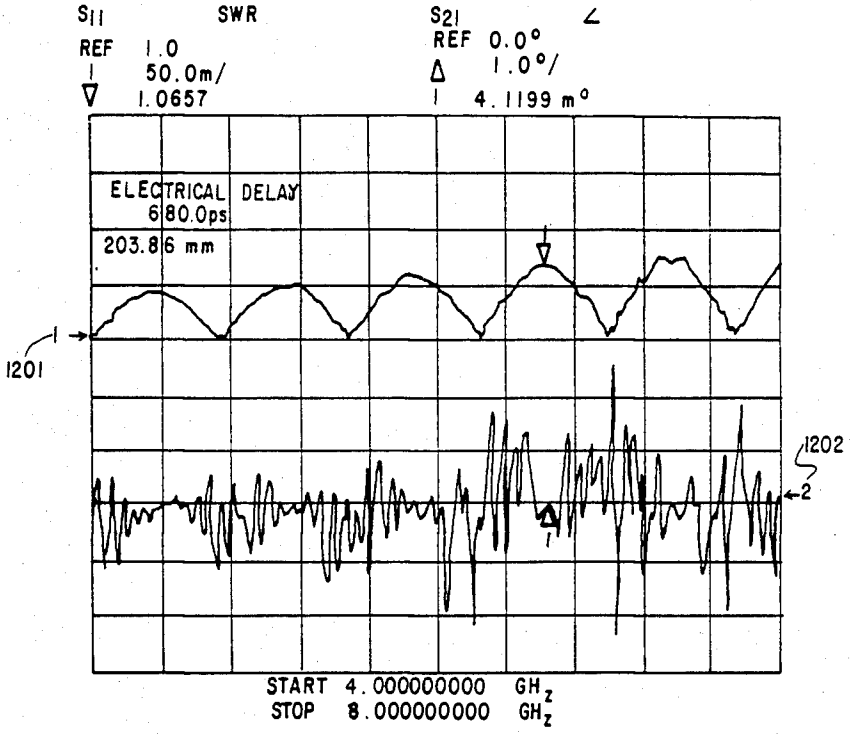

S11 SWR
REF 1.0
50.0m/
1.0657
S21 ∠
REF 0.0°
Δ 1.0°/
4.1199 m°
ELECTRICAL DELAY
680.0ps
203.86 mm
1201
1202
START 4.000000000 GHz
STOP 8.000000000 GHz

FIG 13

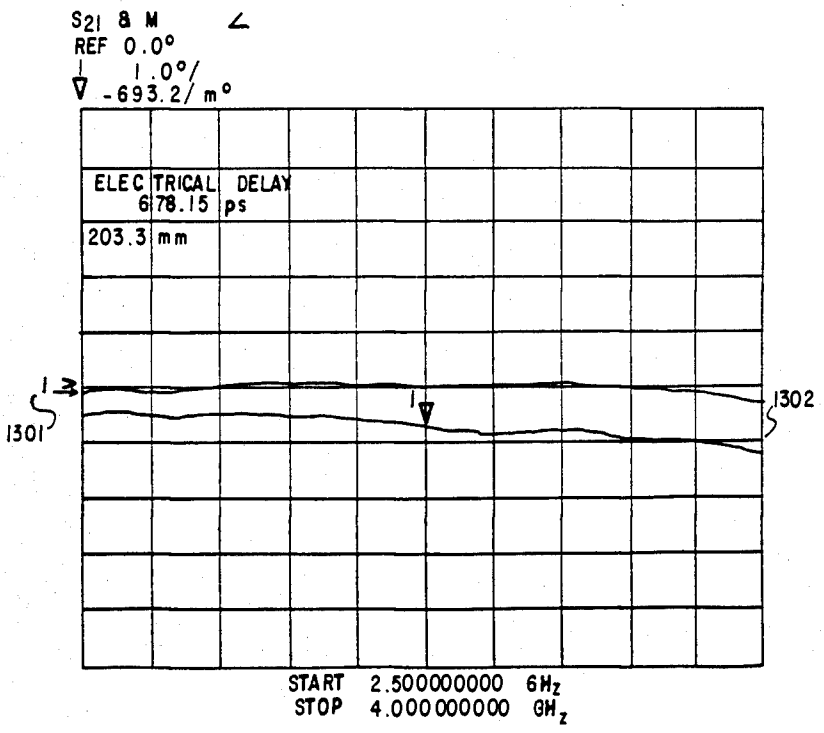
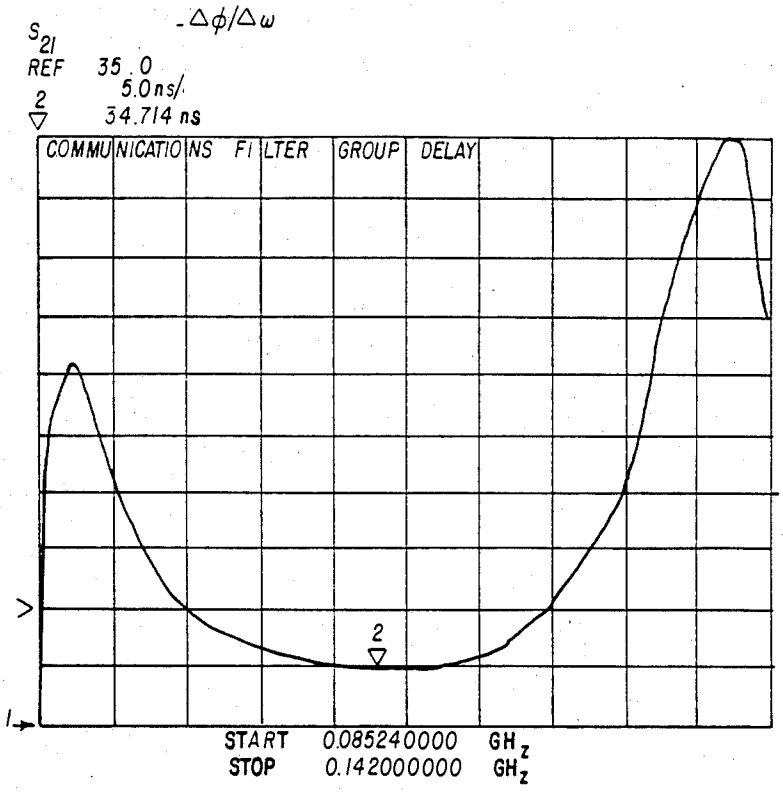

S21 8 M ∠
REF 0.0°
1.0°/
-693.2/ m°
ELECTRICAL DELAY
678.15 ps
203.3 mm
1301
1302
START 2.500000000 GHz
STOP 4.000000000 GHz

FIG 14



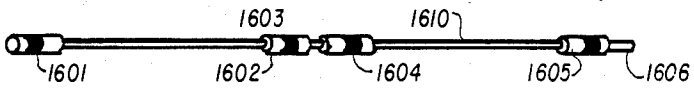


FIG 16

FIG 15

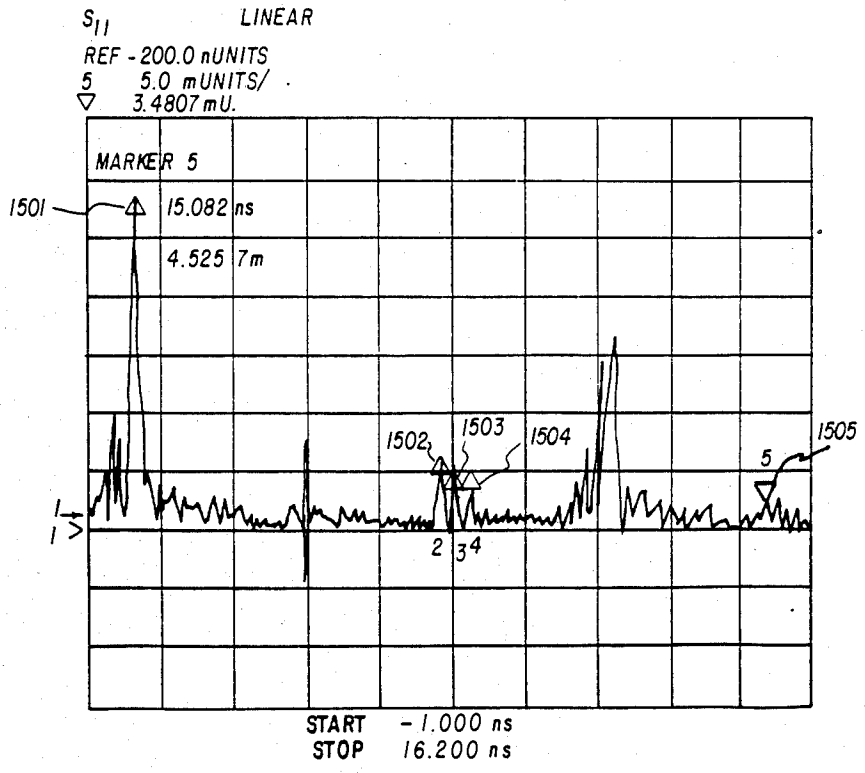


FIG 17

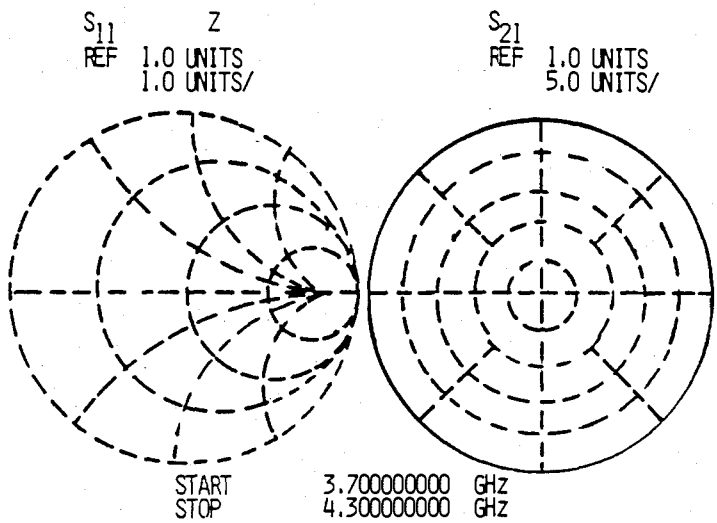
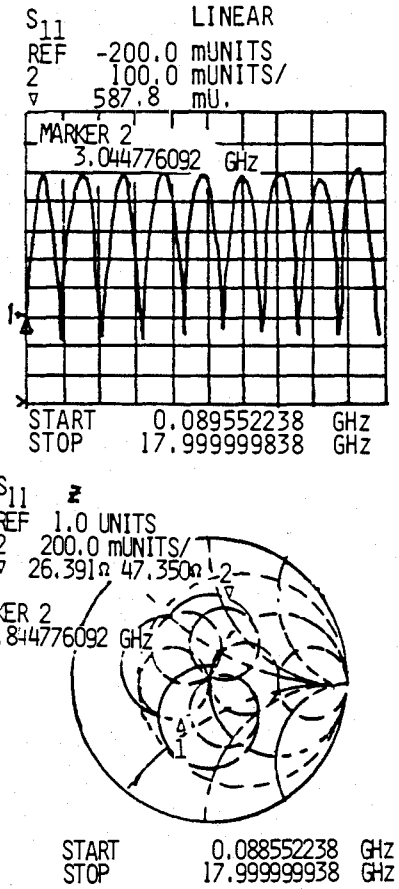
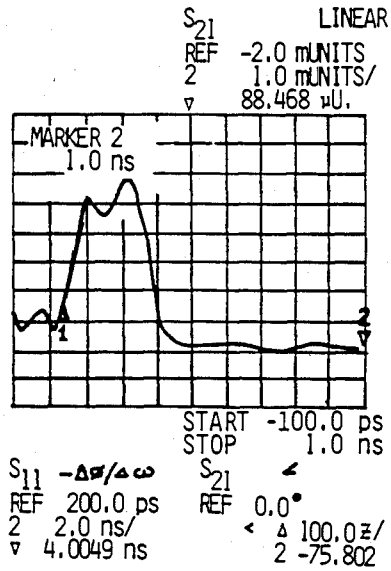
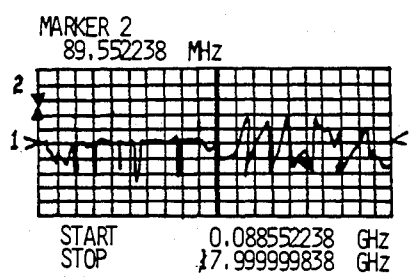

S11 Z
REF 1.0 UNITS
1.0 UNITS/
S21
REF 1.0 UNITS
5.0 UNITS/
START 3.700000000 GHz
STOP 4.300000000 GHz

FIG 18


S11 LINEAR
REF -200.0 mUNITS
2 100.0 mUNITS/
▽ 587.8 mU.
MARKER 2
3.044776092 GHz
START 0.089552238 GHz
STOP 17.999999838 GHz
S11 Z
REF 1.0 UNITS
2 200.0 mUNITS/
▽ 26.391Ω 47.350Ω
MARKER 2
3.844776092 GHz
START 0.088552238 GHz
STOP 17.999999938 GHz


S21 LINEAR
REF -2.0 mUNITS
2 1.0 mUNITS/
▽ 88.468 µU.
MARKER 2
1.0 ns
START -100.0 ps
STOP 1.0 ns
S11 -Δφ/Δω
REF 200.0 ps
2 2.0 ns/
▽ 4.0049 ns
S21
REF 0.0°
< Δ 100.0 z/
2 -75.802


MARKER 2
89.552238 MHz
START 0.088552238 GHz
STOP 17.999999838 GHz

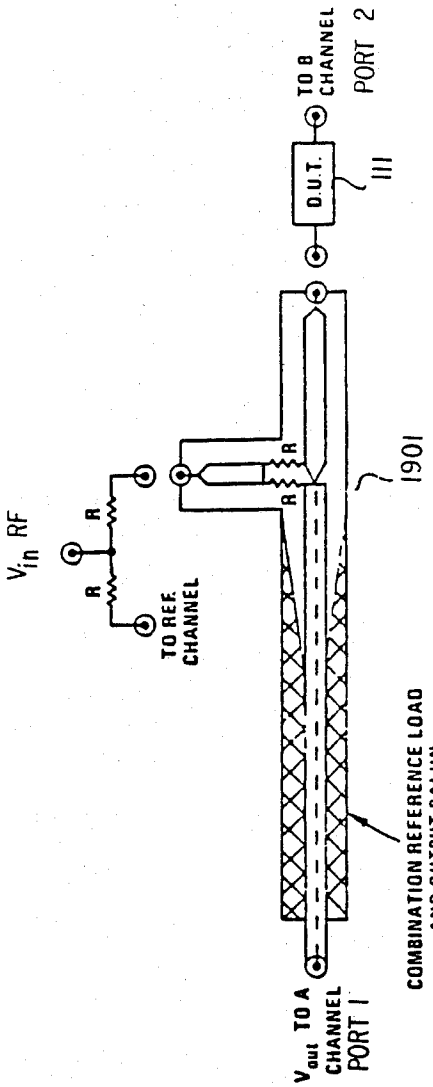


FIG 19B

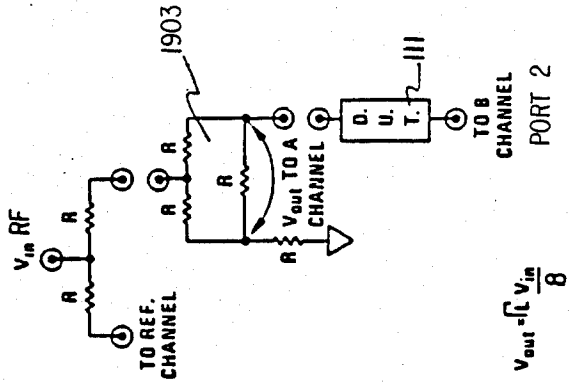


FIG 19A

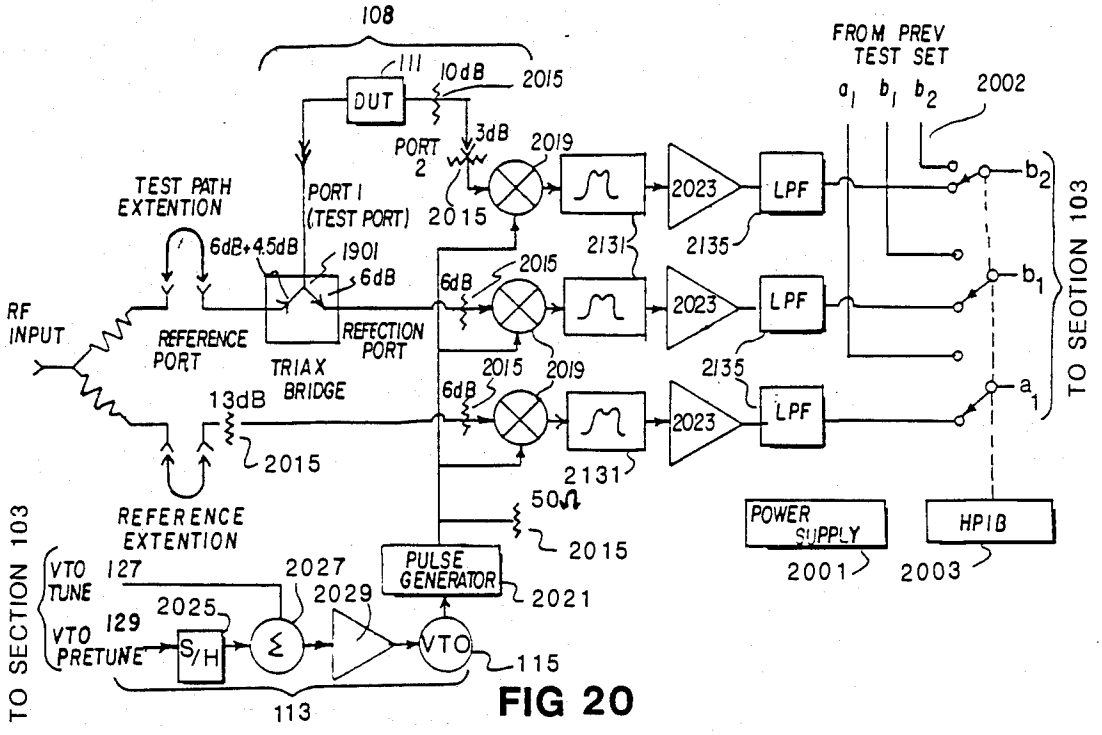

108
111
DUT
10dB
2015
3dB
PORT 2
PORT 1 (TEST PORT)
TEST PATH EXTENTION
6dB+4.5dB
1901
6dB
RF INPUT
REFERENCE PORT
REFECTION PORT
TRIAX BRIDGE
13dB
2015
REFERENCE EXTENTION
2019
2023
LPF
2131
2135
FROM PREV TEST SET
a_1 b_1 b_2
2002
b_2
b_1
a_1
TO SEOTION 103
50Ω
PULSE GENERATOR
2021
POWER SUPPLY
2001
HPIB
2003
TO SECTION 103
VTO TUNE
127
VTO PRETUNE
129
2025
S/H
2027
2029
VTO
115
113

FIG 20

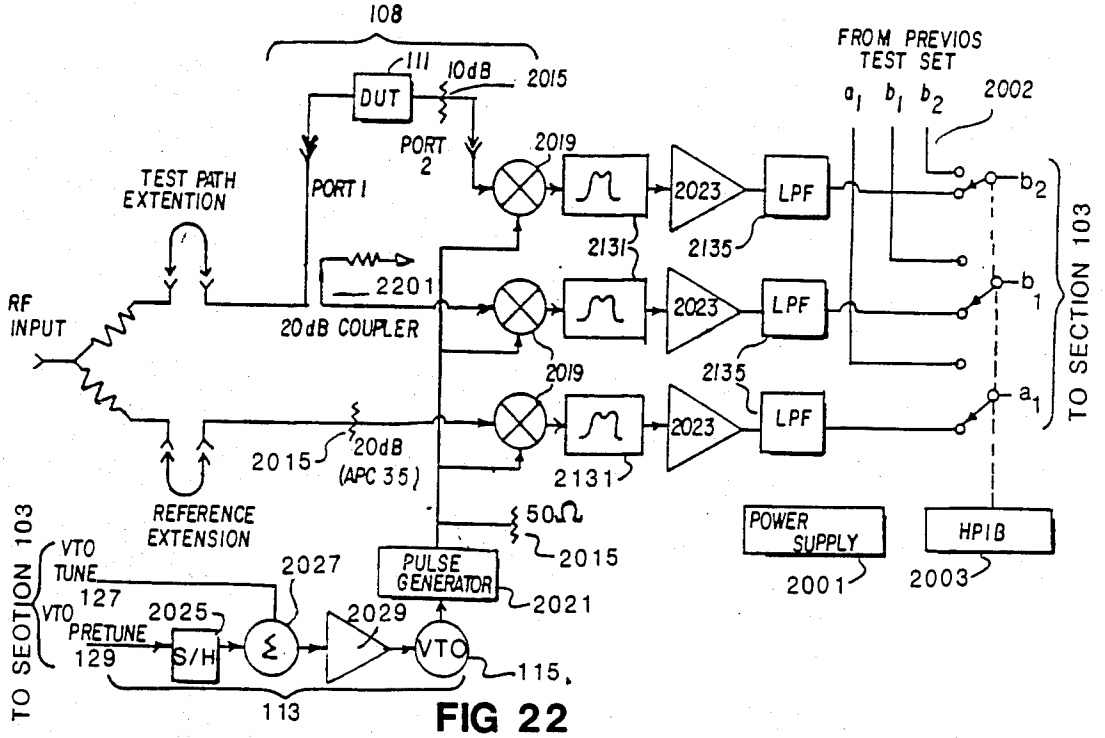

108
111
DUT
10dB
2015
PORT 2
PORT 1
TEST PATH EXTENTION
2019
2023
LPF
2131
2135
FROM PREVIOS TEST SET
a_1 b_1 b_2
2002
b_2
b_1
a_1
TO SECTION 103
2201
20dB COUPLER
RF INPUT
2015
20dB (APC 35)
REFERENCE EXTENSION
50Ω
PULSE GENERATOR
2021
POWER SUPPLY
2001
HPIB
2003
TO SEOTION 103
VTO TUNE
127
VTO PRETUNE
129
2025
S/H
2027
2029
VTO
115
113

FIG 22

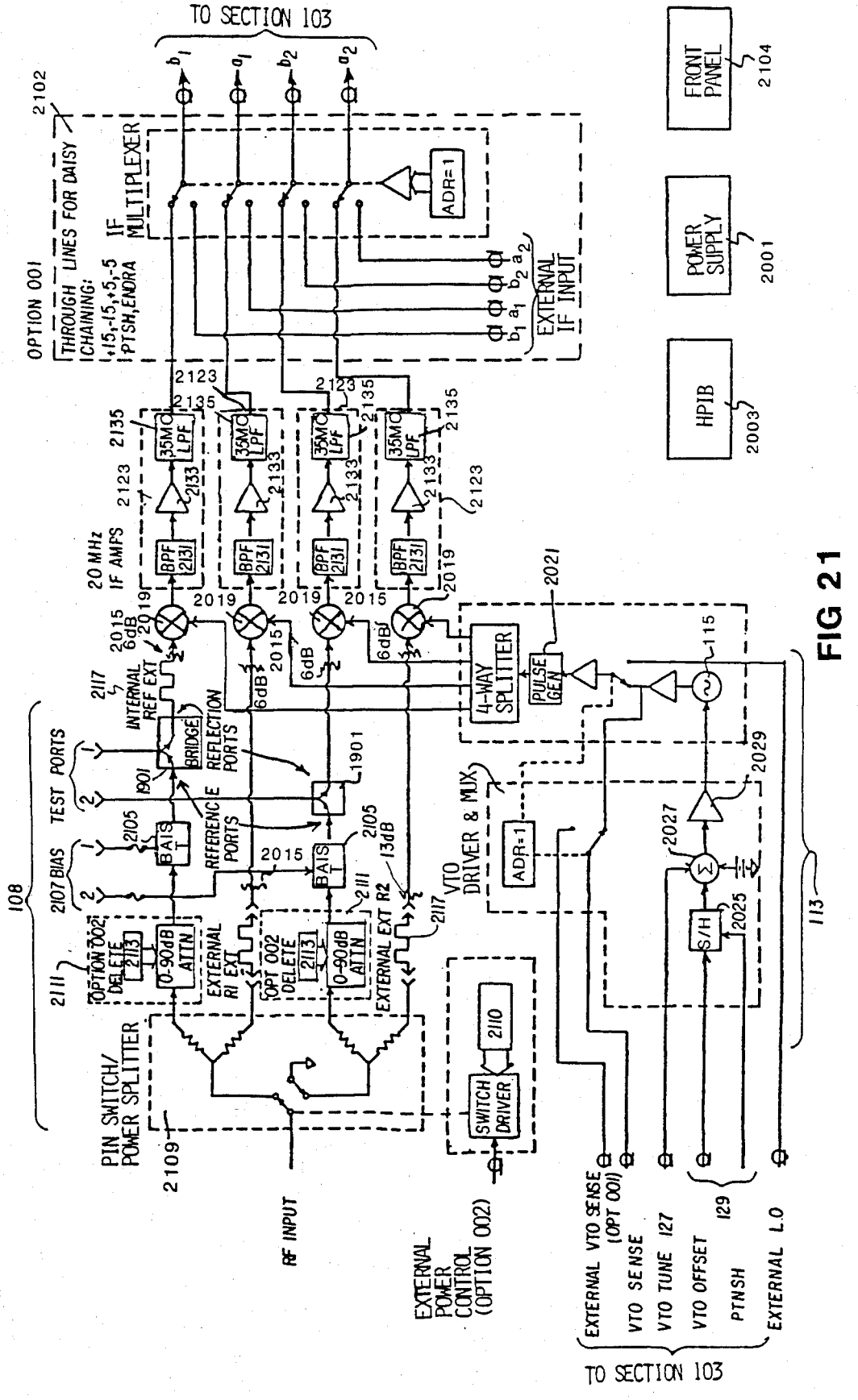

TO SECTION 103
OPTION 001
THROUGH LINES FOR DAISY CHAINING: +15,-15,+5,-5 PTSH,ENDRA
IF MULTIPLEXER
ADR=1
EXTERNAL IF INPUT
FRONT PANEL
POWER SUPPLY
HPIB
20 MHz IF AMPS
35MC LPF
BPF
6dB
4-WAY SPLITTER
PULSE GEN
INTERNAL REF EXT
BRIDGE
REFLECTION PORTS
REFERENCE PORTS
TEST PORTS
BIAS T
0-90dB ATTN
OPTION 002 DELETE
EXTERNAL REF EXT
EXTERNAL REF R2
13dB
VTO DRIVER & MUX
S/H
PIN SWITCH/ POWER SPLITTER
SWITCH DRIVER
RF INPUT
EXTERNAL POWER CONTROL (OPTION 002)
EXTERNAL VTO SENSE (OPT 001)
VTO SENSE
VTO TUNE
VTO OFFSET
PTNSH
EXTERNAL LO
TO SECTION 103

FIG 21

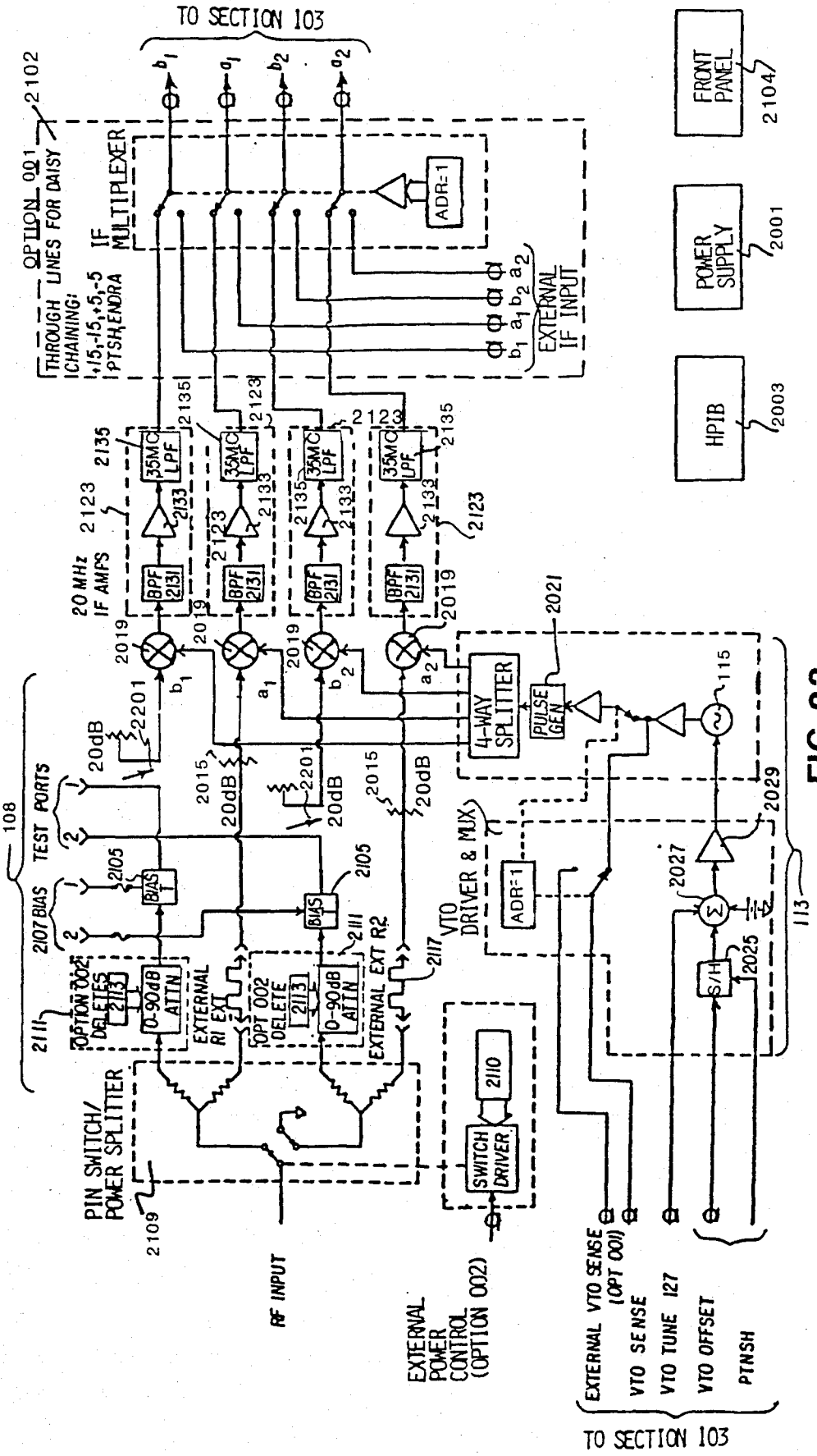

TO SECTION 103
OPTION 001
2102
THROUGH LINES FOR DAISY CHAINING:
+15,-15,+5,-5 PTSH,ENDRA
IF MULTIPLEXER
ADR=1
EXTERNAL IF INPUT
FRONT PANEL
2104
POWER SUPPLY
2001
HPIB
2003
20 MHz IF AMPS
2123
35MC LPF
2133
BPF
2131
2019
2201
20dB
2015
4-WAY SPLITTER
PULSE GEN
2021
115
108
TEST PORTS
2107 BIAS
2105
BIAS
OPTION 002 DELETES
2113
0-90dB ATTN
EXTERNAL RI EXT
OPT 002 DELETE
EXTERNAL EXT R2
2111
2117
VTO DRIVER & MUX
2029
2027
2025
S/H
113
PIN SWITCH/ POWER SPLITTER
2109
2110
SWITCH DRIVER
RF INPUT
EXTERNAL POWER CONTROL (OPTION 002)
EXTERNAL VTO SENSE (OPT 001)
VTO SENSE
VTO TUNE 127
VTO OFFSET
PTNSH
TO SECTION 103

FIG 23

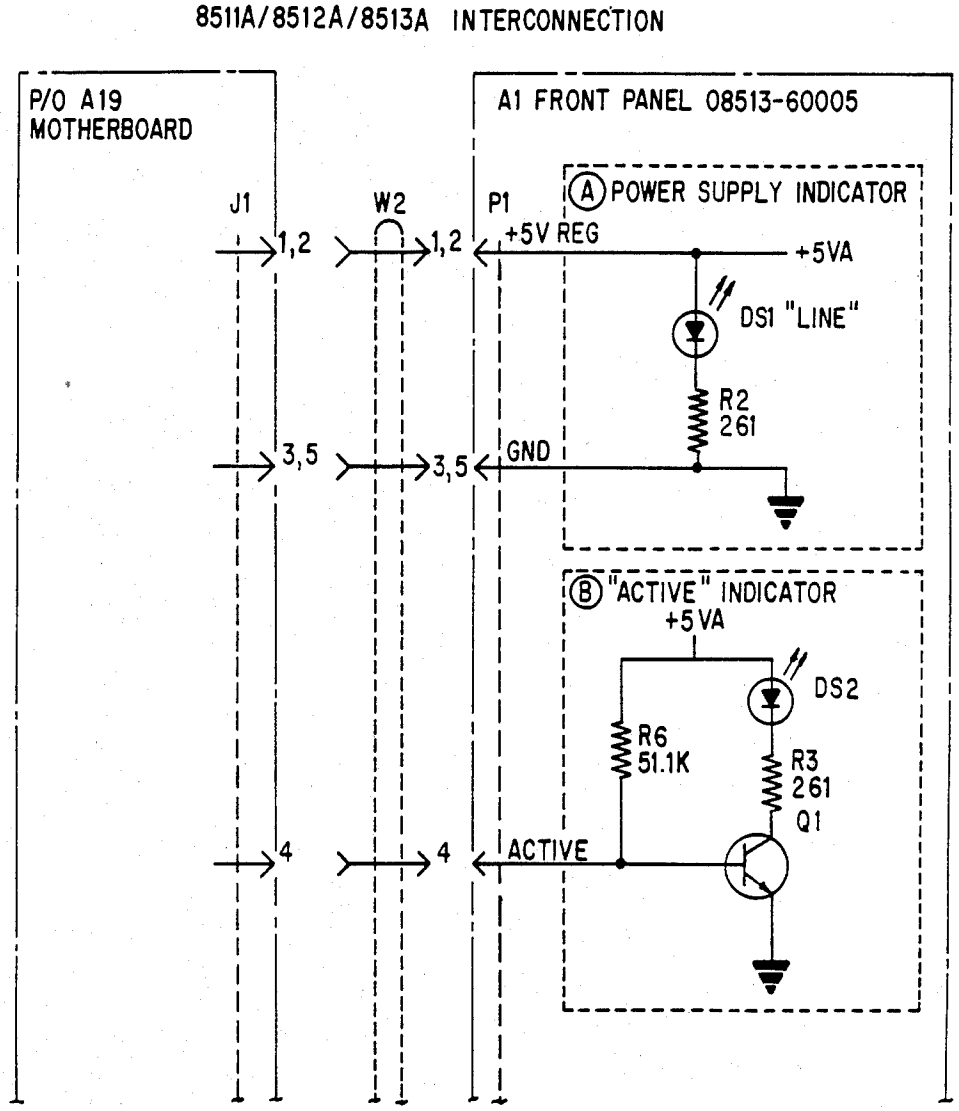

8511A/8512A/8513A INTERCONNECTION
P/O A19
MOTHERBOARD
A1 FRONT PANEL 08513-60005
J1
W2
P1
1,2
1,2
+5V REG
A POWER SUPPLY INDICATOR
+5VA
DS1 "LINE"
R2
261
3,5
3,5
GND
B "ACTIVE" INDICATOR
+5VA
DS2
R6
51.1K
R3
261
Q1
4
4
ACTIVE

FIG. 24.1A

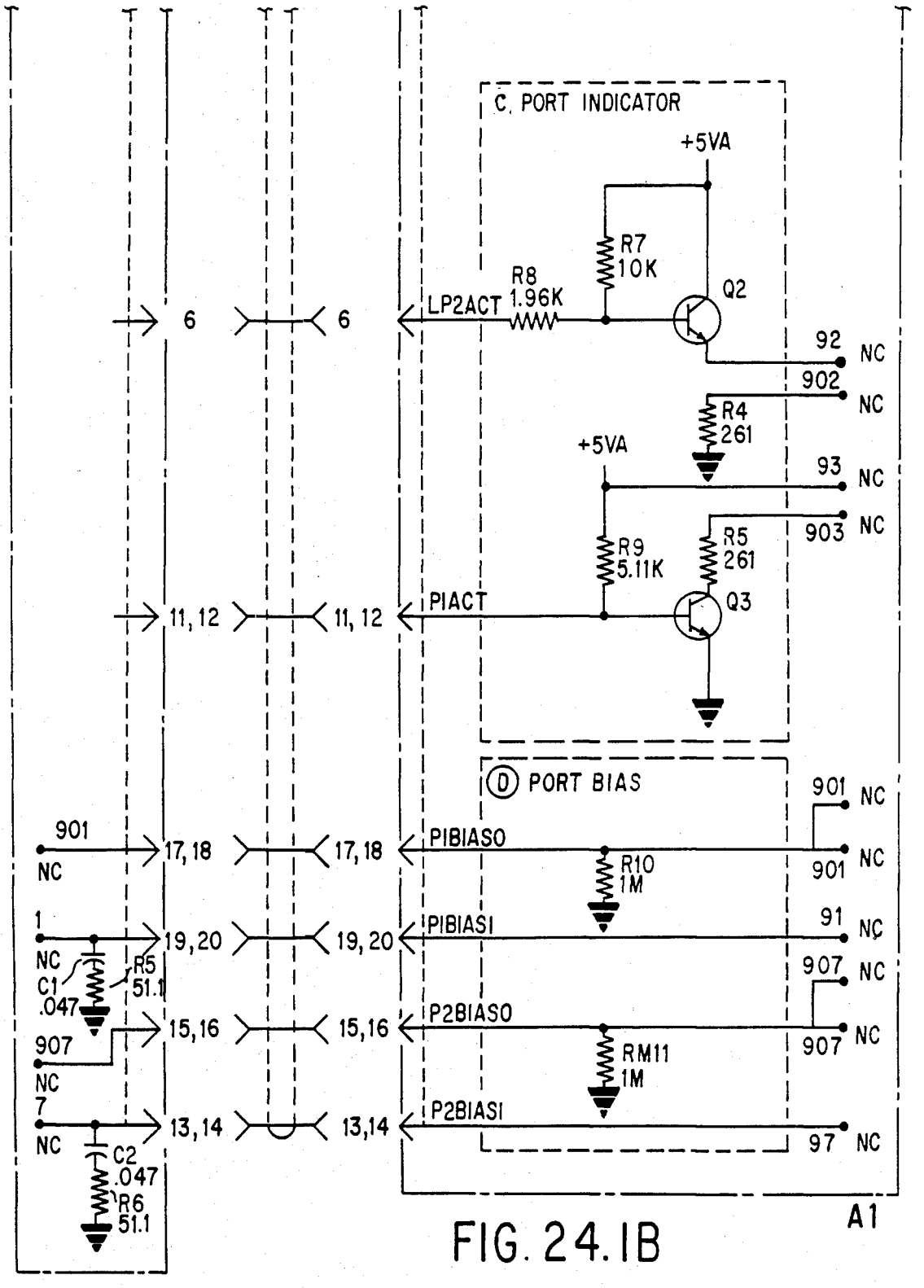

C. PORT INDICATOR
+5VA
R7
10K
R8
1.96K
Q2
LP2ACT
6
6
92
NC
902
NC
R4
261
+5VA
93
NC
903
NC
R9
5.11K
R5
261
Q3
PIACT
11, 12
11, 12
D PORT BIAS
901
NC
901
NC
PIBIASO
R10
1M
17, 18
17, 18
PIBIASI
91
NC
19, 20
19, 20
907
NC
P2BIASO
RM11
1M
15, 16
15, 16
907
NC
P2BIASI
97
NC
13, 14
13, 14
A1
C1
.047
R5
51.1
C2
.047
R6
51.1

FIG. 24.1B

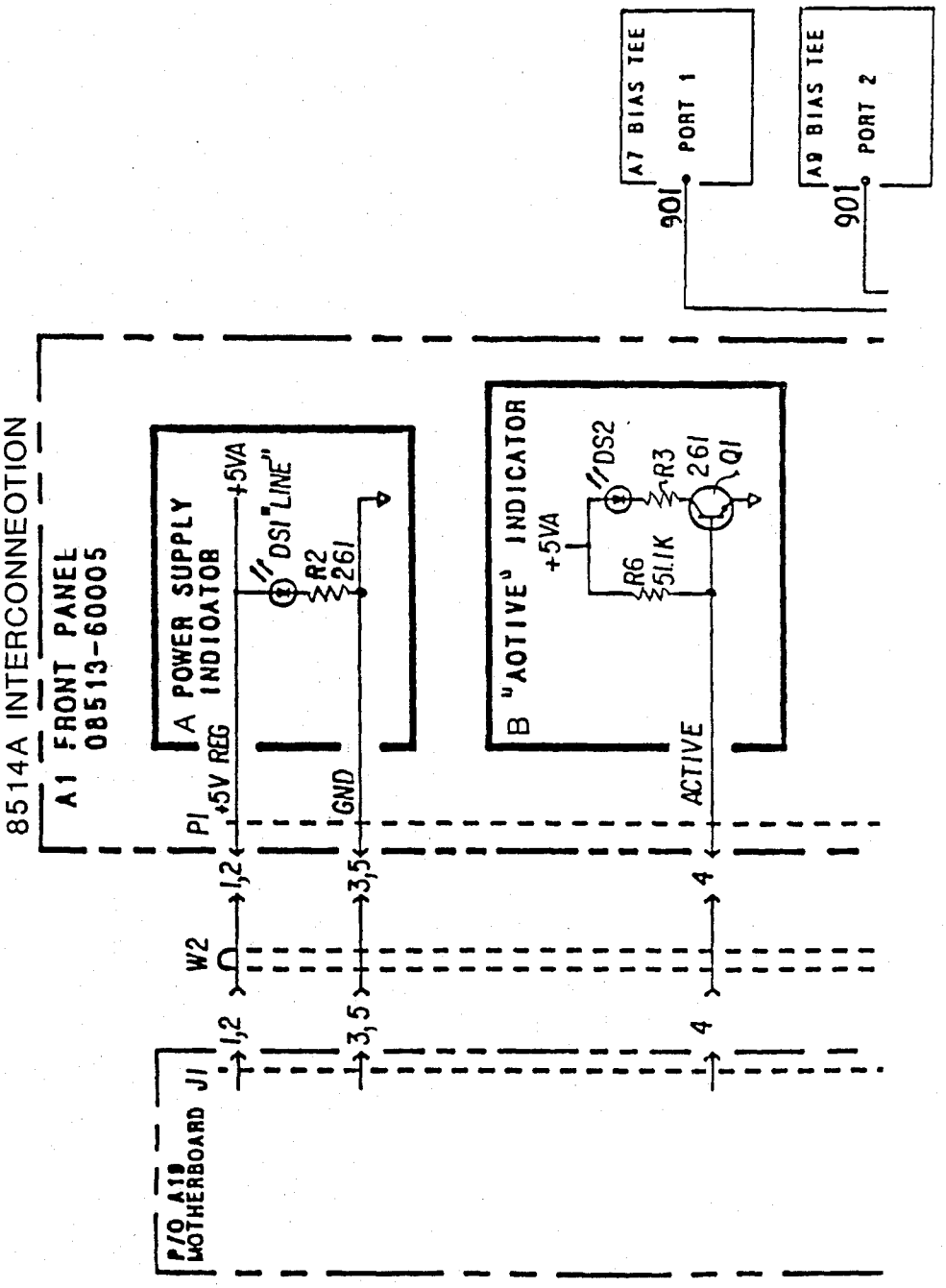

8514A INTERCONNEOTION
A1 FRONT PANEL
08513-60005
A POWER SUPPLY
INDIOATOR
+5V REG
+5VA
DSI "LINE"
R2
261
GND
B "AOTIVE" INDICATOR
+5VA
DS2
R3
261
Q1
R6
511K
ACTIVE
A7 BIAS TEE
PORT 1
901
A9 BIAS TEE
PORT 2
901
P1
1,2
3,5
4
W2
P/O A18
MOTHERBOARD J1
1,2
3,5
4

FIG 24.2A

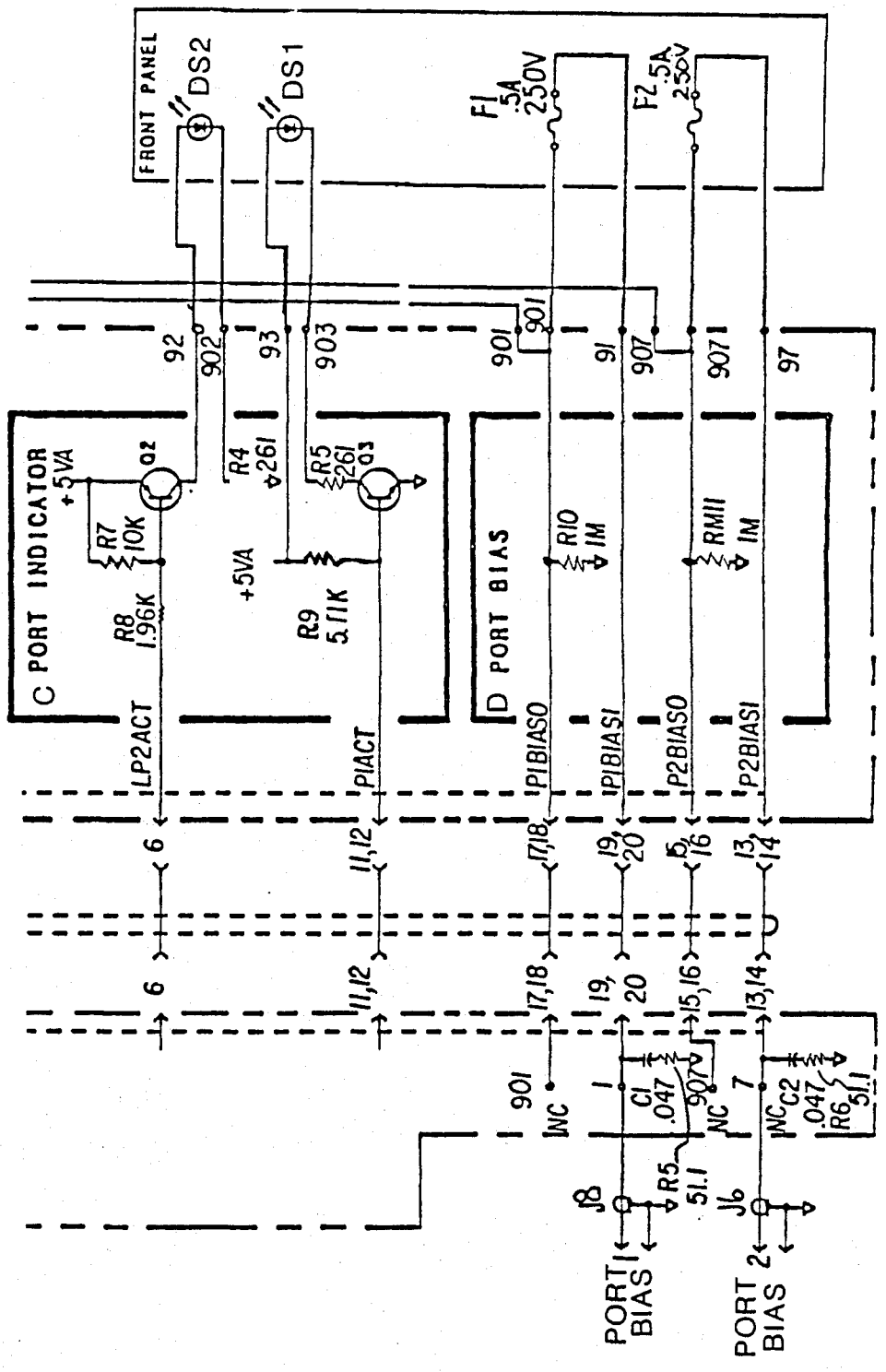

FRONT PANEL
DS2
DS1
F1 .5A 250V
F2 .5A 250V
C PORT INDICATOR
+5VA
Q2
Q3
R7 10K
R8 1.96K
R4 261
R5 261
R9 5.11K
D PORT BIAS
R10 1M
RM11 1M
LP2ACT
P1ACT
P1BIAS0
P1BIAS1
P2BIAS0
P2BIAS1
92
902
93
903
901
91
907
97
C1 .047
C2 .047
R6 5.1
R5 51.1
J8
J6
PORT 1 BIAS
PORT 2 BIAS
NC

FIG 24.2B

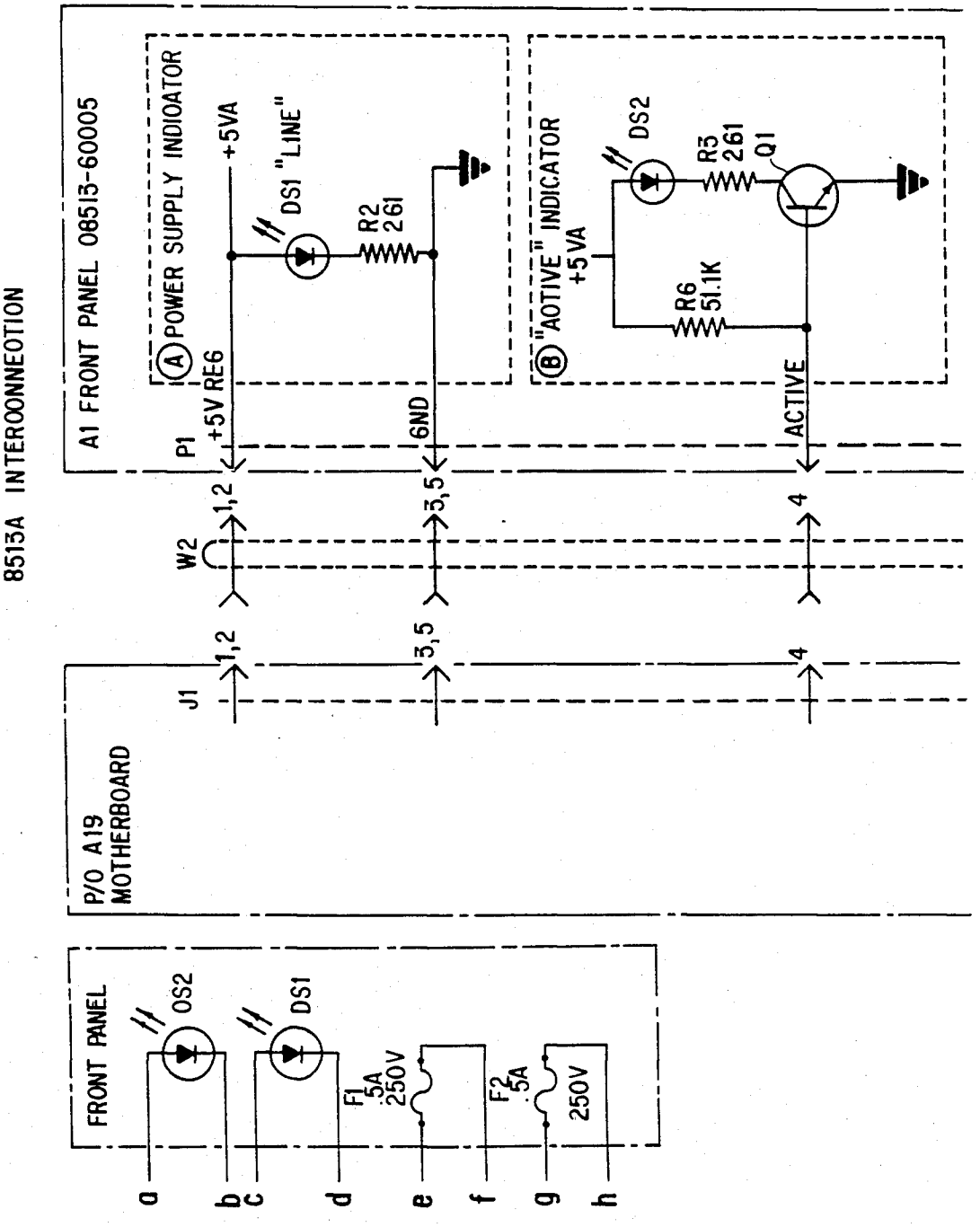

8513A INTEROONNEOTION
A1 FRONT PANEL 08513-60005
A POWER SUPPLY INDIOATOR
+5VA
DS1 "LINE"
R2 261
P1
+5V RE6
6ND
B "AOTIVE" INDICATOR
+5VA
DS2
R3 261
Q1
R6 5I.1K
ACTIVE
W2
1,2
3,5
4
J1
P/O A19 MOTHERBOARD
FRONT PANEL
OS2
DS1
F1 .5A 250V
F2 .5A 250V
a
b
c
d
e
f
g
h

FIG. 24.3A

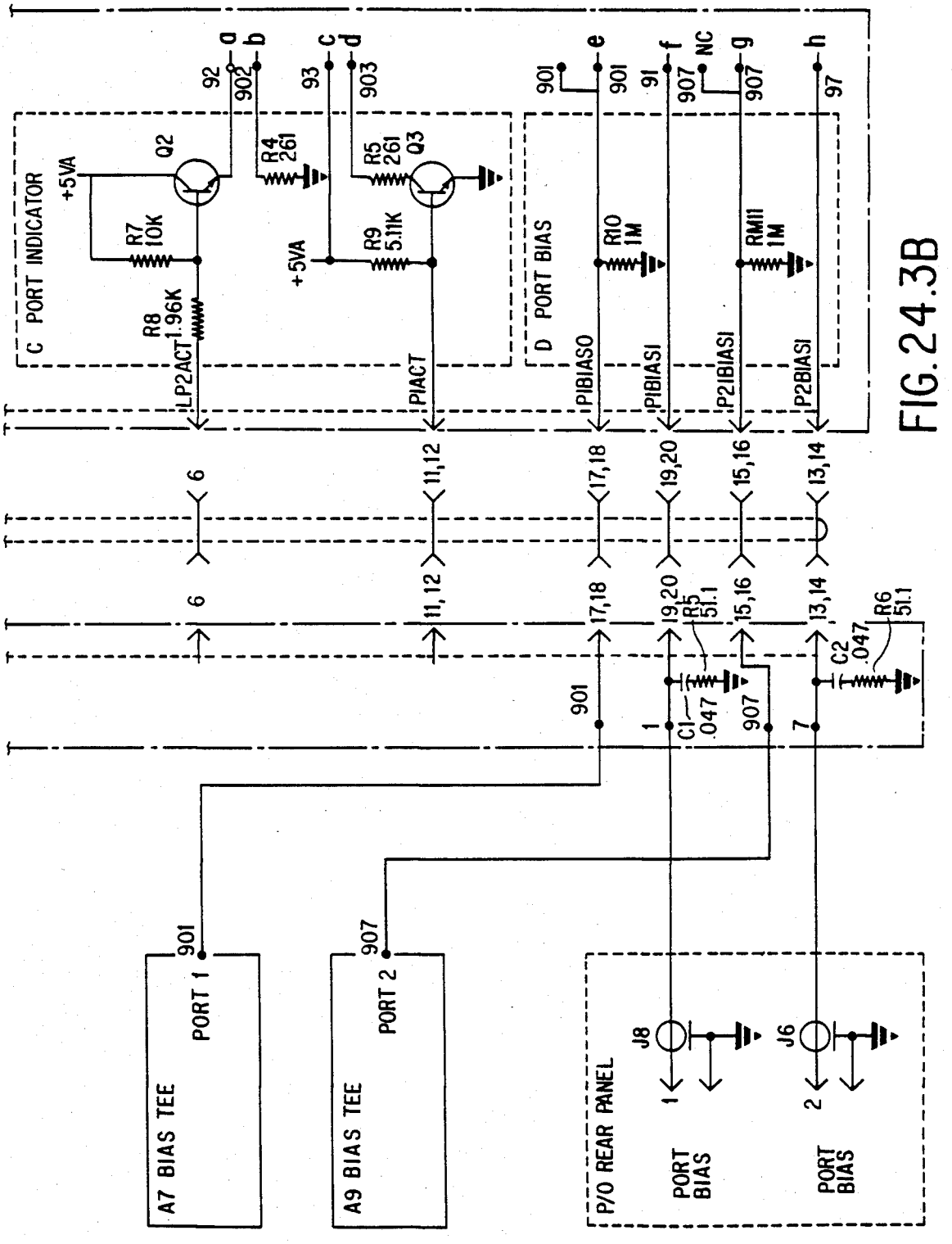

C PORT INDICATOR
+5VA
Q2
R7 10K
R8 1.96K
LP2ACT
R4 261
92
902
a
b
93
903
c
d
+5VA
R5 261
Q3
R9 5.11K
PIACT
D PORT BIAS
901
e
R10 1M
PIBIASO
901
91
f
PIBIASI
907
NC
RM11 1M
P2IBIASI
907
g
97
h
P2BIASI
6
11,12
17,18
19,20
15,16
13,14
R5 51.1
C1 .047
R6 51.1
C2 .047
1
7
A7 BIAS TEE
PORT 1
A9 BIAS TEE
PORT 2
P/O REAR PANEL
J8
J6
PORT BIAS
PORT BIAS

FIG. 24.3B

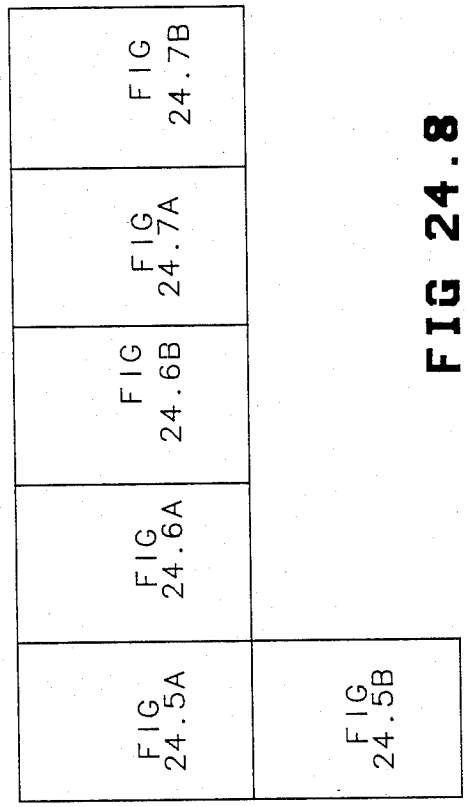


FIG 24.8

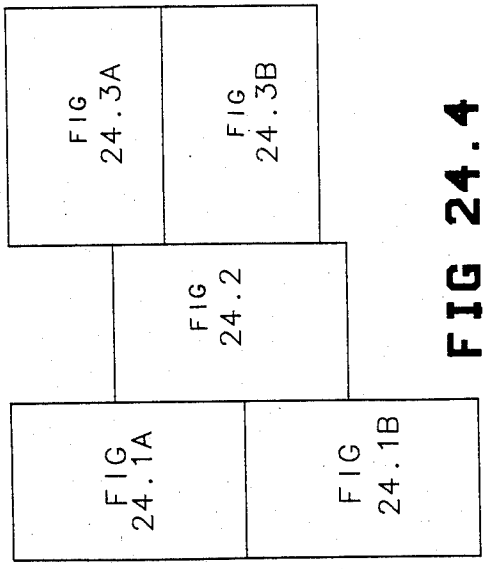


FIG 24.4

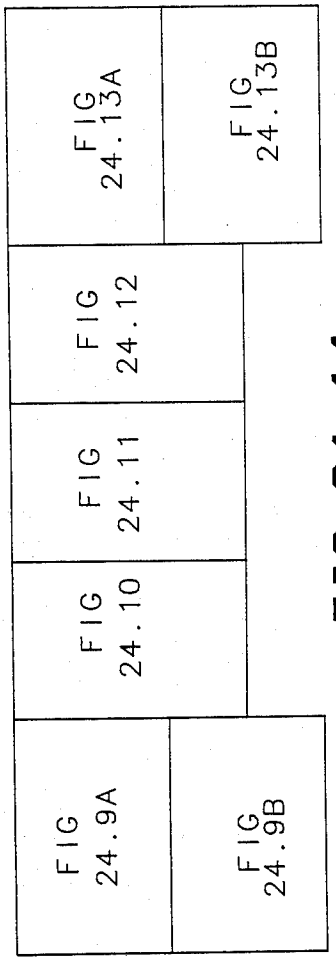


FIG 24.14

FIG. 24.5A

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 23			
2 24	IF1 IF2	NC NC	B
3 25			
4 26			
5 27	LBIOS	A4	A
6 28	PNON	A15	B
7 29	AB0	A4	A
8 30	AB1 AB2	A4 A4	A
9 31	AB3 AB4	A4 A4	A
10 32	+15V REG	A15	G
11 33	GND	GND BUS	G
12 34	GND	GND BUS	G
13 35	-15V REG	A15	G
14 36	+5V REG	A15	G
15 37	DB0 DB1	A4 A4	B
16 38	DB2 DB3	A4 A4	B
17 39			
18 40	DB6 DB7	A4 A4	B
19 41			
20 42	IF NUX	A3	A
21 43			
22 44			

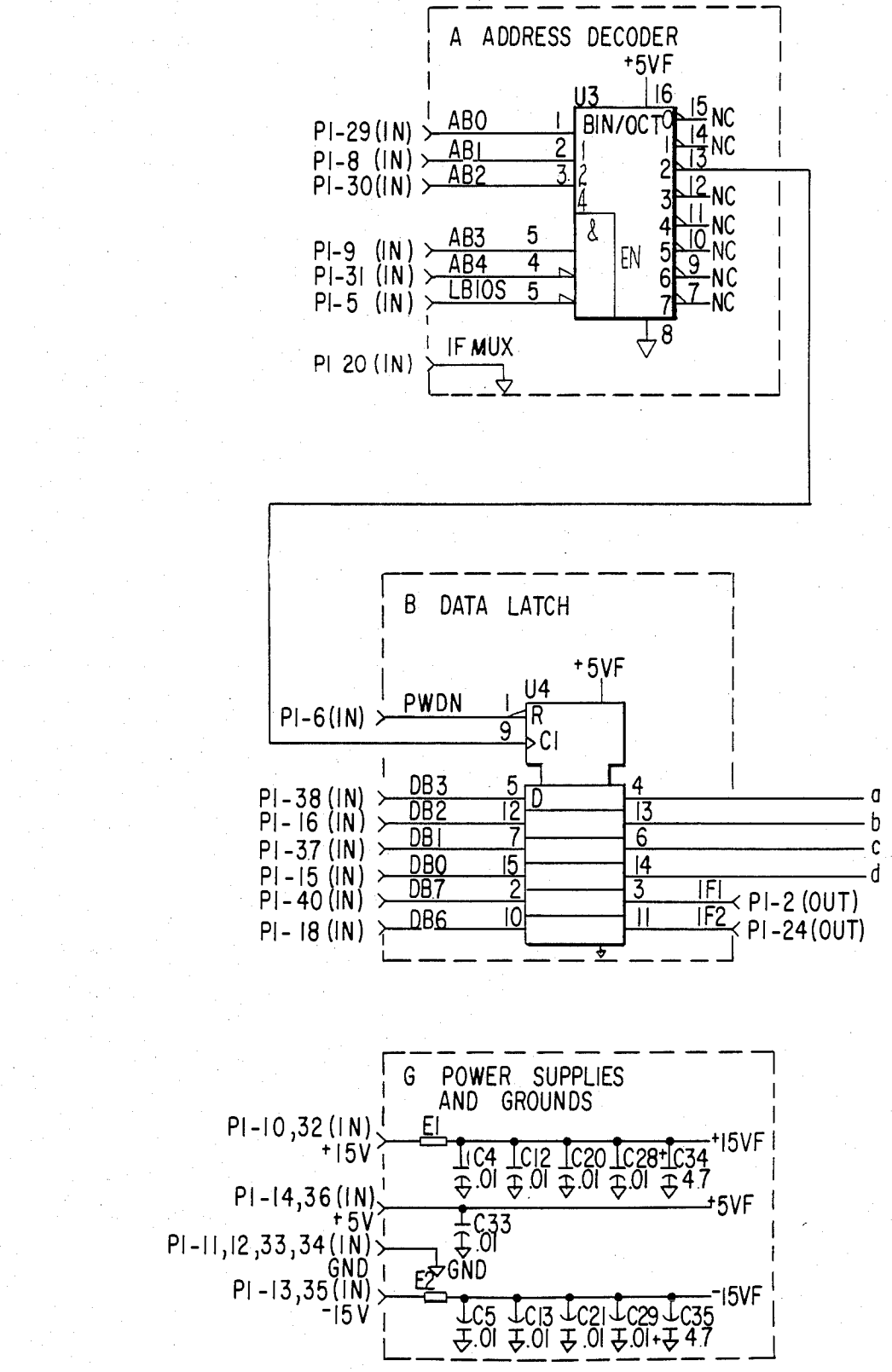

A ADDRESS DECODER
+5VF
U3
BIN/OCT
PI-29(IN)
PI-8 (IN)
PI-30(IN)
PI-9 (IN)
PI-31 (IN)
PI-5 (IN)
PI 20 (IN)
AB0
AB1
AB2
AB3
AB4
LBIOS
IF MUX
EN
NC
B DATA LATCH
+5VF
U4
PWDN
PI-6(IN)
R
CI
DB3
DB2
DB1
DB0
DB7
DB6
PI-38 (IN)
PI-16 (IN)
PI-37 (IN)
PI-15 (IN)
PI-40 (IN)
PI-18 (IN)
D
IF1
IF2
PI-2 (OUT)
PI-24(OUT)
G POWER SUPPLIES
AND GROUNDS
PI-10,32 (IN)
+15V
E1
+15VF
C4
C12
C20
C28
C34
.01
4.7
PI-14,36(IN)
+5V
+5VF
C33
PI-11,12,33,34(IN)
GND
GND
E2
PI-13,35(IN)
-15V
-15VF
C5
C13
C21
C29
C35

FIG 24.5B

FIG. 24.6A

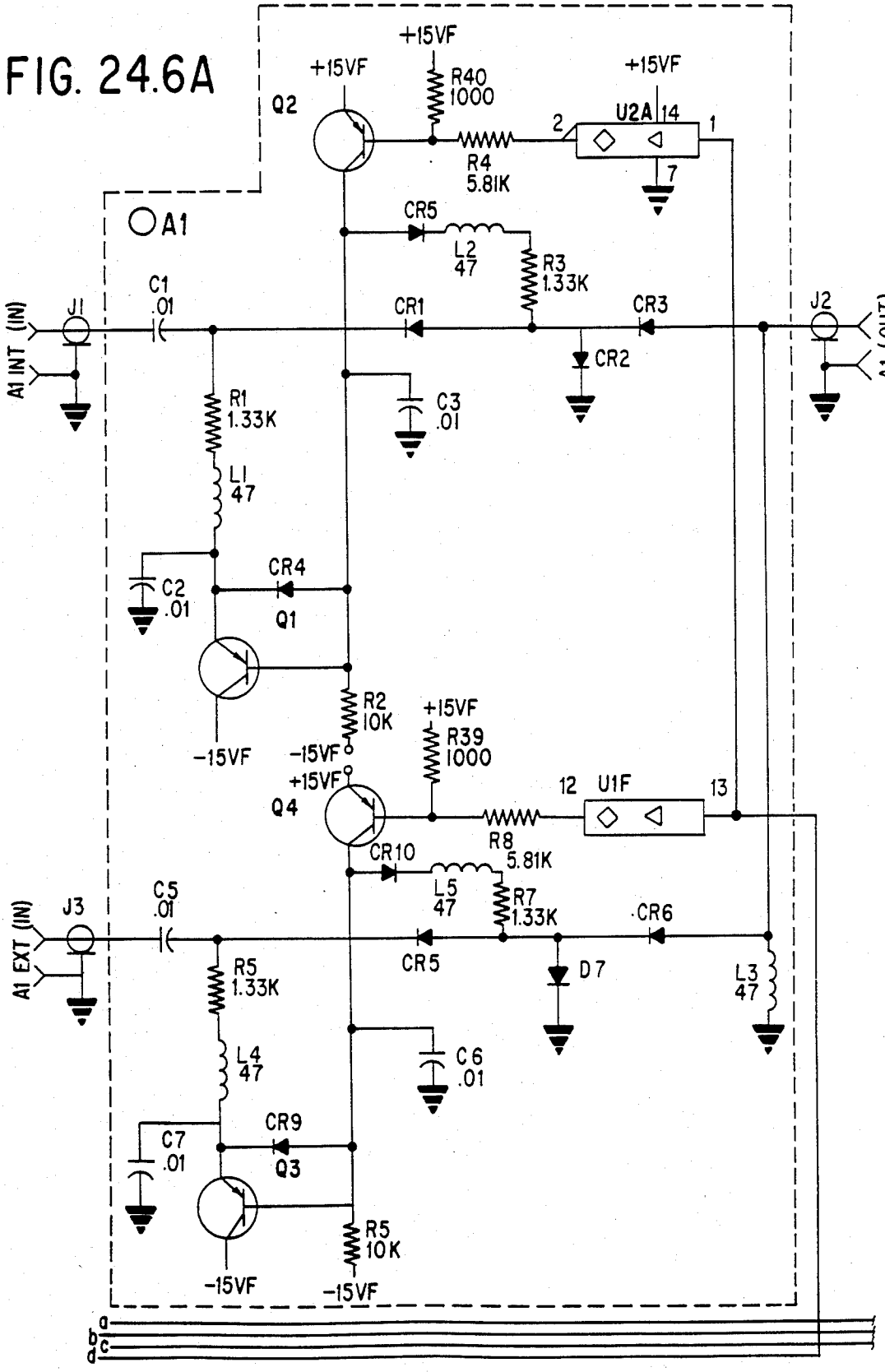

A1
+15VF
+15VF
R40
1000
Q2
+15VF
U2A
14
2
1
7
R4
5.81K
CR5
L2
47
R3
1.33K
C1
.01
J1
A1 INT (IN)
CR1
CR3
J2
A1 (OUT)
CR2
R1
1.33K
C3
.01
L1
47
CR4
C2
.01
Q1
R2
10K
-15VF
-15VF
+15VF
R39
1000
+15VF
Q4
12
U1F
13
R8
5.81K
CR10
L5
47
R7
1.33K
C5
.01
J3
A1 EXT (IN)
CR6
CR5
D7
L3
47
R5
1.33K
L4
47
C6
.01
CR9
C7
.01
Q3
R5
10K
-15VF
-15VF
a
b
c
d

FIG. 24.6B

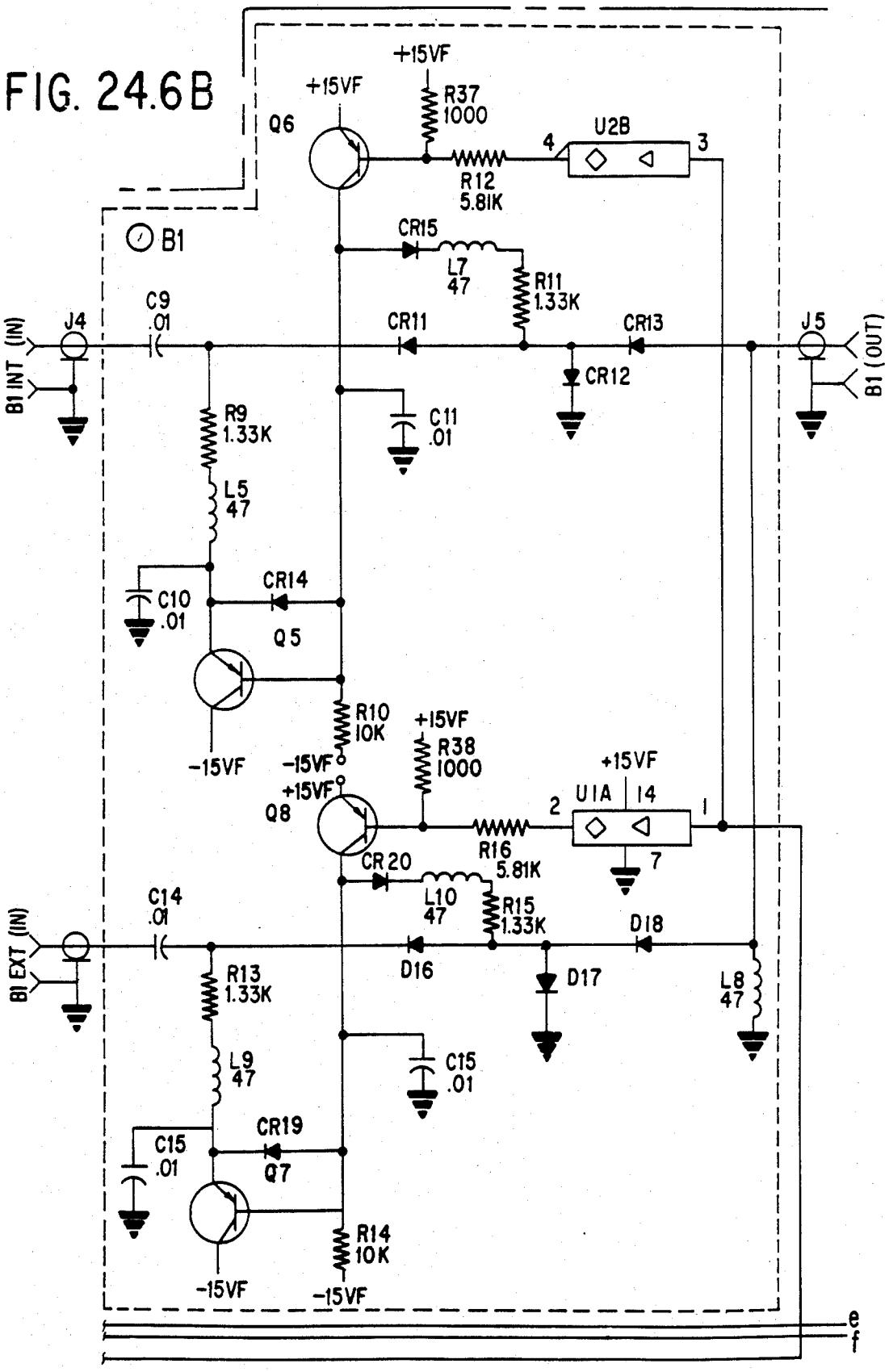

+15VF
+15VF
R37
1000
Q6
U2B
4
3
R12
5.81K
B1
CR15
L7
47
R11
1.33K
C9
.01
J4
CR11
CR13
J5
B1 INT (IN)
B1 (OUT)
CR12
C11
.01
R9
1.33K
L5
47
CR14
C10
.01
Q5
R10
10K
+15VF
R38
1000
-15VF
-15VF
+15VF
+15VF
Q8
U1A
14
2
1
R16
5.81K
7
CR20
L10
47
R15
1.33K
C14
.01
D18
B1 EXT (IN)
D16
D17
L8
47
R13
1.33K
L9
47
C15
.01
CR19
C15
.01
Q7
R14
10K
-15VF
-15VF
e
f

FIG. 24.7A

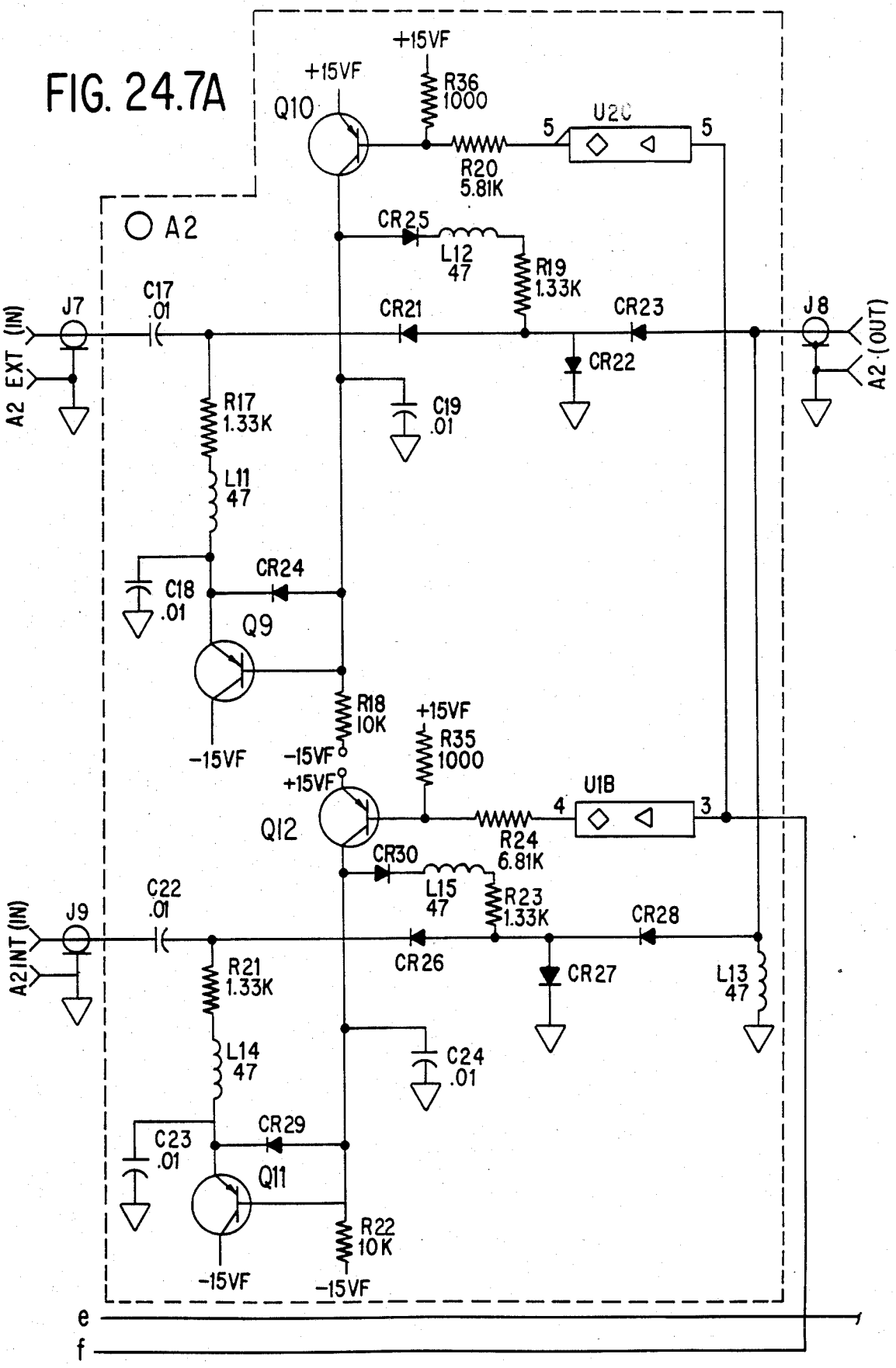

A2
+15VF
+15VF
Q10
R36
1000
U2C
5
5
R20
5.81K
CR25
L12
47
R19
1.33K
C17
.01
J7
A2 EXT (IN)
CR21
CR23
J8
A2 (OUT)
CR22
C19
.01
R17
1.33K
L11
47
CR24
C18
.01
Q9
R18
10K
-15VF
-15VF
+15VF
R35
1000
+15VF
U1B
4
3
Q12
R24
6.81K
CR30
L15
47
R23
1.33K
C22
.01
J9
A2 INT (IN)
CR28
CR26
CR27
L13
47
R21
1.33K
L14
47
C24
.01
CR29
C23
.01
Q11
R22
10K
-15VF
-15VF
e
f

FIG. 24.7B

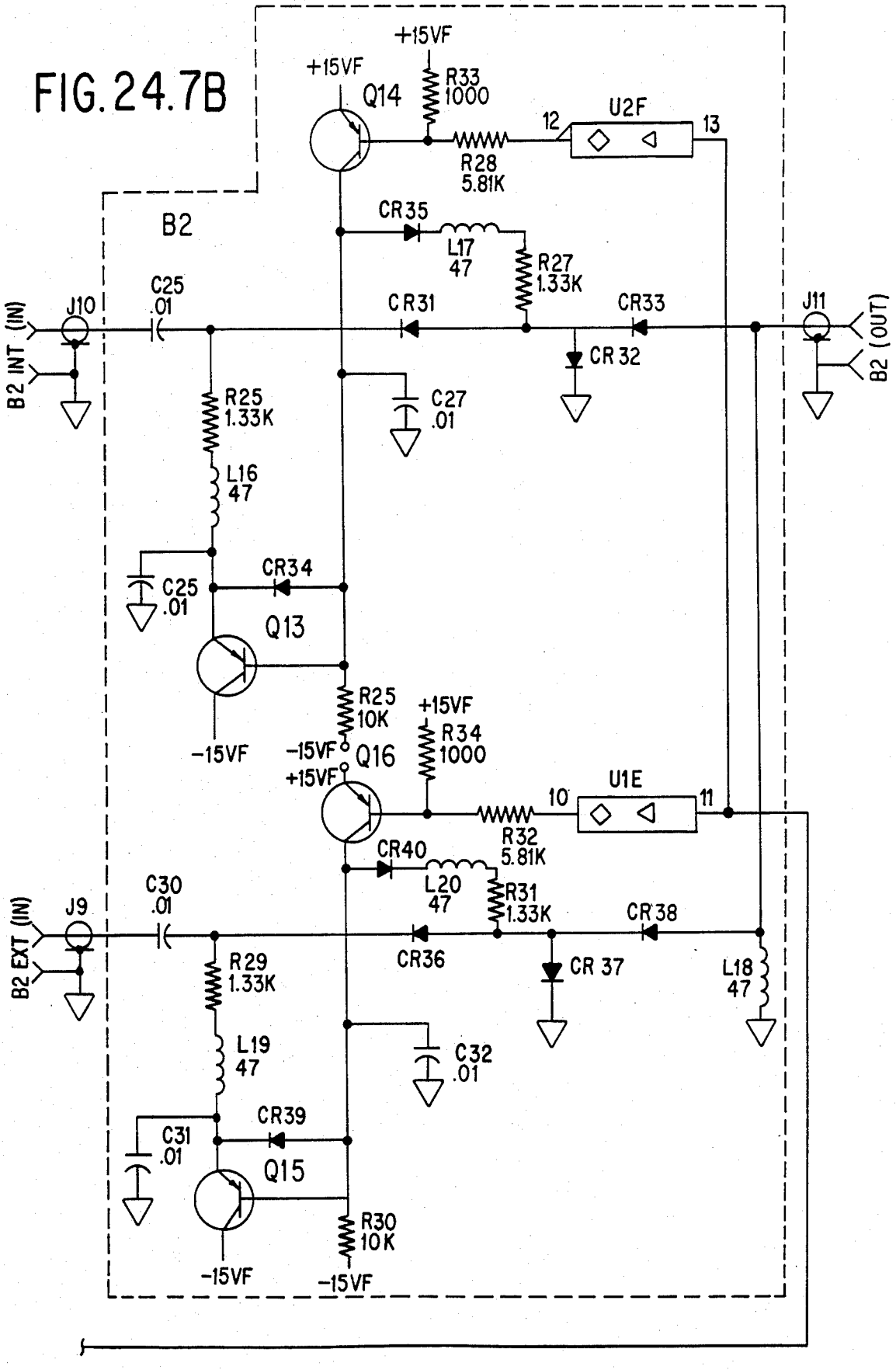
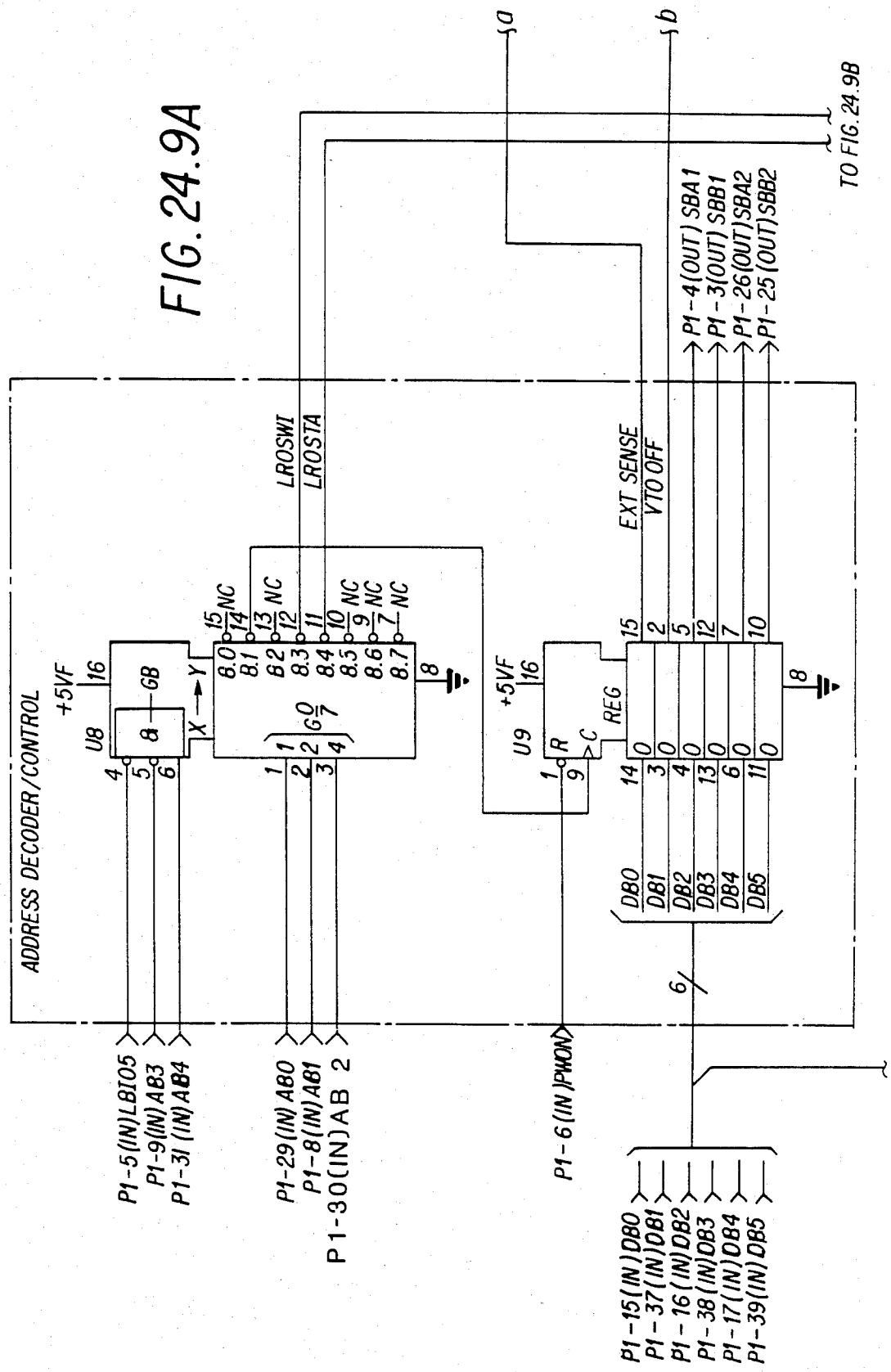

+15VF
+15VF
Q14
R33
1000
U2F
12
13
R28
5.81K
B2
CR35
L17
47
R27
1.33K
C25
.01
J10
CR31
CR33
J11
B2 INT (IN)
B2 (OUT)
CR32
R25
1.33K
C27
.01
L16
47
CR34
C25
.01
Q13
R25
10K
+15VF
R34
1000
-15VF
-15VF
Q16
+15VF
U1E
10
11
R32
5.81K
CR40
L20
47
R31
1.33K
C30
.01
J9
CR38
B2 EXT (IN)
CR36
CR 37
L18
47
R29
1.33K
L19
47
C32
.01
CR39
C31
.01
Q15
R30
10K
-15VF
-15VF

FIG. 24.9A


a
b
TO FIG. 24.9B
ADDRESS DECODER/CONTROL
+5VF
U8
GB
X
Y
LROSWI
LROSTA
EXT SENSE
VTO OFF
U9
REG
P1-4(OUT) SBA1
P1-3(OUT) SBB1
P1-26(OUT)SBA2
P1-25(OUT)SBB2
P1-5(IN)LBIO5
P1-9(IN) AB3
P1-31 (IN)AB4
P1-29(IN) AB0
P1-8(IN)AB1
P1-30(IN)AB 2
P1-6(IN)PWON
P1-15(IN)DB0
P1-37(IN)DB1
P1-16(IN)DB2
P1-38(IN)DB3
P1-17(IN)DB4
P1-39(IN)DB5

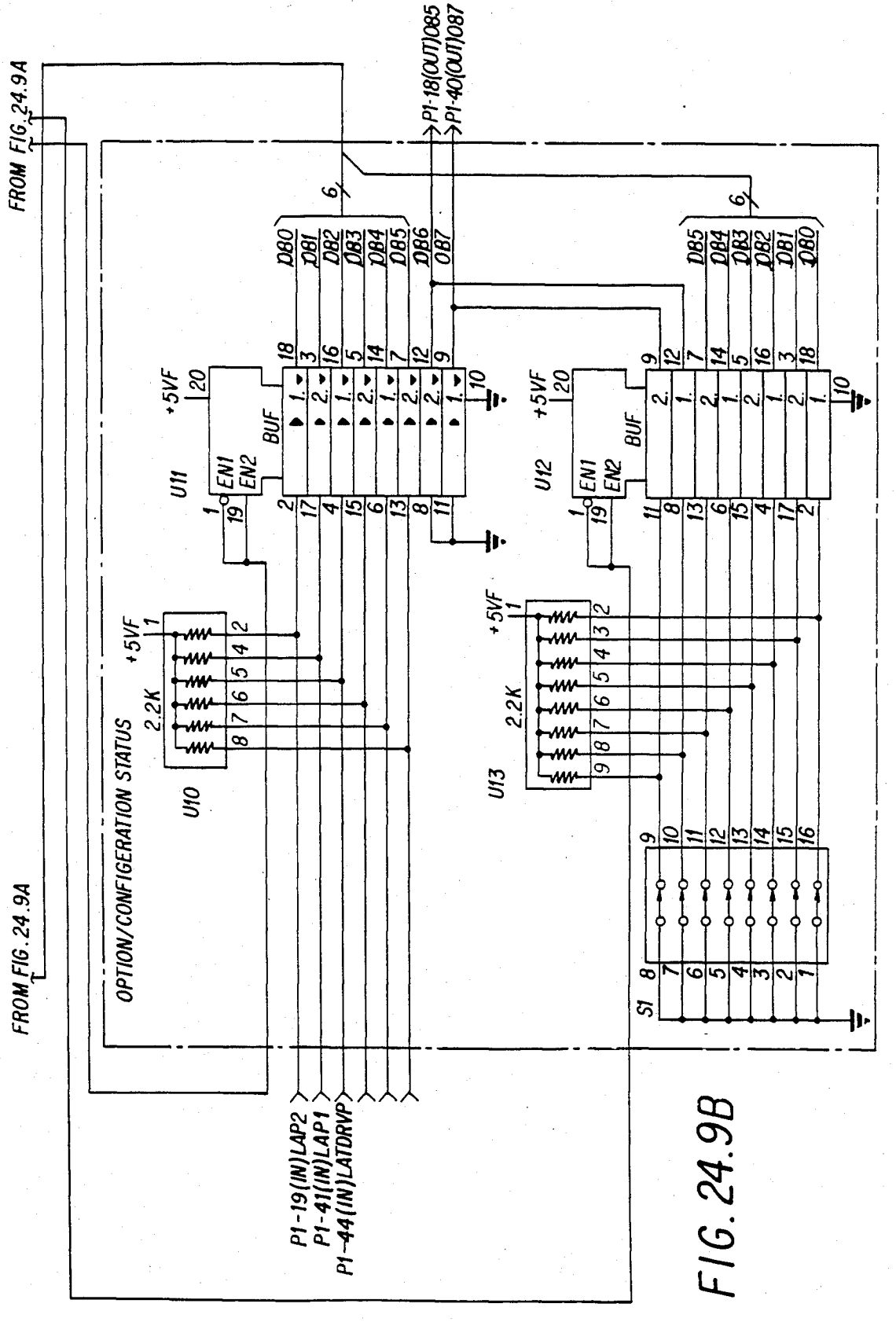

FROM FIG. 24.9A
FROM FIG. 24.9A
P1-18(OUT)085
P1-40(OUT)087
OPTION/CONFIGERATION STATUS
+5VF
2.2K
U10
U11
U12
U13
BUF
EN1
EN2
S1
P1-19(IN)LAP2
P1-41(IN)LAP1
P1-44(IN)LATDRVP

FIG. 24.9B

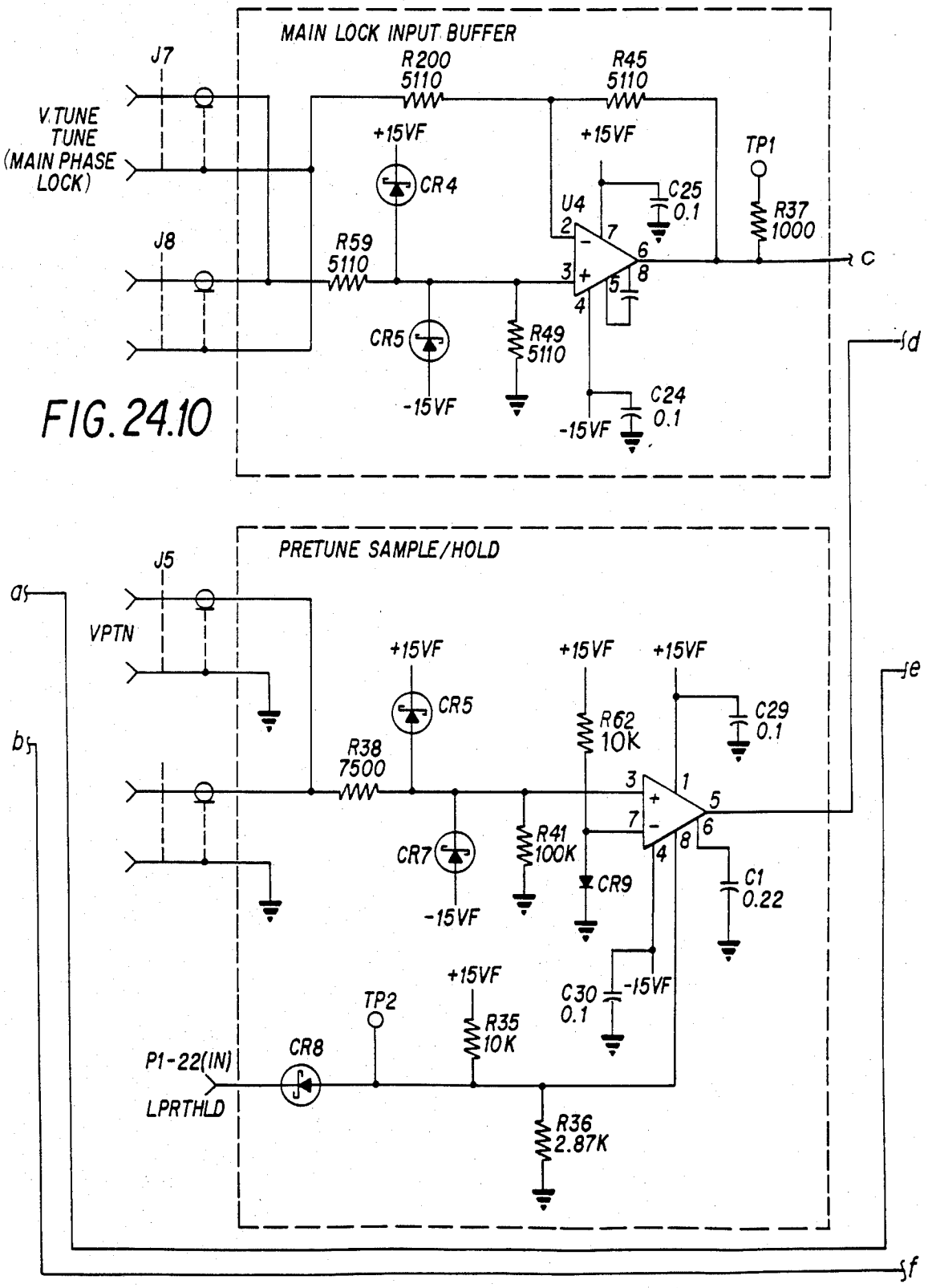

MAIN LOCK INPUT BUFFER
J7
V.TUNE
TUNE
(MAIN PHASE
LOCK)
J8
R200
5110
R45
5110
+15VF
+15VF
CR4
U4
C25
0.1
TP1
R37
1000
R59
5110
C
CR5
R49
5110
-15VF
C24
0.1
-15VF
d
PRETUNE SAMPLE/HOLD
J5
a
VPTN
b
+15VF
+15VF
+15VF
CR5
R62
10K
C29
0.1
e
R38
7500
CR7
R41
100K
CR9
C1
0.22
-15VF
+15VF
TP2
C30
0.1
-15VF
R35
10K
P1-22(IN)
LPRTHLD
CR8
R36
2.87K
f

FIG. 24.10

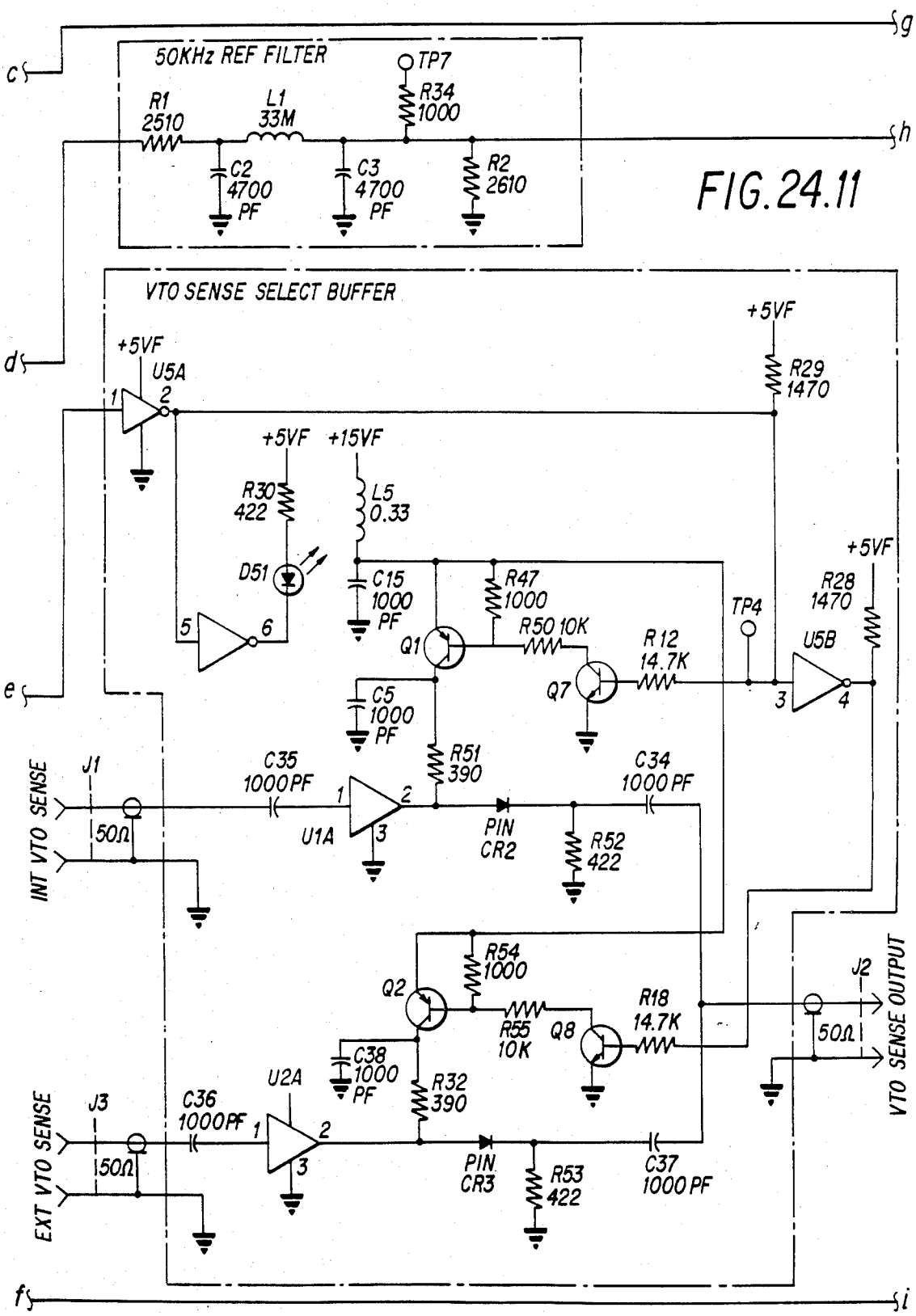

50KHz REF FILTER
TP7
R34 1000
R1 2510
L1 33M
C2 4700 PF
C3 4700 PF
R2 2610
VTO SENSE SELECT BUFFER
+5VF
U5A
R29 1470
+15VF
R30 422
L5 0.33
D51
C15 1000 PF
R47 1000
R50 10K
Q1
Q7
R12 14.7K
TP4
U5B
R28 1470
C5 1000 PF
R51 390
C35 1000PF
U1A
C34 1000 PF
PIN CR2
R52 422
J1
INT VTO SENSE
50Ω
R54 1000
Q2
R55 10K
Q8
R18 14.7K
J2
VTO SENSE OUTPUT
C38 1000 PF
R32 390
U2A
J3
C36 1000PF
EXT VTO SENSE
150Ω
PIN CR3
R53 422
C37 1000 PF
c
d
e
f
g
h
i

FIG. 24.11

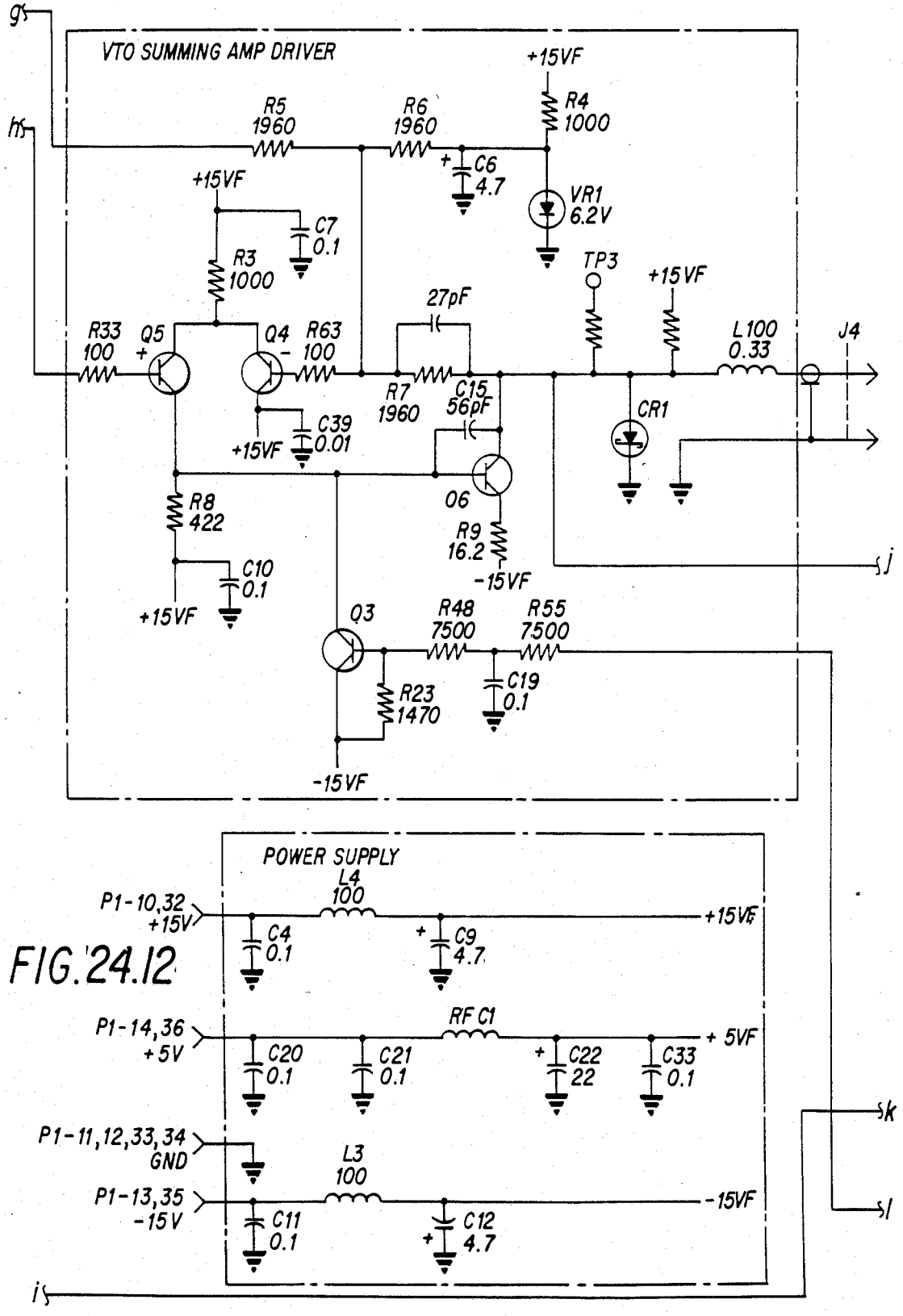

VTO SUMMING AMP DRIVER
+15VF
R5 1960
R6 1960
R4 1000
C6 4.7
VR1 6.2V
C7 0.1
R3 1000
TP3
27pF
R33 100
Q5
Q4
R63 100
R7 1960
C15 56pF
L100 0.33
J4
CR1
C39 0.01
Q6
R8 422
R9 16.2
-15VF
C10 0.1
Q3
R48 7500
R55 7500
C19 0.1
R23 1470
POWER SUPPLY
L4 100
P1-10,32 +15V
C4 0.1
C9 4.7
RFC1
P1-14,36 +5V
C20 0.1
C21 0.1
C22 22
C33 0.1
+5VF
P1-11,12,33,34 GND
L3 100
P1-13,35 -15V
C11 0.1
C12 4.7
g
h
i
j
k
l

FIG. 24.12

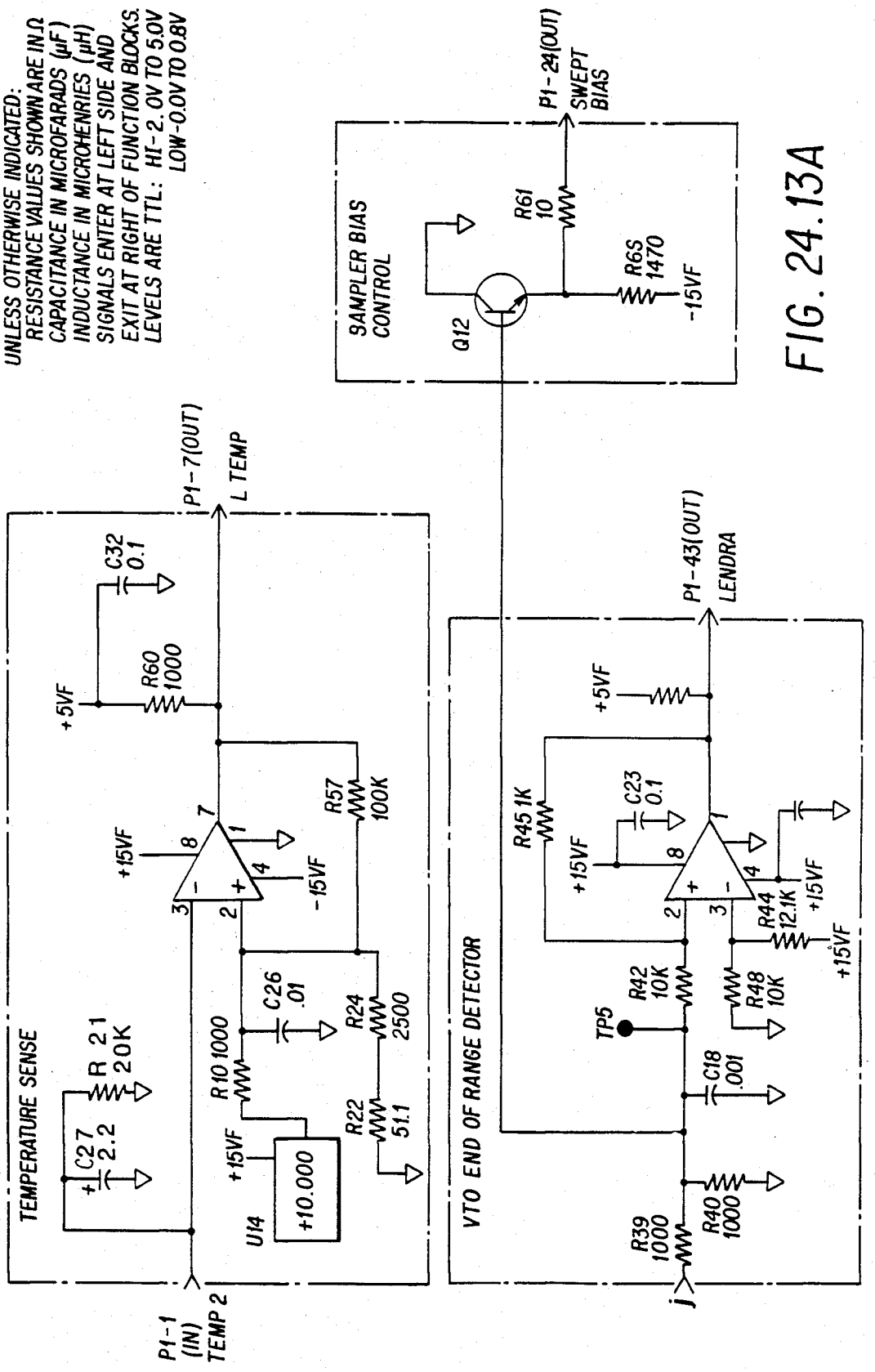

UNLESS OTHERWISE INDICATED:
RESISTANCE VALUES SHOWN ARE IN Ω
CAPACITANCE IN MICROFARADS (μF)
INDUCTANCE IN MICROHENRIES (μH)
SIGNALS ENTER AT LEFT SIDE AND
EXIT AT RIGHT OF FUNCTION BLOCKS.
LEVELS ARE TTL: HI-2.0V TO 5.0V
LOW-0.0V TO 0.8V
SAMPLER BIAS CONTROL
Q12
R61 10
R65 1470
-15VF
P1-24(OUT) SWEPT BIAS
P1-7(OUT) L TEMP
P1-43(OUT) LENDRA
TEMPERATURE SENSE
VTO END OF RANGE DETECTOR
C32 0.1
R60 1000
+5VF
+15VF
-15VF
R57 100K
C26 .01
R24 2500
R10 1000
R22 51.1
R21 20K
C27 2.2
U14
+10.000
R45 1K
C23 0.1
R42 10K
R48 10K
R44 12.1K
TP5
C18 .001
R39 1000
R40 1000
P1-1 (IN) TEMP 2
j

FIG. 24.13A

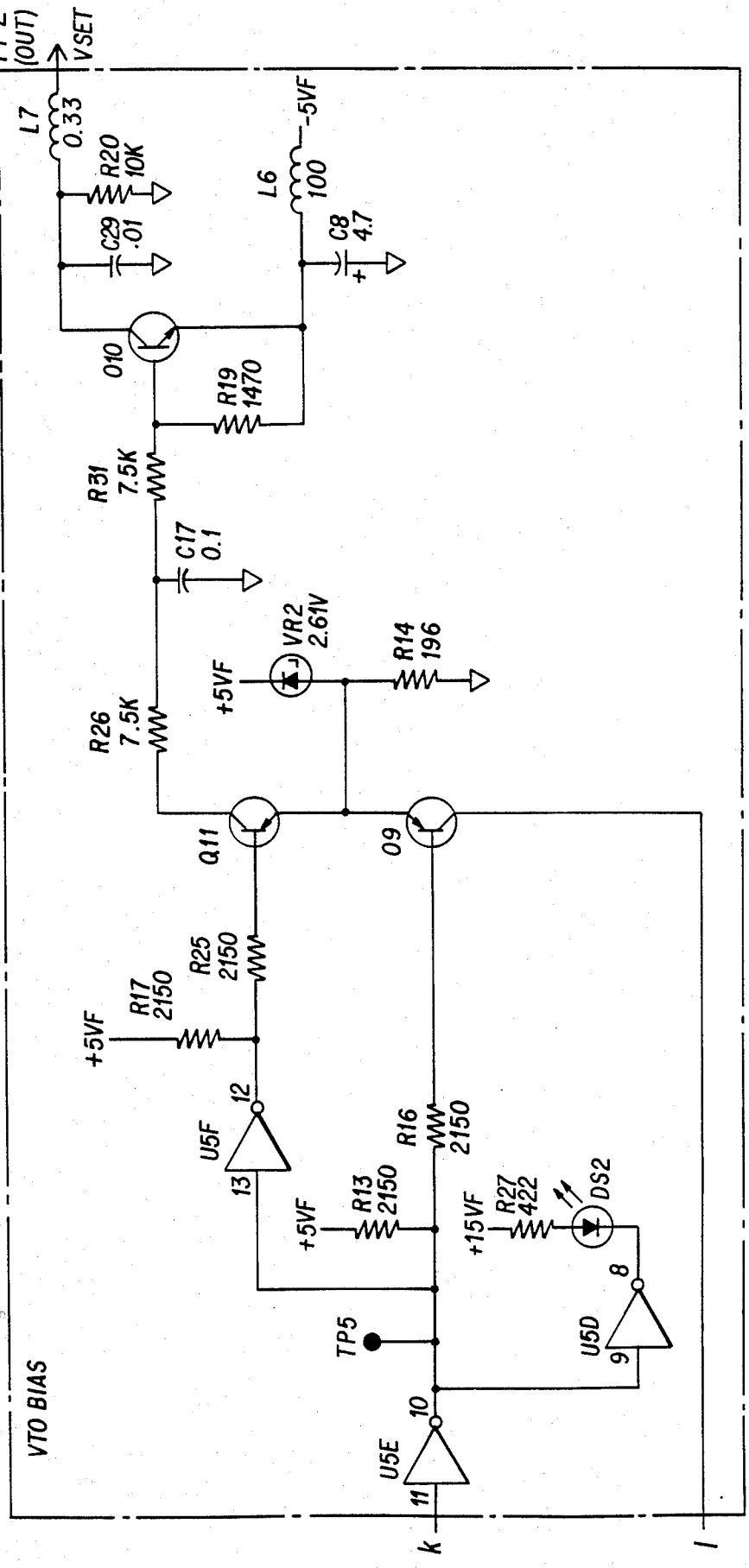

P1-2 (OUT)
VSET
L7 0.33
R20 10K
C29 .01
L6 100
-5VF
C8 4.7
Q10
R19 1470
R31 7.5K
C17 0.1
VR2 2.61V
+5VF
R14 196
R26 7.5K
Q11
Q9
R25 2150
R17 2150
+5VF
U5F
12
13
R16 2150
R13 2150
+5VF
R27 422
+15VF
DS2
8
U5D
9
TP5
10
U5E
11
VTO BIAS
k
l

FIG. 24.13B

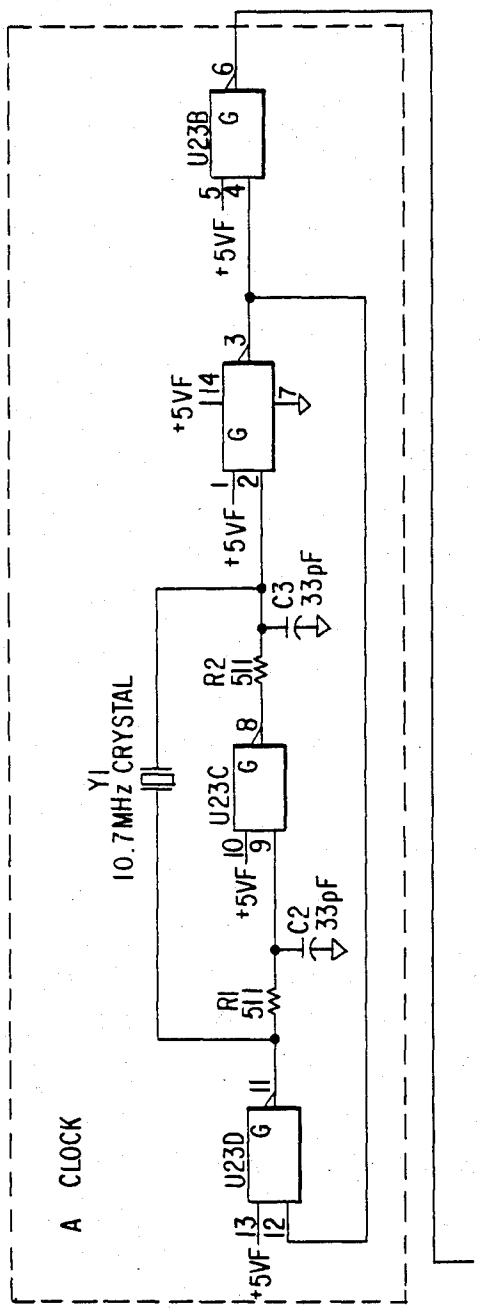
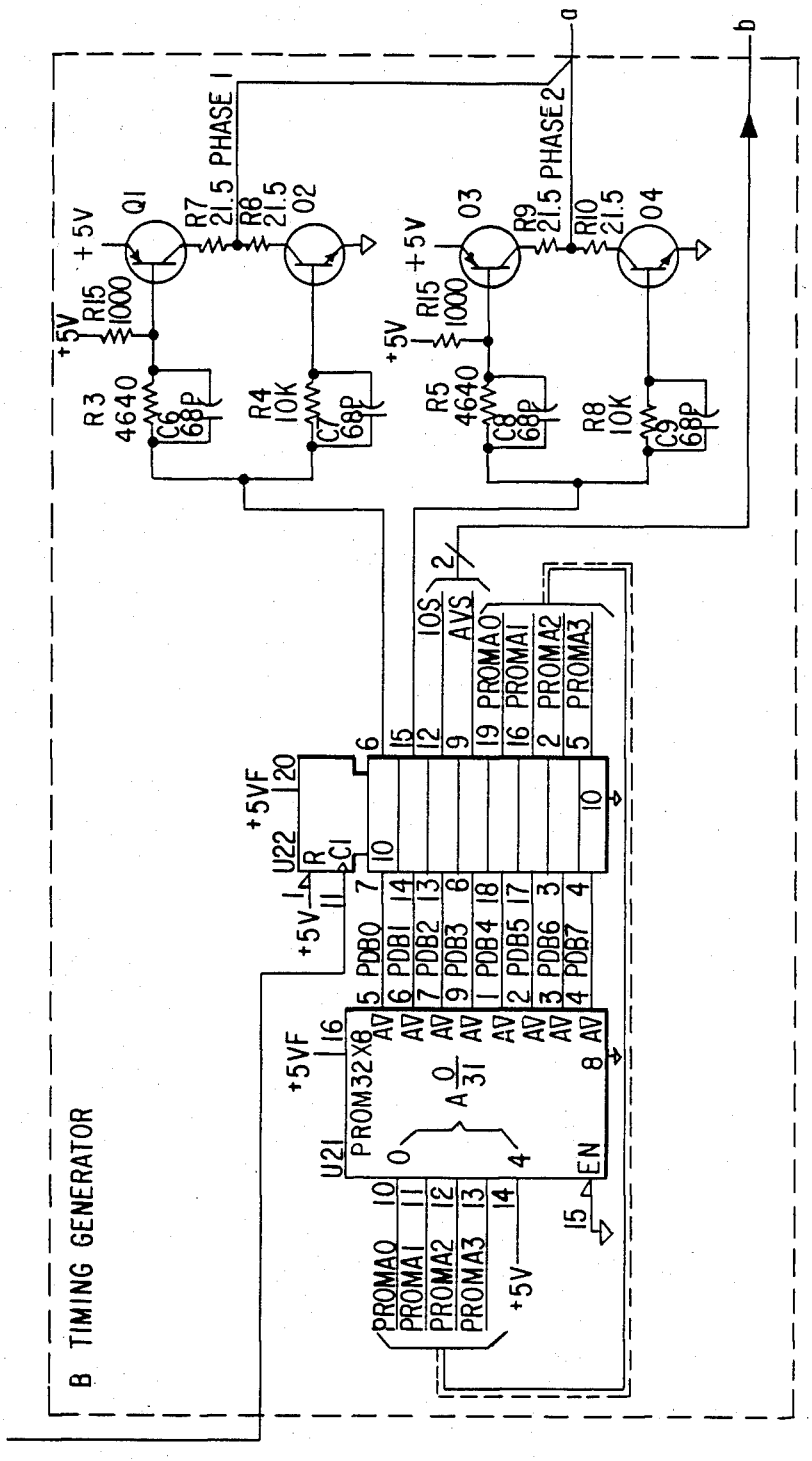

A CLOCK
Y1
10.7MHz CRYSTAL
U23D
U23C
U23B
R1
511
R2
511
C2
33pF
C3
33pF
+5VF
J POWER SUPPLIES AND GROUNDS
RFC1
TP5
GND
C1
47
PI-14,36 (IN)
+5VREG
PI-11,12,33,34 (IN)
GND
PIN'S 13,14,22 THRU 31 (A4P2): PIN'S
4 THRU 11,13,21,22 (A20 J1): PIN'S 18
THRU 23 (A20 J12) ARE ALL SHORTED TOGETHER.
PIN 24 IS GROUNDED.

FIG. 24.15A

FIG. 24.15B


B TIMING GENERATOR
PHASE 1
PHASE 2
Q1
Q2
Q3
Q4
R7 21.5
R8 21.5
R9 21.5
R10 21.5
R15 1000
R3 4640
R4 10K
R5 4640
R8 10K
C6 68P
C7 68P
C8 68P
C9 68P
+5V
+5VF
U22
U21
PROM32X8
PROMA0
PROMA1
PROMA2
PROMA3
PDB0
PDB1
PDB2
PDB3
PDB4
PDB5
PDB6
PDB7
IOS
AVS
EN
a
b

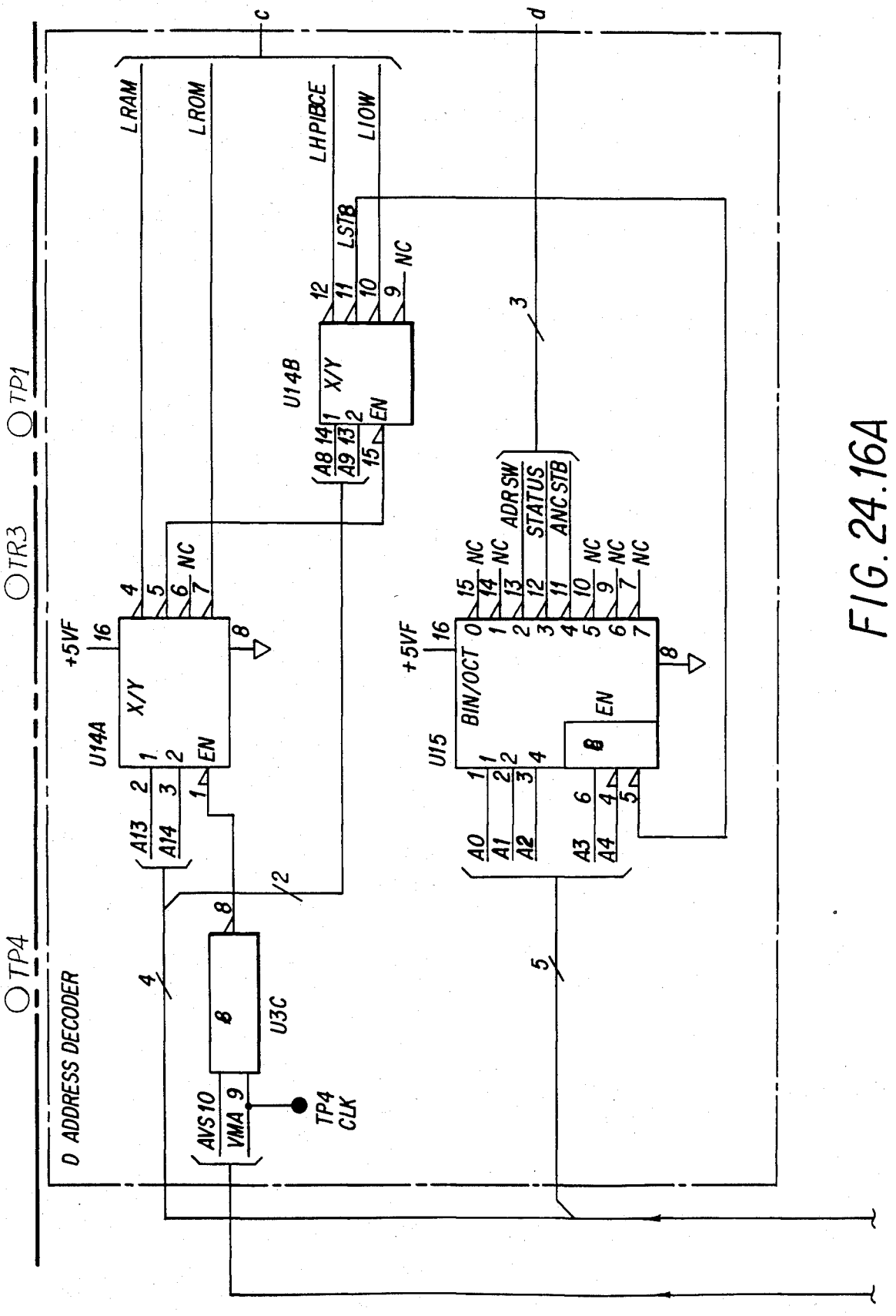

TP4
TP1
TR3
D ADDRESS DECODER
c
d
LRAM
LROM
LHPIBCE
LIOW
LSTB
NC
U14B
X/Y
EN
A8 14
A9 13
15
12
11
10
9
3
+5VF
16
8
4
5
6
7
U14A
1
2
A13
A14
2
3
1
2
8
4
U3C
AVS 10
VMA 9
TP4
CLK
5
U15
BIN/OCT
0
1
2
3
4
5
6
7
15
14
13
12
11
10
9
7
ADR SW
STATUS
ANC STB
A0
A1
A2
A3
A4
6
4
5

FIG. 24.16A

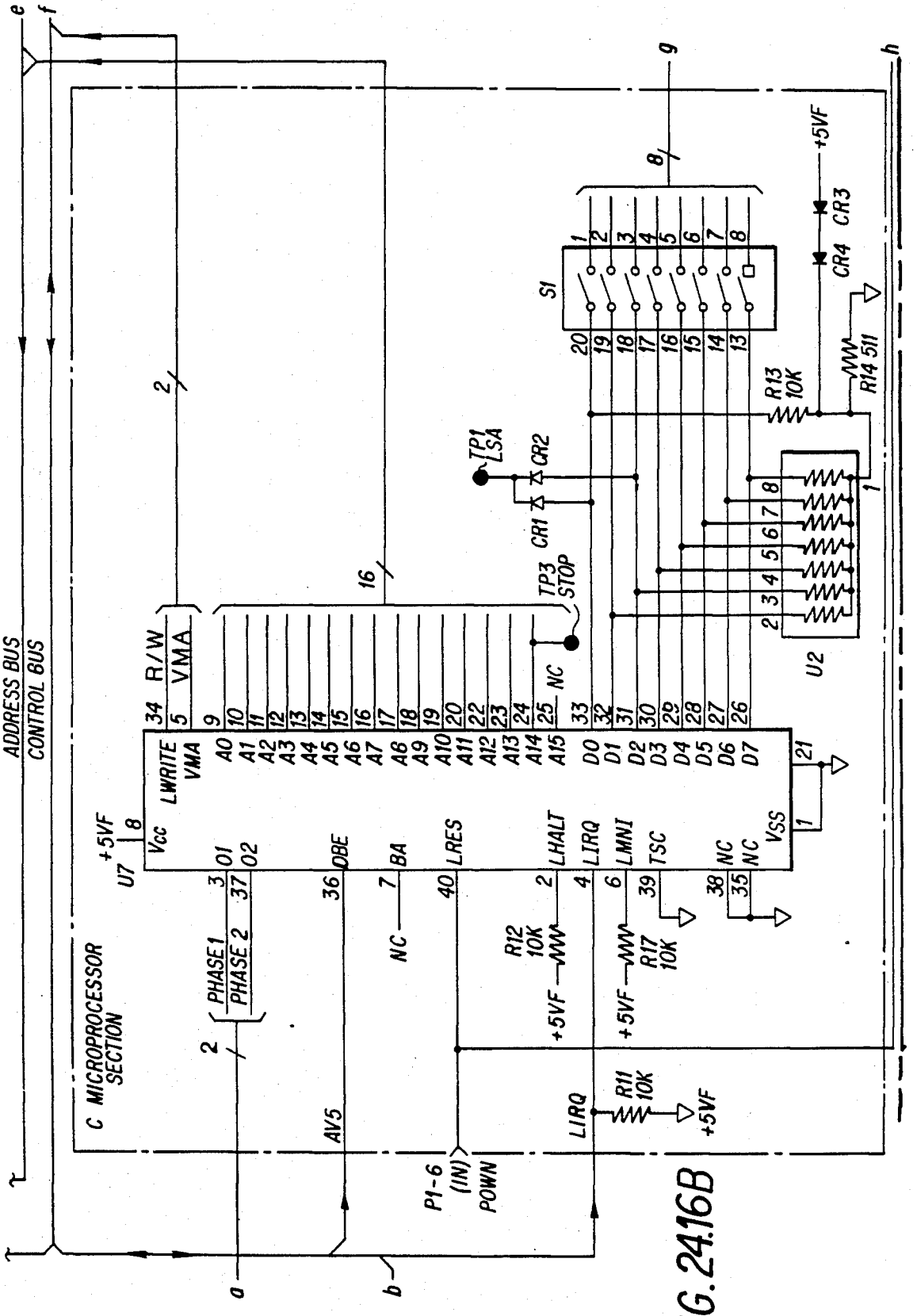

ADDRESS BUS
CONTROL BUS
C MICROPROCESSOR SECTION
U7
+5VF
Vcc
LWRITE
VMA
R/W
VMA
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
D0
D1
D2
D3
D4
D5
D6
D7
Vss
O1
O2
DBE
BA
LRES
LHALT
LIRQ
LMNI
TSC
NC
NC
PHASE 1
PHASE 2
AVS
P1-6 (IN)
POWN
R12 10K
R17 10K
R11 10K
LIRQ
+5VF
U2
S1
R13 10K
R14 511
CR1
CR2
CR3
CR4
TP1 LSA
TP3 STOP
a
b
e
f
g
h

FIG. 2416B

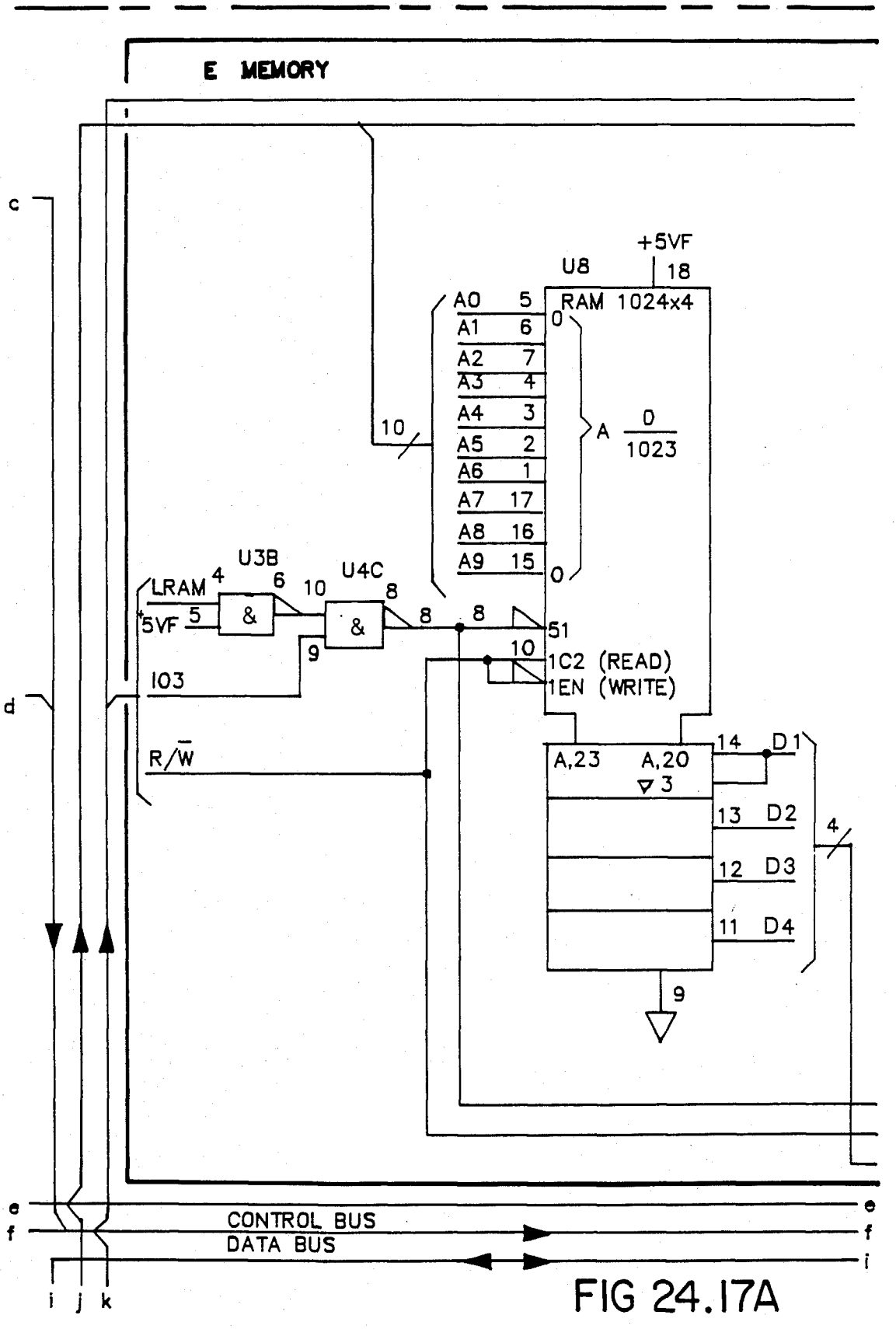

E MEMORY
c
d
e
f
i
j
k
+5VF
U8
18
RAM 1024x4
A0 5
A1 6
A2 7
A3 4
A4 3
A5 2
A6 1
A7 17
A8 16
A9 15
0
A 0/1023
10
LRAM
4
U3B
6
10
U4C
8
5VF
5
&
&
8
8
51
9
10
1C2 (READ)
1EN (WRITE)
103
R/W
A,23
A,20
3
14
D1
13
D2
12
D3
11
D4
4
9
CONTROL BUS
DATA BUS

FIG 24.17A

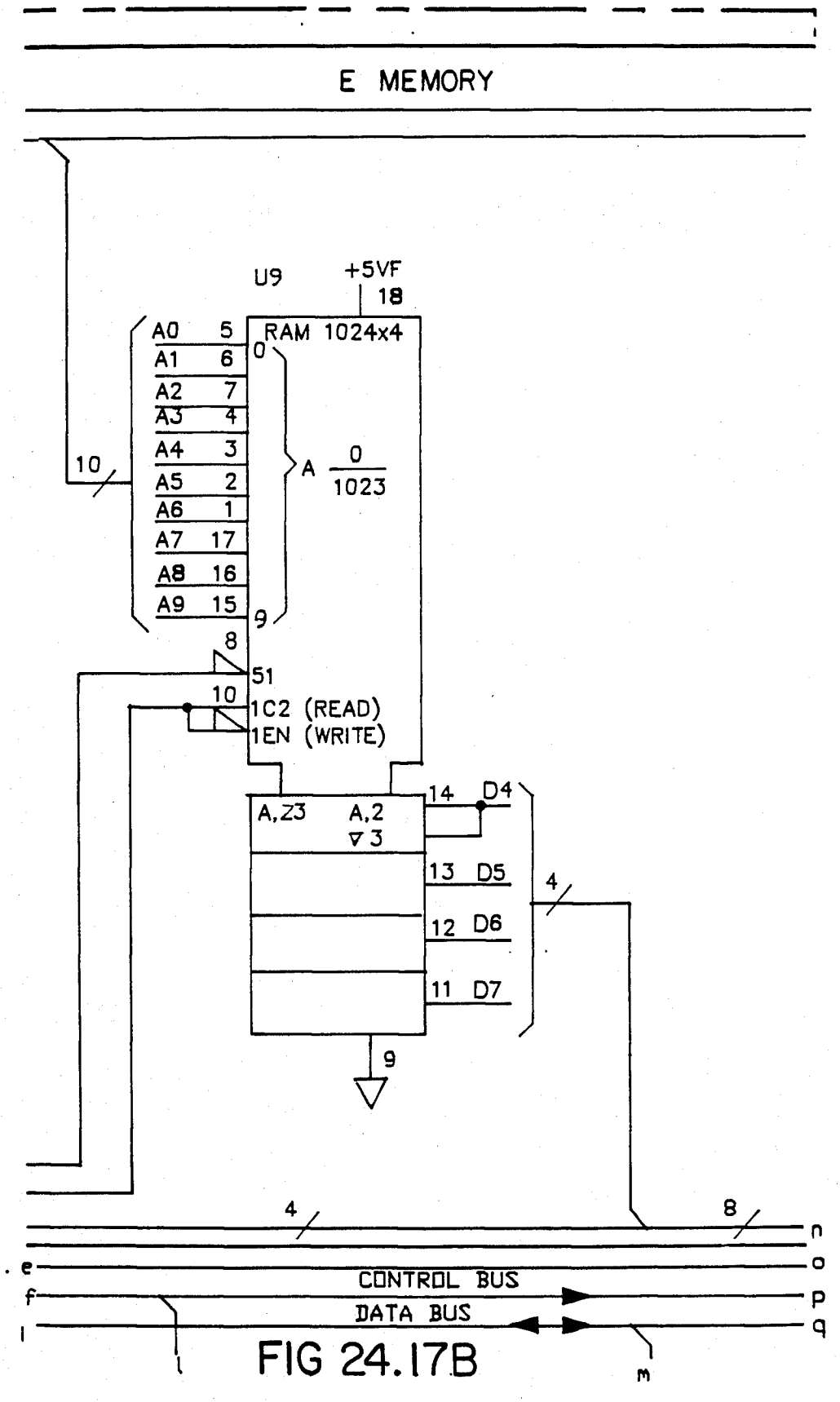

E MEMORY
U9
+5VF
18
RAM 1024x4
A0 5
A1 6
A2 7
A3 4
A4 3
A5 2
A6 1
A7 17
A8 16
A9 15
10
0
A 0/1023
9
8
51
10
1C2 (READ)
1EN (WRITE)
A,Z3
A,2
▽3
14 D4
13 D5
12 D6
11 D7
4
9
4
8
n
e
o
CONTROL BUS
f
p
DATA BUS
l
q
l
m

FIG 24.17B

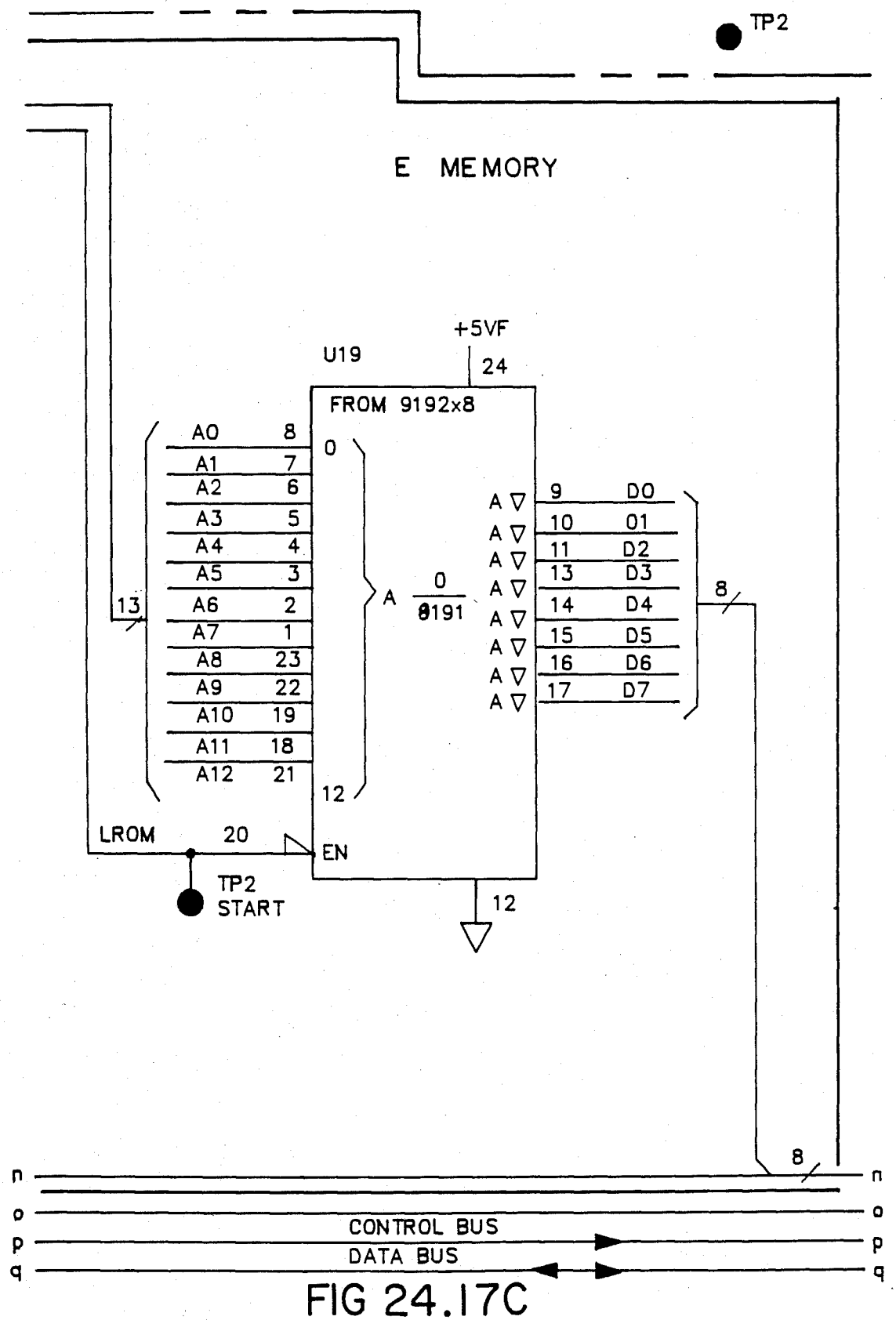

TP2
E MEMORY
+5VF
U19
24
FROM 9192x8
A0 8
A1 7
A2 6
A3 5
A4 4
A5 3
A6 2
A7 1
A8 23
A9 22
A10 19
A11 18
A12 21
13
0
12
A
0
8191
A 9 DO
A 10 01
A 11 D2
A 13 D3
A 14 D4
A 15 D5
A 16 D6
A 17 D7
8
LROM
20
EN
TP2
START
12
8
n
o
p
q
CONTROL BUS
DATA BUS

FIG 24.17C

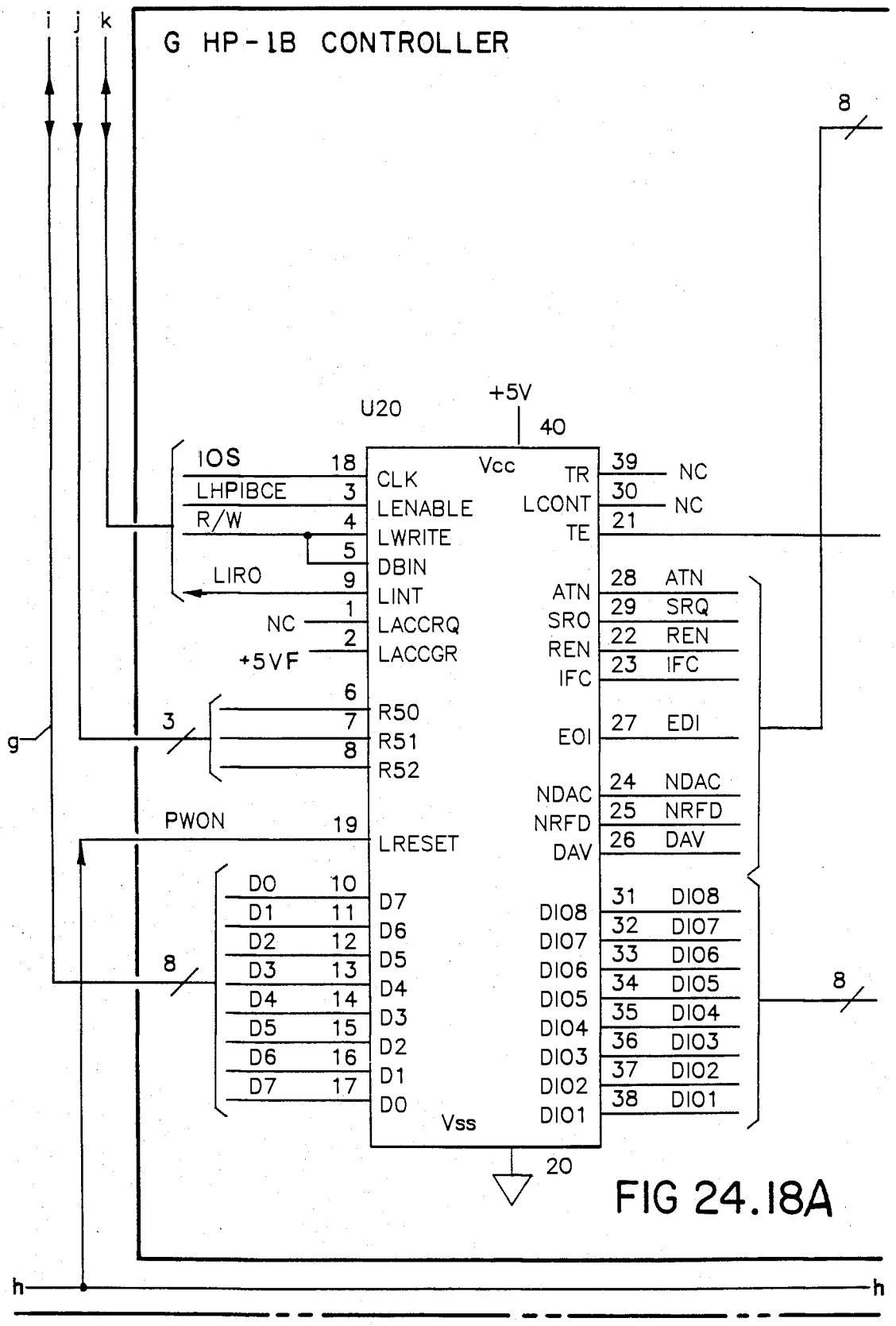

G HP-1B CONTROLLER
i
j
k
8
U20
+5V
40
IOS
18
CLK
Vcc
TR
39
NC
LHPIBCE
3
LENABLE
LCONT
30
NC
R/W
4
LWRITE
TE
21
5
DBIN
LIRO
9
LINT
ATN
28
ATN
1
SRQ
29
SRQ
NC
LACCRQ
SRO
22
REN
2
LACCGR
REN
23
IFC
+5VF
IFC
6
3
g
7
R50
EOI
27
EDI
8
R51
R52
24
NDAC
NDAC
25
NRFD
PWON
19
LRESET
NRFD
26
DAV
DAV
DO
10
D7
31
DIO8
D1
11
D6
DIO8
32
DIO7
D2
12
D5
DIO7
33
DIO6
8
D3
13
D4
DIO6
34
DIO5
8
D4
14
D3
DIO5
35
DIO4
D5
15
D2
DIO4
36
DIO3
D6
16
D1
DIO3
37
DIO2
D7
17
DO
DIO2
38
DIO1
Vss
DIO1
20
h
h

FIG 24.18A

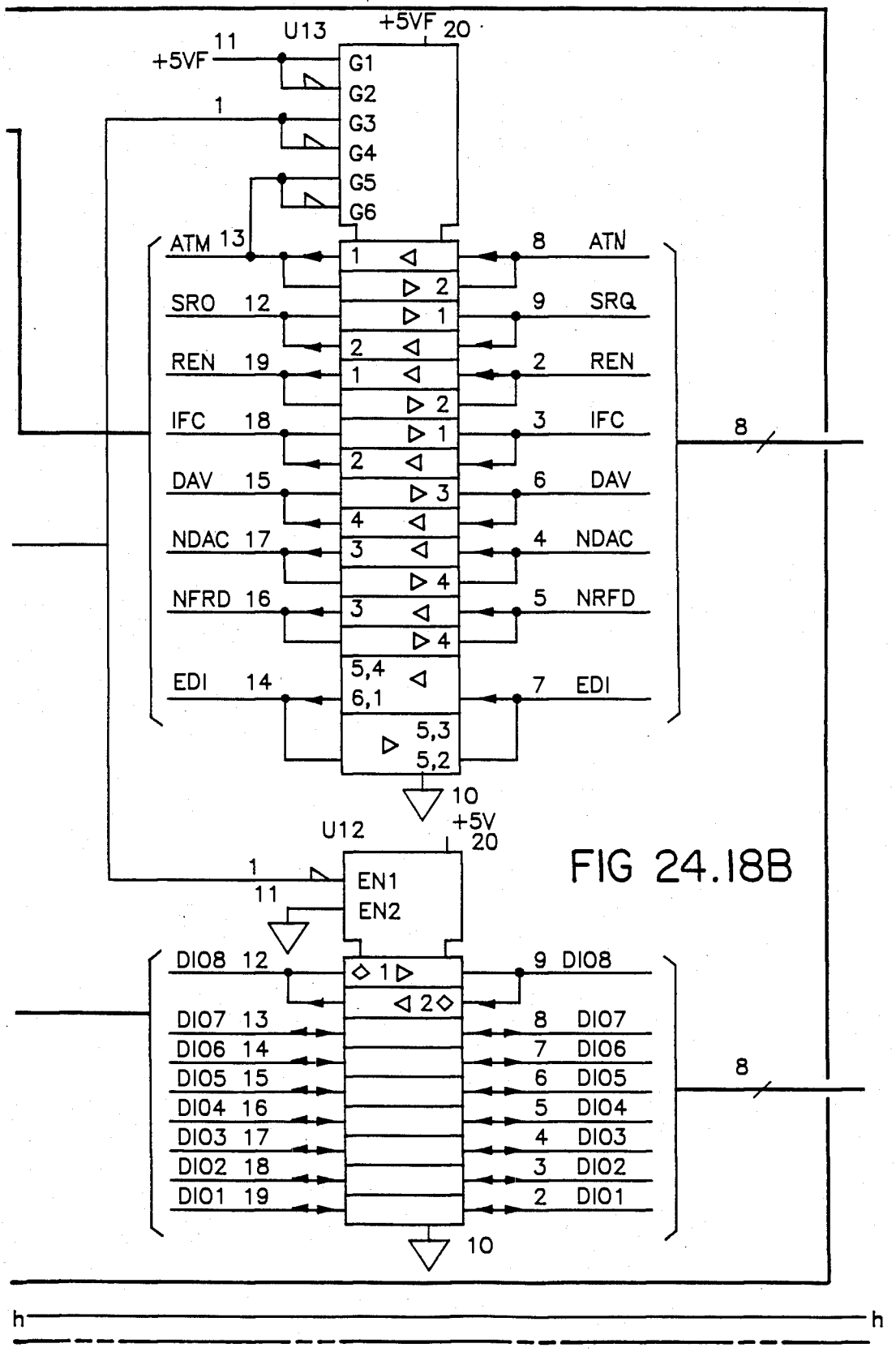

U13
+5VF
11
+5VF
20
1
G1
G2
G3
G4
G5
G6
ATM 13
SRO 12
REN 19
IFC 18
DAV 15
NDAC 17
NFRD 16
EDI 14
8 ATN
9 SRQ
2 REN
3 IFC
6 DAV
4 NDAC
5 NRFD
7 EDI
8
10
U12
+5V
20
1
11
EN1
EN2
DIO8 12
DIO7 13
DIO6 14
DIO5 15
DIO4 16
DIO3 17
DIO2 18
DIO1 19
9 DIO8
8 DIO7
7 DIO6
6 DIO5
5 DIO4
4 DIO3
3 DIO2
2 DIO1
8
10
h
h

FIG 24.18B

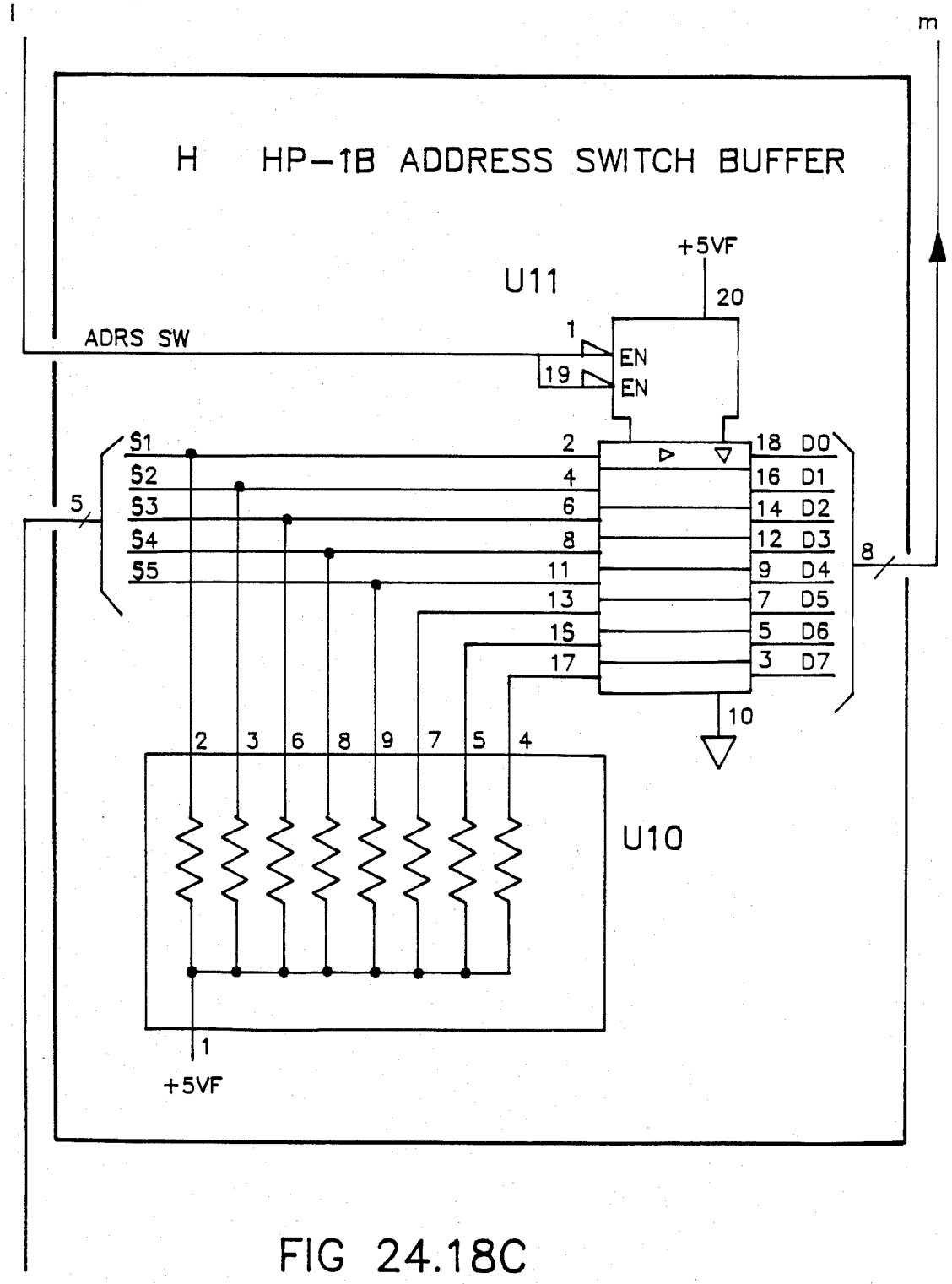

l
m
H HP-1B ADDRESS SWITCH BUFFER
+5VF
U11
20
ADRS SW
1
19
EN
EN
S1
S2
S3
S4
S5
5
2
4
6
8
11
13
15
17
18 D0
16 D1
14 D2
12 D3
9 D4
7 D5
5 D6
3 D7
8
10
2 3 6 8 9 7 5 4
U10
1
+5VF

FIG 24.18C

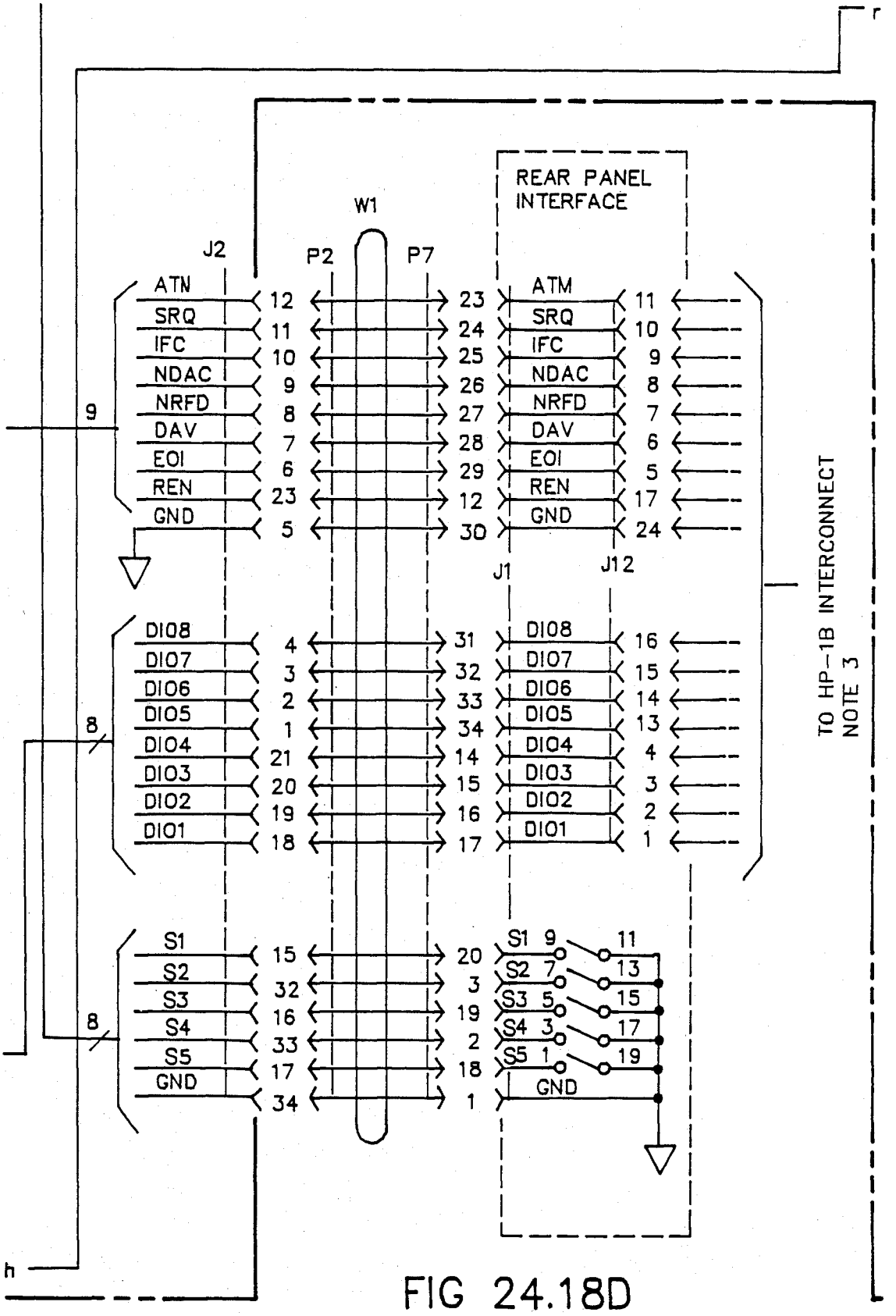

REAR PANEL INTERFACE
W1
J2
P2
P7
J1
J12
ATN 12 23 ATM 11
SRQ 11 24 SRQ 10
IFC 10 25 IFC 9
NDAC 9 26 NDAC 8
NRFD 8 27 NRFD 7
DAV 7 28 DAV 6
EOI 6 29 EOI 5
REN 23 12 REN 17
GND 5 30 GND 24
9
DIO8 4 31 DIO8 16
DIO7 3 32 DIO7 15
DIO6 2 33 DIO6 14
DIO5 1 34 DIO5 13
DIO4 21 14 DIO4 4
DIO3 20 15 DIO3 3
DIO2 19 16 DIO2 2
DIO1 18 17 DIO1 1
8
S1 15 20 S1 9 11
S2 32 3 S2 7 13
S3 16 19 S3 5 15
S4 33 2 S4 3 17
S5 17 18 S5 1 19
GND 34 1 GND
8
TO HP-1B INTERCONNECT NOTE 3
h

FIG 24.18D

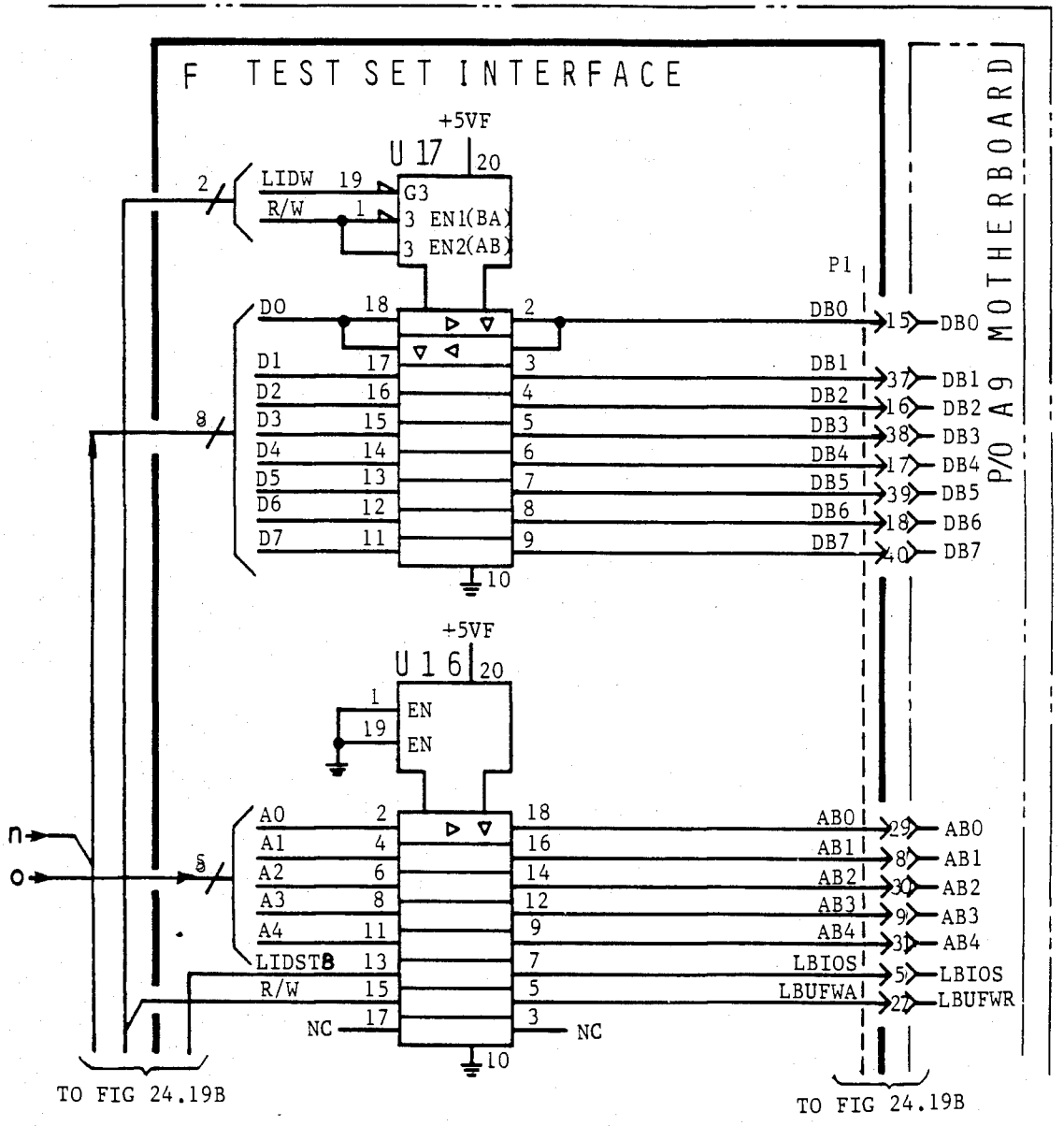

F TEST SET INTERFACE
P/O A9 MOTHERBOARD
+5VF
U17
LIDW
R/W
G3
EN1(BA)
EN2(AB)
P1
DO
D1
D2
D3
D4
D5
D6
D7
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
+5VF
U16
EN
EN
A0
A1
A2
A3
A4
LIDST
R/W
NC
AB0
AB1
AB2
AB3
AB4
LBIOS
LBUFWR
TO FIG 24.19B
TO FIG 24.19B

FIG 24.19A

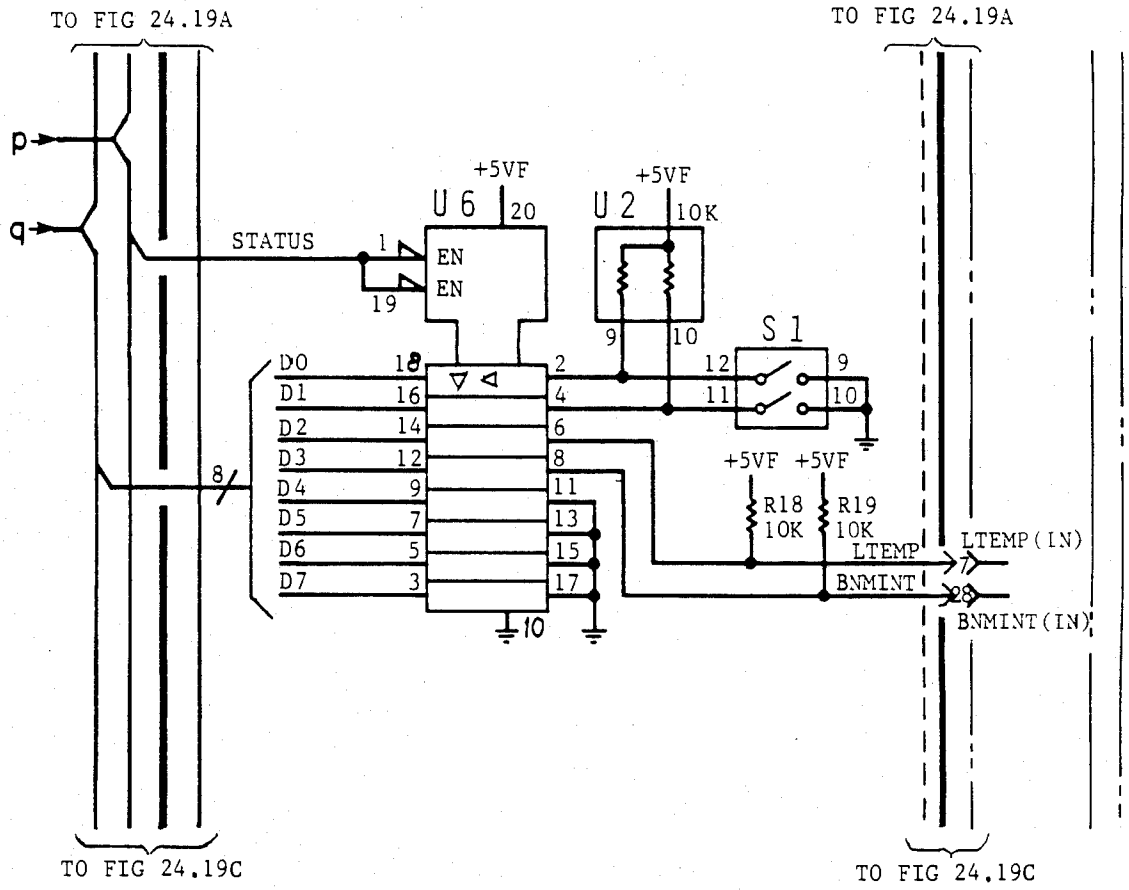

TO FIG 24.19A
TO FIG 24.19A
p
q
STATUS
+5VF
U 6
20
+5VF
U 2
10K
1
19
EN
EN
9
10
S 1
12
11
9
10
D0
D1
D2
D3
D4
D5
D6
D7
18
16
14
12
9
7
5
3
2
4
6
8
11
13
15
17
10
8
+5VF
+5VF
R18
10K
R19
10K
LTEMP
BNMINT
LTEMP(IN)
BNMINT(IN)
TO FIG 24.19C
TO FIG 24.19C

FIG 24.19 B

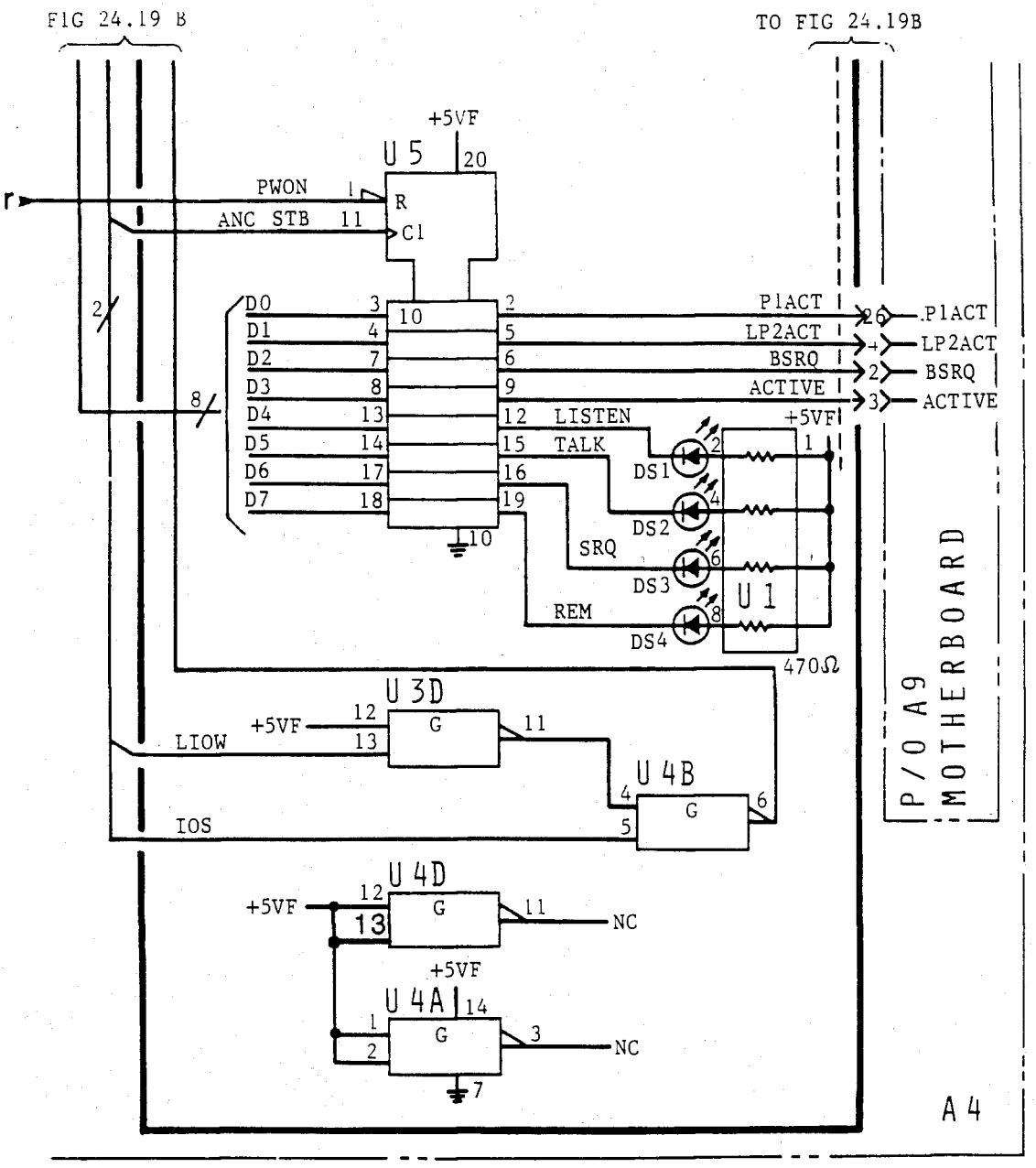


FIG 24.19 B
TO FIG 24.19B
+5VF
U 5
20
PWON
1
R
ANC STB
11
C1
2
8
D0
D1
D2
D3
D4
D5
D6
D7
3
4
7
8
13
14
17
18
10
2
5
6
9
12
15
16
19
LISTEN
TALK
SRQ
REM
P1ACT
LP2ACT
BSRQ
ACTIVE
DS1
DS2
DS3
DS4
U 1
470Ω
P/O A9 MOTHERBOARD
U 3D
+5VF
12
13
G
11
LIOW
U 4B
4
5
6
IOS
U 4D
NC
U 4A
14
1
2
3
7
A 4

FIG 24.19C

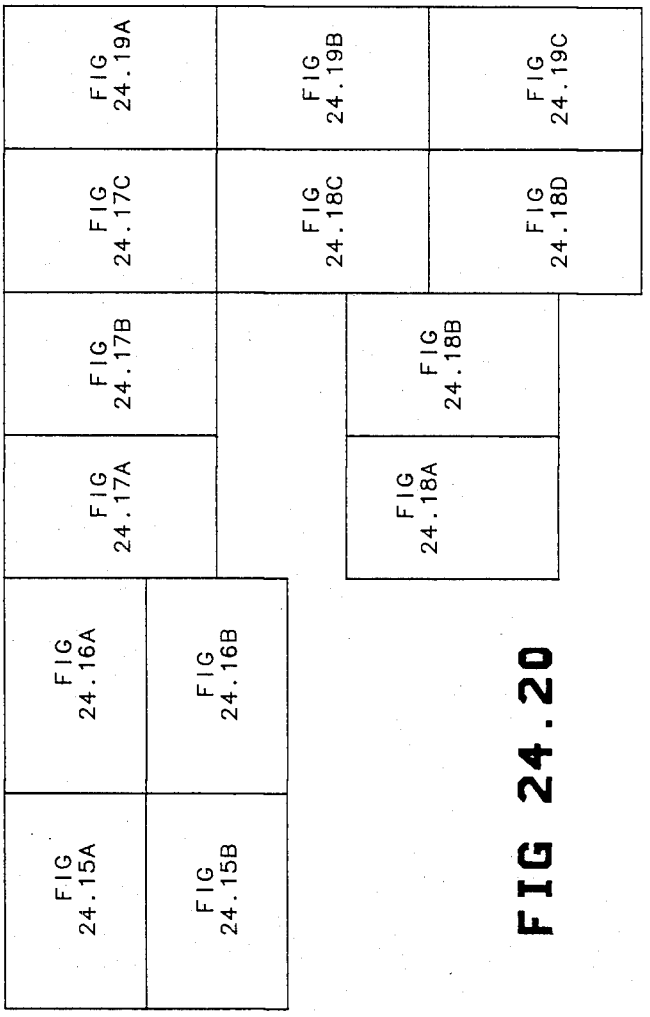


FIG 24.20

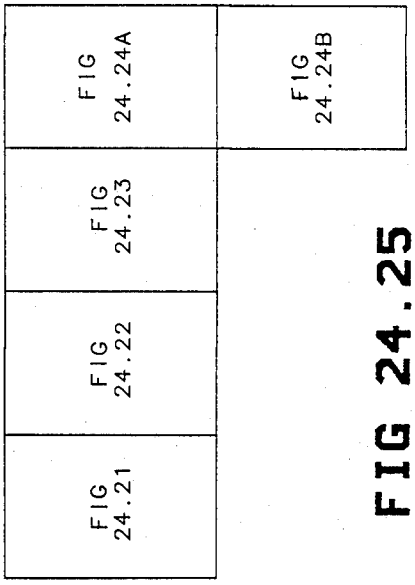


FIG 24.25

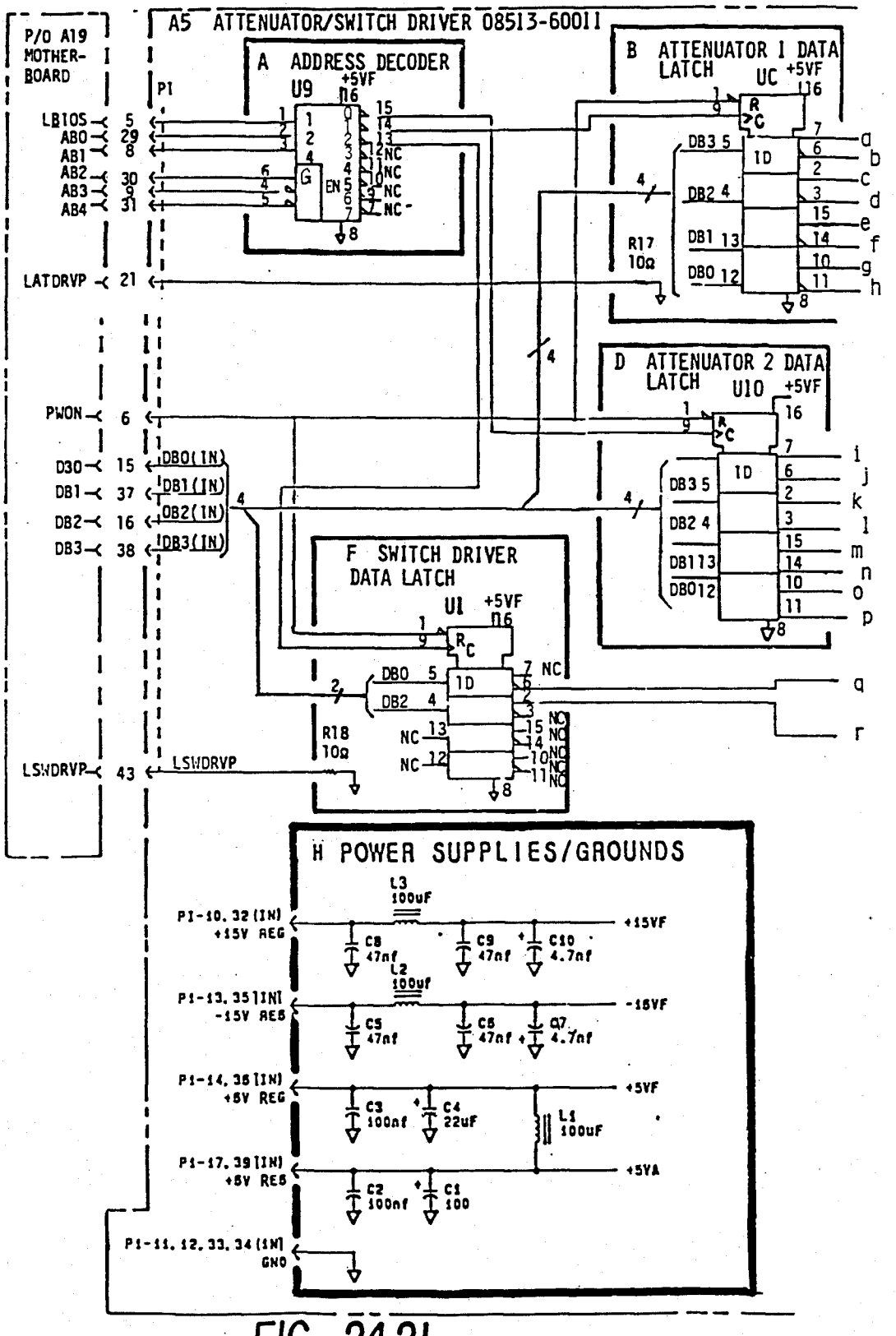
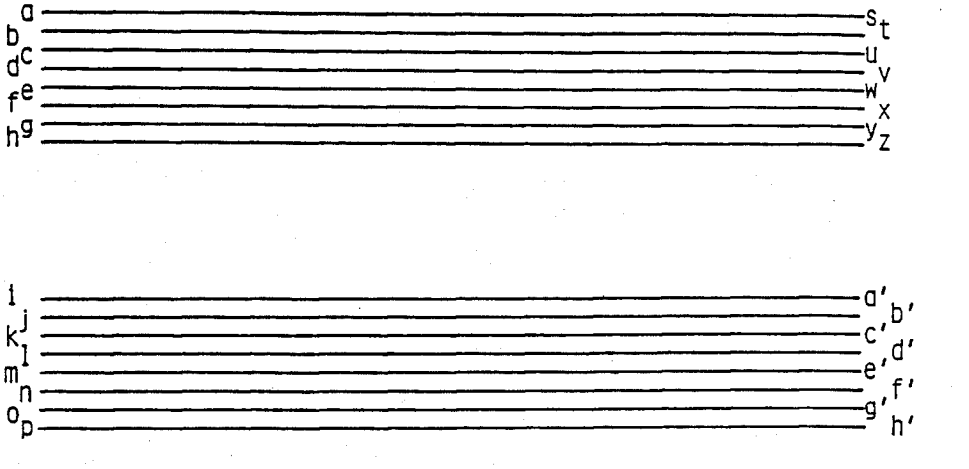

A5 ATTENUATOR/SWITCH DRIVER 08513-60011
P/O A19 MOTHER-BOARD
P1
A ADDRESS DECODER
U9
+5VF
B ATTENUATOR 1 DATA LATCH
UC
D ATTENUATOR 2 DATA LATCH
U10
F SWITCH DRIVER DATA LATCH
U1
LB10S
AB0
AB1
AB2
AB3
AB4
LATDRVP
PWON
D30
DB1
DB2
DB3
DBO(IN)
DB1(IN)
DB2(IN)
DB3(IN)
LSWDRVP
R17 10Ω
R18 10Ω
H POWER SUPPLIES/GROUNDS
L3 100uF
L2 100uF
L1 100uF
P1-10, 32 (IN) +15V REG
P1-13, 35 (IN) -15V REG
P1-14, 36 (IN) +5V REG
P1-17, 39 (IN) +5V REG
P1-11, 12, 33, 34 (IN) GND
+15VF
-15VF
+5VF
+5VA

FIG 24.21

FIG 24.22


a
b
c
d
e
f
g
h
s
t
u
v
w
x
y
z
i
j
k
l
m
n
o
p
a'
b'
c'
d'
e'
f'
g'
h'
G SWITCH DRIVER
DRIVER 1
+5VF
U5D
14
9
8
7
q
R2
6.81K
R1
100Ω
+15VF
+15VF
+15VF
Q5
Q6
R8
470
CR20
J1
PRT1SWO
i'
j'
Q2
Q1
R4
2.15K
R7
330
R3
10K
-15VF
-15VF -15VF
DS2
'OFF'
DS1
'ON'
DRIVER 2
U5F
13
12
r
R10
6.81K
R9
100Ω
+15VF
+15VF
+15VF
Q8
Q7
R27
220
J2
SWOCOM
k'
l'
R15
470
CR24
J3
PRT2SWO
m'
n'
Q3
Q4
R12
2.15K
R14
330
R11
10K
-15VF
-15VF -15VF
DS4
'OFF'
DS3
'ON'

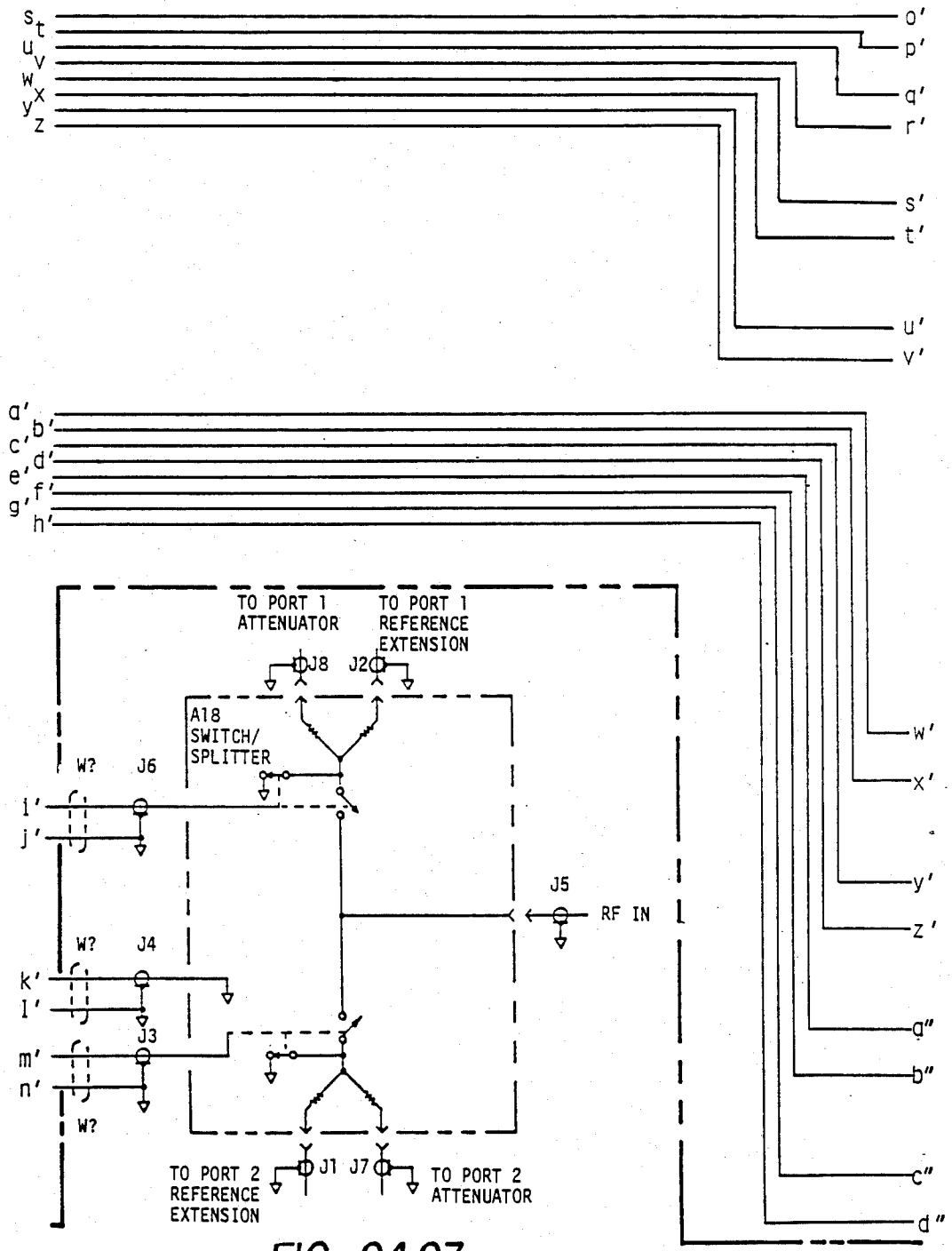

s
t
u
v
w
x
y
z
o'
p'
q'
r'
s'
t'
u'
v'
a'
b'
c'
d'
e'
f'
g'
h'
TO PORT 1 ATTENUATOR
TO PORT 1 REFERENCE EXTENSION
J8
J2
A18 SWITCH/ SPLITTER
W?
J6
i'
j'
J5
RF IN
W?
J4
k'
l'
J3
m'
n'
W?
TO PORT 2 REFERENCE EXTENSION
J1
J7
TO PORT 2 ATTENUATOR
w'
x'
y'
z'
a"
b"
c"
d"

FIG 24.23

FIG 24.24A

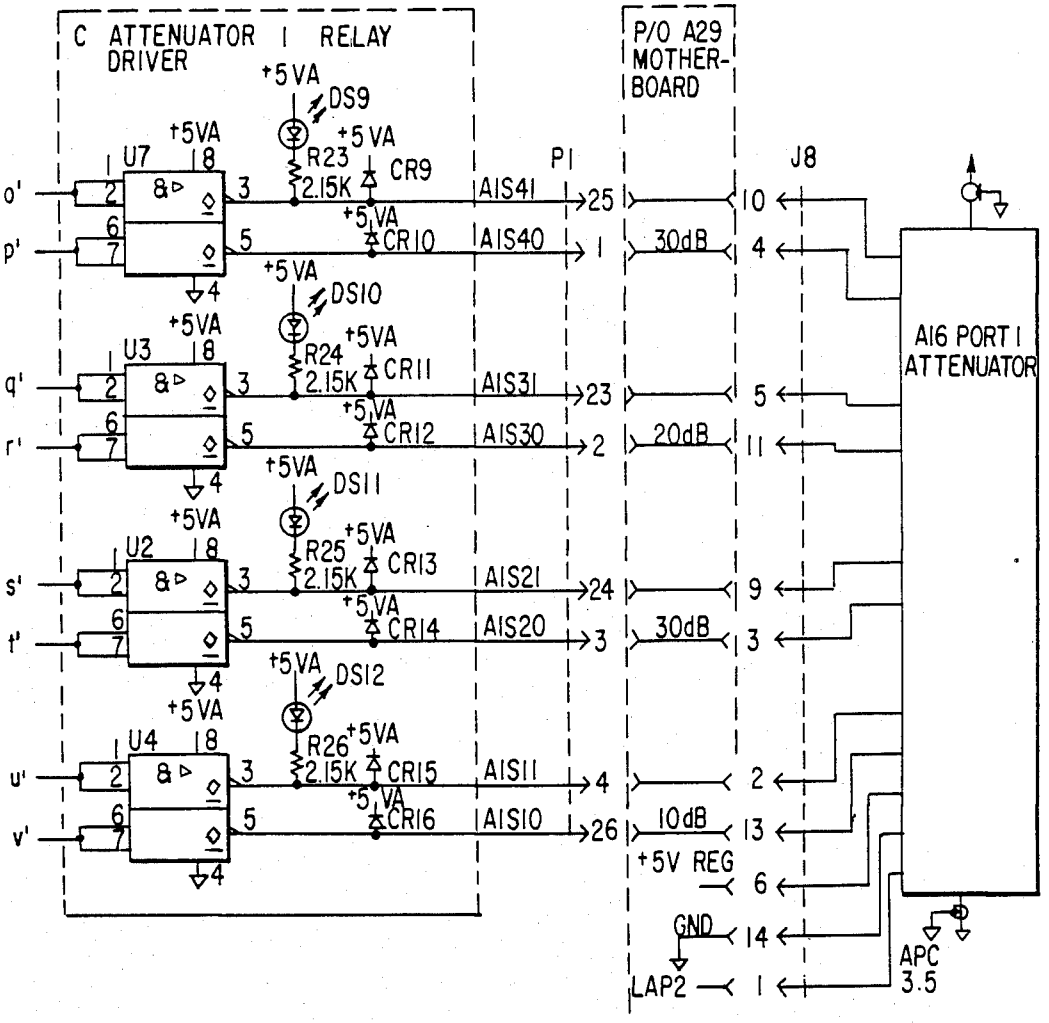
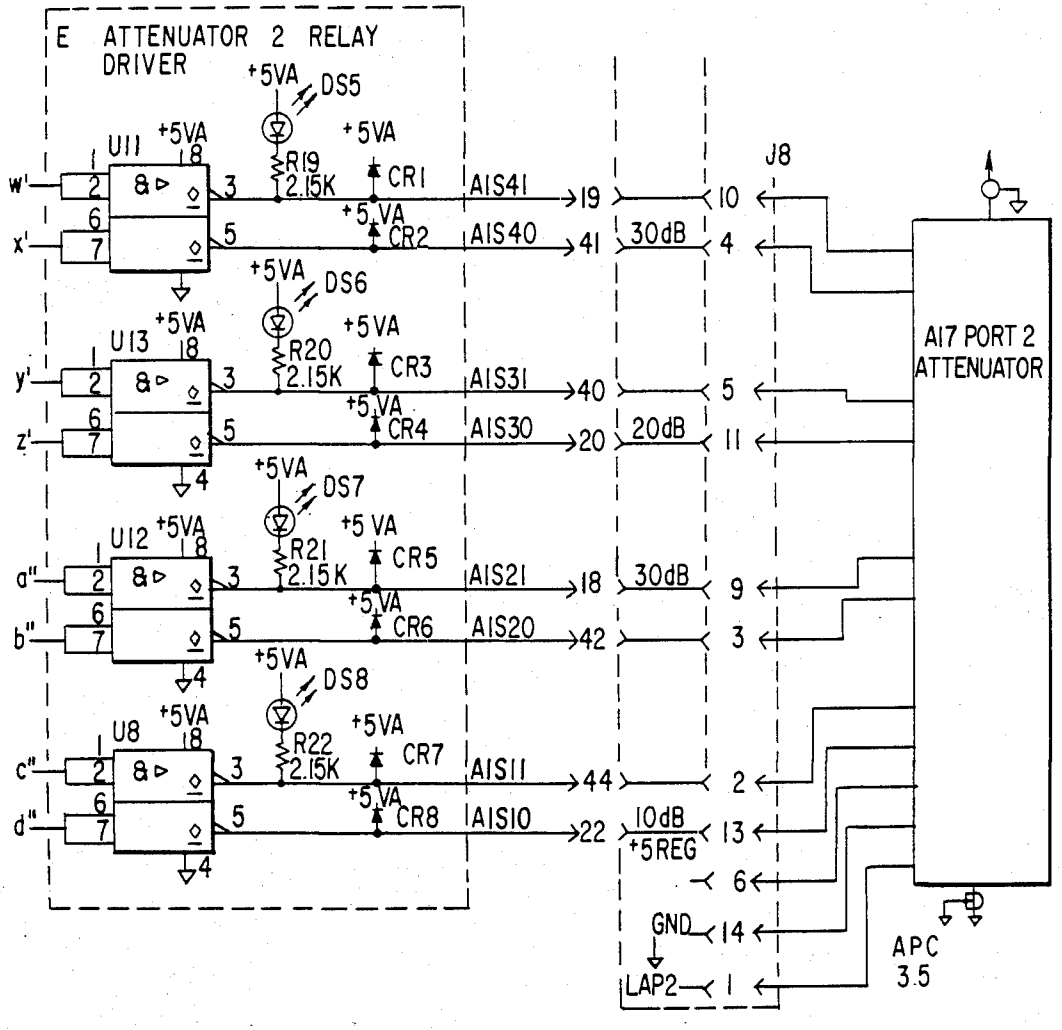

C ATTENUATOR I RELAY DRIVER
P/O A29 MOTHER-BOARD
P1
J8
A16 PORT I ATTENUATOR
U7
U3
U2
U4
R23 2.15K
R24 2.15K
R25 2.15K
R26 2.15K
CR9
CR10
CR11
CR12
CR13
CR14
CR15
CR16
DS9
DS10
DS11
DS12
+5VA
AIS41
AIS40
AIS31
AIS30
AIS21
AIS20
AIS11
AIS10
30dB
20dB
10dB
+5V REG
GND
LAP2
APC 3.5

FIG 24.24B


E ATTENUATOR 2 RELAY DRIVER
+5VA
DS5
DS6
DS7
DS8
U11
U13
U12
U8
R19 2.15K
R20 2.15K
R21 2.15K
R22 2.15K
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
w'
x'
y'
z'
a"
b"
c"
d"
AIS41
AIS40
AIS31
AIS30
AIS21
AIS20
AIS11
AIS10
19
41
40
20
18
42
44
22
30dB
20dB
10dB
+5REG
GND
LAP2
J8
10
4
5
11
9
3
2
13
6
14
1
AI7 PORT 2 ATTENUATOR
APC 3.5

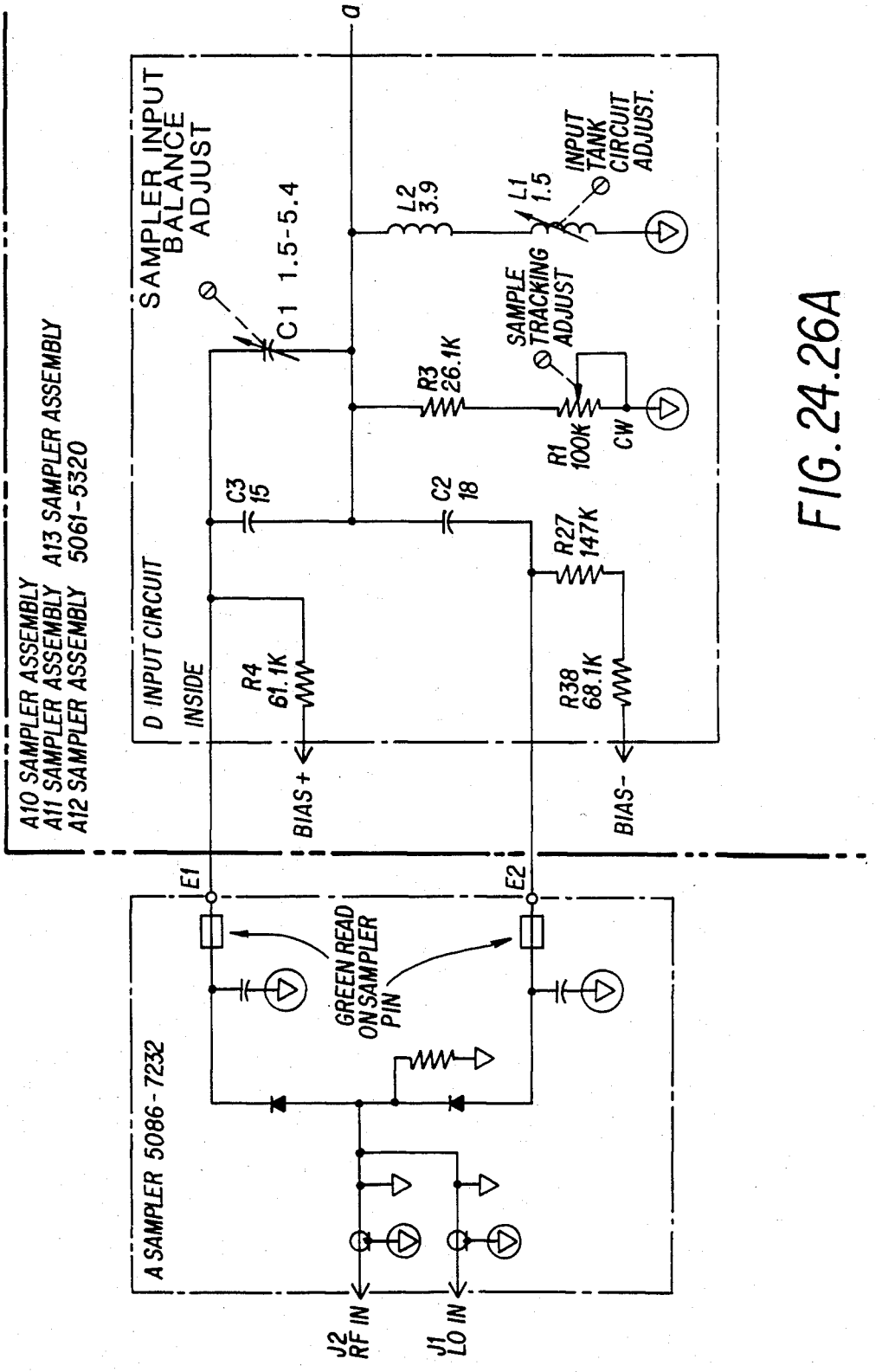

A10 SAMPLER ASSEMBLY
A11 SAMPLER ASSEMBLY A13 SAMPLER ASSEMBLY
A12 SAMPLER ASSEMBLY 5061-5320
D INPUT CIRCUIT
INSIDE
SAMPLER INPUT BALANCE ADJUST
C1 1.5-5.4
L2 3.9
L1 1.5
INPUT TANK CIRCUIT ADJUST.
SAMPLE TRACKING ADJUST
R3 26.1K
R1 100K
CW
C3 15
C2 18
R27 147K
R4 61.1K
R38 68.1K
BIAS+
BIAS-
E1
E2
GREEN READ ON SAMPLER PIN
A SAMPLER 5086-7232
J2 RF IN
J1 LO IN

FIG. 24.26A

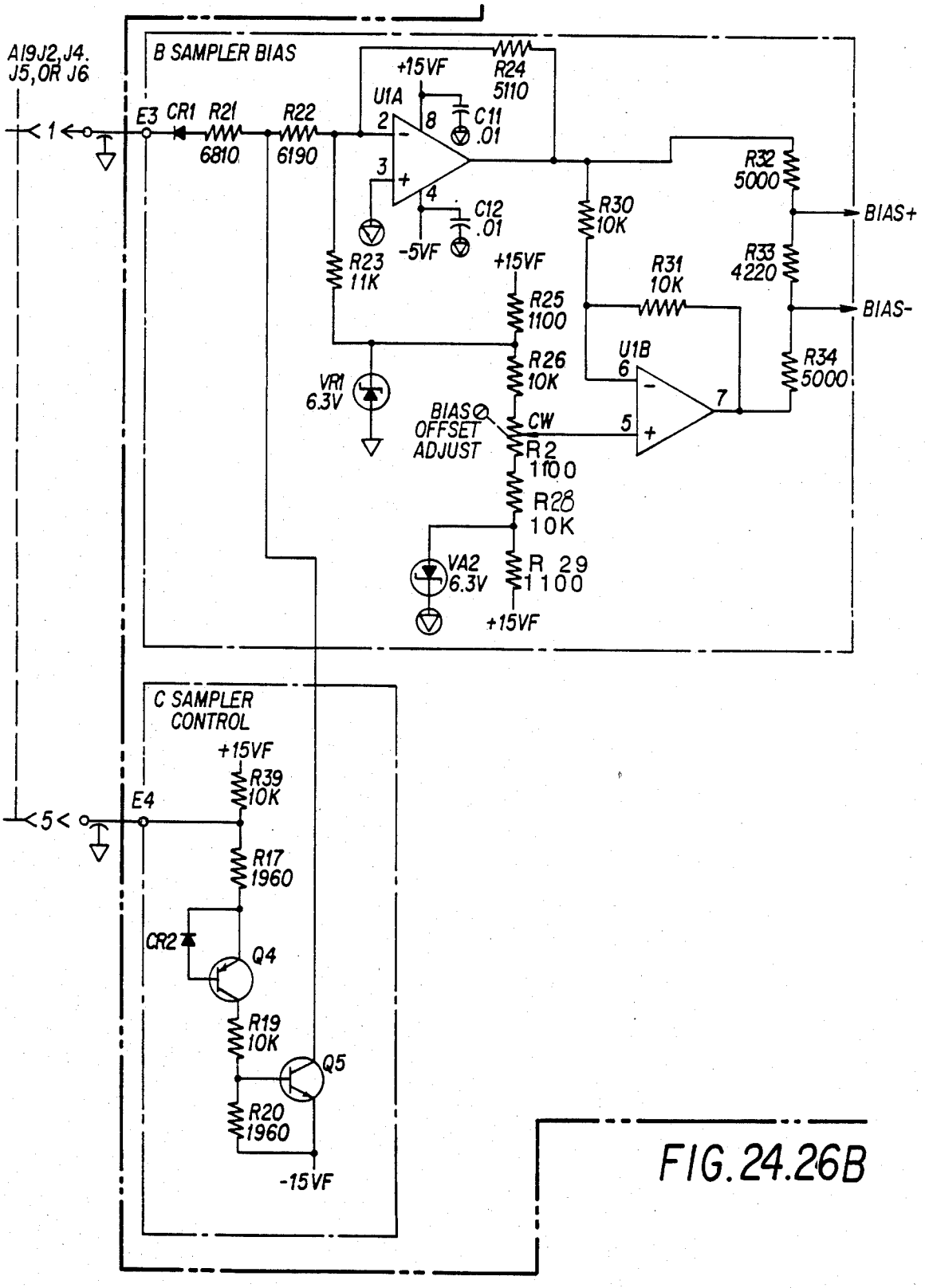

A19J2,J4.
J5,OR J6
B SAMPLER BIAS
+15VF
R24
5110
U1A
C11
.01
E3
CR1
R21
6810
R22
6190
R32
5000
R30
10K
BIAS+
C12
.01
-5VF
R23
11K
+15VF
R31
10K
R33
4220
R25
1100
BIAS-
U1B
R26
10K
R34
5000
VR1
6.3V
BIAS
OFFSET
ADJUST
CW
R2
1100
R28
10K
VA2
6.3V
R 29
1100
+15VF
C SAMPLER
CONTROL
+15VF
R39
10K
E4
R17
1960
CR2
Q4
R19
10K
Q5
R20
1960
-15VF

FIG. 24.26B

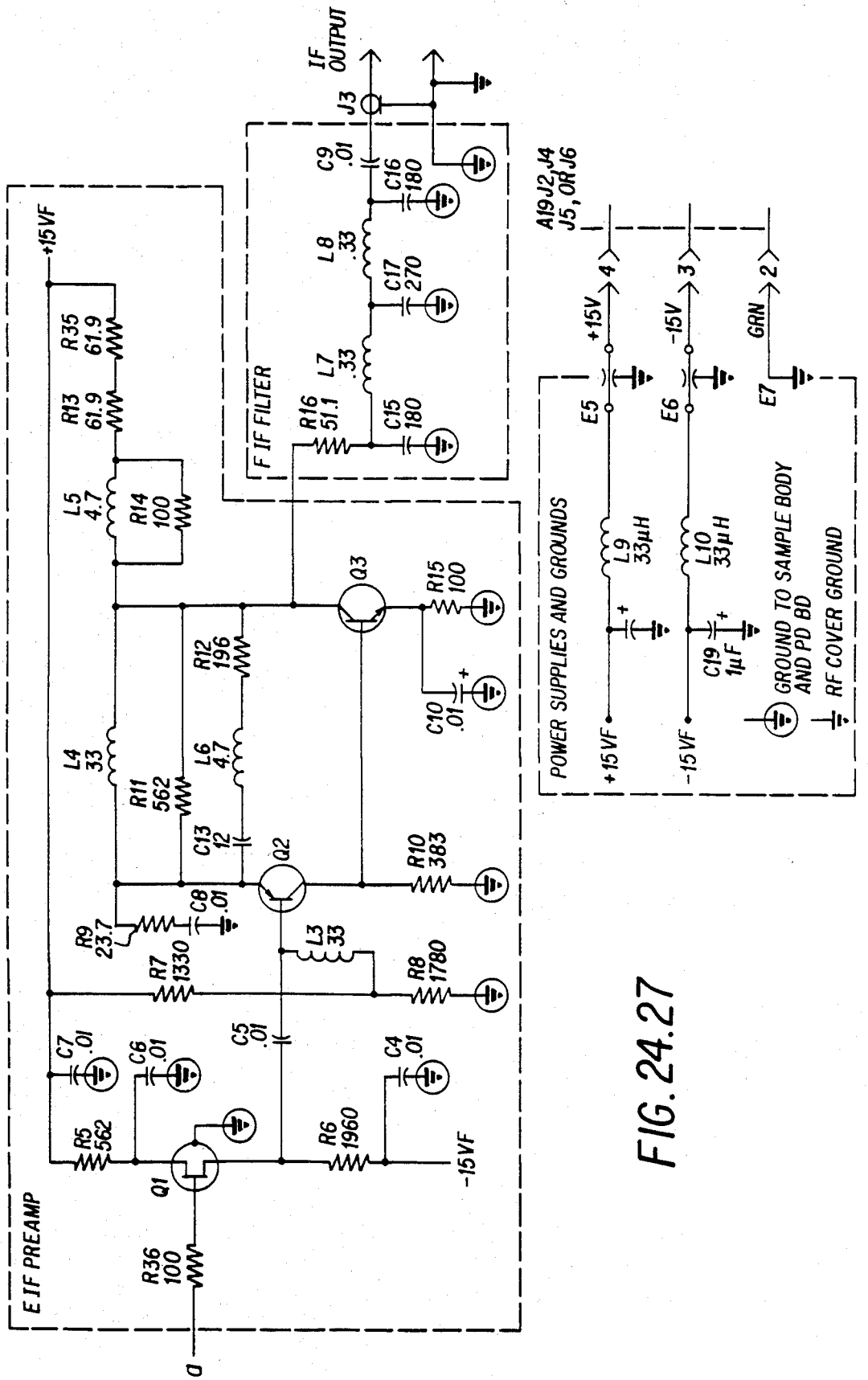

E IF PREAMP
+15VF
R35 61.9
R13 61.9
L5 4.7
R14 100
L4 33
R11 562
L6 4.7
R12 196
C13 12
Q3
R15 100
C10 .01
Q2
R10 383
C8 .01
R9 23.7
L3 33
R7 1330
R8 1780
C7 .01
C6 .01
C5 .01
C4 .01
R5 562
R6 1960
Q1
-15VF
R36 100
a
F IF FILTER
IF OUTPUT
J3
C9 .01
C16 180
L8 .33
C17 270
L7 .33
R16 51.1
C15 180
A19J2,J4 J5, OR J6
POWER SUPPLIES AND GROUNDS
E5
E6
E7
+15V
-15V
GRN
4
3
2
L9 33μH
L10 33μH
C19 1μF
+15VF
-15VF
GROUND TO SAMPLE BODY AND PD BD
RF COVER GROUND

FIG. 24.27

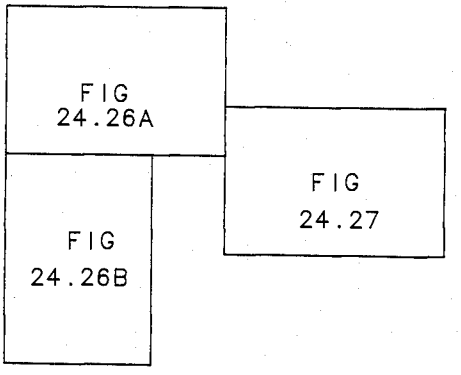


FIG 24.28

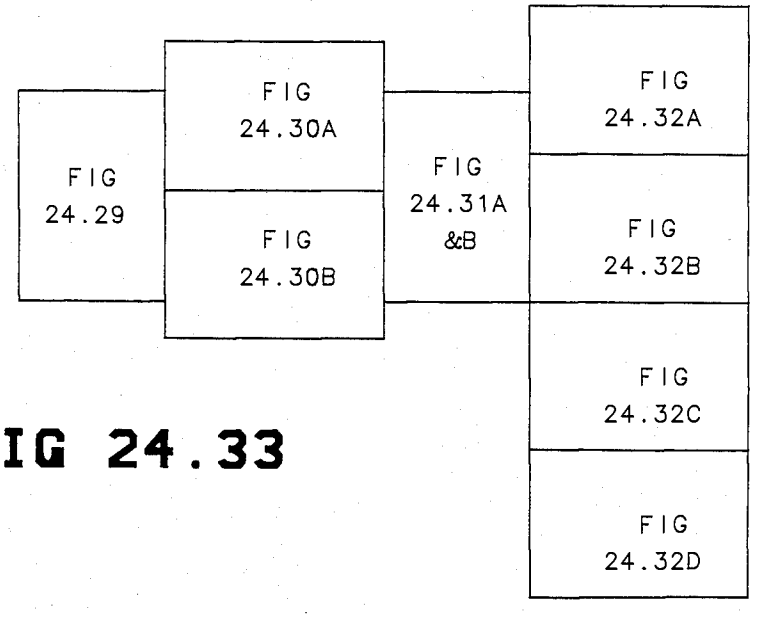


FIG 24.33

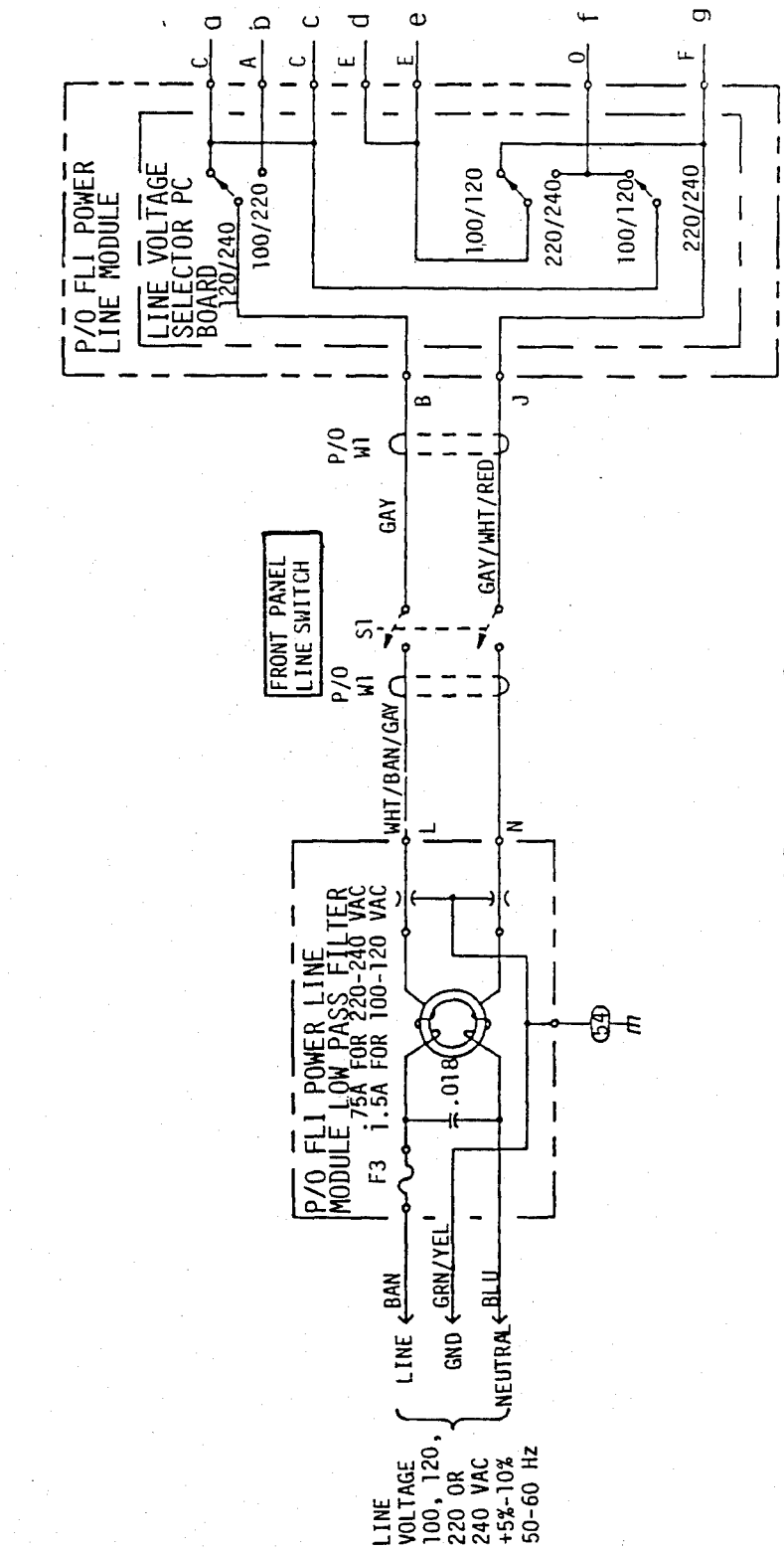

P/O FL1 POWER LINE MODULE
LINE VOLTAGE SELECTOR PC BOARD
120/240
100/220
100/120
220/240
100/120
220/240
a
b
c
d
e
f
g
C
A
C
E
E
O
F
P/O W1
B
J
GAY
GAY/WHT/RED
FRONT PANEL LINE SWITCH
S1
P/O W1
WHT/BAN/GAY
L
N
P/O FL1 POWER LINE MODULE LOW PASS FILTER
F3 1.5A FOR 100-120 VAC
.75A FOR 220-240 VAC
.018
G4
m
LINE
GND
NEUTRAL
BAN
GRN/YEL
BLU
LINE VOLTAGE 100, 120, 220 OR 240 VAC +5%-10% 50-60 Hz

FIG 24.29

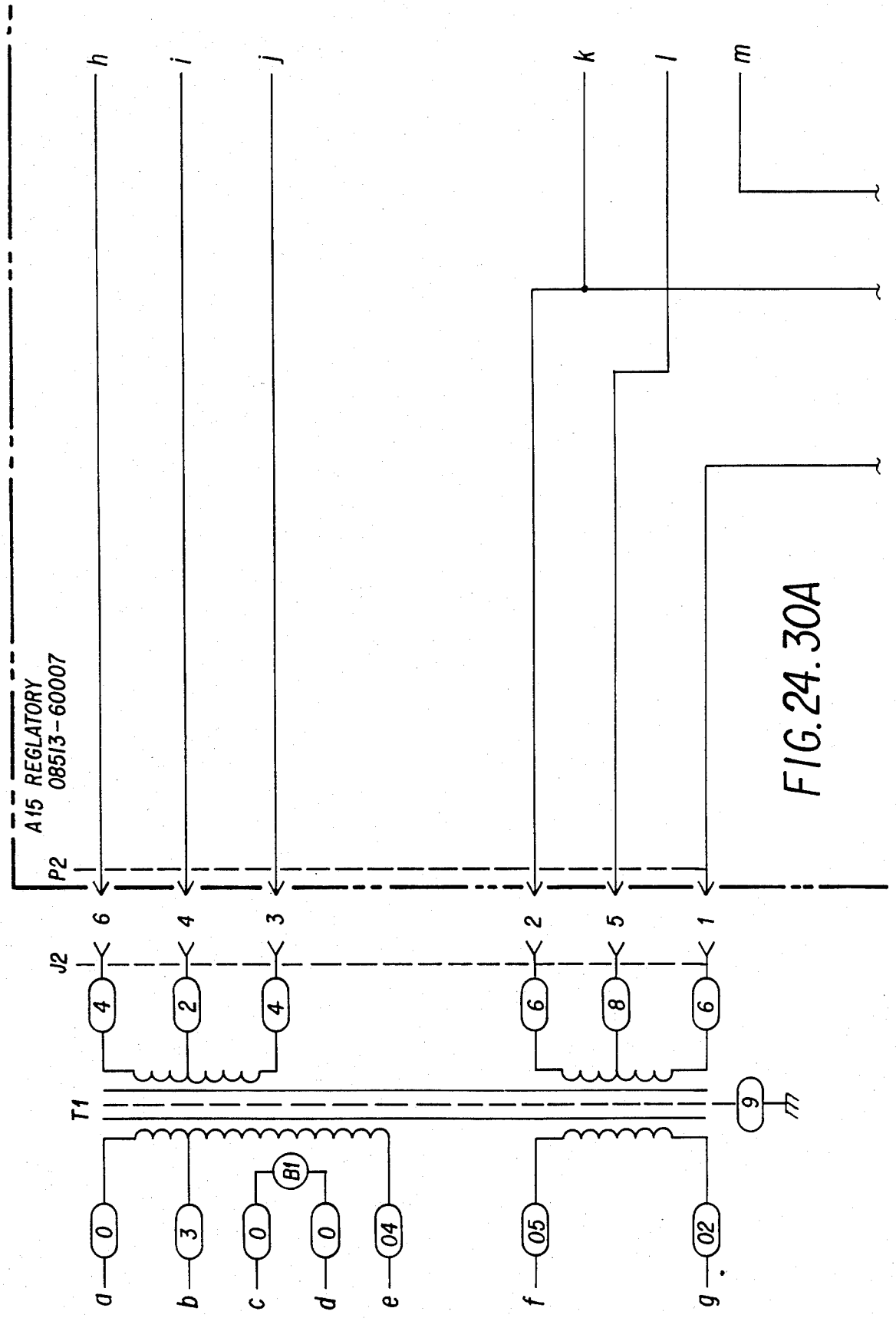

A15 REGLATORY
08513-60007
P2
h
i
j
k
l
m
J2
6
4
3
2
5
1
4
2
4
6
8
6
T1
9
B1
0
3
0
0
04
05
02
a
b
c
d
e
f
g

FIG. 24. 30A

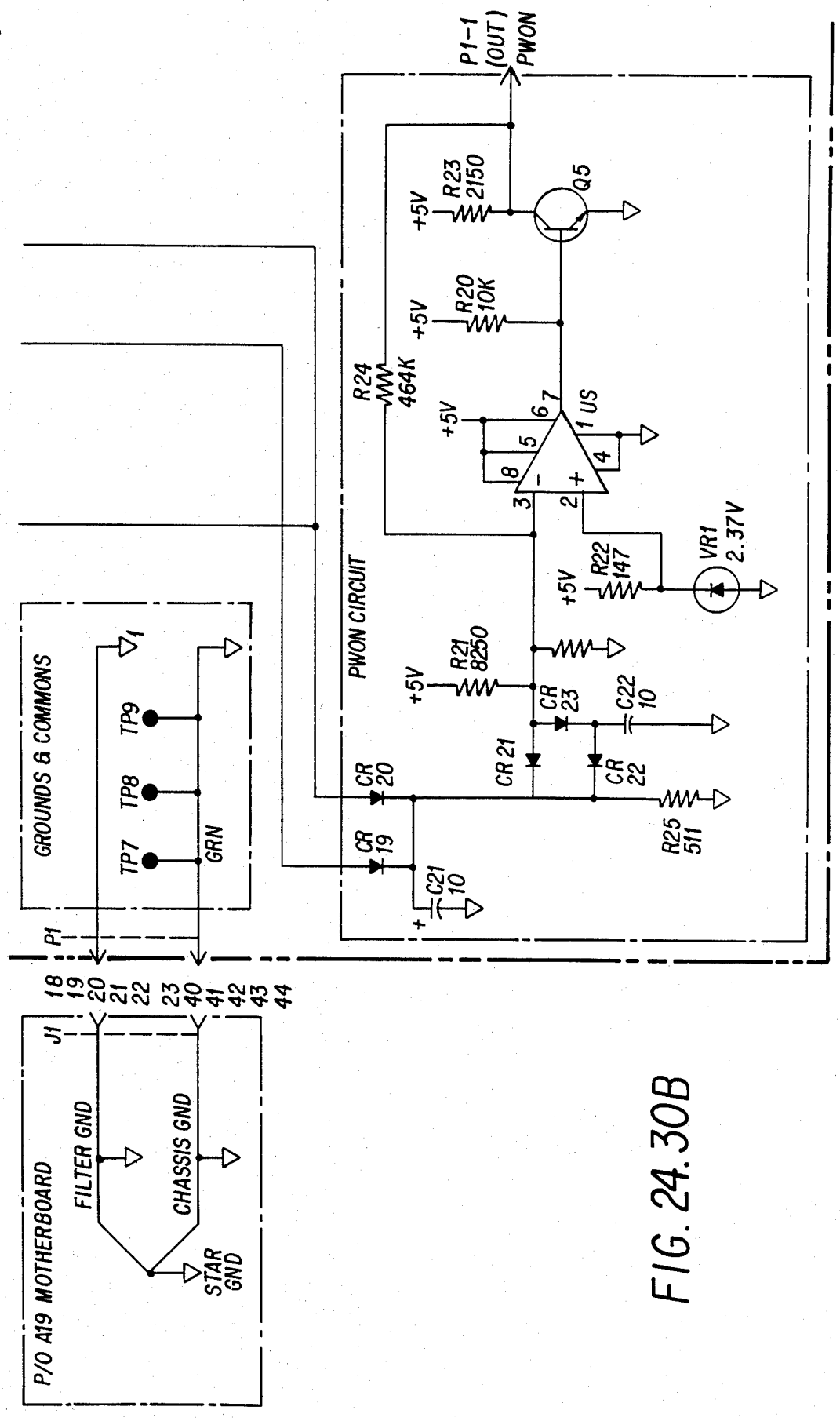

P1-1 (OUT) PWON
R23 2150
Q5
+5V
R20 10K
R24 464K
1 US
VR1 2.37V
R22 147
R21 8250
CR 23
C22 10
CR 21
CR 22
CR 20
CR 19
C21 10
R25 511
PWON CIRCUIT
GROUNDS & COMMONS
TP9
TP8
TP7
GRN
P1
J1
18 19 20 21 22 23 40 41 42 43 44
P/O A19 MOTHERBOARD
FILTER GND
CHASSIS GND
STAR GND

FIG. 24.30B

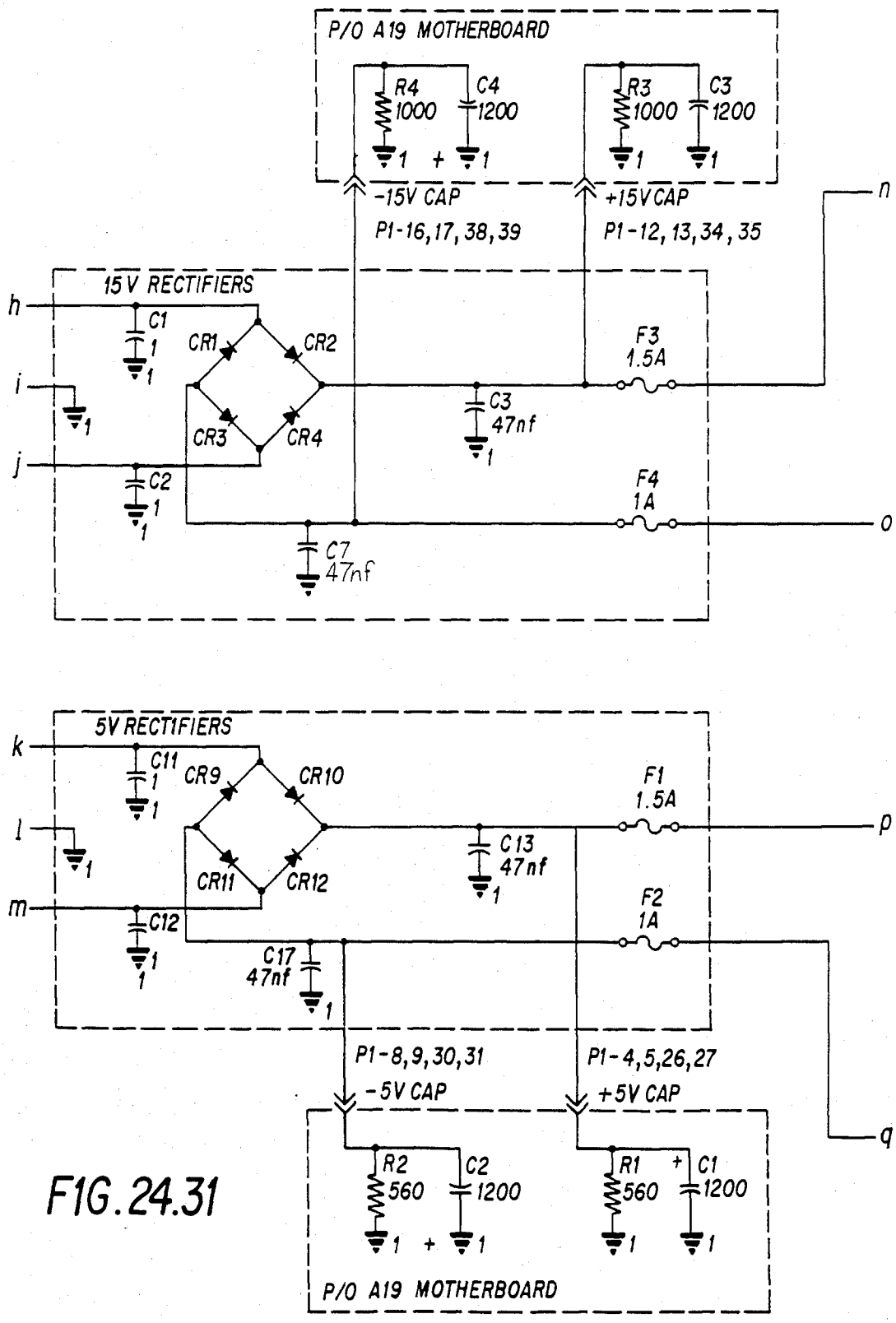

P/O A19 MOTHERBOARD
R4
1000
C4
1200
R3
1000
C3
1200
-15V CAP
P1-16,17,38,39
+15V CAP
P1-12,13,34,35
n
15V RECTIFIERS
h
i
j
C1
CR1
CR2
CR3
CR4
C2
F3
1.5A
C3
47nf
F4
1A
o
C7
47nf
5V RECTIFIERS
k
l
m
C11
CR9
CR10
CR11
CR12
C12
C13
47nf
F1
1.5A
p
F2
1A
C17
47nf
q
P1-8,9,30,31
-5V CAP
P1-4,5,26,27
+5V CAP
R2
560
C2
1200
R1
560
C1
1200
P/O A19 MOTHERBOARD

FIG. 24.31

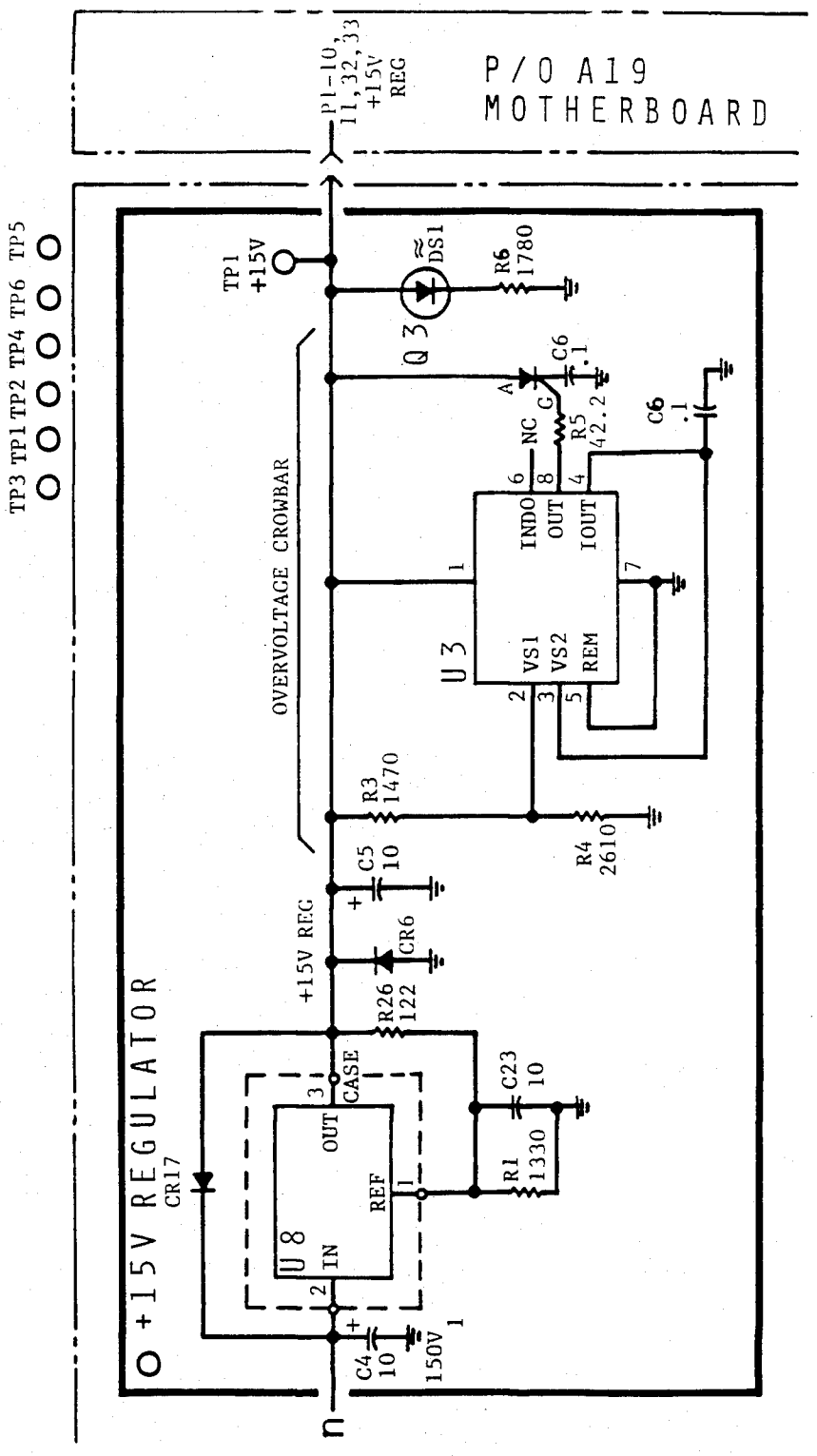

P/O A19
MOTHERBOARD
P1-10, 11, 32, 33
+15V REG
TP3 TP1 TP2 TP4 TP6 TP5
TP1
+15V
DS1
R6
1780
Q3
C6
.1
A
C
NC
R5
42.2
INDO
OUT
IOUT
VS1
VS2
REM
U3
OVERVOLTAGE CROWBAR
R3
1470
R4
2610
C5
10
+15V REG
CR6
R26
122
CASE
C23
10
R1
1330
OUT
REF
IN
U8
CR17
+15V REGULATOR
C4
10
150V

FIG 24.32A

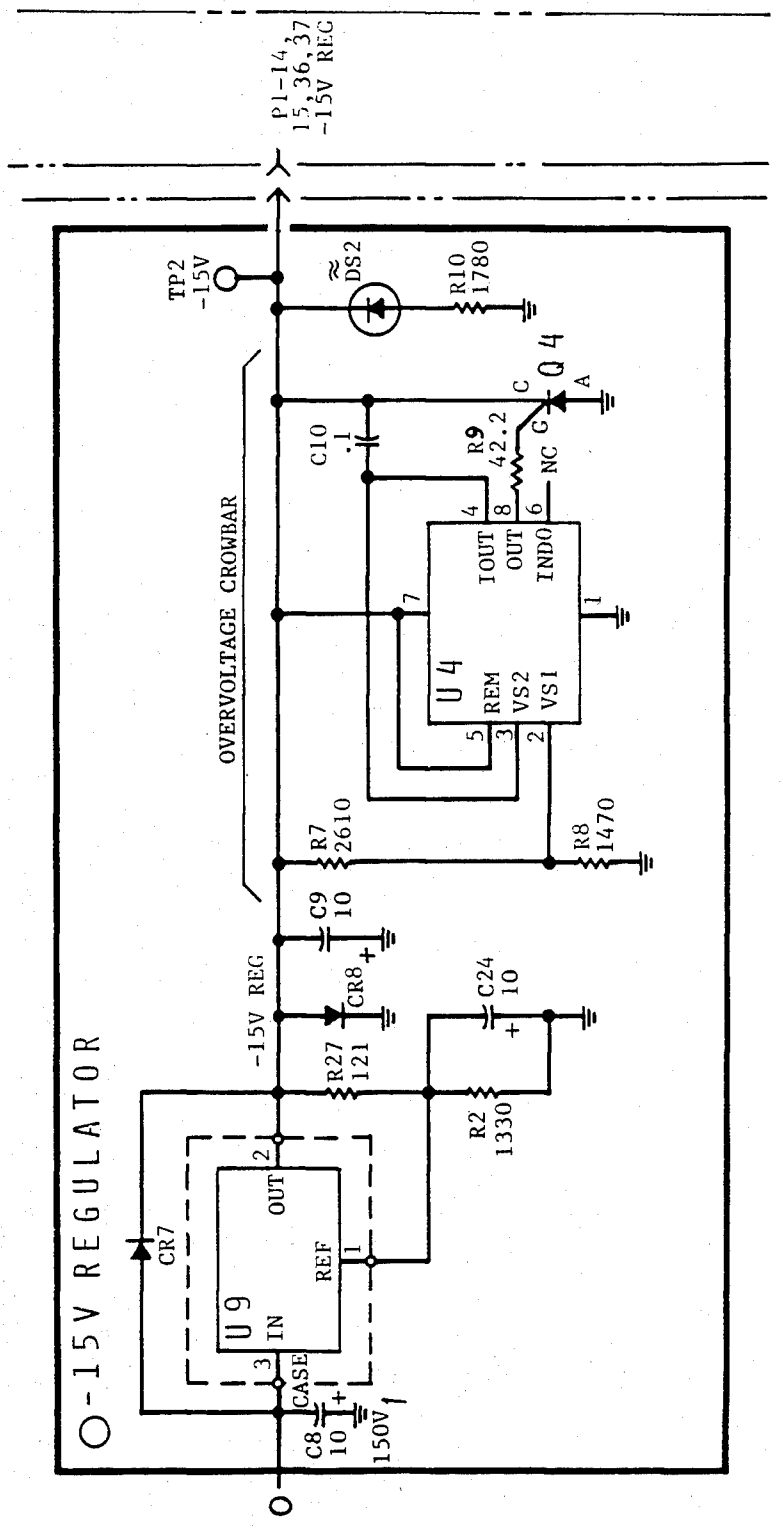

P1-14, 15, 36, 37
-15V REC
TP2
-15V
DS2
R10
1780
Q4
C
A
G
NC
C10
.1
R9
42.2
4
8
6
IOUT
OUT
IND0
7
1
U4
REM
VS2
VS1
5
3
2
OVERVOLTAGE CROWBAR
R7
2610
R8
1470
C9
10
CR8
C24
10
-15V REG
R27
121
R2
1330
2
OUT
REF
1
U9
IN
3
CASE
CR7
C8
10
150V
O-15V REGULATOR
O

FIG 24.32B

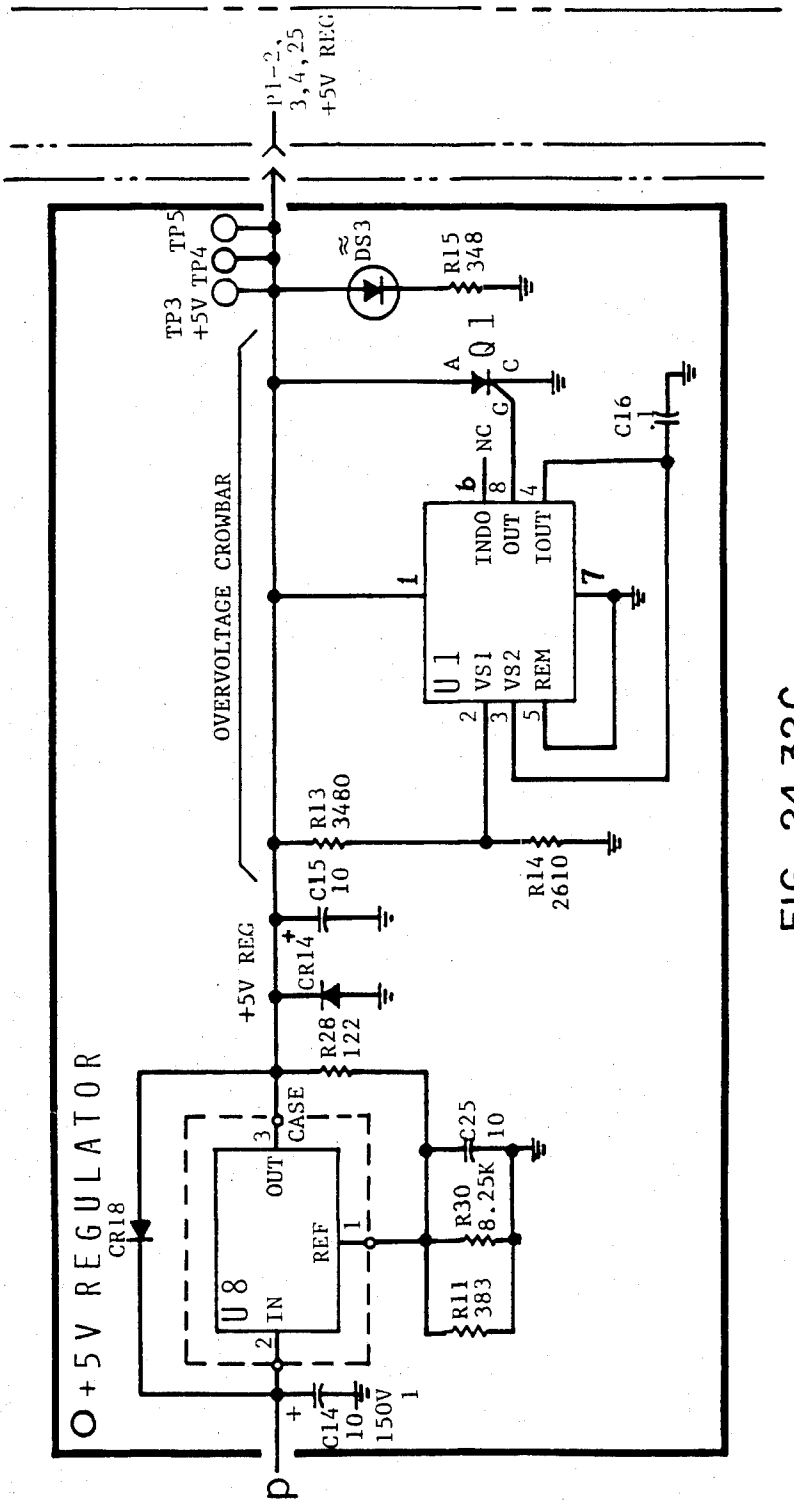

P1-2, 3, 4, 25 +5V REG
TP5
TP4
TP3 +5V
DS3
R15 348
Q1
A
C
G
NC
C16
U1
INDO
OUT
IOUT
VS1
VS2
REM
OVERVOLTAGE CROWBAR
R13 3480
R14 2610
C15 10
CR14
+5V REG
R28 122
+5V REGULATOR
CR18
U8
IN
OUT
REF
CASE
C25 10
R30 8.25K
R11 383
C14 10 150V
P

FIG 24.32C

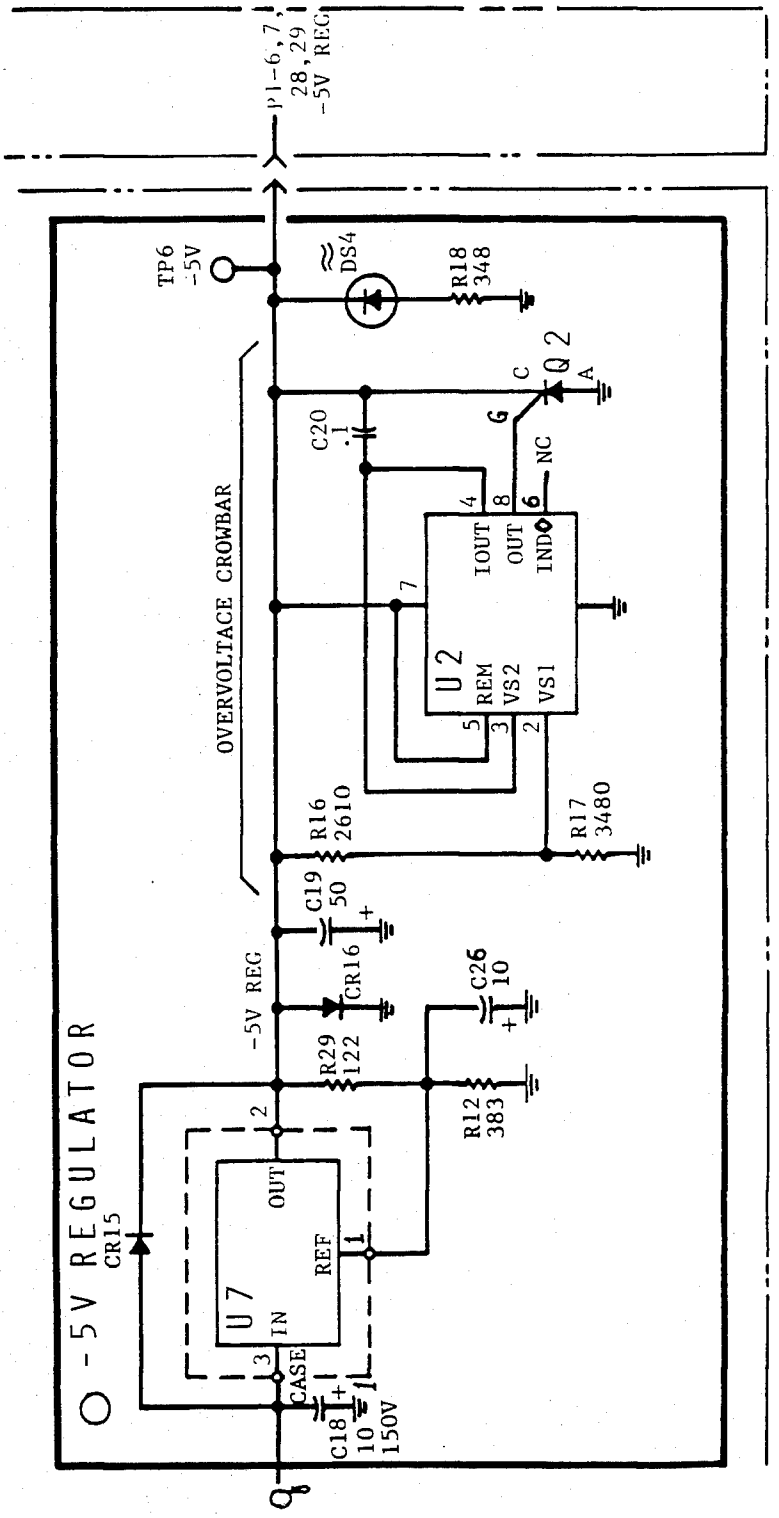

P1-6,7,28,29 -5V REG
TP6 -5V
DS4
R18 348
Q2
C
G
A
C20 .1
NC
4
8
6
IOUT
OUT
IND
7
U2
REM
VS2
VS1
5
3
2
OVERVOLTAGE CROWBAR
R16 2610
R17 3480
C19 50
CR16
C26 10
-5V REG
R29 122
R12 383
2
OUT
REF
1
U7
IN
CASE
3
CR15
C18 10 150V
-5V REGULATOR

FIG 24.32D

FIG. 25.1A

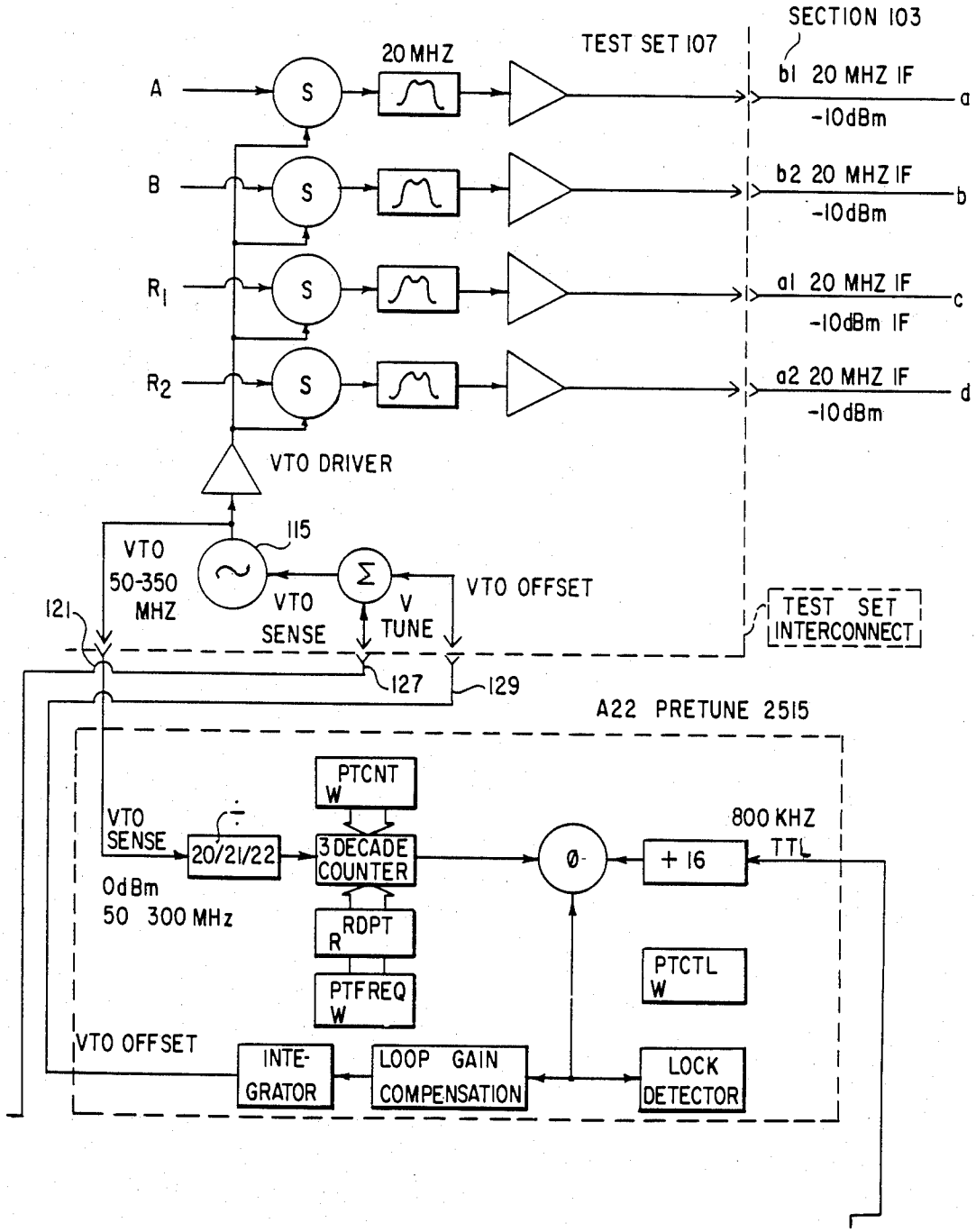
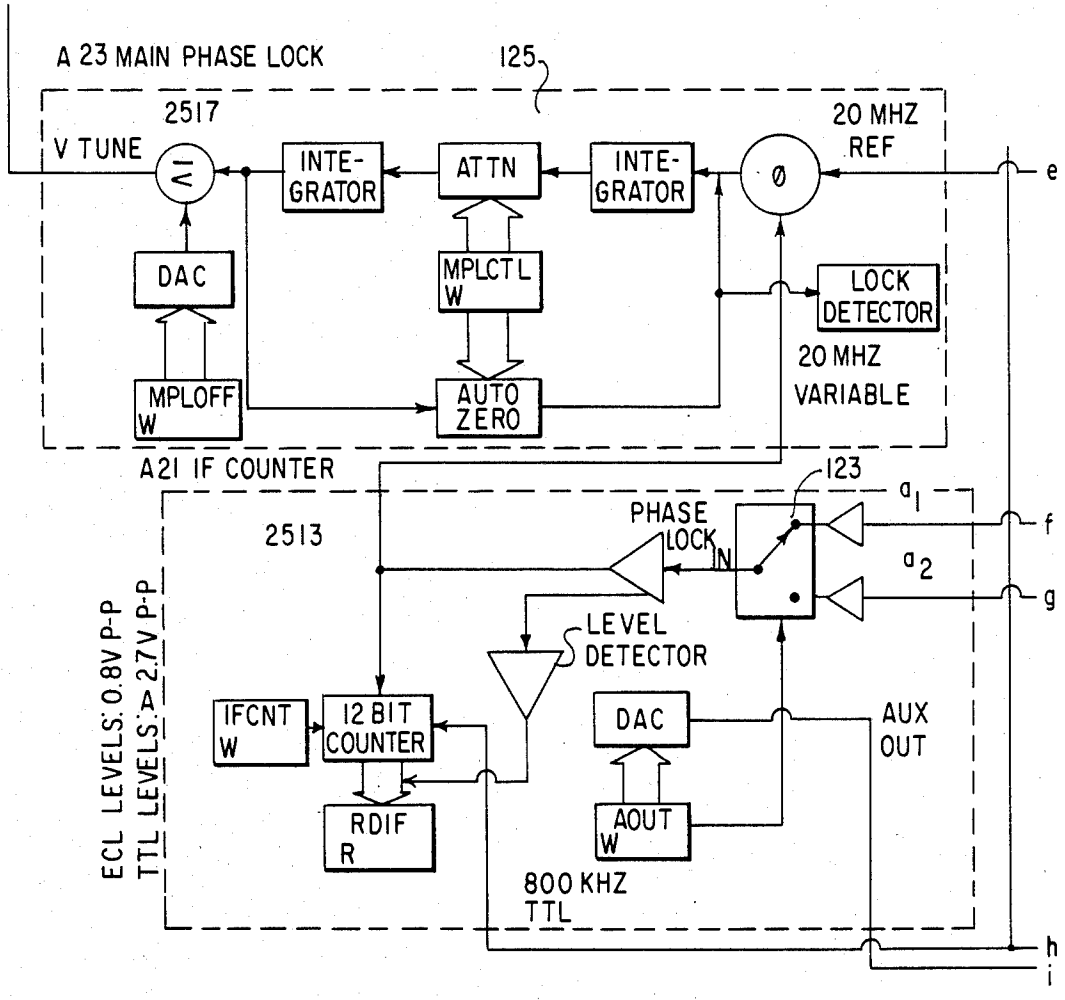

SECTION 103
TEST SET 107
20 MHZ
A
B
R1
R2
S
b1 20 MHZ IF
-10dBm
a
b2 20 MHZ IF
-10dBm
b
a1 20 MHZ IF
-10dBm IF
c
a2 20 MHZ IF
-10dBm
d
VTO DRIVER
115
VTO
50-350
MHZ
VTO
SENSE
V
TUNE
VTO OFFSET
121
TEST SET
INTERCONNECT
127
129
A22 PRETUNE 2515
PTCNT
W
VTO
SENSE
20/21/22
3 DECADE
COUNTER
0dBm
50 300 MHz
RDPT
R
PTFREQ
W
800 KHZ
TTL
+ 16
PTCTL
W
VTO OFFSET
INTE-
GRATOR
LOOP GAIN
COMPENSATION
LOCK
DETECTOR

FIG. 25.1B


A 23 MAIN PHASE LOCK
125
2517
V TUNE
INTE-GRATOR
ATTN
INTE-GRATOR
20 MHZ REF
e
DAC
MPLCTL W
LOCK DETECTOR
20 MHZ VARIABLE
MPLOFF W
AUTO ZERO
A21 IF COUNTER
123
a_1
2513
PHASE LOCK IN
a_2
f
g
LEVEL DETECTOR
ECL LEVELS: 0.8V P-P
TTL LEVELS: ≥ 2.7V P-P
IFCNT W
12 BIT COUNTER
DAC
AUX OUT
RDIF R
AOUT W
800 KHZ TTL
h
i

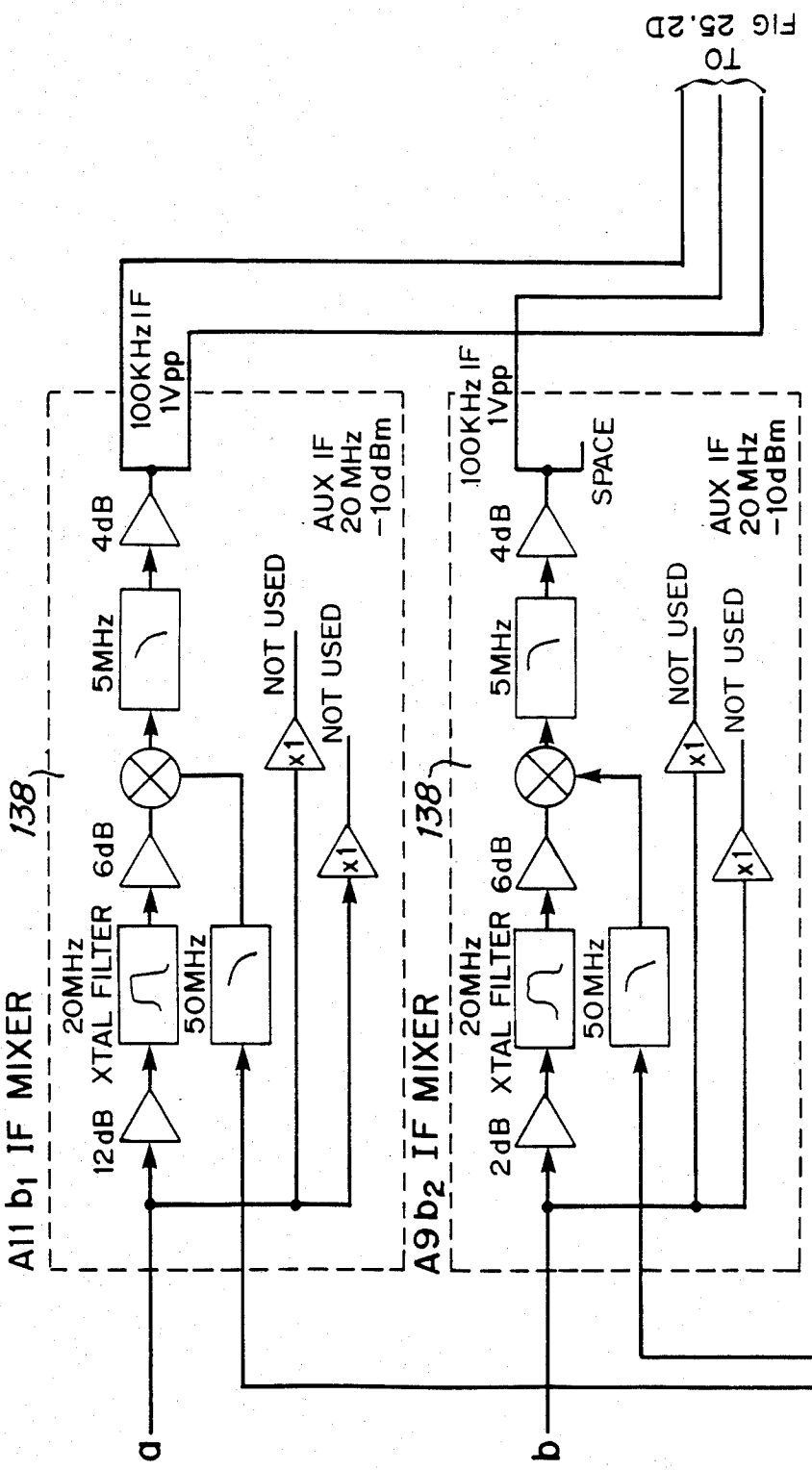

TO FIG 25.2D
100KHz IF 1Vpp
A11 b1 IF MIXER
138
12dB
20MHz XTAL FILTER
50MHz
6dB
5MHz
4dB
NOT USED
AUX IF 20 MHz -10dBm
x1
a
A9 b2 IF MIXER
2dB
SPACE
b
TO FIG 25.2B

FIG 25.2A

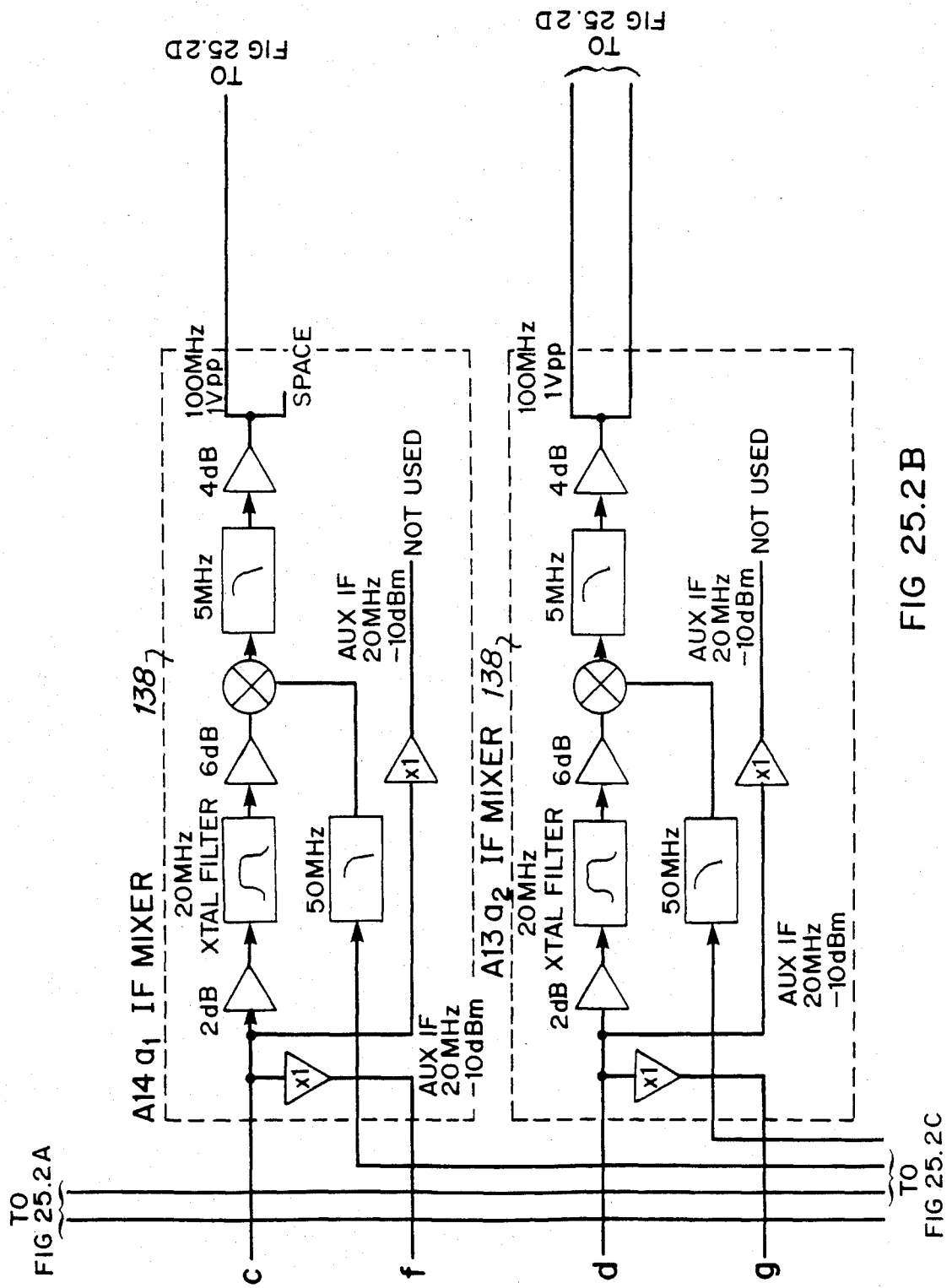

TO FIG 25.2D
TO FIG 25.2D
100MHz 1Vpp
SPACE
4dB
5MHz
6dB
AUX IF 20MHz -10dBm
NOT USED
20MHz XTAL FILTER
2dB
50MHz
x1
A14 a1 IF MIXER 138
A13 a2 IF MIXER 138
TO FIG 25.2A
TO FIG 25.2C
c
f
d
g

FIG 25.2B

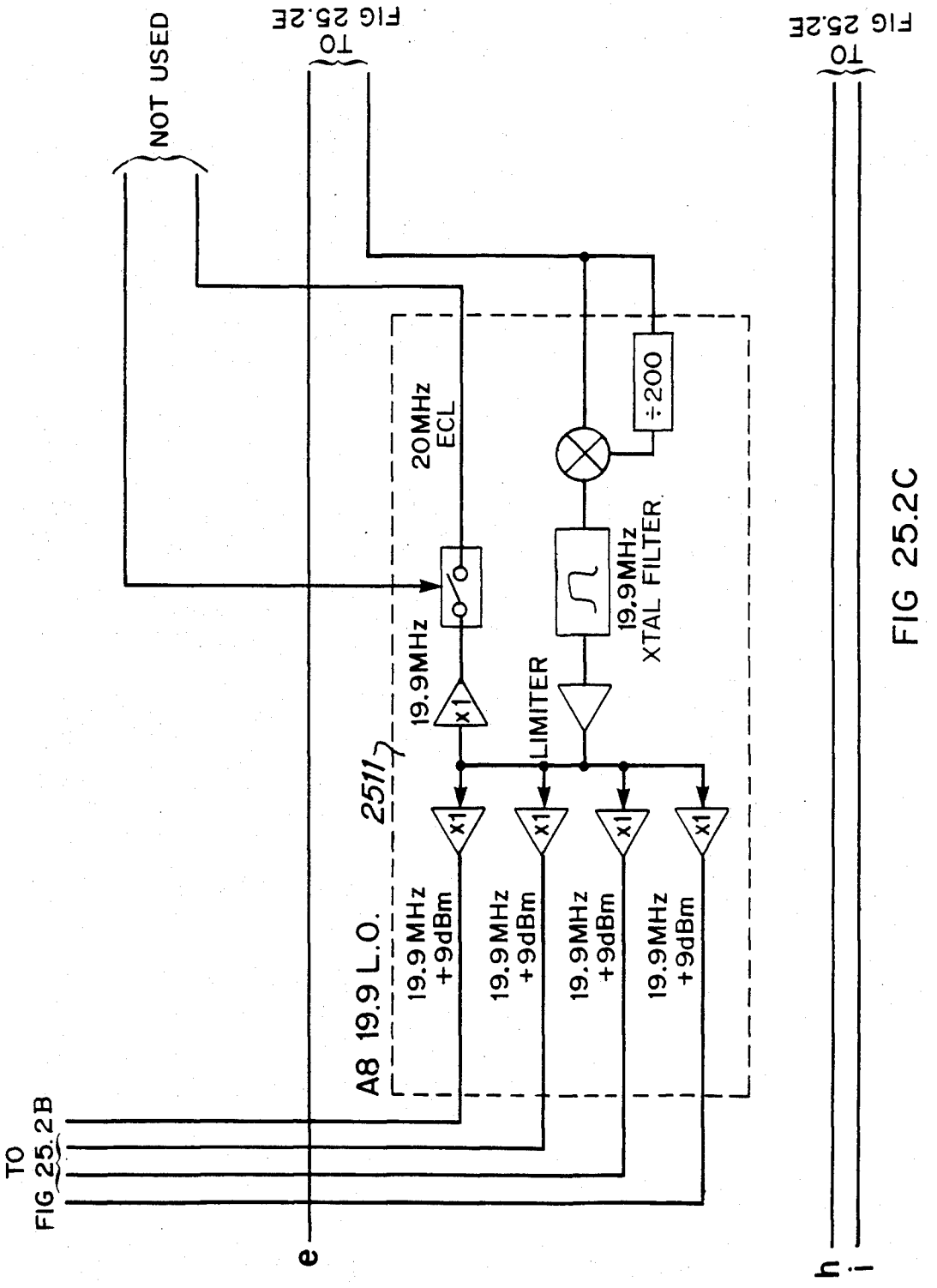

NOT USED
TO FIG 25.2E
TO FIG 25.2E
20MHz ECL
÷200
19.9MHz XTAL FILTER
LIMITER
19.9MHz x1
2511
A8 19.9 L.O.
19.9MHz +9dBm
19.9MHz +9dBm
19.9MHz +9dBm
19.9MHz +9dBm
x1
x1
x1
x1
TO FIG 25.2B
e
h
i

FIG 25.2C

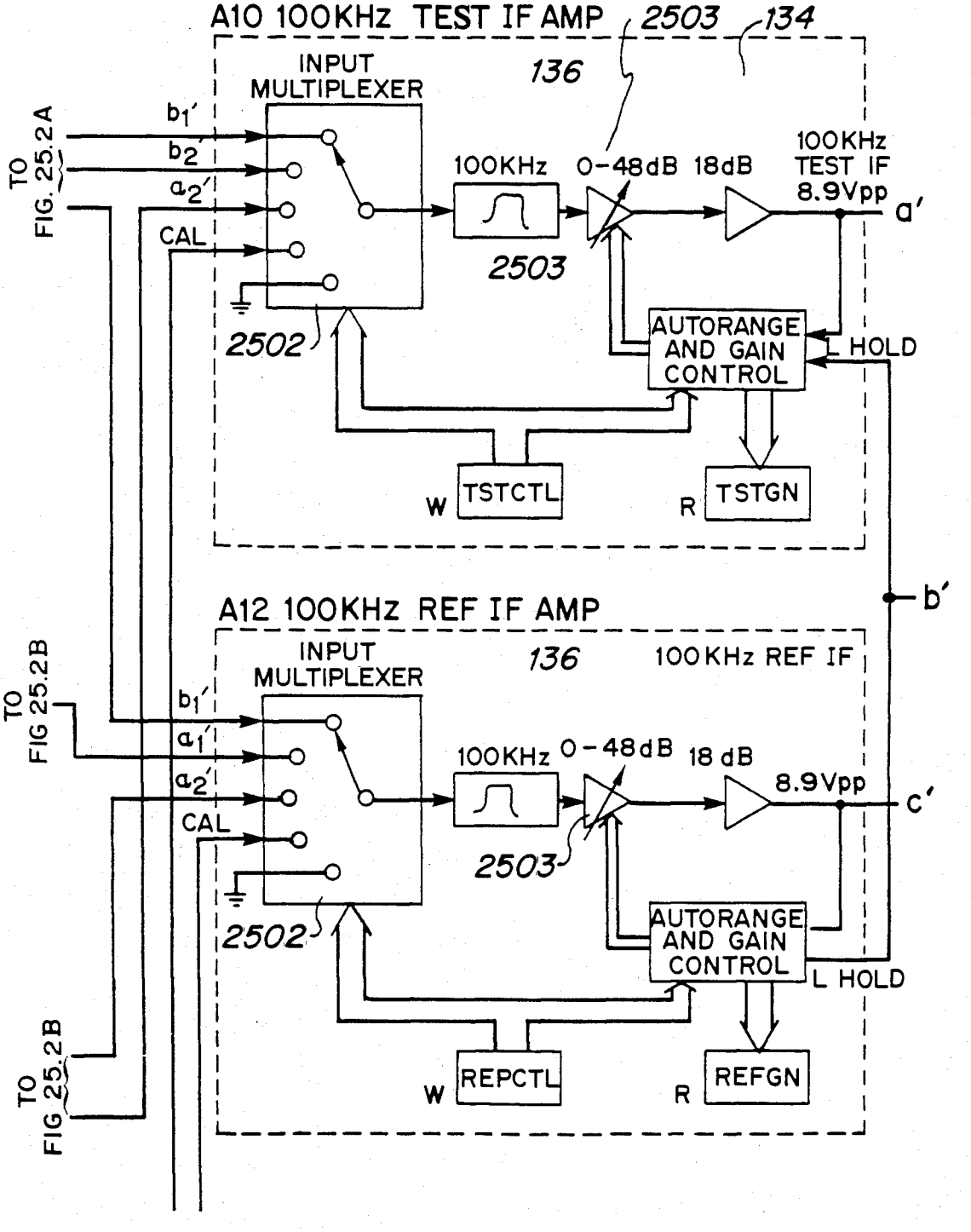

A10 100KHz TEST IF AMP
2503
134
136
INPUT MULTIPLEXER
TO FIG. 25.2A
b1'
b2'
a2'
CAL
100KHz
0-48dB
18dB
100KHz TEST IF 8.9Vpp
a'
2503
2502
AUTORANGE AND GAIN CONTROL
L HOLD
W
TSTCTL
R
TSTGN
b'
A12 100KHz REF IF AMP
136
100KHz REF IF
INPUT MULTIPLEXER
TO FIG 25.2B
b1'
a1'
a2'
CAL
100KHz
0-48dB
18 dB
8.9Vpp
c'
2503
2502
AUTORANGE AND GAIN CONTROL
L HOLD
TO FIG 25.2B
W
REPCTL
R
REFGN

FIG. 25.2D

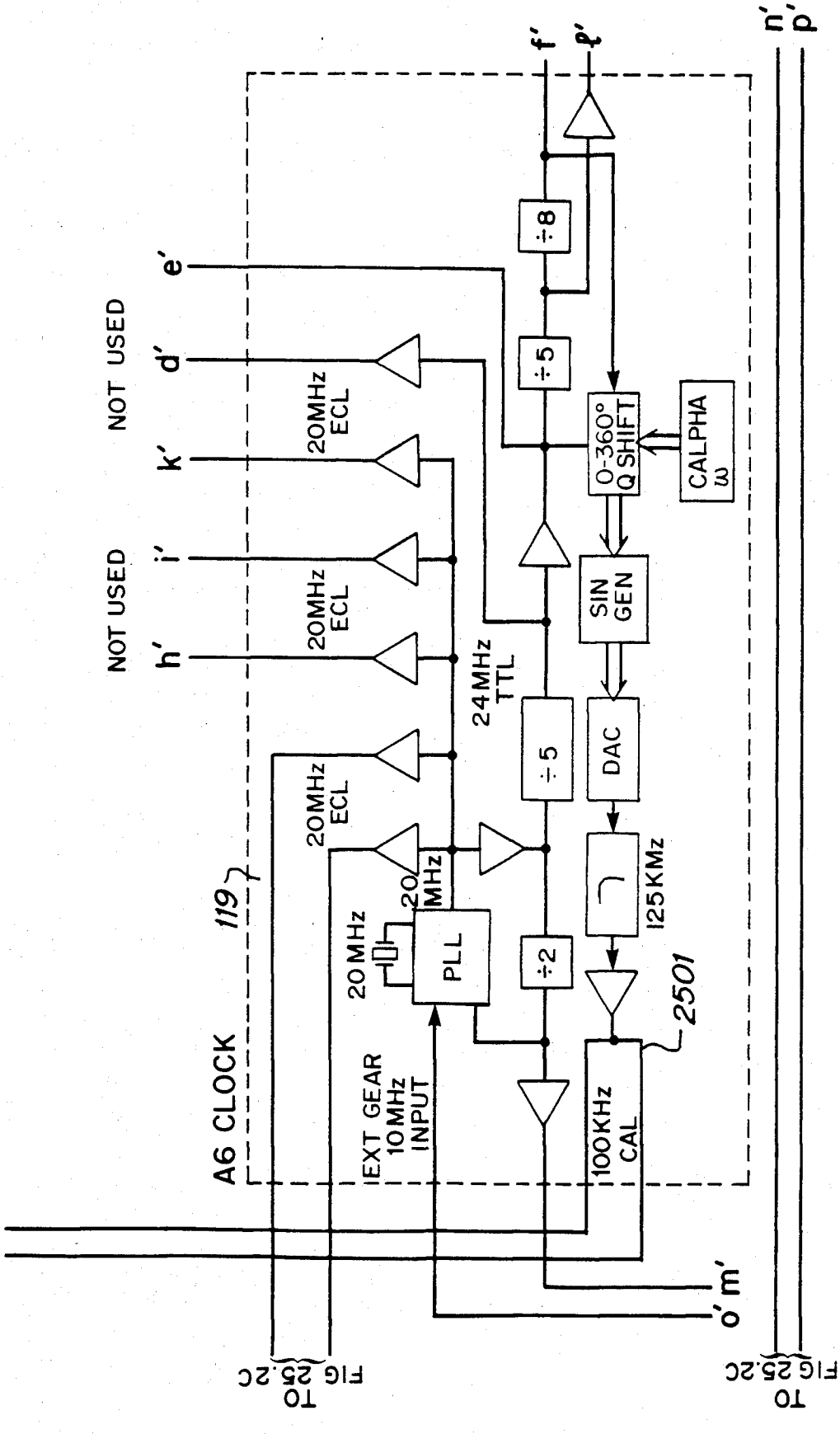

A6 CLOCK
119
EXT GEAR 10MHz INPUT
20 MHz
20 MHz
PLL
÷2
÷5
÷8
24MHz TTL
÷5
DAC
125KMz
100KHz CAL
2501
0-360° Q SHIFT
CALPHA ω
SIN GEN
20MHz ECL
20MHz ECL
20MHz ECL
NOT USED
NOT USED
e'
d'
k'
i'
h'
f'
g'
n'
p'
o'
m'
TO FIG 25.2C
TO FIG 25.2C

FIG 25.2E

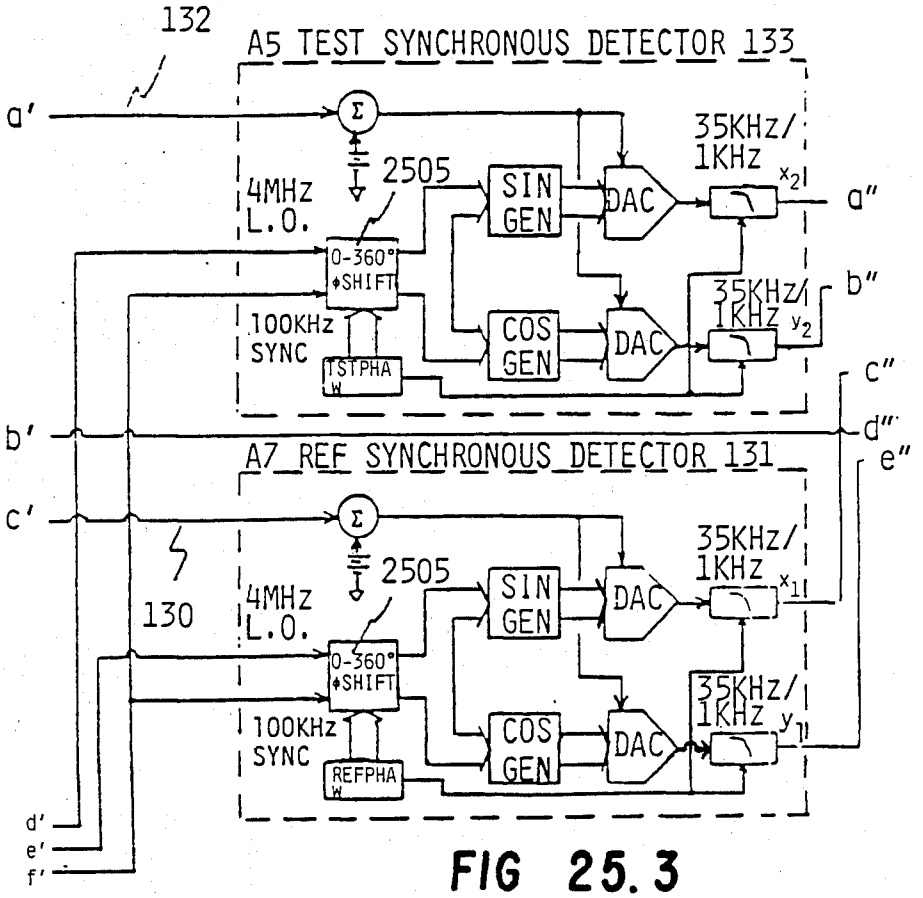


FIG 25.3

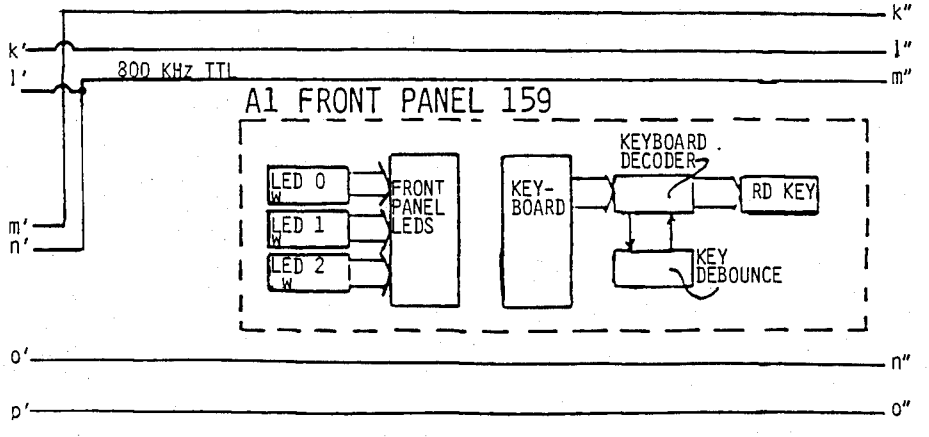


FIG 25.4

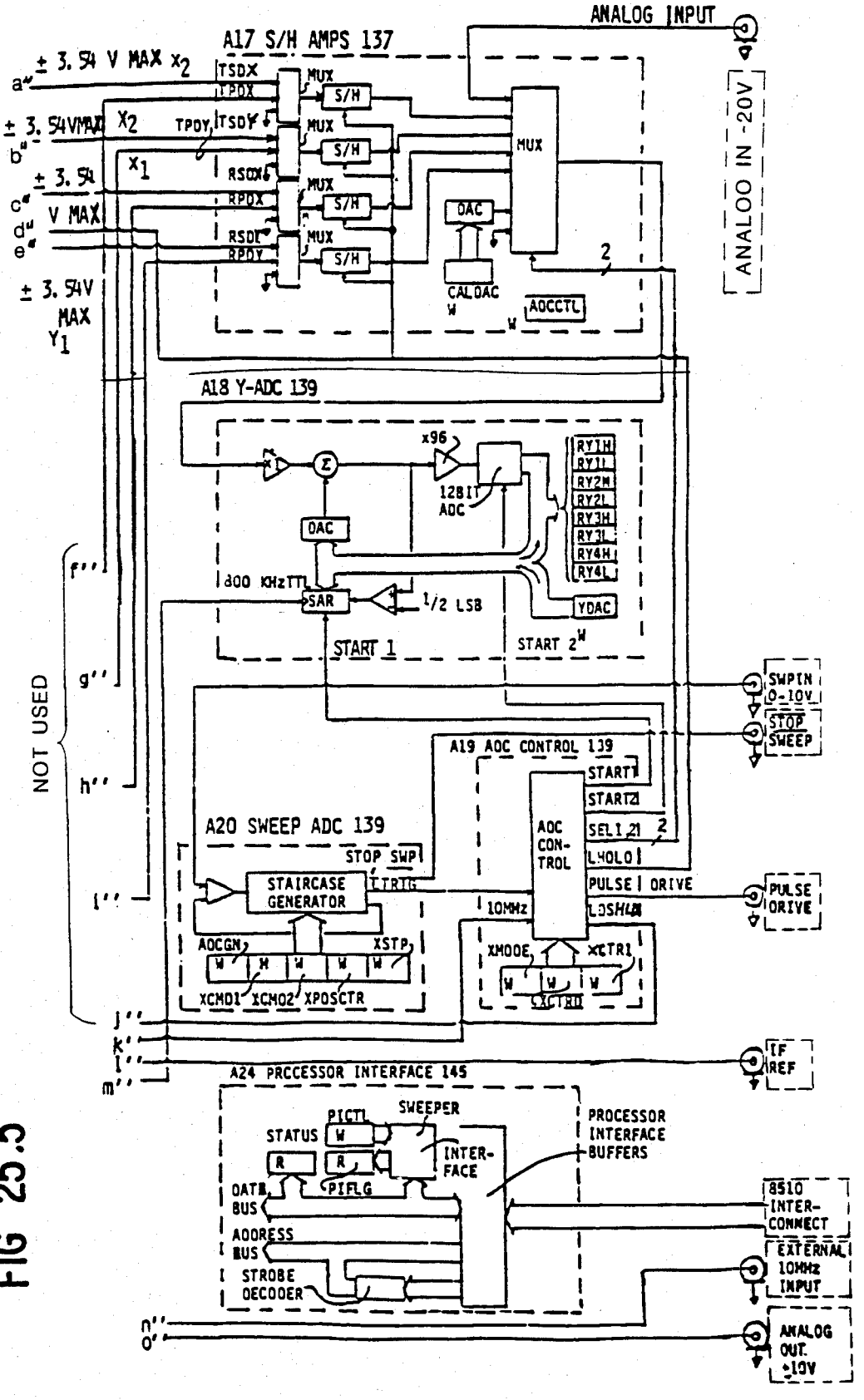

ANALOG INPUT
A17 S/H AMPS 137
± 3.54 V MAX X2
± 3.54VMAX X2
± 3.54 V MAX Y1
TSDX
TPDX
TPDY
TSDY
RSDX
RPDX
RSDY
RPDY
MUX
S/H
DAC
CALDAC
AOCCTL
ANALOO IN -20V
A18 Y-ADC 139
x96
12BIT ADC
RY1H
RY1L
RY2H
RY2L
RY3H
RY3L
RY4H
RY4L
YDAC
800 KHzTTL
SAR
1/2 LSB
START 1
START 2
NOT USED
SWPIN 0-10V
STOP SWEEP
A19 AOC CONTROL 139
START1
START2
SEL1,2
LHOLO
PULSE DRIVE
A20 SWEEP ADC 139
STOP SWP
STAIRCASE GENERATOR
TTRIG
AOCGN
XSTP
XCMD1
XCMD2
XPOSCTR
AOC CON-TROL
10MHz
XMODE
XCTRL
PULSE ORIVE
IF REF
A24 PROCESSOR INTERFACE 145
PICTL
SWEEPER
STATUS
INTER-FACE
PIFLG
DATA BUS
ADDRESS BUS
STROBE DECODER
PROCESSOR INTERFACE BUFFERS
8510 INTER-CONNECT
EXTERNAL 10MHz INPUT
ANALOG OUT. ±10V

FIG 25.5

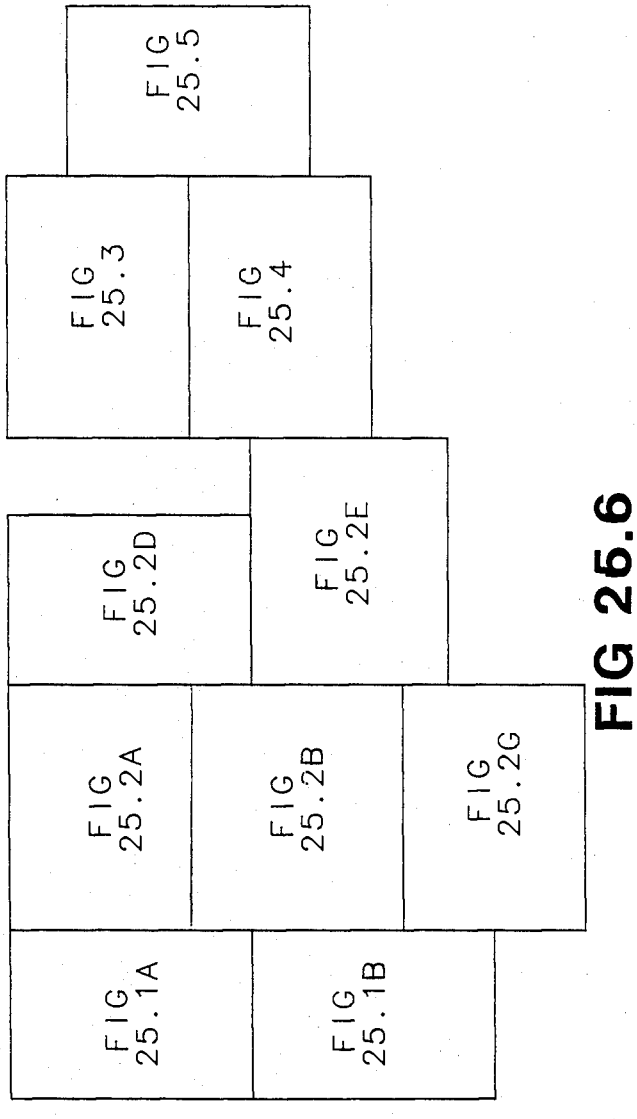


FIG 25.5
FIG 25.3
FIG 25.4
FIG 25.2D
FIG 25.2E
FIG 25.2A
FIG 25.2B
FIG 25.2G
FIG 25.1A
FIG 25.1B

FIG 25.6

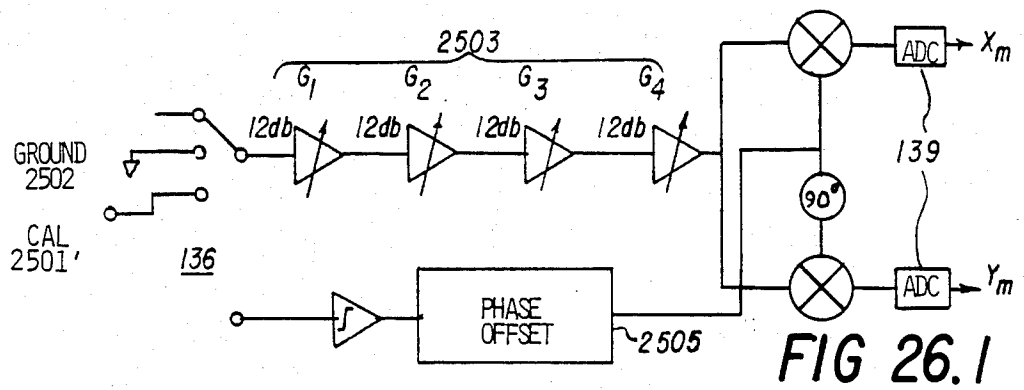


FIG 26.1

$$\begin{bmatrix} X \\ Y \end{bmatrix} = \begin{bmatrix} H_{11} & H_{12} \\ H_{21} & H_{22} \end{bmatrix} \begin{bmatrix} X_m - X_0 \\ Y_m - Y_0 \end{bmatrix}$$

$$[H]$$

FIG 26.2

$$X_0 = \frac{1}{4} \Sigma X_m \quad ; \quad y_0 = \frac{1}{4} \Sigma Y_m$$

FIG 26.3

1) $\begin{bmatrix} X \\ Y \end{bmatrix}_{0^\circ} = \begin{bmatrix} A \\ 0 \end{bmatrix}$;2) $\begin{bmatrix} X \\ Y \end{bmatrix}_{90^\circ} = \begin{bmatrix} 0 \\ A \end{bmatrix}$; 3) $\begin{bmatrix} X \\ Y \end{bmatrix}_{180^\circ} = \begin{bmatrix} -A \\ 0 \end{bmatrix}$;4) $\begin{bmatrix} X \\ Y \end{bmatrix}_{270} = \begin{bmatrix} 0 \\ -A \end{bmatrix}$

FIG 26.4

$$\begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix} \begin{bmatrix} H_{11} \\ H_{12} \\ H_{21} \\ H_{22} \end{bmatrix} = \frac{A}{\Sigma(x^2)\Sigma(y^2) - (\Sigma(xy))^2} \cdot \begin{bmatrix} 0 & -(Y_1-Y_3) & (X_1-X_3) \\ (Y_1-Y_3) & -(X_1-X_3) & 0 \\ 0 & -(Y_2-Y_4) & (X_2-X_4) \\ (Y_2-Y_4) & -(X_2-X_4) & 0 \end{bmatrix} \begin{bmatrix} \Sigma(x^2) \\ \Sigma(xy) \\ \Sigma(y^2) \end{bmatrix}$$

$$\text{II}$$
$$A$$

FIG 26.5

$$a_1 = A \cdot \left[\frac{(X_1-X_3) + (Y_2-Y_4)}{\Sigma(X^2) + \Sigma(Y^2)} \right]$$

$$b_1 = A \cdot \left[\frac{(X_2-X_4) + (Y_3-Y_1)}{\Sigma(X^2) + \Sigma(Y^2)} \right]$$

FIG 26.6

PI A6 CLOCK

PIN	SIGNAL	TO/FROM	FUCTION CLOCK
1 23			
2	LTSDS	A5	A
24	LRSDS	A7	A
3	LTIFWS	A10	A
25	LRIFWS	A12	A
4	LTIFRS	A10	A
26 5	LRIFRS LHOST	A12 ADR BUS	A A
27	LIFSRQ		
6	CLK	A2-A5 A16-A21	F
28	LRDS		
7	GND		
29	A0	ADR BUS	A
8	A1	ADR BUS	A
30	A2	ACR BUS	A
9	A3	ADR BUS	A
31	A4	ADR BUS	A
10 32	+15V REG	POWER BUS	I
11 33	GND		I
12 34	GND		I
13 35	-15V REG	POWER BUS	I
14 36	+5V REG	POWER BUS	I
15	BUF 080	DATA BUS	C
37	BUF 081	"	C
16	BUF 082	"	C
38	BUF 083	"	C
17	BUF D84	"	C
39	BUF D85	"	C
18	BUF D86	"	C
40	BUF D87	"	C
19 41	100 KHz RET	A5, A7	F F
20	100K SA	A5	F
42	100K SB	A7	F
21 43	100KHz RETA	A5, A7	F F
22 44			

FIG. 27.1A

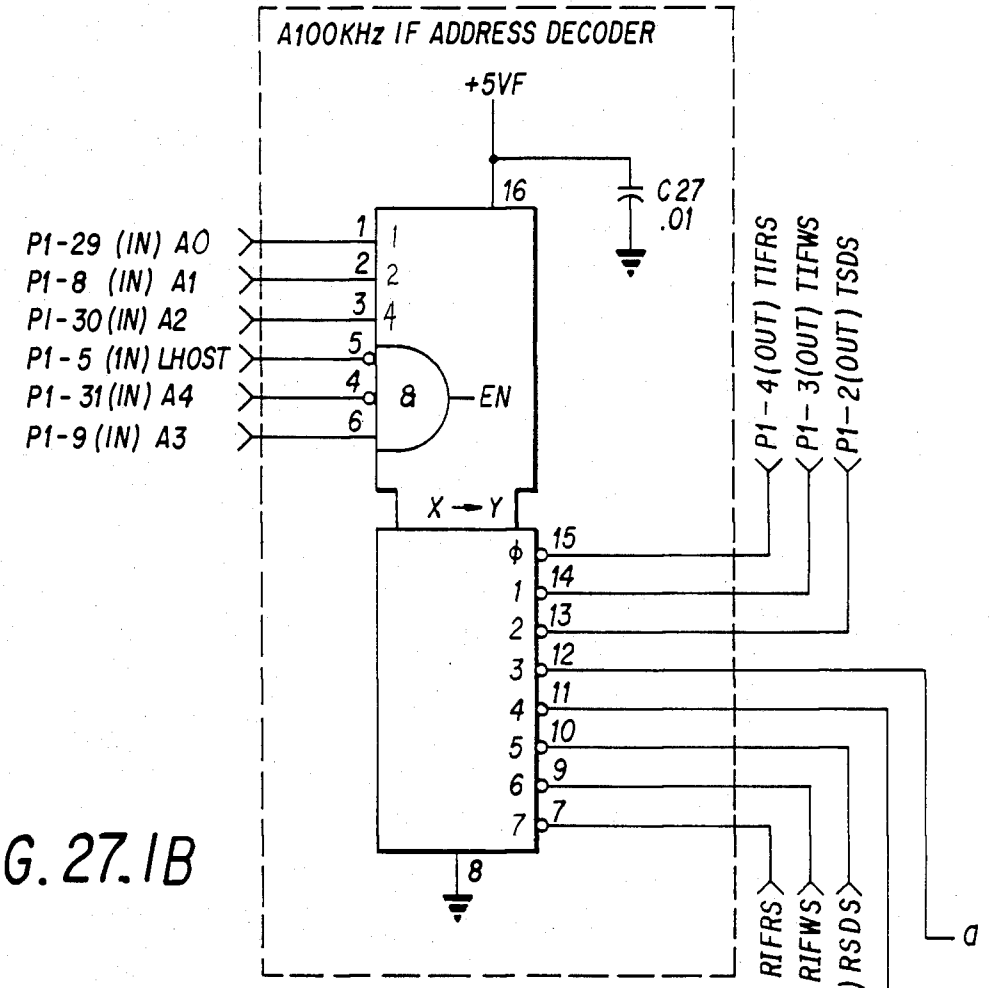


FIG. 27.1B

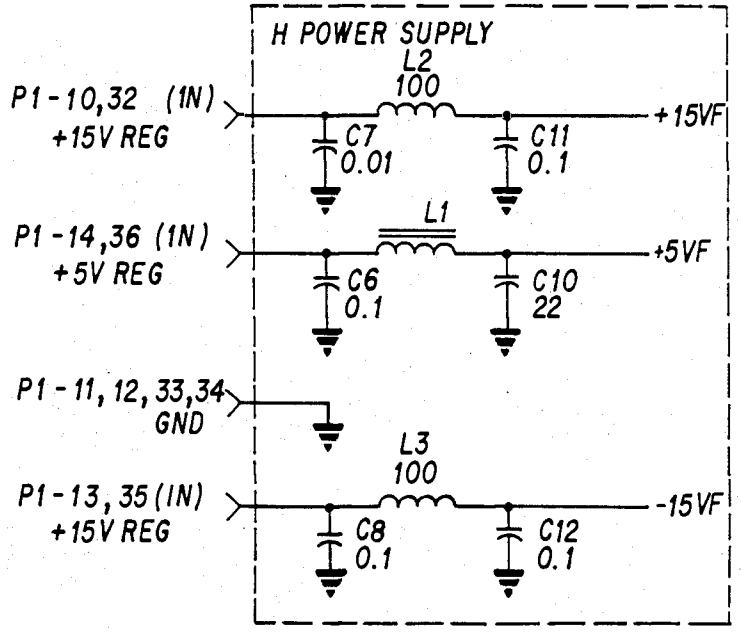


FIG. 27.1C

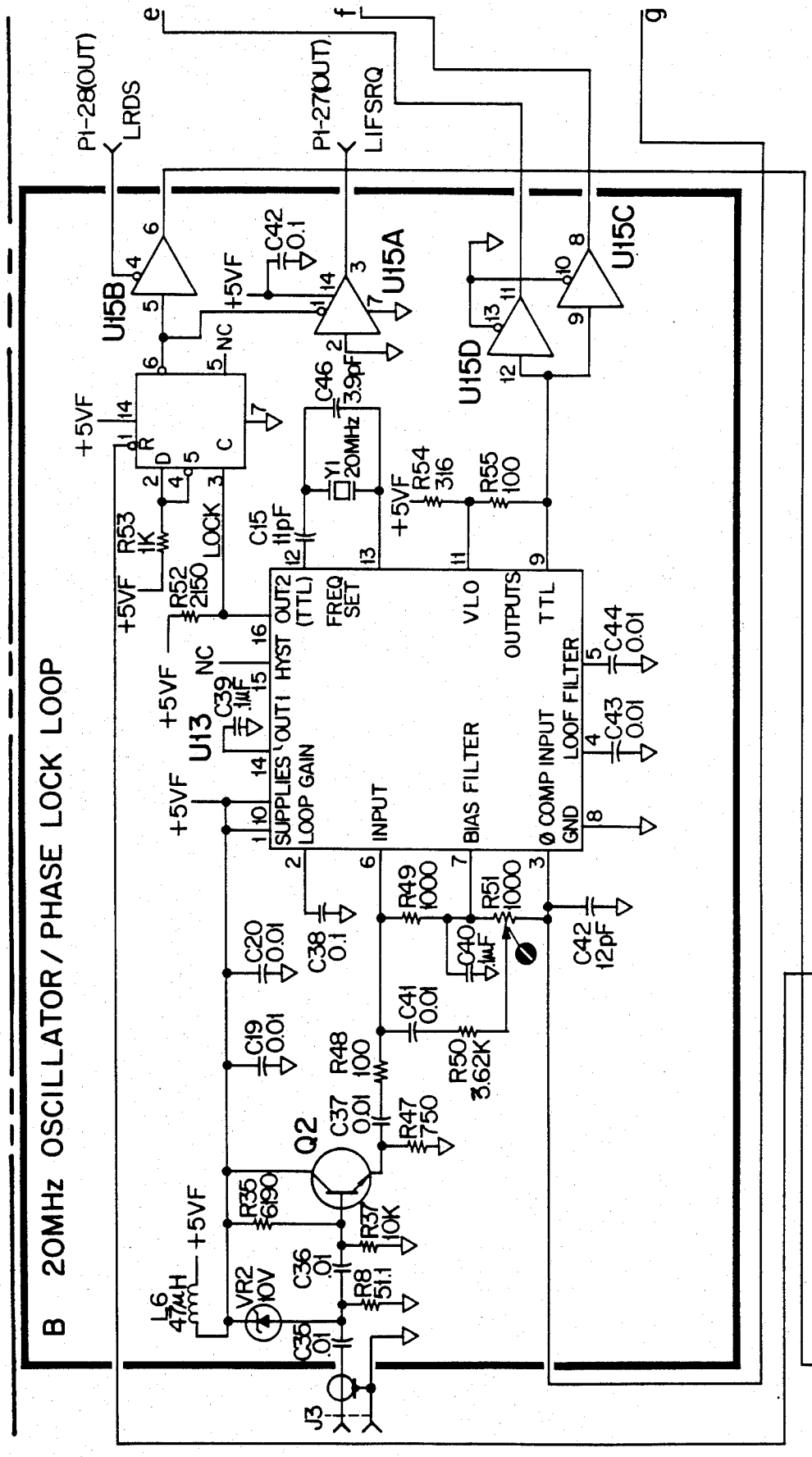

B 20MHz OSCILLATOR / PHASE LOCK LOOP
P1-28(OUT)
LRDS
P1-27(OUT)
LIFSRQ
U15B
U15A
U15C
U15D
U13
+5VF
C42 0.1
C46 3.9pF
Y1 20MHz
C15 11pF
R53 1K
R52 2150
R54 316
R55 100
LOCK
FREQ SET
VLO
OUTPUTS
TTL
NC
HYST
OUT2 (TTL)
OUT1
SUPPLIES
LOOP GAIN
INPUT
BIAS FILTER
Ø COMP INPUT
LOOP FILTER
GND
C39 .1μF
C44 0.01
C43 0.01
C38 0.1
C40 .1μF
C42 12pF
R49 1000
R51 1000
C20 0.01
C19 0.01
C41 0.01
R48 100
R50 3.62K
C37 0.01
R47 750
Q2
R35 680
R37 10K
L6 47μH
VR2 10V
C36 .01
R8 51.1
J3
a
b
c
d
e
f
g

FIG 27.2

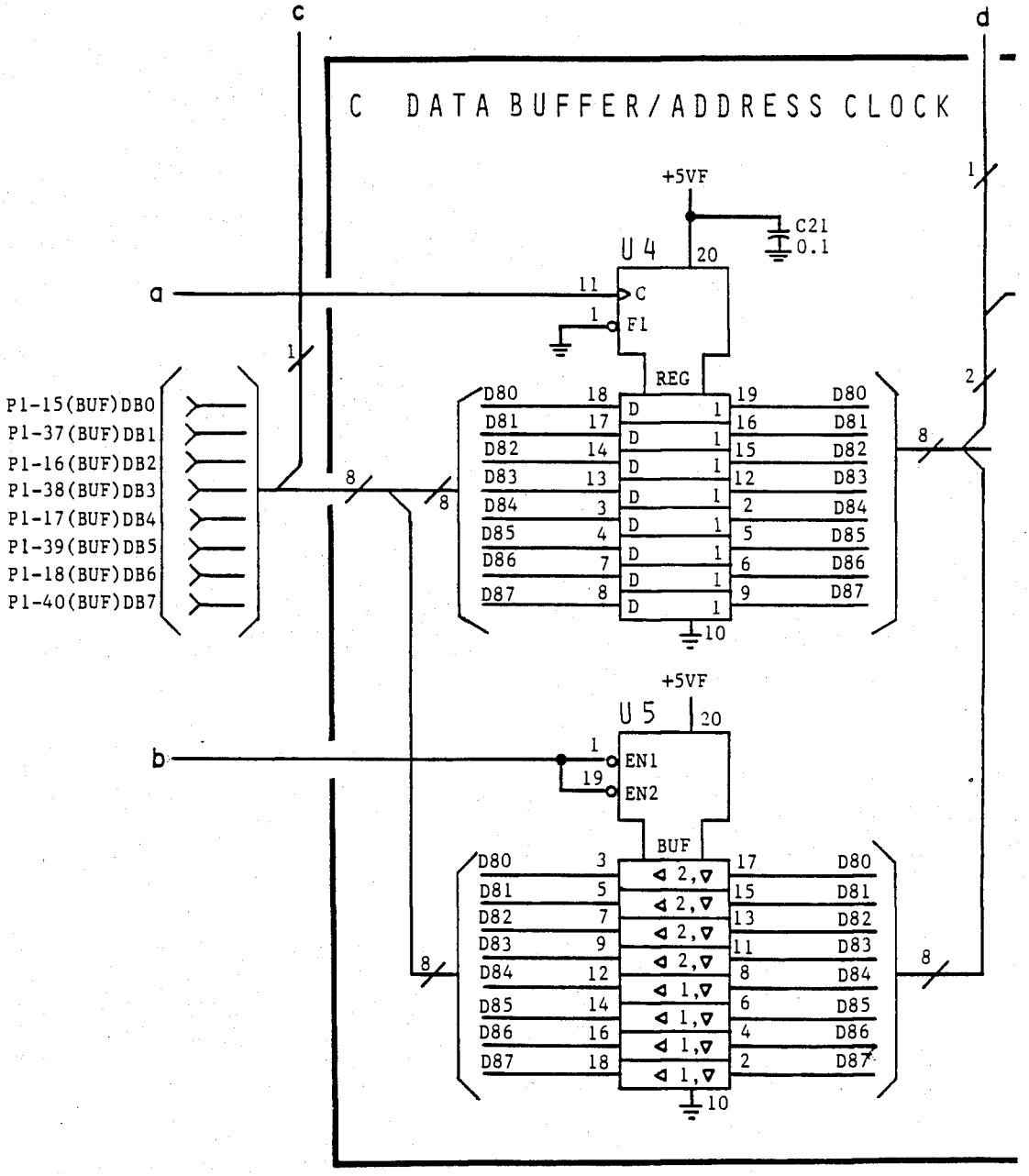

C
d
C DATA BUFFER/ADDRESS CLOCK
+5VF
C21
0.1
U4
20
a
11
C
1
F1
REG
P1-15(BUF)DB0
P1-37(BUF)DB1
P1-16(BUF)DB2
P1-38(BUF)DB3
P1-17(BUF)DB4
P1-39(BUF)DB5
P1-18(BUF)DB6
P1-40(BUF)DB7
D80 18
D81 17
D82 14
D83 13
D84 3
D85 4
D86 7
D87 8
D 1
19 D80
16 D81
15 D82
12 D83
2 D84
5 D85
6 D86
9 D87
10
+5VF
U5
20
b
1
EN1
19
EN2
BUF
D80 3
D81 5
D82 7
D83 9
D84 12
D85 14
D86 16
D87 18
2,▽
1,▽
17 D80
15 D81
13 D82
11 D83
8 D84
6 D85
4 D86
2 D87
10
1
2
8

FIG 27.3A

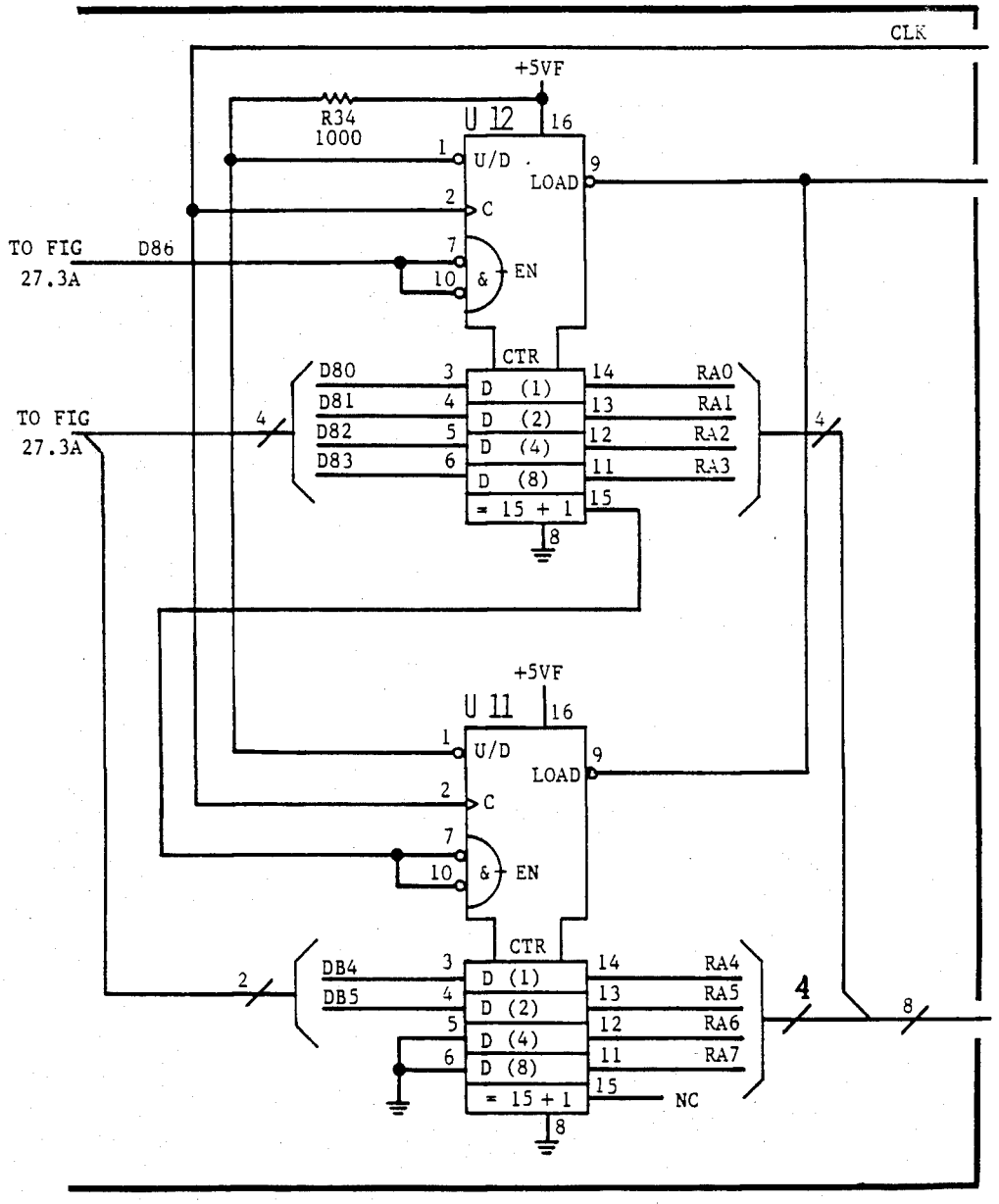

CLK
+5VF
R34
1000
U 12
16
1
U/D
9
LOAD
2
C
TO FIG
27.3A
D86
7
10
&
EN
CTR
D80
3
D (1)
14
RA0
D81
4
D (2)
13
RA1
TO FIG
27.3A
4
D82
5
D (4)
12
RA2
4
D83
6
D (8)
11
RA3
= 15 + 1
15
8
+5VF
U 11
16
1
U/D
9
LOAD
2
C
7
10
&
EN
CTR
2
DB4
3
D (1)
14
RA4
DB5
4
D (2)
13
RA5
4
5
D (4)
12
RA6
8
6
D (8)
11
RA7
= 15 + 1
15
NC
8

FIG 27.3B

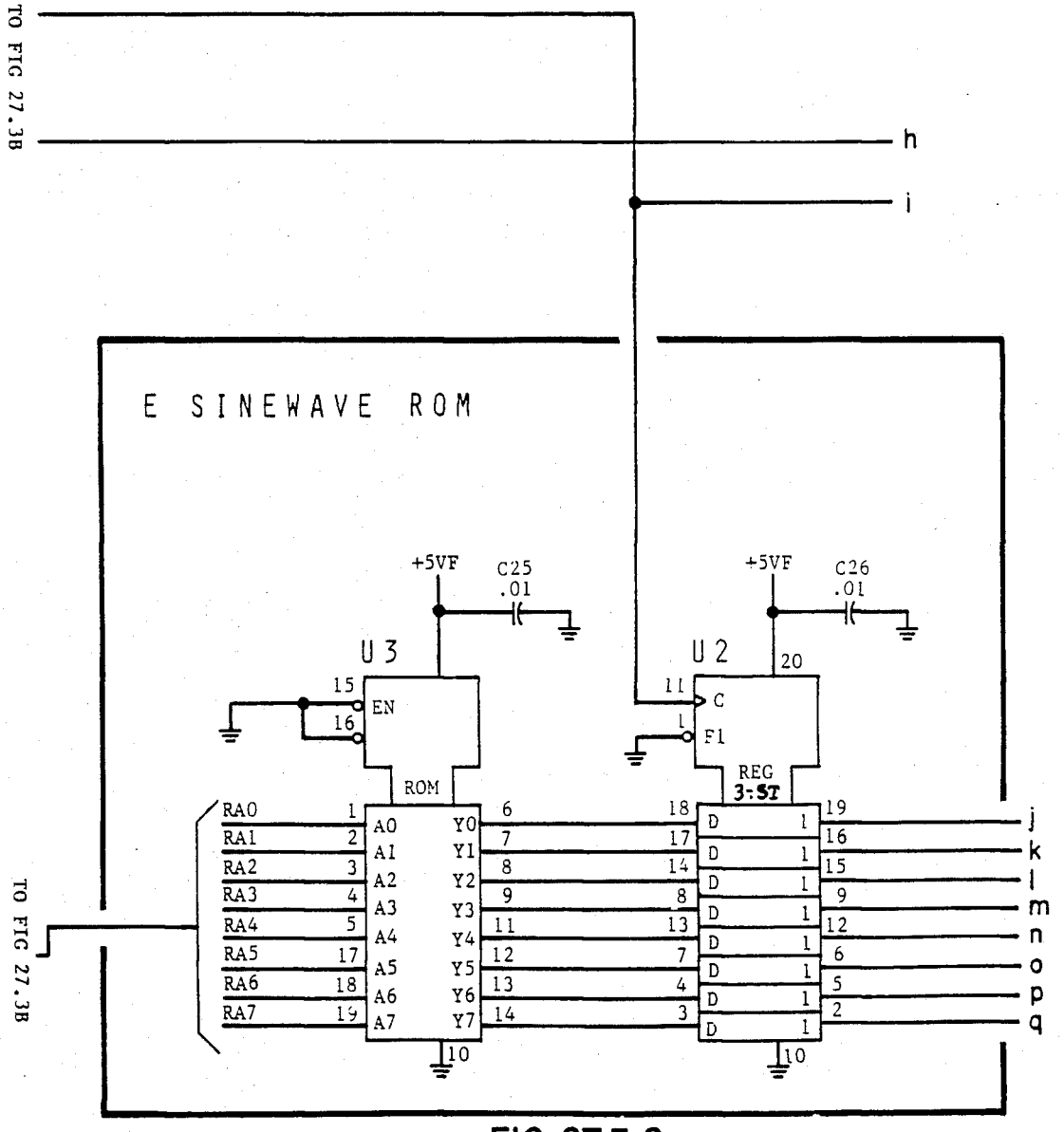

TO FIG 27.3B
h
i
E SINEWAVE ROM
+5VF
C25
.01
U3
15
EN
16
ROM
+5VF
C26
.01
U2
20
11
C
1
F1
REG
3-ST
RA0
RA1
RA2
RA3
RA4
RA5
RA6
RA7
A0
A1
A2
A3
A4
A5
A6
A7
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
D
j
k
l
m
n
o
p
q
TO FIG 27.3B

FIG 27.3 C

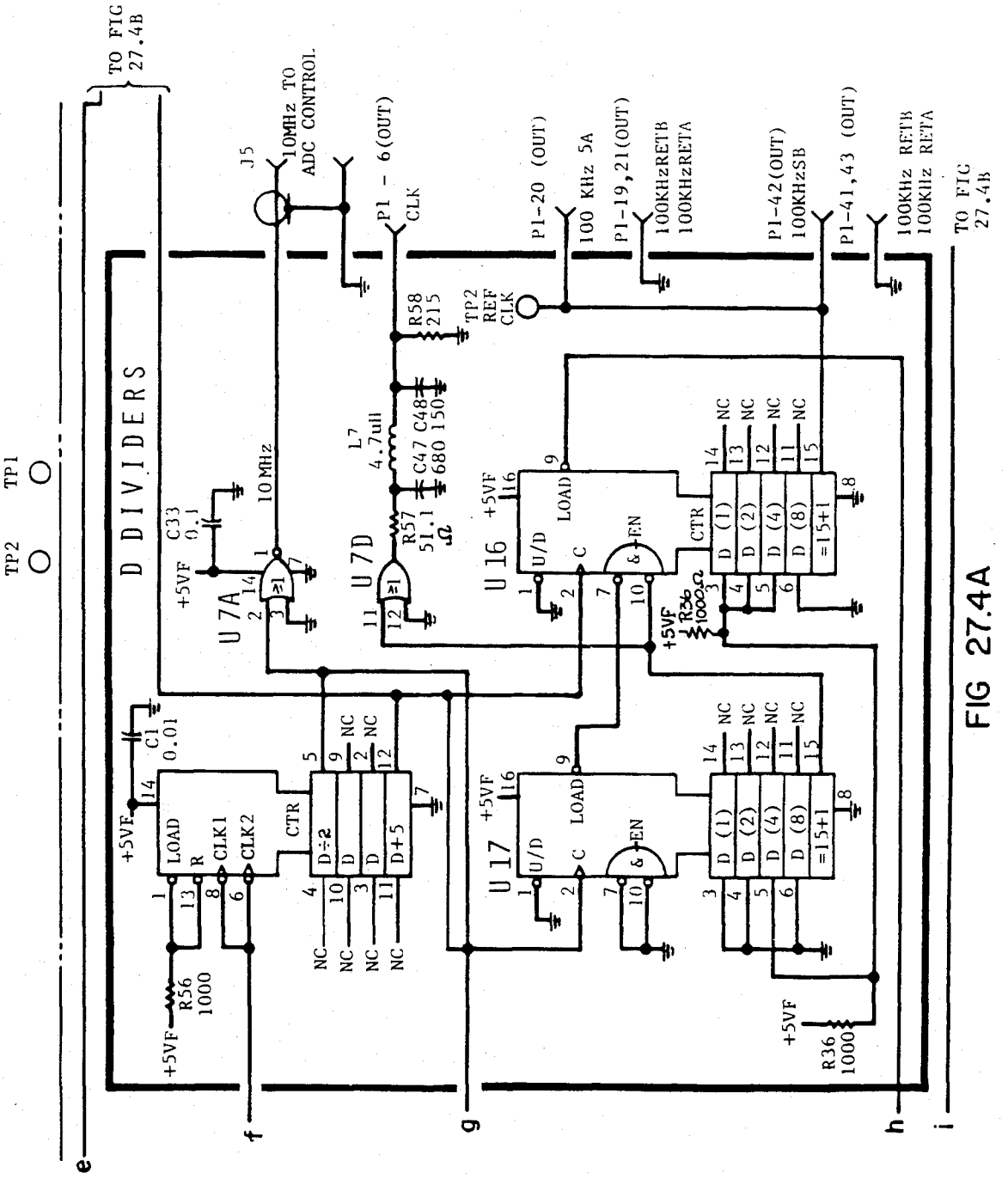

TO FIG 27.4B
J5
10MHz TO ADC CONTROL
P1 - 6(OUT) CLK
P1-20 (OUT) 100 KHz 5A
P1-19,21(OUT) 100KHzRETB 100KHzRETA
P1-42(OUT) 100KHzSB
P1-41,43 (OUT) 100KHz RETB 100KHz RETA
TO FIG 27.4B
TP2
TP1
D DIVIDERS
U7A
U7D
U16
U17
10MHz
C33 0.1
C1 0.01
L7 4.7uH
C47 C48 680 150
R57 51.1Ω
R58 215
TP2 REF CLK
R56 1000
R36 1000Ω
+5VF
LOAD
CLK1
CLK2
CTR
D÷2
D+5
U/D
EN
D (1)
D (2)
D (4)
D (8)
=15+1
NC
e
f
g
h
i

FIG 27.4A

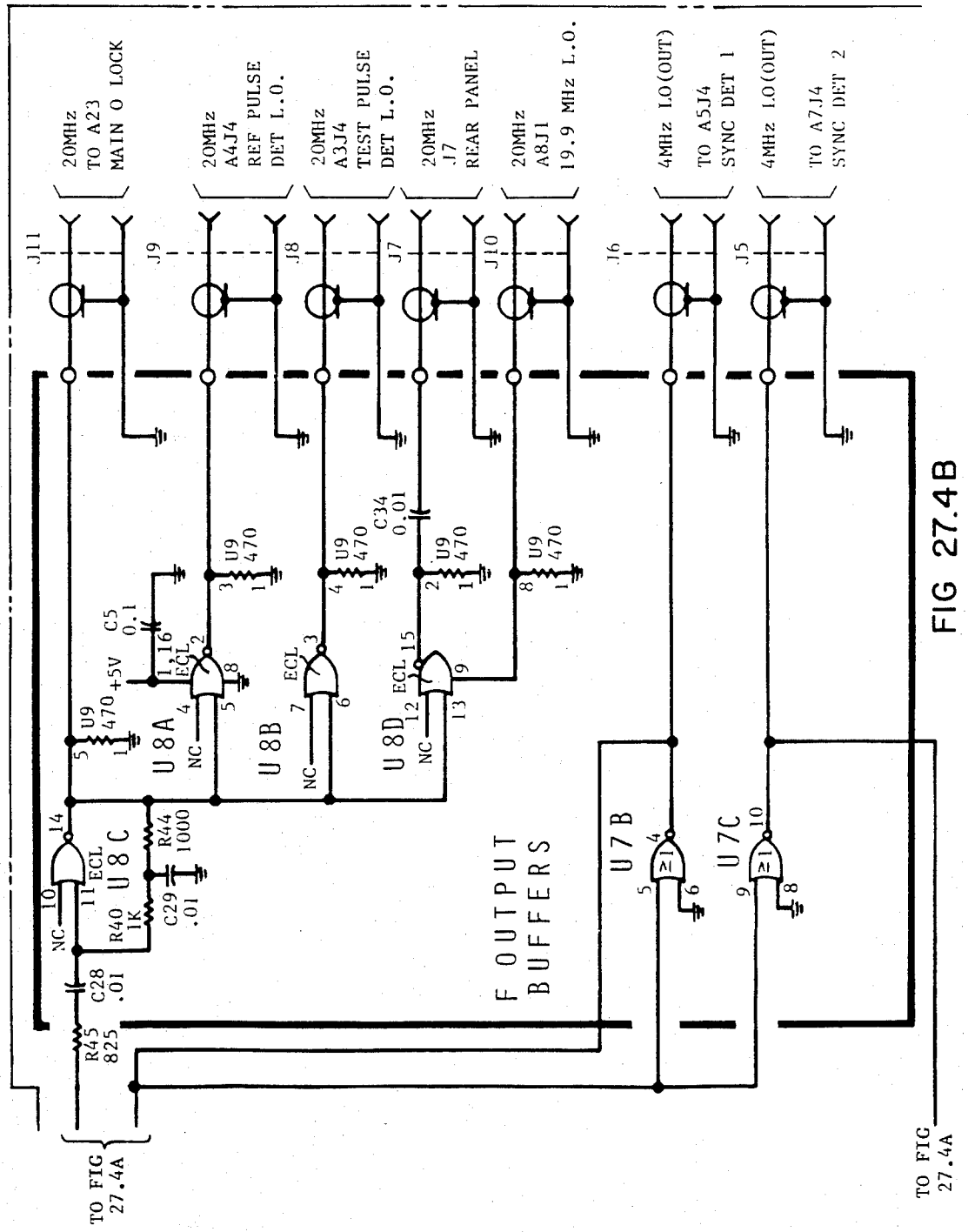

20MHz
TO A23
MAIN O LOCK
20MHz
A4J4
REF PULSE
DET L.O.
20MHz
A3J4
TEST PULSE
DET L.O.
20MHz
J7
REAR PANEL
20MHz
A8J1
19.9 MHz L.O.
4MHz LO(OUT)
TO A5J4
SYNC DET 1
4MHz LO(OUT)
TO A7J4
SYNC DET 2
J11
J9
J8
J7
J10
J6
J5
U9
470
C5
0.1
C34
0.01
+5V
U8A
U8B
U8D
U8C
U7B
U7C
ECL
NC
R44
1000
R40
1K
C29
.01
C28
.01
R45
825
F OUTPUT
BUFFERS
TO FIG
27.4A
TO FIG
27.4A

FIG 27.4B

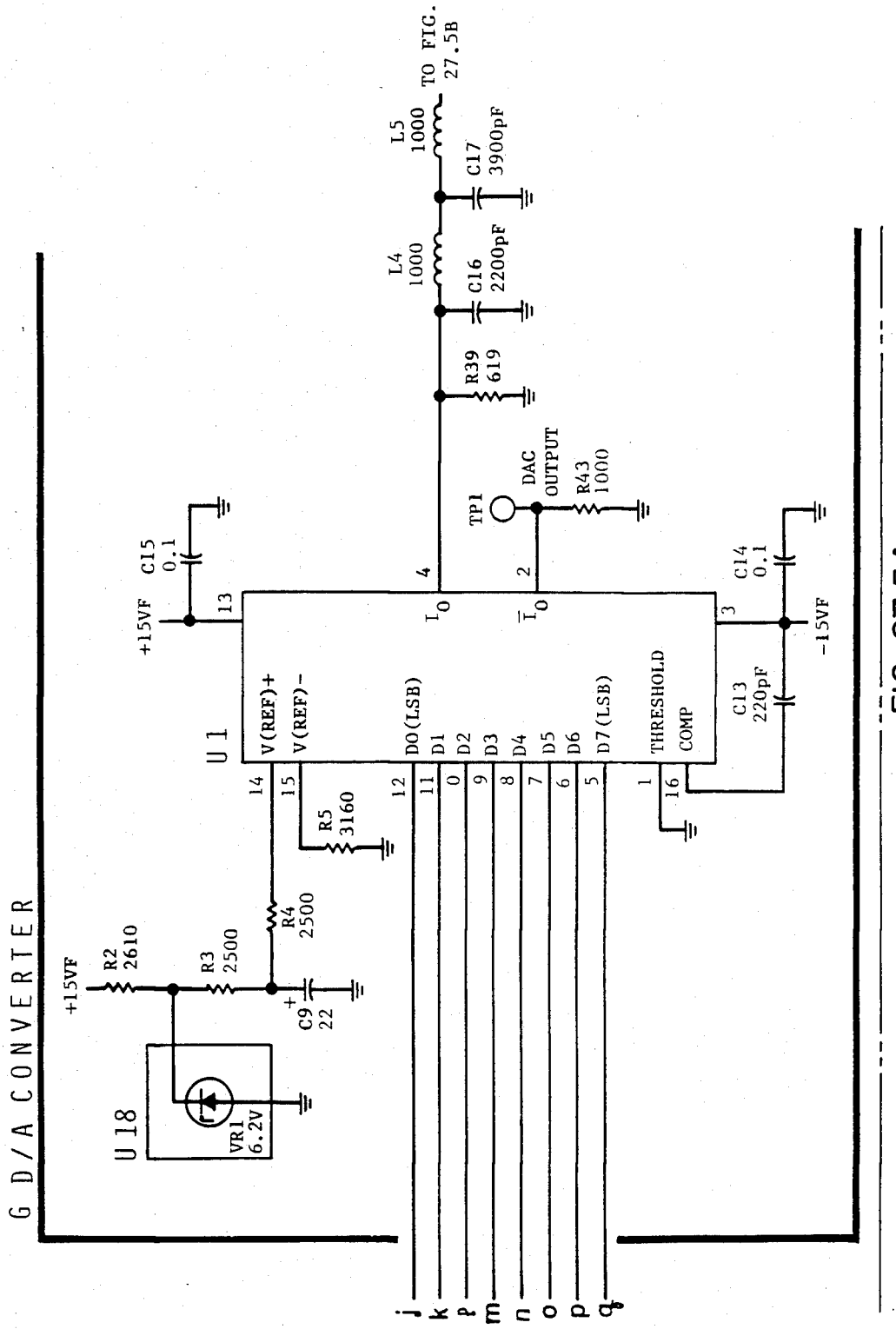

G D/A CONVERTER
U18
VR1
6.2V
+15VF
R2
2610
R3
2500
R4
2500
C9
22
R5
3160
U1
V(REF)+
V(REF)-
DO(LSB)
D1
D2
D3
D4
D5
D6
D7(LSB)
THRESHOLD
COMP
C13
220pF
C14
0.1
-15VF
C15
0.1
+15VF
I_O
$\overline{I}_O$
TP1
DAC
OUTPUT
R43
1000
R39
619
C16
2200pF
L4
1000
C17
3900pF
L5
1000
TO FIG.
27.5B
i
k
p
m
n
o
p
q

FIG 27.5A

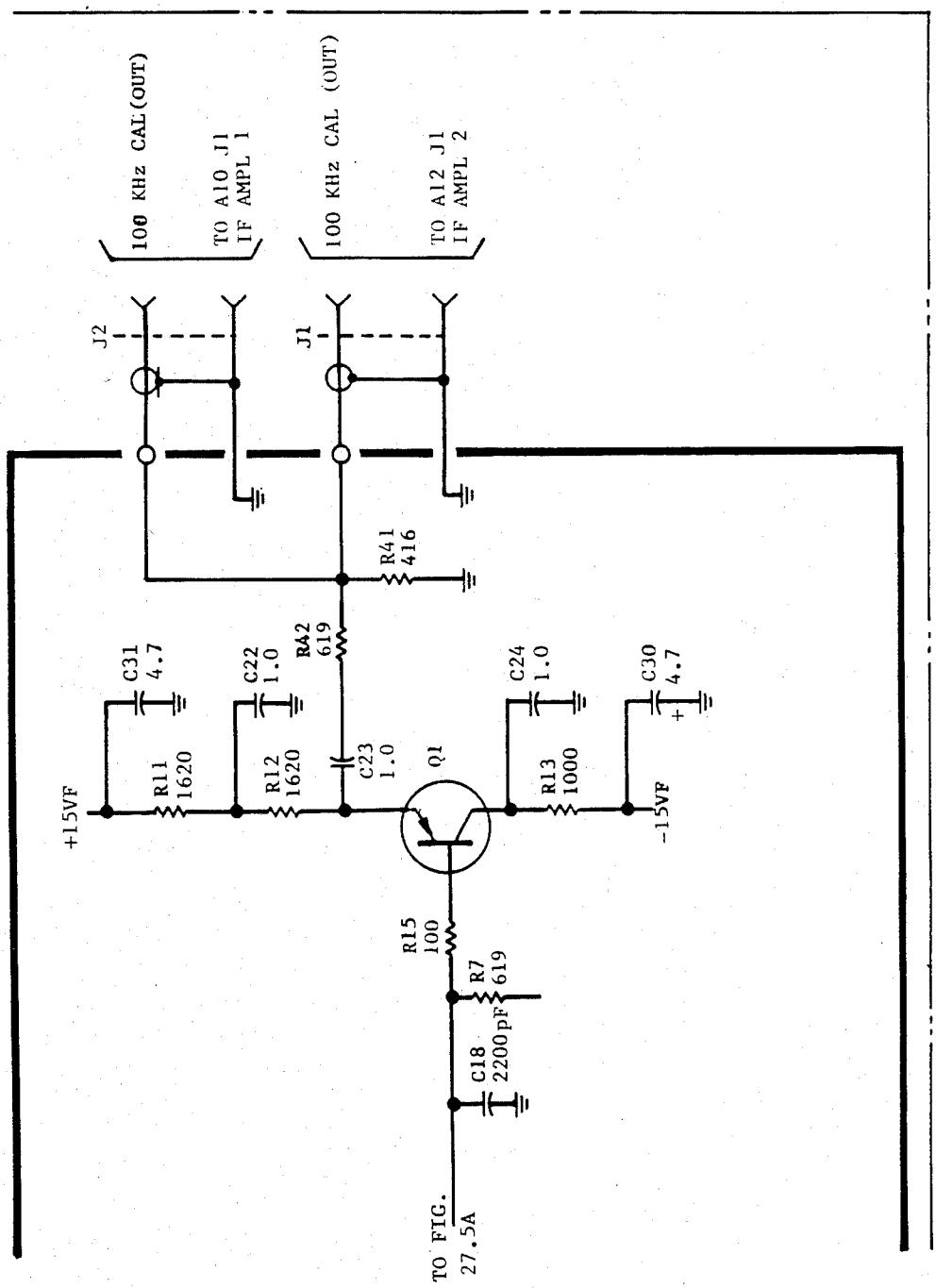

100 KHz CAL (OUT)
TO A10 J1 IF AMPL 1
100 KHz CAL (OUT)
TO A12 J1 IF AMPL 2
J2
J1
R41 416
C31 4.7
C22 1.0
R42 619
C24 1.0
C30 4.7
+15VF
R11 1620
R12 1620
C23 1.0
Q1
R13 1000
-15VF
R15 100
R7 619
C18 2200pF
TO FIG. 27.5A

FIG 27.5B

ACTIVE COMPONENTS PARTS LISTS (U's and Q's)

REFERENCE DESIGNATORS	PART NUMBER	MANUFACTURER'S PART NUMBER
U1	1820-1934	DAC-08
U2	1820-1997	74 LS 374
U4	1820-1997	74 LS 374
U5	1820-2024	74 LS 244
U6	1820-1869	74 S 196
U7	1820-107 4	74 128
U8	1820-0802	MC10102
U9		
U10	1820-1216	74 LS 138
U11,12,16,17	1820-1435	74 LS 669
U13		SE 564
U14	1820-0693	74 S 74
U15	1820-1568	74 LS 125
Q1	1853-0314	2N2905A
Q2	1854-0477	2N2222

FIG 27.6

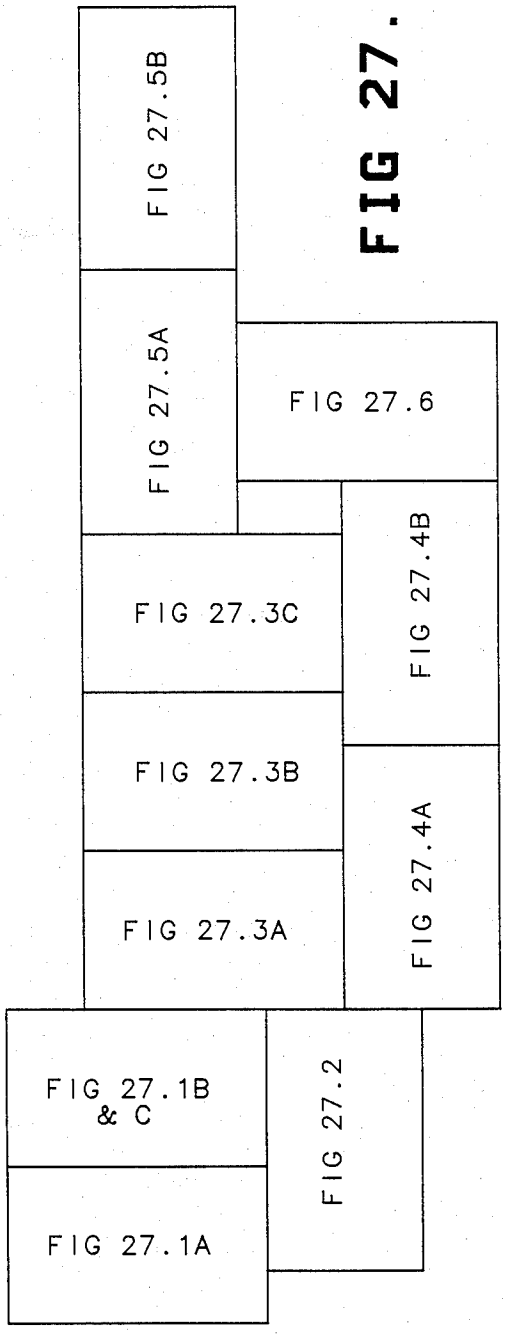


FIG 27.7

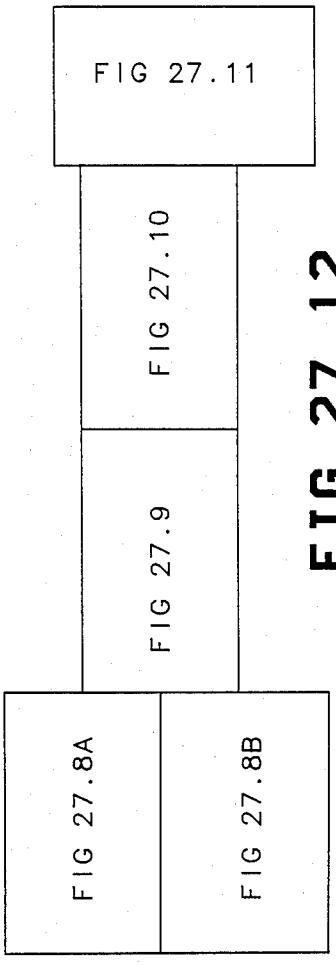


FIG 27.12

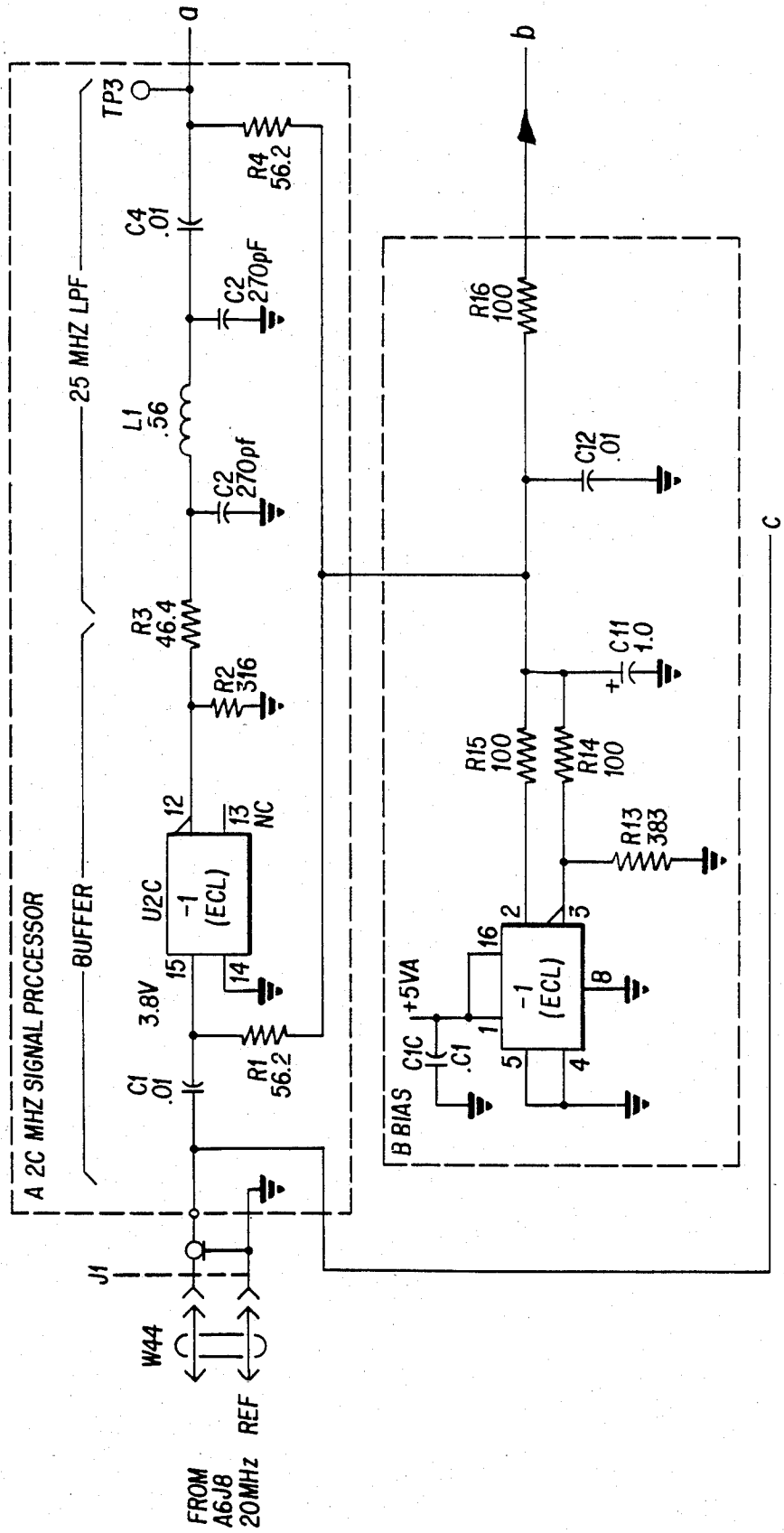

A 2C MHZ SIGNAL PRCCESSOR
BUFFER
25 MHZ LPF
B BIAS
FROM A6J8 20MHz
REF
W44
J1
TP3
C1 .01
C4 .01
C2 270pF
C2 270pf
C2 270pf
C1C
C1
C12 .01
C11 1.0
L1 .56
R1 56.2
R2 316
R3 46.4
R4 56.2
R13 383
R14 100
R15 100
R16 100
3.8V
+5VA
U2C
-1 (ECL)
-1 (ECL)
NC
a
b
c

FIG. 27.8A

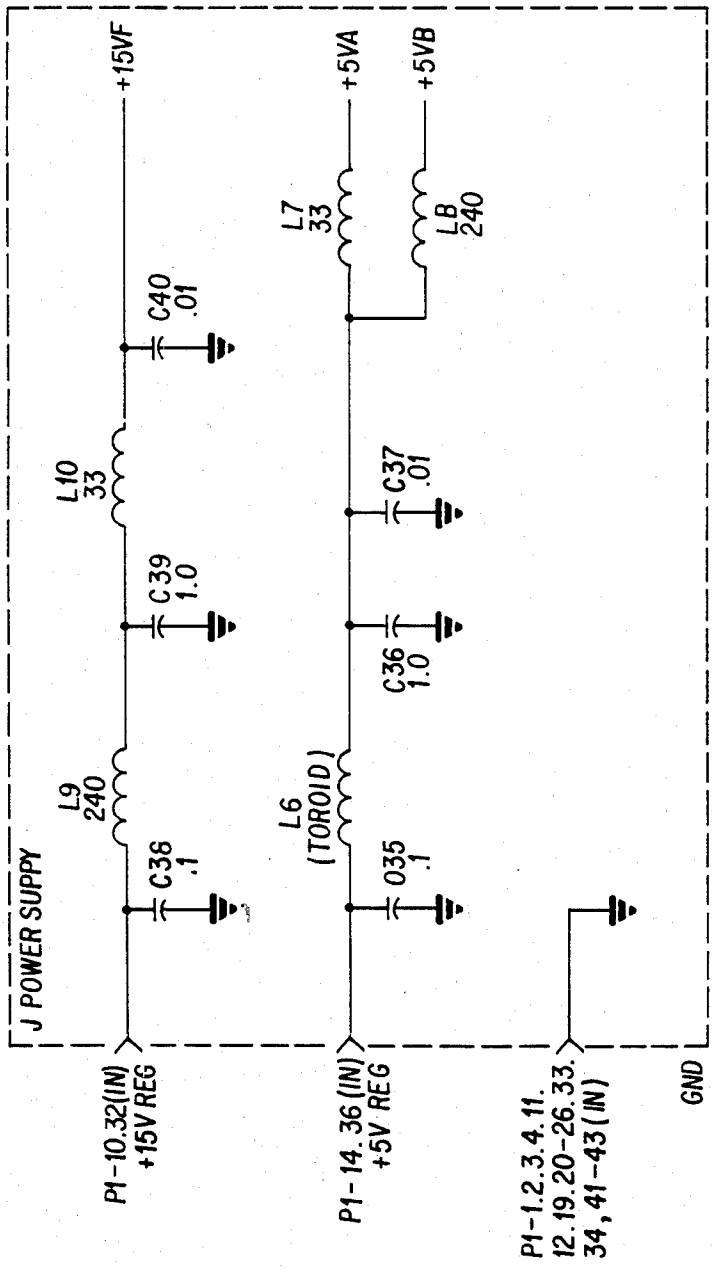

J POWER SUPPY
L9
240
C36
.1
L10
33
C39
1.0
C40
.01
+15VF
L6
(TOROID)
035
.1
C36
1.0
L7
33
C37
.01
+5VA
L8
240
+5VB
P1-10.32(IN)
+15V REG
P1-14.36(IN)
+5V REG
P1-1.2.3.4.11.
12.19.20-26.33.
34,41-43(IN)
GND

FIG. 27.8B

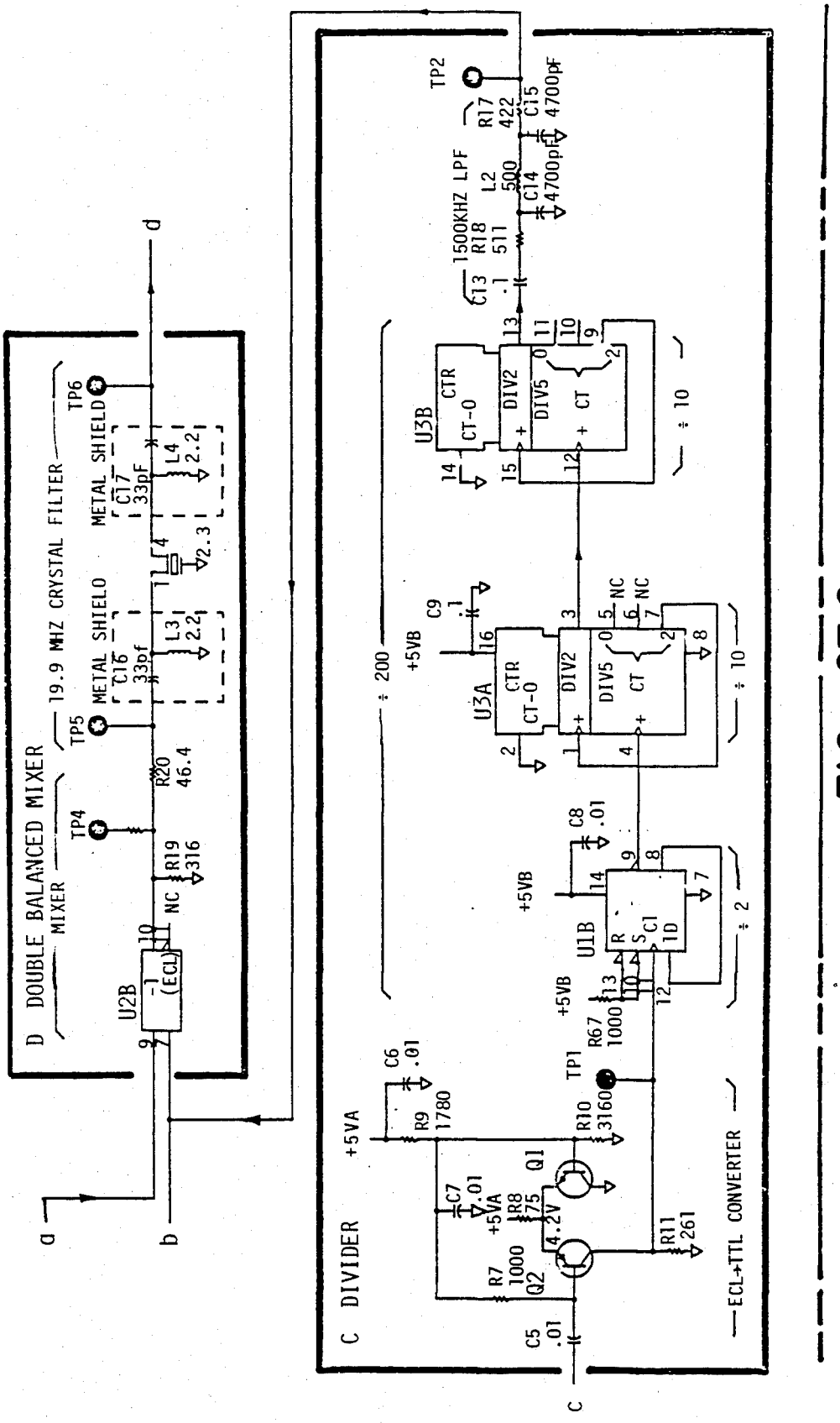

D DOUBLE BALANCED MIXER
MIXER
19.9 MHZ CRYSTAL FILTER
TP5
TP6
METAL SHIELD
METAL SHIELD
C17 33pf
L4 2.2
2.3
L3 2.2
C16 33pf
TP4
R20 46.4
R19 316
NC
U2B
(ECL)
a
b
d
C DIVIDER
+5VA
C6 .01
R9 1780
C7 .01
R8 175
Q1
Q2
4.2V
R7 1000
C5 .01
R10 3160
TP1
R67 1000
R11 261
+5VB
C8 .01
U1B
R
S
C1
1D
÷ 2
÷ 200
U3A
CTR
CT-0
DIV2
DIV5
CT
÷ 10
C9 .1
U3B
1500KHZ LPF
C13 .1
R18 511
L2 500
C14 4700pf
TP2
R17 422
C15 4700pf
ECL-TTL CONVERTER
c

FIG 27.9

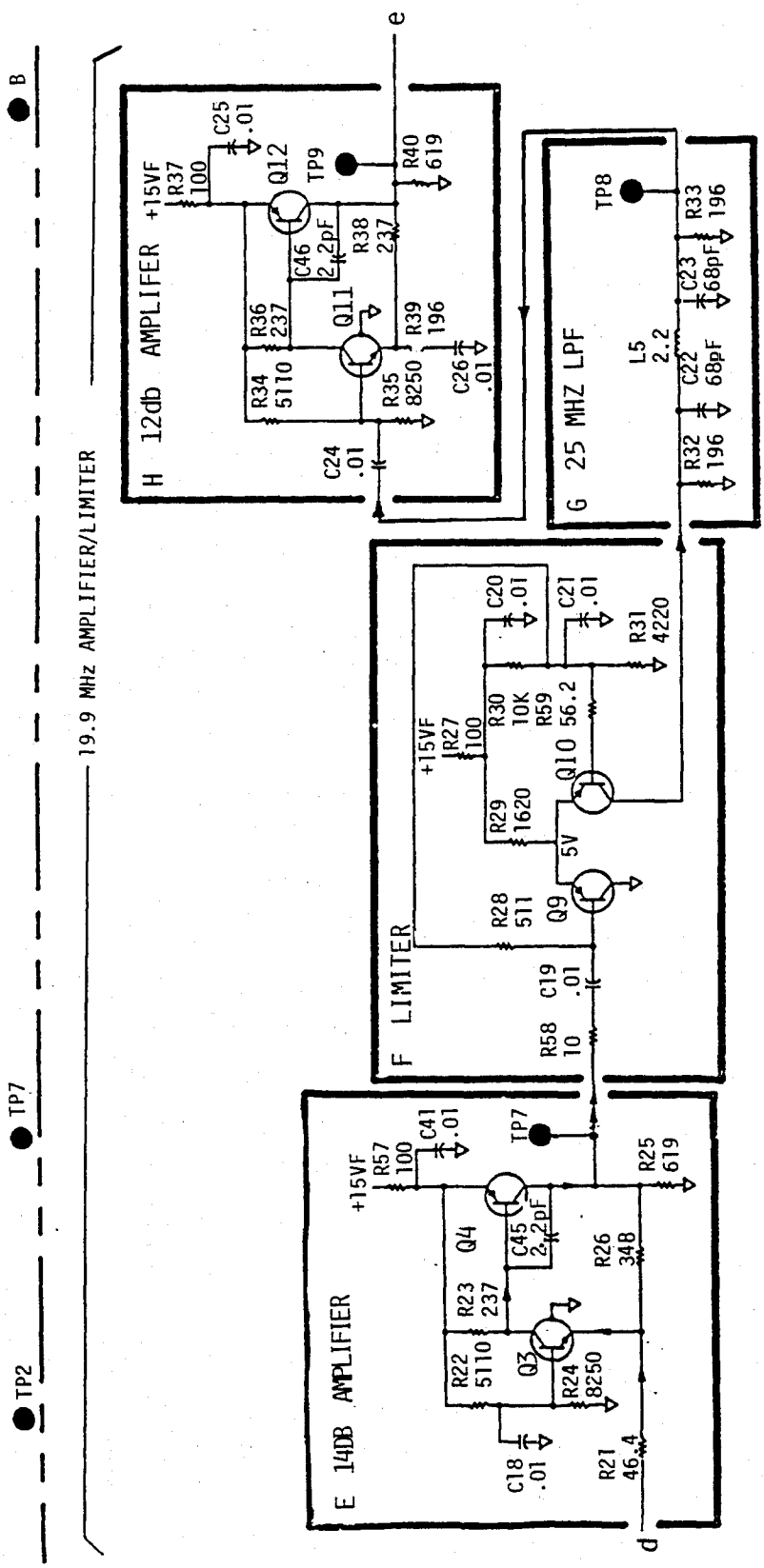

B
TP7
TP2
19.9 MHz AMPLIFIER/LIMITER
H 12db AMPLIFER
+15VF
R37 100
C25 .01
Q12
TP9
R40 619
C46 2.2pF
R38 237
R36 237
Q11
R39 196
R34 5110
R35 8250
C26 .01
C24 .01
e
G 25 MHZ LPF
TP8
L5 2.2
C22 68pF
C23 68pF
R33 196
R32 196
F LIMITER
+15VF
R27 100
C20 .01
C21 .01
R31 4220
R30 10K
R59 56.2
Q10
R29 1620
5V
R28 511
Q9
C19 .01
R58 10
E 14DB AMPLIFIER
+15VF
R57 100
C41 .01
TP7
R25 619
Q4
C45 2.2pF
R26 348
R23 237
R22 5110
Q3
R24 8250
C18 .01
R21 46.4
d

FIG 27.10

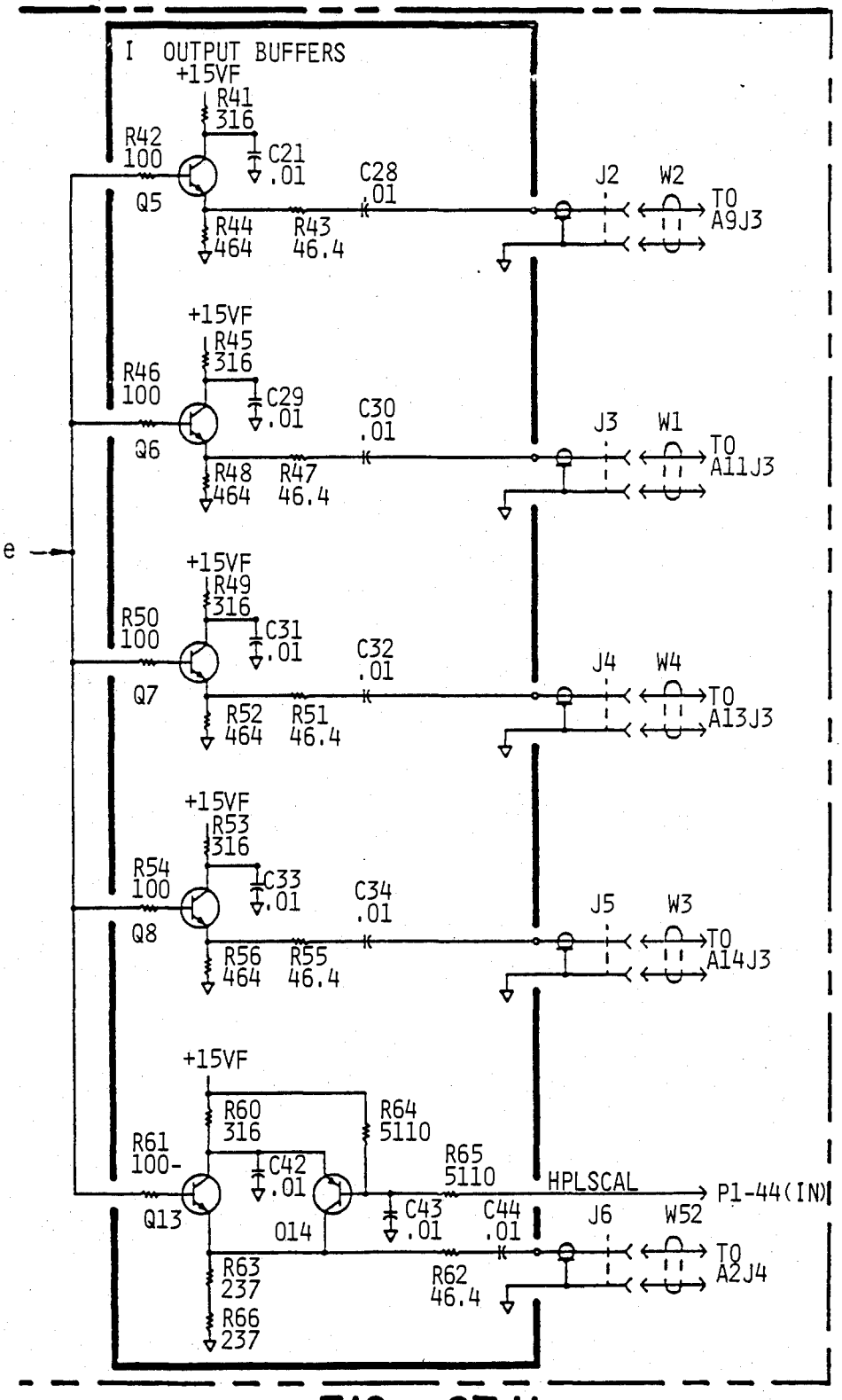
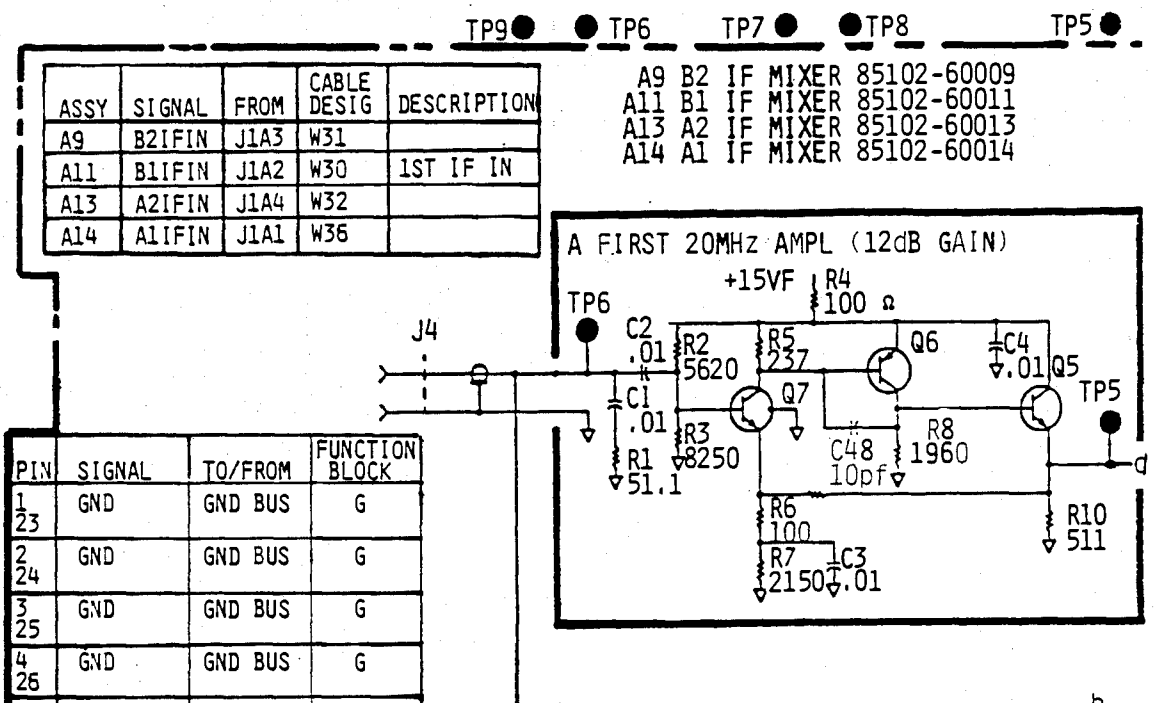

I OUTPUT BUFFERS
+15VF
R41
316
R42
100
C21
.01
C28
.01
Q5
R44
464
R43
46.4
J2
W2
TO
A9J3
+15VF
R45
316
R46
100
C29
.01
C30
.01
Q6
R48
464
R47
46.4
J3
W1
TO
A11J3
e
+15VF
R49
316
R50
100
C31
.01
C32
.01
Q7
R52
464
R51
46.4
J4
W4
TO
A13J3
+15VF
R53
316
R54
100
C33
.01
C34
.01
Q8
R56
464
R55
46.4
J5
W3
TO
A14J3
+15VF
R60
316
R64
5110
R61
100-
C42
.01
R65
5110
HPLSCAL
P1-44(IN)
Q13
Q14
C43
.01
C44
.01
J6
W52
TO
A2J4
R63
237
R62
46.4
R66
237

FIG 27.11

ASSY	SIGNAL	FROM	CABLE DESIG	DESCRIPTION
A9	B2IFIN	J1A3	W31	
A11	B1IFIN	J1A2	W30	1ST IF IN
A13	A2IFIN	J1A4	W32	
A14	A1IFIN	J1A1	W36	

A9 B2 IF MIXER 85102-60009
A11 B1 IF MIXER 85102-60011
A13 A2 IF MIXER 85102-60013
A14 A1 IF MIXER 85102-60014



PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1/23	GND	GND BUS	G
2/24	GND	GND BUS	G
3/25	GND	GND BUS	G
4/26	GND	GND BUS	G
5/27			NOT USED
6/28			NOT USED
7/29			
8/30			
9/31			
10/32	+15V REG	+15V BUS	G
11/33	GND	GND BUS	G
12/34	GND	GND BUS	G
13/35	-15V REG	-15V BUS	G
14/36			
15/37			
16/38			
17/39			
18/40			
19/41	GND	GND BUS	G
20/42	GND	GND BUS	G
21/43	GND	GND BUS	G
22/44	GND	GND BUS	G

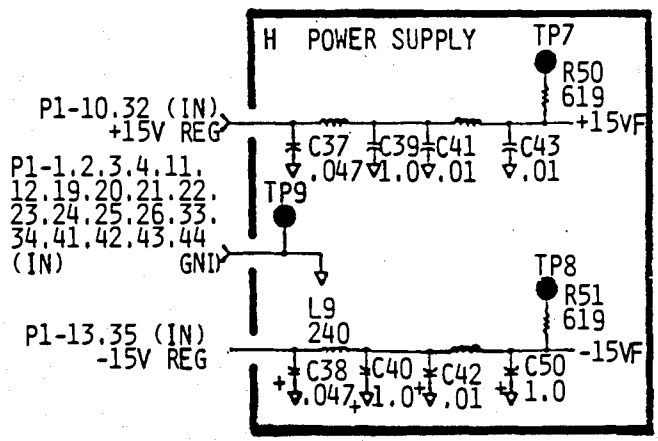
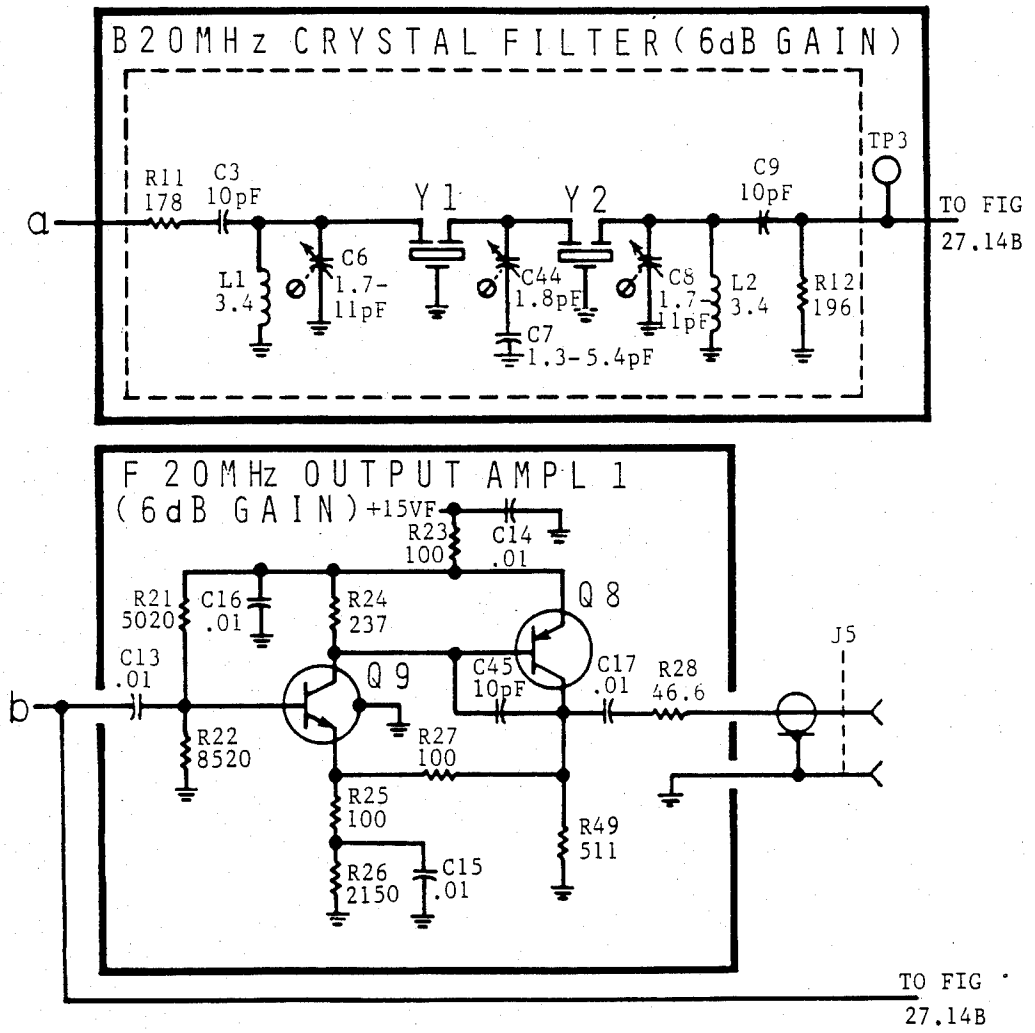
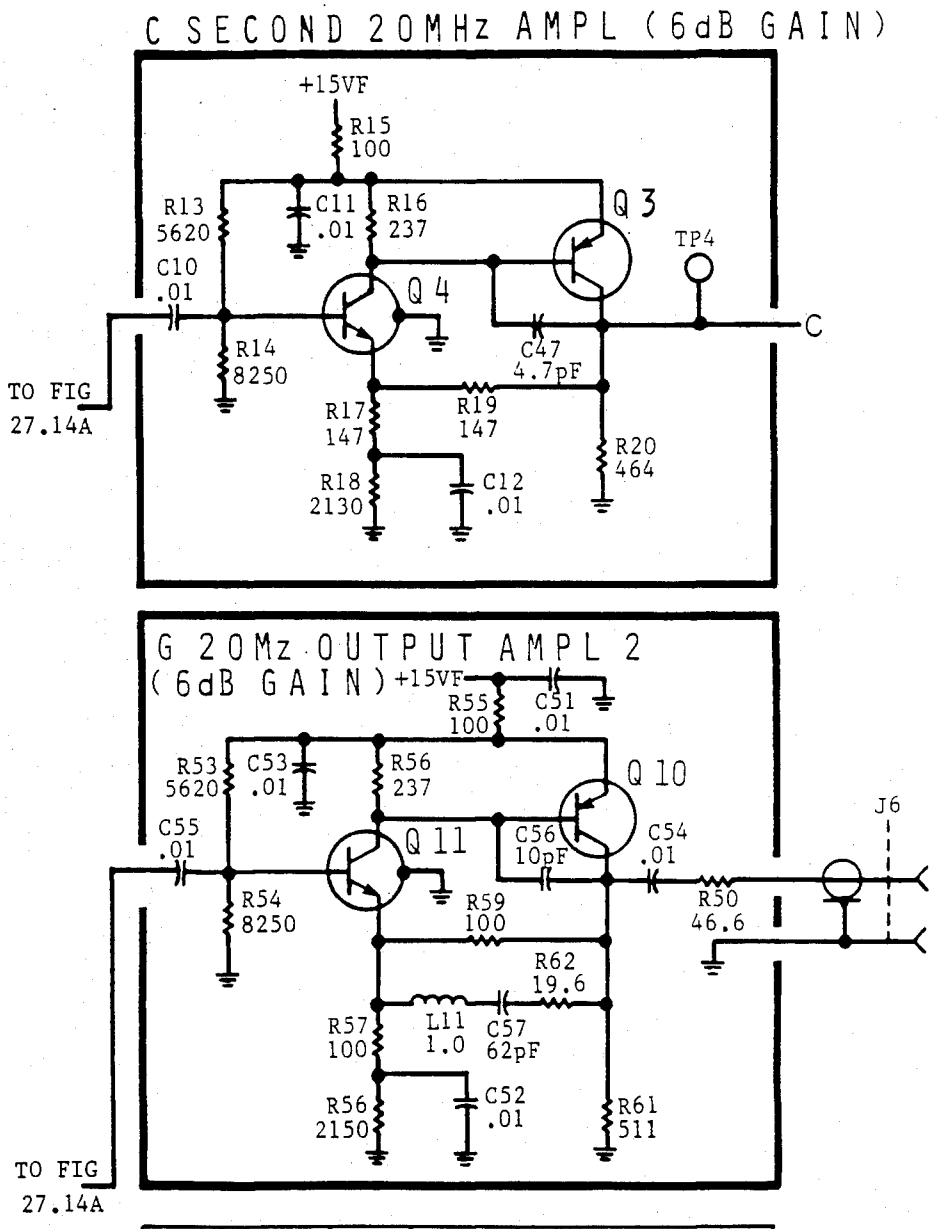


FIG 27.13



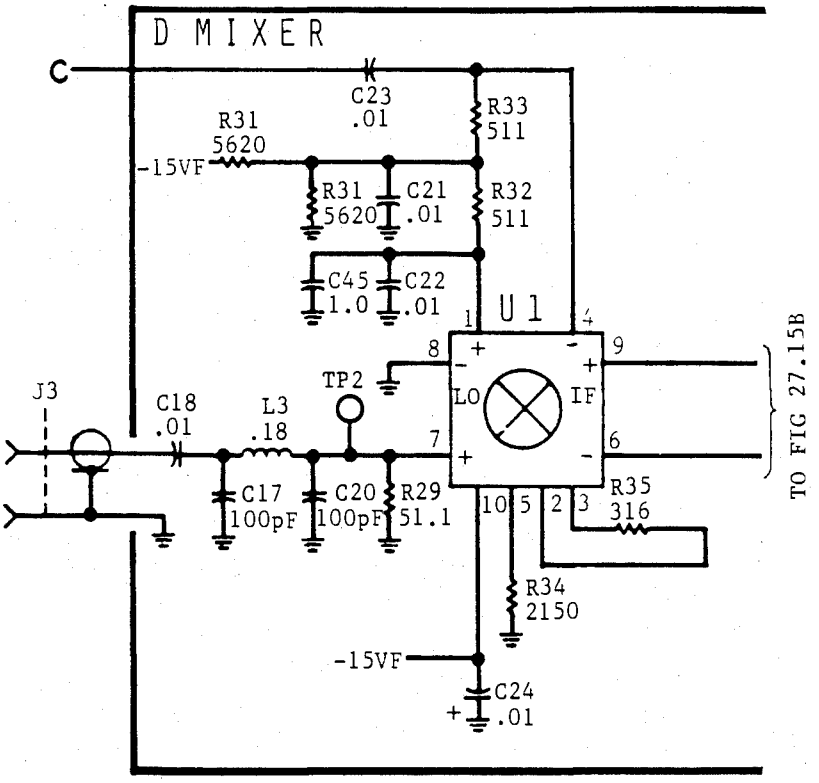
ASSY.	SIGNAL	TO	CABLE DESIG	DESCRIPTION
A9	PLIFB2	A2J3	W41	1ST IF OUT
A11	PLIFB1	A2J1	W40	
A13	FLIFA2	A2J5	W45	
A14	PLIFA1	A2J7	W45	

FIG 27.14A



ASSY	SIGNAL	TO	CABLE DESIG	DESCRIPTION
A9		N.C.		1ST IF OUT
A11		N.C.		
A13	IFCNTRA2	A21J2	W37	
A14	IFCNTRA1	A21J1	W18	

FIG 27.14 B



ASSY	SIGNAL	FROM	CABLE DESIG	DESCRIPTION
A9	B2LO	ABJ2	W2	LO IN
A11	B1LO	ABJ3	W1	
A13	A2LO	ABJ4	W4	
A14	A1LO	ABJ5	W3	

FIG 27.15A

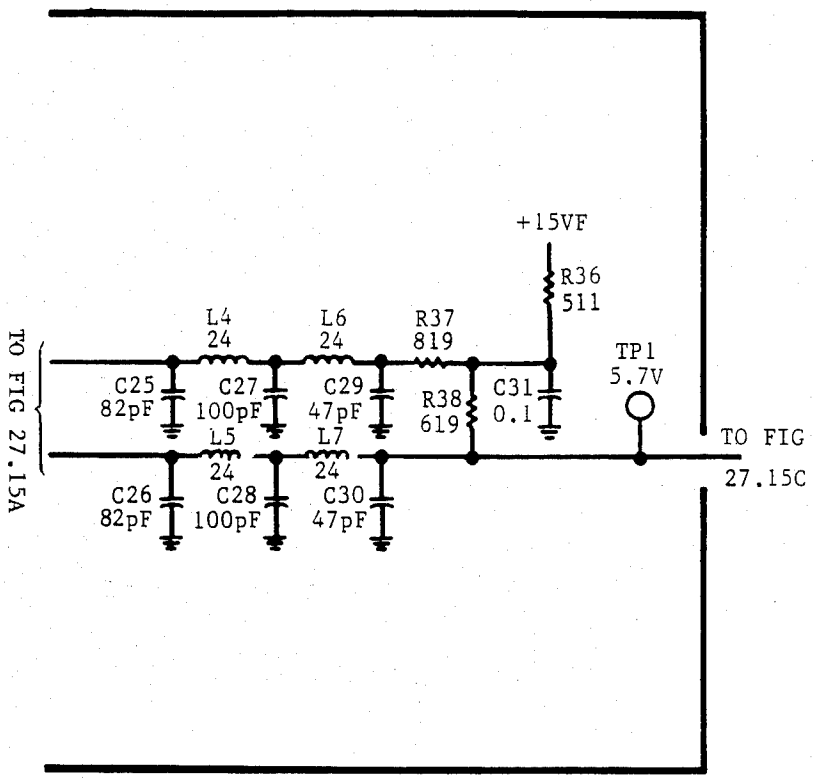
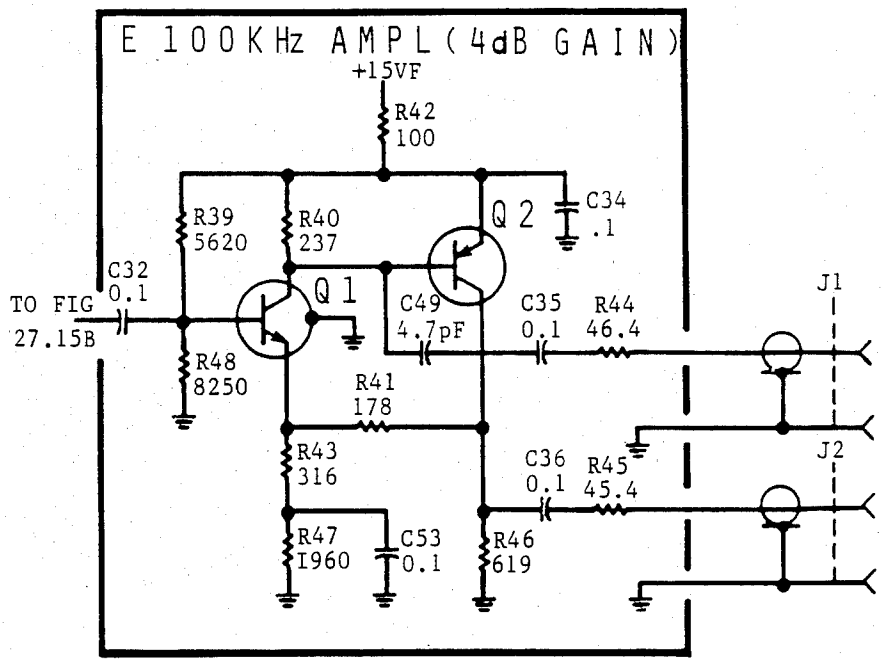

+15VF
R36
511
L4
24
L6
24
R37
819
TP1
5.7V
C25
82pF
C27
100pF
C29
47pF
R38
619
C31
0.1
TO FIG 27.15A
L5
24
L7
24
C26
82pF
C28
100pF
C30
47pF
TO FIG
27.15C

FIG 27.15B

ASSY	SIGNAL	TO	CABLE DESIG	DESCRIPTION
A9	B2IF	A10J3	W9	100KHz IF OUT
A11	B1IF	A12J4	W12	
A13	A2IF	A10J2	W10	
A14	A1IF	A12J3	W13	



ASSY	SIGNAL	TO	CABLE DESIG	DESCRIPTION
A9		N.C.		100KHz IF OUT
A11	B1IF	A10J4	W8	
A13	A2IF	A12J2	W14	
A14		N.C.		

FIG 27.15C

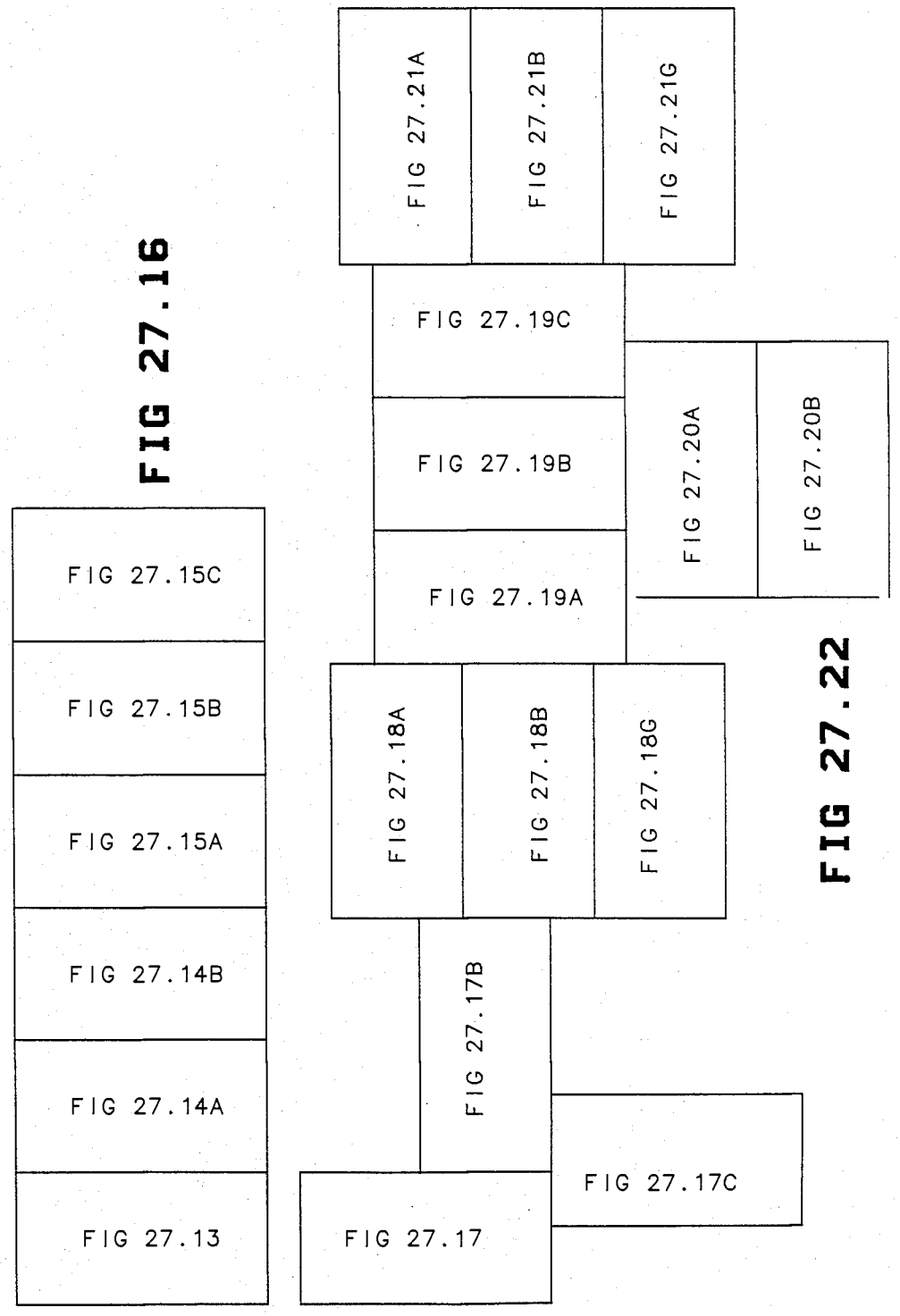


FIG 27.16
FIG 27.15C
FIG 27.15B
FIG 27.15A
FIG 27.14B
FIG 27.14A
FIG 27.13
FIG 27.17
FIG 27.17B
FIG 27.17C
FIG 27.18A
FIG 27.18B
FIG 27.18G
FIG 27.19A
FIG 27.19B
FIG 27.19C
FIG 27.20A
FIG 27.20B
FIG 27.21A
FIG 27.21B
FIG 27.21G
FIG 27.22

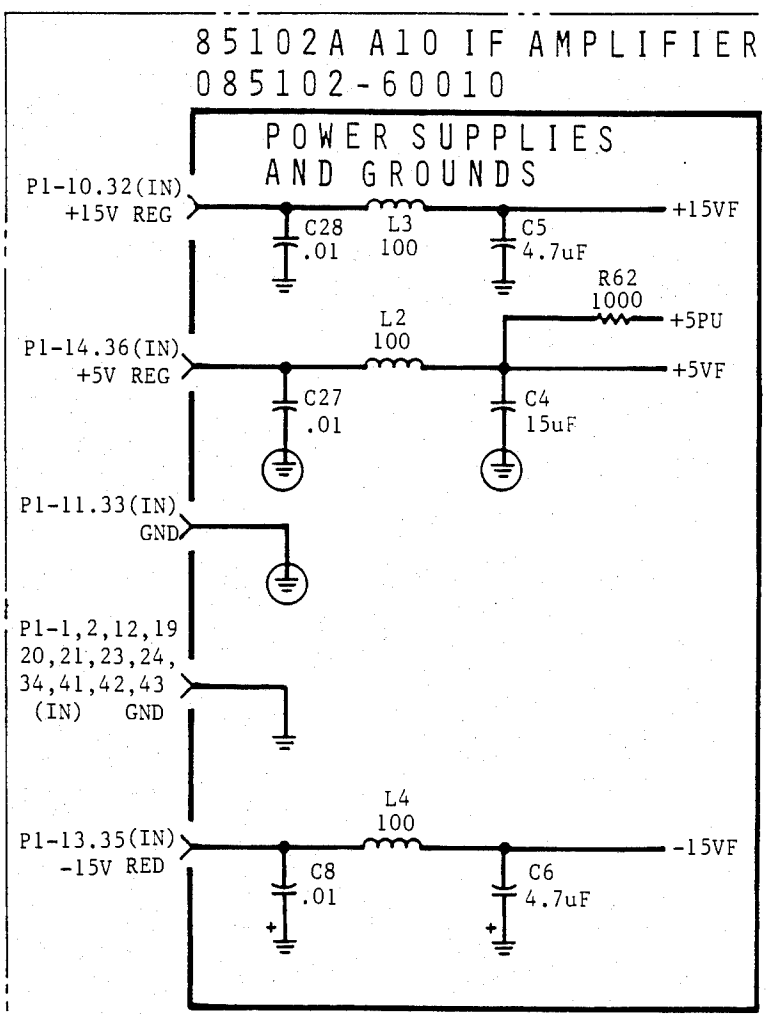

85102A A10 IF AMPLIFIER
085102-60010
POWER SUPPLIES
AND GROUNDS
P1-10.32(IN)
+15V REG
C28
.01
L3
100
C5
4.7uF
+15VF
R62
1000
+5PU
L2
100
P1-14.36(IN)
+5V REG
+5VF
C27
.01
C4
15uF
P1-11.33(IN)
GND
P1-1,2,12,19
20,21,23,24,
34,41,42,43
(IN) GND
L4
100
P1-13.35(IN)
-15V RED
C8
.01
C6
4.7uF
-15VF

FIG 27.17A

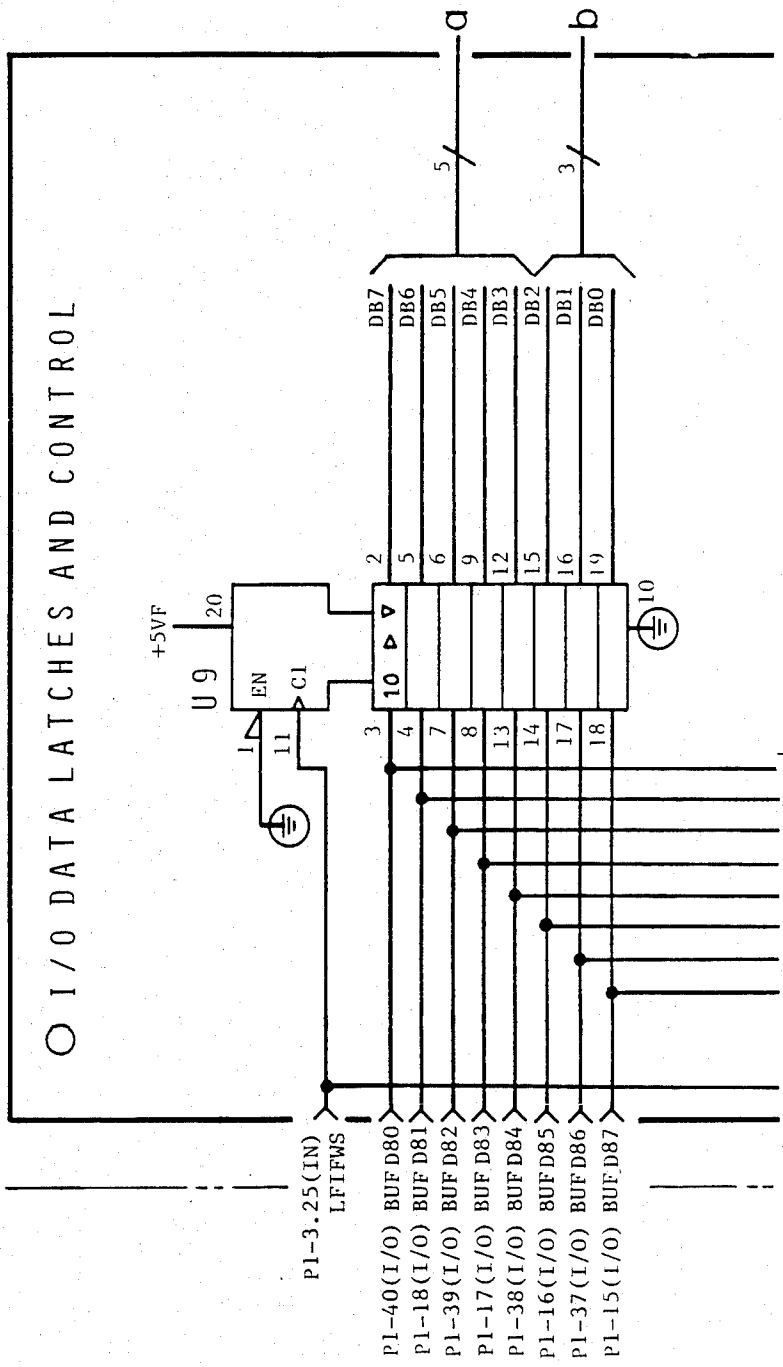

I/O DATA LATCHES AND CONTROL
a
b
5
3
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
+5VF
20
U9
EN
C1
10
1
11
2
5
6
9
12
15
16
19
3
4
7
8
13
14
17
18
10
TO FIG. 27.17C
P1-3.25(IN)
LFIFWS
P1-40(I/O) BUF D80
P1-18(I/O) BUF D81
P1-39(I/O) BUF D82
P1-17(I/O) BUF D83
P1-38(I/O) BUF D84
P1-16(I/O) BUF D85
P1-37(I/O) BUF D86
P1-15(I/O) BUF D87

FIG 27.17B

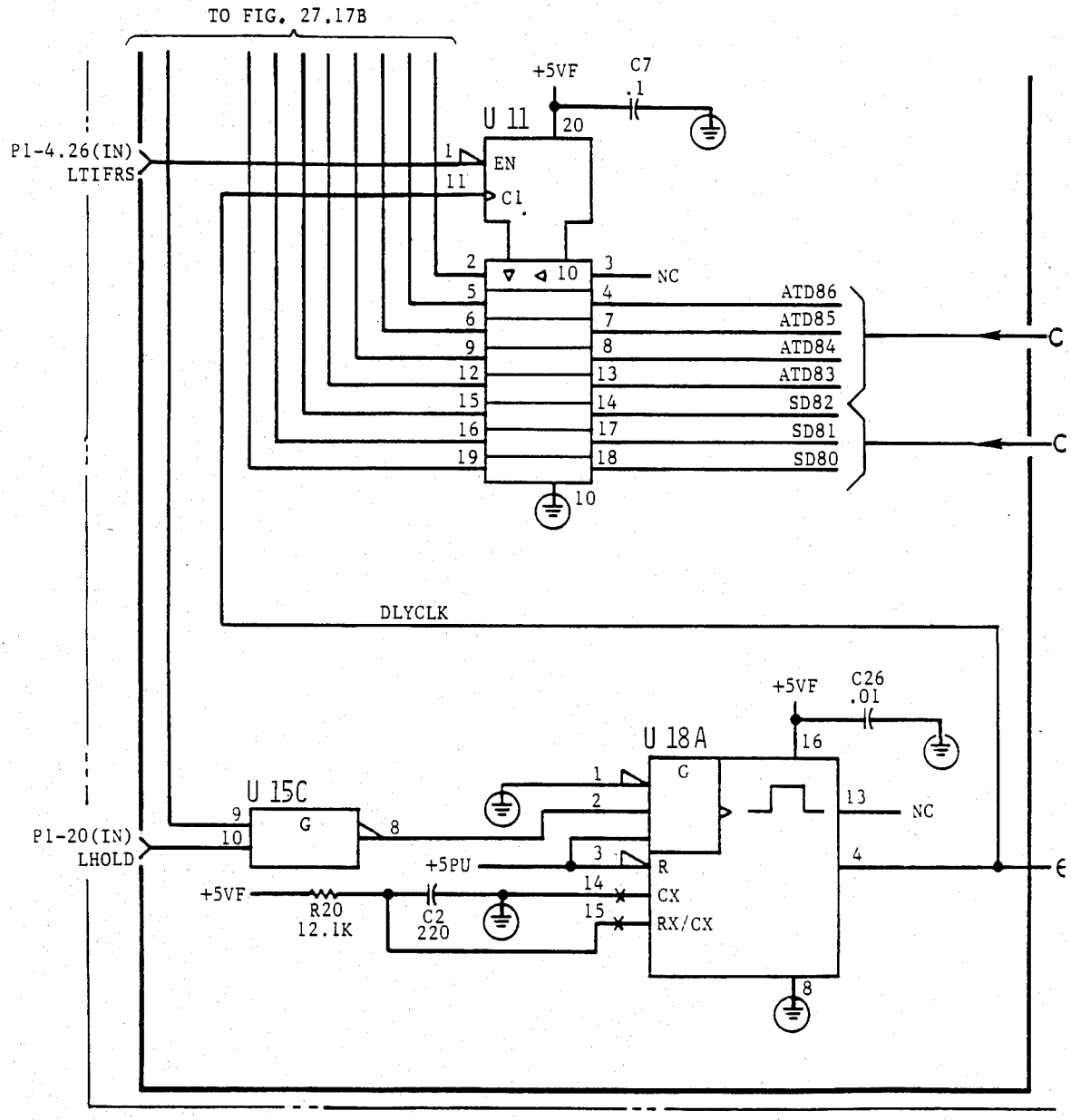

TO FIG. 27.17B
+5VF
C7
.1
U 11
20
P1-4.26(IN)
LTIFRS
1
11
EN
C1
2
10
3
NC
5
4
ATD86
6
7
ATD85
9
8
ATD84
12
13
ATD83
15
14
SD82
16
17
SD81
19
18
SD80
10
C
C
DLYCLK
+5VF
C26
.01
U 18A
16
U 15C
1
G
2
13
NC
9
10
G
8
P1-20(IN)
LHOLD
+5PU
3
R
4
+5VF
R20
12.1K
C2
220
14
CX
15
RX/CX
8

FIG 27.17C

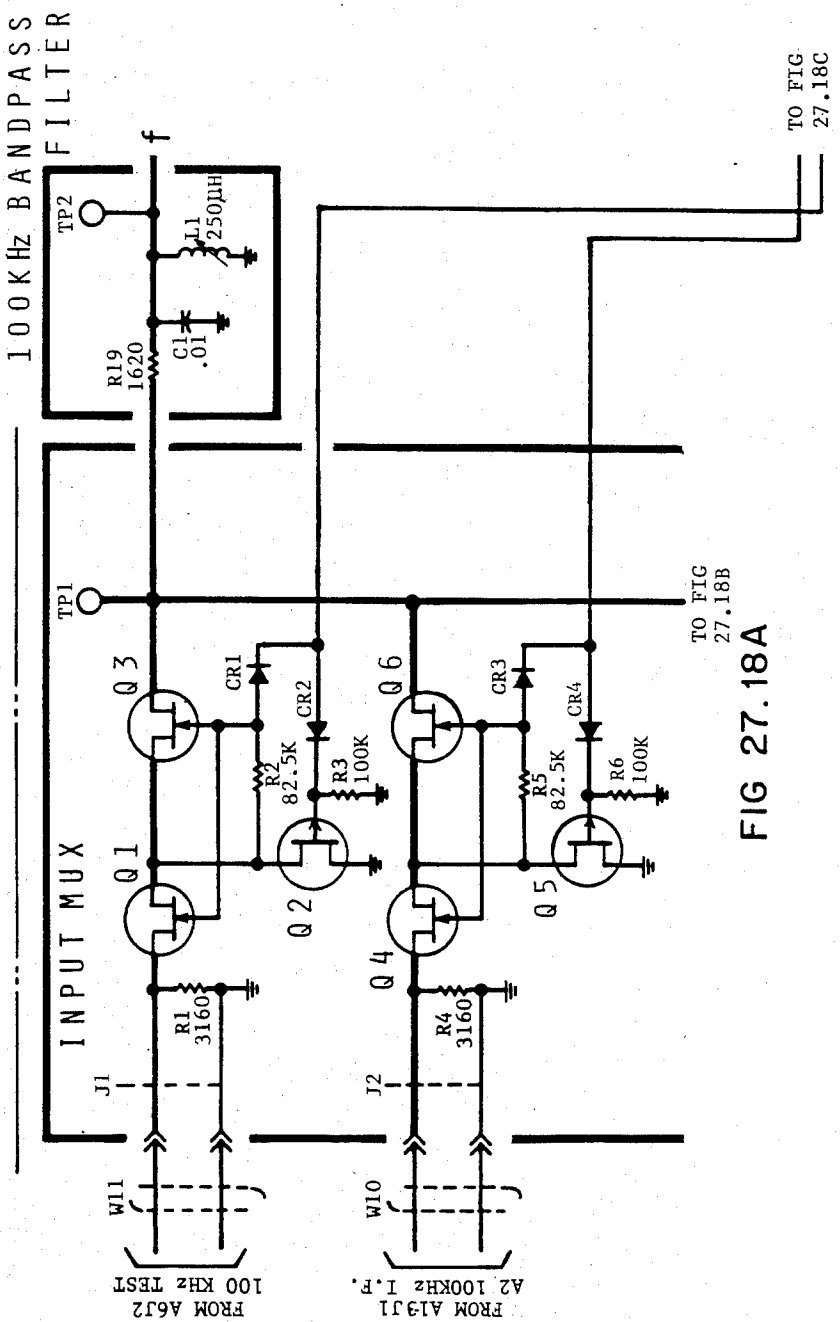

100KHz BANDPASS FILTER
f
TP2
L1
250μH
C1
.01
R19
1620
TO FIG
27.18C
TP1
TO FIG
27.18B
INPUT MUX
Q1
Q2
Q3
Q4
Q5
Q6
CR1
CR2
CR3
CR4
R1
3160
R2
82.5K
R3
100K
R4
3160
R5
82.5K
R6
100K
J1
J2
W11
W10
FROM A6J2
100 KHz TEST
FROM A19J1
A2 100KHz I.F.

FIG 27.18A

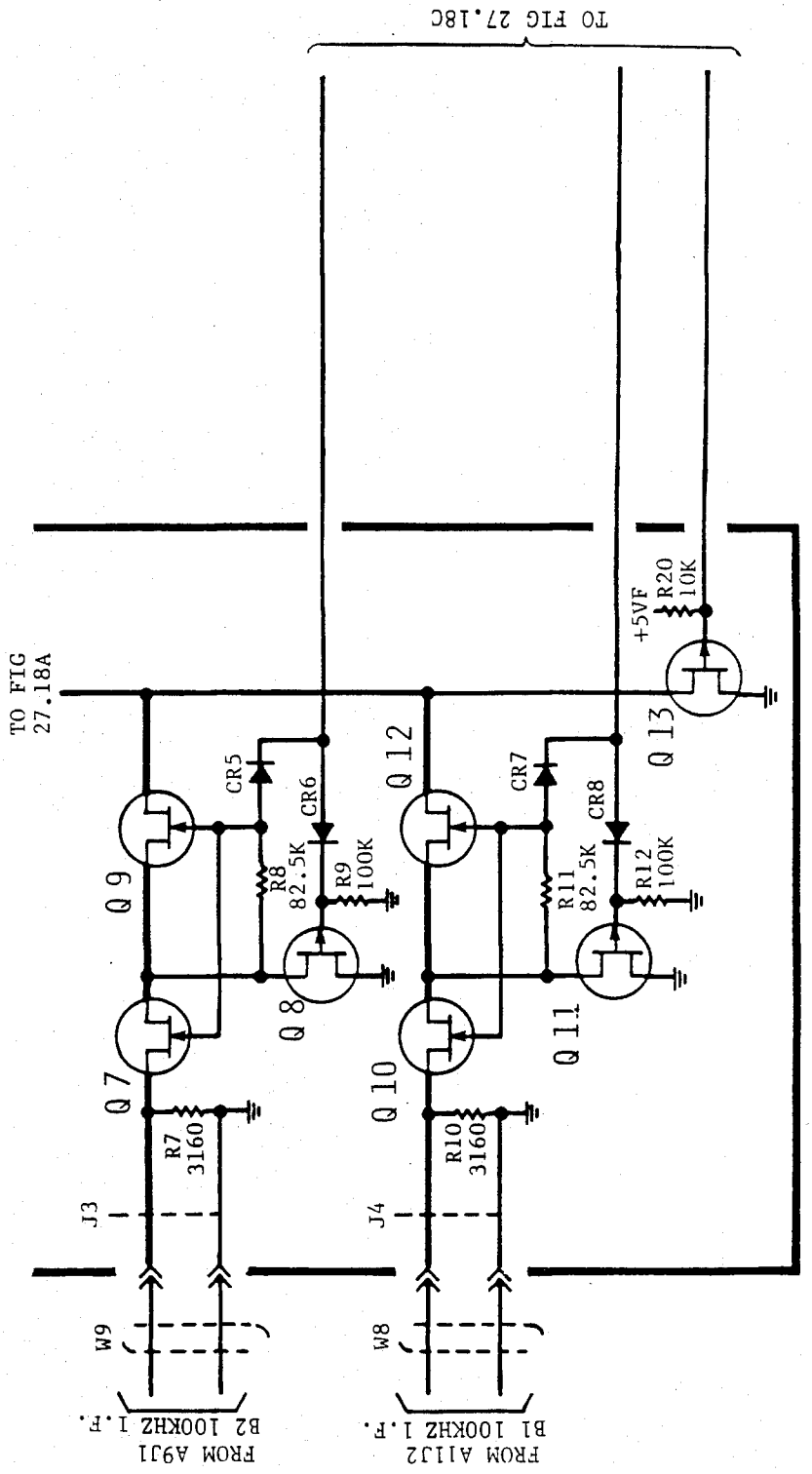

TO FIG 27.18C
TO FIG 27.18A
+5VF
R20 10K
Q 13
Q 12
Q 11
Q 10
Q 9
Q 8
Q 7
CR5
CR6
CR7
CR8
R8 82.5K
R9 100K
R11 82.5K
R12 100K
R7 3160
R10 3160
J3
J4
W9
W8
FROM A9J1 B2 100KHZ I.F.
FROM A11J2 B1 100KHZ I.F.

FIG 27.18B

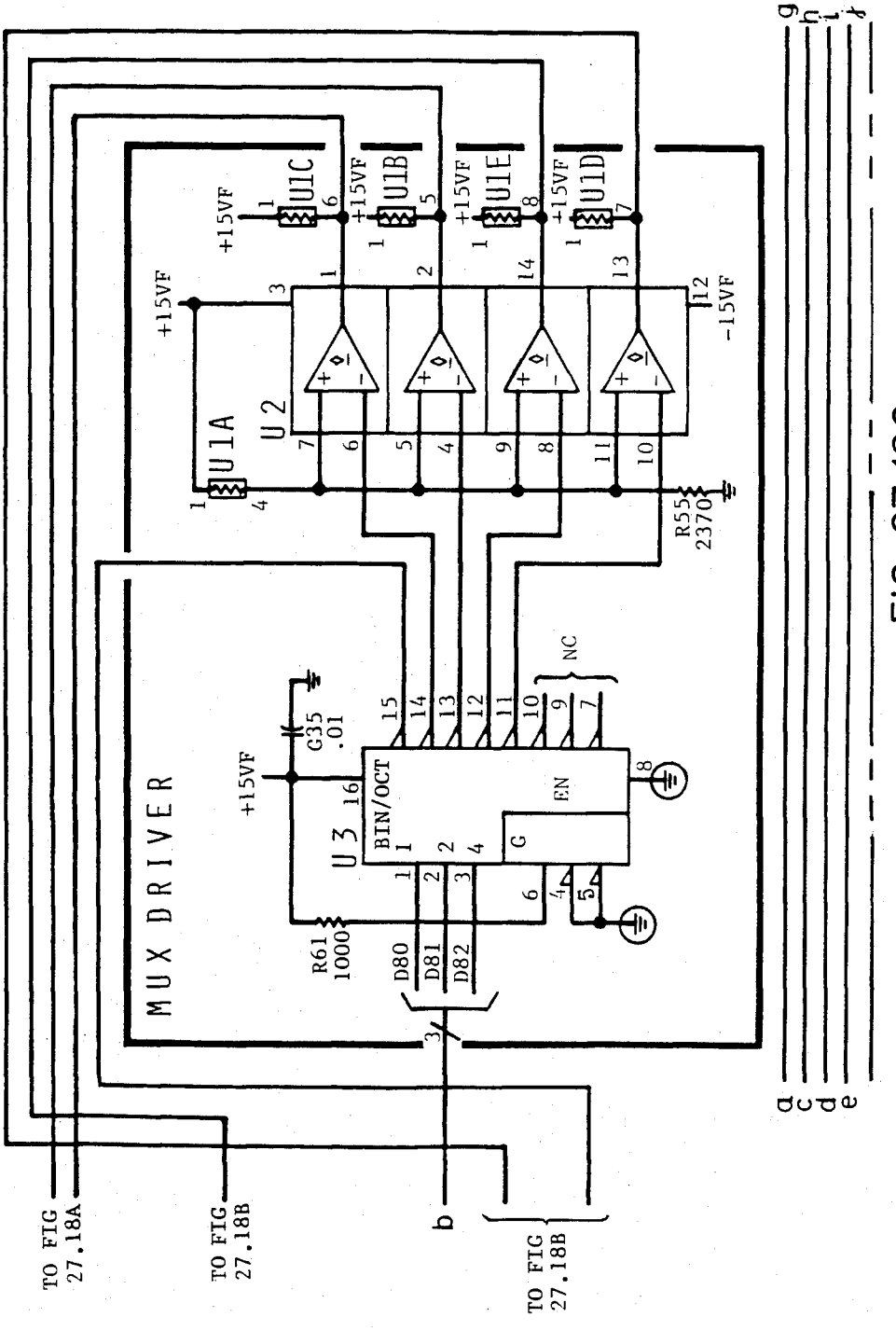

MUX DRIVER
U1A
U1C
U1B
U1E
U1D
U2
U3
+15VF
-15VF
BIN/OCT
EN
G
NC
C35 .01
R61 1000
R55 2370
D80
D81
D82
TO FIG 27.18A
TO FIG 27.18B
TO FIG 27.18B
a
b
c
d
e
g
h
i
k

FIG 27.18C

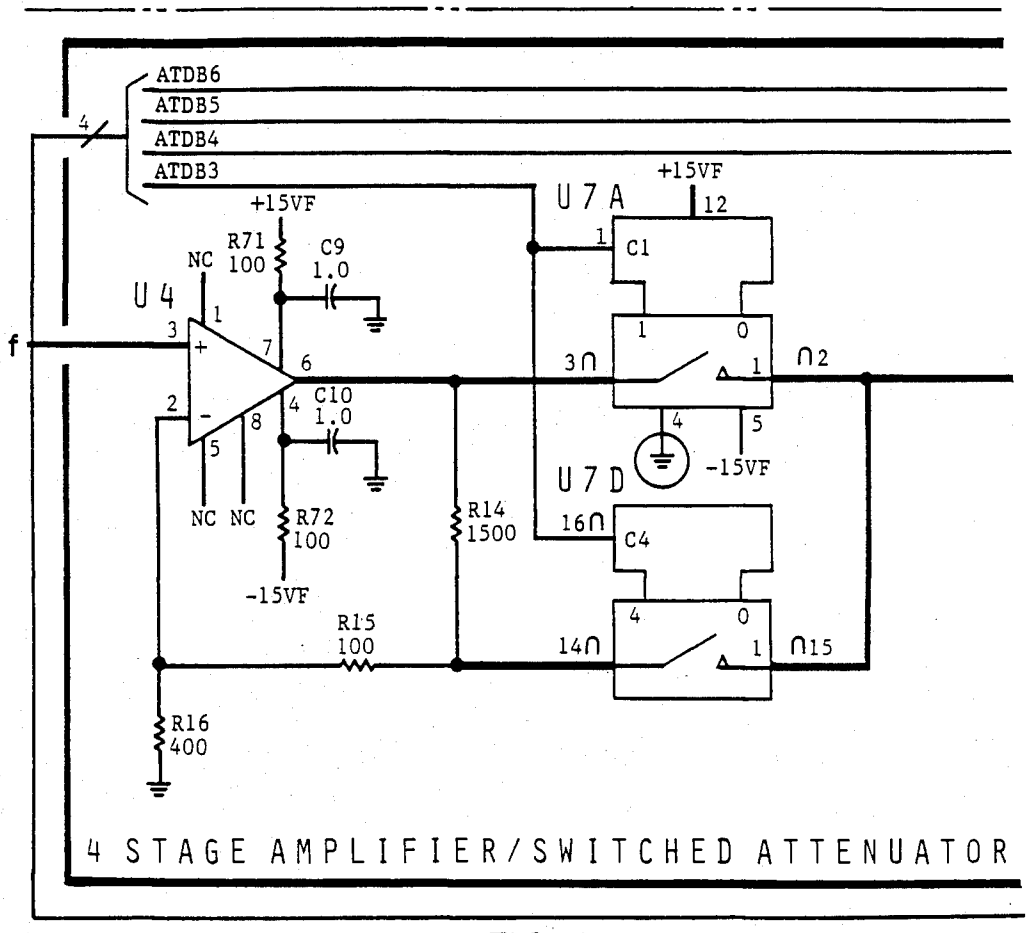

ATDB6
ATDB5
ATDB4
ATDB3
4
+15VF
R71
100
NC
C9
1.0
U4
f
3
1
+
7
6
2
-
8
4
C10
1.0
5
NC
NC
R72
100
-15VF
R14
1500
R15
100
R16
400
U7A
+15VF
12
1
C1
1
0
3Ω
1
Ω2
4
5
-15VF
U7D
16Ω
C4
4
0
14Ω
1
Ω15
4 STAGE AMPLIFIER/SWITCHED ATTENUATOR

FIG 27.19A

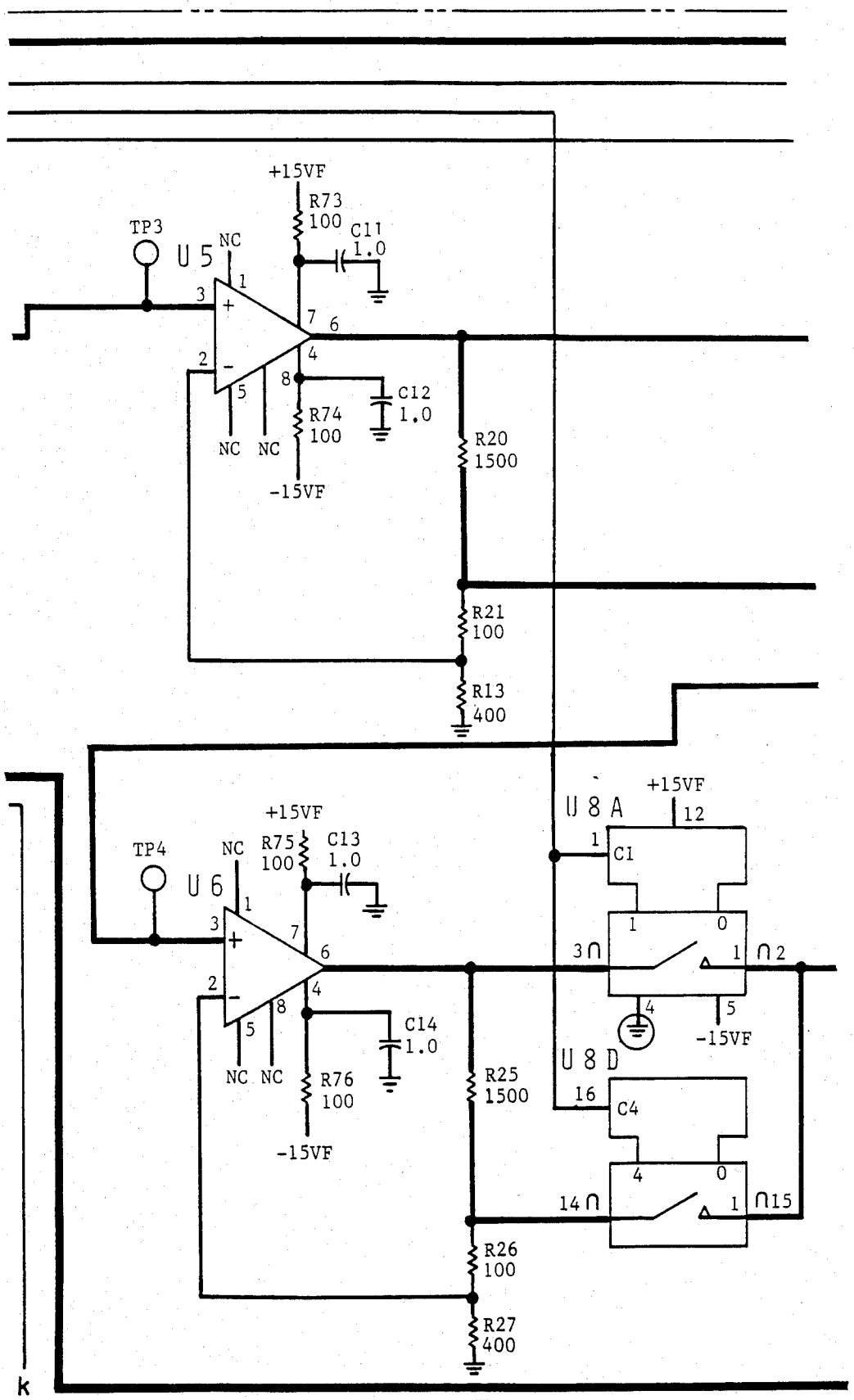

+15VF
R73
100
C11
1.0
TP3
U 5
NC
1
3
+
7
6
2
-
4
8
5
C12
1.0
R74
100
NC
NC
-15VF
R20
1500
R21
100
R13
400
+15VF
TP4
NC
R75
100
C13
1.0
U 6
1
3
+
7
6
2
-
4
8
5
C14
1.0
NC
NC
R76
100
-15VF
R25
1500
R26
100
R27
400
k
U 8 A
+15VF
12
1
C1
1
0
3∩
1
∩2
4
5
-15VF
U 8 D
16
C4
4
0
14∩
1
∩15

FIG 27.19B

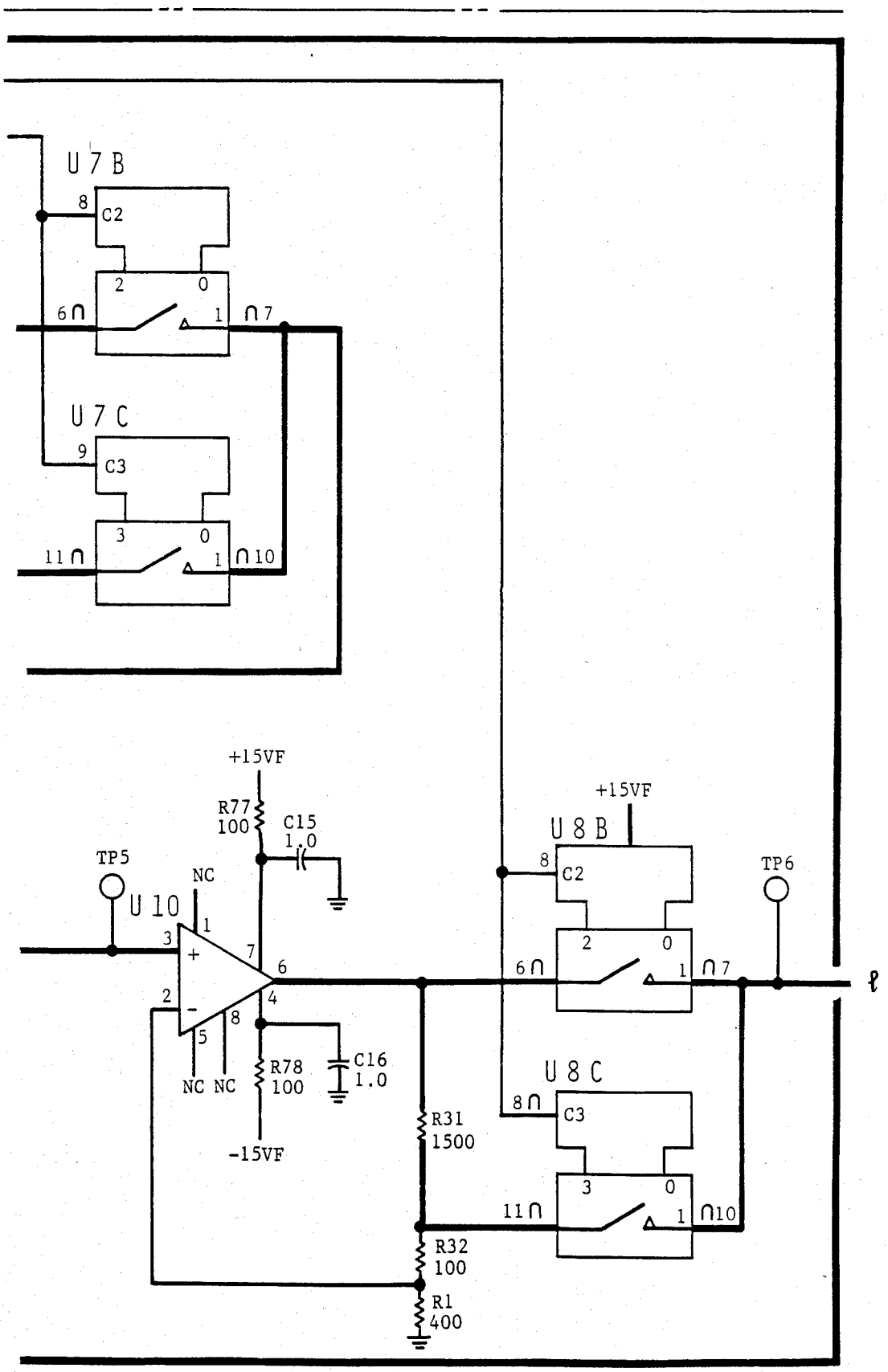

U7B
8
C2
2
0
6
1
7
U7C
9
C3
3
0
11
1
10
+15VF
R77
100
C15
1.0
TP5
NC
U10
1
3
7
6
2
4
8
5
NC NC
R78
100
C16
1.0
-15VF
R31
1500
R32
100
R1
400
+15VF
U8B
8
C2
2
0
6
1
7
TP6
U8C
8
C3
3
0
11
1
10

FIG 27.19C

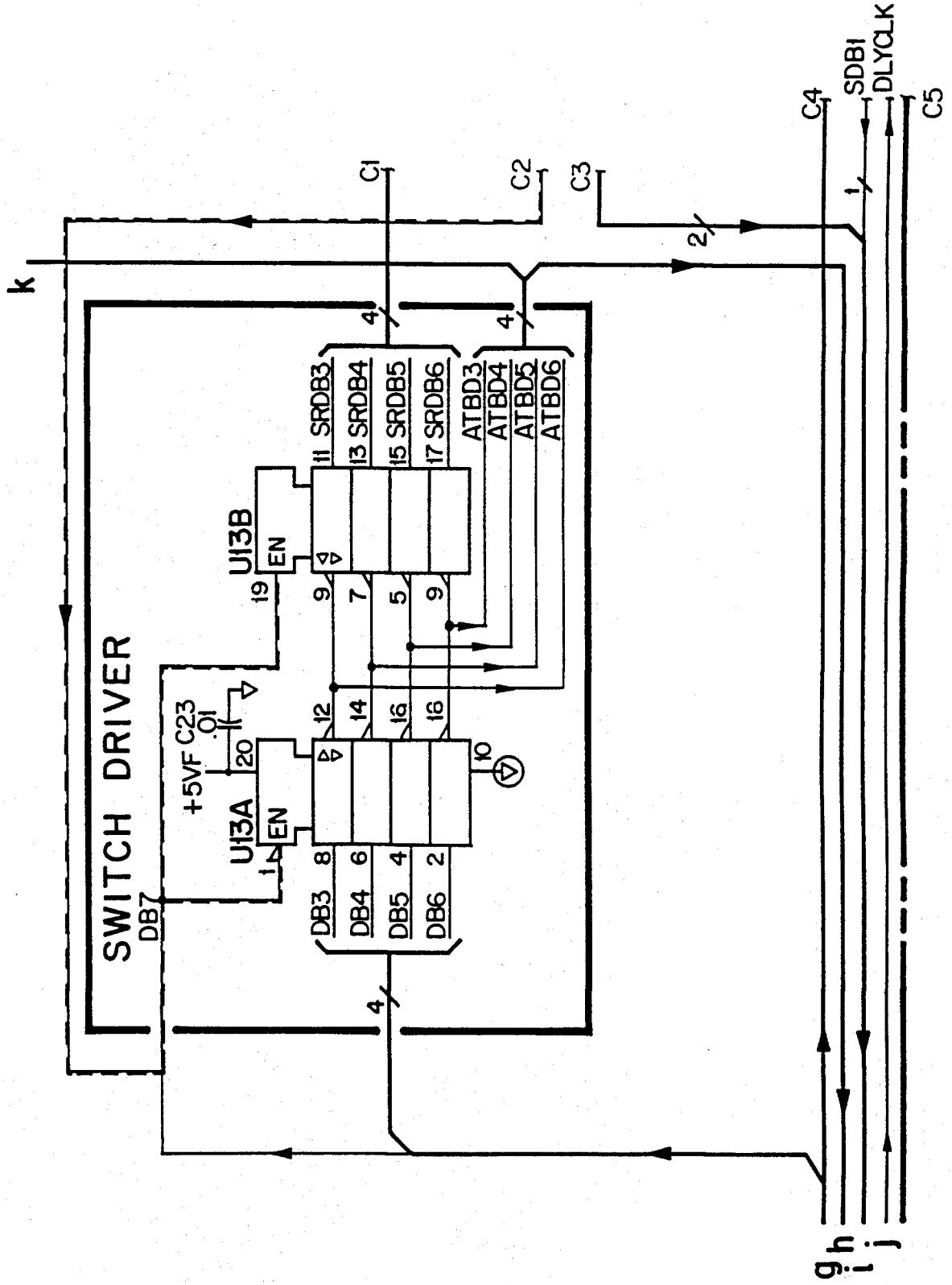

SWITCH DRIVER
DB7
U13A
U13B
EN
+5VF
C23
.01
SRDB3
SRDB4
SRDB5
SRDB6
ATBD3
ATBD4
ATBD5
ATBD6
DB3
DB4
DB5
DB6
C1
C2
C3
C4
C5
SDBI
DLYCLK
k
g
h
i
j

FIG 27.20A

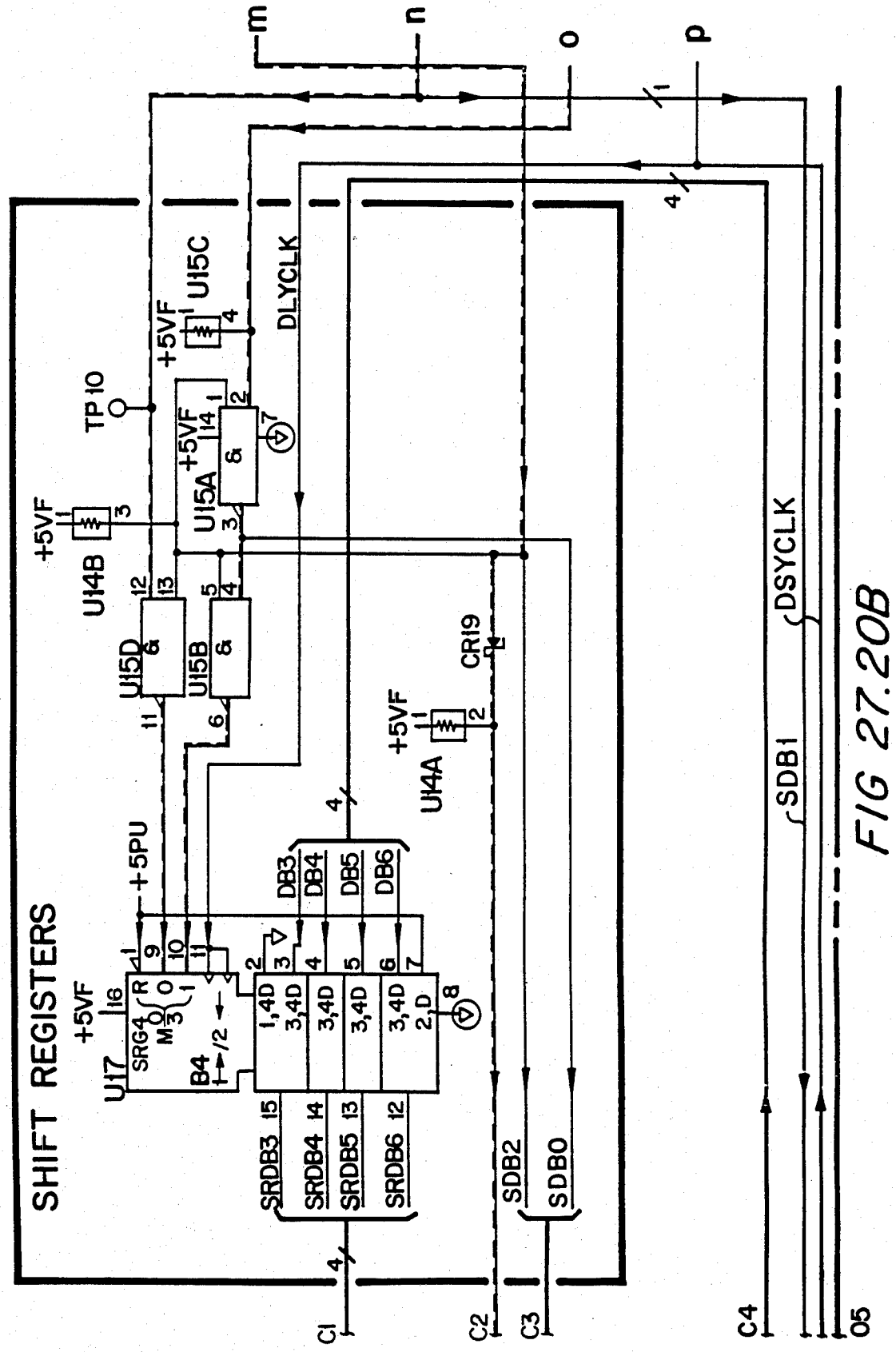

SHIFT REGISTERS
U17
SRG4
B4
/2
+5VF
+5PU
U14B
U15D
U15B
U15A
U15C
U14A
TP10
CR19
DLYCLK
DSYCLK
SDB1
SDB2
SDB0
SRDB3
SRDB4
SRDB5
SRDB6
DB3
DB4
DB5
DB6
1,4D
3,4D
2,D
C1
C2
C3
C4
05
m
n
o
p

FIG 27.20B

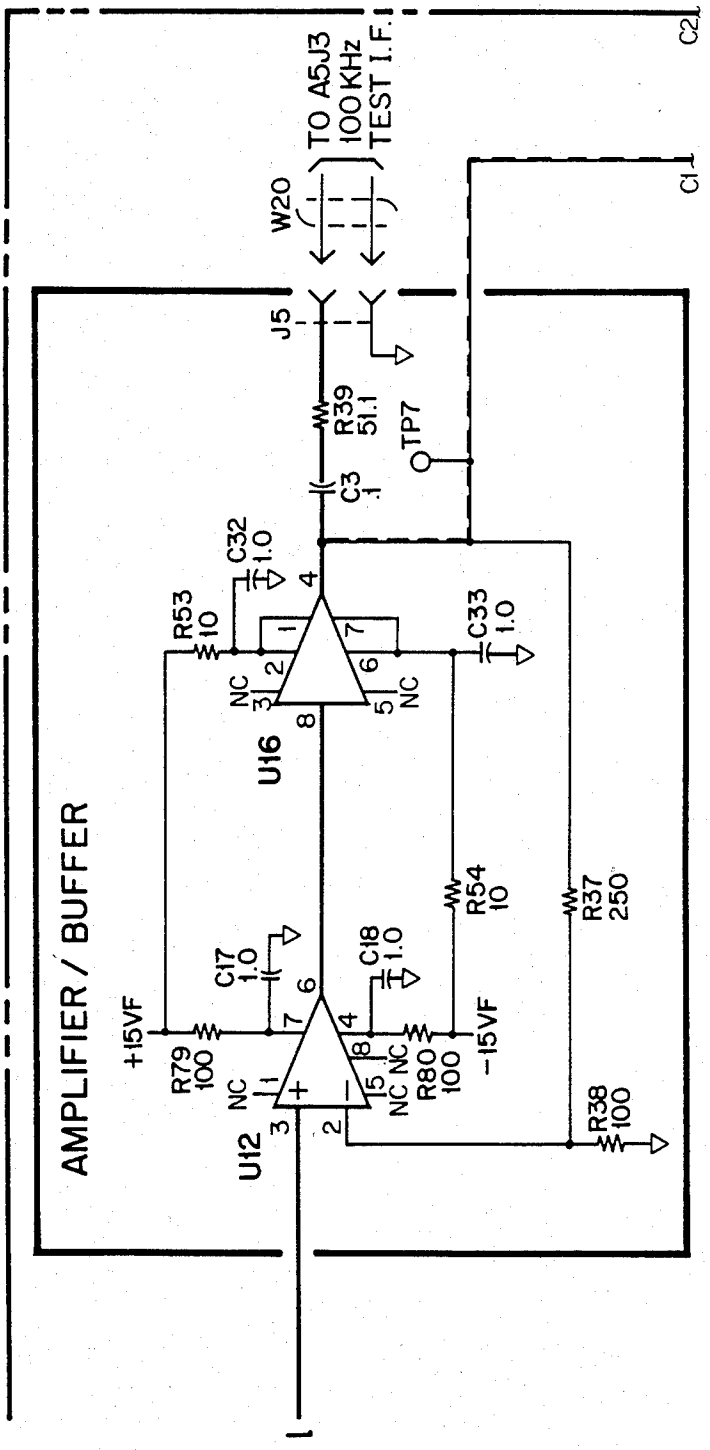

AMPLIFIER / BUFFER
C2
C1
TO A5J3
100 KHz
TEST I.F.
W20
J5
TP7
R39
51.1
C3
.1
C32
1.0
R53
10
U16
C33
1.0
R54
10
R37
250
C17
1.0
C18
1.0
+15VF
-15VF
R79
100
R80
100
U12
R38
100

FIG 27.21A

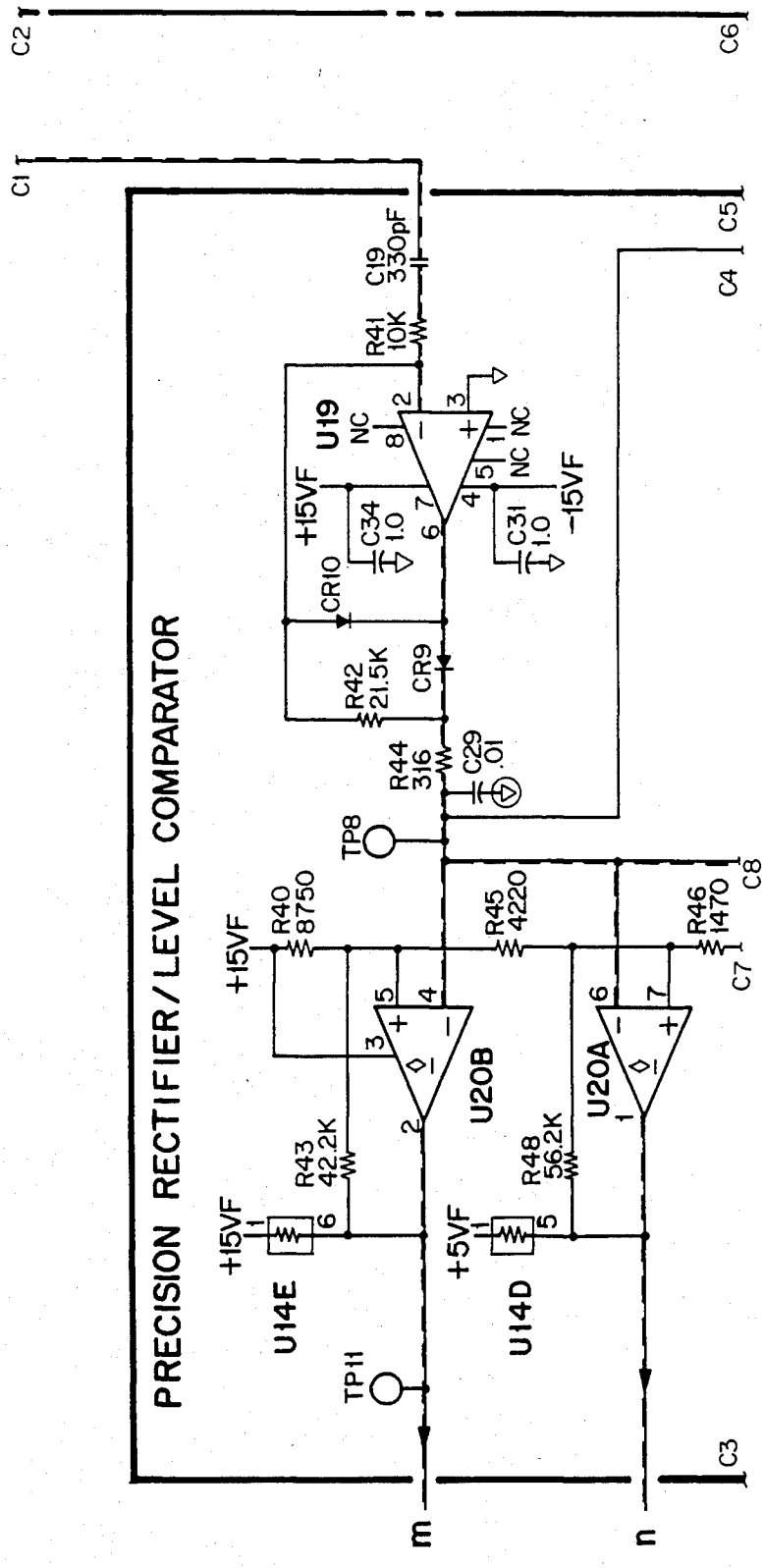

PRECISION RECTIFIER/LEVEL COMPARATOR
C1
C2
C3
C4
C5
C6
C7
C8
C19 330pF
R41 10K
U19
NC
NC NC
+15VF
-15VF
C34 1.0
C31 1.0
CR10
CR9
R42 21.5K
R44 316
C29 .01
TP8
R40 8750
R45 4220
R46 1470
U20B
U20A
R43 42.2K
R48 56.2K
+5VF
U14E
U14D
TP11
m
n

FIG 27.21B

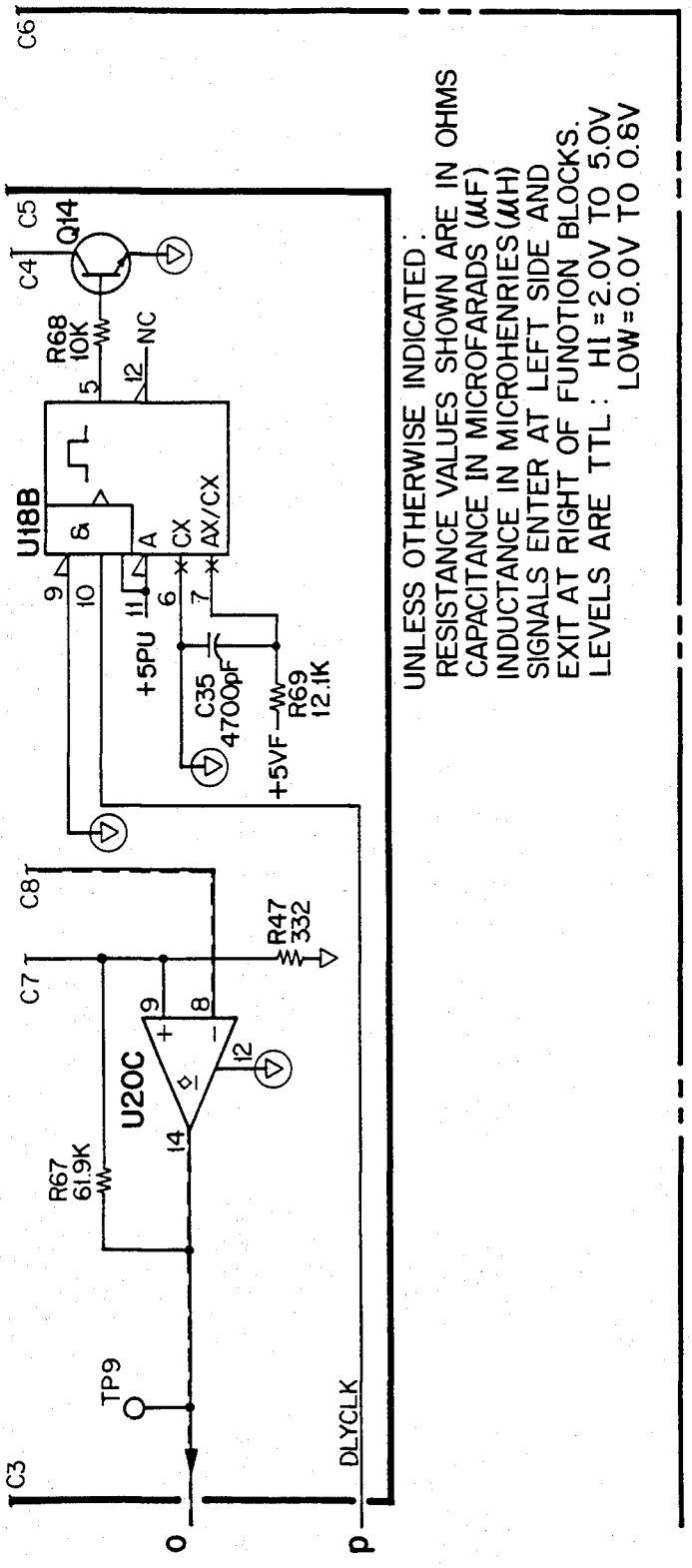

C6
C5
C4
Q14
R68
10K
NC
5
12
U18B
8
A
CX
AX/CX
9
10
11
6
7
+5PU
C35
4700pF
+5VF
R69
12.1K
C8
R47
332
C7
9
8
U20C
12
14
R67
61.9K
TP9
C3
DLYCLK
O
P
UNLESS OTHERWISE INDICATED:
RESISTANCE VALUES SHOWN ARE IN OHMS
CAPACITANCE IN MICROFARADS (μF)
INDUCTANCE IN MICROHENRIES (μH)
SIGNALS ENTER AT LEFT SIDE AND
EXIT AT RIGHT OF FUNOTION BLOCKS.
LEVELS ARE TTL: HI=2.0V TO 5.0V
LOW=0.0V TO 0.6V

FIG 27.21C

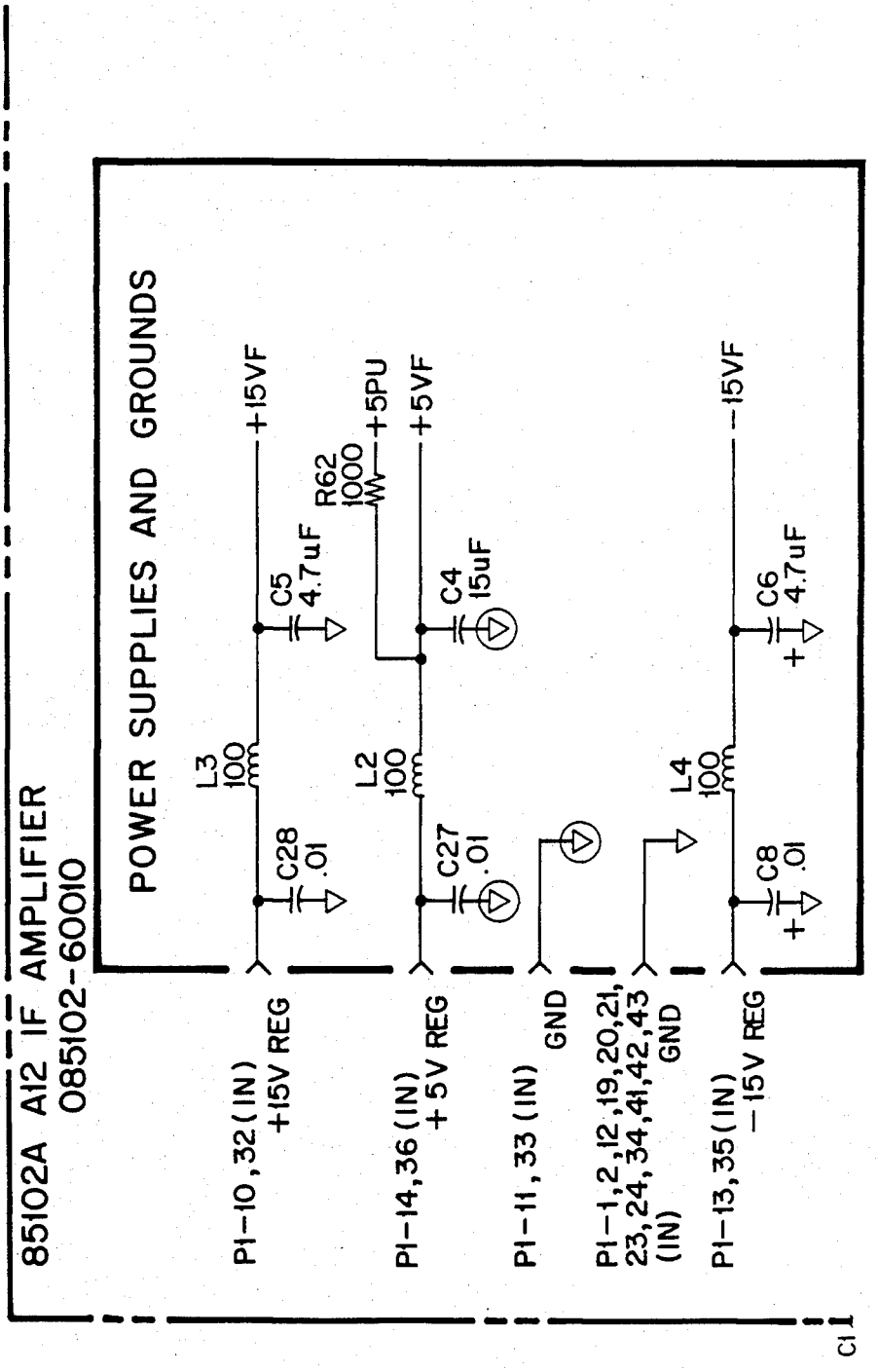

85102A A12 IF AMPLIFIER
085102-60010
POWER SUPPLIES AND GROUNDS
P1-10, 32 (IN)
+15V REG
L3
100
C28
.01
C5
4.7uF
+15VF
P1-14, 36 (IN)
+5V REG
L2
100
C27
.01
R62
1000
+5PU
C4
15uF
+5VF
P1-11, 33 (IN)
GND
P1-1, 2, 12, 19, 20, 21, 23, 24, 34, 41, 42, 43 (IN)
GND
P1-13, 35 (IN)
-15V REG
L4
100
C8
.01
C6
4.7uF
-15VF
C1

FIG 27.23A

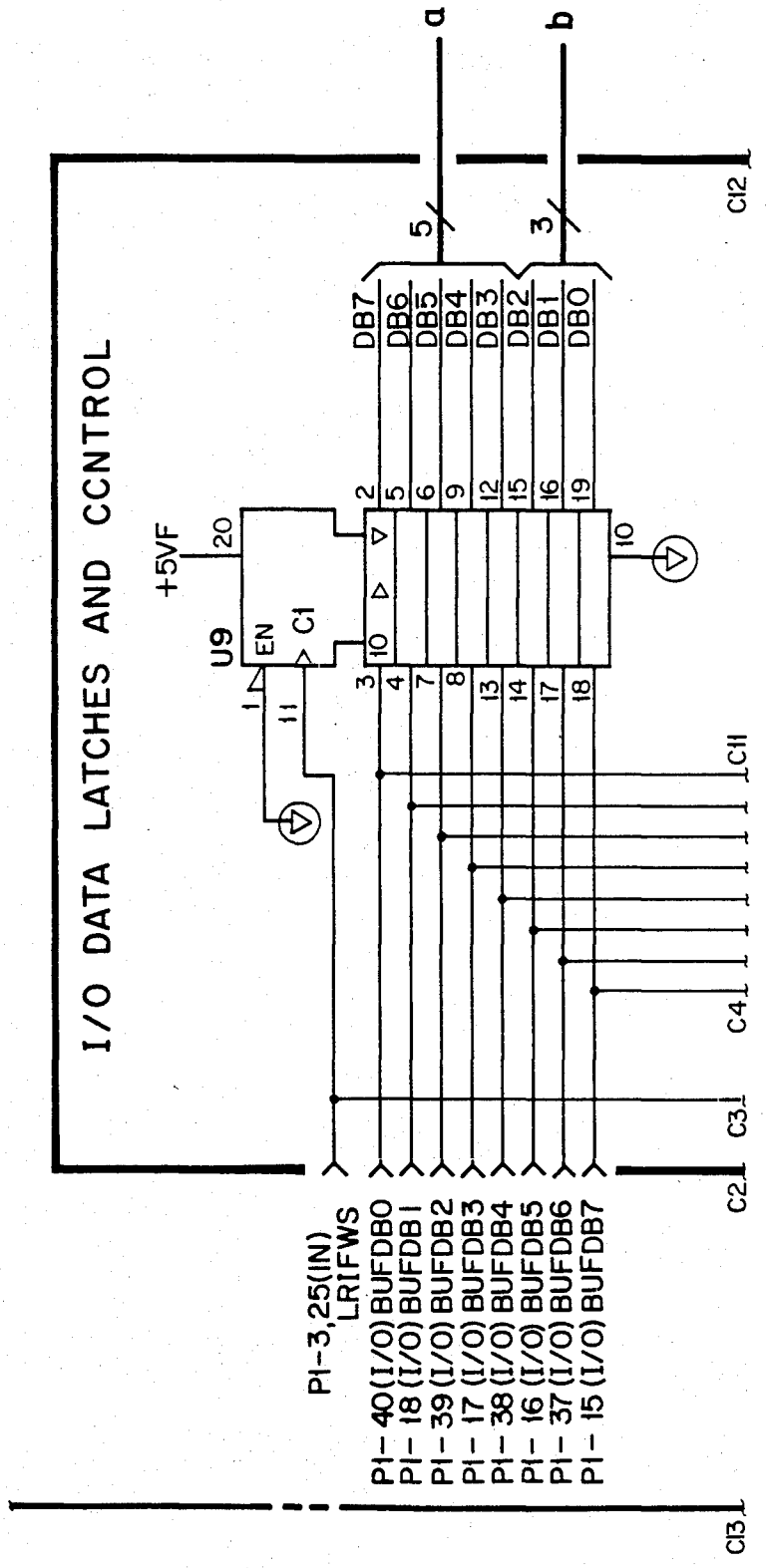

I/O DATA LATCHES AND CCNTROL
a
b
5
3
C12
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
+5VF
20
U9
EN
C1
2
5
6
9
12
15
16
19
10
3
4
7
8
13
14
17
18
1
11
C11
C4
C3
C2
C13
P1-3,25(IN)
LRIFWS
P1-40(I/O)BUFDB0
P1-18(I/O)BUFDB1
P1-39(I/O)BUFDB2
P1-17(I/O)BUFDB3
P1-38(I/O)BUFDB4
P1-16(I/O)BUFDB5
P1-37(I/O)BUFDB6
P1-15(I/O)BUFDB7

FIG 27.23B

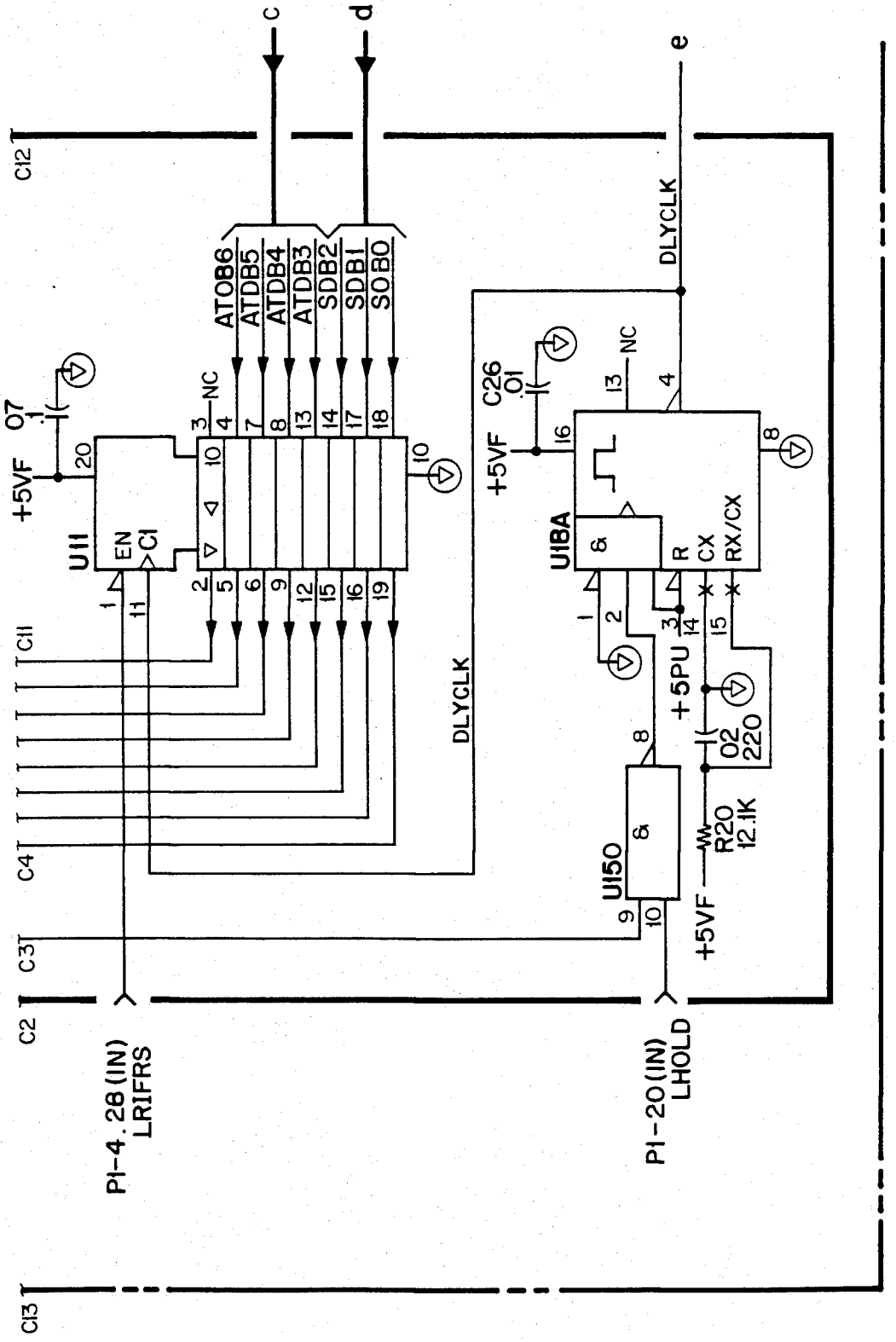

C
d
e
C12
C11
C4
C3
C2
C13
ATOB6
ATDB5
ATDB4
ATDB3
SDB2
SDB1
SOBO
NC
C7
.1
+5VF
U11
EN
CI
DLYCLK
C26
.01
U18A
R
CX
RX/CX
+5PU
C2
220
R20
12.1K
U15O
P1-4.28(IN)
LRIFRS
P1-20(IN)
LHOLD

FIG 27.23C

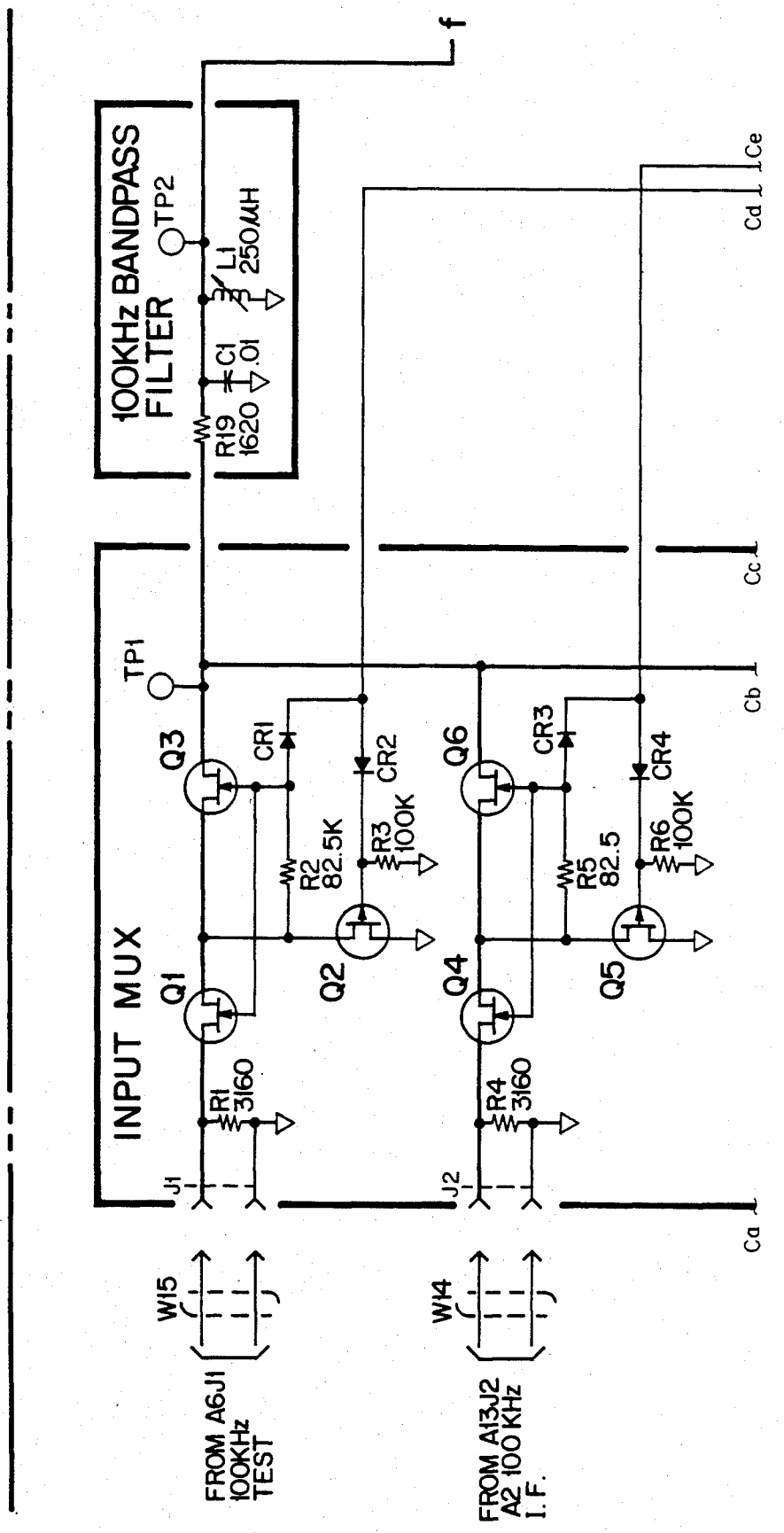

f
100KHz BANDPASS FILTER
TP2
L1 250μH
C1 .01
R19 1620
INPUT MUX
TP1
Q1
Q2
Q3
Q4
Q5
Q6
CR1
CR2
CR3
CR4
R1 3160
R2 82.5K
R3 100K
R4 3160
R5 82.5
R6 100K
J1
J2
Ca
Cb
Cc
Cd
Ce
W15
W14
FROM A6J1 100KHz TEST
FROM A13J2 A2 100 KHz I.F.

FIG 27.24A

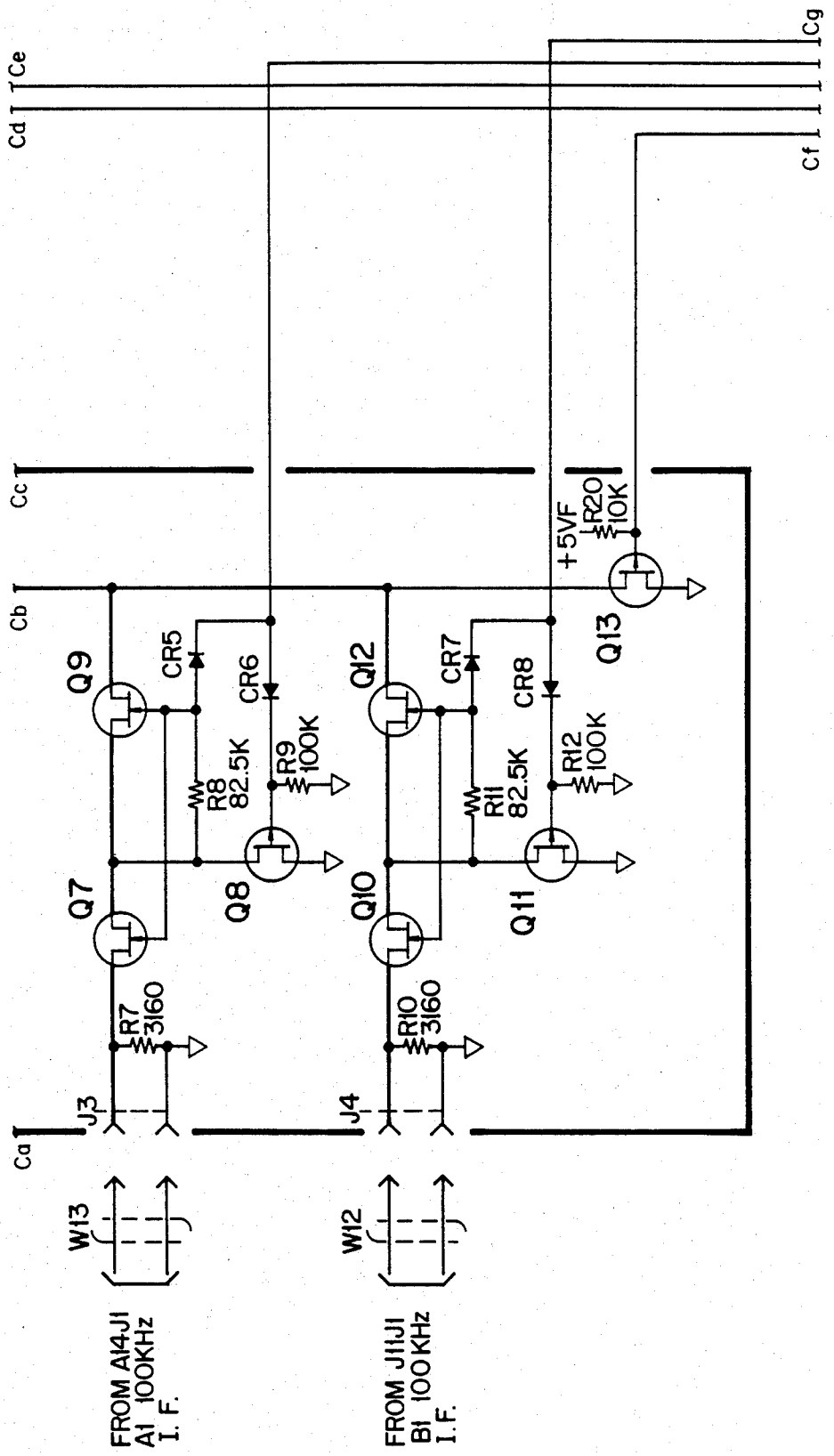

Ce
Cd
Cg
Cf
Cc
Cb
Ca
+5VF
R20
10K
Q9
CR5
CR6
R8
82.5K
R9
100K
Q8
Q7
R7
3160
J3
Q12
CR7
CR8
R11
82.5K
R12
100K
Q11
Q10
R10
3160
J4
Q13
W13
W12
FROM A14J1
A1 100KHz
I.F.
FROM J11J1
B1 100KHz
I.F.

FIG 27.24B

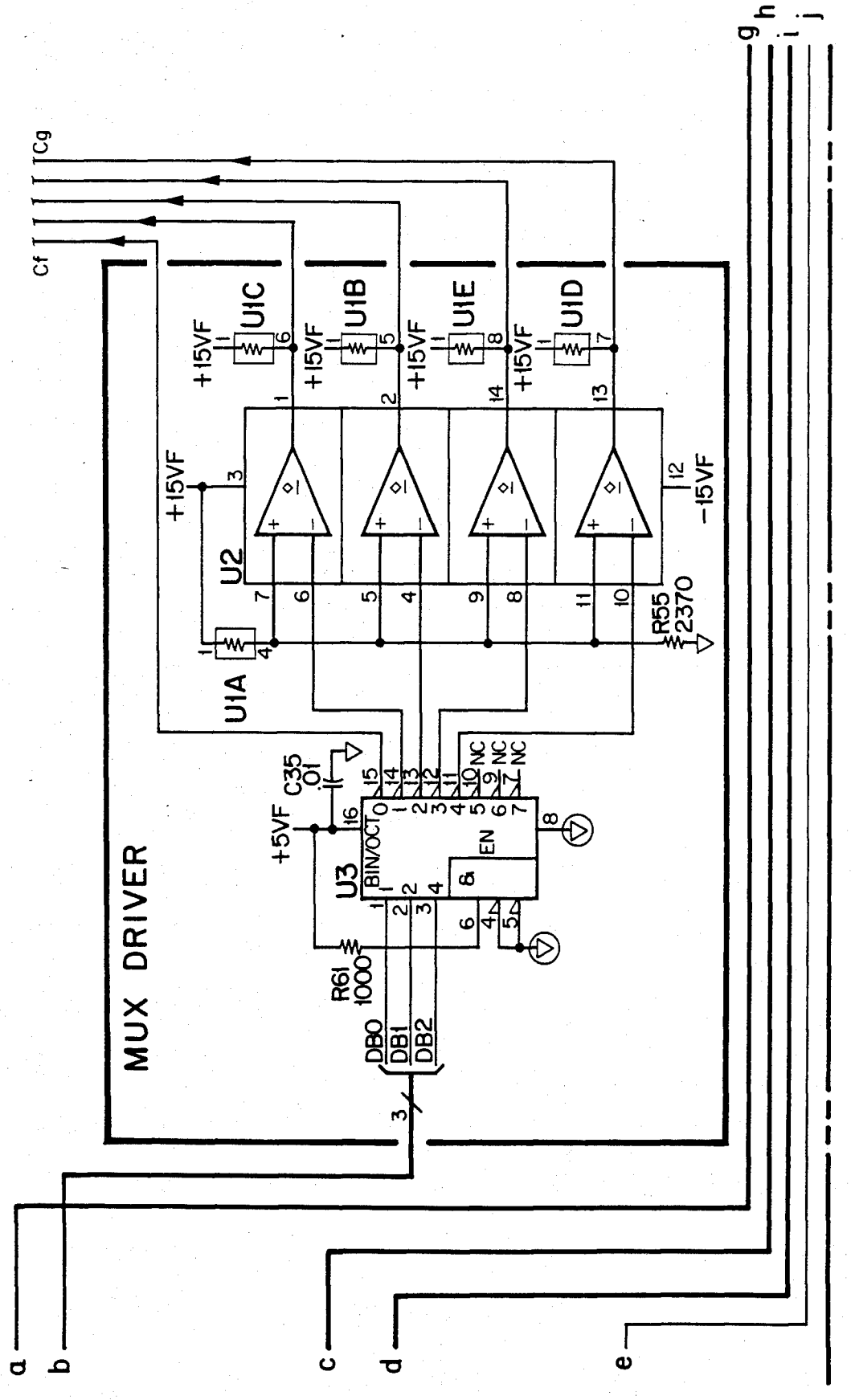

MUX DRIVER
U1A
U1B
U1C
U1D
U1E
U2
U3
+15VF
-15VF
+5VF
R55 2370
R61 1000
C35 .01
DB0
DB1
DB2
BIN/OCT
EN
NC
Cf
Cg
a
b
c
d
e
g
h
i
j

FIG 27.24C

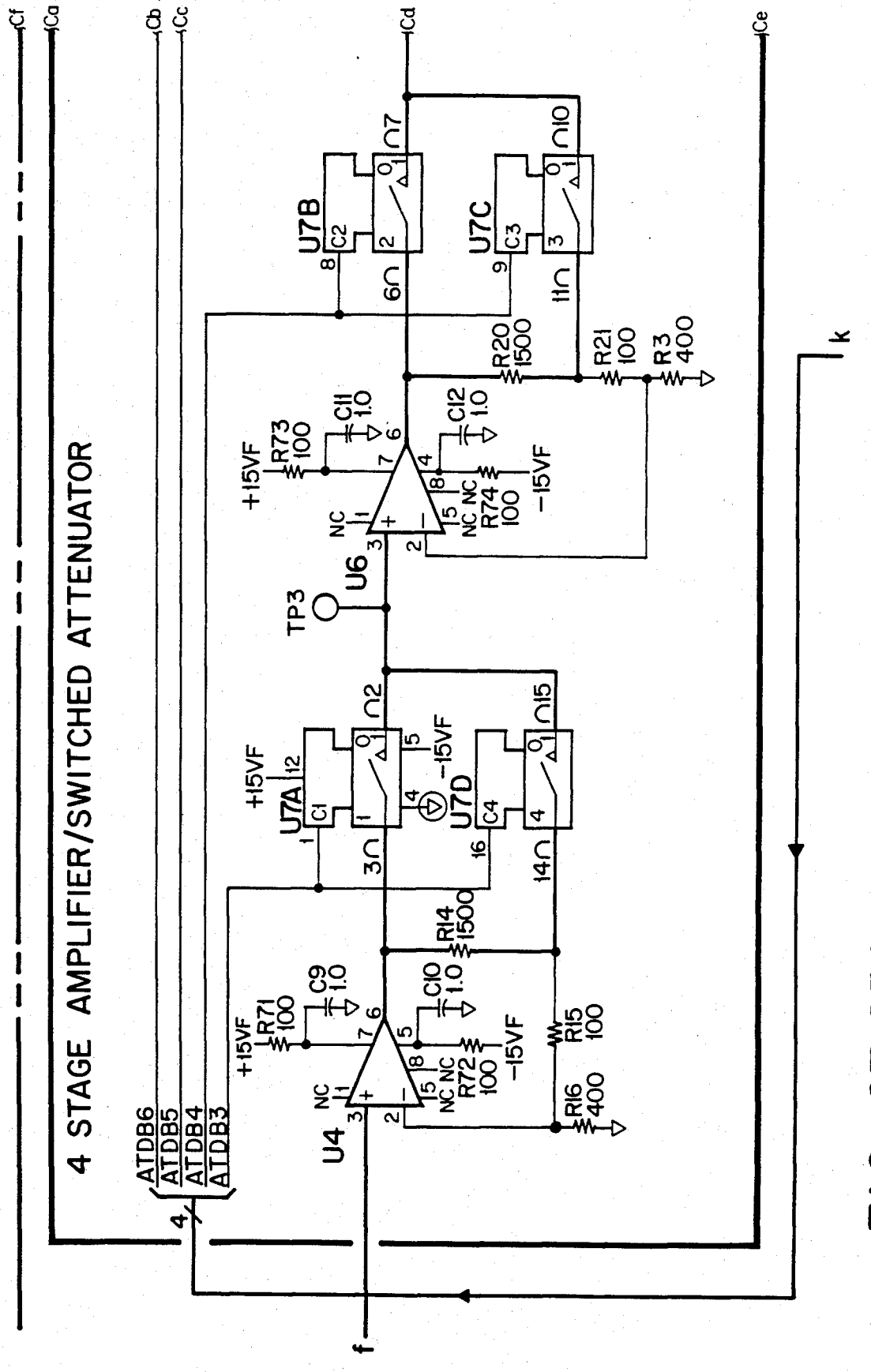

4 STAGE AMPLIFIER/SWITCHED ATTENUATOR
Cf
Ca
Cb
Cc
Cd
Ce
ATDB6
ATDB5
ATDB4
ATDB3
4
U4
U6
U7A
U7B
U7C
U7D
TP3
+15VF
-15VF
R71 100
R72 100
R73 100
R74 100
R14 1500
R20 1500
R15 100
R16 400
R21 100
R3 400
C9 1.0
C10 1.0
C11 1.0
C12 1.0
NC
NC NC
f
k

FIG 27.25A

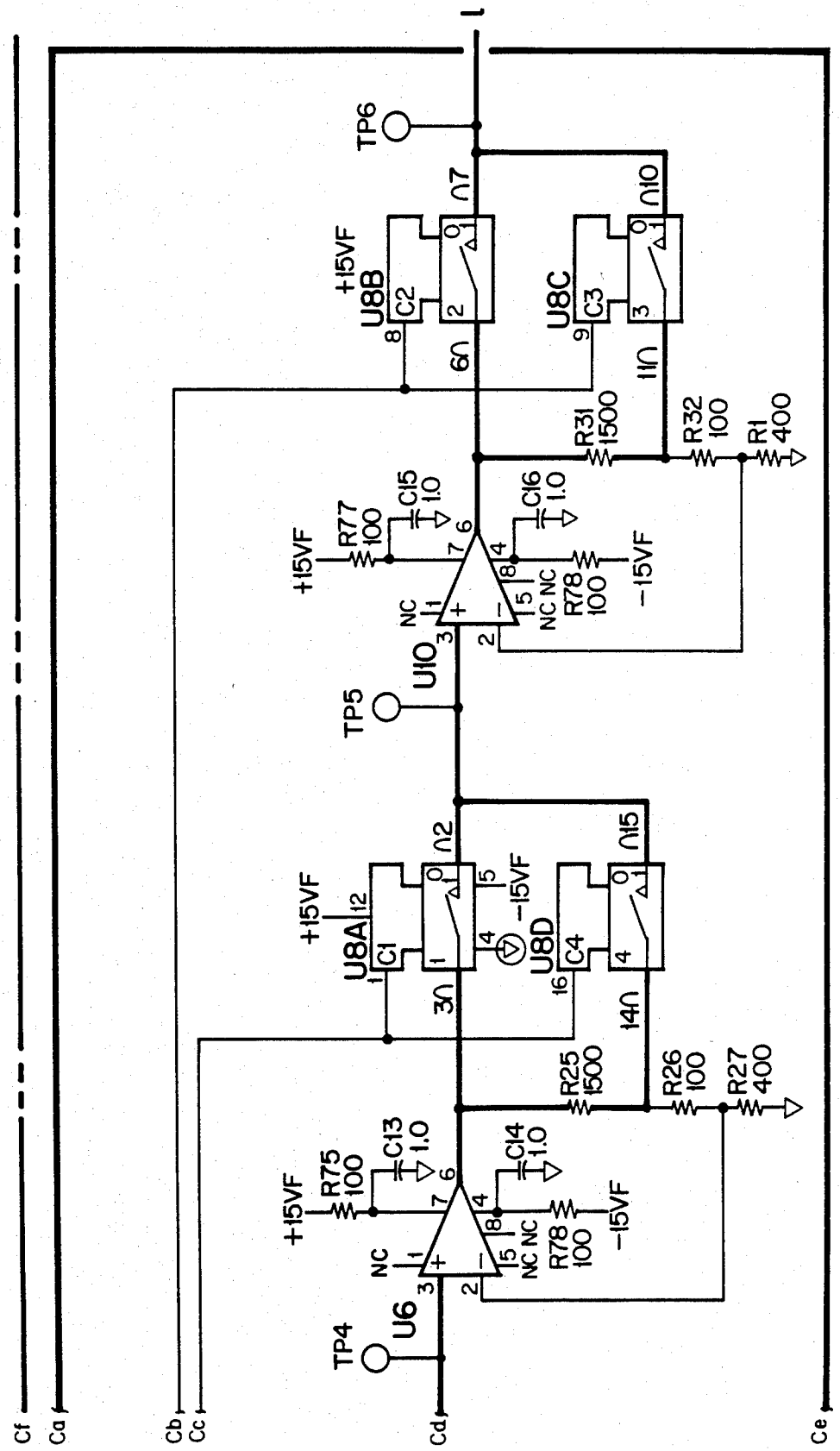

TP6
TP5
TP4
U6
U8A
U8B
U8C
U8D
U10
+15VF
-15VF
R31 1500
R32 100
R1 400
R25 1500
R26 100
R27 400
R75 100
R77 100
R78 100
C13 1.0
C14 1.0
C15 1.0
C16 1.0
NC
NC NC
Cf
Ca
Cb
Cc
Cd
Ce

FIG 27.25B

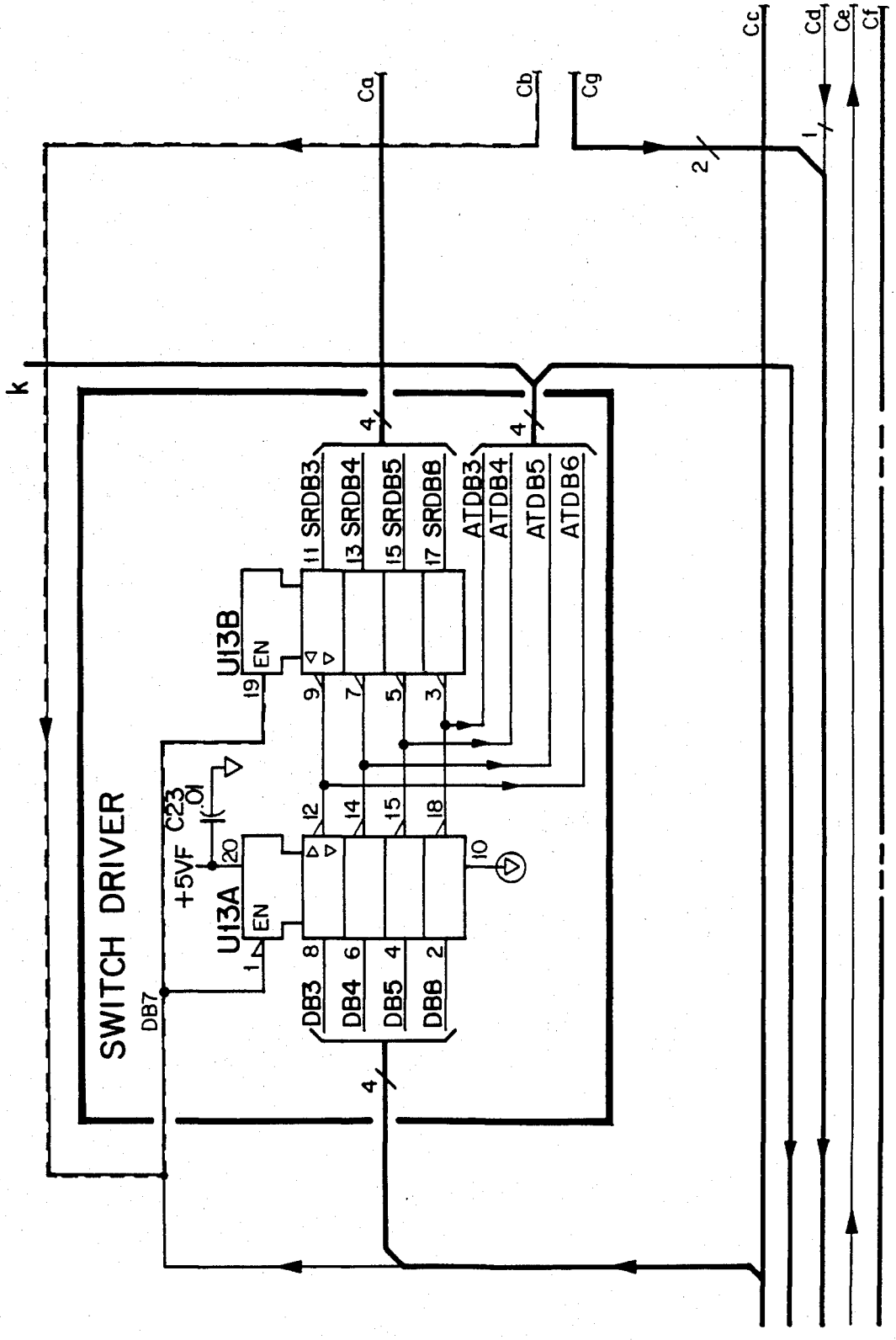

Ca
Cb
Cg
Cc
Cd
Ce
Cf
k
SWITCH DRIVER
DB7
+5VF
C23
.01
U13A
U13B
EN
SRDB3
SRDB4
SRDB5
SRDB6
ATDB3
ATDB4
ATDB5
ATDB6
DB3
DB4
DB5
DB6

FIG 27.26A

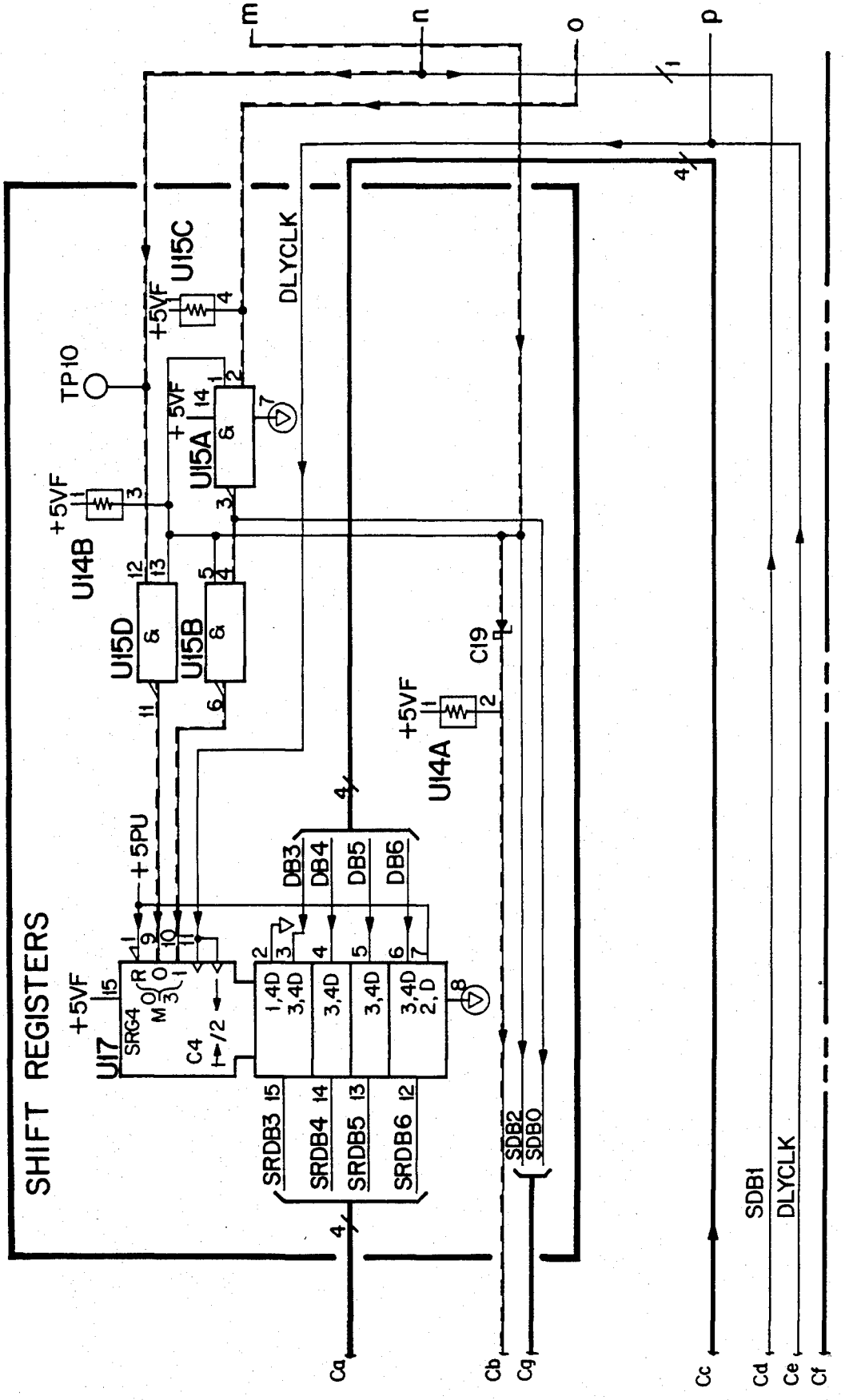

SHIFT REGISTERS
m
n
o
p
DLYCLK
U15C
U15A
U15D
U15B
U14B
U14A
U17
TP10
+5VF
+5PU
C19
C4
SRG4
1,4D 3,4D
3,4D
3,4D
3,4D 2,D
DB3
DB4
DB5
DB6
SRDB3
SRDB4
SRDB5
SRDB6
SDB2
SDB0
SDB1
Ca
Cb
Cg
Cc
Cd
Ce
Cf

FIG 27.26B

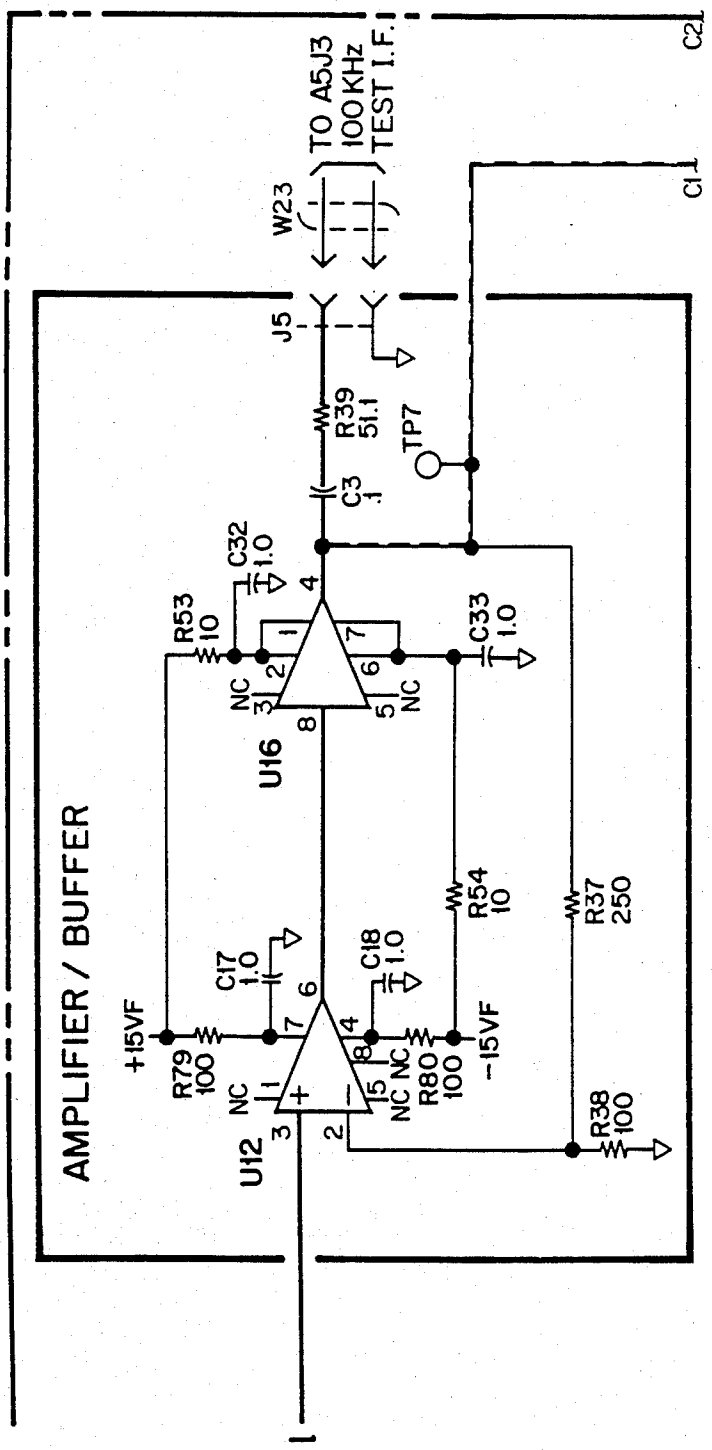

AMPLIFIER / BUFFER
C21
C11
TO A5J3
100 KHz
TEST I.F.
W23
J5
TP7
R39
51.1
C3
.1
C32
1.0
R53
10
U16
C33
1.0
R54
10
R37
250
C17
1.0
C18
1.0
+15VF
-15VF
R79
100
R80
100
U12
R38
100

FIG 27.27A

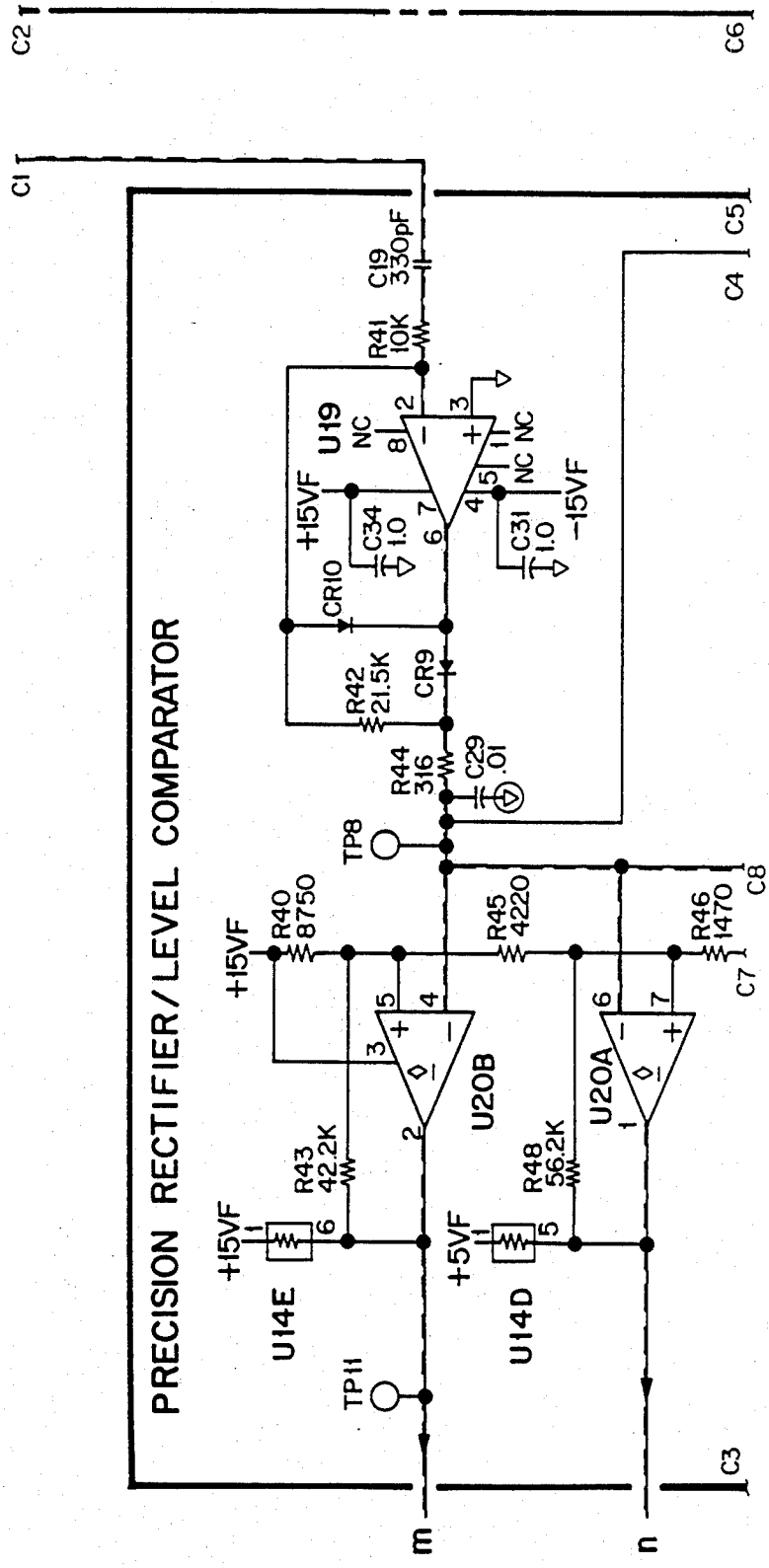

C2
C6
C1
C5
C4
C3
PRECISION RECTIFIER/LEVEL COMPARATOR
C19 330pF
R41 10K
U19
NC
NC NC
+15VF
-15VF
C34 1.0
C31 1.0
CR10
CR9
R42 21.5K
R44 316
C29 .01
TP8
C8
C7
R40 8750
R45 4220
R46 1470
U20B
U20A
R43 42.2K
R48 56.2K
+15VF
+5VF
U14E
U14D
TP11
m
n

FIG 27.27B

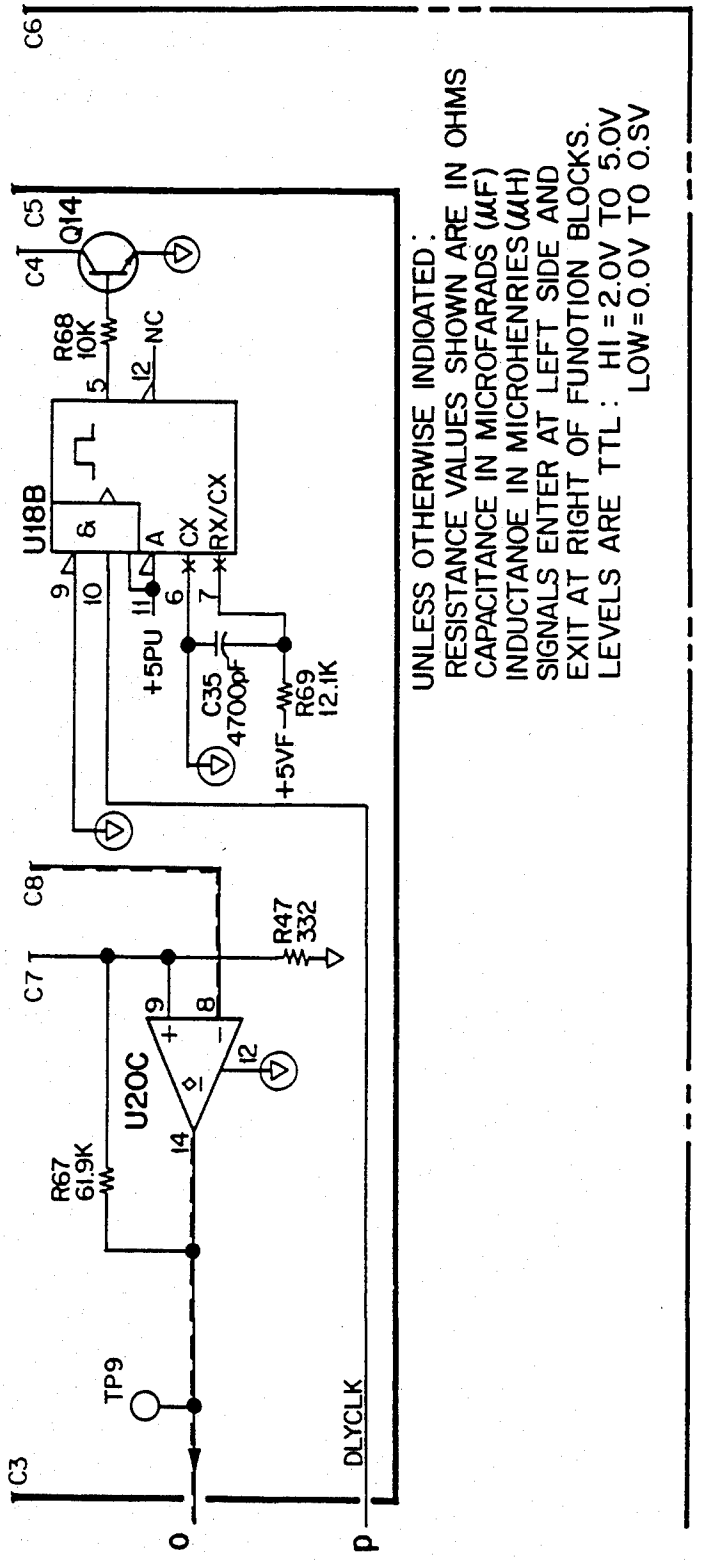

C6
C5
C4
Q14
R68
10K
NC
U18B
RX/CX
CX
+5PU
C35
4700pF
+5VF
R69
12.1K
C8
C7
R47
332
U20C
R67
61.9K
TP9
C3
DLYCLK
O
P
UNLESS OTHERWISE INDIOATED:
RESISTANCE VALUES SHOWN ARE IN OHMS
CAPACITANCE IN MICROFARADS (μF)
INDUCTANOE IN MICROHENRIES (μH)
SIGNALS ENTER AT LEFT SIDE AND
EXIT AT RIGHT OF FUNOTION BLOCKS.
LEVELS ARE TTL: HI = 2.0V TO 5.0V
LOW = 0.0V TO 0.5V

FIG 27.27C

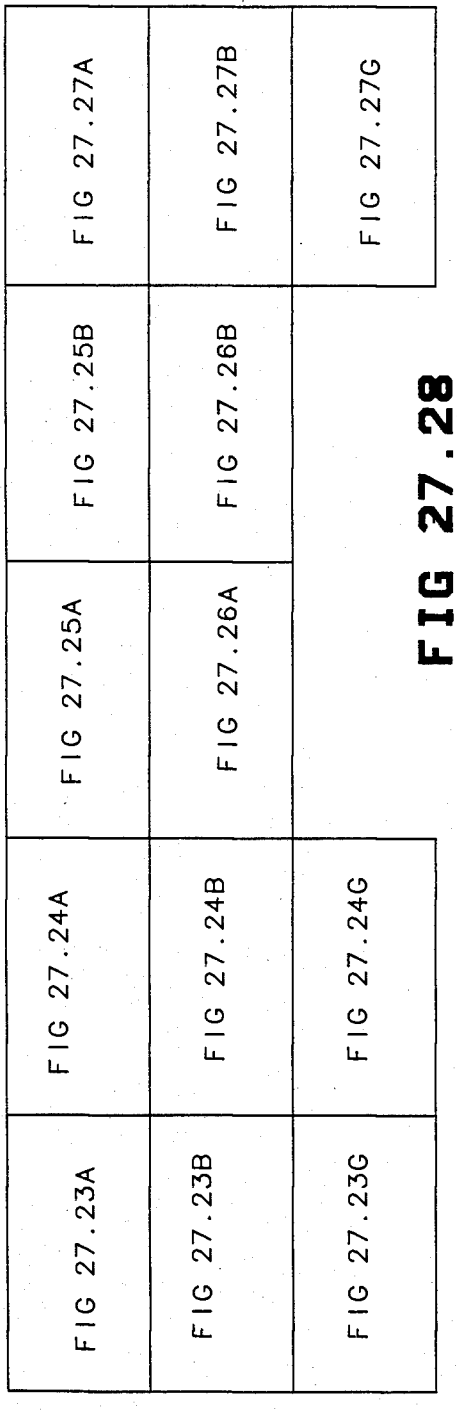


FIG 27.28

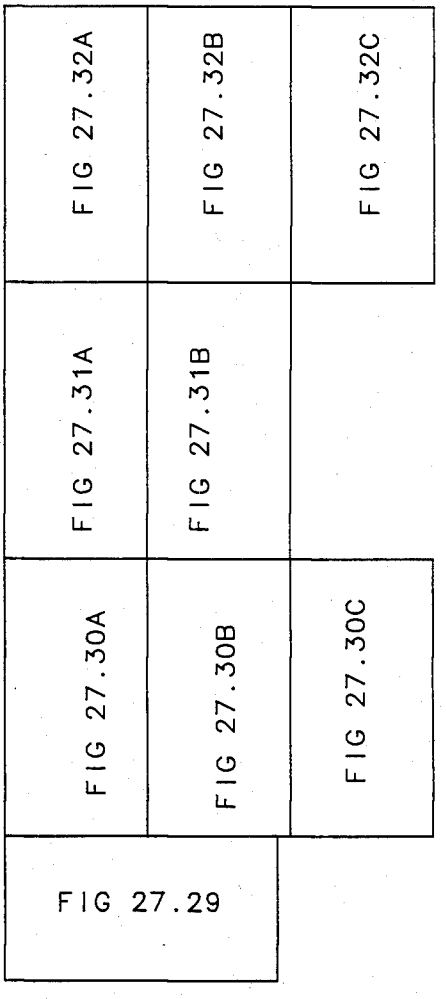


FIG 27.33

A15 REGULATOR
85102-60015

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	Q2R	A25Q2 BASE	J
23			
2			
24			
3	-5V SENSE	-5V BUS	J
25			
4			
25			
5			
27			
6			
28			
7			
29			
8			
30			
9			
31			
10	+15V REG	+15V BUS	E
32			
11	GND	GND BUS	A
33			
12	GND	GND BUS	A
34			
13	-15V REG	-15V BUS	H
35			
14	-5V REG	+5V BUS	I
35			
16			
37	+5V SENSE	+5V BUS	I
16			
38	-15V SENSE	-15V BUS	H
17	-15VUNREG	A26	C G
39	Q4B	A25Q4 BASE	G R
18			
40	+15VUNREG	A25	B D
19	Q1B	A25Q1 BASE	I
41	Q3B	A25Q3 BASE	D E
20	Q5B	A25Q5 BASE	I
42			
21	SENSE GND	GND	E H I J
43	TBER 1	A25RT1	F
22	+15 SENSE	+15V BUS	E H I J
44	TBER 2	A25RT1	E

ACTIVE COMPONENTS PARTS LISTS
(U's and Q's)

REFERENCE DESIGNATORS	HP PART NUMBER	MANUFACTURER'S PART NUMBER
U8	1826-0458	LF255
U2	1826-0458	LF255
U9	1826-0458	LF255
U6	1826-0458	LF255
U10	1826-0261	741
U5	1826-0316	LH0070
U4	1826-0468	MC3423
U3	1826-0468	MC3423
U1	1826-0468	MC3423
U7	1826-0468	MC3423
Q18	1853-0281	2N2907
Q3	1854-0477	2N222
Q13	1854-0477	2N222A
Q12	1854-0022	2N2102
Q11	1853-0281	2N2907
Q15	1853-0281	2N2907A
Q9	1853-0281	2N2907A
Q8	1854-0404	S59333
Q7	1884-0244	
Q2	1884-0293	
Q4	1884-0244	
Q9	1884-0244	
Q17	1884-0073	
Q10	1854-0404	S59333
Q14	1853-0314	2N2905A
Q16	1854-0637	2N2219A
Q1,Q6	1854-0477	2N222A

CHASSIS	MOUNTED	SEMICONDUCTORS
Q1	1854-0679	2N5885
Q2	1853-0351	2N6053
Q3	1854-0611	2N6055
Q4	1853-0351	2N6053

MOTHERBOARD	SEMICONDUCTORS
Q5 1854-0441	40372

FIG 27.29

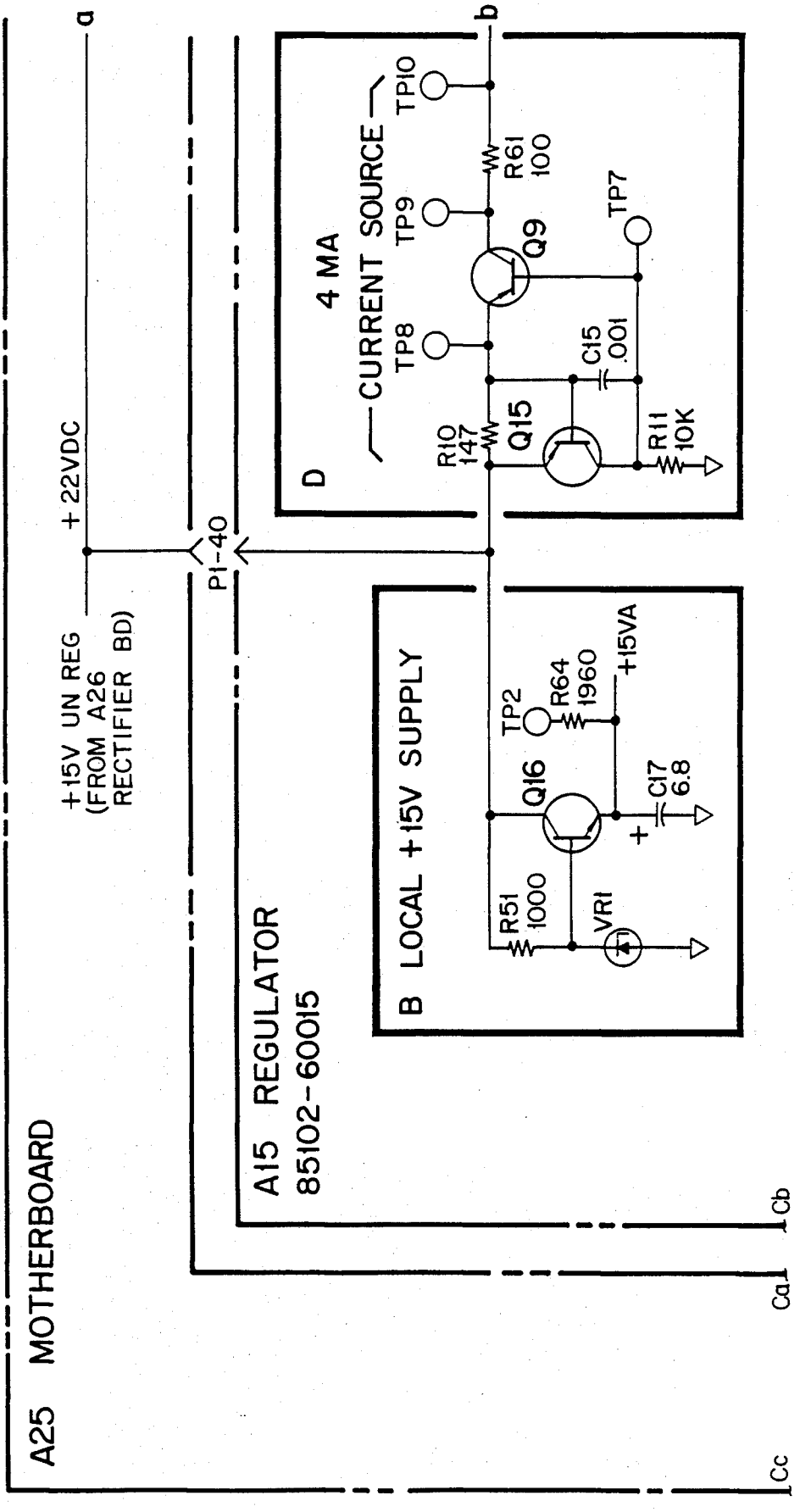

A25 MOTHERBOARD
+15V UN REG
(FROM A26
RECTIFIER BD)
+ 22VDC
a
P1-40
A15 REGULATOR
85102-60015
B LOCAL +15V SUPPLY
TP2
R64
1960
+15VA
Q16
C17
6.8
R51
1000
VR1
D
4 MA
CURRENT SOURCE
TP8
TP9
TP10
b
R61
100
Q9
TP7
C15
.001
R10
147
Q15
R11
10K
Cc
Ca
Cb

FIG 27.30A

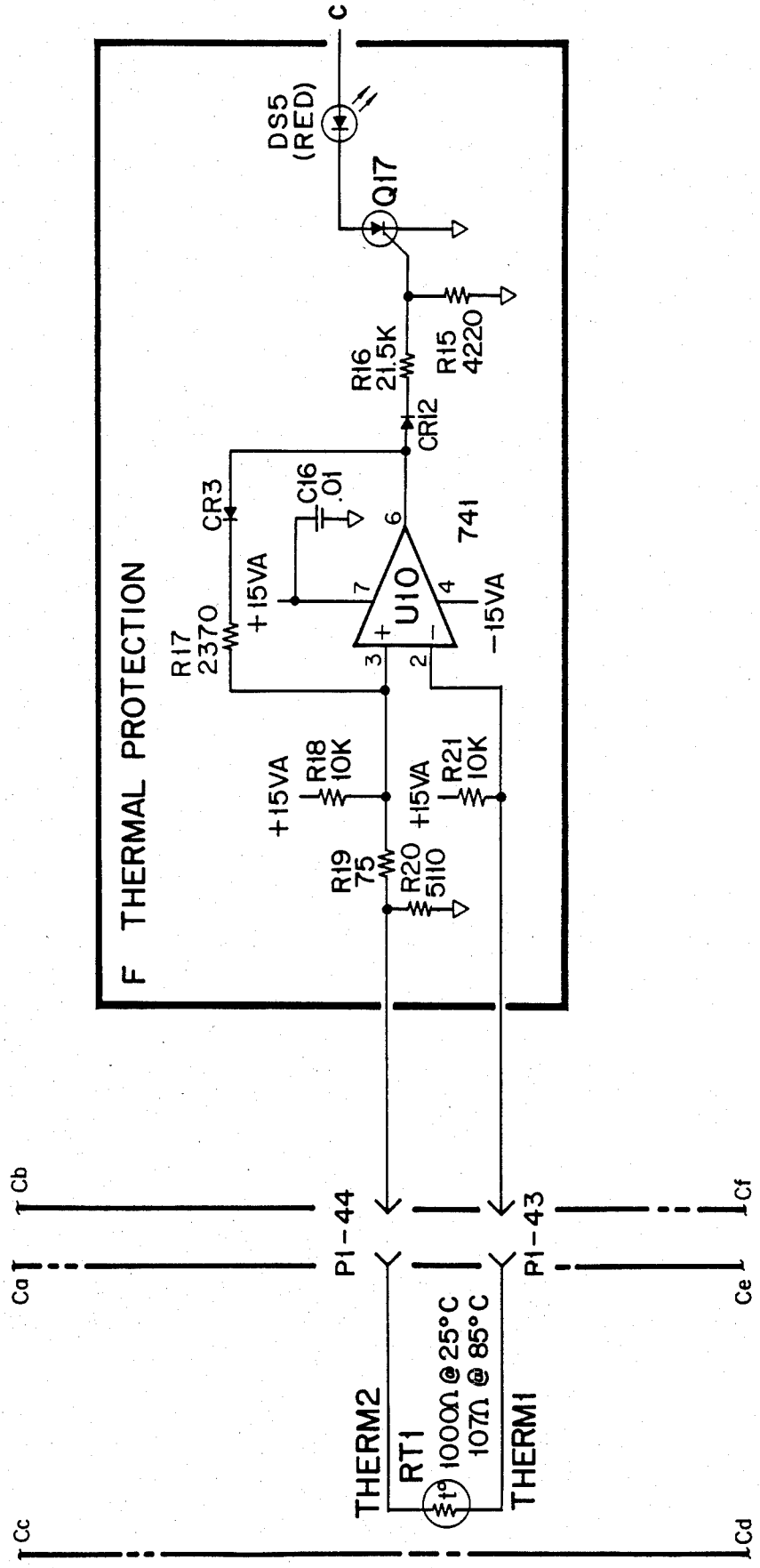

F THERMAL PROTECTION
C
DS5 (RED)
Q17
R16 21.5K
R15 4220
CR12
CR3
C16 .01
741
U10
+15VA
-15VA
R17 2370
R18 10K
R21 10K
R19 75
R20 5110
P1-44
P1-43
Ca
Cb
Cc
Cd
Ce
Cf
THERM2
THERM1
RT1
100Ω @ 25°C
107Ω @ 85°C

FIG 27.30B

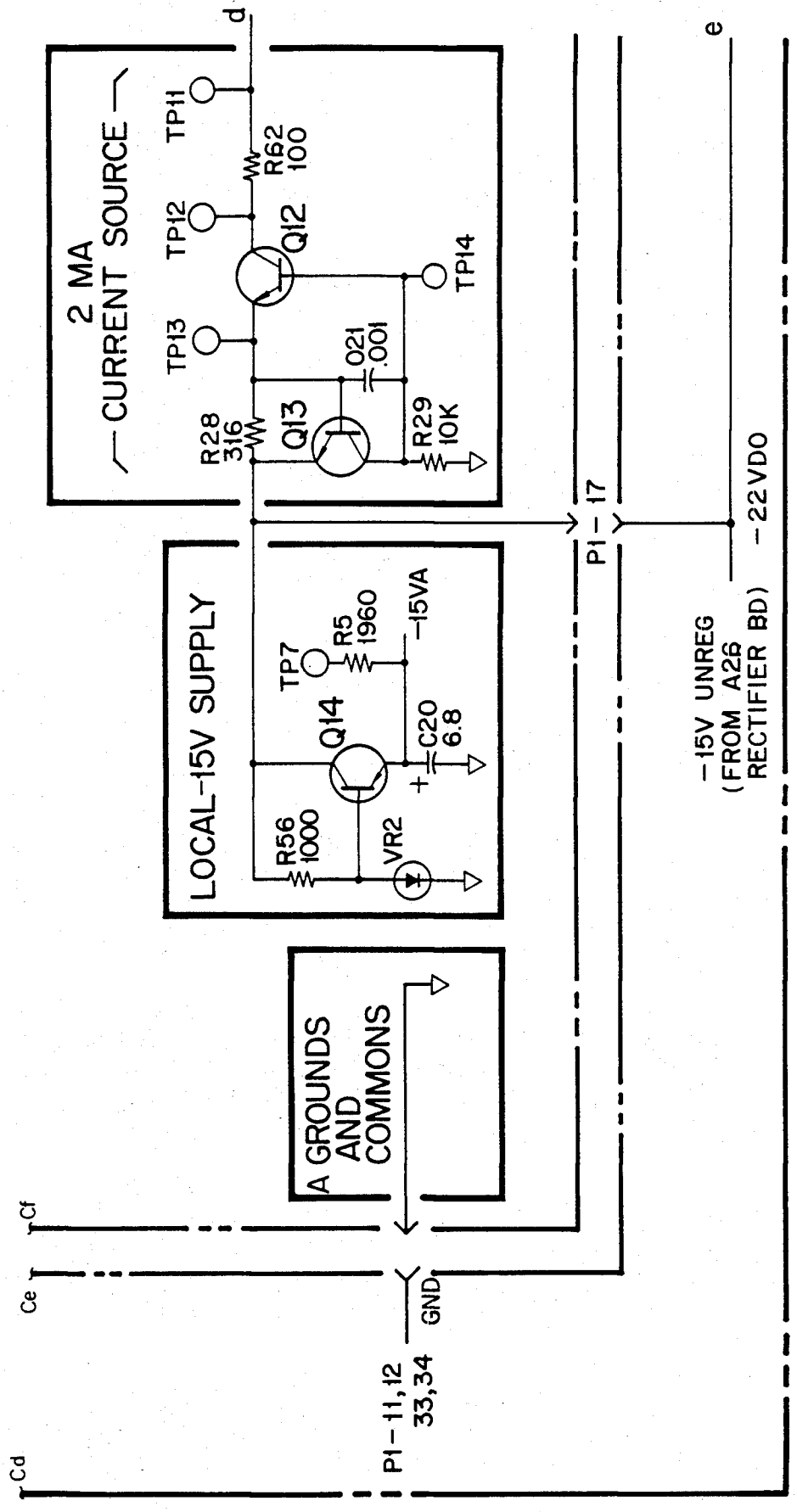

2 MA
CURRENT SOURCE
TP11
TP12
TP13
TP14
R62
100
Q12
Q13
R28
316
C21
.001
R29
10K
d
e
LOCAL -15V SUPPLY
TP7
R5
1960
-15VA
Q14
C20
6.8
R56
1000
VR2
A GROUNDS
AND
COMMONS
P1 - 17
-15V UNREG
(FROM A26
RECTIFIER BD)
-22 VDC
Cf
Ce
Cd
P1 - 11, 12
33, 34
GND

FIG 27.30C

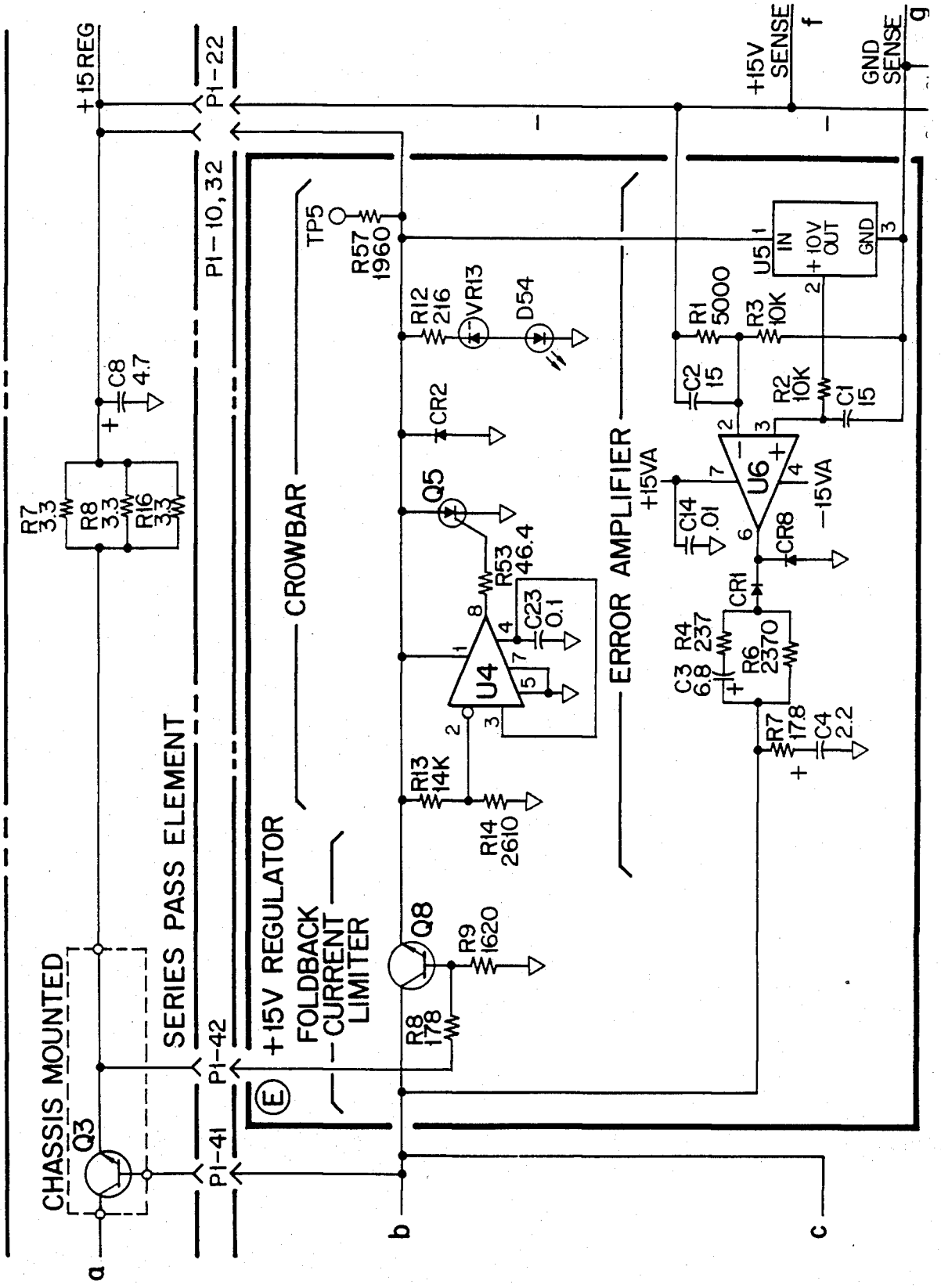

+15 REG
P1-22
P1-10, 32
P1-42
P1-41
+15V SENSE
GND SENSE
f
g
a
b
c
CHASSIS MOUNTED
SERIES PASS ELEMENT
+15V REGULATOR
FOLDBACK CURRENT LIMITER
CROWBAR
ERROR AMPLIFIER
Q3
Q5
Q8
U4
U5
U6
TP5
R57 1960
R12 216
VR13
D54
CR2
R7 3.3
R8 3.3
R16 3.3
C8 4.7
R53 46.4
C23 0.1
R13 14K
R14 2610
R9 1620
R8 178
R1 5000
R3 10K
R2 10K
C2 15
C1 15
C14 .01
CR8
CR1
R4 237
R6 2370
C3 6.8
R7 178
C4 2.2
+15VA
-15VA
IN
+10V OUT
GND

FIG 27.31A

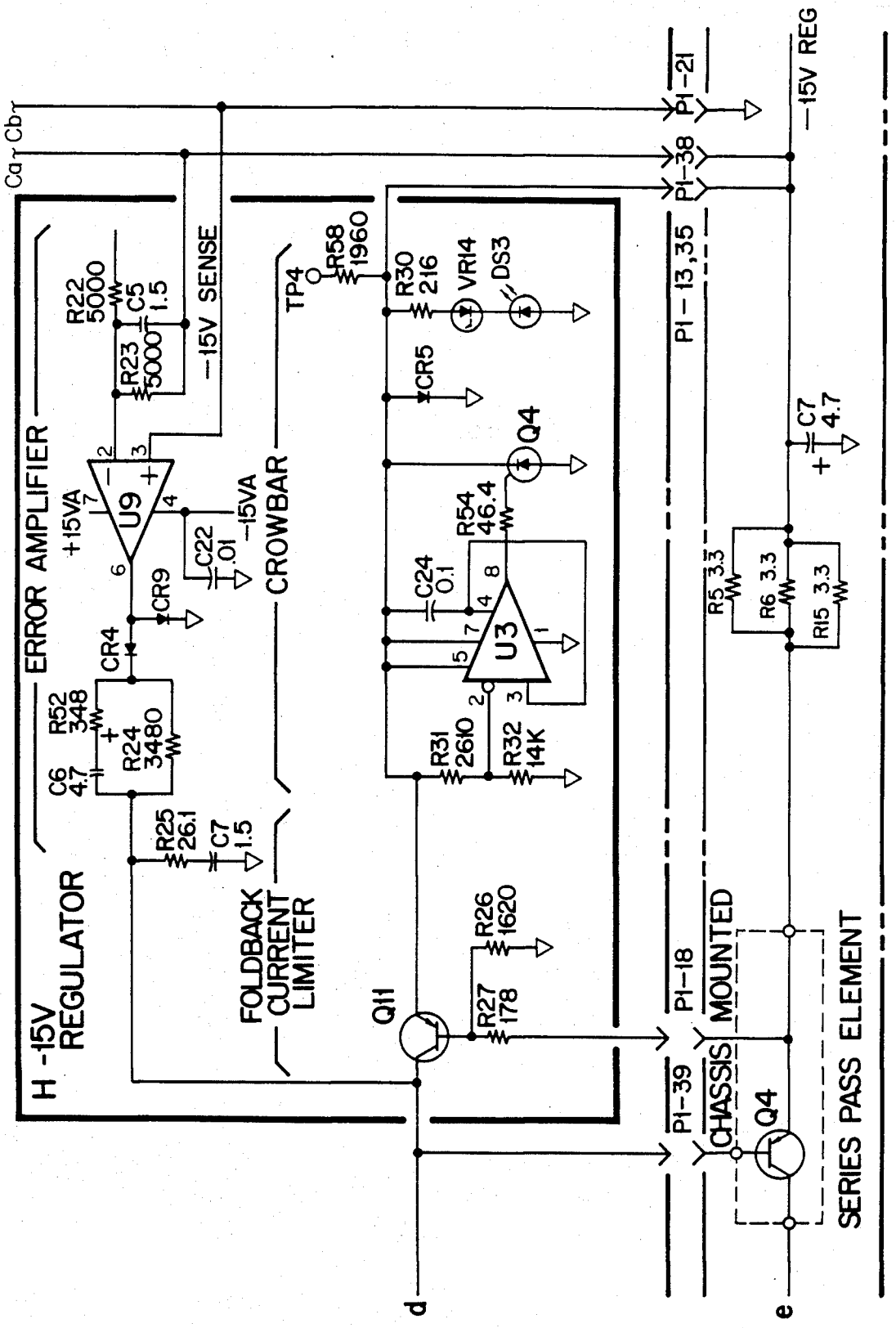

H -15V REGULATOR
ERROR AMPLIFIER
FOLDBACK CURRENT LIMITER
CROWBAR
SERIES PASS ELEMENT
MOUNTED
CHASSIS
-15V SENSE
-15V REG
+15VA
-15VA
U9
U3
Q4
Q11
VR14
DS3
CR4
CR5
CR9
TP4
R22 5000
R23 5000
C5 1.5
R24 3480
R25 26.1
R26 1620
R27 178
R30 216
R31 2610
R32 14K
R52 348
R54 46.4
R58 1960
C6 4.7
C7 1.5
C22 .01
C24 0.1
C7 4.7
R5 3.3
R6 3.3
R15 3.3
P1-21
P1-38
P1-13,35
P1-18
P1-39
Ca
Cb
d
e

FIG 27.31B

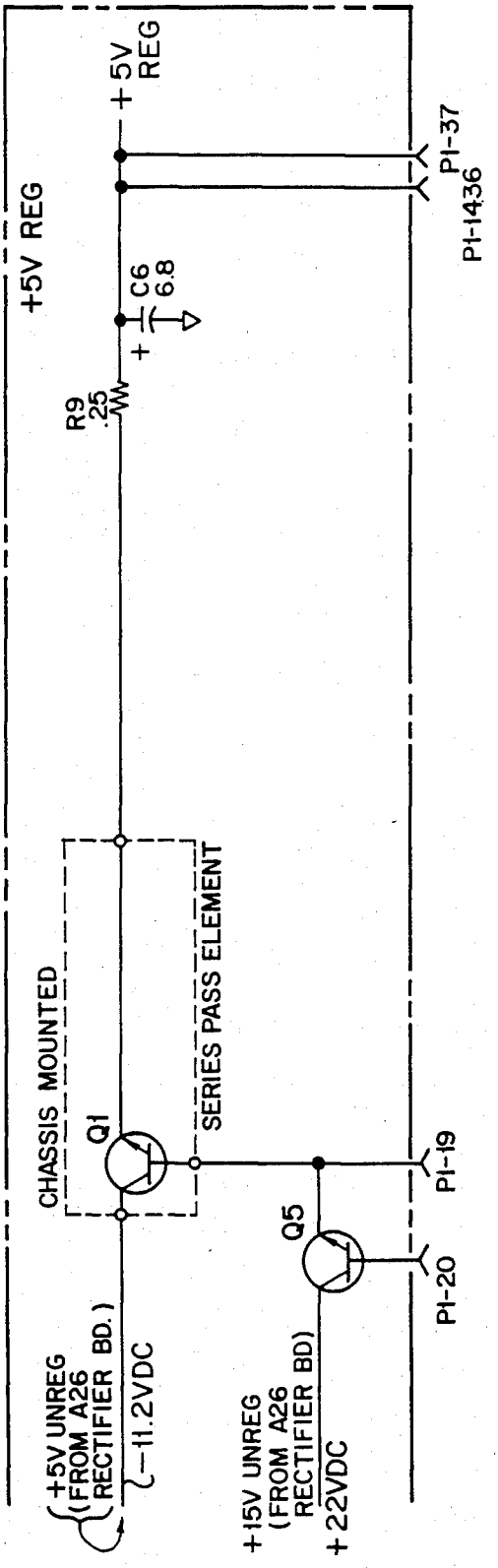

+5V REG
+5V REG
P1-37
P1-1436
C6
6.8
R9
.25
CHASSIS MOUNTED
SERIES PASS ELEMENT
Q1
Q5
P1-19
P1-20
+5V UNREG
(FROM A26
RECTIFIER BD.)
11.2VDC
+15V UNREG
(FROM A26
RECTIFIER BD)
+22VDC

FIG 27.32A

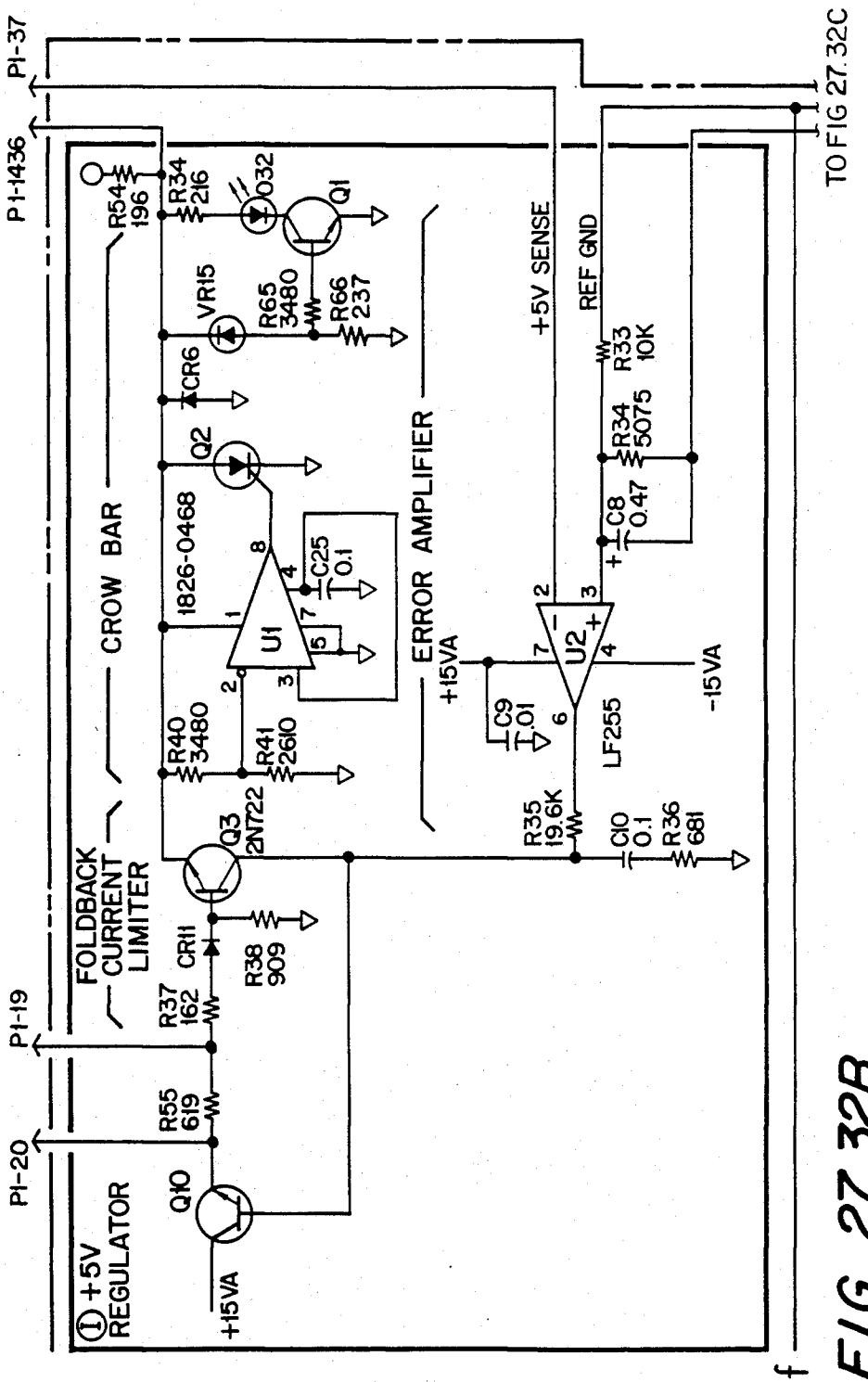

P1-37
P1-1436
P1-19
P1-20
TO FIG 27.32C
R54 196
R34 216
D32
Q1
VR15
R65 3480
R66 237
CR6
Q2
1826-0468
U1
C25 0.1
R40 3480
R41 2610
Q3 2N722
CR11
R38 909
R37 162
R55 619
Q10
+15VA
+5V REGULATOR
FOLDBACK CURRENT LIMITER
CROW BAR
ERROR AMPLIFIER
+5V SENSE
REF GND
R33 10K
R34 5075
C8 0.47
U2
LF255
C9 .01
R35 19.6K
C10 0.1
R36 681
-15VA

FIG 27.32B

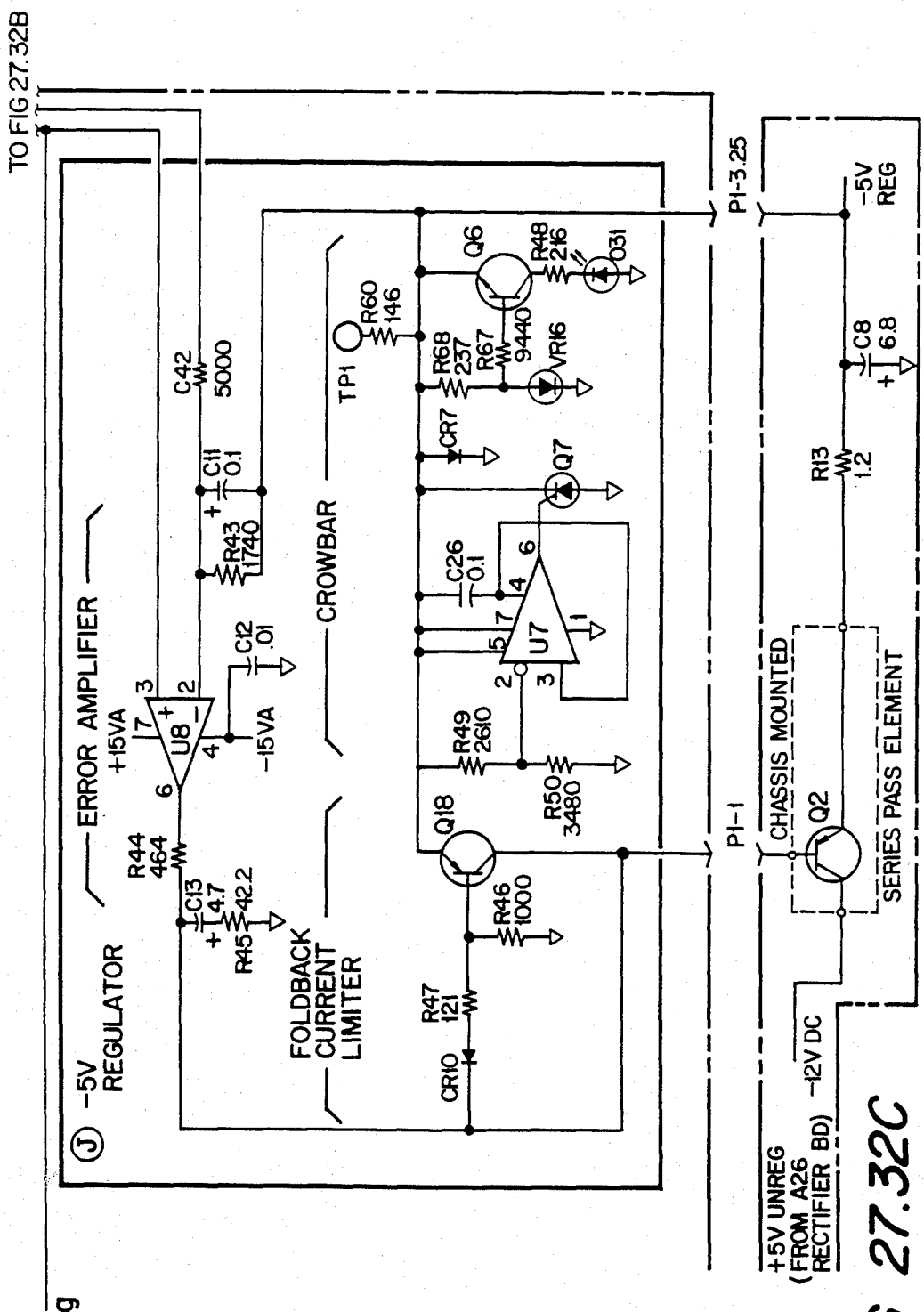

TO FIG 27.32B
-5V REGULATOR
ERROR AMPLIFIER
+15VA
-15VA
U8
R44 464
C13 4.7
R45 42.2
C42 5000
C11 0.1
R43 1740
C12 .01
FOLDBACK CURRENT LIMITER
CROWBAR
TP1
R60 146
R68 237
R67 9440
VR16
Q6
R48 216
CR7
Q7
C26 0.1
U7
R49 2610
R50 3480
Q18
R46 1000
R47 121
CR10
P1-3.25
P1-1
CHASSIS MOUNTED
Q2
SERIES PASS ELEMENT
R13 1.2
C8 6.8
-5V REG
+5V UNREG (FROM A26 RECTIFIER BD)
-12V DC

FIG 27.32C

A17

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 23	PLSTSTX TEMP	A16 A25	
2 24	PLSTSTY +10 VR	A16 A18	
3 25	PLSREFX LHOLD	A16 A19	
4 26	PLSREFY NOT USED	A16	
5 27	LLOST LIFSRQ	ADR BUS A24	NOT USED
6 28	CLK LRDS	A6 A24	NOT USED
7 29	LADCSRQ ABO	A24 ADR BUS	NOT USED
8 30	AB1 AB2	ADR BUS ADR BUS	
9 31	AB3 AB4	ADR BUS ADR BUS	
10 32	+15V REG +15V REG	PWR BUS	
11 33	GND		
12 34	GND		
13 35	-15V REG -15V REG	PWR BUS	
14 36	+ 5V REG + 5V REG	PWR BUS	
15 37	DBO DB1	DATA BUS DATA BUS	
15 38	DB2 DB3	DATA BUS DATA BUS	
17 39	DB4 DB5	DATA BUS DATA BUS	
18 40	DB6 DB7	DATA BUS DATA BUS	
19 41	DB8 DB9	DATA BUS DATA BUS	
20 42	DB10 DB11	DATA BUS DATA BUS	
21 43	SEL1 SEL2	A19 A19	
22 44	NOT USED NOT USED		

A17 SAMPLE AND HOLD
85102-60017

P1-15(IN) DBO
P1-37(IN) DB1
P1-16(IN) DB2
P1-38(IN) DB3
P1-17(IN) DB4
P1-39(IN) DB5
P1-18(IN) DB6
P1-40(IN) DB7
P1-19(IN) DB8
P1-41(IN) DB9
P1-20(IN) DB10
P1-42(IN) DB11
12
a
12
b
c

I POWER SUPPLIES

P1-10,32(IN)
+15V REG
L2
15
+15VF
C6 0.1
C9 5μF
C15-20 0.1
CR7
R11 1
R1 1.62K
+5VPU
L1
15
+5VF
P1-14,36(IN)
+5V REG
C5 0.1
C8 20
C13,19 0.1
P1-11,12,
33,34(IN)
GND
TP8
P1-13,35(IN)
-15V REG
13
15
-15VF
C7 0.1
C10 5μF
C21-26 0.1
CR8
R12 1

FIG 2734

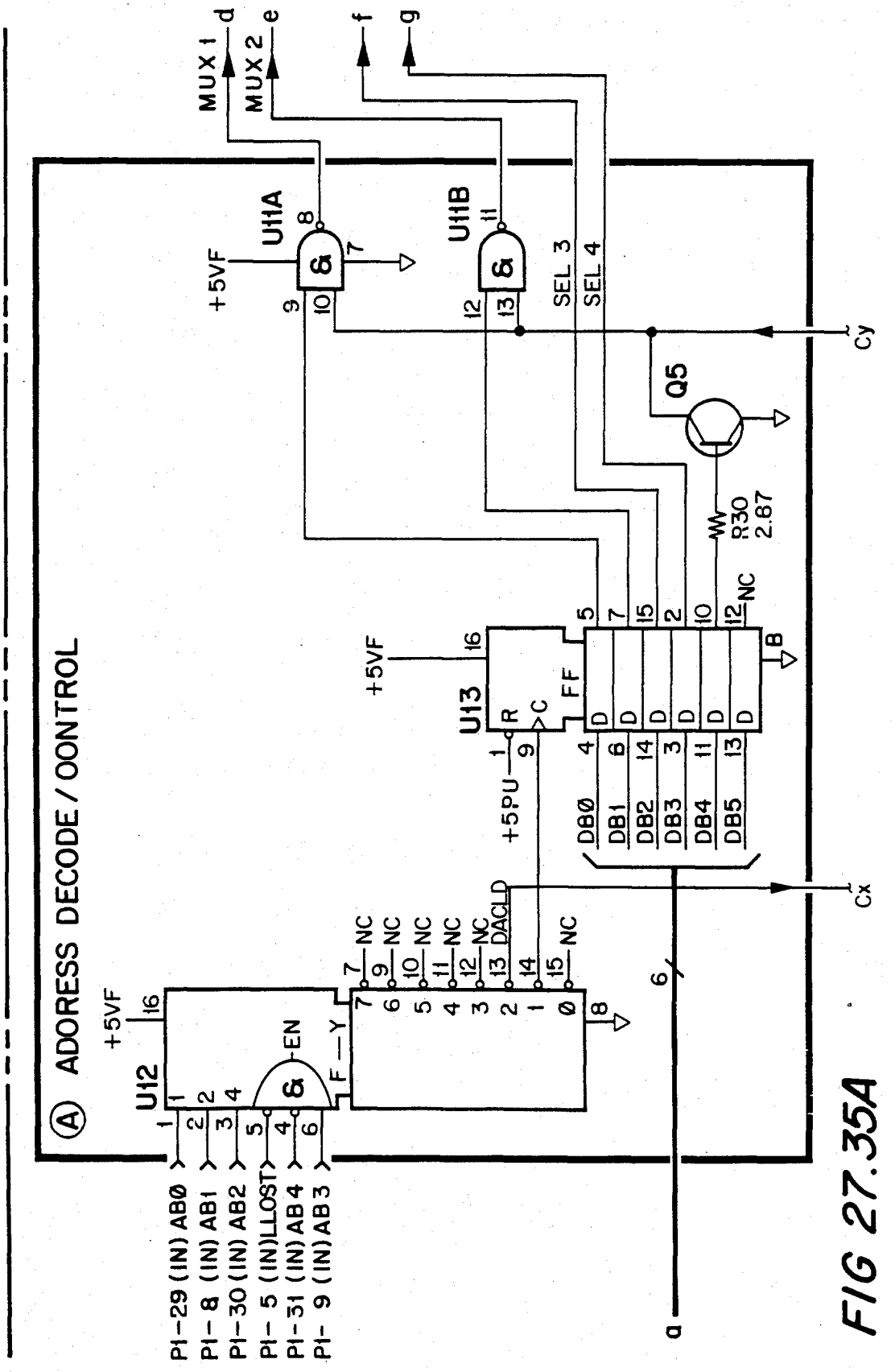

MUX 1 d
MUX 2 e
f
g
U11A
U11B
+5VF
SEL 3
SEL 4
Cy
Q5
R30
2.87
NC
B
U13
FF
+5PU
DB0
DB1
DB2
DB3
DB4
DB5
Cx
DACLD
U12
EN
F — Y
P1-29 (IN) AB0
P1- 8 (IN) AB1
P1-30 (IN) AB2
P1- 5 (IN) LLOST
P1-31 (IN) AB4
P1- 9 (IN) AB3
ADORESS DECODE / OONTROL

FIG 27.35A

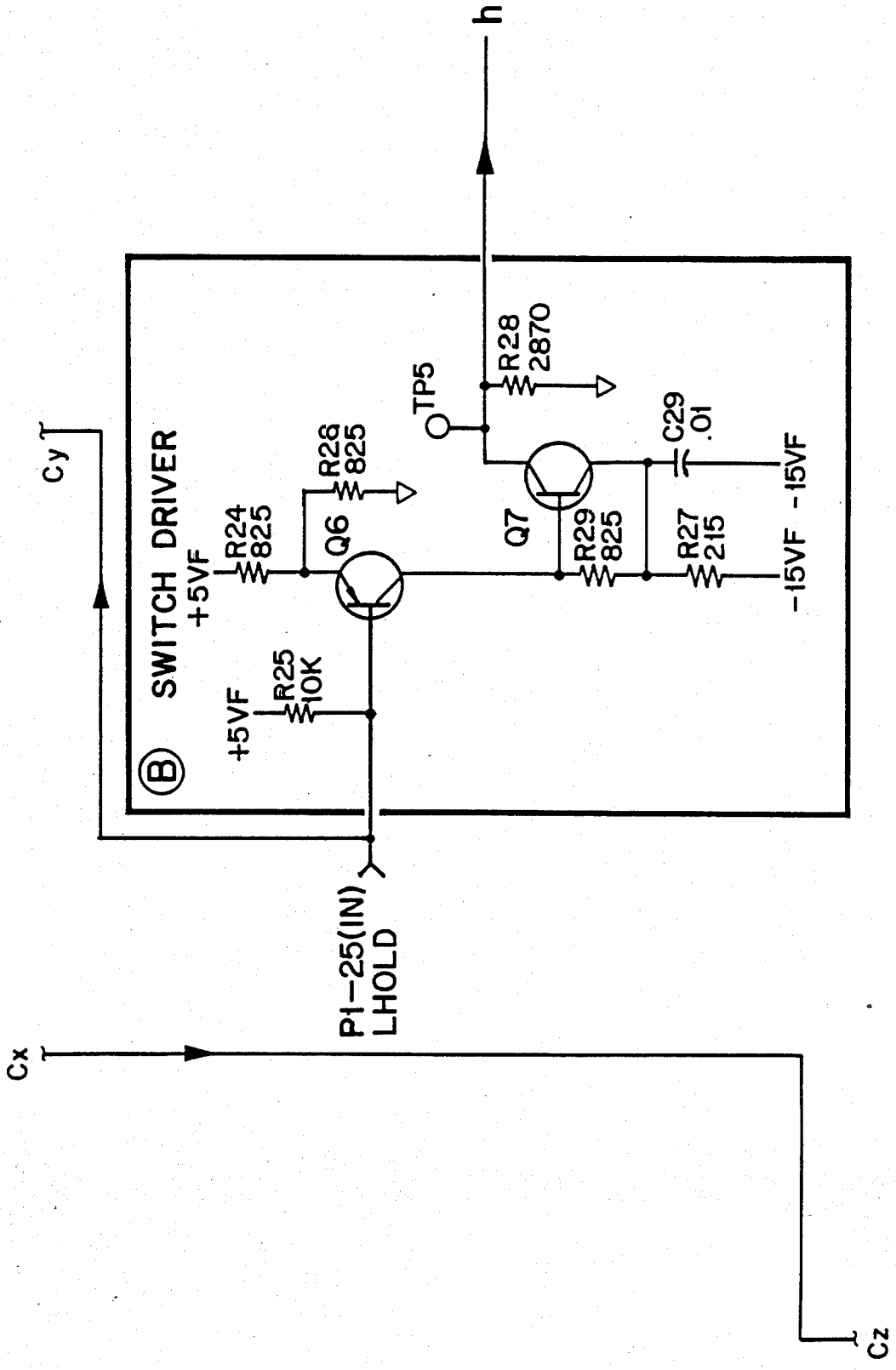

h
R28
2870
TP5
C29
.01
-15VF
Cy
R26
825
Q7
R29
825
R27
215
-15VF
R24
825
Q6
+5VF
SWITCH DRIVER
B
R25
10K
+5VF
P1-25(IN)
LHOLD
Cx
Cz

FIG 27.35B

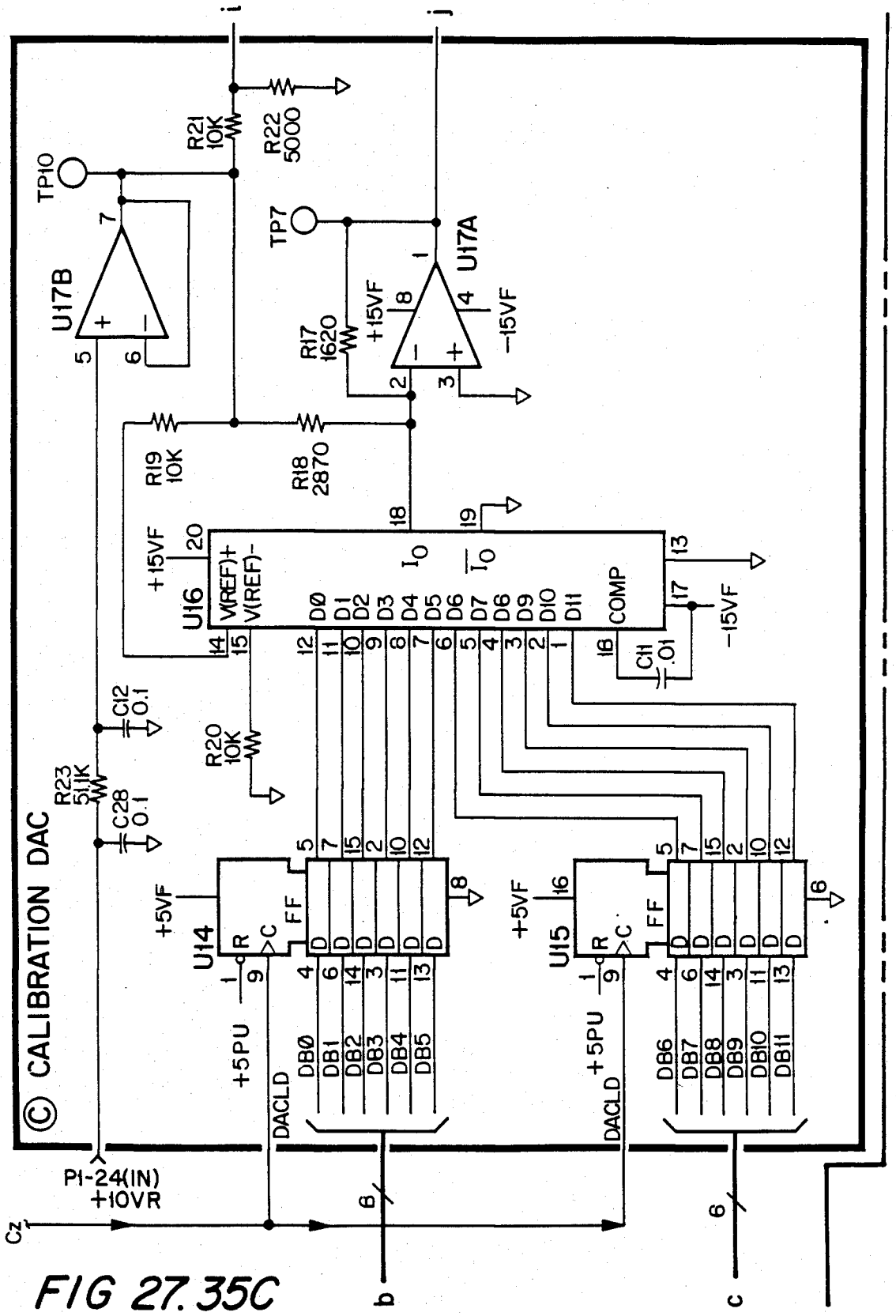

© CALIBRATION DAC
P1-24(IN)
+10VR
Cz
TP10
TP7
R21
10K
R22
5000
U17B
U17A
R17
1620
+15VF
-15VF
R19
10K
R18
2870
U16
V(REF)+
V(REF)-
COMP
C11
.01
C12
0.1
R20
10K
R23
5.1K
C28
0.1
U14
U15
FF
+5VF
+5PU
DACLD
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
DB8
DB9
DB10
DB11
b
c

FIG 27.35C

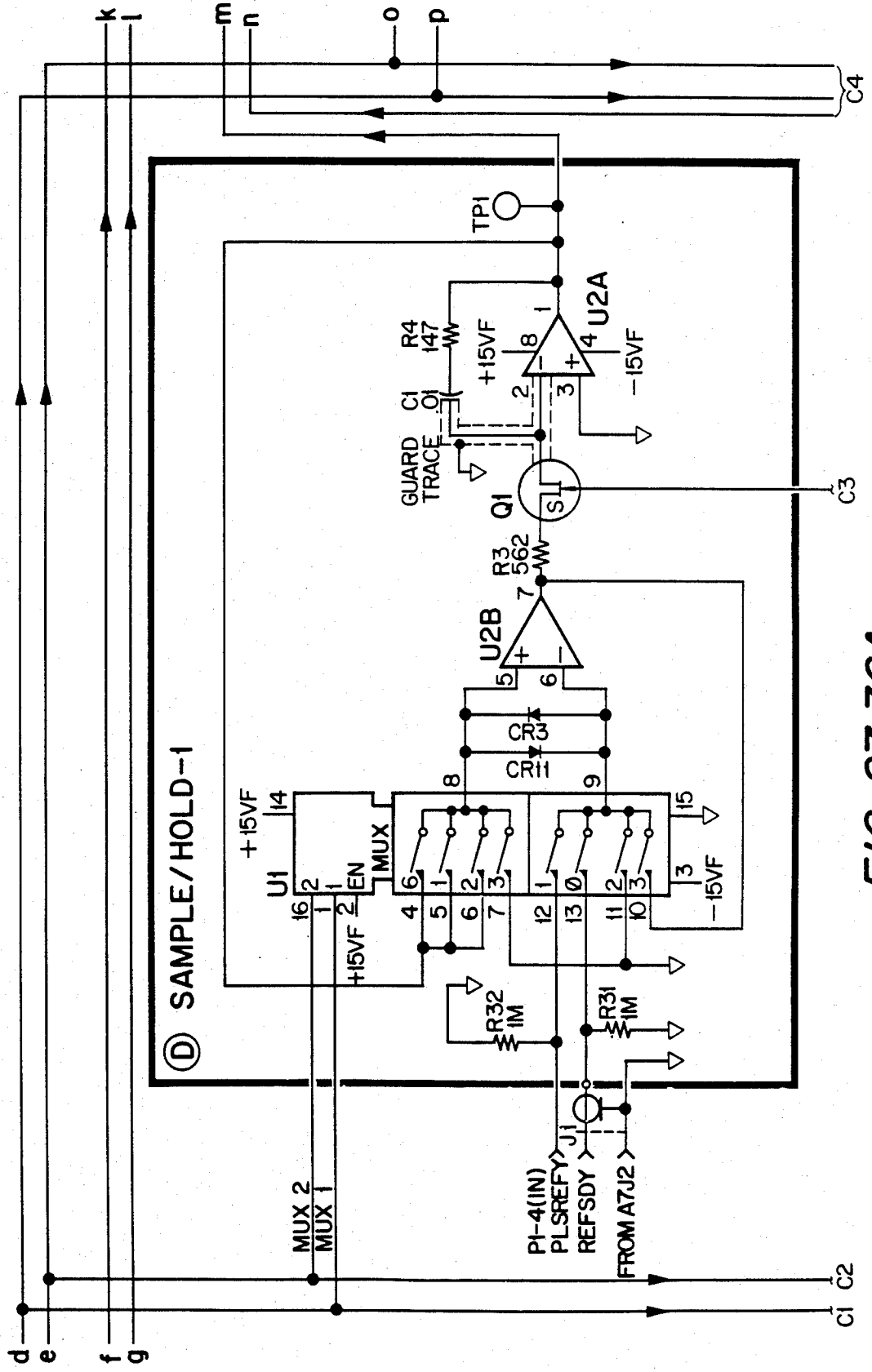

D SAMPLE/HOLD-1
TP1
U2A
U2B
R4 147
R3 562
C1
Q1
GUARD TRACE
+15VF
-15VF
CR3
CR11
U1
MUX
EN
R32 1M
R31 1M
J1
P1-4(IN) PLSREFY
REFSDY
FROM A7J2
MUX 2
MUX 1
C1
C2
C3
C4

FIG 27.36A

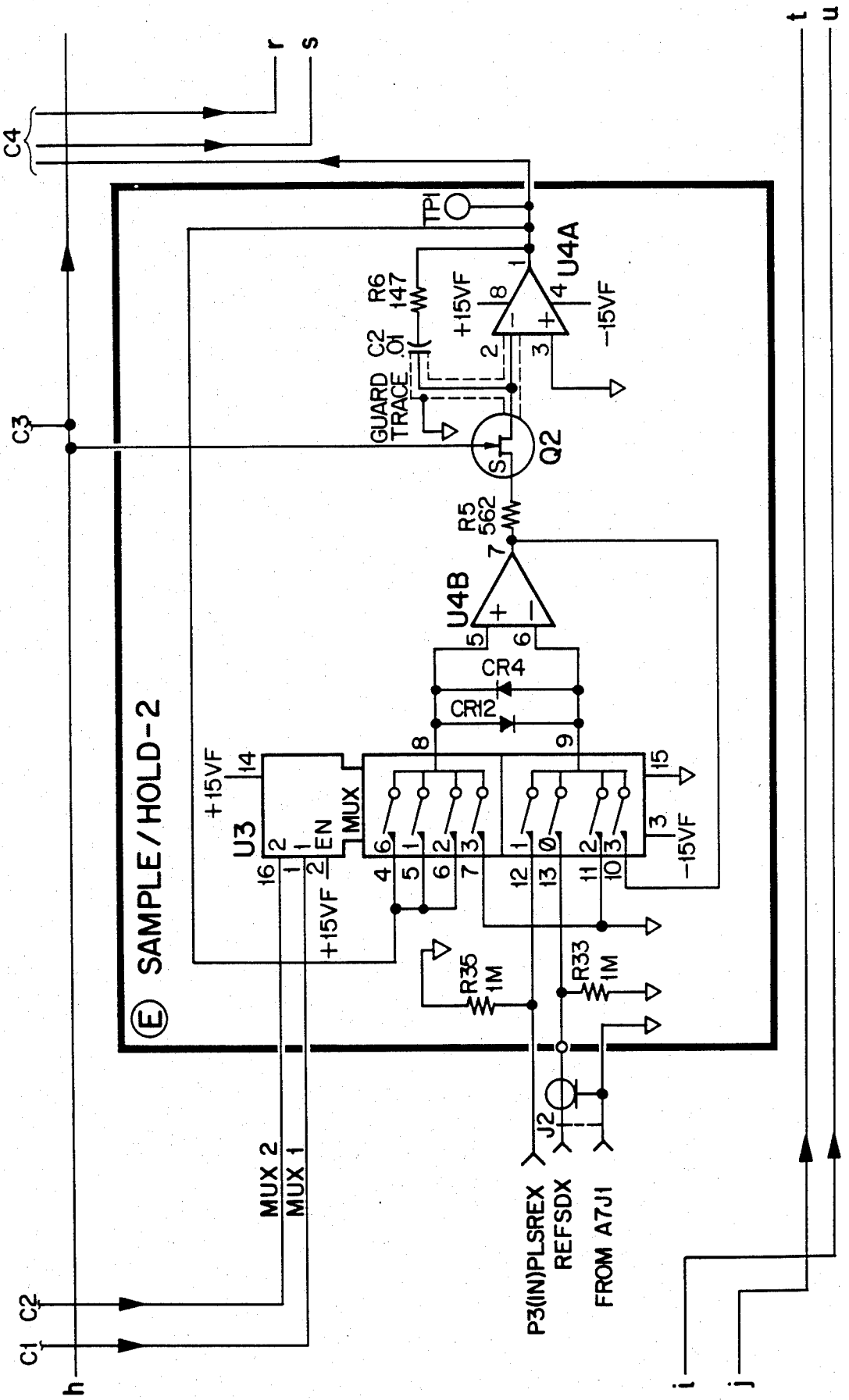

SAMPLE/HOLD-2
U3
MUX
EN
+15VF
-15VF
U4A
U4B
R6 147
R5 562
C2 .01
GUARD TRACE
Q2
TP1
CR4
CR12
R35 1M
R33 1M
J2
MUX 2
MUX 1
P3(IN)PLSREX
REFSDX
FROM A7J1
C1
C2
C3
C4
h
i
j
r
s
t
u

FIG 27.36B

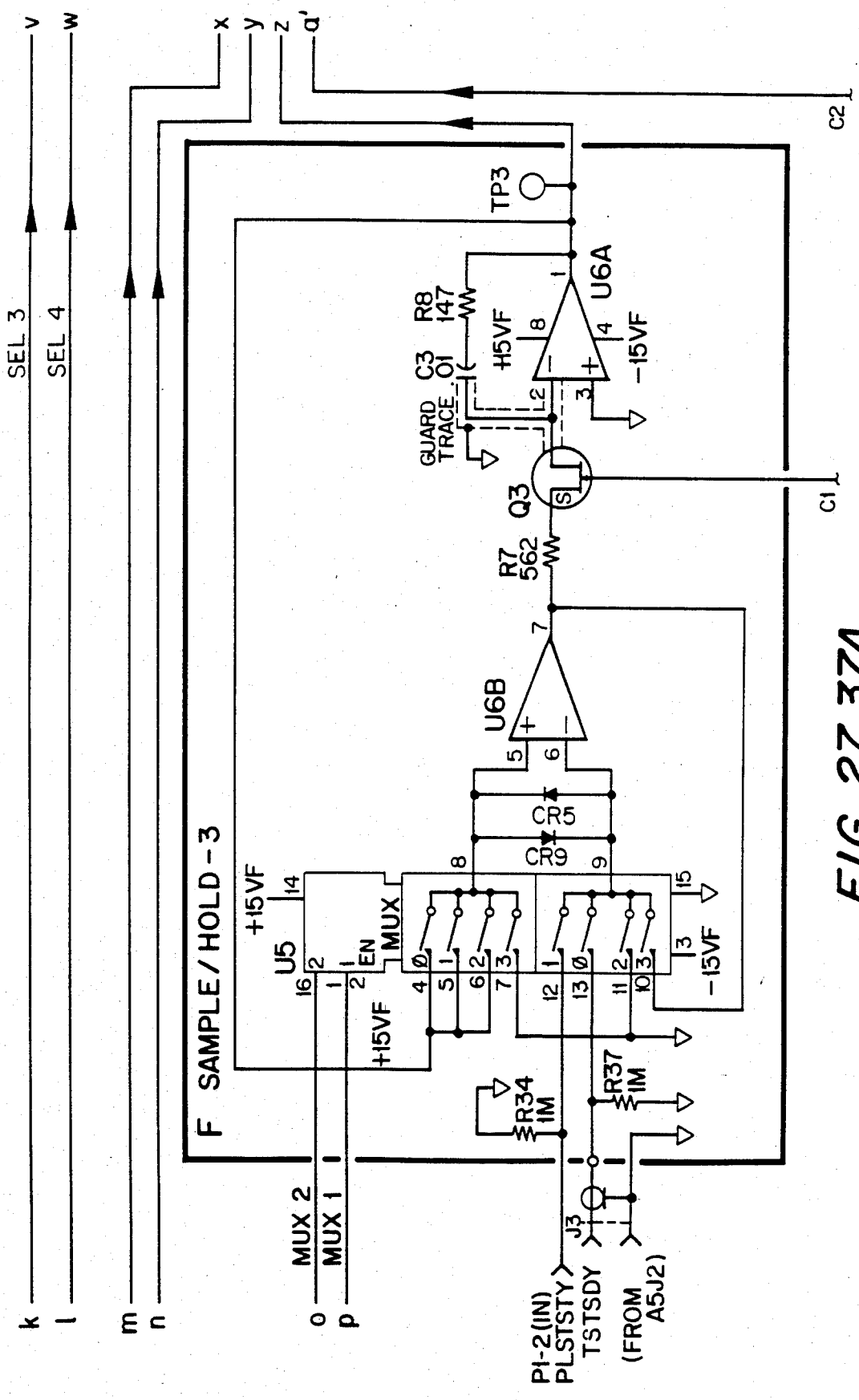

SEL 3
SEL 4
k
l
m
n
o
p
v
w
x
y
z
q'
C2
C1
TP3
U6A
R8
147
C3
01
+15VF
-15VF
GUARD TRACE
L2
Q3
R7
562
U6B
CR5
CR9
F SAMPLE/HOLD-3
U5
MUX
EN
MUX 2
MUX 1
R34
1M
R37
1M
J3
P1-2(IN)
PLSTSTY
TSTSDY
(FROM A5J2)

FIG 27.37A

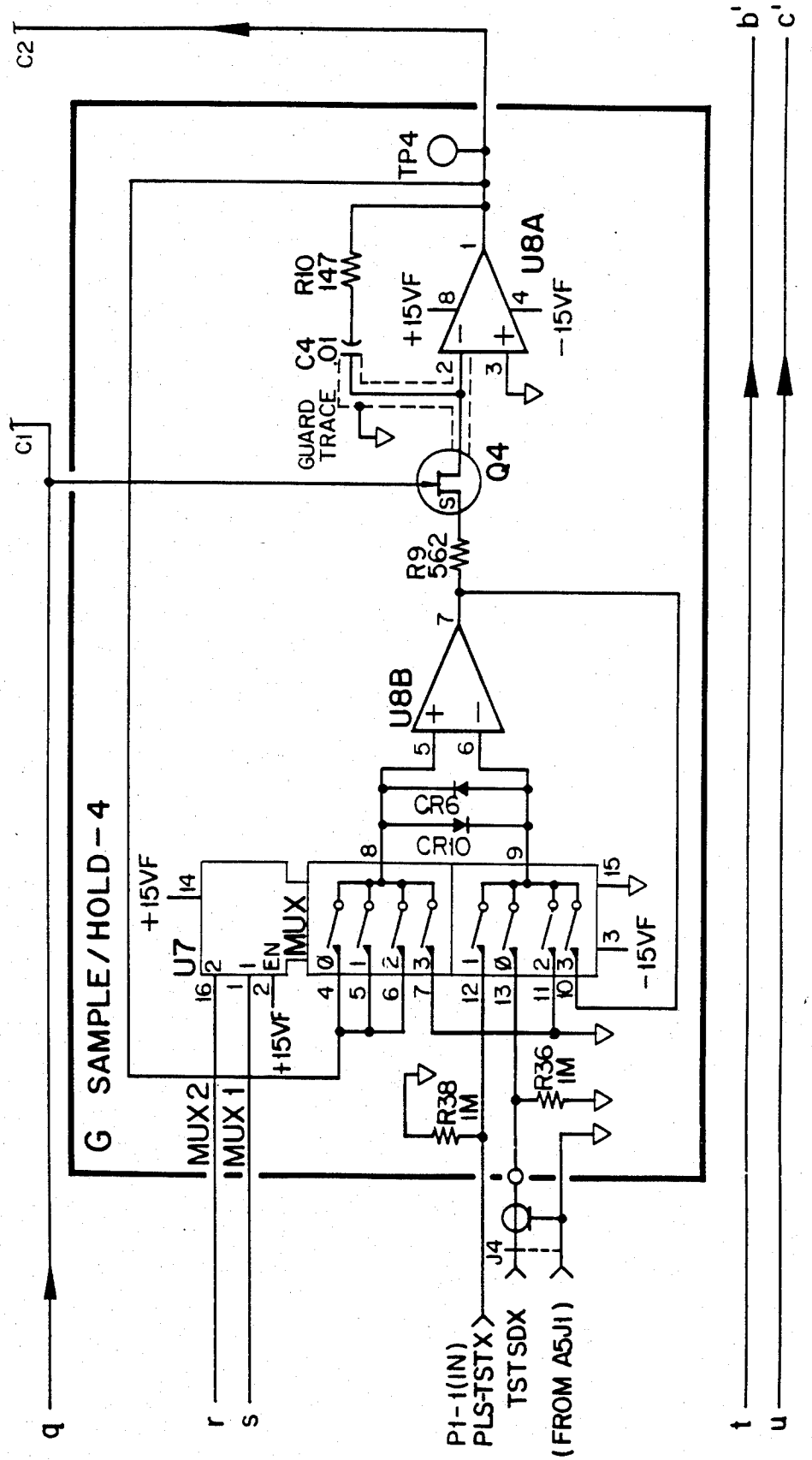

C2
C1
TP4
R10
147
C4
.01
+15VF
U8A
-15VF
GUARD
TRACE
Q4
R9
562
U8B
CR6
CR10
G SAMPLE/HOLD-4
U7
MUX
EN
MUX2
MUX1
R38
1M
R36
1M
J4
P1-1(IN)
PLS-TSTX
TST SDX
(FROM A5J1)
q
r
s
t
u
b'
c'

FIG 27.37B

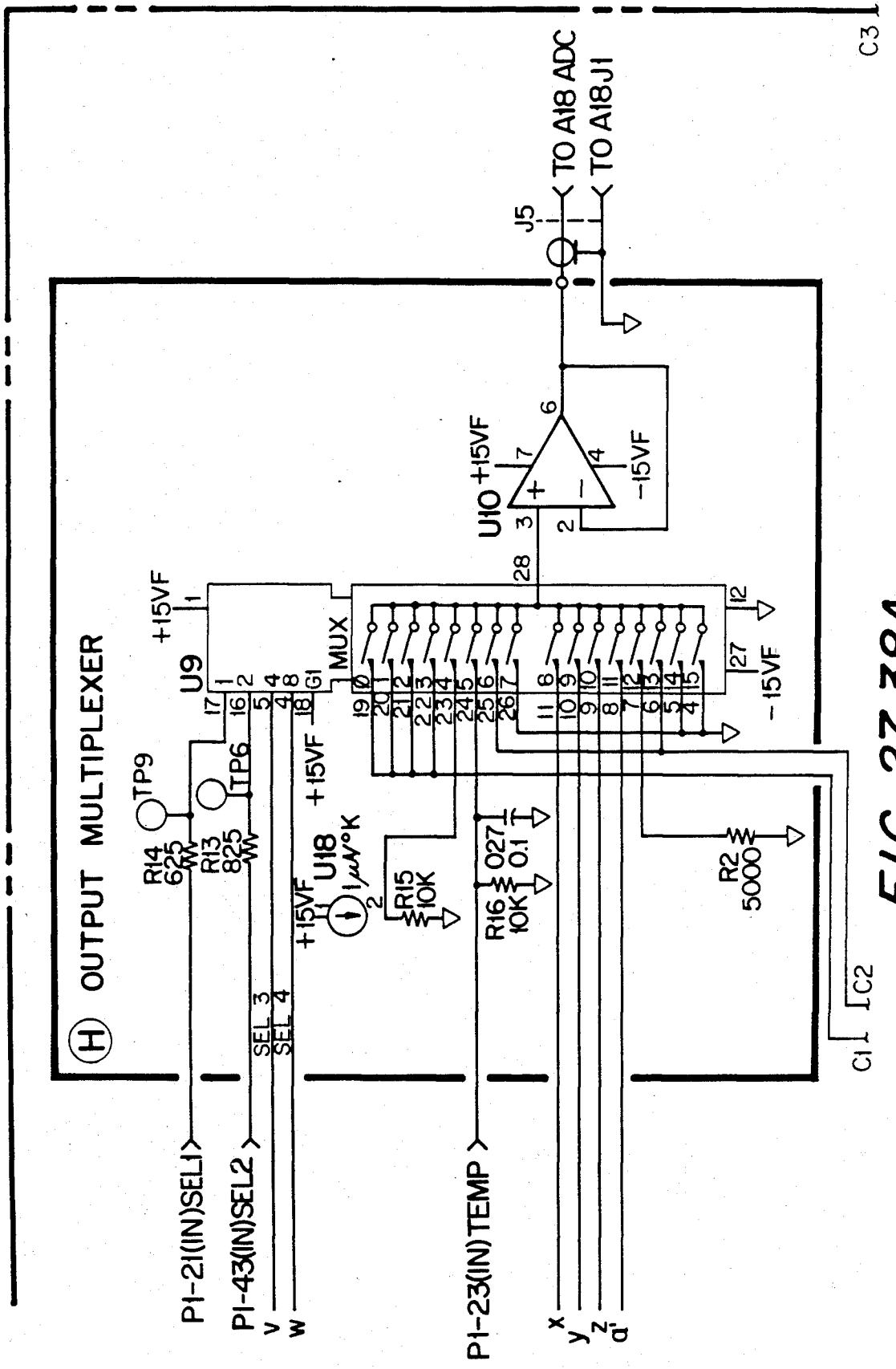
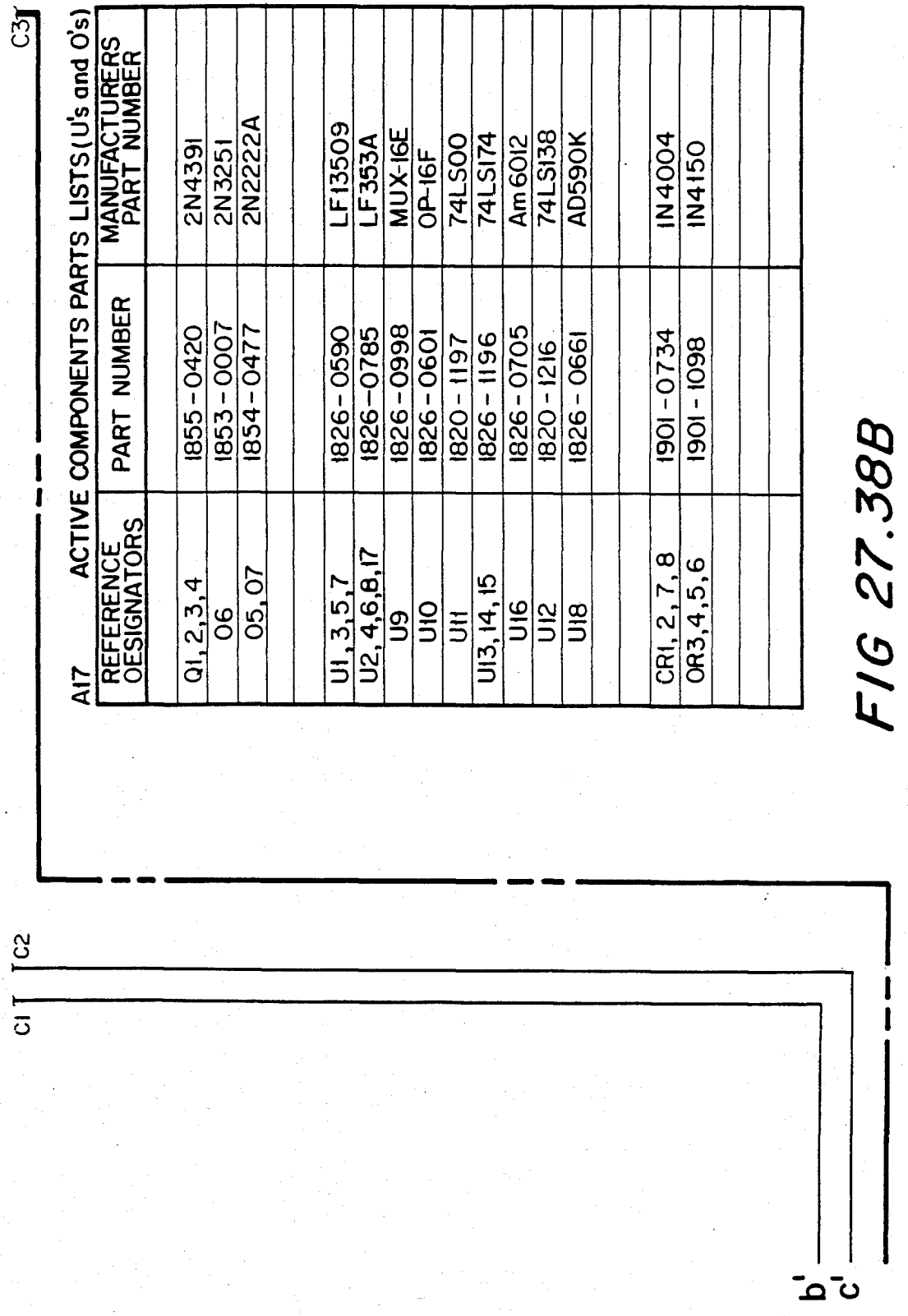

C3
TO A18 ADC
TO A18 J1
J5
U10
+15VF
-15VF
U9
MUX
OUTPUT MULTIPLEXER
TP9
TP6
R14 625
R13 825
U18
R15 10K
R16 10K
.027 0.1
R2 5000
SEL 3
SEL 4
P1-21(IN)SEL1
P1-43(IN)SEL2
P1-23(IN)TEMP
V
W
X
Y
Z
C1
C2

FIG 27.38A



A17 ACTIVE COMPONENTS PARTS LISTS (U's and O's)

REFERENCE OESIGNATORS	PART NUMBER	MANUFACTURERS PART NUMBER
Q1,2,3,4	1855-0420	2N4391
06	1853-0007	2N3251
05,07	1854-0477	2N2222A
U1,3,5,7	1826-0590	LF13509
U2,4,6,8,17	1826-0785	LF353A
U9	1826-0998	MUX-16E
U10	1826-0601	OP-16F
U11	1820-1197	74LS00
U13,14,15	1826-1196	74LS174
U16	1826-0705	Am6012
U12	1820-1216	74LS138
U18	1826-0661	AD590K
CR1,2,7,8	1901-0734	IN4004
OR3,4,5,6	1901-1098	IN4150

FIG 27.38B

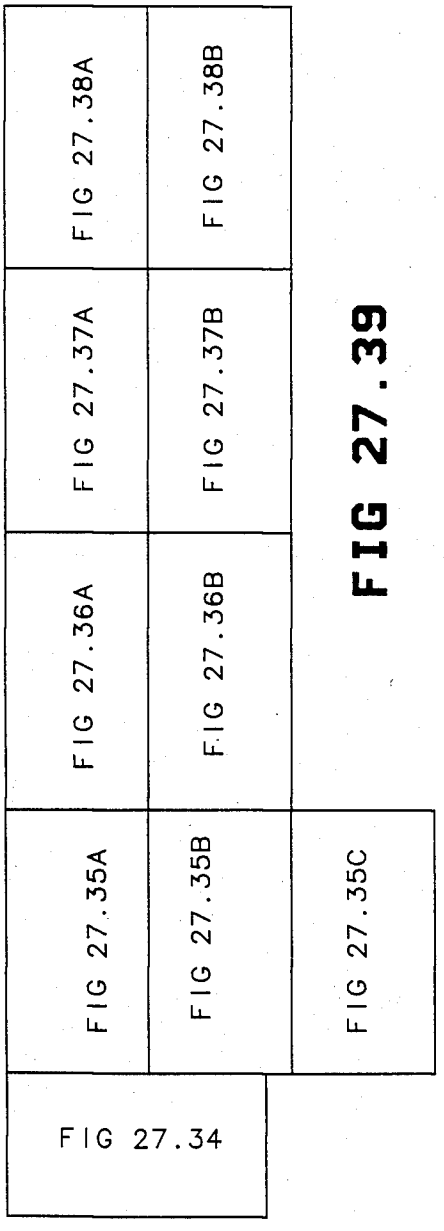


FIG 27.39

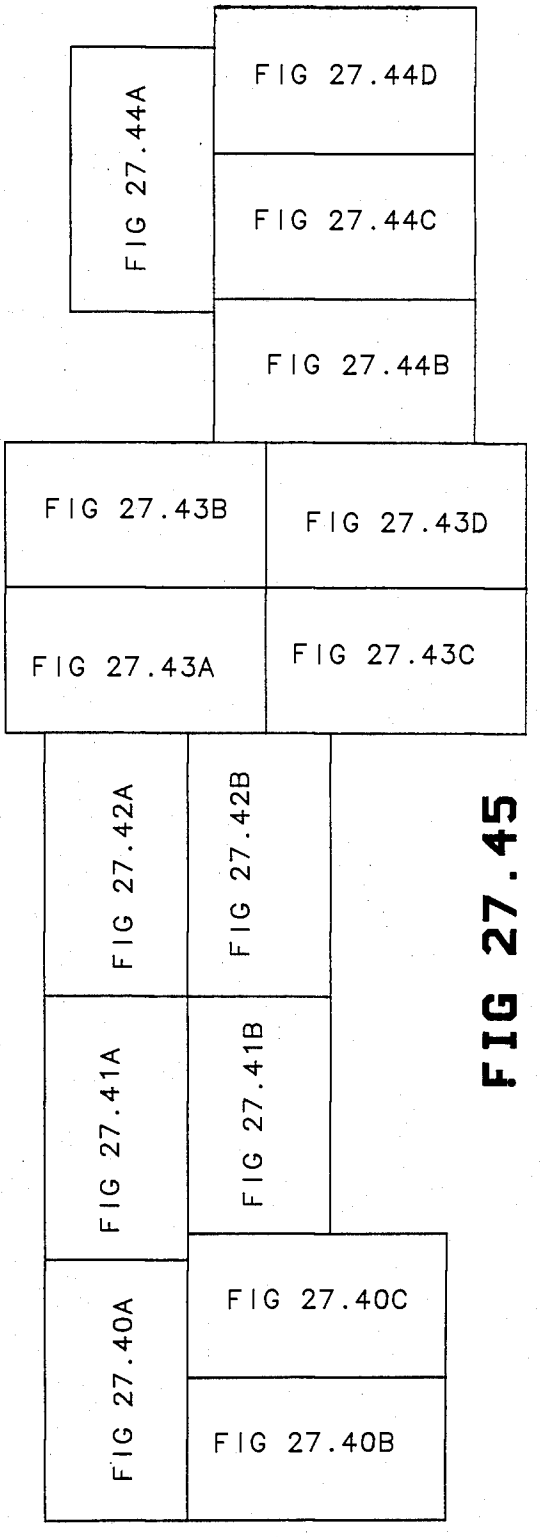


FIG 27.45

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 23			
2 24	+10VR	A17	G
3 25	L HOLD H START 2	A19 A19	NOT USEO B E
4 26	L START 1	A 19	B
5 27	L LOST LIFSRQ	ADR BUS A24	A NOT USED
6 28	CLK LRDS	A 6 A 24	B NOT USED
7 29	LADCSRQ AB Ø	A 24 ADR BUS	F A F

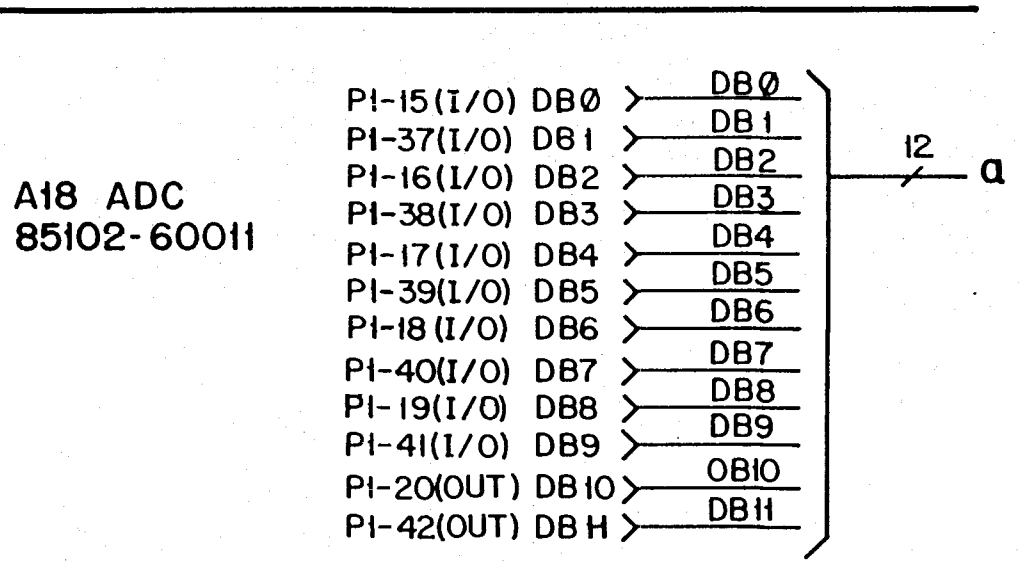


FIG 27.40A

8 30	AB 1 AB 2	ADR BUS " "	A A F
9 31	AB 3 AB 4	" " " "	A A
10 32	+15V REG	POWER BUS	G
11 33	GND		G
12 34	GND		G
13 35	-15V REG	POWER BUS	G
14 36	+5V REG	"	G
15 37	DB Ø DB 1	DATA BUS	F F
16 38	DB 2 DB 3	"	B F B F
17 39	DB 4 DB 5	"	B F B F
18 40	DB 6 DB 7	"	B F B F
19 41	DB 8 DB 9	"	F B F B
20 42	DB10 DB11	"	F F
21 43	SEL 1 SEL 2	A19 A19	F F
22 44			

FIG 27.40B

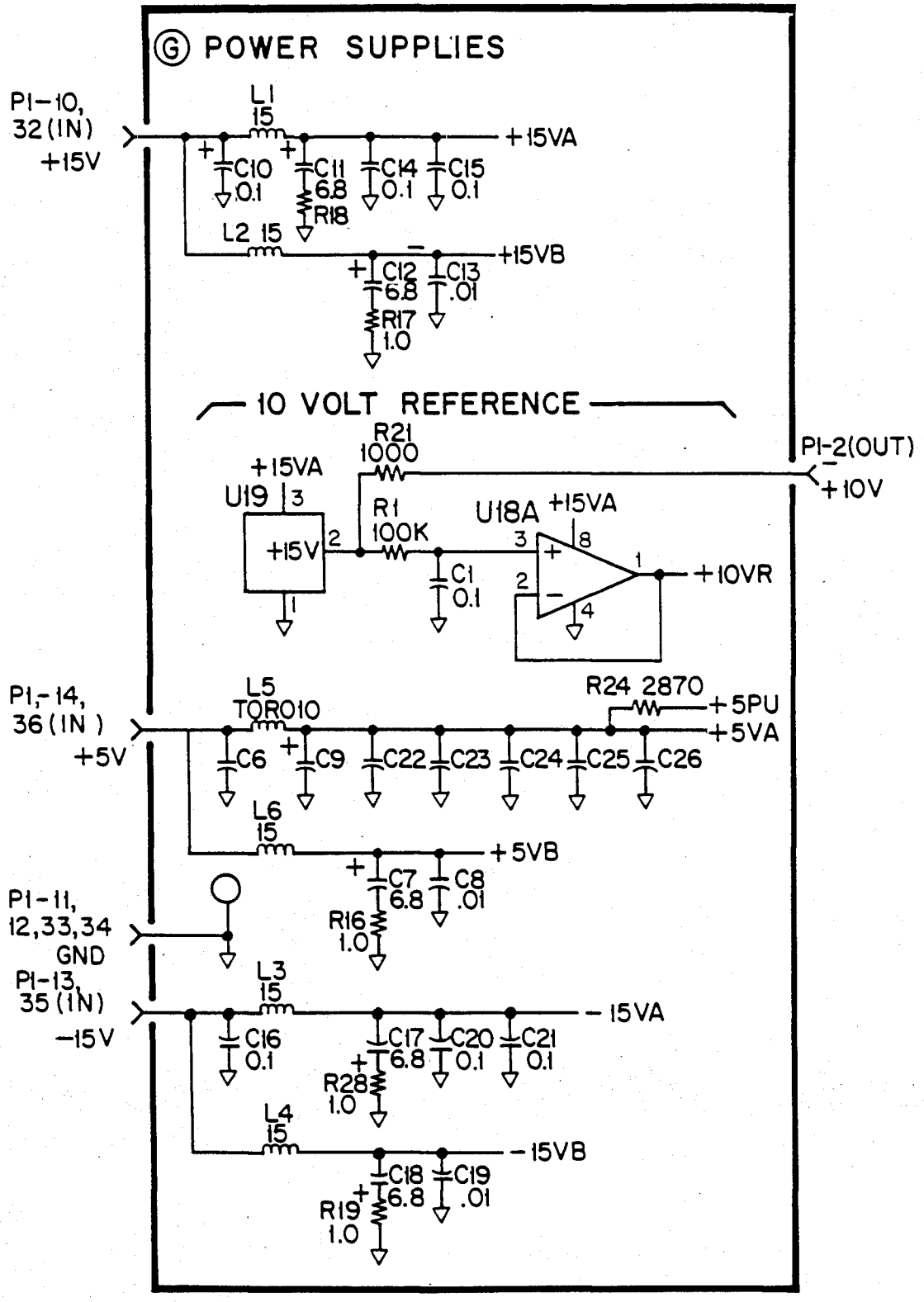
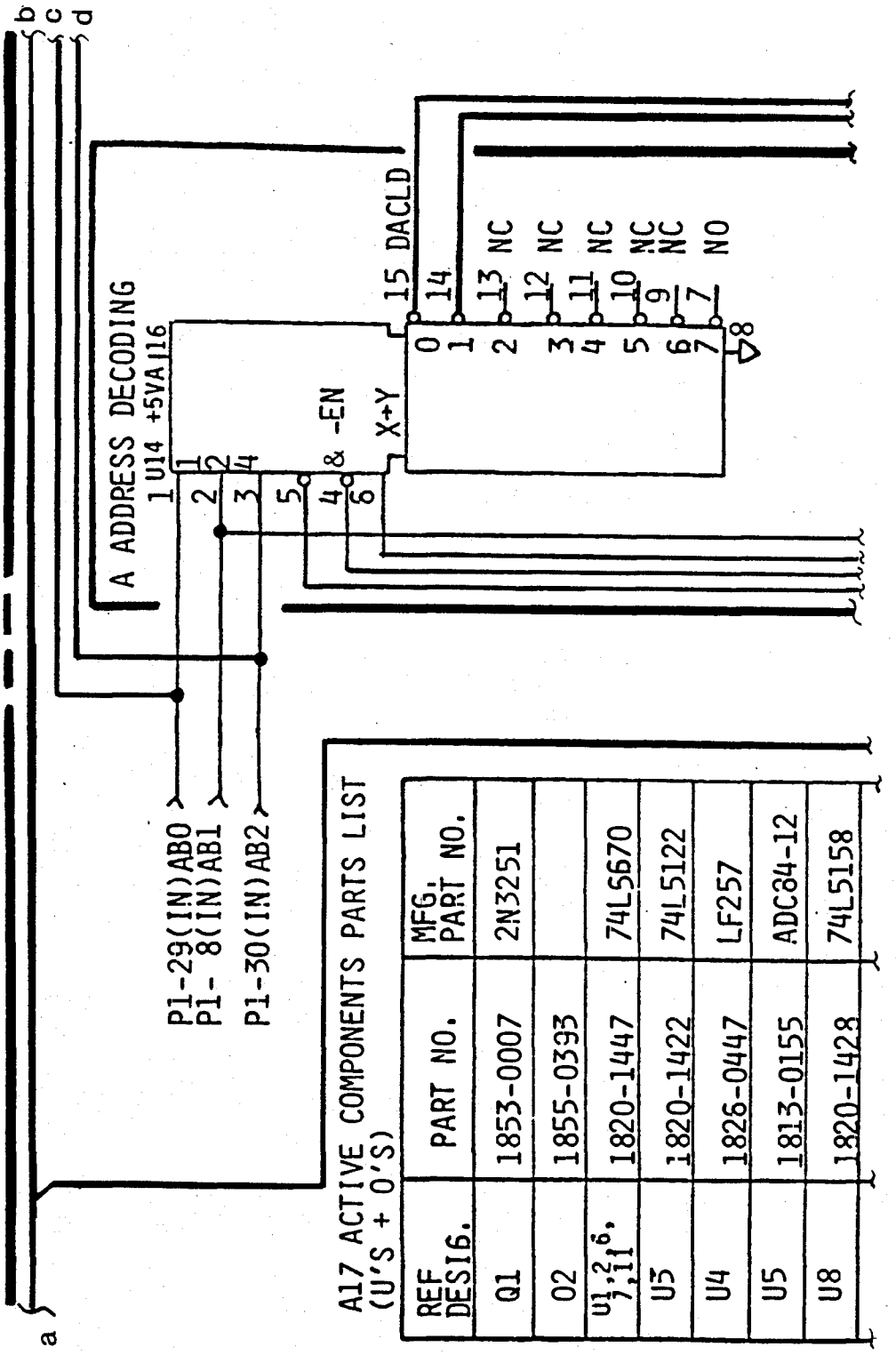

G POWER SUPPLIES
P1-10, 32(IN) +15V
L1 15
+15VA
C10 0.1
C11 6.8
R18
C14 0.1
C15 0.1
L2 15
+15VB
C12 6.8
C13 .01
R17 1.0
10 VOLT REFERENCE
R21 1000
P1-2(OUT) +10V
+15VA
U19
+15V
R1 100K
C1 0.1
U18A
+10VR
P1,-14, 36(IN) +5V
L5 TOROID
R24 2870
+5PU
+5VA
C6
C9
C22
C23
C24
C25
C26
L6 15
+5VB
C7 6.8
C8 .01
R16 1.0
P1-11, 12,33,34 GND
P1-13, 35(IN) -15V
L3 15
-15VA
C16 0.1
C17 6.8
C20 0.1
C21 0.1
R28 1.0
L4 15
-15VB
C18 6.8
C19 .01
R19 1.0

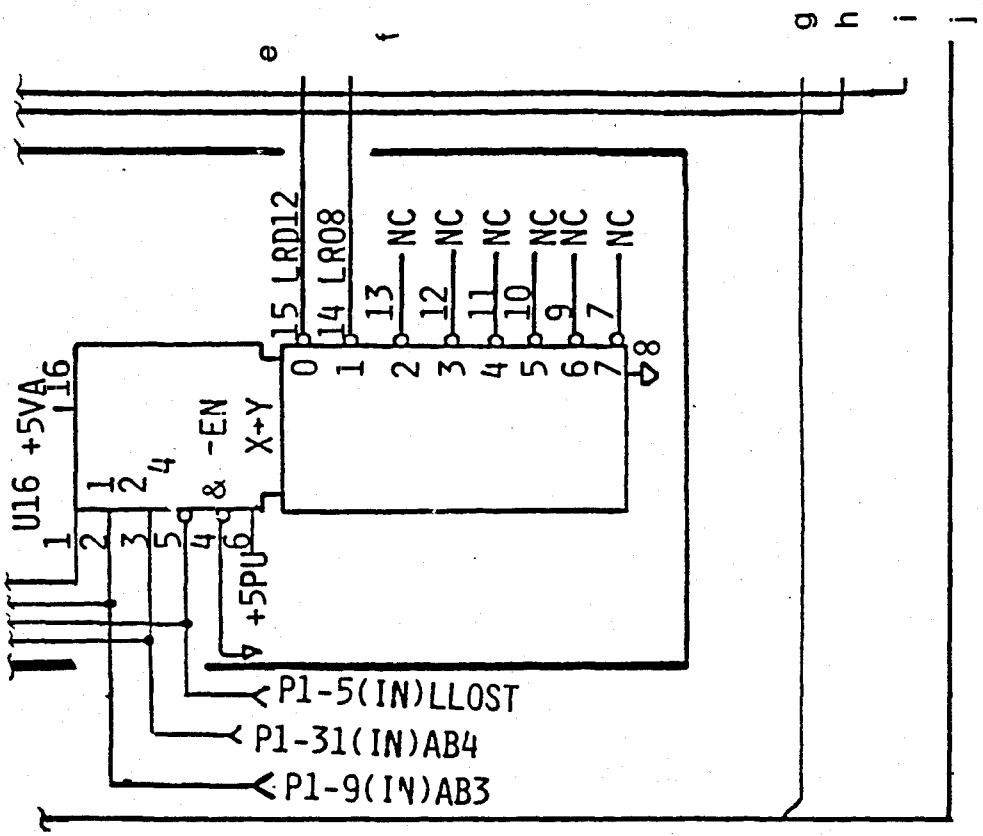
FIG 27.40C

FIG 27.41A



A17 ACTIVE COMPONENTS PARTS LIST (U'S + O'S)

REF DESIG.	PART NO.	MFG. PART NO.
Q1	1853-0007	2N3251
Q2	1855-0393	
U1,2,6, 7,11	1820-1447	74L5670
U3	1820-1422	74L5122
U4	1826-0447	LF257
U5	1813-0155	ADC84-12
U8	1820-1428	74L5158



U9	1826-0116	CMP-01
U12	1820-2990	25L02
U13	1820-1975	74L5165
U14,16	1820-1216	74L5138
U17	1820-1197	74L500
U18	1826-0785	LF353A
U19	1826-0742	A0581d
U20	1820-1112	74L574
U15	1826-1091	DAC-08H
CR1,CR2	1901-0539	
CR3	1901-1098	1N4150
U10	1826-0516	17F
U21	1820-2024	74L5244

FIG 27.41B

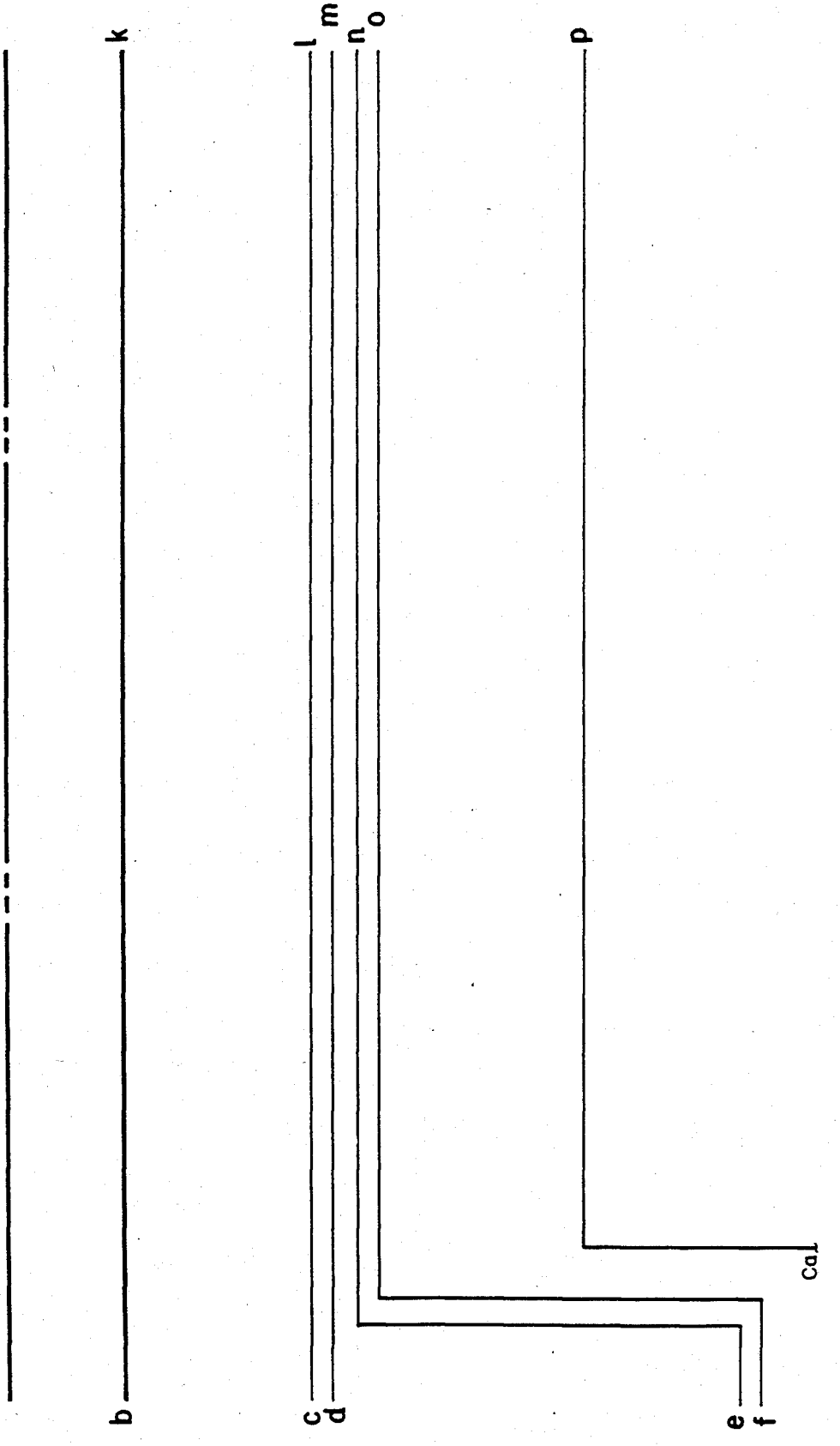


FIG 27.42A

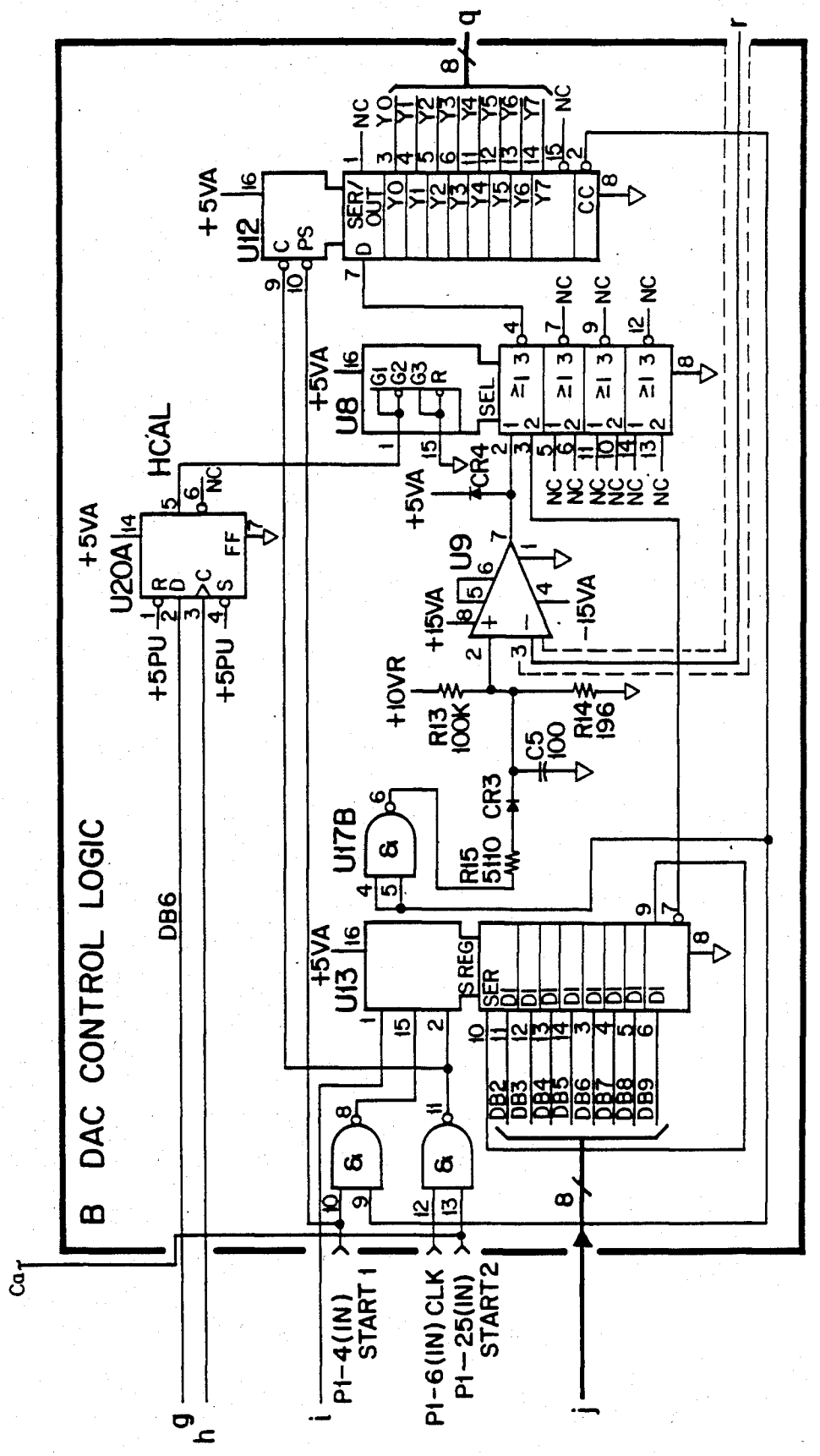
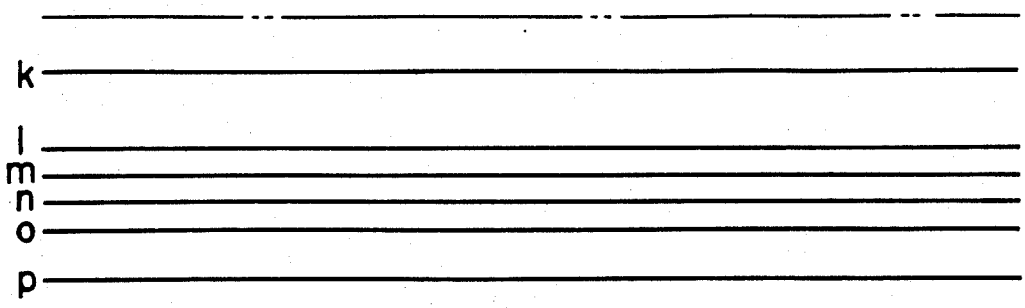

B DAC CONTROL LOGIC
+5VA
U12
U8
U9
U20A
HCAL
U17B
U13
+15VA
-15VA
+10VR
R13 100K
R14 196
R15 5110
C5 100
CR3
CR4
+5PU
DB6
DB2
DB3
DB4
DB5
DB6
DB7
DB8
DB9
P1-4(IN) START 1
P1-6(IN) CLK
P1-25(IN) START2
Car
g
h
i
j
q
r

FIG 27.42B



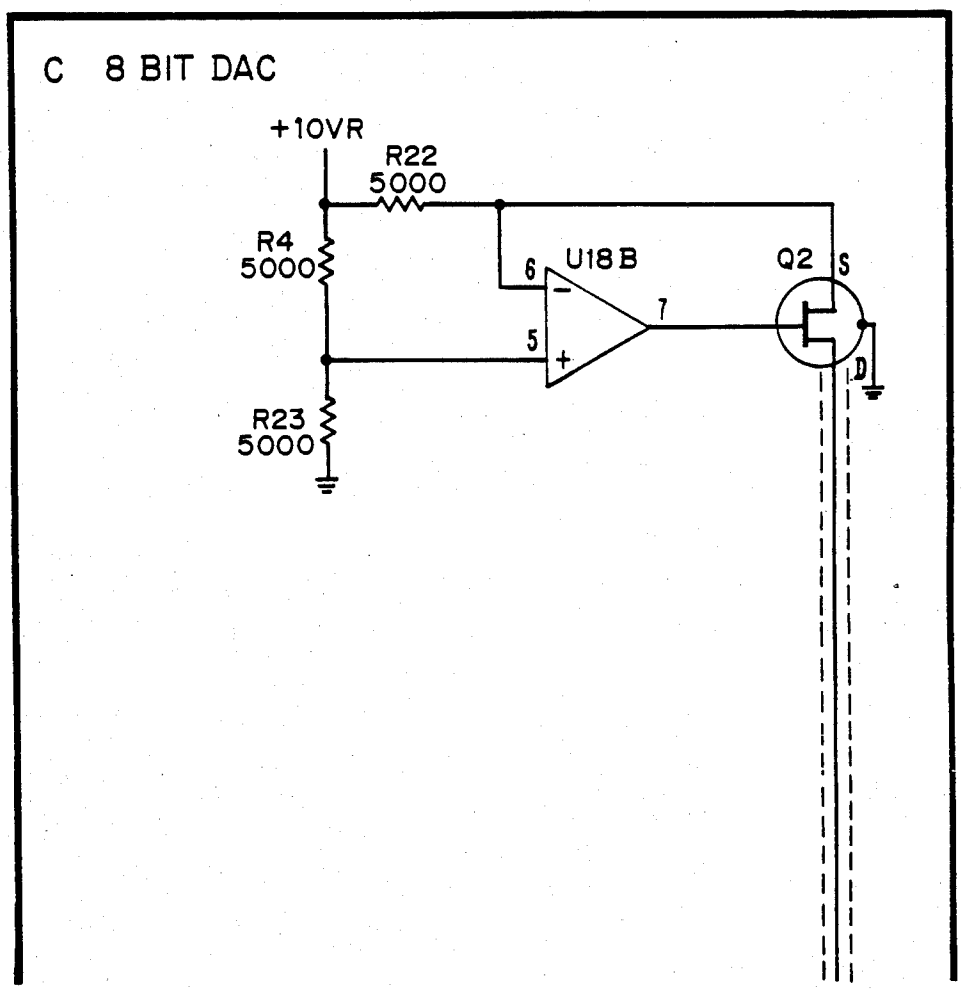


FIG 27.43A

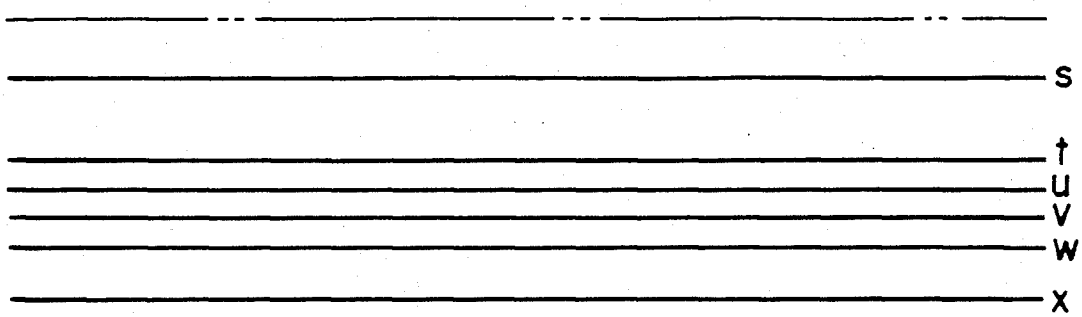


FIG. 27.43B

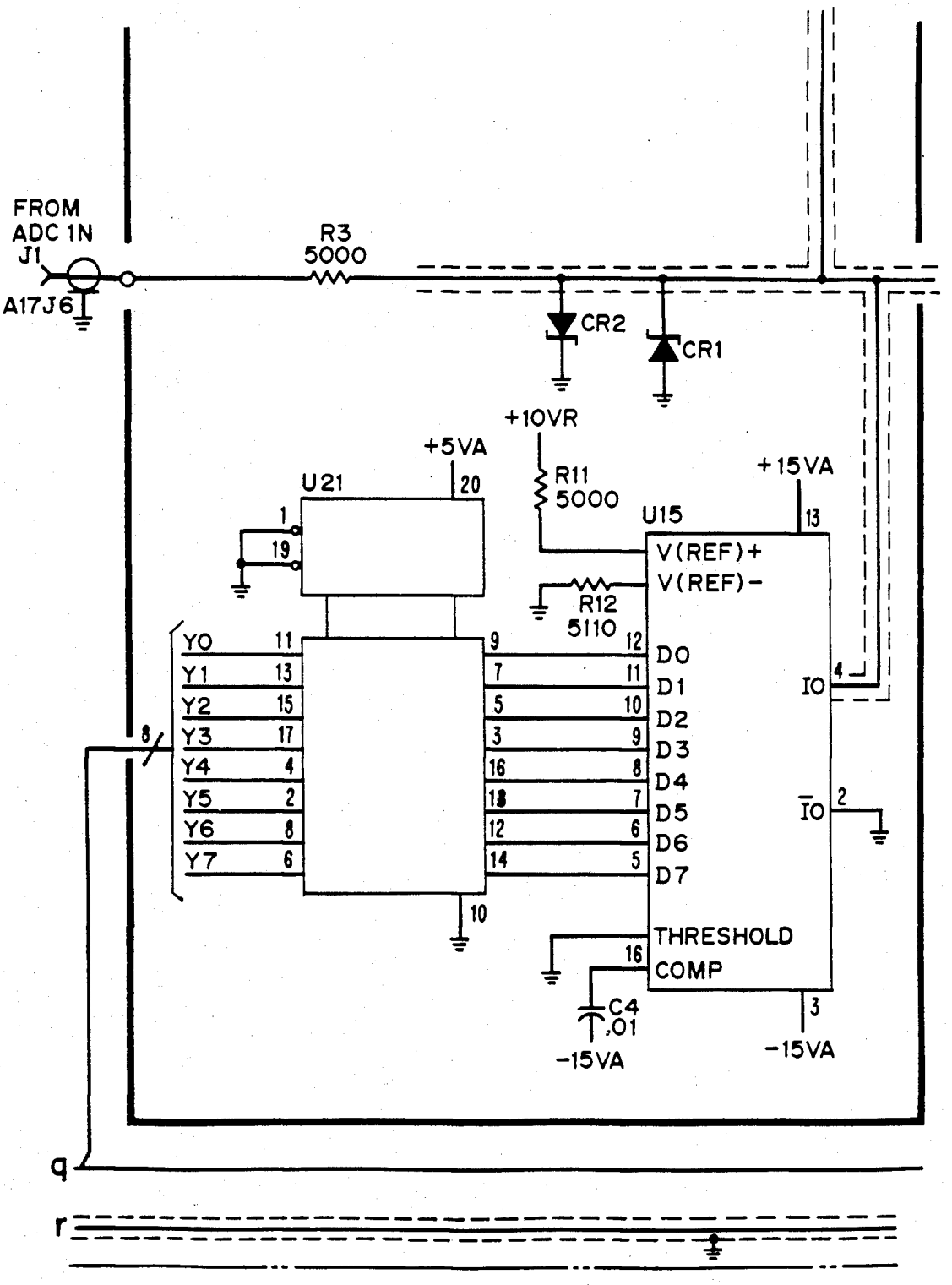

FROM
ADC 1N
J1
A17J6
R3
5000
CR2
CR1
+10VR
+5VA
U21
20
1
19
R11
5000
+15VA
U15
13
V(REF)+
V(REF)-
R12
5110
Y0 11
Y1 13
Y2 15
Y3 17
Y4 4
Y5 2
Y6 8
Y7 6
8
9 12 D0
7 11 D1
5 10 D2
3 9 D3
16 8 D4
18 7 D5
12 6 D6
14 5 D7
10
IO 4
IO 2
THRESHOLD
16
COMP
C4
.01
-15VA
3
-15VA
q
r

FIG 27.43C

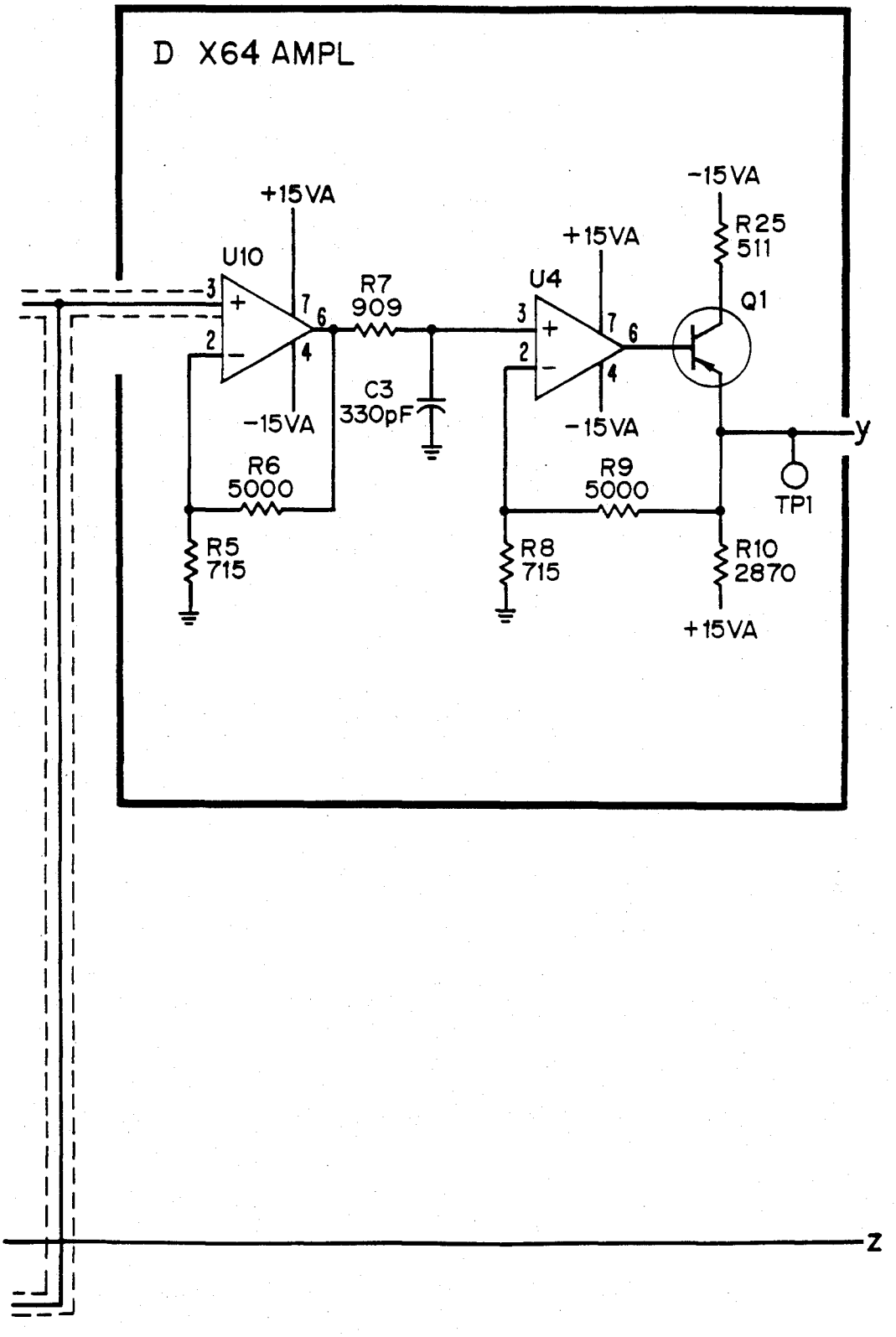

D X64 AMPL
+15VA
U10
R7
909
-15VA
C3
330pF
R6
5000
R5
715
U4
+15VA
-15VA
R25
511
Q1
y
R9
5000
TP1
R8
715
R10
2870
+15VA
z

FIG 27.43D

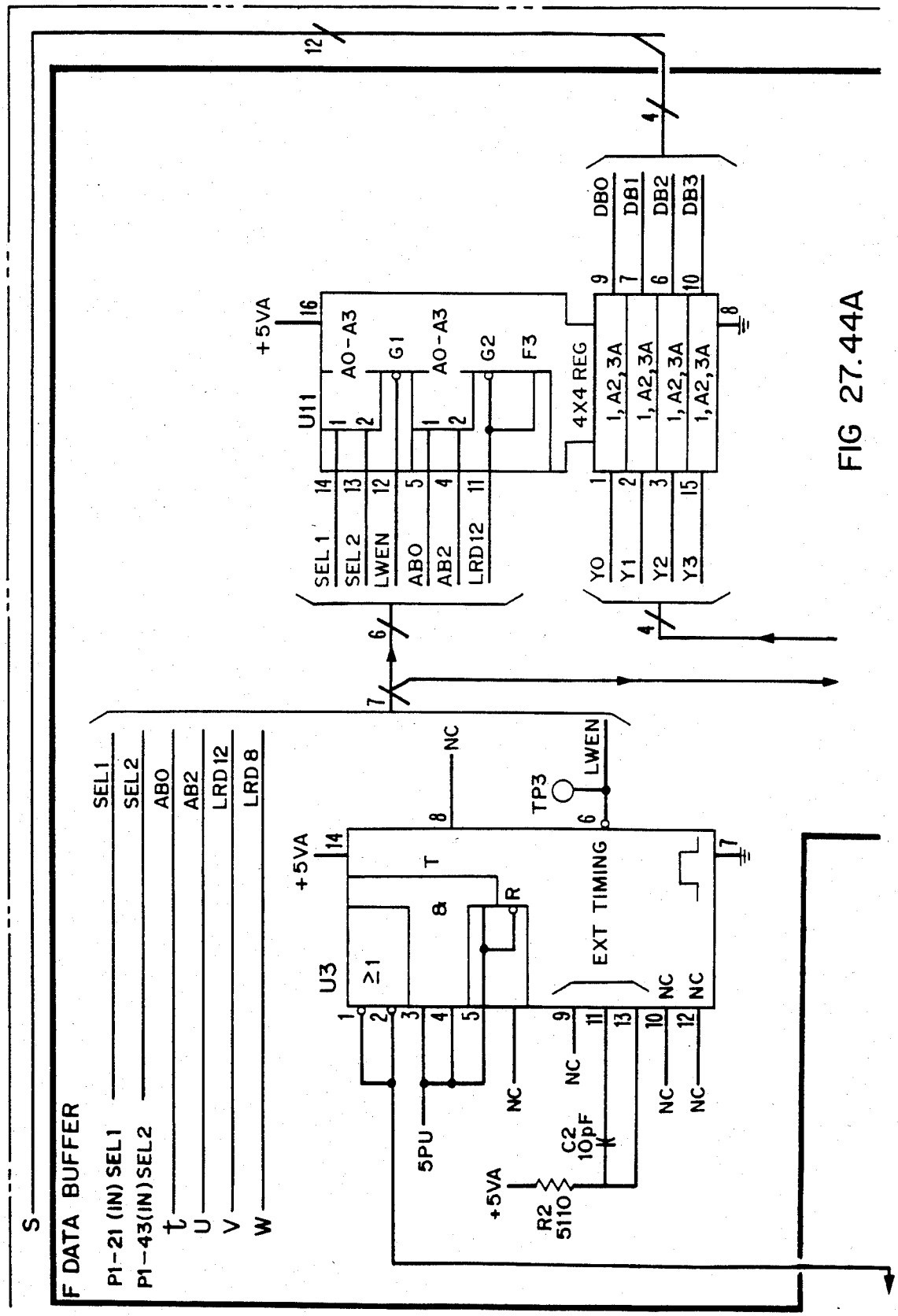

F DATA BUFFER
P1-21 (IN) SEL1
P1-43(IN) SEL2
S
t
U
V
W
SEL1
SEL2
ABO
AB2
LRD12
LRD8
+5VA
U11
A0-A3
G1
G2
F3
4X4 REG
1, A2, 3A
DB0
DB1
DB2
DB3
SEL 1
SEL 2
LWEN
ABO
AB2
LRD12
YO
Y1
Y2
Y3
U3
≥1
T
R
EXT TIMING
TP3
NC
5PU
C2
10pF
R2
5110

FIG 27.44A

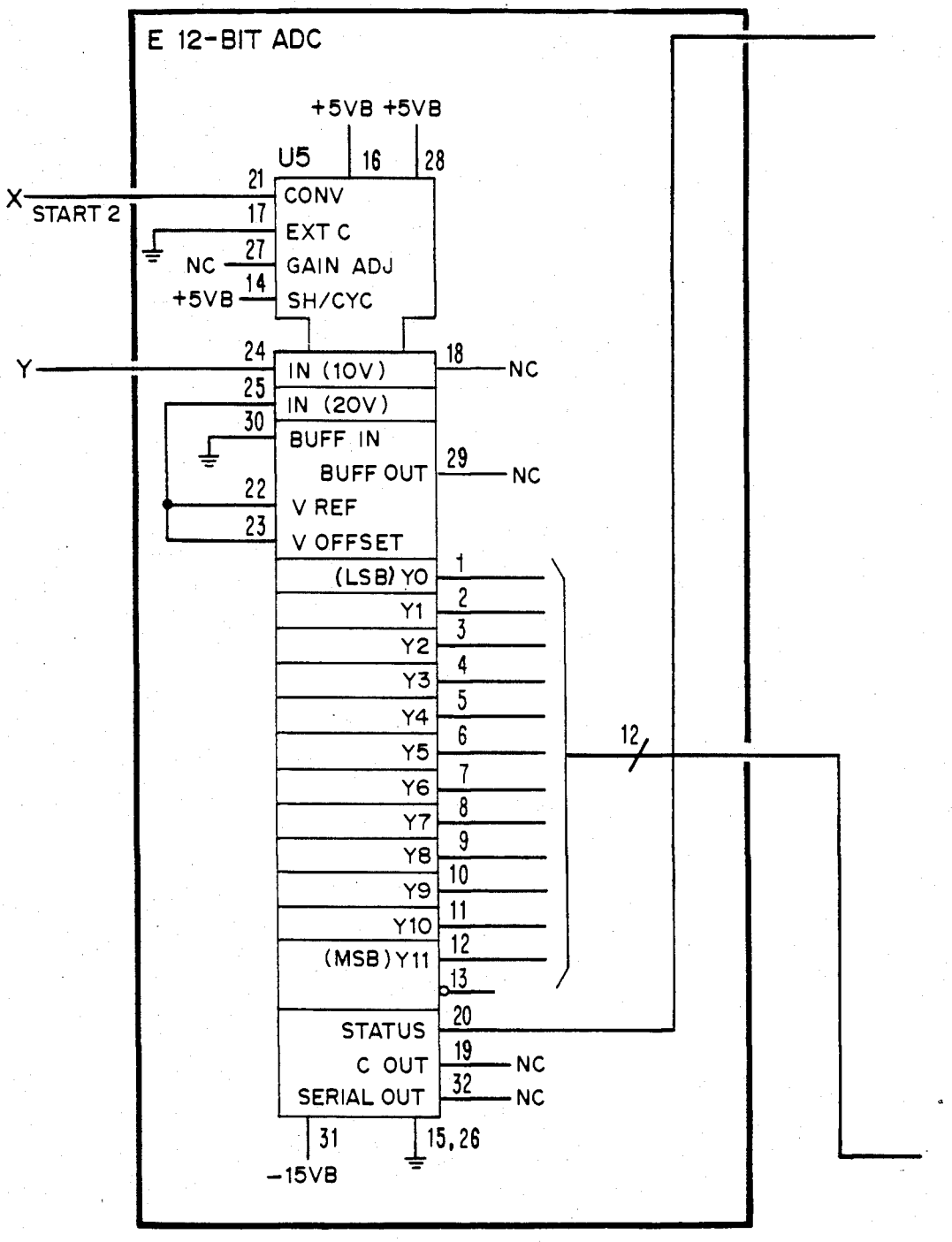

E 12-BIT ADC
+5VB +5VB
U5
16
28
21
CONV
X
START 2
17
EXT C
27
NC
GAIN ADJ
14
+5VB
SH/CYC
24
IN (10V)
18
NC
Y
25
IN (20V)
30
BUFF IN
BUFF OUT
29
NC
22
V REF
23
V OFFSET
(LSB) Y0
1
Y1
2
Y2
3
Y3
4
Y4
5
Y5
6
12
Y6
7
Y7
8
Y8
9
Y9
10
Y10
11
(MSB) Y11
12
13
STATUS
20
C OUT
19
NC
SERIAL OUT
32
NC
31
15,26
-15VB

FIG 27.44B

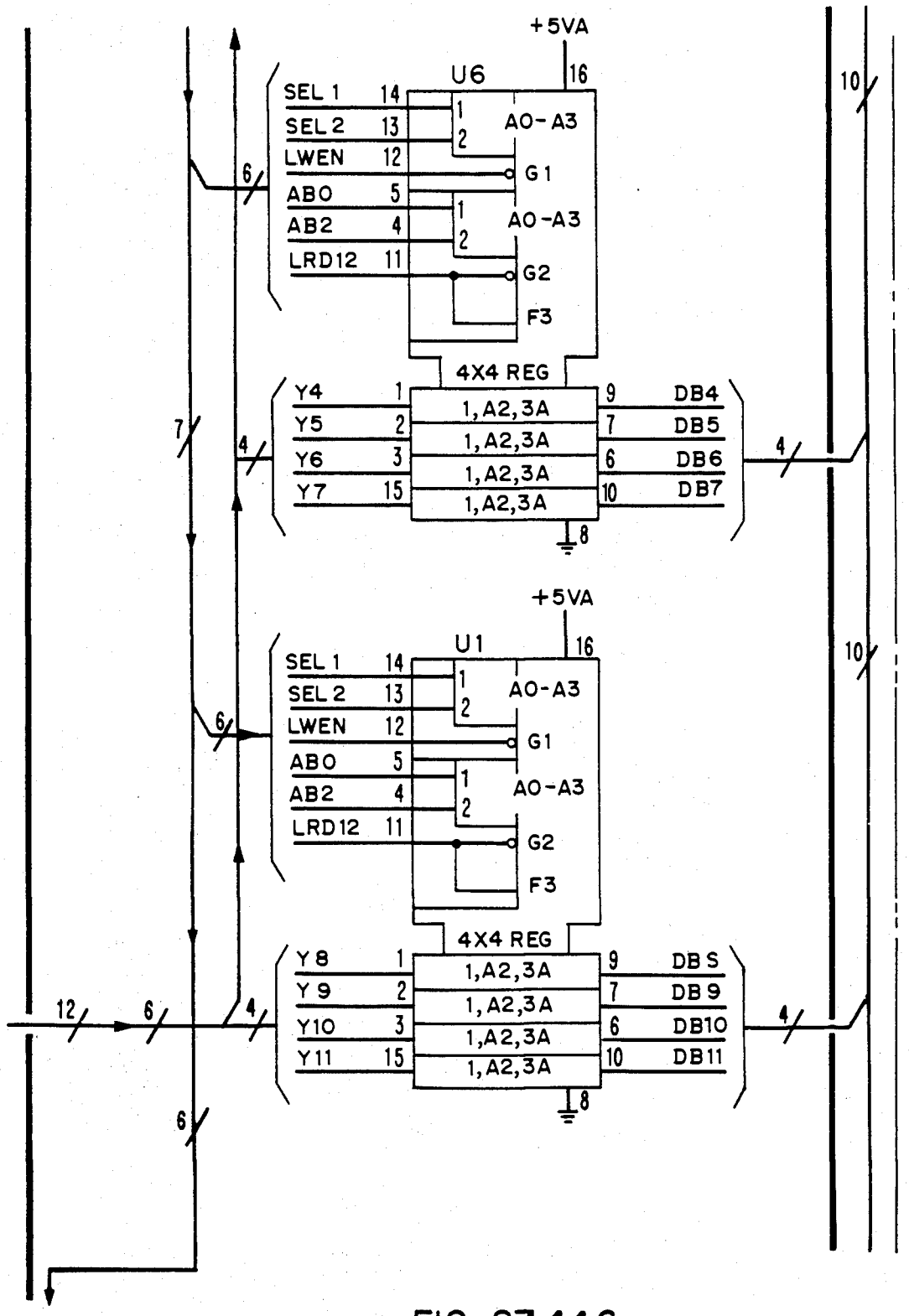

+5VA
U6
16
SEL 1
14
SEL 2
13
LWEN
12
ABO
5
AB2
4
LRD12
11
1
2
AO-A3
G1
1
2
AO-A3
G2
F3
4X4 REG
Y4
1
Y5
2
Y6
3
Y7
15
1,A2,3A
9
DB4
7
DB5
6
DB6
10
DB7
8
+5VA
U1
16
SEL 1
14
SEL 2
13
LWEN
12
ABO
5
AB2
4
LRD12
11
AO-A3
G1
AO-A3
G2
F3
4X4 REG
Y8
1
Y9
2
Y10
3
Y11
15
1,A2,3A
9
DB8
7
DB9
6
DB10
10
DB11
8
12
6
4
7
10

FIG 27.44C

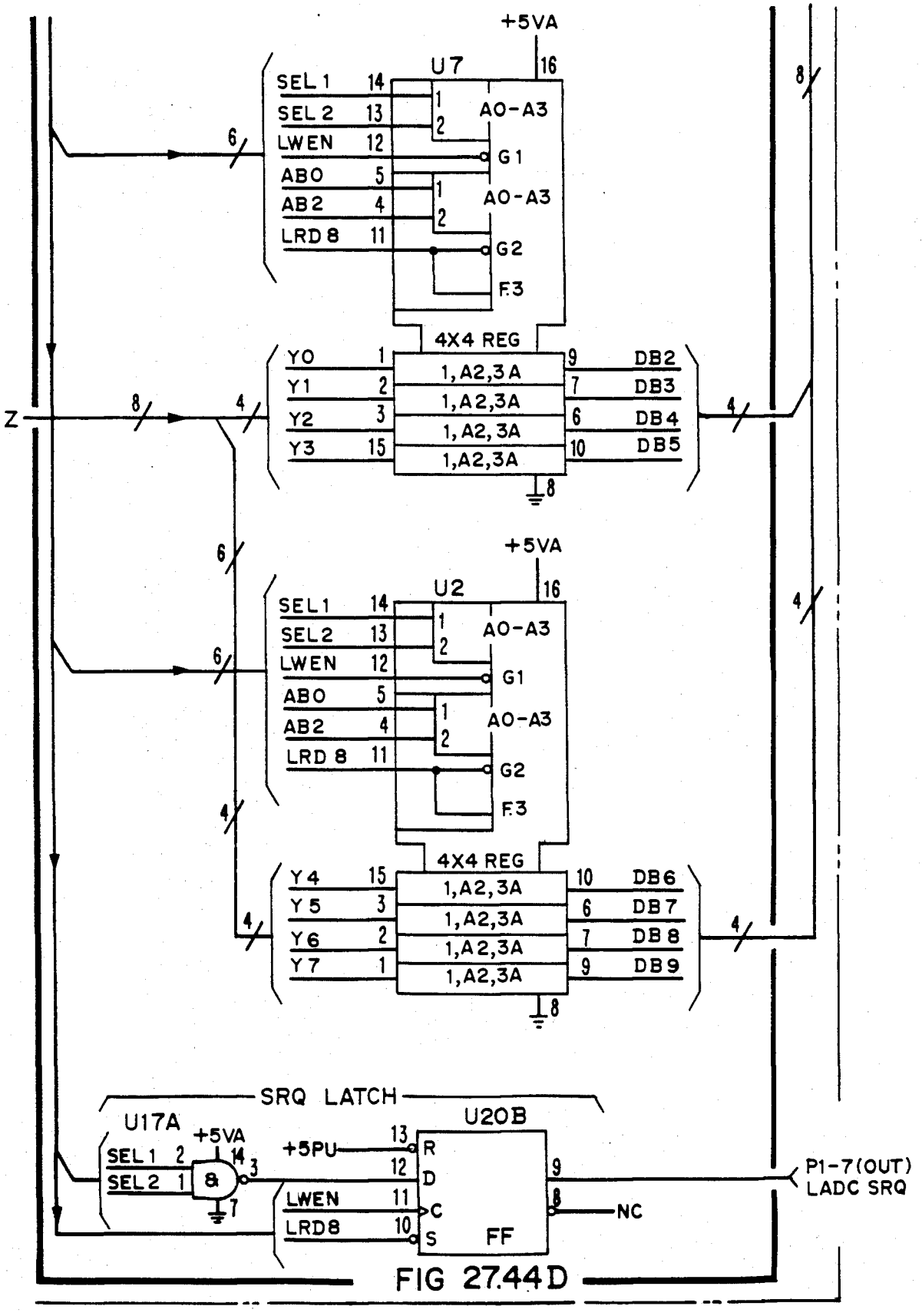

+5VA
U7
SEL 1
SEL 2
LWEN
ABO
AB2
LRD 8
AO-A3
G1
G2
F3
4X4 REG
YO
Y1
Y2
Y3
1,A2,3A
DB2
DB3
DB4
DB5
Z
U2
Y4
Y5
Y6
Y7
DB6
DB7
DB8
DB9
SRQ LATCH
U17A
U20B
+5PU
R
D
C
S
FF
P1-7(OUT)
LADC SRQ
NC

FIG 27.44D

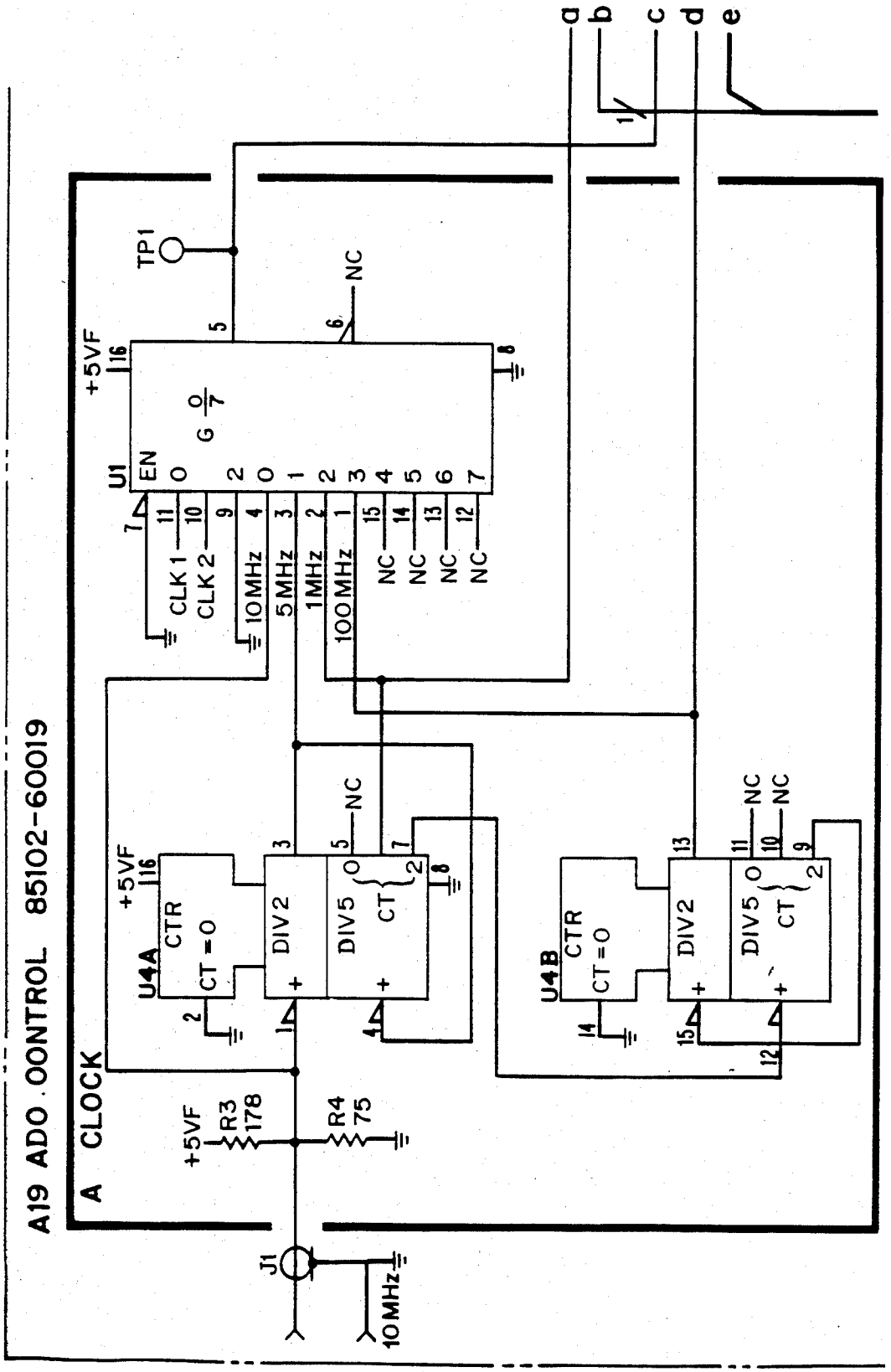

A19 ADO .OONTROL 85102-60019
A CLOCK
TP1
+5VF
U1
EN
G 0/7
CLK 1
CLK 2
10MHz
5MHz
1MHz
100MHz
NC
U4A
CTR
CT=0
DIV2
DIV5
CT
U4B
R3 178
R4 75
J1
10MHz
a
b
c
d
e

FIG 27.46A

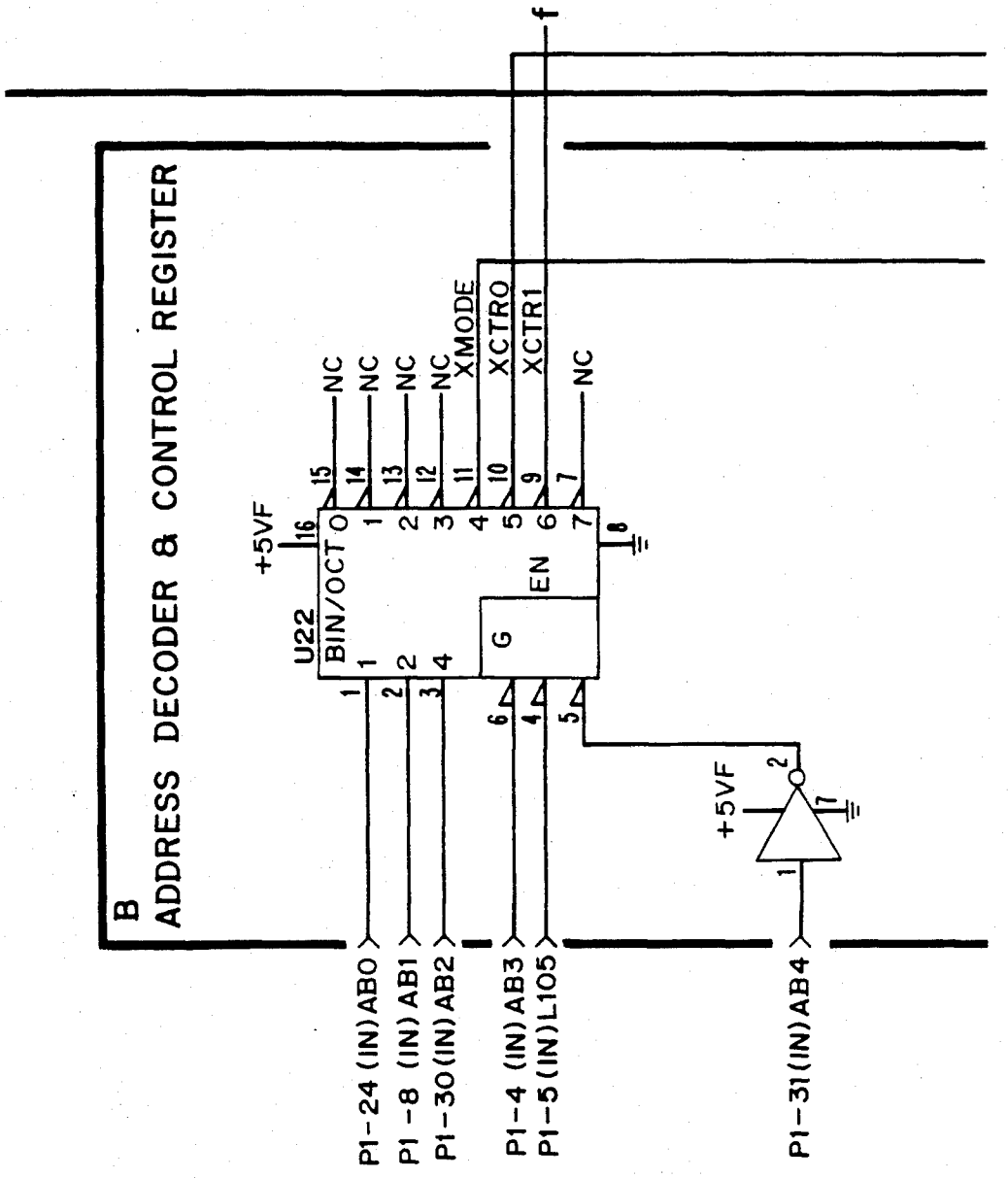

B
ADDRESS DECODER & CONTROL REGISTER
f
U22
BIN/OCT 0
+5VF
NC
NC
NC
NC
XMODE
XCTR0
XCTR1
NC
EN
G
+5VF
P1-24 (IN) AB0
P1 -8 (IN) AB1
P1-30 (IN) AB2
P1-4 (IN) AB3
P1-5 (IN) L105
P1-31 (IN) AB4

FIG 27.46B

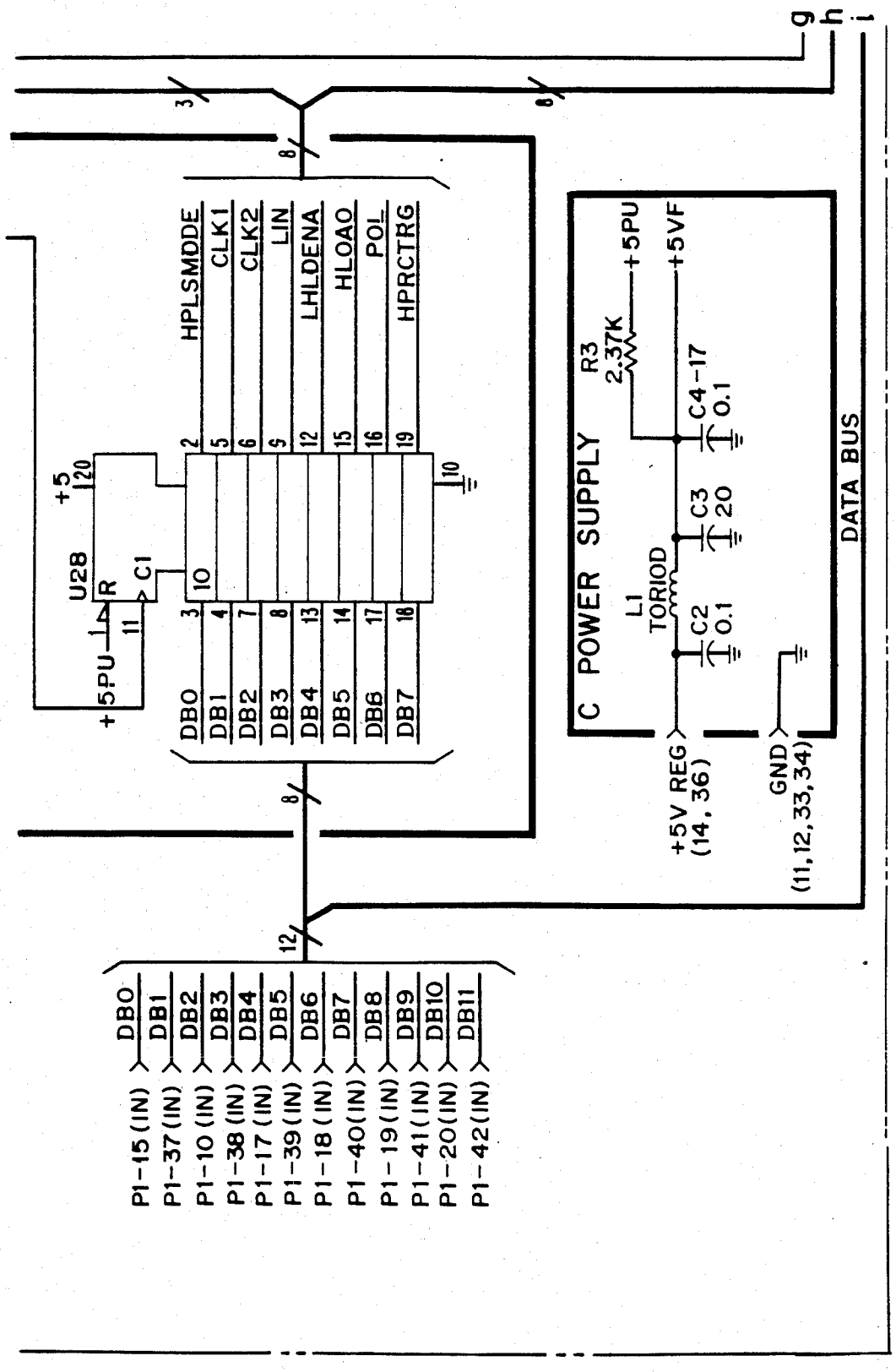

g
h
i
3
8
8
HPLSMDDE
CLK1
CLK2
LIN
LHLDENA
HLOAO
POL
HPRCTRG
2
5
6
9
12
15
16
19
+5
20
U28
R
C1
10
11
+5PU
3
4
7
8
13
14
17
18
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
10
8
C POWER SUPPLY
R3
2.37K
+5PU
+5VF
C4-17
0.1
C3
20
L1
TORIOD
C2
0.1
+5V REG
(14, 36)
GND
(11, 12, 33, 34)
DATA BUS
12
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
DB8
DB9
DB10
DB11
P1-15 (IN)
P1-37 (IN)
P1-10 (IN)
P1-38 (IN)
P1-17 (IN)
P1-39 (IN)
P1-18 (IN)
P1-40 (IN)
P1-19 (IN)
P1-41 (IN)
P1-20 (IN)
P1-42 (IN)

FIG 27.46C

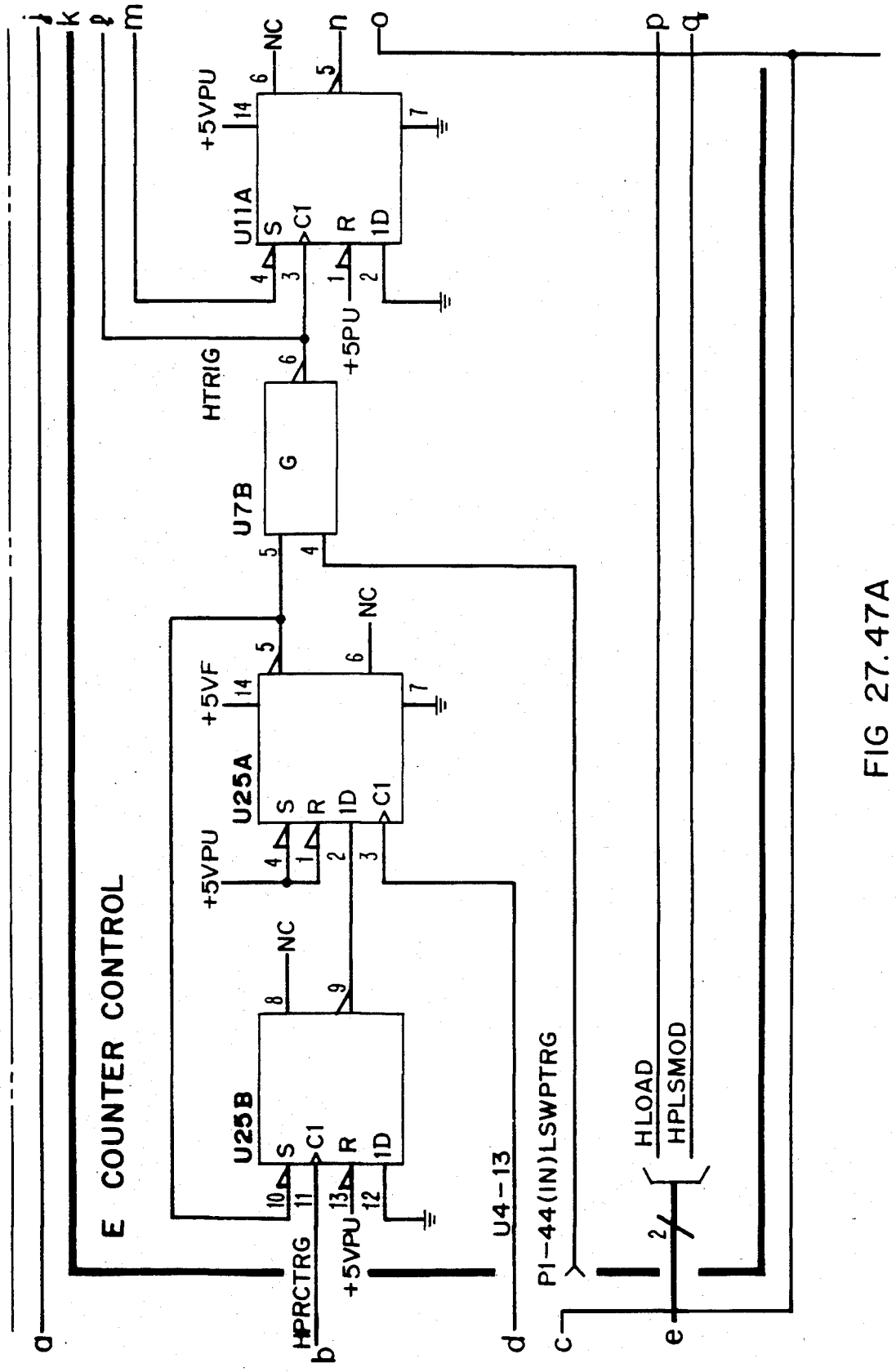

E COUNTER CONTROL
U11A
U7B
U25A
U25B
+5VPU
+5VF
+5PU
NC
HTRIG
HPRCTRG
U4-13
P1-44(IN)LSWPTRG
HLOAD
HPLSMOD

FIG 27.47A

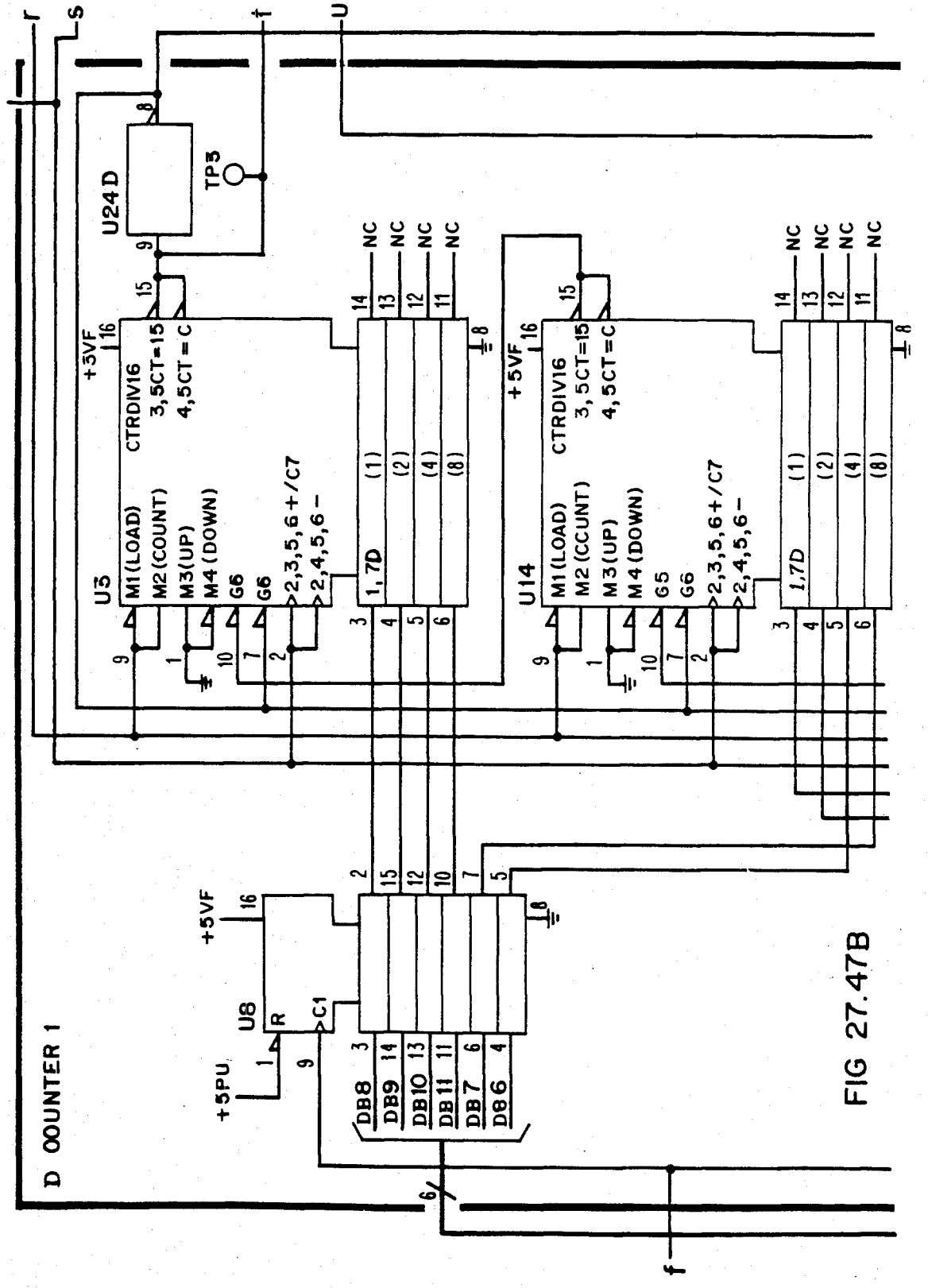

r
s
t
u
U24D
TP5
U5
CTRDIV16
M1(LOAD)
M2(COUNT)
M3(UP)
M4(DOWN)
3,5CT=15
4,5CT=C
+5VF
U14
U8
+5PU
D OUNTER 1
DB8
DB9
DB10
DB11
DB7
DB6
NC
f

FIG 27.47B

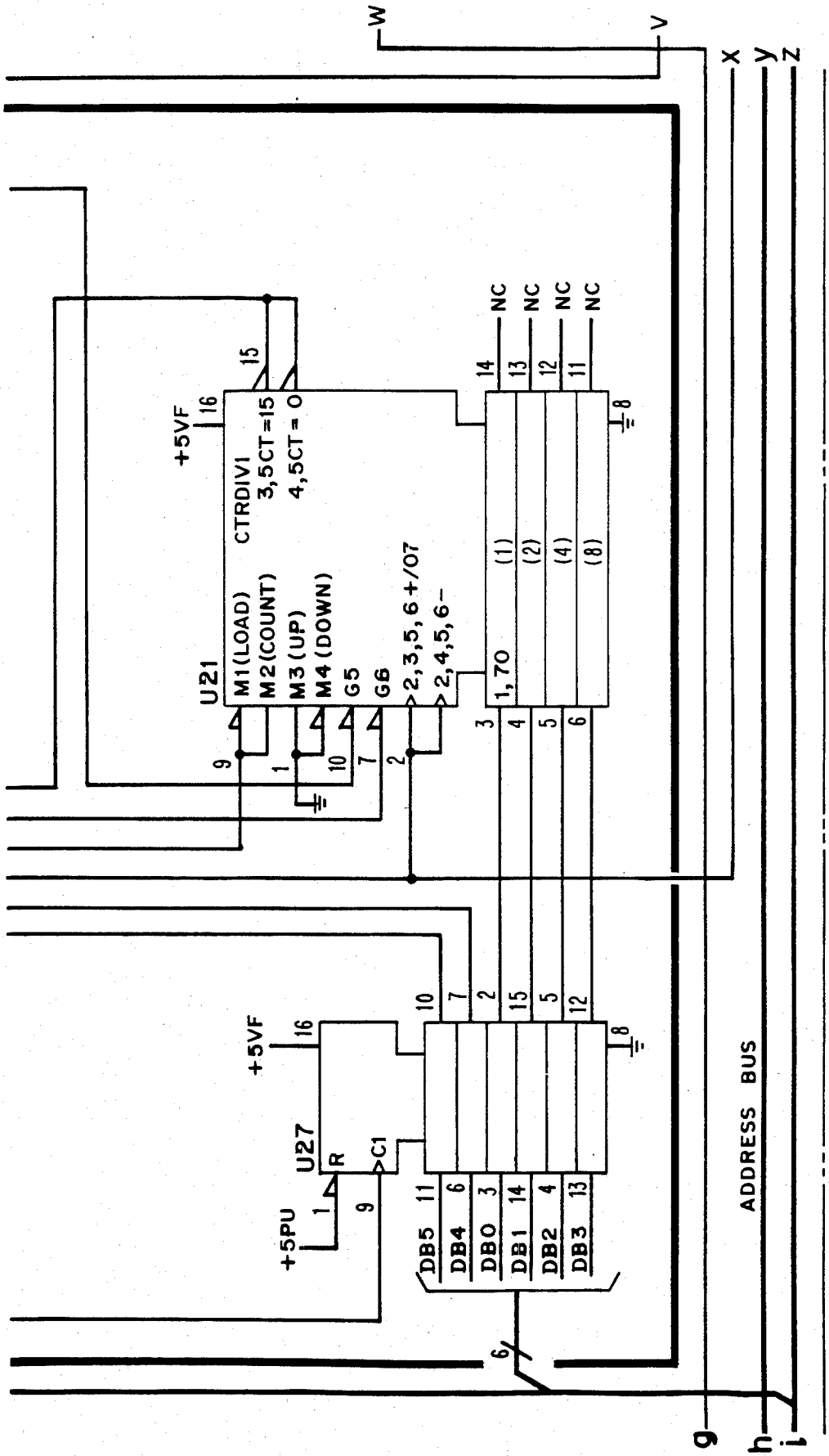

W
V
X
Y
Z
+5VF
16
15
U21
CTRDIVI
3,5CT=15
4,5CT=0
M1(LOAD)
M2(COUNT)
M3(UP)
M4(DOWN)
G5
G6
2,3,5,6+/07
2,4,5,6-
9
1
10
7
2
NC
NC
NC
NC
14
13
12
11
8
(1)
(2)
(4)
(8)
1,70
3
4
5
6
+5VF
16
U27
R
C1
+5PU
1
9
10
7
2
15
5
12
8
DB5
DB4
DB0
DB1
DB2
DB3
11
6
3
14
4
13
6
ADDRESS BUS
g
h
i

FIG 27.47C

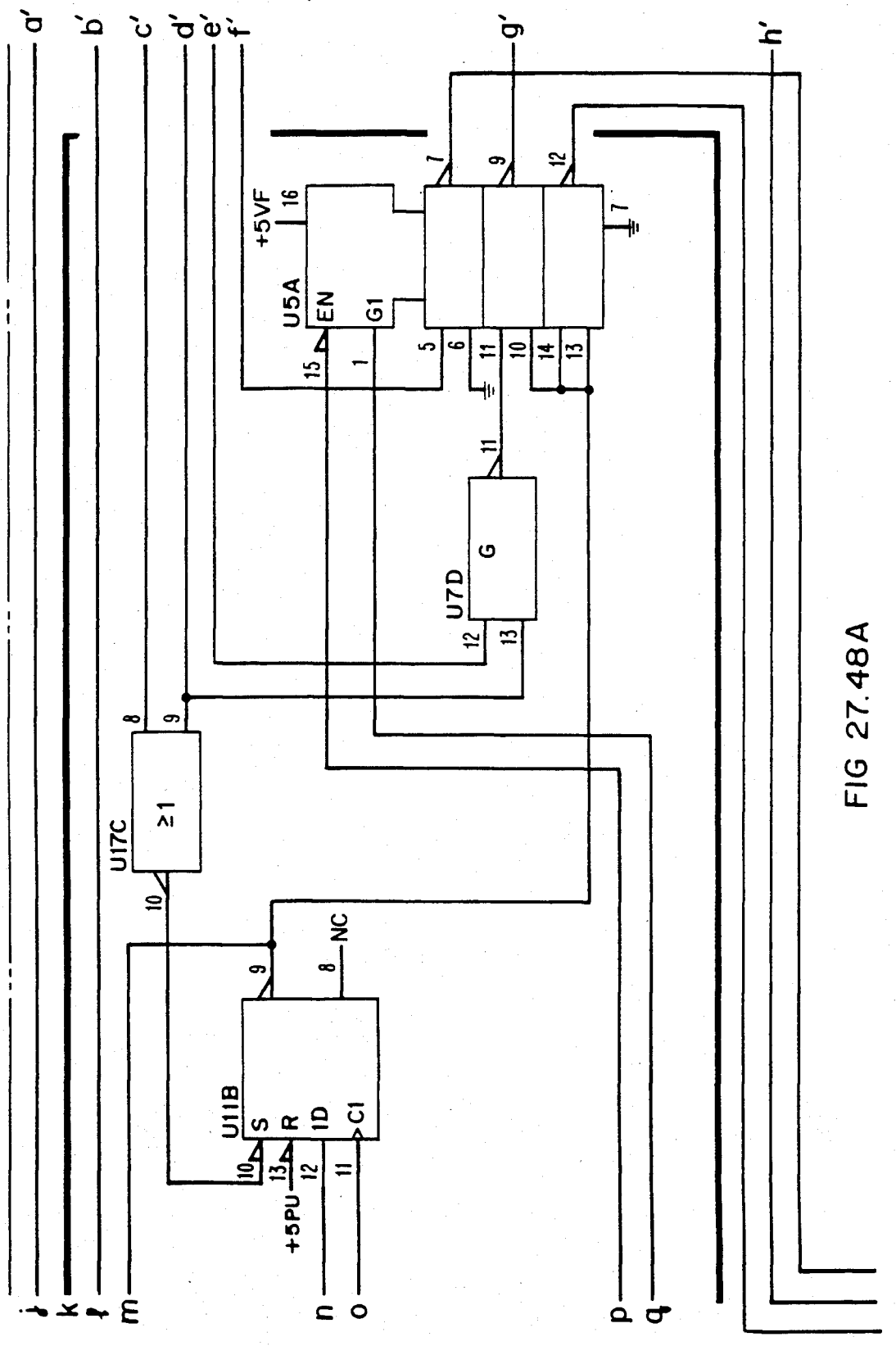

a'
b'
c'
d'
e'
f'
g'
h'
+5VF
U5A
EN
G1
U7D
G
U17C
≥1
U11B
S
R
1D
C1
NC
+5PU
i
k
l
m
n
o
p
q

FIG 27.48A

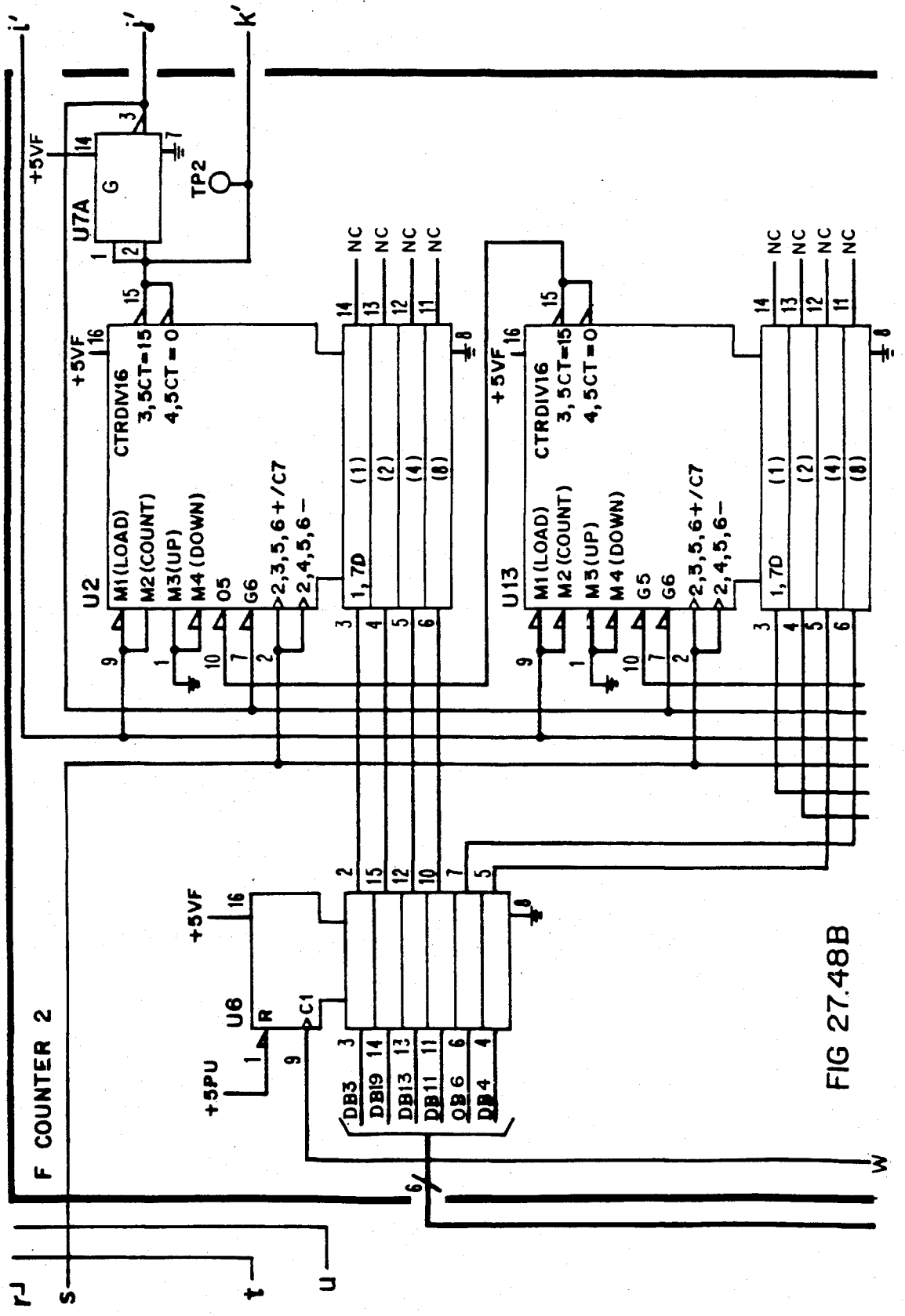

F COUNTER 2
U7A
TP2
+5VF
U2
U13
U6
CTRDIV16
3,5CT=15
4,5CT=0
M1(LOAD)
M2(COUNT)
M3(UP)
M4(DOWN)
+5PU
NC
DB3
DB9
DB13
DB11
DB6
DB4
i'
j'
k'
r
s
t
u
w

FIG 27.48B

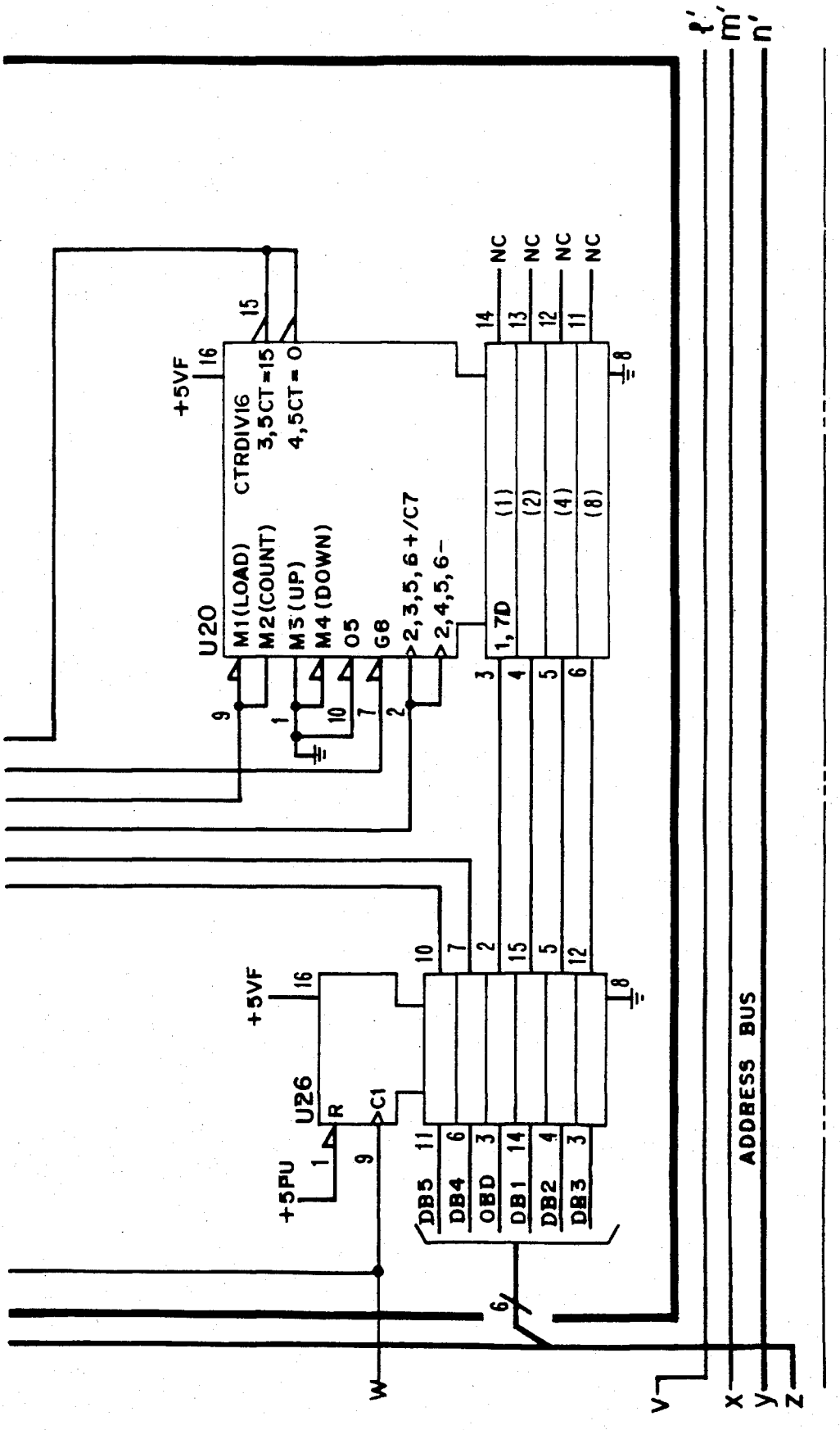

+5VF
U20
CTRDIV16
3,5CT=15
4,5CT=0
M1(LOAD)
M2(COUNT)
M3(UP)
M4(DOWN)
O5
G8
2,3,5,6+/C7
2,4,5,6-
1,7D
NC
(1)
(2)
(4)
(8)
+5VF
U26
R
C1
+5PU
DB5
DB4
OBD
DB1
DB2
DB3
ADDRESS BUS
p'
m'
n'
v
w
x
y
z

FIG 27.48C

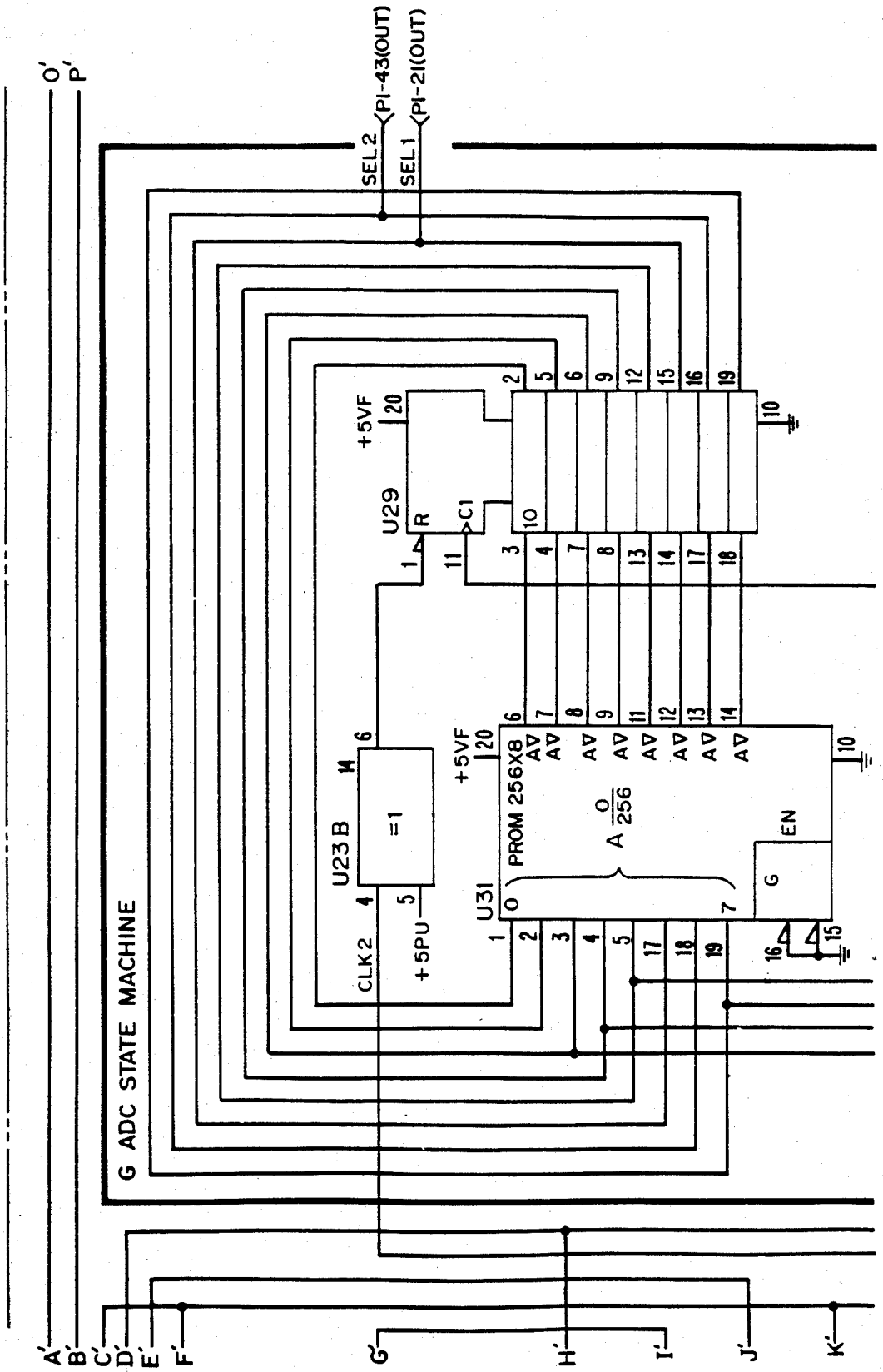

G ADC STATE MACHINE
SEL2
SEL1
PI-43(OUT)
PI-2I(OUT)
+5VF
U29
R
C1
U23B
=1
+5PU
CLK2
U31
PROM 256X8
A 0/256
EN
G
O'
P'
A'
B'
C'
D'
E'
F'
G'
H'
I'
J'
K'

FIG 27.49A

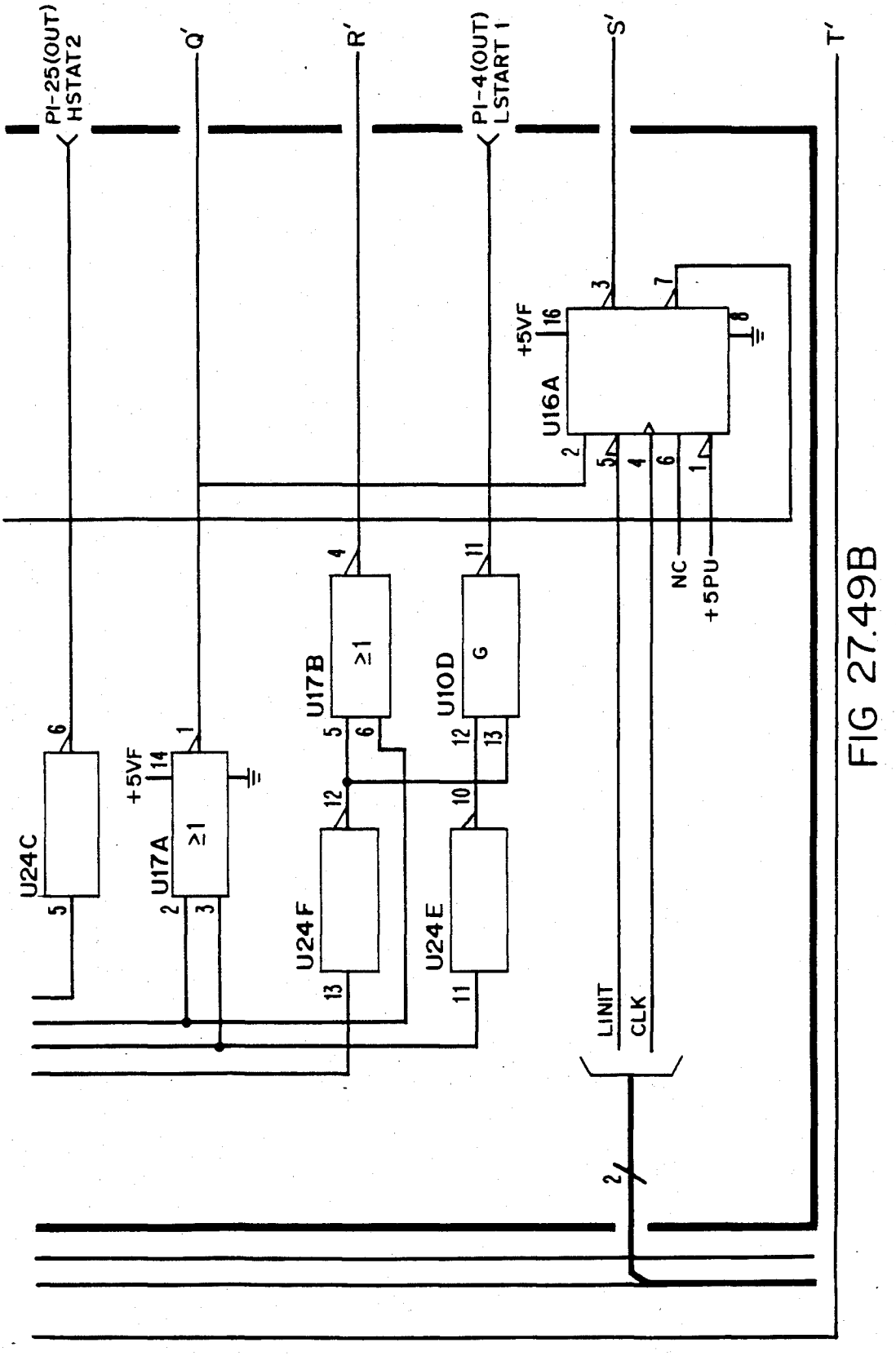

PI-25(OUT)
HSTAT2
Q'
R'
PI-4(OUT)
LSTART 1
S'
T'
U16A
+5VF
NC
+5PU
U17B
≥1
U10D
G
U24C
U17A
≥1
+5VF
U24F
U24E
LINIT
CLK
2

FIG 27.49B

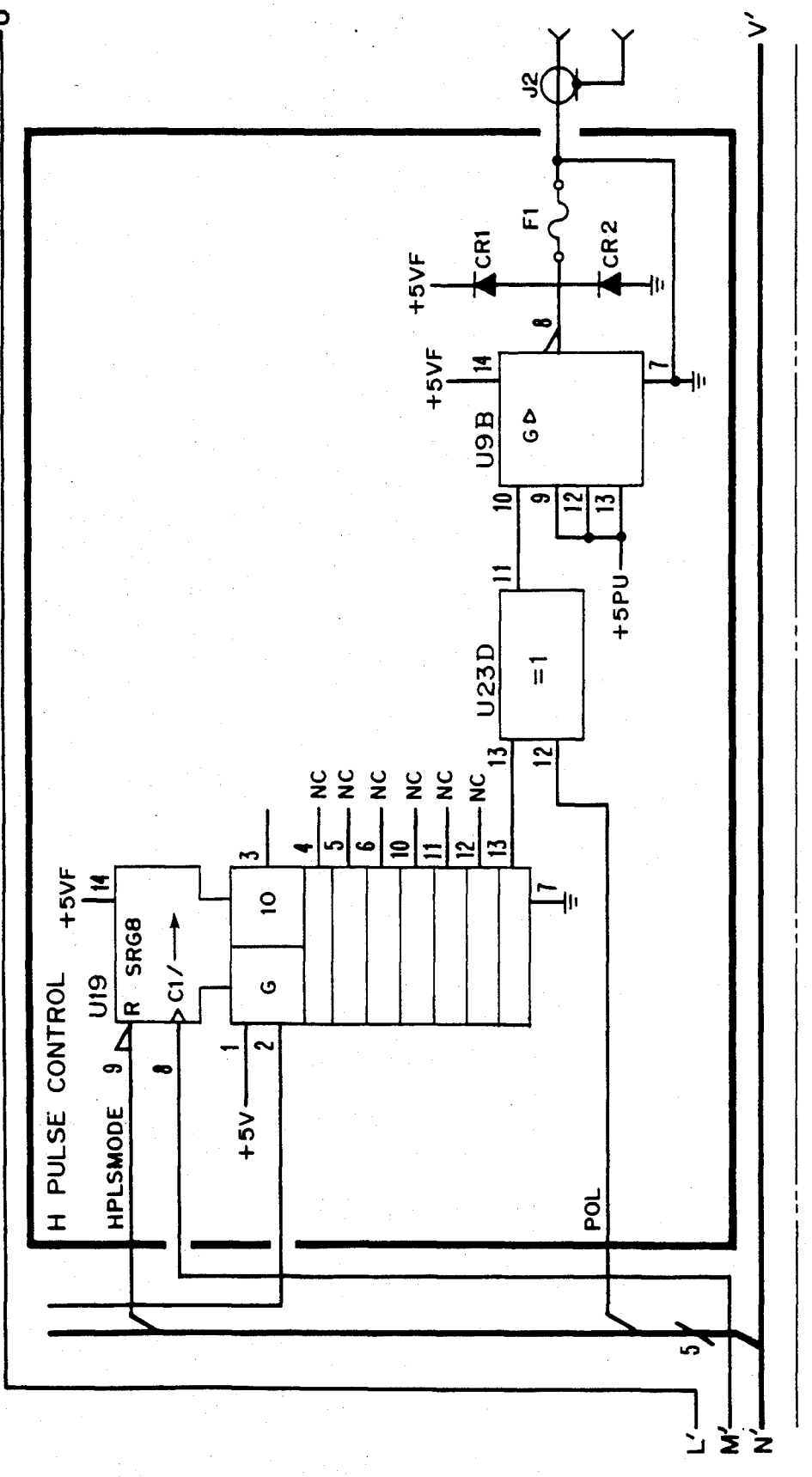

U'
V'
J2
F1
CR1
CR2
+5VF
U9B
G
+5PU
U23D
=1
NC
U19
SRG8
C1/
10
G
H PULSE CONTROL
HPLSMODE
+5V
POL
L'
M'
N'

FIG 27.49C

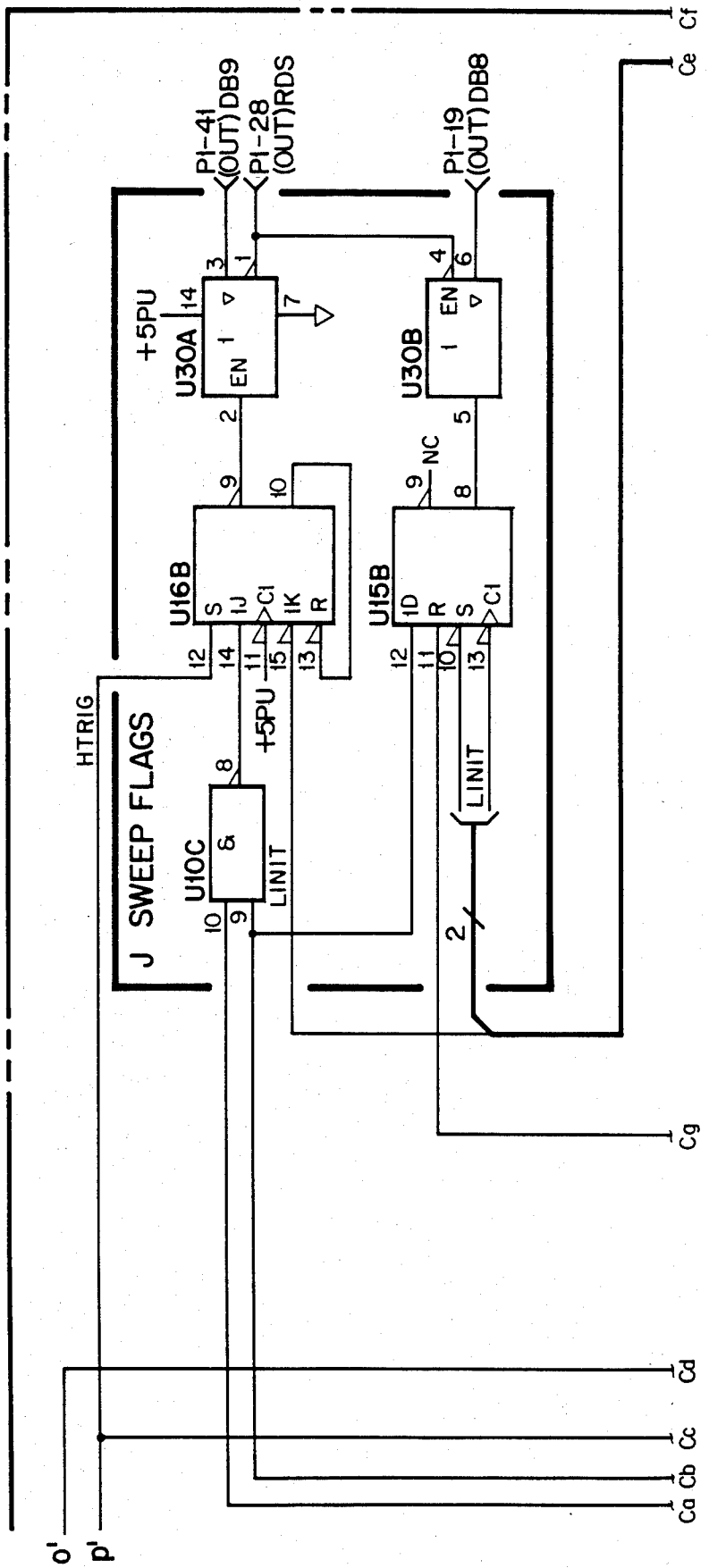

J SWEEP FLAGS
HTRIG
P1-41 (OUT) DB9
P1-28 (OUT) RDS
P1-19 (OUT) DB8
+5PU
U30A
U30B
U16B
U15B
U10C
LINIT
NC
Cf
Ce
Cg
Cd
Cc
Cb
Ca
o'
p'

FIG 27.50A

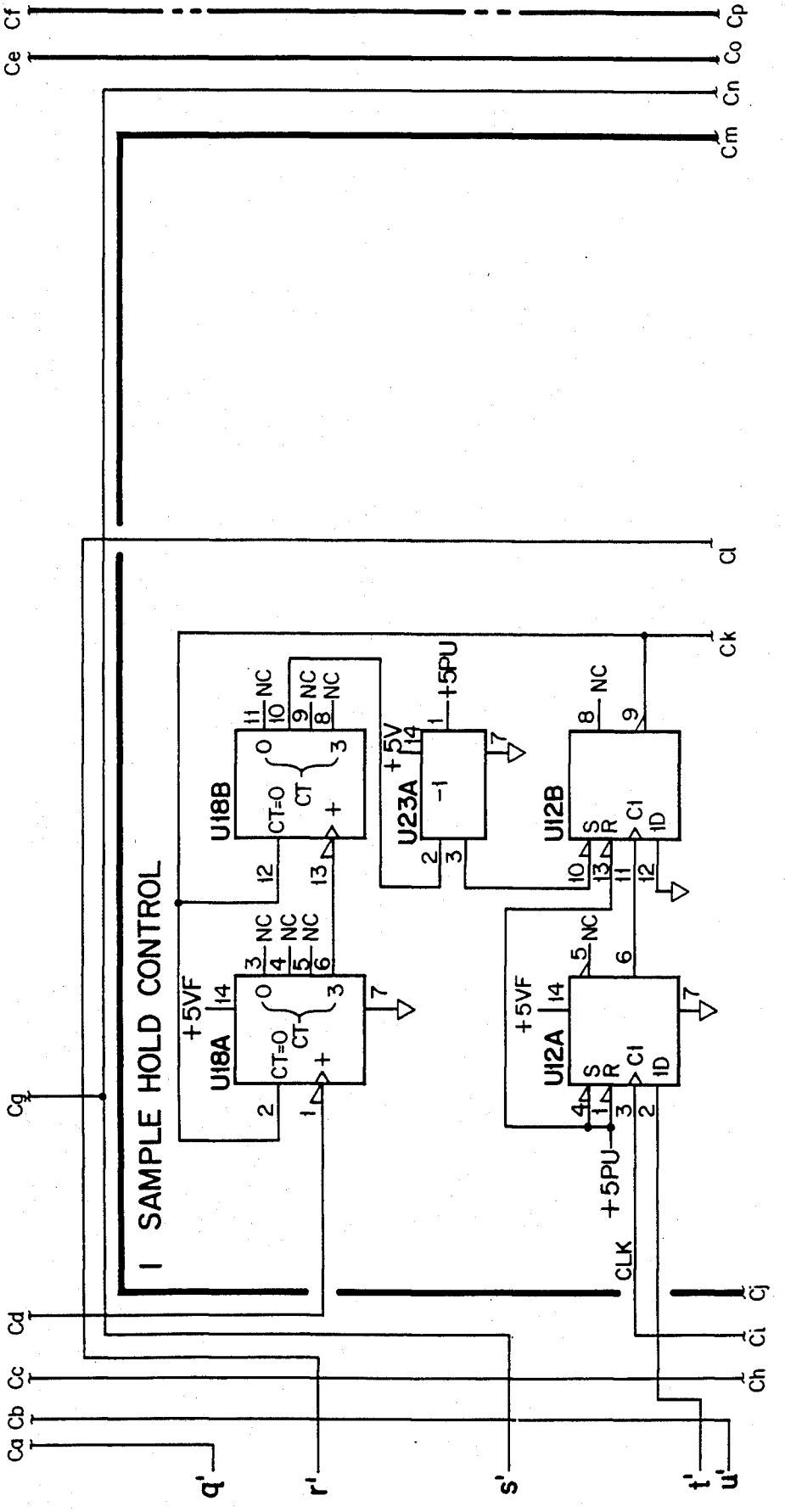

Cf
Ce
Cp
Co
Cn
Cm
Cl
Ck
Cg
Cd
Cc
Cb
Ca
Cj
Ci
Ch
1 SAMPLE HOLD CONTROL
U18A
U18B
U23A
U12A
U12B
+5VF
+5V
+5PU
CT=0
CT
NC
CLK
S
R
C1
1D
q'
r'
s'
t'
u'

FIG 27.50B

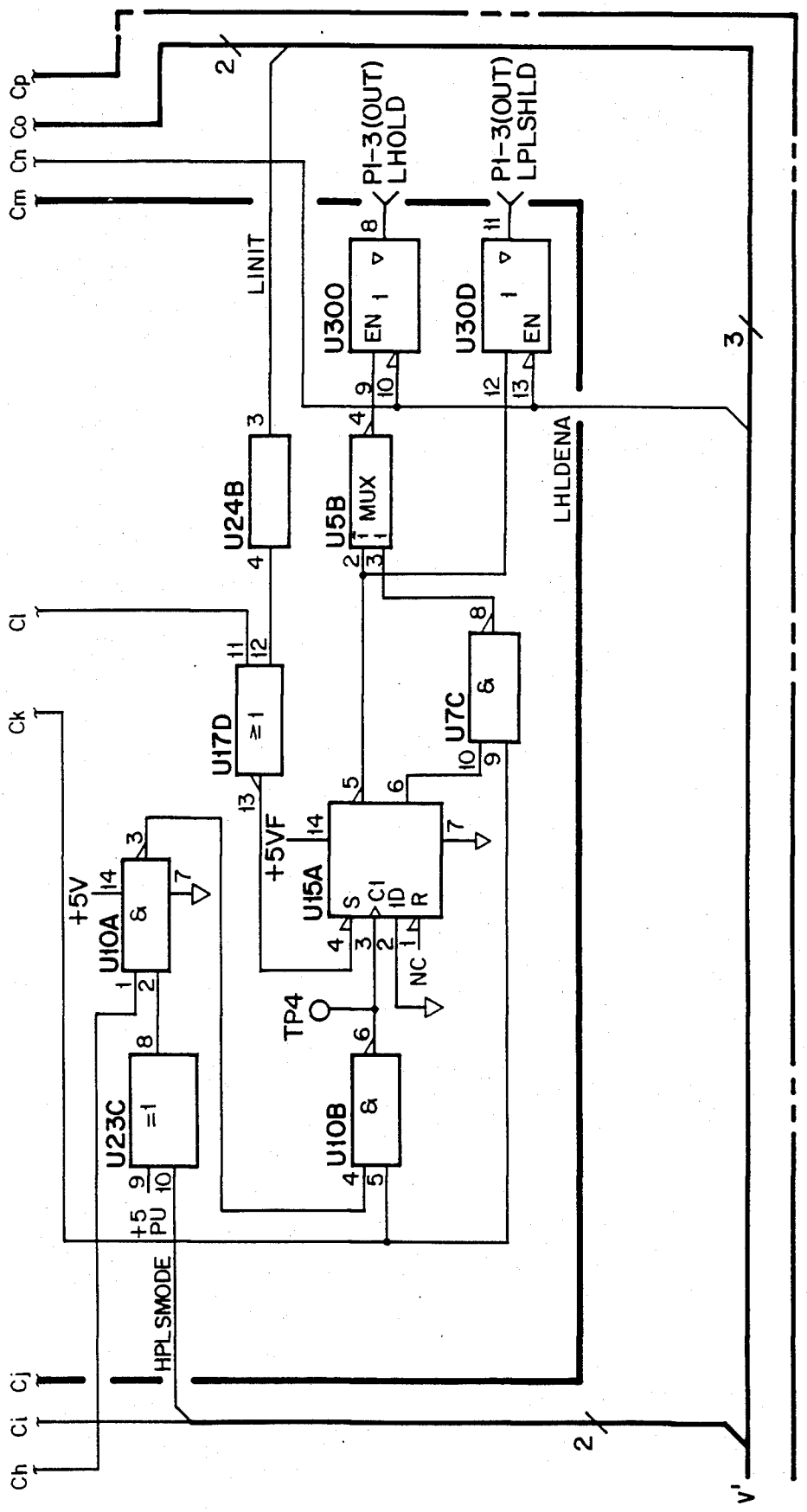

Cp
Co
Cn
Cm
Ck
Cl
Ci
Cj
Ch
2
3
V'
PI-3(OUT) LHOLD
PI-3(OUT) LPLSHLD
LINIT
LHLDENA
HPLSMODE
U300
U30D
U24B
U5B
MUX
U17D
≥1
U7C
&
U15A
S
C1
1D
R
NC
TP4
U10A
U10B
U23C
=1
+5V
+5VF
+5
PU

FIG 27.50C

FIG 27.51

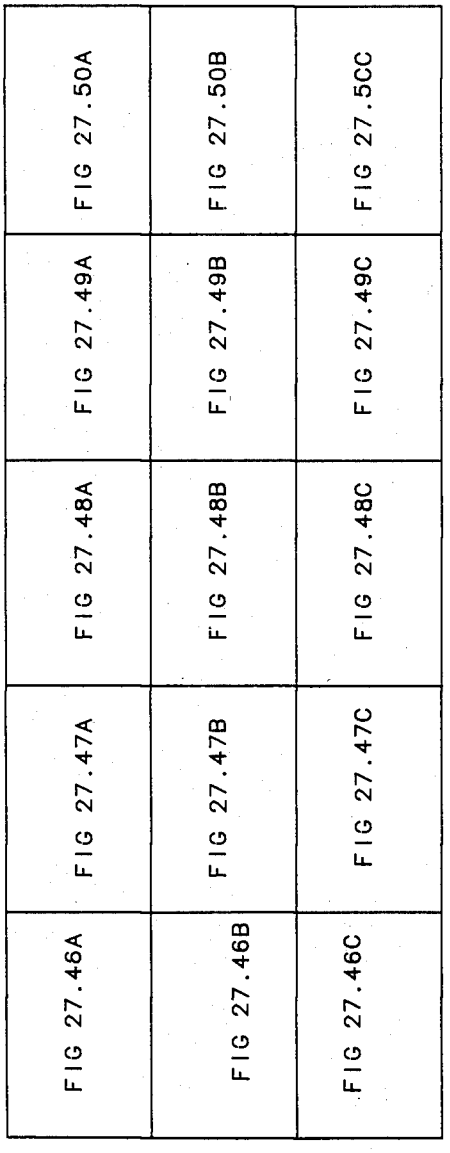
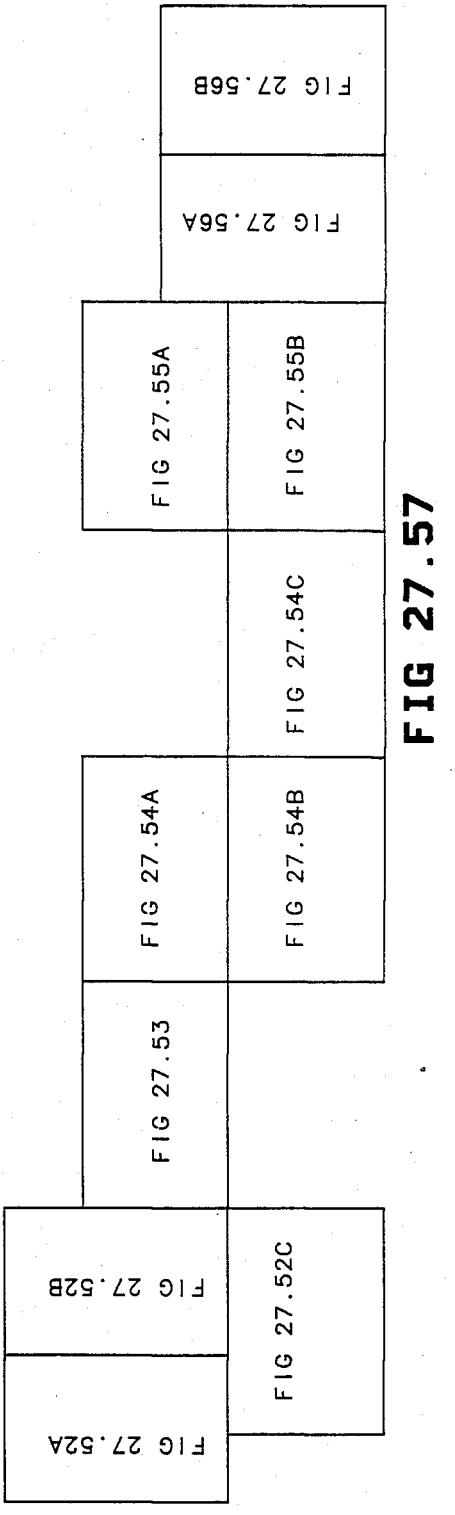


FIG 27.57



A20 SWEEP ADC
85102-60020

Cc

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 23			
2 24	+10VR LSS	A18 A24	NOT USED
3 25			
4 26			
5 27	LLOST LIFSRQ	ADR BUSS A24	
6 28	CLK LRDS	A6 A24	
7 29	LADCSRQ AB0	A24 ADR BUSS	NOT USED
8 30	AB1 AB2	,, ,,	
9 31	AB3 AB4	,, ,,	
10 32	+15V REG +15V REG	POWER BUSS	
11 33	GND GND		
12 34	GND GND		
13 35	-15V REG -15V REG	POWER BUSS	
14 36	+5V REG +5V REG	,, ,,	
15 37	DB0 DB1	DATA BUSS	
16 38	DB2 DB3	,, ,,	
17 39	DB4 DB5	,, ,,	
18 40	DB6 DB7	,, ,,	
19 41	DB8 DB9	,, ,,	
20 42	DB10 DB11	,, ,,	
21 43			
22 44	LSWPTRG	A19	

Cd

FIG 27.52A

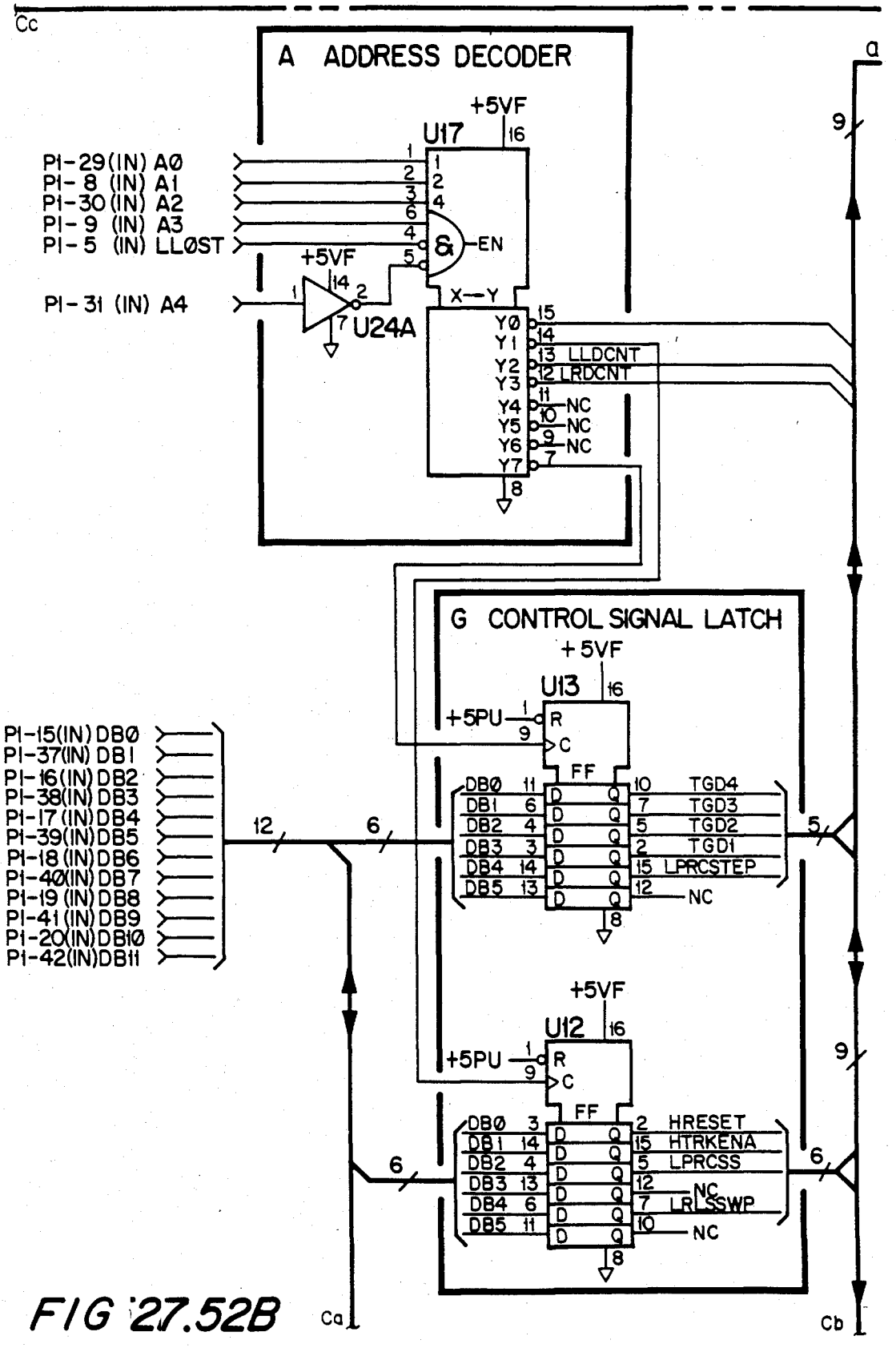

Cc
A ADDRESS DECODER
+5VF
U17
PI-29(IN) A0
PI-8 (IN) A1
PI-30(IN) A2
PI-9 (IN) A3
PI-5 (IN) LLØST
PI-31 (IN) A4
U24A
X-Y
EN
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
LLDCNT
LRDCNT
NC
NC
NC
a
9
G CONTROL SIGNAL LATCH
U13
+5PU
R
C
FF
PI-15(IN) DB0
PI-37(IN) DB1
PI-16(IN) DB2
PI-38(IN) DB3
PI-17(IN) DB4
PI-39(IN) DB5
PI-18(IN) DB6
PI-40(IN) DB7
PI-19(IN) DB8
PI-41(IN) DB9
PI-20(IN) DB10
PI-42(IN) DB11
12
6
TGD4
TGD3
TGD2
TGD1
LPRCSTEP
NC
5
U12
HRESET
HTRKENA
LPRCSS
NC
LRLSSWP
NC
Ca
Cb

FIG 27.52B

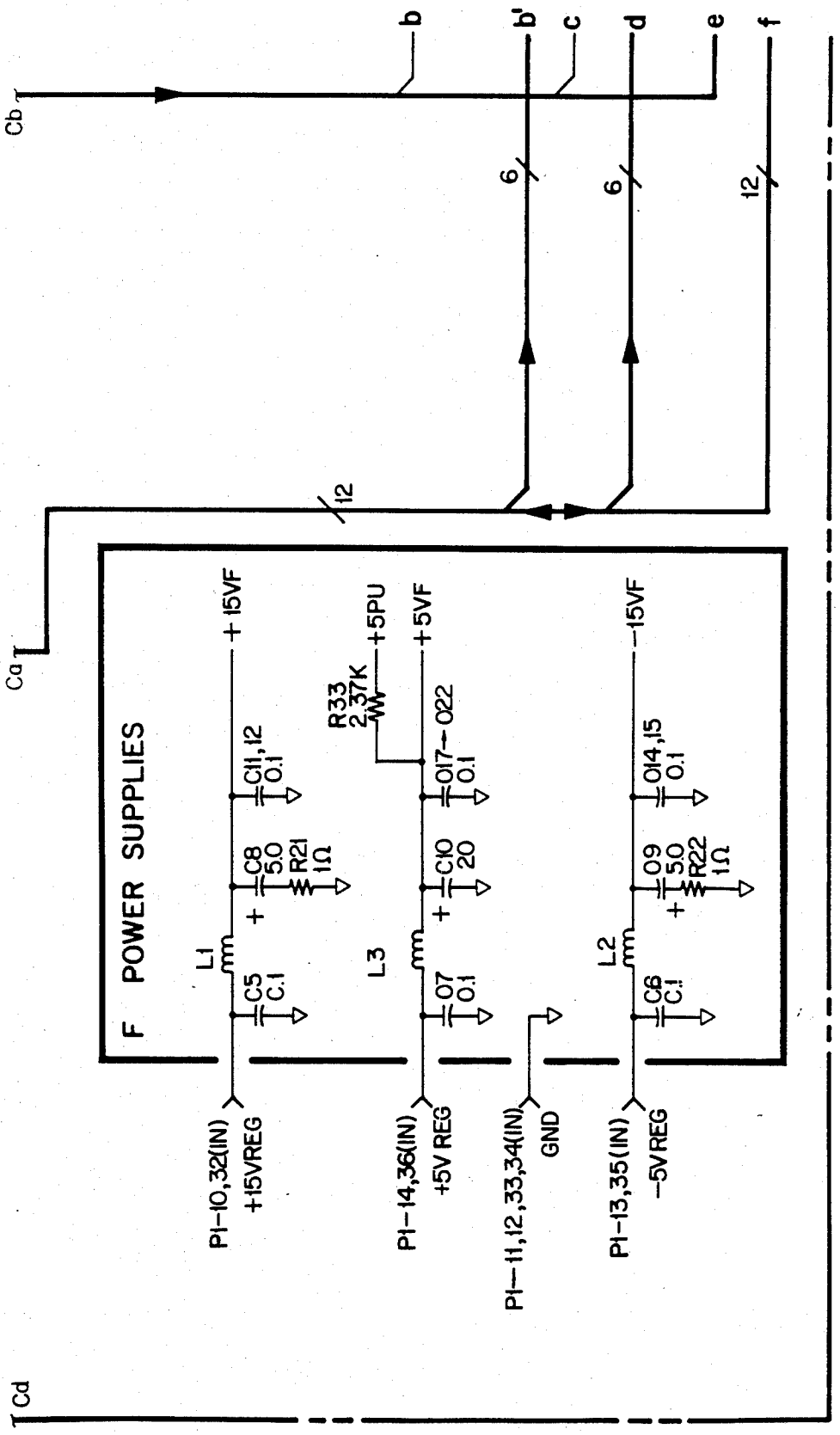

Cb
b
b'
c
d
e
f
6
6
12
12
Ca
F POWER SUPPLIES
+15VF
C11,12 0.1
C8 50
R21 1Ω
L1
C5 .1
P1-10,32(IN) +15VREG
R33 2.37K
+5PU
+5VF
C17-22 0.1
C10 20
L3
C7 0.1
P1-14,36(IN) +5V REG
P1-11,12,33,34(IN) GND
-15VF
C14,15 0.1
C9 50
R22 1Ω
L2
C6 .1
P1-13,35(IN) -5VREG
Cd

FIG 27.52C

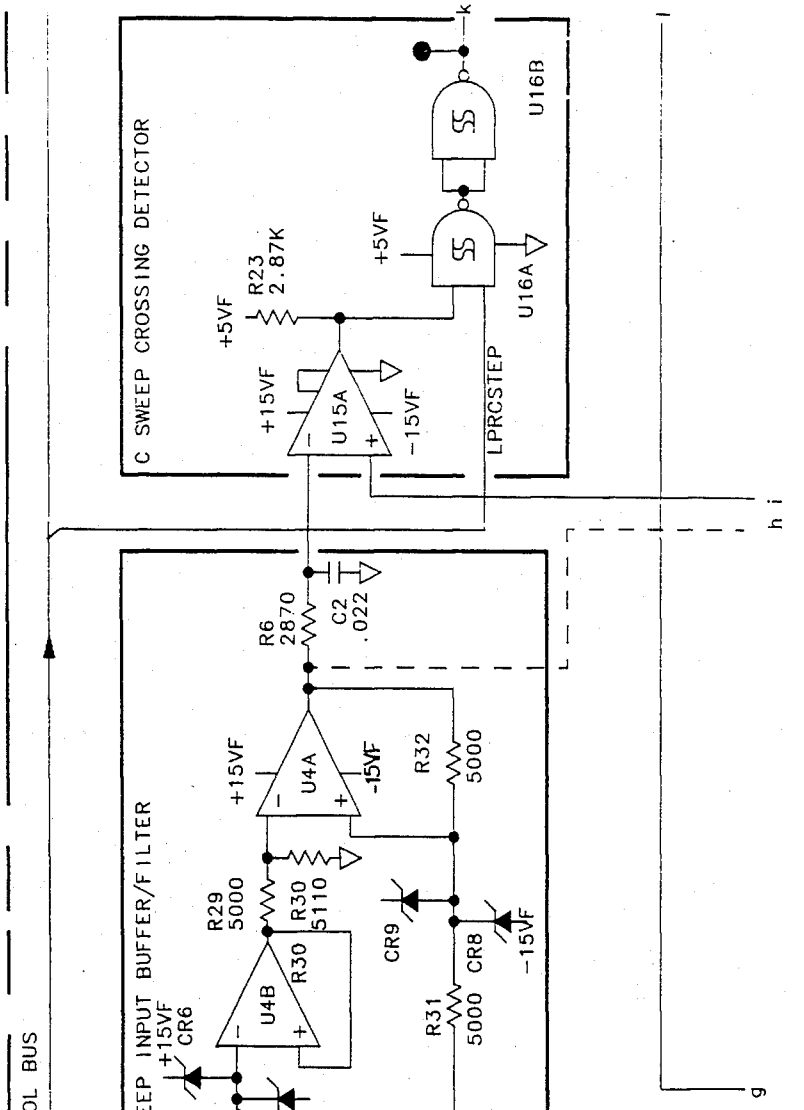


FIG 27.53

ACTIVE COMPONENTS PARTS LISTS (U's and Q's)

REFERENCE DESIGNATORS	PART NUMBER	MANUFACTURER'S PART NUMBER
Q1	1854-0475	
Q2	1855-0301	2N5198
Q3	1855-0420	2N4351
Q4,Q5	1854-0404	
Q6	1853-0007	2N3251
CR6-CR9	1901-0743	1N4004
CR1-CR3	1901-1098	1N4150
U1,U4	1826-0785	1C7228
U2	1826-0705	AM6012
U3	1820-2270	25LS2569
U5	1820-1202	74LS10
U6,U7,U12,U13	1820-1196	74LS174
U8	1820-1144	74LS02
U9	1826-0371	LF256
U10,U20	1820-1112	74LS74
U11	1820-1435	74LS669
U14	1820-1568	74LS125
U15	1826-0026	LM311
U16	1820-1425	74LS132
U17	1820-1216	74LS138
U18,U19,U23	1820-1278	74LS191
U21,U22	1820-1491	74LS367
U24	1820-1199	74LS04
VR1	1902-0692	

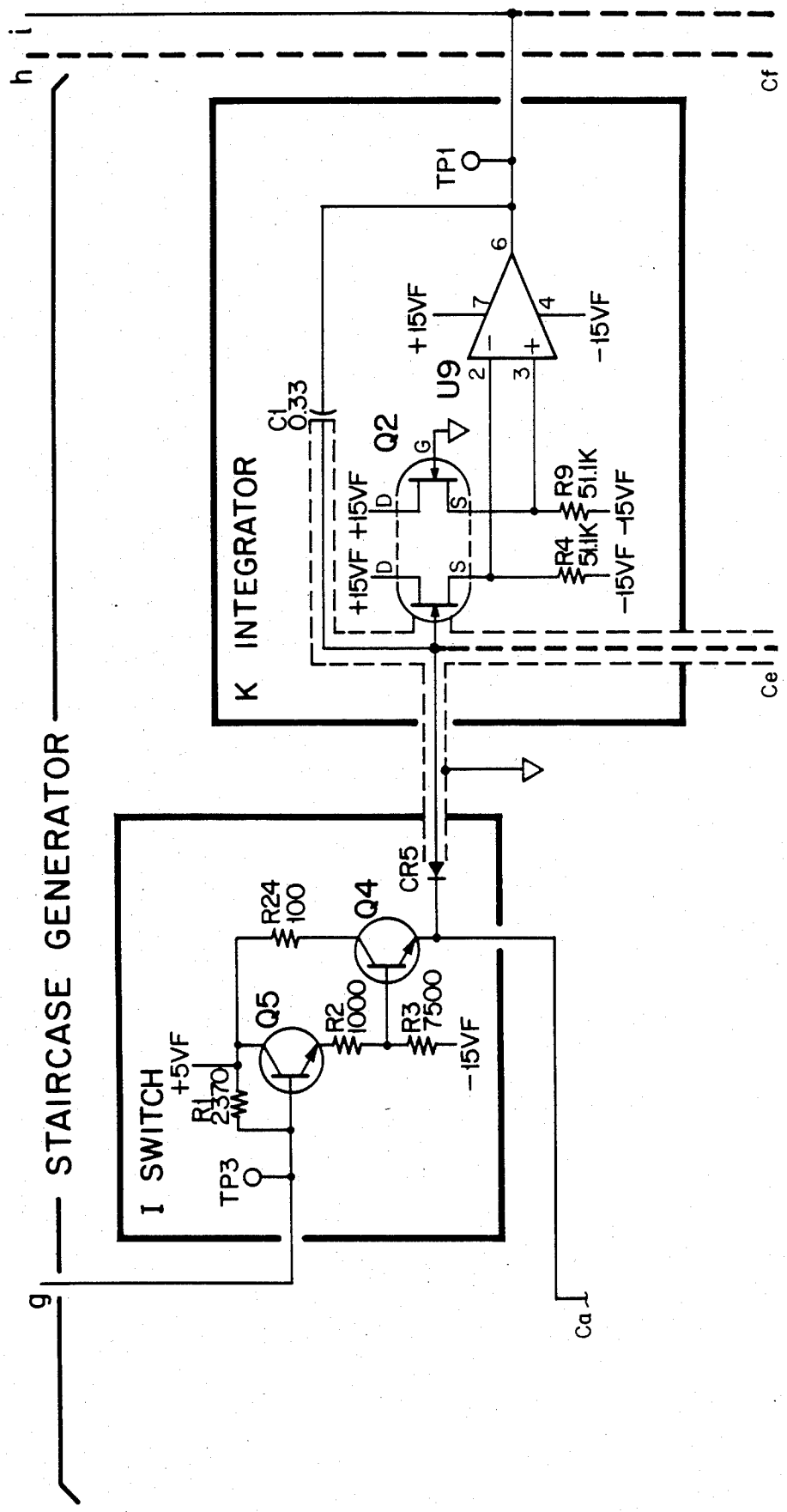

h
i
Cf
TP1
6
+15VF
7
4
-15VF
U9
2
3
C1
0.33
Q2
G
D
S
+15VF +15VF
R9
51.1K
-15VF -15VF
R4
51.1K
K INTEGRATOR
Ce
CR5
R24
100
Q4
Q5
R2
1000
R3
7500
-15VF
+5VF
R1
2370
TP3
I SWITCH
STAIRCASE GENERATOR
g
Ca

FIG 27.54A

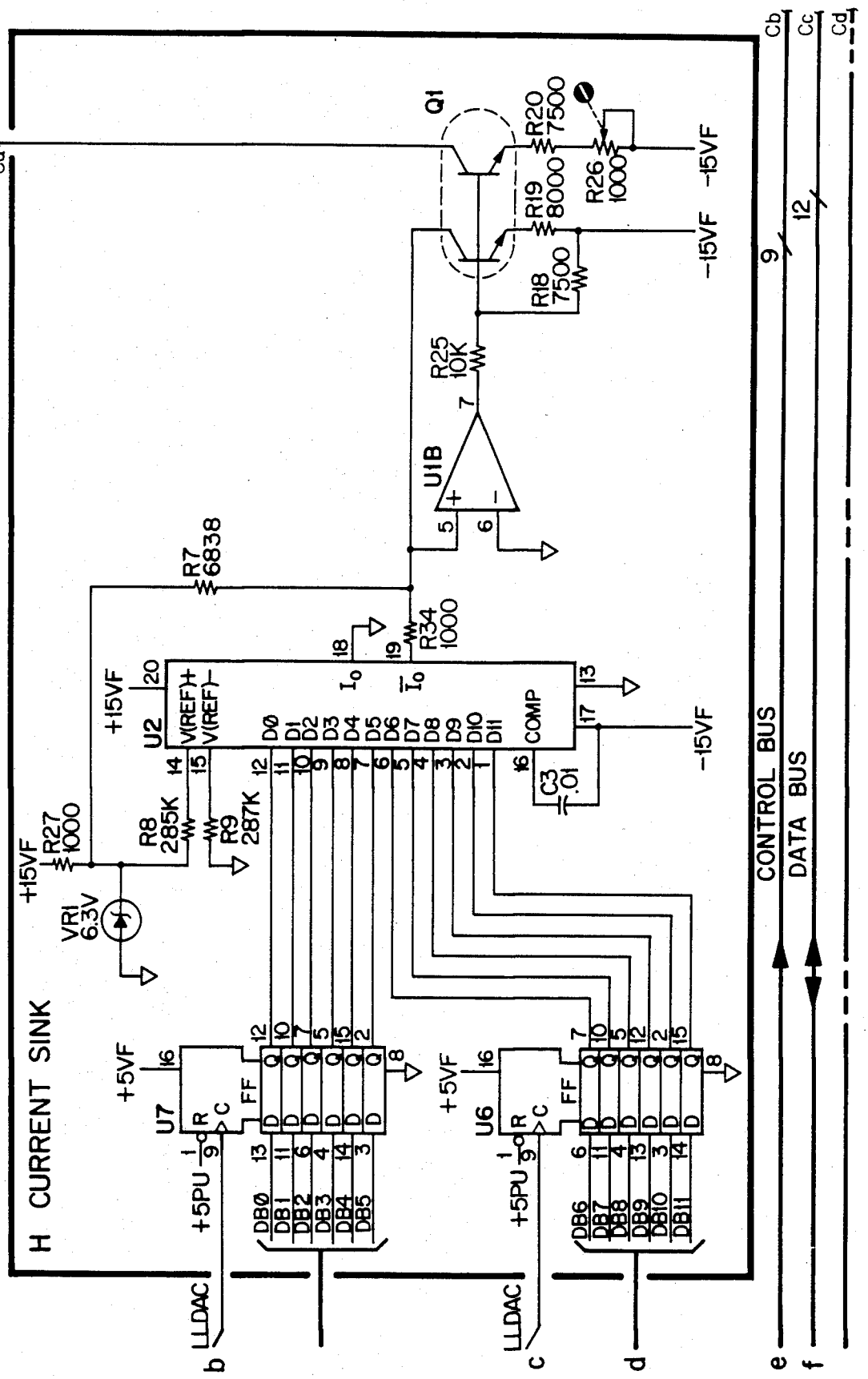

H CURRENT SINK
Ca
Cb
Cc
Cd
Q1
R20 7500
R26 1000
R19 8000
R18 7500
-15VF
R25 10K
U1B
R7 6838
R34 1000
U2
+15VF
V(REF)+
V(REF)-
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11
COMP
C3 .01
R27 1000
R8 285K
R9 287K
VR1 6.3V
U7
U6
+5VF
+5PU
FF
DB0 DB1 DB2 DB3 DB4 DB5
DB6 DB7 DB8 DB9 DB10 DB11
LLDAC
CONTROL BUS
DATA BUS
9
12
b
c
d
e
f

FIG 27.54B

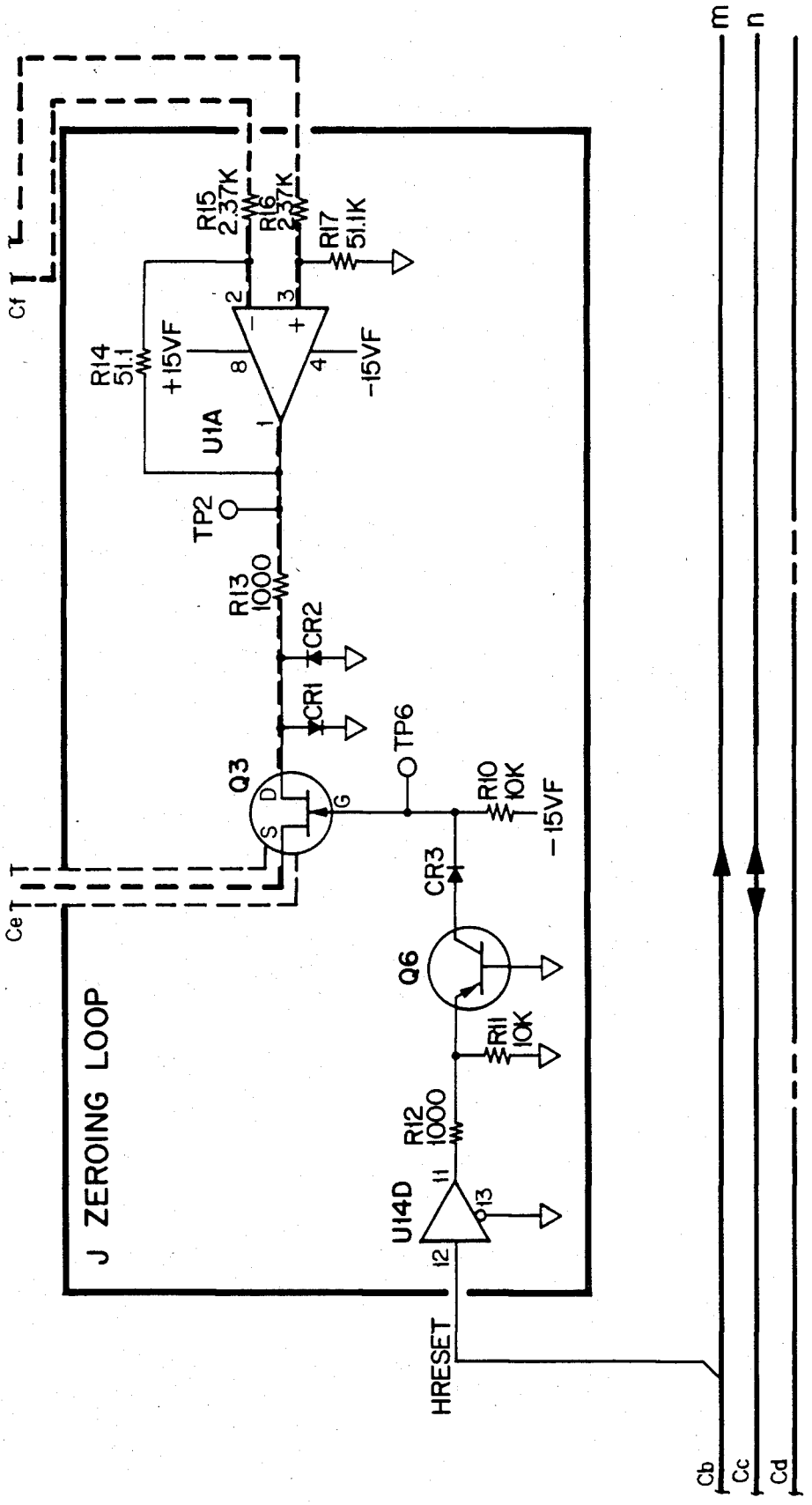

J ZEROING LOOP
Cf
Ce
R15 2.37K
R16 2.37K
R17 51.1K
R14 51.1
+15VF
-15VF
U1A
TP2
R13 1000
CR2
CR1
TP6
Q3
R10 10K
-15VF
CR3
Q6
R11 10K
R12 1000
U14D
HRESET
m
n
Cb
Cc
Cd

FIG 27.54C

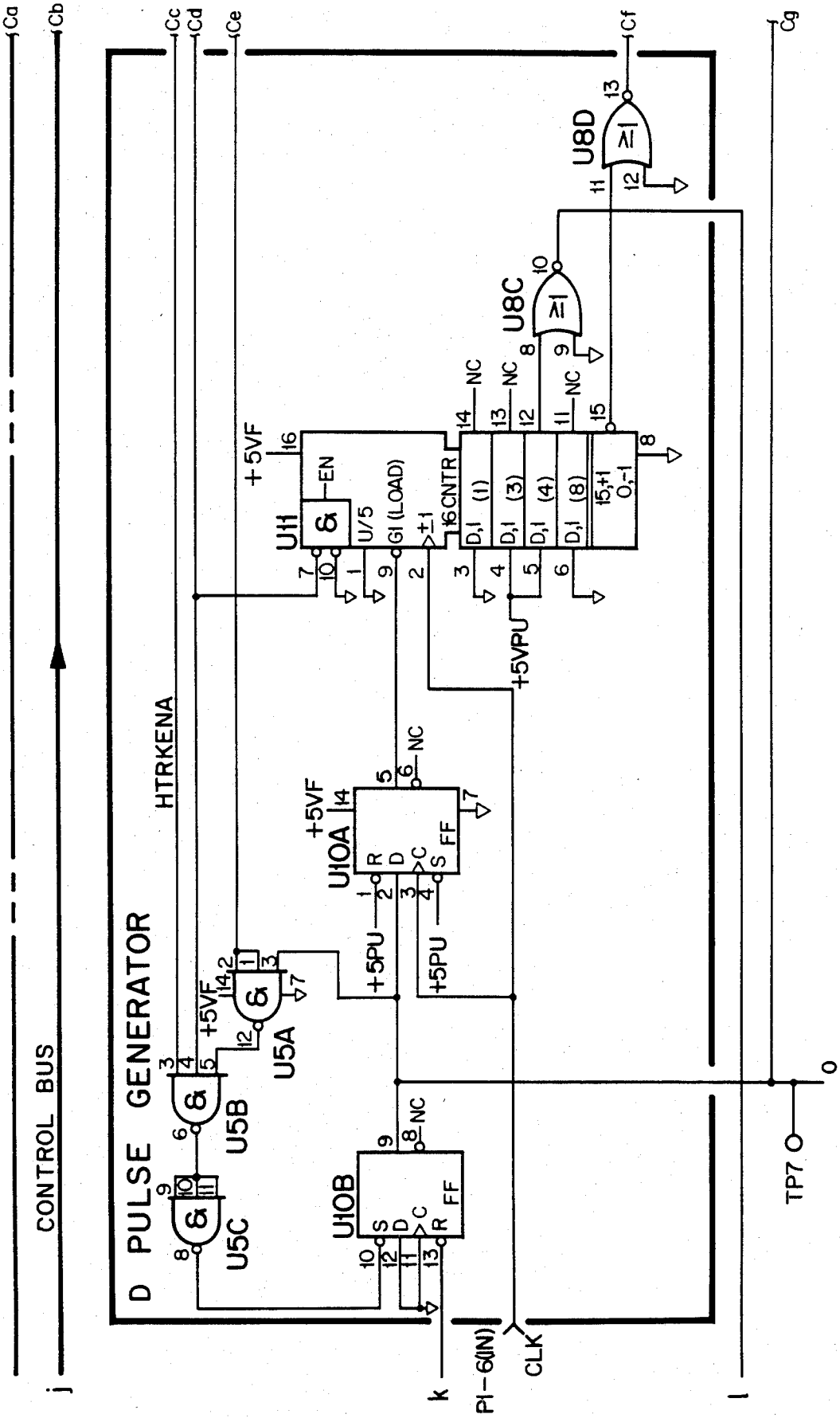

Ca
Cb
Cc
Cd
Ce
Cf
Cg
CONTROL BUS
D PULSE GENERATOR
HTRKENA
U8D
U8C
U11
U10A
U10B
U5A
U5B
U5C
+5VF
+5VPU
+5PU
NC
EN
U/5
GI (LOAD)
CNTR
D,I (1)
D,I (3)
D,I (4)
D,I (8)
15,+1
0,-1
FF
TP7
j
k
P1-6(IN)
CLK
l
O

FIG 27.55A

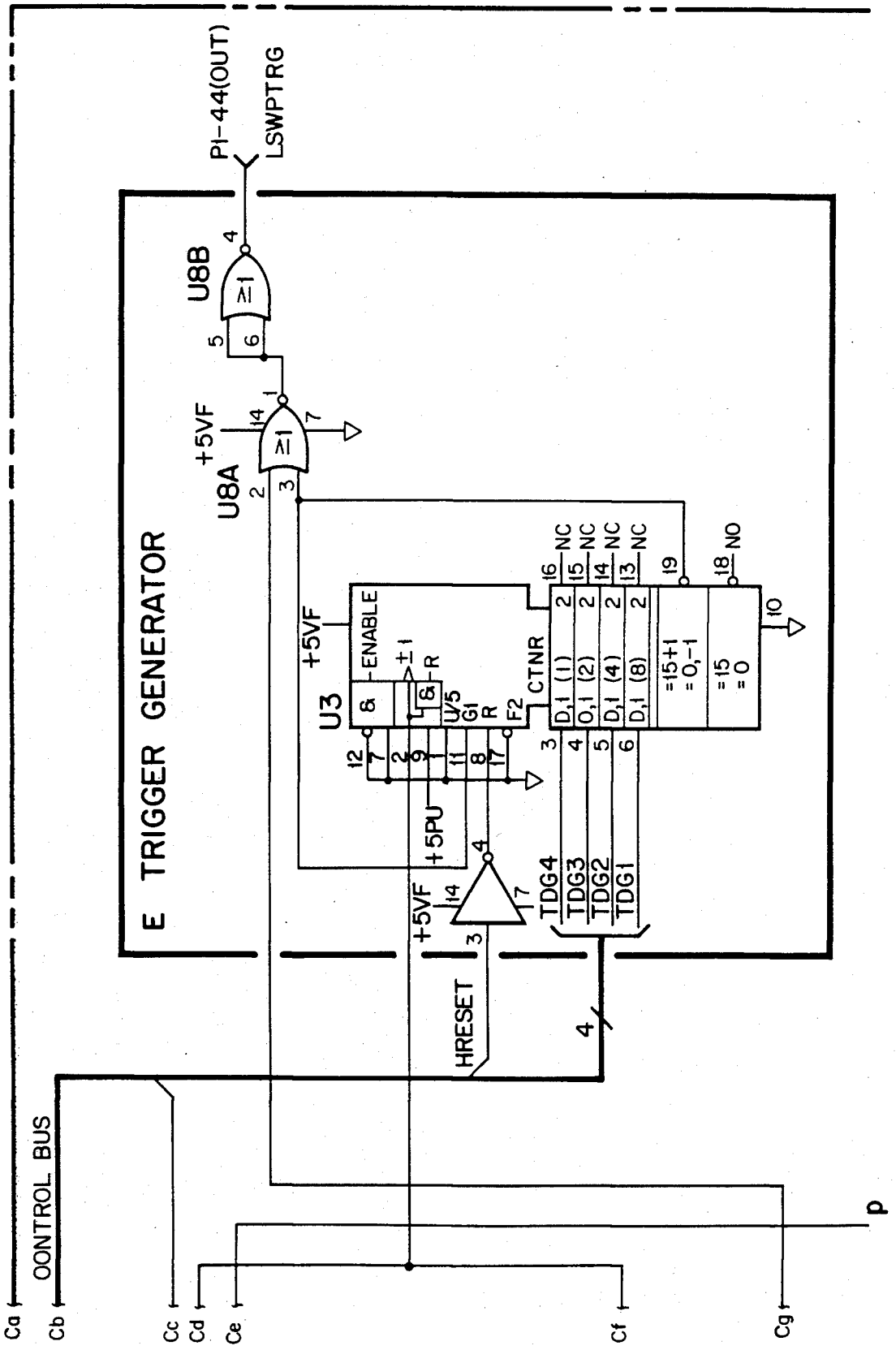

E TRIGGER GENERATOR
P1-44(OUT)
LSWPTRG
U8B
U8A
+5VF
U3
ENABLE
CTNR
TDG4
TDG3
TDG2
TDG1
+5PU
HRESET
CONTROL BUS
Ca
Cb
Cc
Cd
Ce
Cf
Cg
p

FIG 27.55B

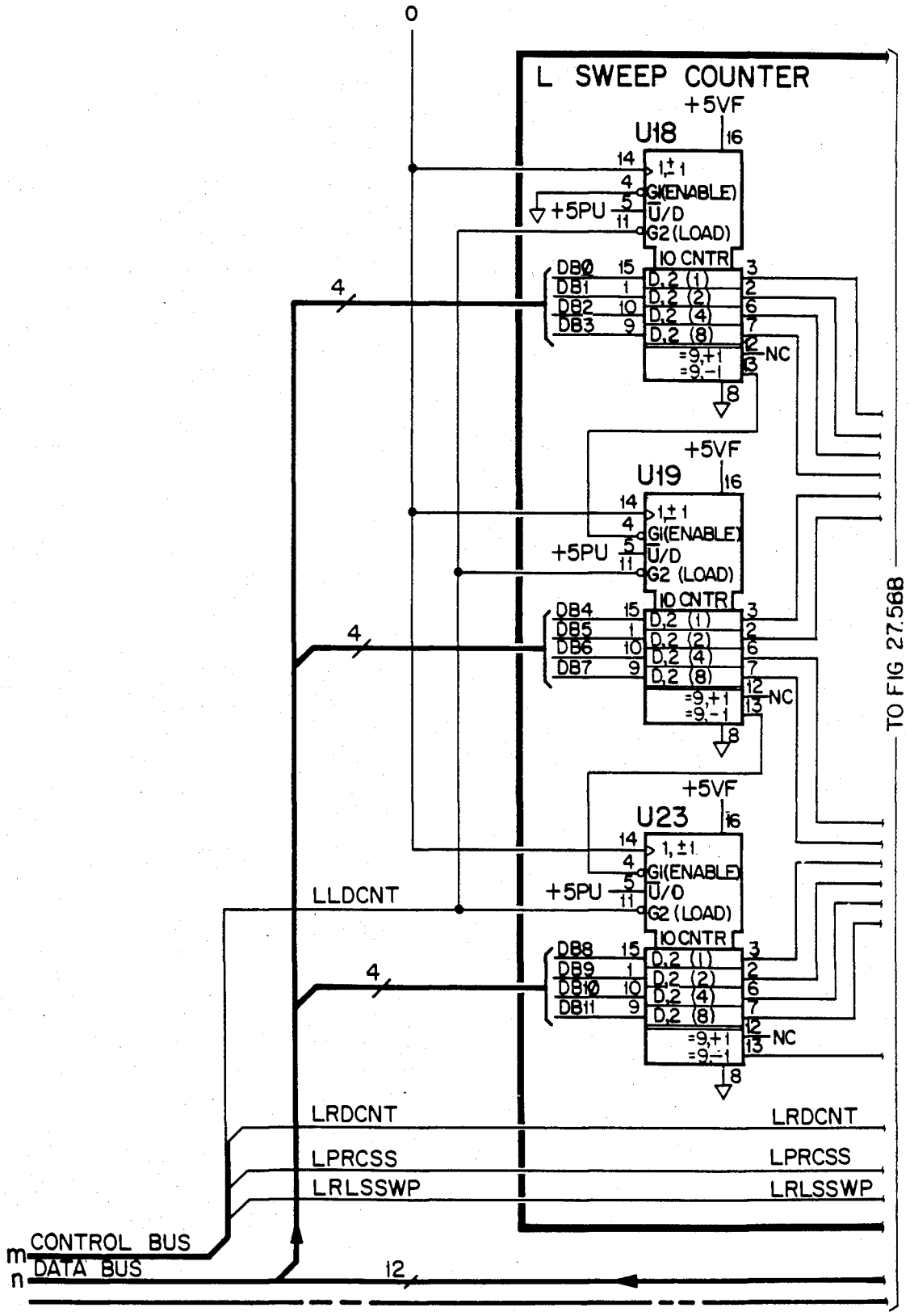

L SWEEP COUNTER
+5VF
U18
U19
U23
10 CNTR
D,2 (1)
D,2 (2)
D,2 (4)
D,2 (8)
=9,+1
=9,-1
NC
G1(ENABLE)
G2 (LOAD)
U/D
+5PU
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
DB8
DB9
DB10
DB11
LLDCNT
LRDCNT
LPRCSS
LRLSSWP
CONTROL BUS
DATA BUS
TO FIG 27.56B

FIG 27.56A

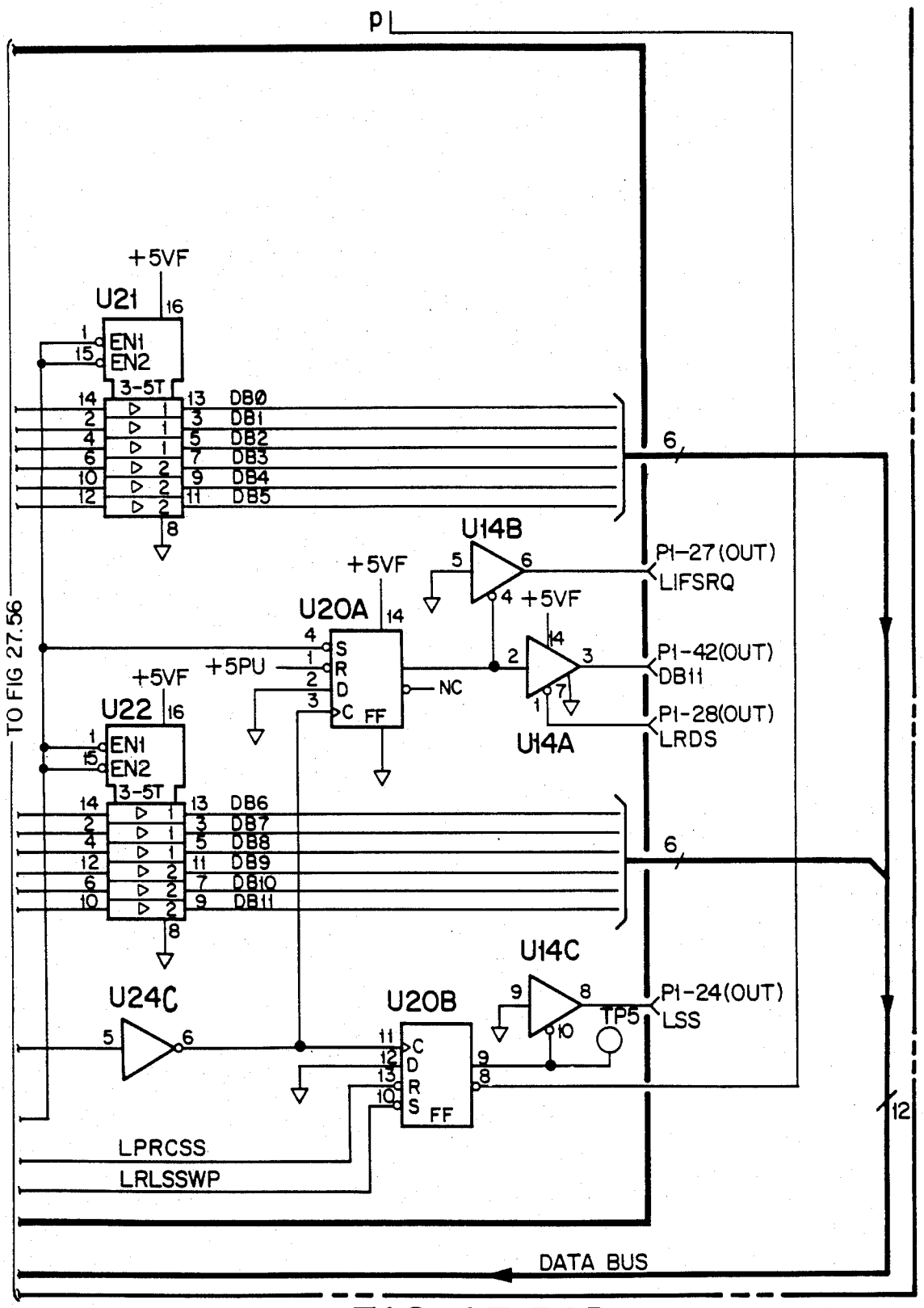

P
+5VF
U21
16
EN1
EN2
3-5T
DB0
DB1
DB2
DB3
DB4
DB5
8
6
U14B
+5VF
P1-27(OUT)
LIFSRQ
U20A
14
+5PU
S
R
D
C
FF
NC
+5VF
14
P1-42(OUT)
DB11
U14A
P1-28(OUT)
LRDS
TO FIG 27.56
+5VF
U22
16
EN1
EN2
3-5T
DB6
DB7
DB8
DB9
DB10
DB11
8
6
U14C
U24C
U20B
P1-24(OUT)
TP5
LSS
C
D
R
S
FF
12
LPRCSS
LRLSSWP
DATA BUS

FIG 27.56B

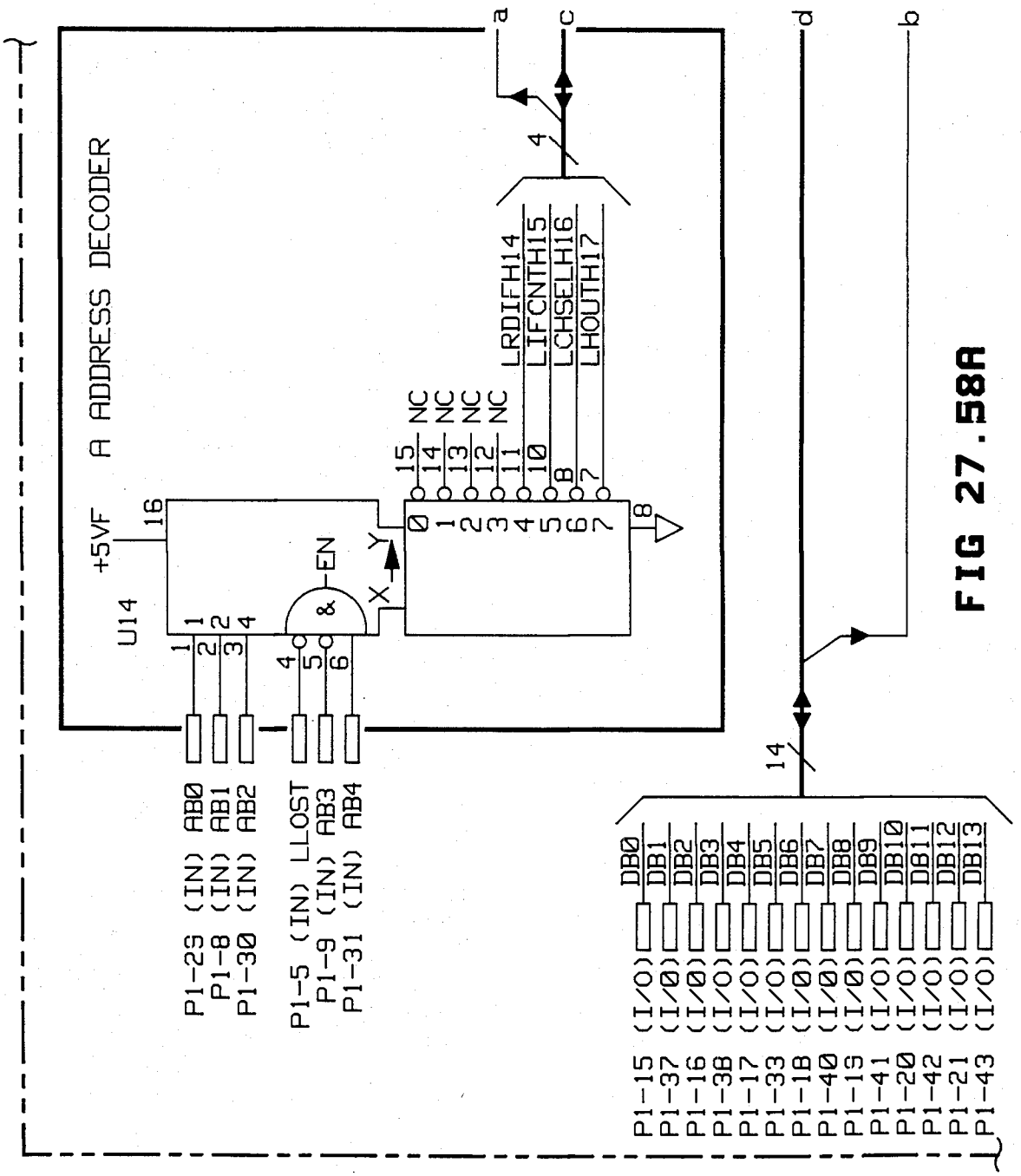

A ADDRESS DECODER
U14
+5VF
16
EN
&
X
Y
1
2
3
4
5
6
7
8
15
14
13
12
11
10
9
NC
NC
NC
NC
LRDIFH14
LIFCNTH15
LCHSELH16
LHOUTH17
a
c
d
b
4
14
P1-25 (IN) AB0
P1-8 (IN) AB1
P1-30 (IN) AB2
P1-5 (IN) LLOST
P1-9 (IN) AB3
P1-31 (IN) AB4
P1-15 (I/O) DB0
P1-37 (I/O) DB1
P1-16 (I/O) DB2
P1-38 (I/O) DB3
P1-17 (I/O) DB4
P1-33 (I/O) DB5
P1-18 (I/O) DB6
P1-40 (I/O) DB7
P1-19 (I/O) DB8
P1-41 (I/O) DB9
P1-20 (I/O) DB10
P1-42 (I/O) DB11
P1-21 (I/O) DB12
P1-43 (I/O) DB13

FIG 27.58A

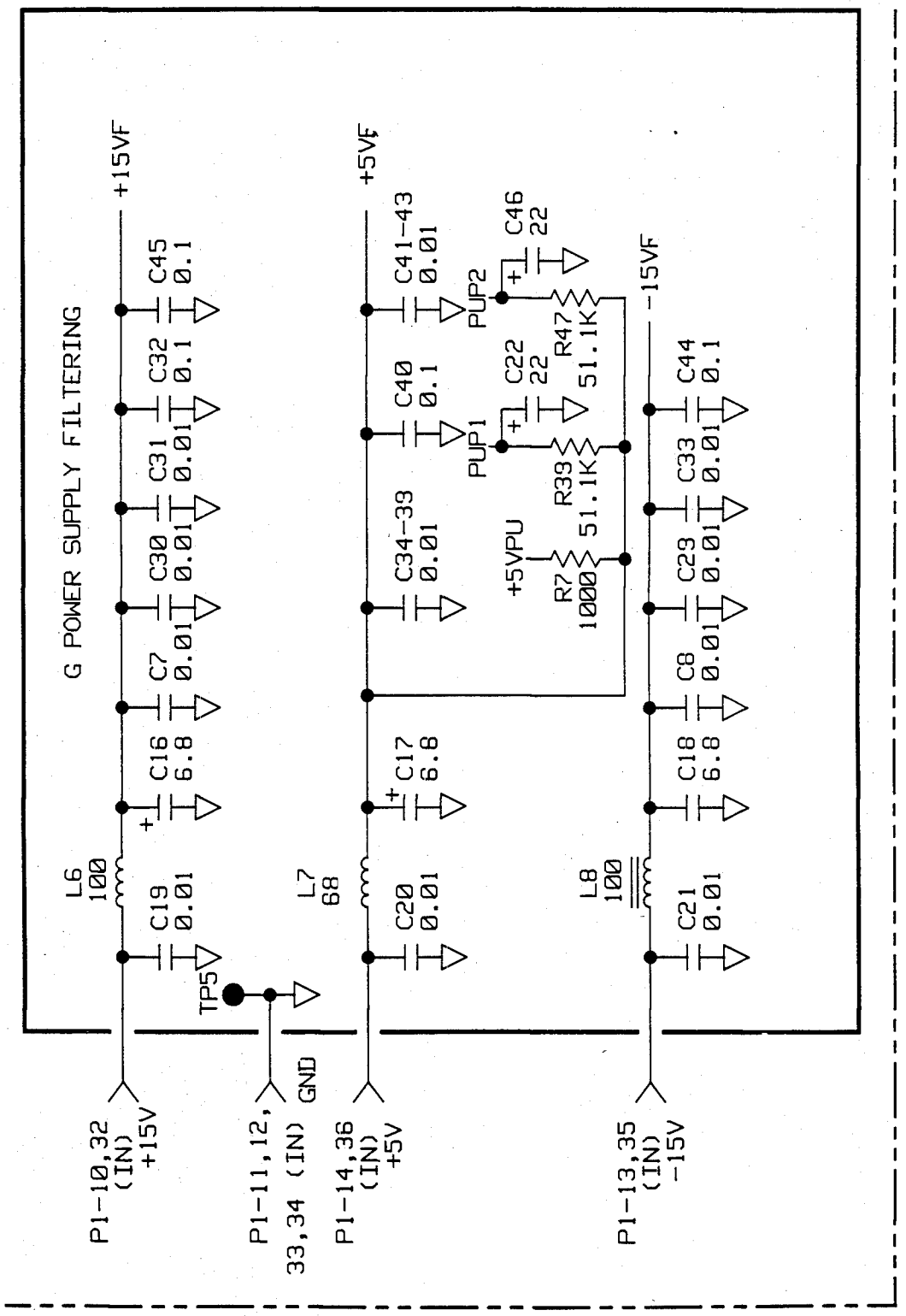

G POWER SUPPLY FILTERING
+15VF
+5VF
-15VF
L6
100
L7
68
L8
100
C19
0.01
C16
6.8
C7
0.01
C30
0.01
C31
0.01
C32
0.1
C45
0.1
C20
0.01
C17
6.8
C34-39
0.01
C40
0.1
C41-43
0.01
C21
0.01
C18
6.8
C8
0.01
C23
0.01
C33
0.01
C44
0.1
PUP1
C22
22
R33
51.1K
+5VPU
R7
1000
PUP2
C46
22
R47
51.1K
TP5
P1-10,32
(IN)
+15V
P1-11,12,
33,34 (IN)
GND
P1-14,36
(IN)
+5V
P1-13,35
(IN)
-15V

FIG 27.58B

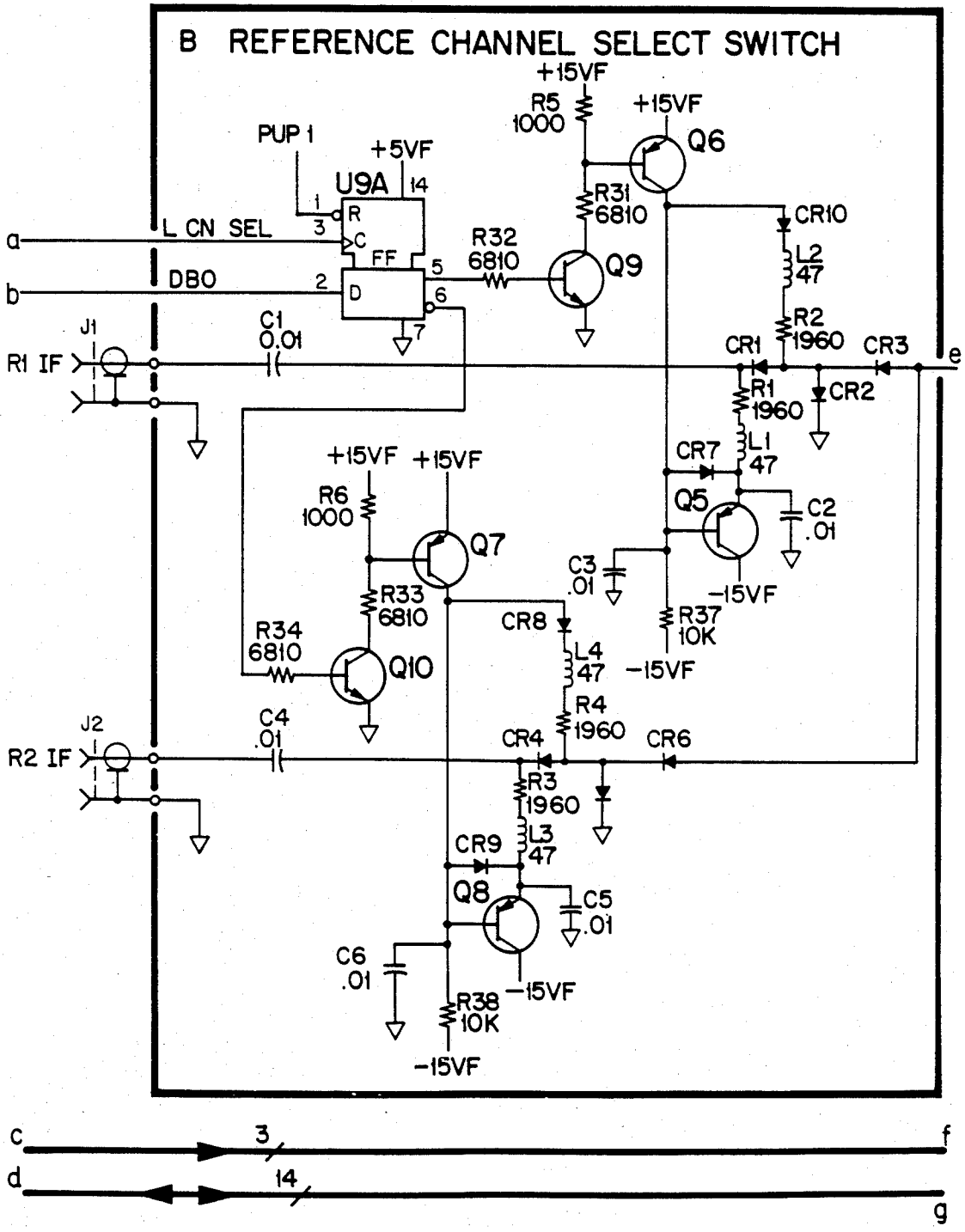

B REFERENCE CHANNEL SELECT SWITCH
+15VF
R5
1000
+15VF
Q6
PUP 1
+5VF
U9A
14
1
3
R
C
FF
5
6
7
2
D
a
L CN SEL
b
DBO
R31
6810
CR10
L2
47
R32
6810
Q9
R2
1960
CR1
CR3
e
J1
R1 IF
C1
0.01
R1
1960
CR2
CR7
L1
47
+15VF
+15VF
R6
1000
Q7
Q5
C2
.01
C3
.01
R33
6810
CR8
R34
6810
Q10
L4
47
-15VF
R37
10K
-15VF
R4
1960
J2
R2 IF
C4
.01
CR4
CR6
R3
1960
L3
47
CR9
Q8
C5
.01
C6
.01
-15VF
R38
10K
-15VF
c
3
f
d
14
g

FIG 27.60A

ACTIVE COMPONENTS PARTS LISTS (U's and Q's)

REFERENCE DESIGNATORS	PART NUMBER	MANUFACTURER'S PART NUMBER
U1	1820-1308	MECL 10116
U2	1820-0026	LM 311
U3	1820-1197	LS 00 (NAND)
U4	1820-1442	LS 290 (CNTR)
U5	1826-0521	TL 072
U6	1820-0693	S74 (FF)
U7	1826-0316	LH 0070 (+10V)
U8	1826-0684	DAC 7541B (DAC)
U9	1820-1195	LS7A
U10	1820-1112	LS74 (FF)
U11, U15	1820-1989	LS393 (CNTR)
U12, U13	1820-1196	LS174
U14	1820-1216	LS138 (DEC)
U16	1820-2024	LS244
U17	1820-1491	LS367
U18		LS02
Q1	1854-0457	
Q2	1854-0477	2N2222A
Q3, Q4	1853-0405	P 2N4209
Q5→Q8	1853-0451	P 2N3799
Q9, Q10	1854-0477	P 2N2222A

FIG 27.60B

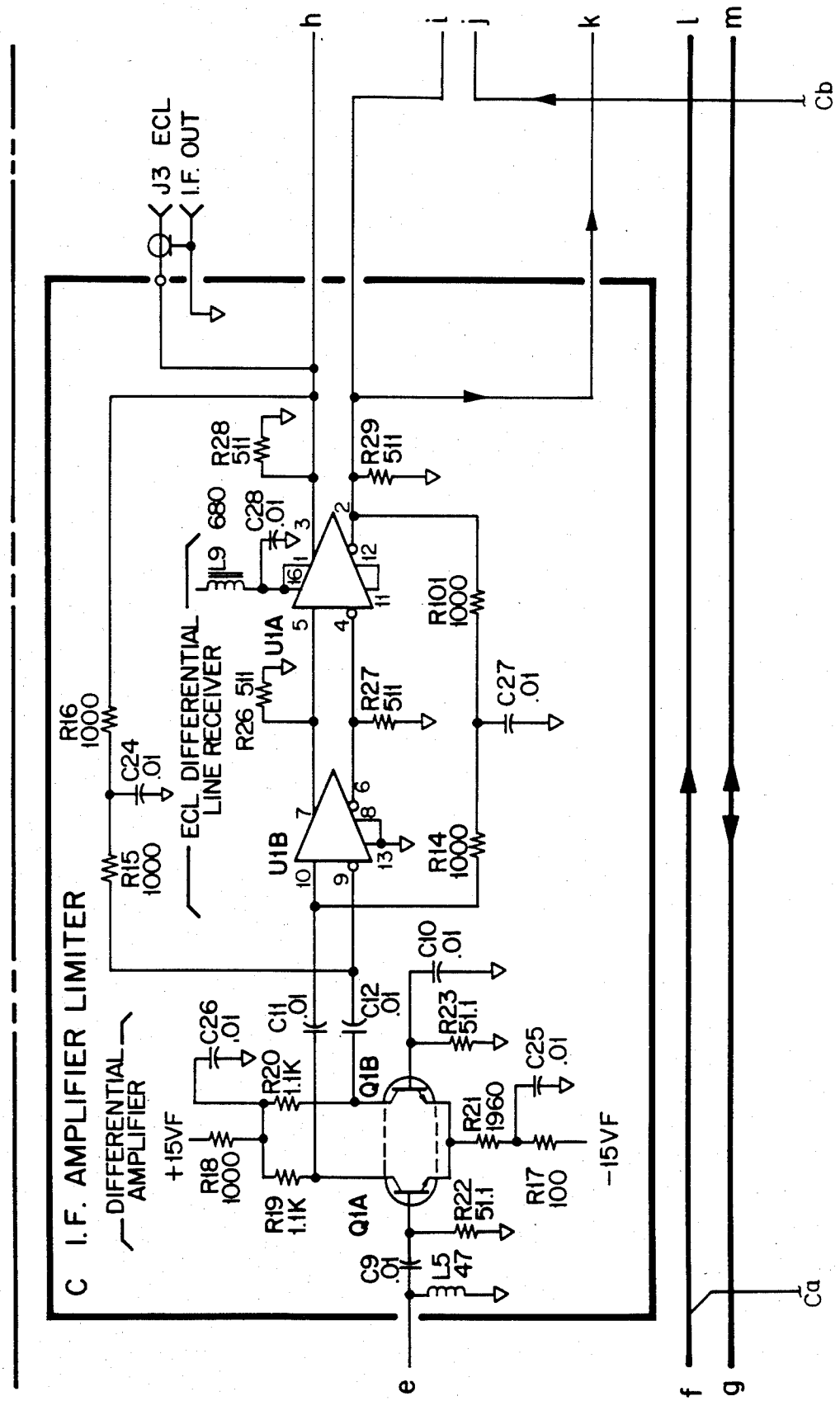

C I.F. AMPLIFIER LIMITER
DIFFERENTIAL AMPLIFIER
ECL DIFFERENTIAL LINE RECEIVER
J3 ECL I.F. OUT
+15VF
-15VF
U1A
U1B
Q1A
Q1B
R16 1000
R15 1000
R14 1000
R101 1000
R18 1000
R17 100
R19 1.1K
R20 1.1K
R21 1960
R22 51.1
R23 51.1
R26 511
R27 511
R28 511
R29 511
C24 .01
C25 .01
C26 .01
C27 .01
C28 .01
C9 .01
C10 .01
C11 .01
C12 .01
L5 47
L9 680
h
i
j
k
l
m
e
f
g
Ca
Cb

FIG 27.61A

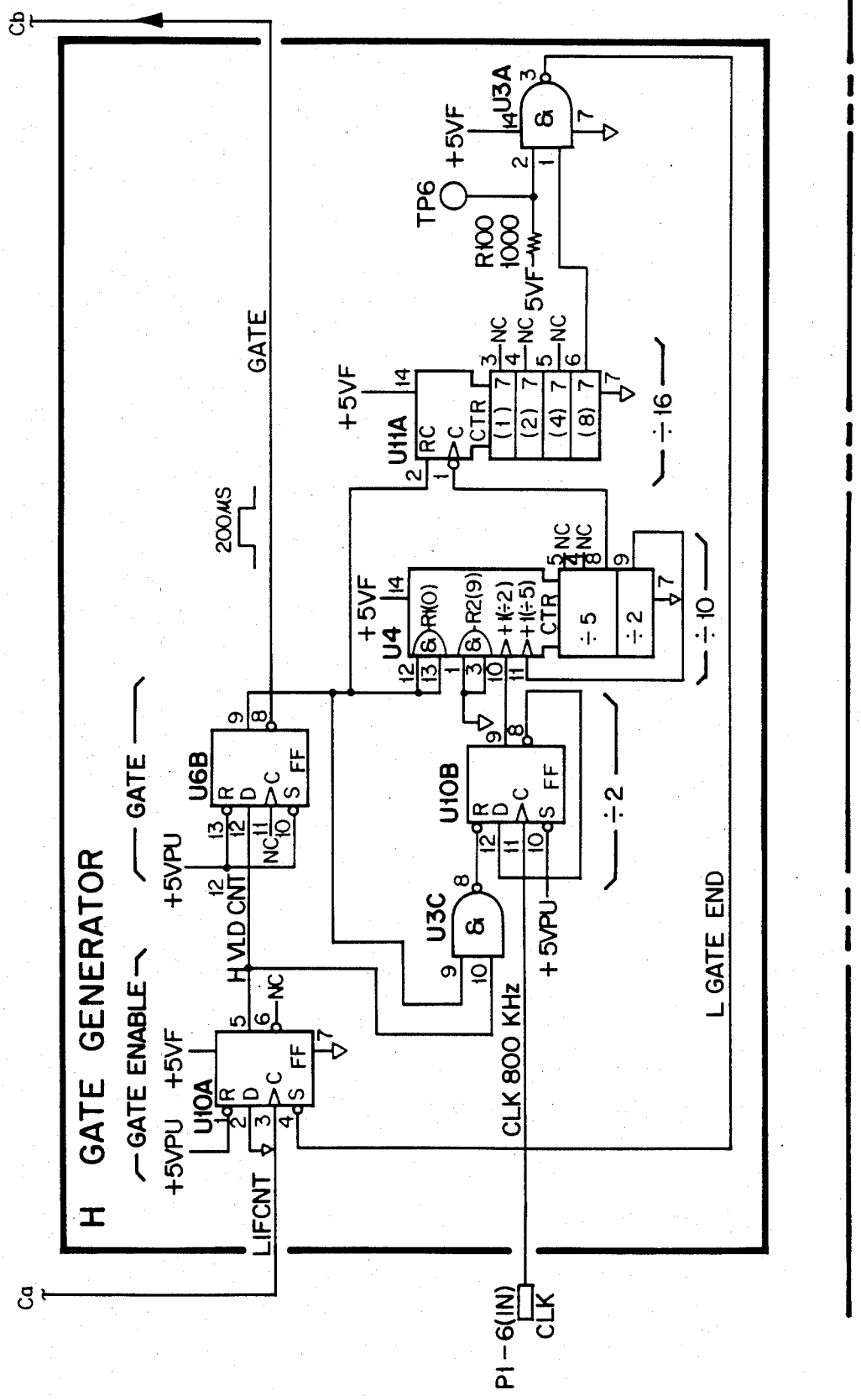

H GATE GENERATOR
GATE ENABLE
+5VPU
+5VF
U10A
R
D
C
S
FF
LIFCNT
H VLD CNT
NC
U6B
GATE
+5VPU
200μS
+5VF
U11A
RC
C
CTR
(1) 7
(2) 7
(4) 7
(8) 7
NC
÷16
+5VF
U4
R(0)
R2(9)
+1(÷2)
+1(÷5)
CTR
÷5
÷2
NC
÷10
U10B
÷2
U3C
&
CLK 800 KHz
+5VPU
L GATE END
U3A
&
+5VF
TP6
R100
1000
5VF
Cb
Ca
P1-6(IN)
CLK

FIG 27.61B

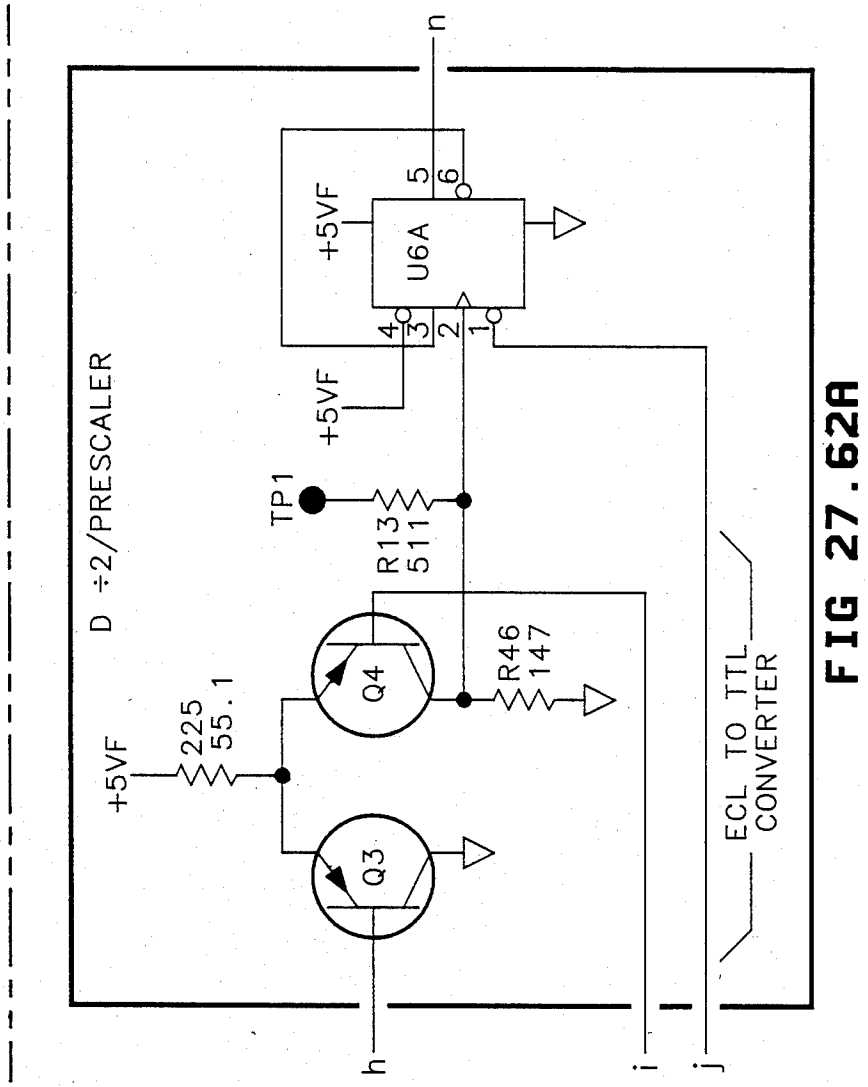

D ÷2/PRESCALER
+5VF
225
55.1
Q4
Q3
R46
147
TP1
R13
511
+5VF
+5VF
U6A
5
6
4
3
2
1
n
h
i
j
ECL TO TTL
CONVERTER

FIG 27.62A

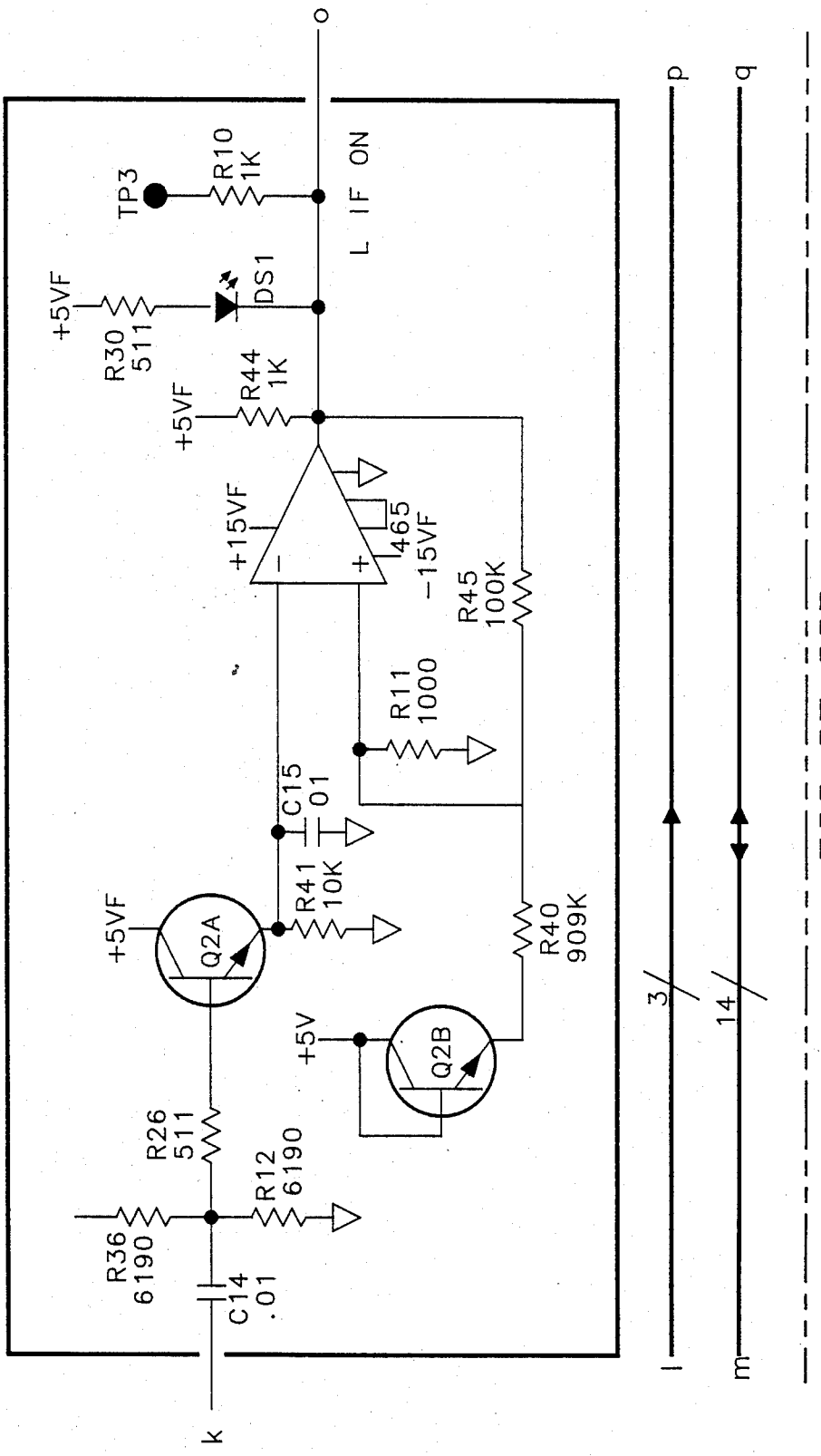

o
TP3
R10
1K
L IF ON
+5VF
R30
511
DS1
+5VF
R44
1K
+15VF
465
−15VF
R45
100K
R11
1000
C15
01
R41
10K
+5VF
Q2A
R40
909K
+5V
Q2B
R26
511
R12
6190
R36
6190
C14
.01
k
p
q
3
14
l
m

FIG 27.62B

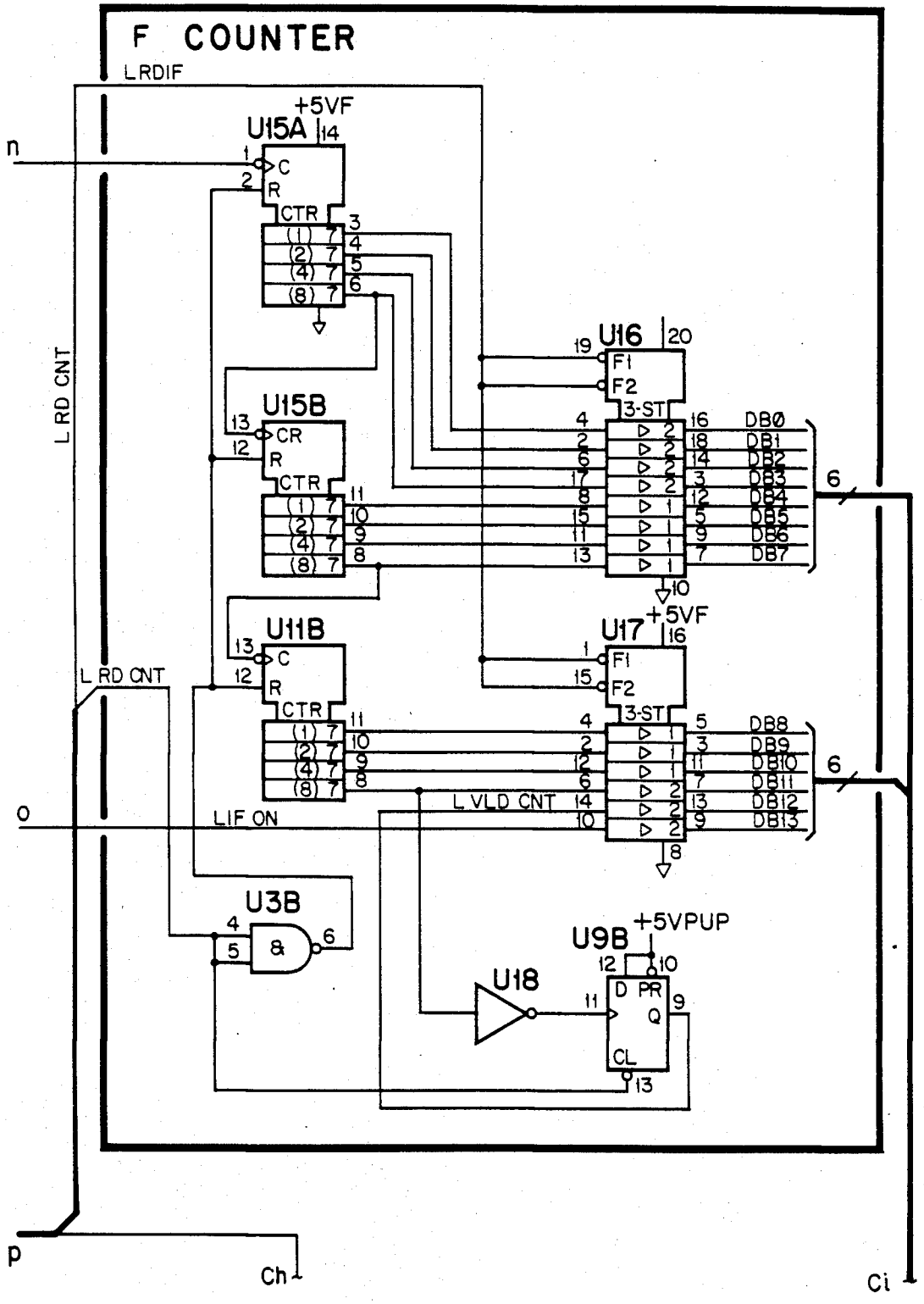

F COUNTER
LRDIF
+5VF
U15A
n
C
R
CTR
(1)
(2)
(4)
(8)
U16
F1
F2
3-ST
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
U15B
CR
L RD CNT
U11B
U17
+5VF
DB8
DB9
DB10
DB11
DB12
DB13
L VLD CNT
o
LIF ON
U3B
&
U9B
+5VPUP
D PR
Q
CL
U18
p
Ch
Ci

FIG 27.63A

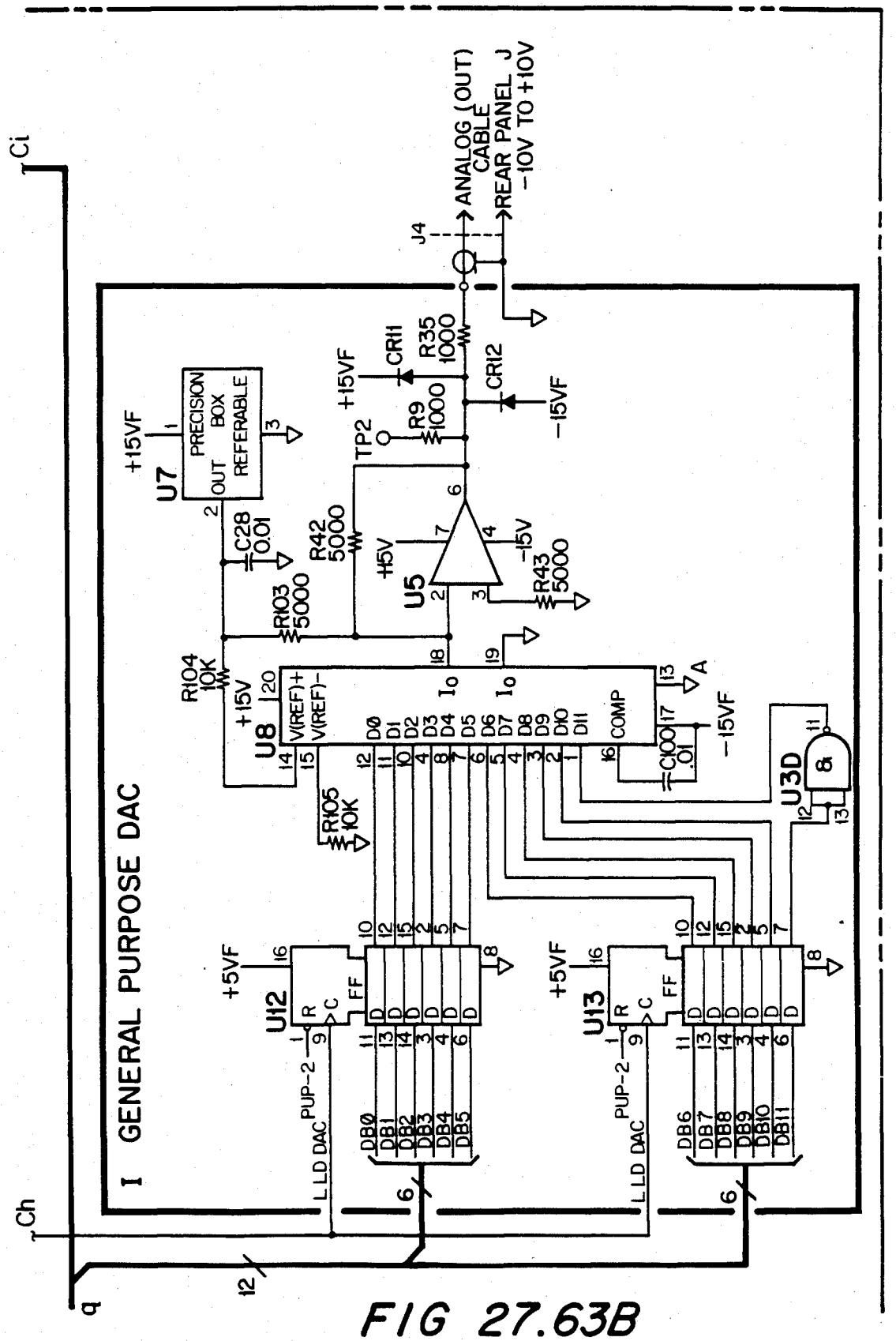

I GENERAL PURPOSE DAC
Ci
Ch
q
12
J4
ANALOG (OUT) CABLE
REAR PANEL J
-10V TO +10V
CR11
CR12
R35 1000
R9 1000
TP2
+15VF
-15VF
U7
PRECISION BOX REFERABLE
C28 0.01
R42 5000
R43 5000
R103 5000
U5
+15V
-15V
R104 10K
R105 10K
U8
V(REF)+
V(REF)-
COMP
C100 .01
U3D
U12
U13
FF
PUP-2
L LD DAC
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
DB8
DB9
DB10
DB11

FIG 27.63B

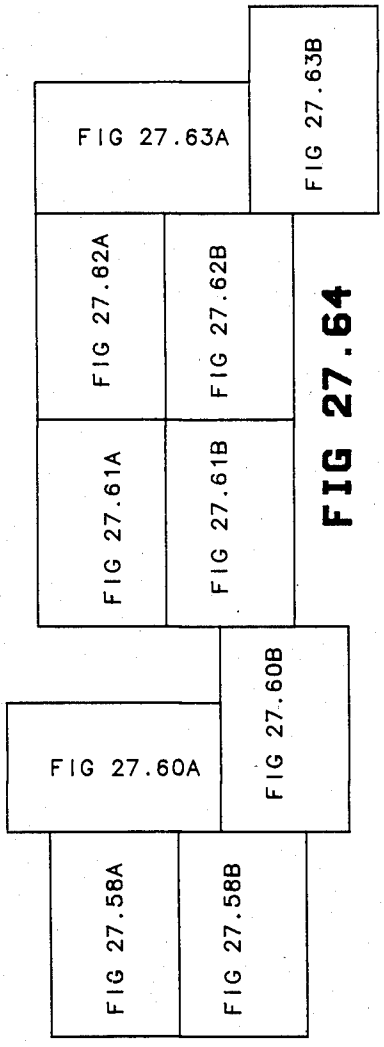


FIG 27.64

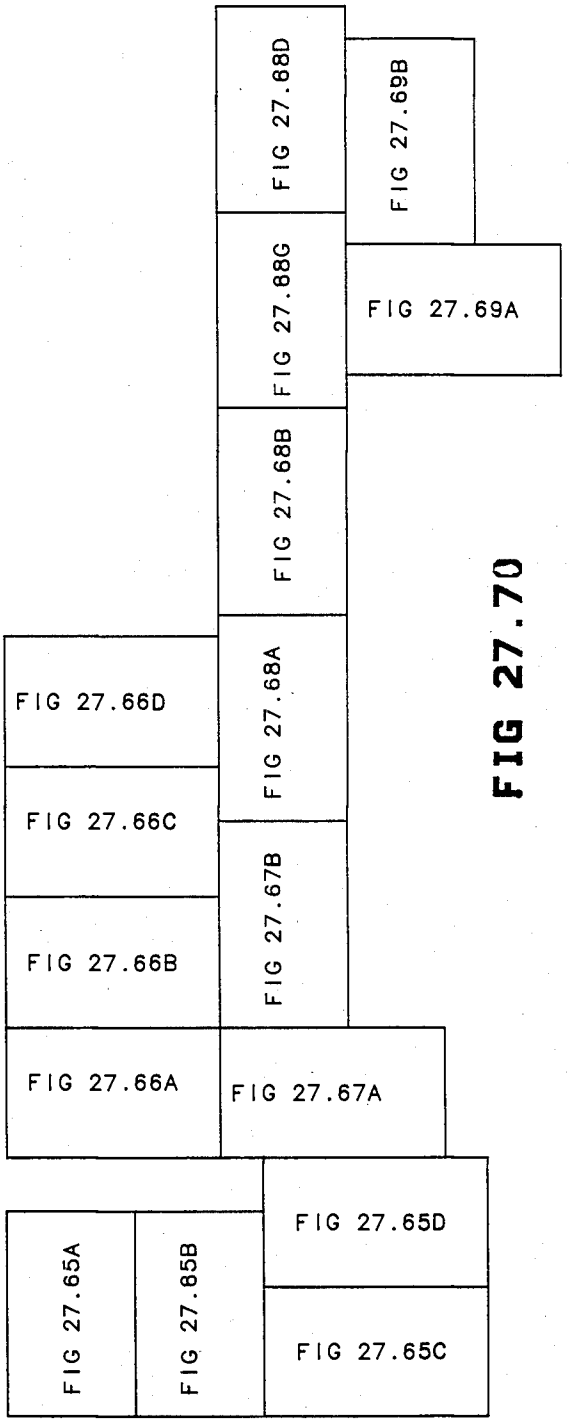


FIG 27.70

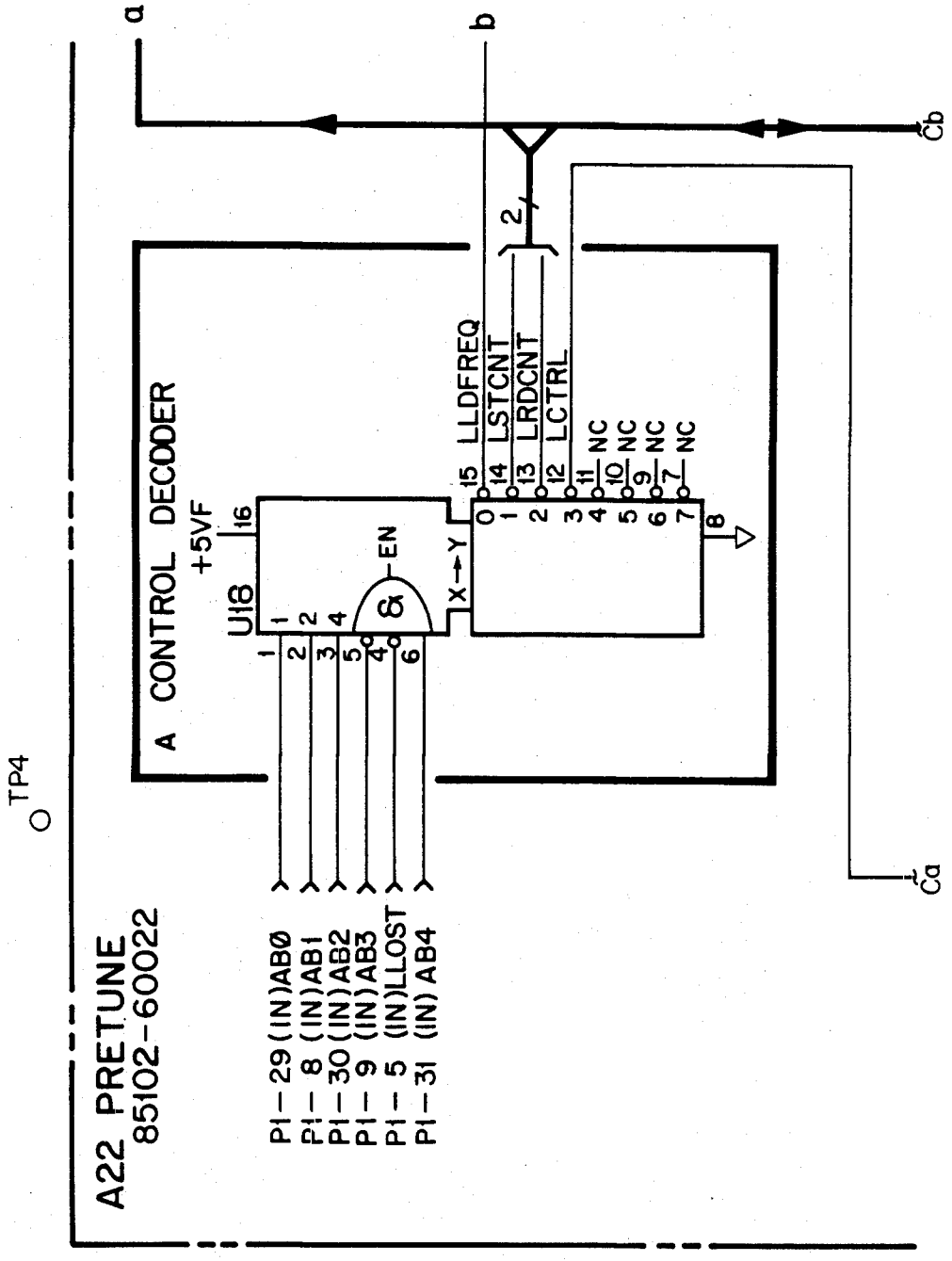

a
b
Cb
Ca
2
A CONTROL DECODER
+5VF
16
U18
EN
X→Y
LLDFREQ
LSTCNT
LRDCNT
LCTRL
NC
NC
NC
NC
TP4
A22 PRETUNE
85102-60022
P1-29 (IN)AB0
P1-8 (IN)AB1
P1-30 (IN)AB2
P1-9 (IN)AB3
P1-5 (IN)LLOST
P1-31 (IN) AB4

FIG 27.65A

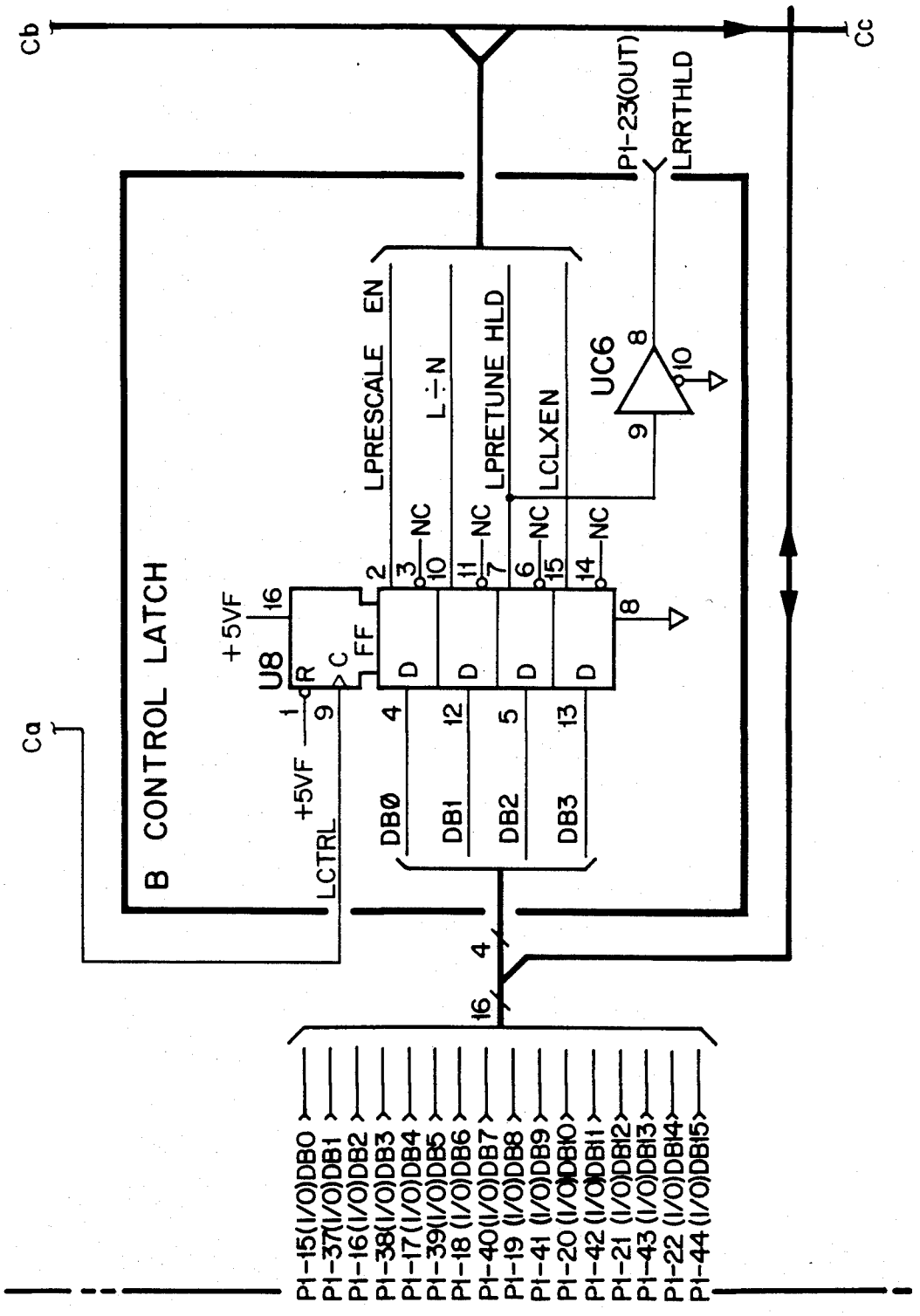

Cb
Cc
P1-23(OUT)
LRRTHLD
LPRESCALE EN
L÷N
LPRETUNE HLD
LCLXEN
UC6
B CONTROL LATCH
+5VF
U8
FF
R
C
D
NC
Ca
LCTRL
DB0
DB1
DB2
DB3
P1-15(I/O)DB0
P1-37(I/O)DB1
P1-16(I/O)DB2
P1-38(I/O)DB3
P1-17(I/O)DB4
P1-39(I/O)DB5
P1-18 (I/O)DB6
P1-40(I/O)DB7
P1-19 (I/O)DB8
P1-41 (I/O)DB9
P1-20 (I/O)DB10
P1-42 (I/O)DB11
P1-21 (I/O)DB12
P1-43 (I/O)DB13
P1-22 (I/O)DB14
P1-44 (I/O)DB15

FIG 27.65B

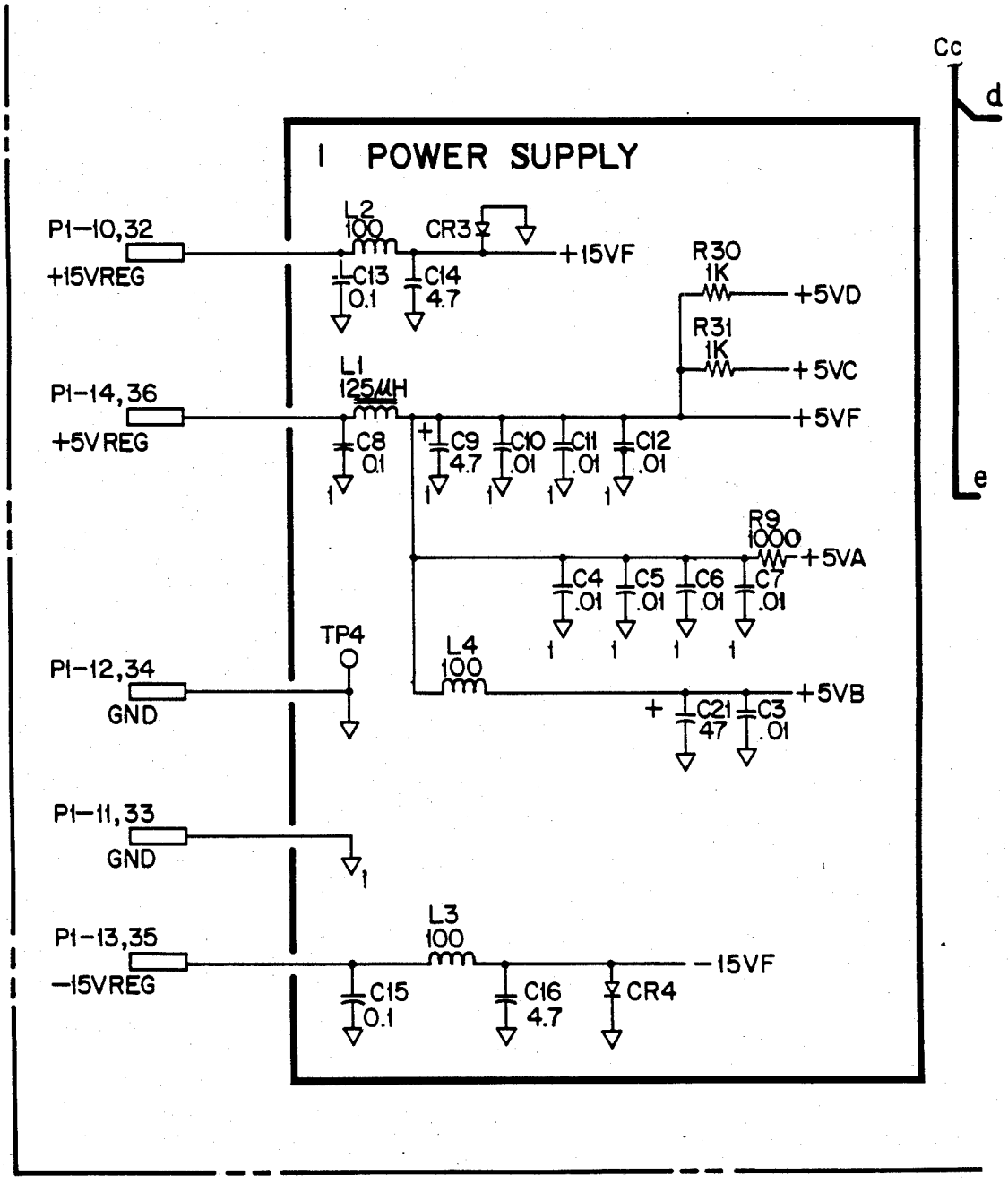

Cc
d
e
1 POWER SUPPLY
P1-10,32
+15VREG
L2
100
CR3
+15VF
C13
0.1
C14
4.7
R30
1K
+5VD
R31
1K
+5VC
P1-14,36
+5VREG
L1
125μH
+5VF
C8
.01
C9
4.7
C10
.01
C11
.01
C12
.01
R9
1000
+5VA
C4
.01
C5
.01
C6
.01
C7
.01
TP4
P1-12,34
GND
L4
100
+5VB
C21
47
C3
.01
P1-11,33
GND
P1-13,35
-15VREG
L3
100
-15VF
C15
0.1
C16
4.7
CR4

FIG 27.65C

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 23	NC LPRTHLD		 B+
2 24	NC NC		
3 25	NC NC		
4 26	NC NC		
5 27	LLOST LIFSRQ		
6 28	CLK LRDS		F G
7 29	LLOST ABO		+ +
8 30	AB1 AB2		+ +
9 31	AB3 AB4		+ +
10 32	+15V REG +15V REG		B
11 33	GRD GND		B
12 34	GND GND		B
13 35	-15V REG -15V REG		B
14 36	+5V REG +5V REG		B
15 37	DBO DB1		B C B C
16 38	DB2 DB3		B C B C
17 39	DB4 DB5		C B C B
18 40	DB6 DB7		C B C B
19 41	DB8 DB9		C B C B
20 42	DB10 DB11		C B C B
21 43	DB12 DB13		B B
22 44	DB14 DB15		C B B

FIG 27.65D

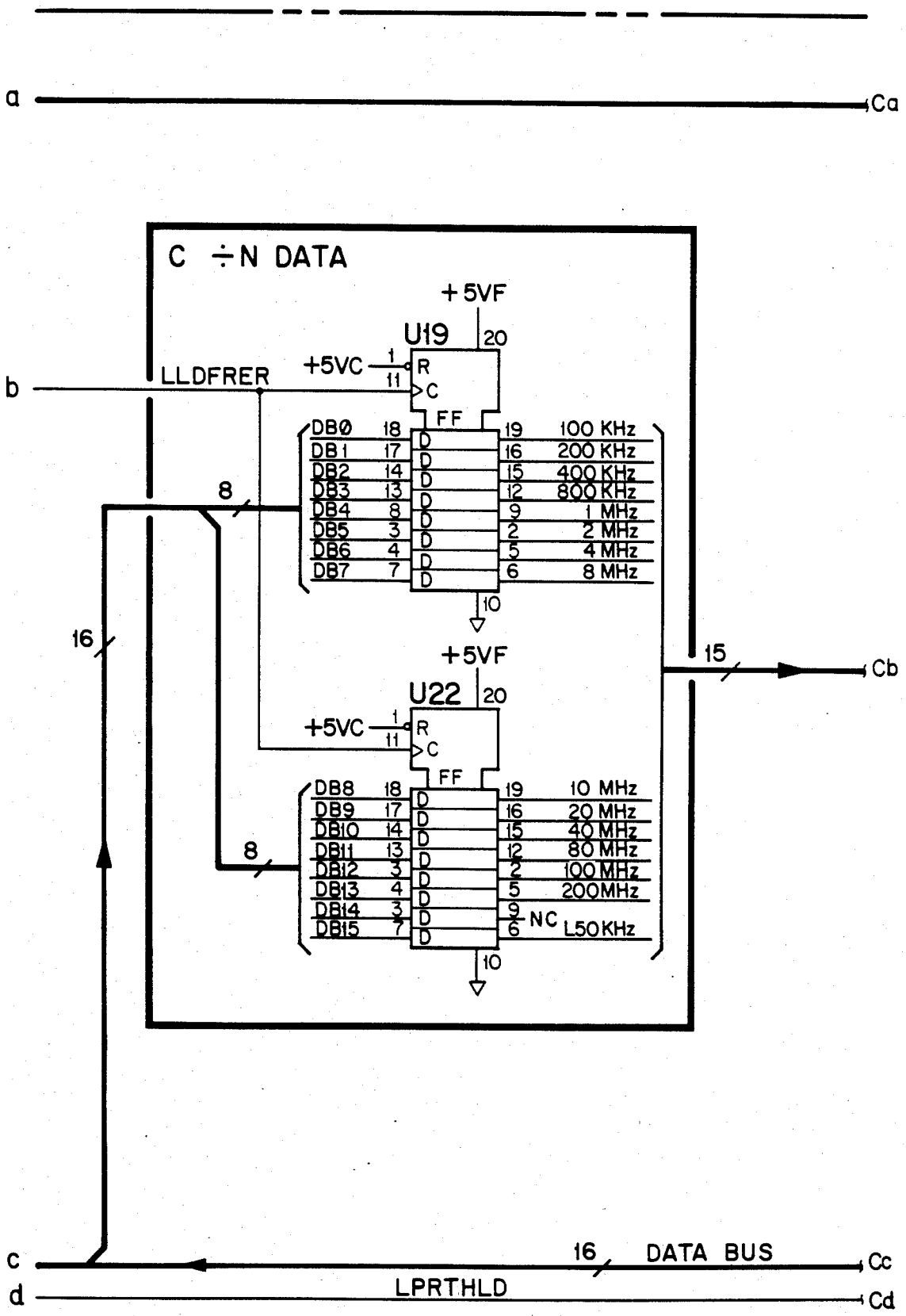

a
Ca
C ÷N DATA
+5VF
U19
20
+5VC
1
11
R
C
FF
b
LLDFRER
DB0 18 D 19 100 KHz
DB1 17 D 16 200 KHz
DB2 14 D 15 400 KHz
DB3 13 D 12 800 KHz
DB4 8 D 9 1 MHz
DB5 3 D 2 2 MHz
DB6 4 D 5 4 MHz
DB7 7 D 6 8 MHz
10
8
16
+5VF
U22
20
+5VC
1
11
R
C
FF
DB8 18 D 19 10 MHz
DB9 17 D 16 20 MHz
DB10 14 D 15 40 MHz
DB11 13 D 12 80 MHz
DB12 3 D 2 100 MHz
DB13 4 D 5 200MHz
DB14 3 D 9 NC
DB15 7 D 6 L50KHz
10
8
15
Cb
c
16 DATA BUS
Cc
d
LPRTHLD
Cd

FIG 27.66A

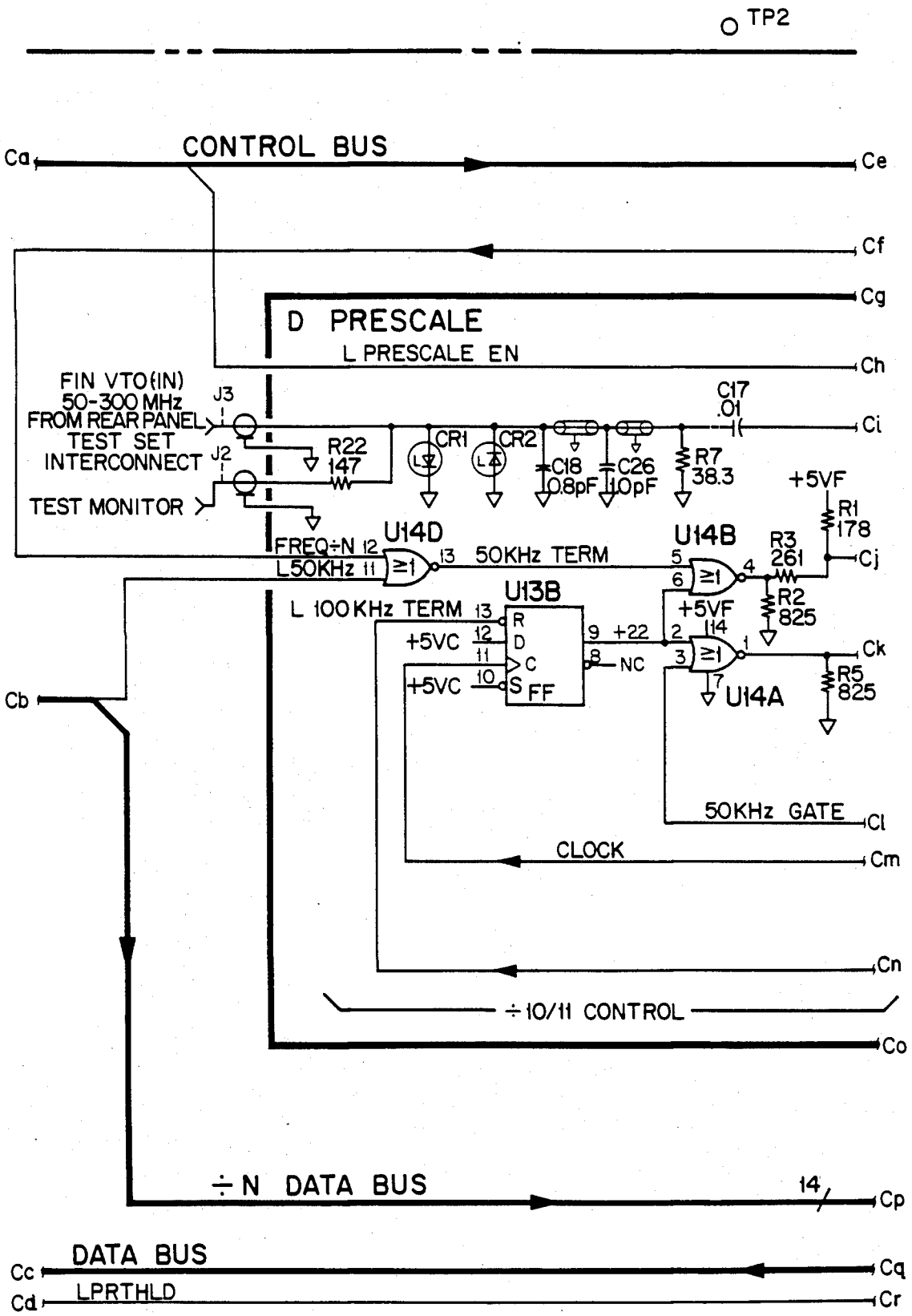

TP2
CONTROL BUS
Ca
Ce
Cf
Cg
D PRESCALE
L PRESCALE EN
Ch
FIN VTO(IN)
50-300 MHz
FROM REAR PANEL
TEST SET
INTERCONNECT
TEST MONITOR
J3
J2
R22
147
CR1
CR2
C18
.8pF
C26
10pF
C17
.01
R7
38.3
Ci
+5VF
R1
178
Cj
U14D
FREQ÷N 12
L50KHz 11
≥1
13
50KHz TERM
U14B
5
6
4
R3
261
R2
825
U13B
L 100KHz TERM 13
+5VC 12
+5VC 10
R
D
C
S
FF
9 +22
8 NC
2
3
14
1
7
U14A
Ck
R5
825
Cb
50KHz GATE
Cl
CLOCK
Cm
Cn
÷10/11 CONTROL
Co
÷N DATA BUS
14
Cp
DATA BUS
Cc
Cq
LPRTHLD
Cd
Cr

FIG 27.66B

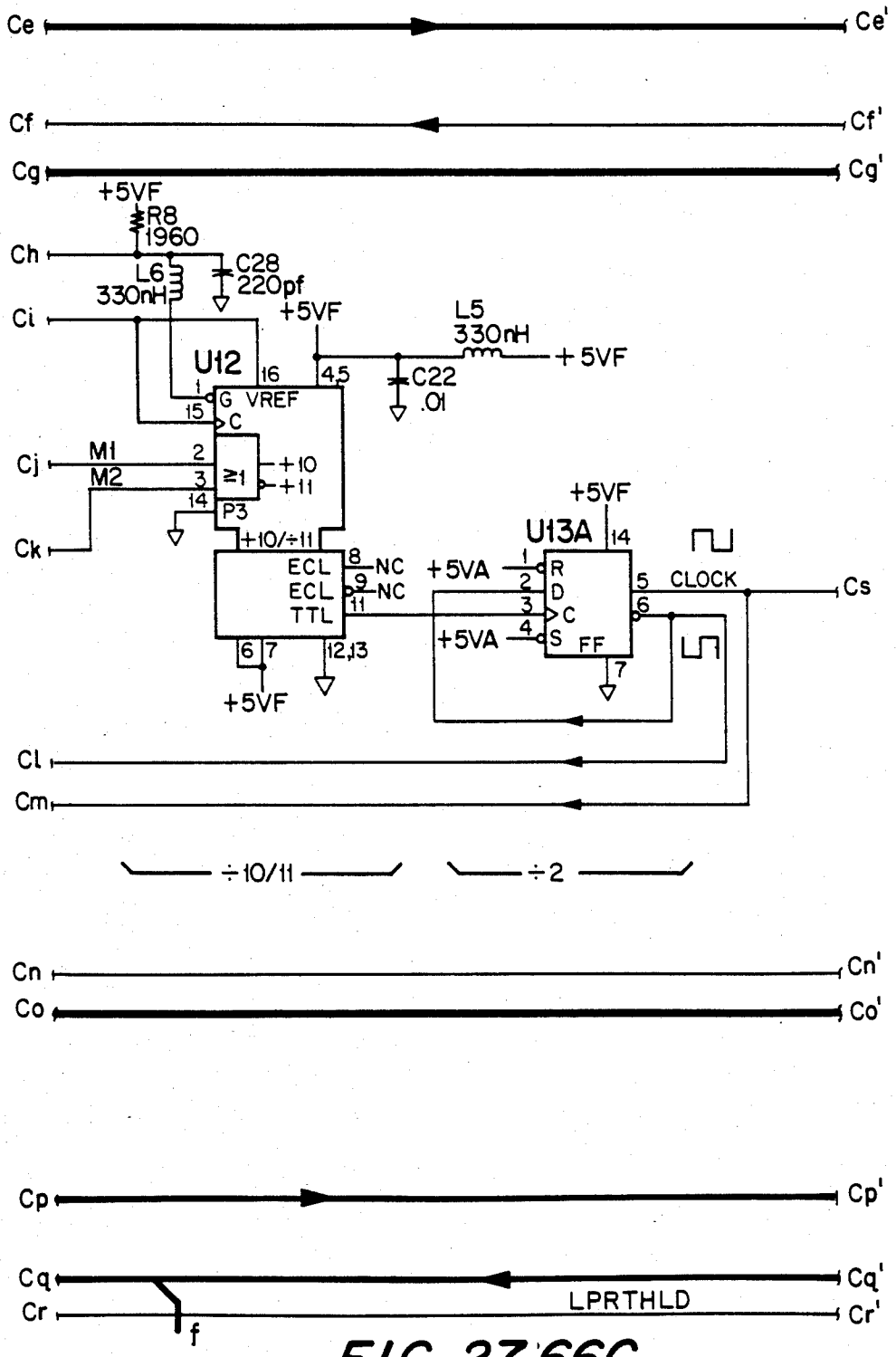

Ce
Ce'
Cf
Cf'
Cg
Cg'
+5VF
R8
1960
Ch
L6
330nH
C28
220pf
Ci
+5VF
L5
330nH
+5VF
U12
16
4,5
C22
.01
1
G VREF
15
C
Cj
M1
M2
2
3
14
≥1
+10
+11
P3
+10/÷11
Ck
ECL
ECL
TTL
8
NC
9
NC
11
6
7
12,13
+5VF
+5VF
U13A
14
1
R
2
D
3
C
4
S
FF
+5VA
+5VA
5
CLOCK
6
7
Cs
Cl
Cm
÷10/11
÷2
Cn
Cn'
Co
Co'
Cp
Cp'
Cq
Cq'
Cr
LPRTHLD
Cr'
f

FIG 27.66C

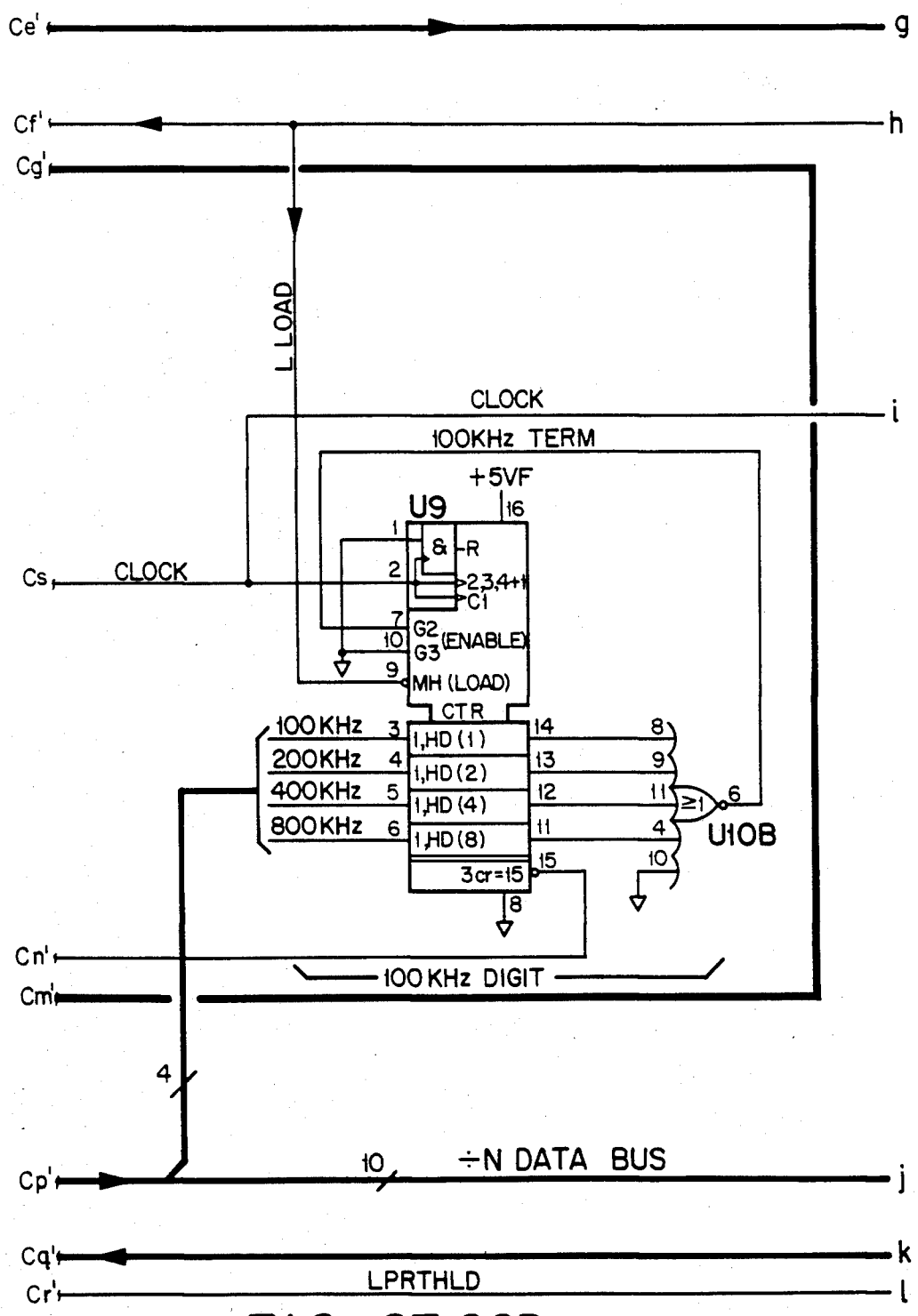

Ce'
g
Cf'
h
Cg'
L LOAD
CLOCK
i
100KHz TERM
+5VF
U9
16
1
&
R
Cs
CLOCK
2
2,3,4+
C1
7
G2
10
G3
(ENABLE)
9
MH (LOAD)
CTR
100KHz
3
1,HD(1)
14
8
200KHz
4
1,HD(2)
13
9
400KHz
5
1,HD(4)
12
11
≥1
6
800KHz
6
1,HD(8)
11
4
U10B
10
3cr=15
15
8
Cn'
100 KHz DIGIT
Cm'
4
Cp'
10
÷N DATA BUS
j
Cq'
k
LPRTHLD
Cr'
l

FIG 27.66D

ACTIVE COMPONENTS PARTS LISTS
(U'S AND Q'S)

REFERENCE DESIGNATORS	PART NUMBER	MANUFACTURERS PART NUMBER
U1	1826-0319	M10PAMP
U2	1826-0026	M1C0AMP
U3	1810-0203	N-R470
U4	1820-1272	74LS33
U5	1826-0417	C4-ASW
U6	1820-1568	74LS125
U7,16	1820-1112	74LS74
U8	1820-1195	74LS175
U9	1820-1434	74LS668
U10	1820-1275	74S260
U11,13	1820-0693	74S74
U12	1820-1780	1C11090
U14	1820-1322	74S020
U15	1820-1147	74LS00
U17	1820-1443	74LS293
U18	1820-1216	74LS138
U19	1820-1730	74LS273
U20,21,23	1820-1013	25LS2568

FIG 27.67A

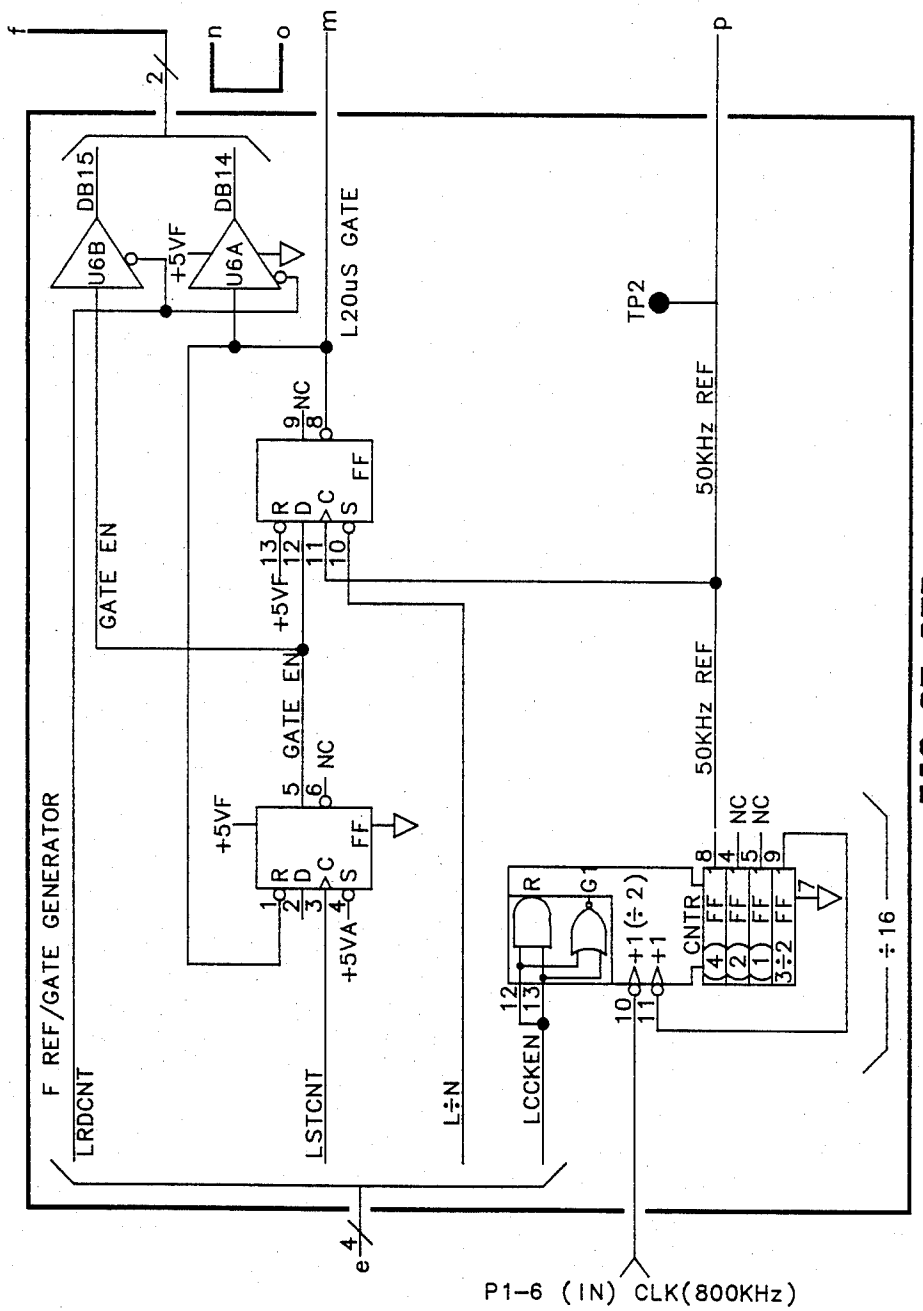

F REF/GATE GENERATOR
f
n
o
m
p
2
DB15
DB14
U6B
U6A
+5VF
L20uS GATE
TP2
50KHz REF
GATE EN
9 NC
8
FF
R
D
C
S
13
12
11
10
+5VF
GATE EN
5 GATE EN
6 NC
+5VF
FF
1
2
3
4
+5VA
LRDCNT
LSTCNT
L÷N
LCCKEN
12
13
R
G1
10
11
+1(÷2)
+1
CNTR
8
4
5
9
NC
NC
(4)
(2)
(1)
3÷2
7
÷16
4
e
P1-6 (IN) CLK(800KHz)

FIG 27.67B

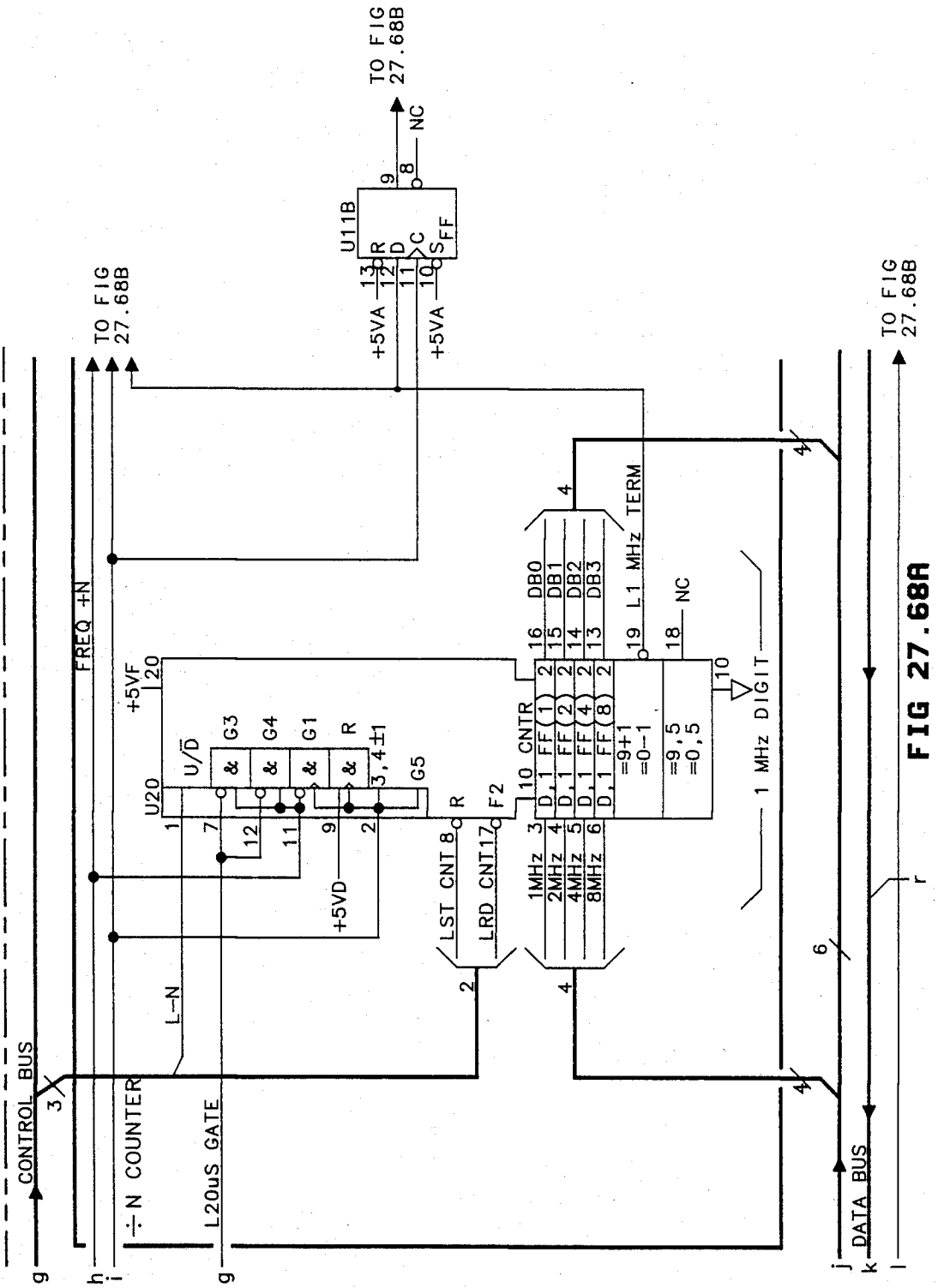
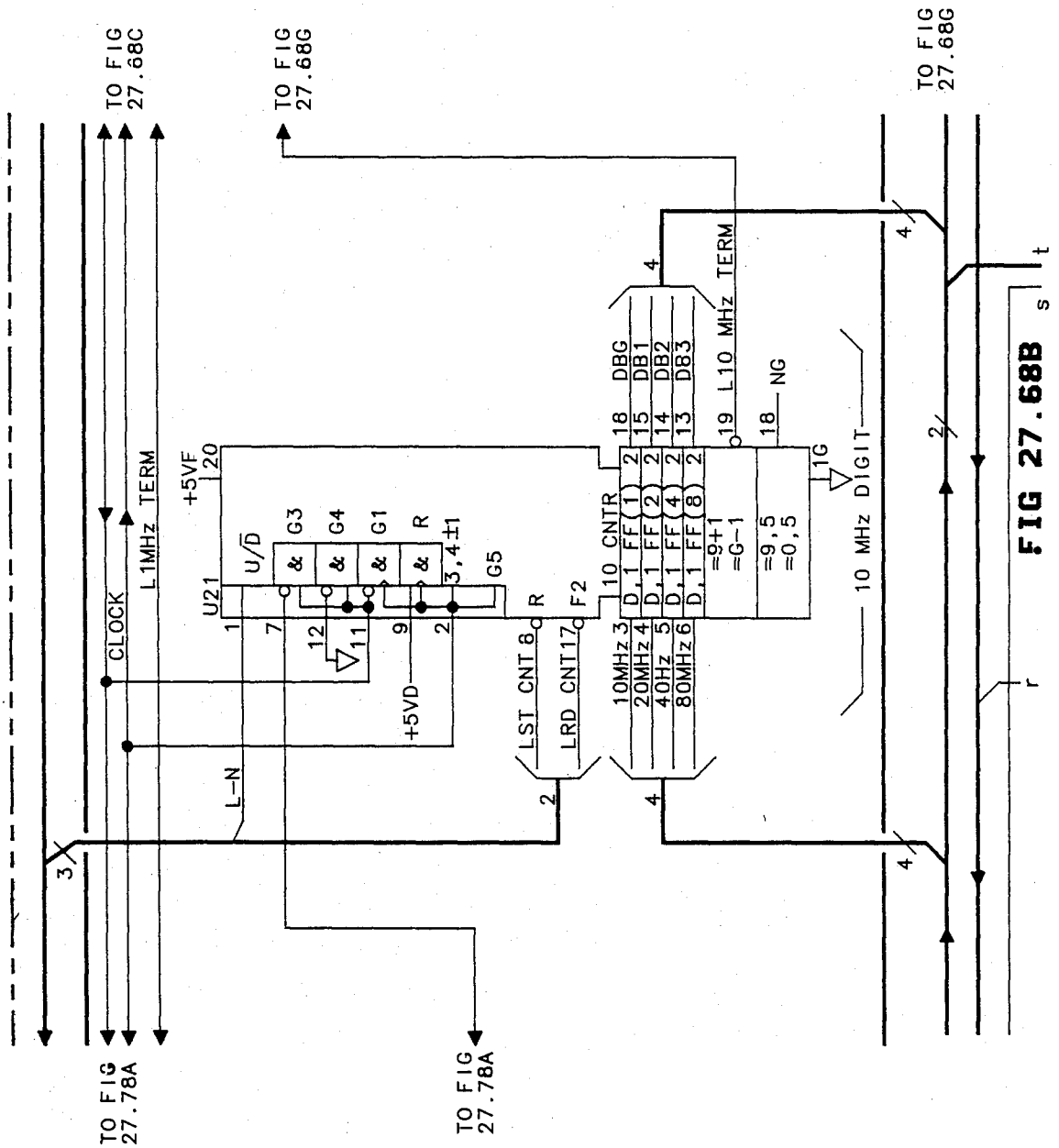

TO FIG 27.68B
U11B
NC
+5VA
+5VA
TO FIG 27.68B
TO FIG 27.68B
FREQ +N
+5VF
U20
U/D
G3
G4
G1
R
3,4±1
G5
R
F2
+5VD
LST CNT 8
LRD CNT17
10 CNTR
DB0
DB1
DB2
DB3
19 L1 MHz TERM
18 NC
1MHz
2MHz
4MHz
8MHz
=9+1
=0-1
=9,5
=0,5
1 MHz DIGIT
L-N
CONTROL BUS
÷ N COUNTER
L20uS GATE
DATA BUS

FIG 27.68A


TO FIG 27.68C
TO FIG 27.68G
TO FIG 27.68G
TO FIG 27.78A
TO FIG 27.78A
CLOCK
L1MHz TERM
L-N
+5VF
+5VD
U21
U/D
G3
G4
G1
R
3,4±1
G5
10 CNTR
LST CNT 8
LRD CNT17
F2
DBG
DB1
DB2
DB3
L10 MHz TERM
NG
10 MHz DIGIT
10MHz
20MHz
40Hz
80MHz
=9+1
=G-1
=9,5
=0,5
FIG 27.68B

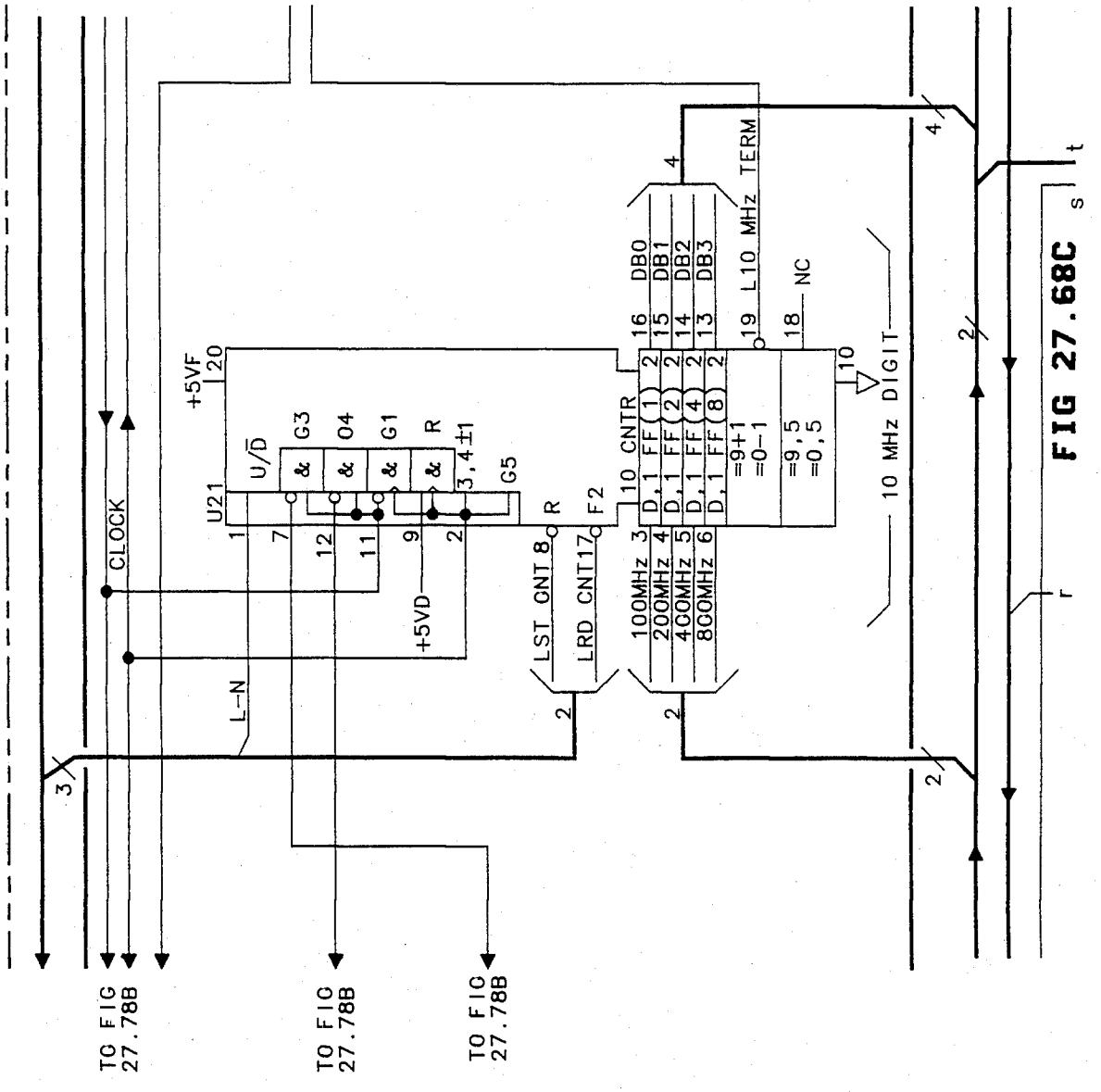

TO FIG 27.78B
TO FIG 27.78B
TO FIG 27.78B
CLOCK
L-N
+5VD
+5VF
U21
U/D
G3
O4
G1
R
3,4±1
G5
LST CNT 8
LRD CNT17
R
F2
10 CNTR
D,1 FF(1)
D,1 FF(2)
D,1 FF(4)
D,1 FF(8)
=9+1
=0-1
=9,5
=0,5
100MHz
200MHz
400MHz
800MHz
DB0
DB1
DB2
DB3
L10 MHz TERM
NC
10 MHz DIGIT

FIG 27.68C

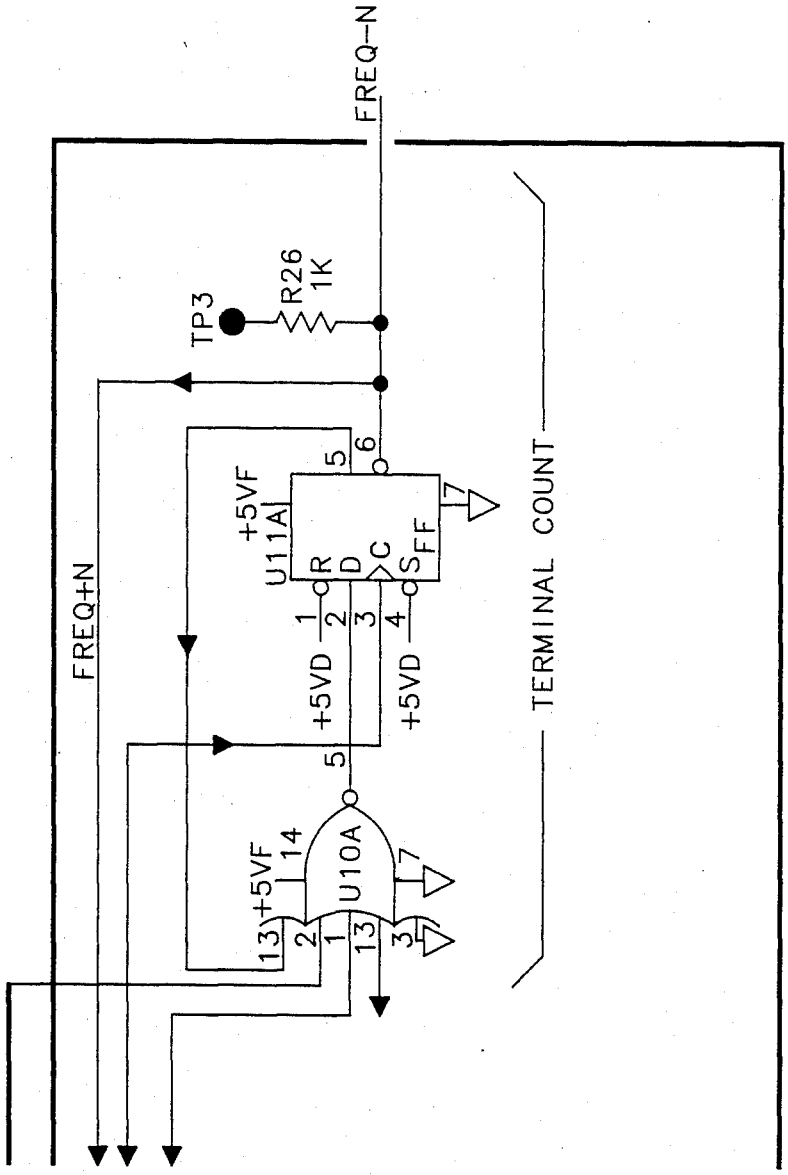

FREQ-N
TP3
R26
1K
+5VF
U11A
R
D
C
S
FF
1
2
3
4
5
6
7
+5VD
+5VD
FREQ+N
+5VF
14
U10A
13
2
1
13
3
7
TERMINAL COUNT

FIG 27.68D

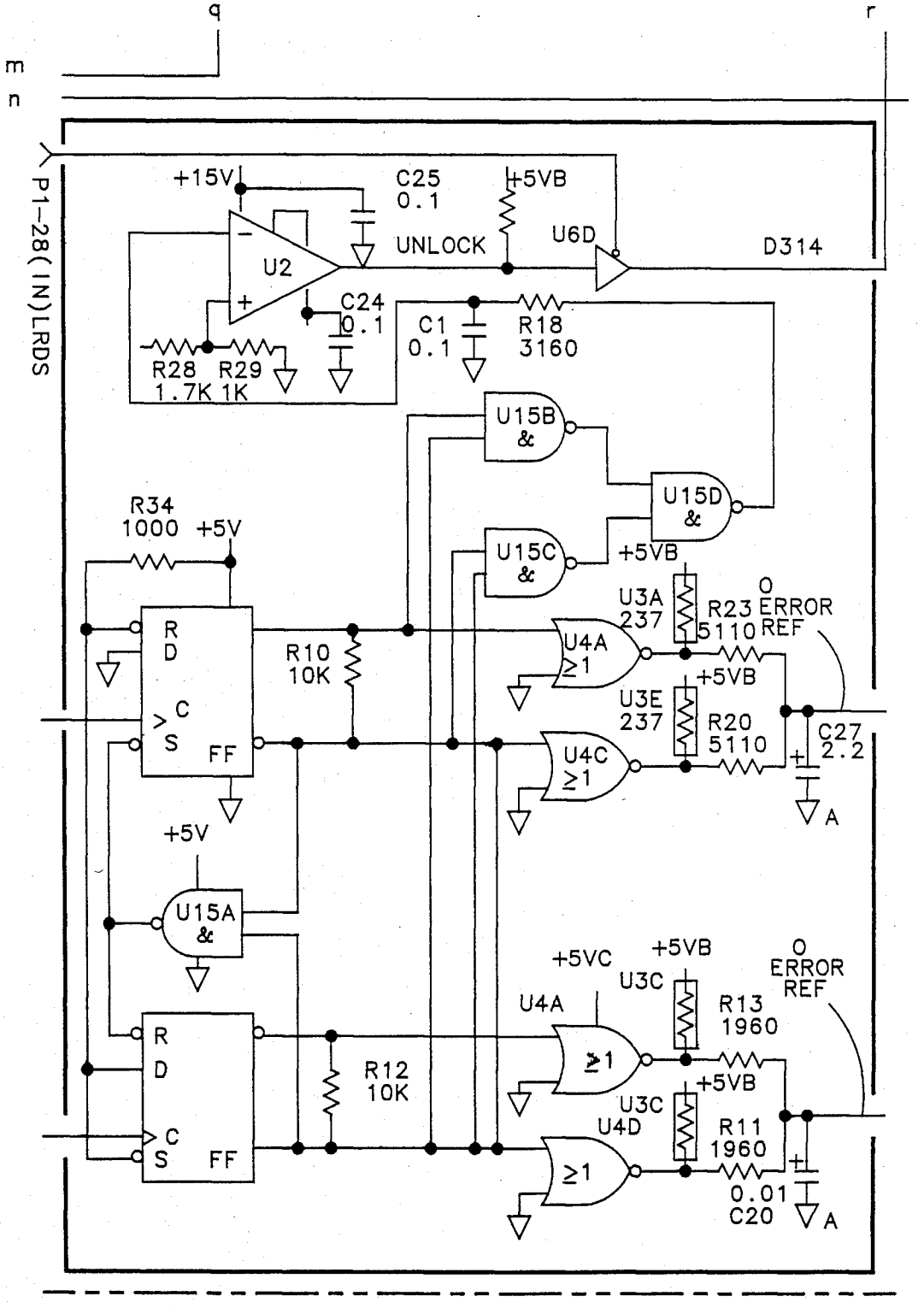

q
r
m
n
P1-28(IN)LRDS
+15V
C25
0.1
+5VB
UNLOCK
U6D
D314
U2
C24
0.1
C1
0.1
R18
3160
R28
1.7K
R29
1K
U15B
&
U15D
&
U15C
&
R34
1000
+5V
+5VB
U3A
237
R23
5110
O
ERROR
REF
U4A
≥1
R10
10K
R
D
C
S
FF
U3E
237
R20
5110
C27
2.2
U4C
≥1
A
+5V
U15A
&
+5VC
+5VB
U3C
R13
1960
O
ERROR
REF
U4A
≥1
R12
10K
U3C
R11
1960
U4D
≥1
0.01
C20
A

FIG 27.69A

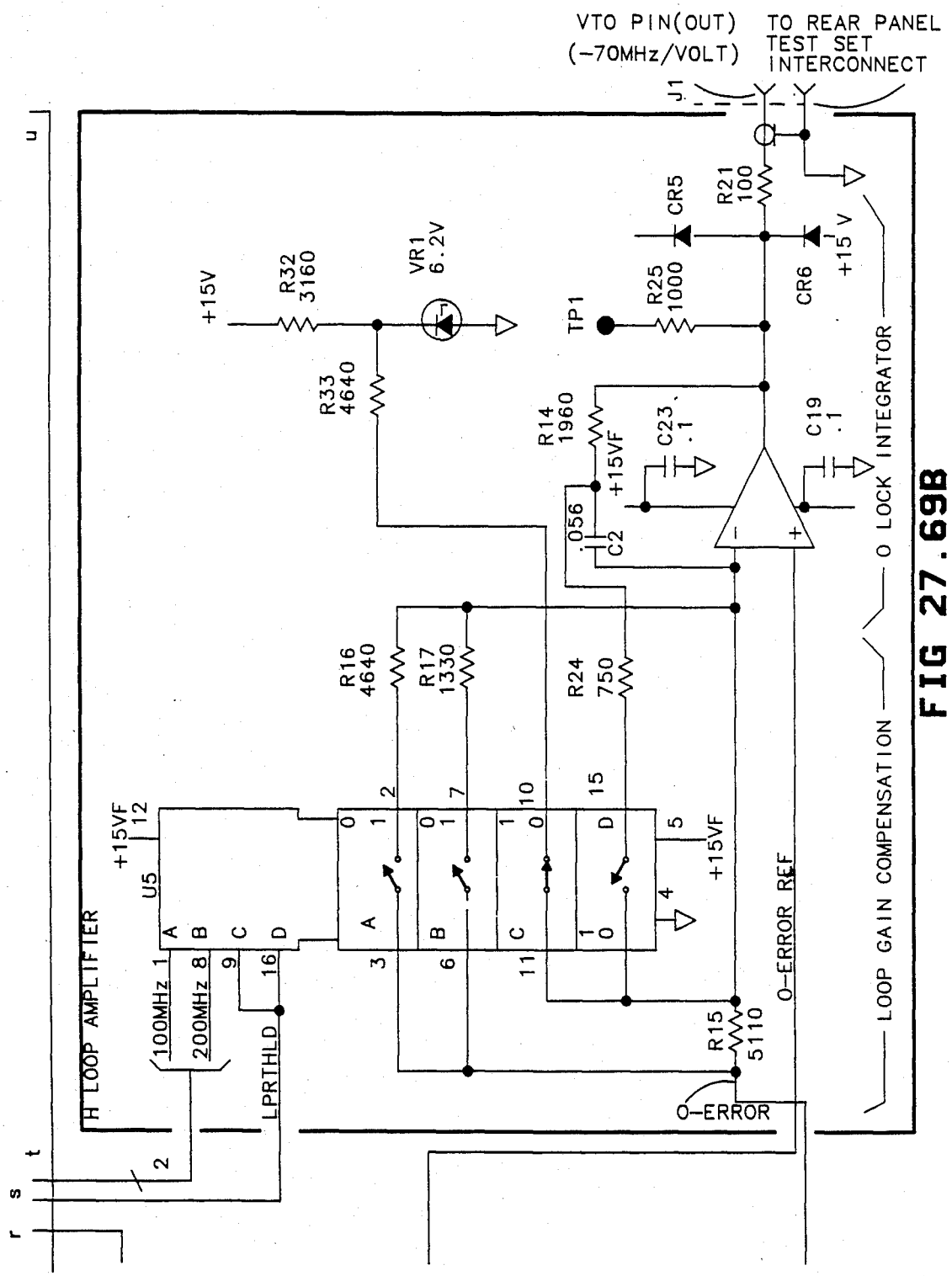

VTO PIN(OUT)
(-70MHz/VOLT)
TO REAR PANEL
TEST SET
INTERCONNECT
J1
R21
100
CR5
CR6
+15 V
+15V
R32
3160
VR1
6.2V
TP1
R25
1000
R33
4640
R14
1960
C23
.1
C19
.1
+15VF
.056
C2
R16
4640
R17
1330
R24
750
U5
+15VF
H LOOP AMPLIFIER
100MHz 1
200MHz 8
LPRTHLD
R15
5110
O-ERROR REF
O-ERROR
O LOCK INTEGRATOR
LOOP GAIN COMPENSATION

FIG 27.69B

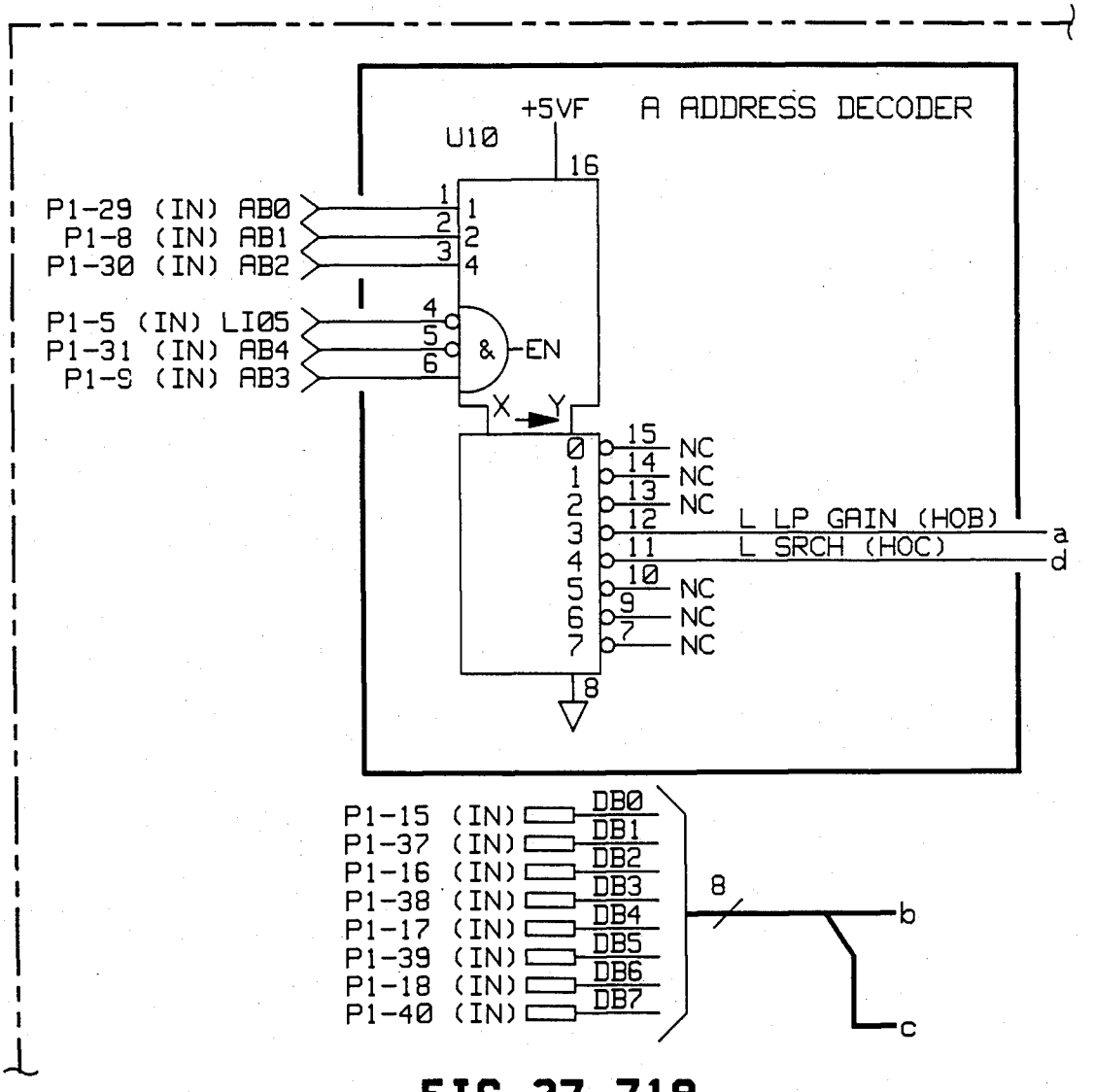

A ADDRESS DECODER
+5VF
U10
16
P1-29 (IN) AB0
P1-8 (IN) AB1
P1-30 (IN) AB2
P1-5 (IN) LI05
P1-31 (IN) AB4
P1-9 (IN) AB3
&
EN
X
Y
NC
L LP GAIN (HOB)
L SRCH (HOC)
a
d
P1-15 (IN) DB0
P1-37 (IN) DB1
P1-16 (IN) DB2
P1-38 (IN) DB3
P1-17 (IN) DB4
P1-39 (IN) DB5
P1-18 (IN) DB6
P1-40 (IN) DB7
8
b
c

FIG 27.71A

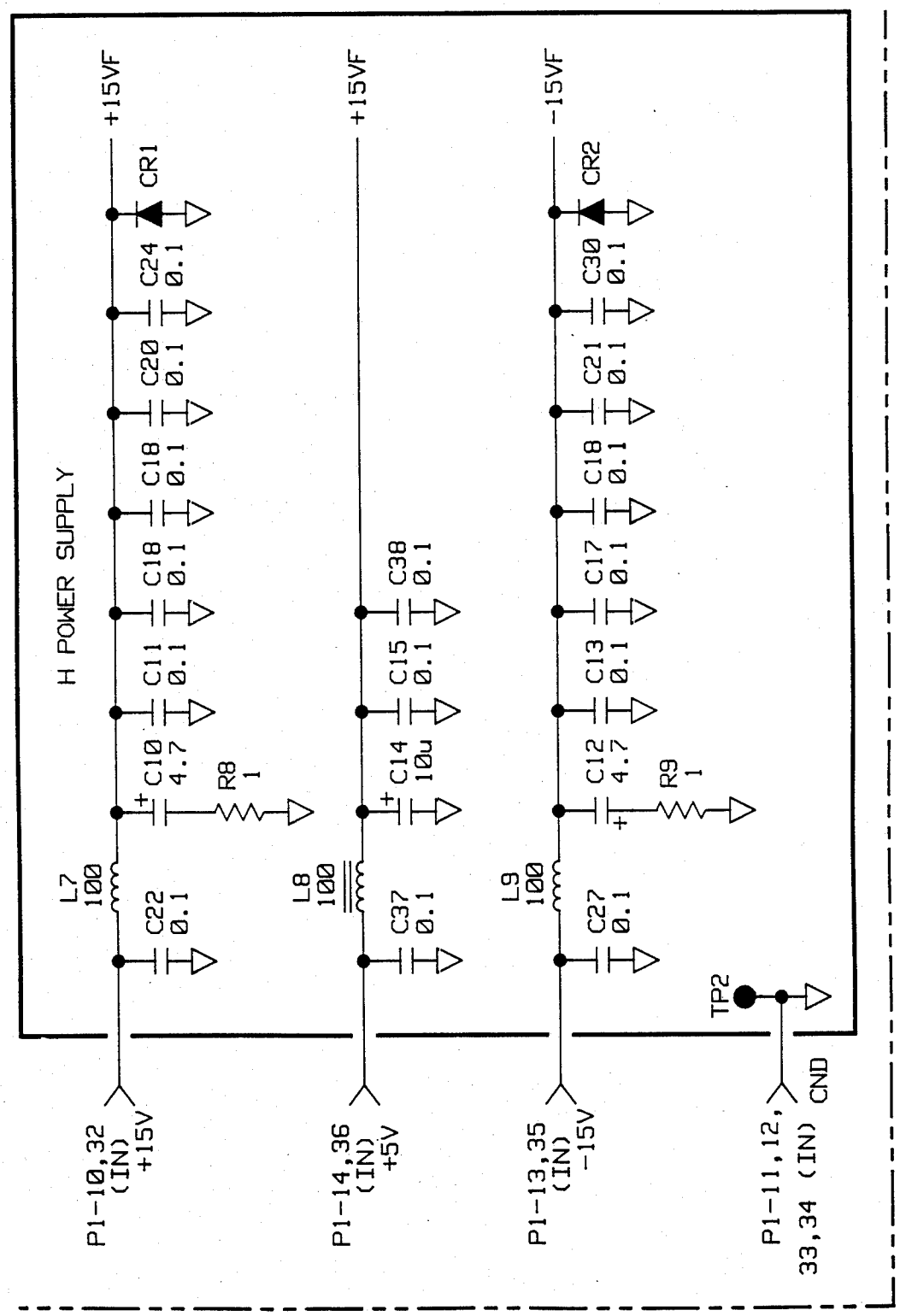

H POWER SUPPLY
+15VF
+15VF
-15VF
CR1
CR2
C24 0.1
C20 0.1
C18 0.1
C11 0.1
C10 4.7
R8 1
C30 0.1
C21 0.1
C18 0.1
C17 0.1
C13 0.1
C12 4.7
R9 1
C38 0.1
C15 0.1
C14 10u
L7 100
L8 100
L9 100
C22 0.1
C37 0.1
C27 0.1
TP2
P1-10,32 (IN) +15V
P1-14,36 (IN) +5V
P1-13,35 (IN) -15V
P1-11,12, 33,34 (IN) GND

FIG 27.71B

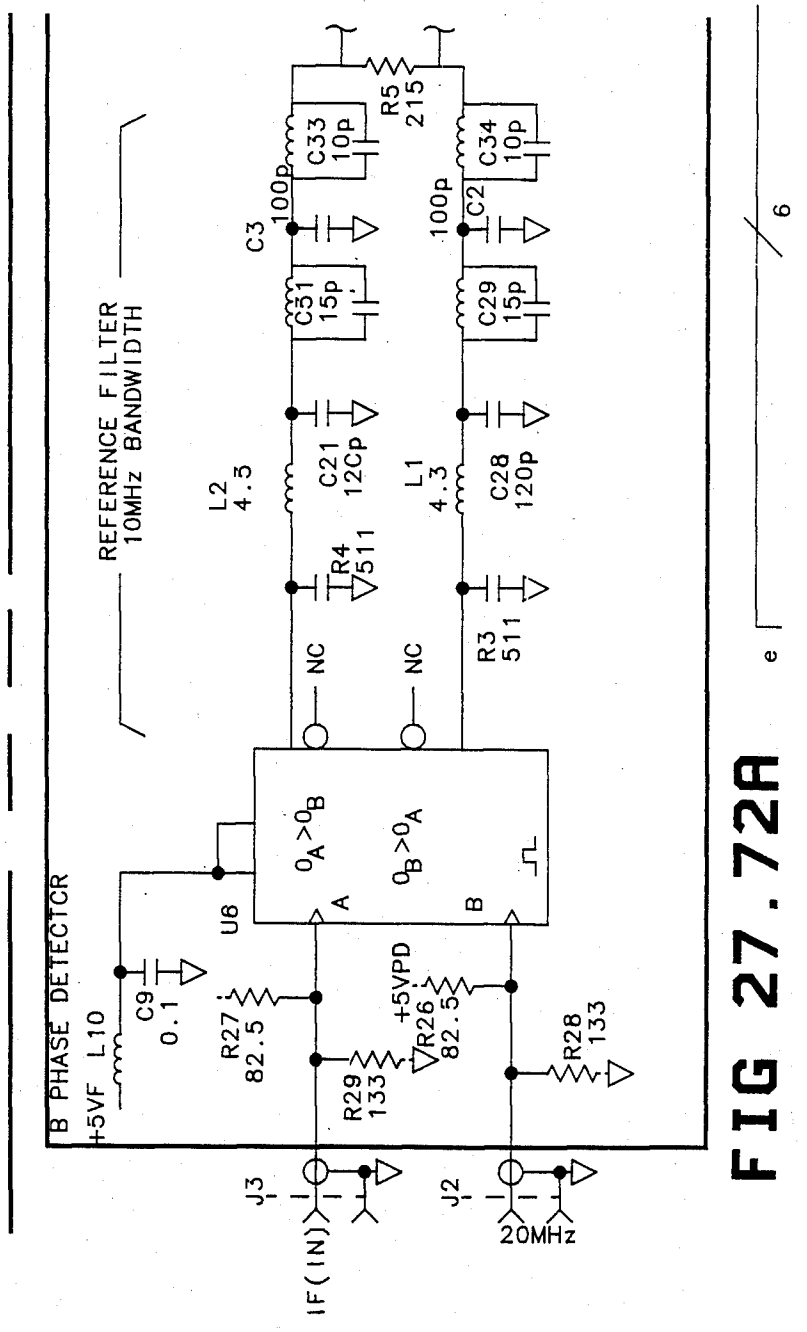

B PHASE DETECTOR
+5VF L10
C9 0.1
R27 82.5
R29 133
+5VPD
R26 82.5
R28 133
U6
A
B
$Q_A > Q_B$
$Q_B > Q_A$
NC
NC
R4 511
R3 511
L2 4.3
L1 4.3
C21 12Cp
C28 120p
C31 15p
C29 15p
C3 100p
100p C2
C33 10p
C34 10p
R5 215
REFERENCE FILTER 10MHz BANDWIDTH
J3
J2
IF(IN)
20MHz
e
6

FIG 27.72A

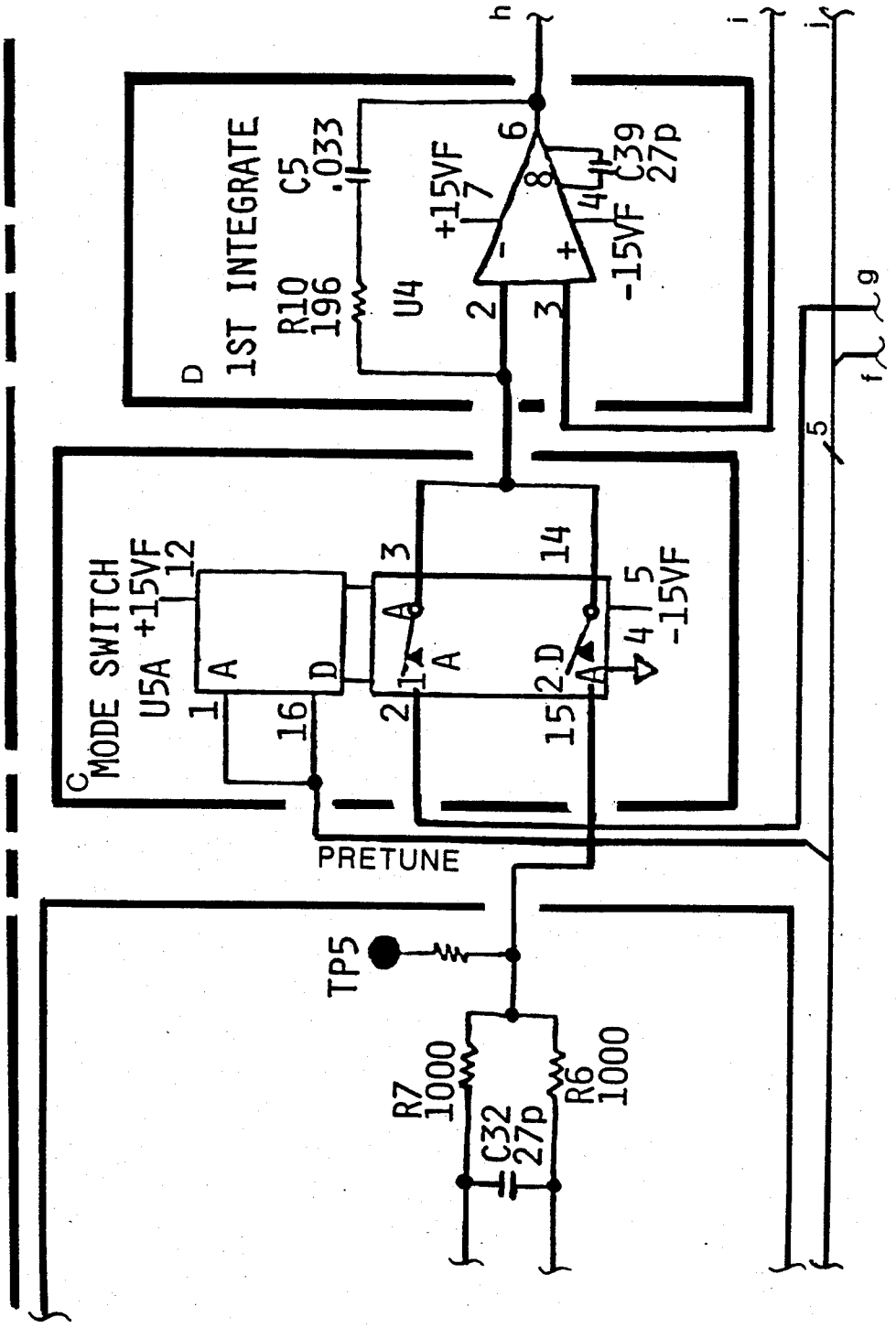

D
1ST INTEGRATE
R10
196
C5
.033
U4
+15VF
7
6
8
4
C39
27p
-15VF
2
3
h
i
j
g
f
5
C
MODE SWITCH
U5A +15VF
12
1
A
D
16
2
3
A
1
A
14
2
D
15
4
5
-15VF
PRETUNE
TP5
R7
1000
C32
27p
R6
1000

FIG 27.72B

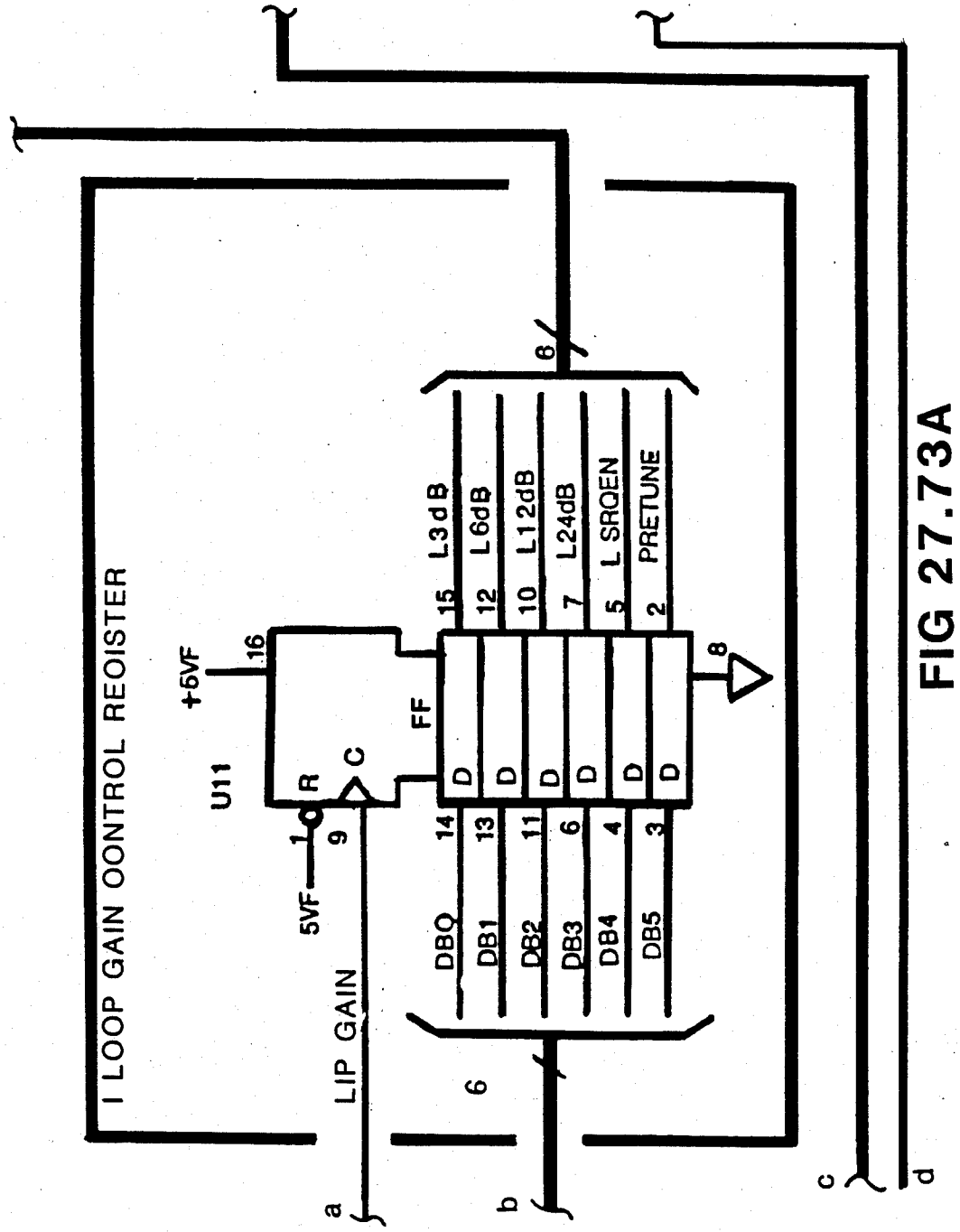
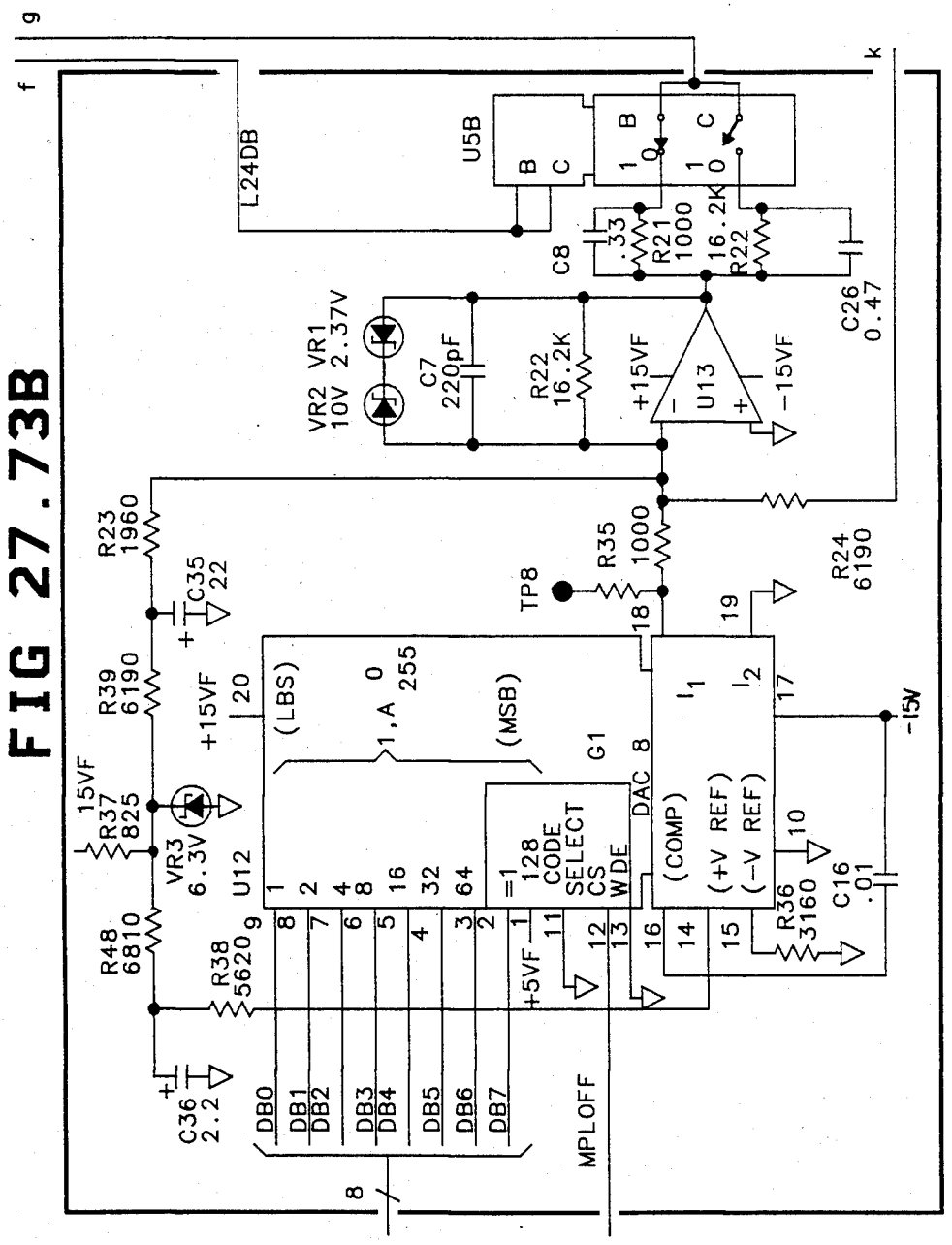

I LOOP GAIN OONTROL REOISTER
+6VF
16
U11
R
C
FF
D
8
1
9
5VF
LIP GAIN
6
L3dB
L6dB
L12dB
L24dB
L SRQEN
PRETUNE
15
12
10
7
5
2
14
13
11
6
4
3
DBO
DB1
DB2
DB3
DB4
DB5
a
b
c
d

FIG 27.73A

FIG 27.73B


g
f
k
L24DB
U5B
B
C
1 B
0
1 C
0
C8
.33
R21
1000
16.2K
R22
C26
0.47
VR2 VR1
10V 2.37V
C7
220pF
R22
16.2K
+15VF
U13
-15VF
R23
1960
C35
22
TP8
R35
1000
R24
6190
R39
6190
+15VF
20
(LBS)
1, A 0
255
(MSB)
18
19
15VF
R37
825
VR3
6.3V
U12
1
2
4
8
16
32
64
=1
128
CODE
SELECT
CS
WDE
G1
DAC
8
I_1
I_2
17
-15V
(COMP)
(+V REF)
(-V REF)
10
R36
3160
C16
.01
R48
6810
R38
5620
9
8
7
6
5
4
3
2
1
11
12
13
16
14
15
+5VF
C36
2.2
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
MPLOFF
8

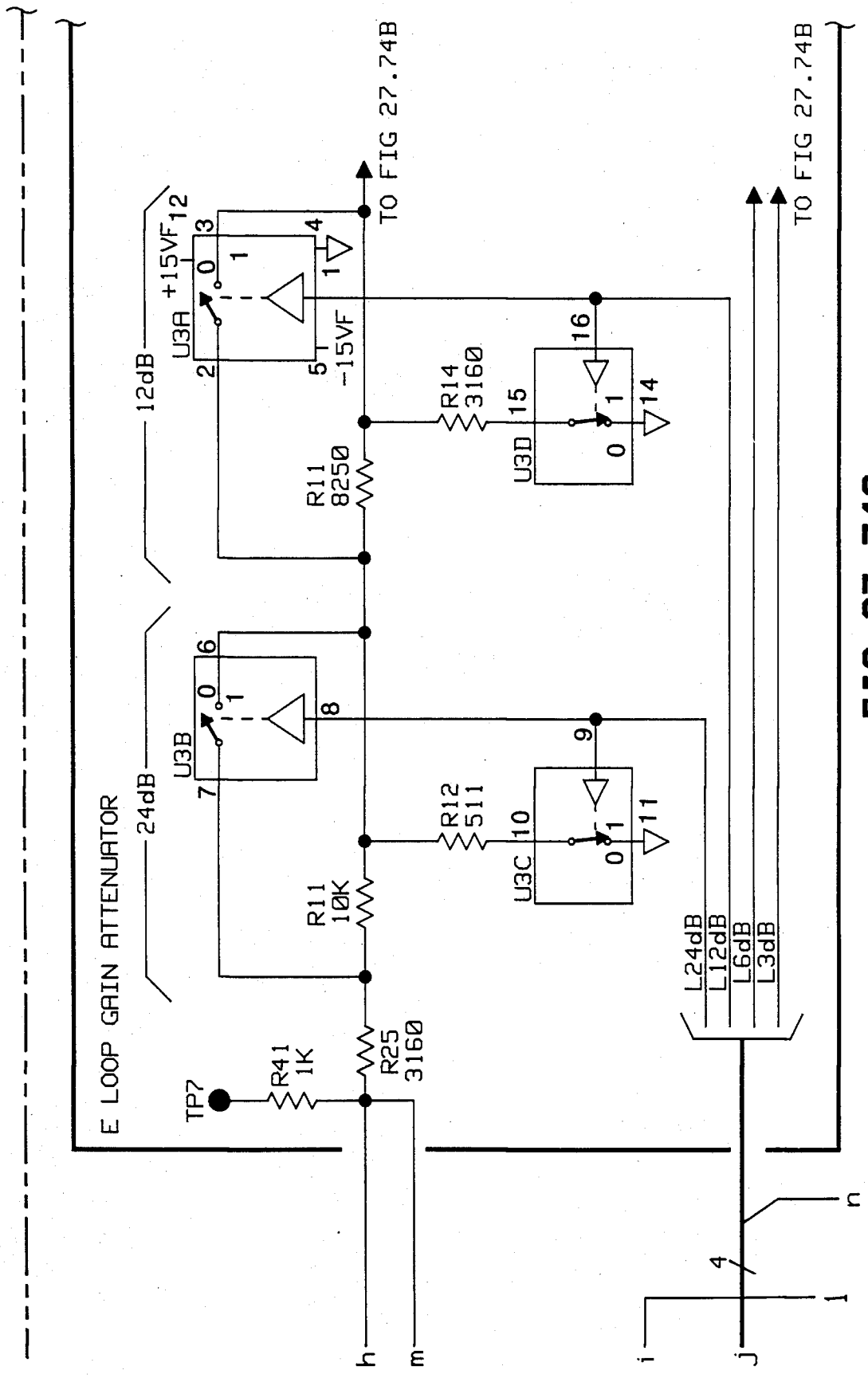

E LOOP GAIN ATTENUATOR
12dB
24dB
U3A
U3B
U3C
U3D
+15VF
-15VF
R11
8250
R11
10K
R12
511
R14
3160
R25
3160
R41
1K
TP7
TO FIG 27.74B
TO FIG 27.74B
L24dB
L12dB
L6dB
L3dB
h
m
i
j
n
4
1

FIG 27.74A

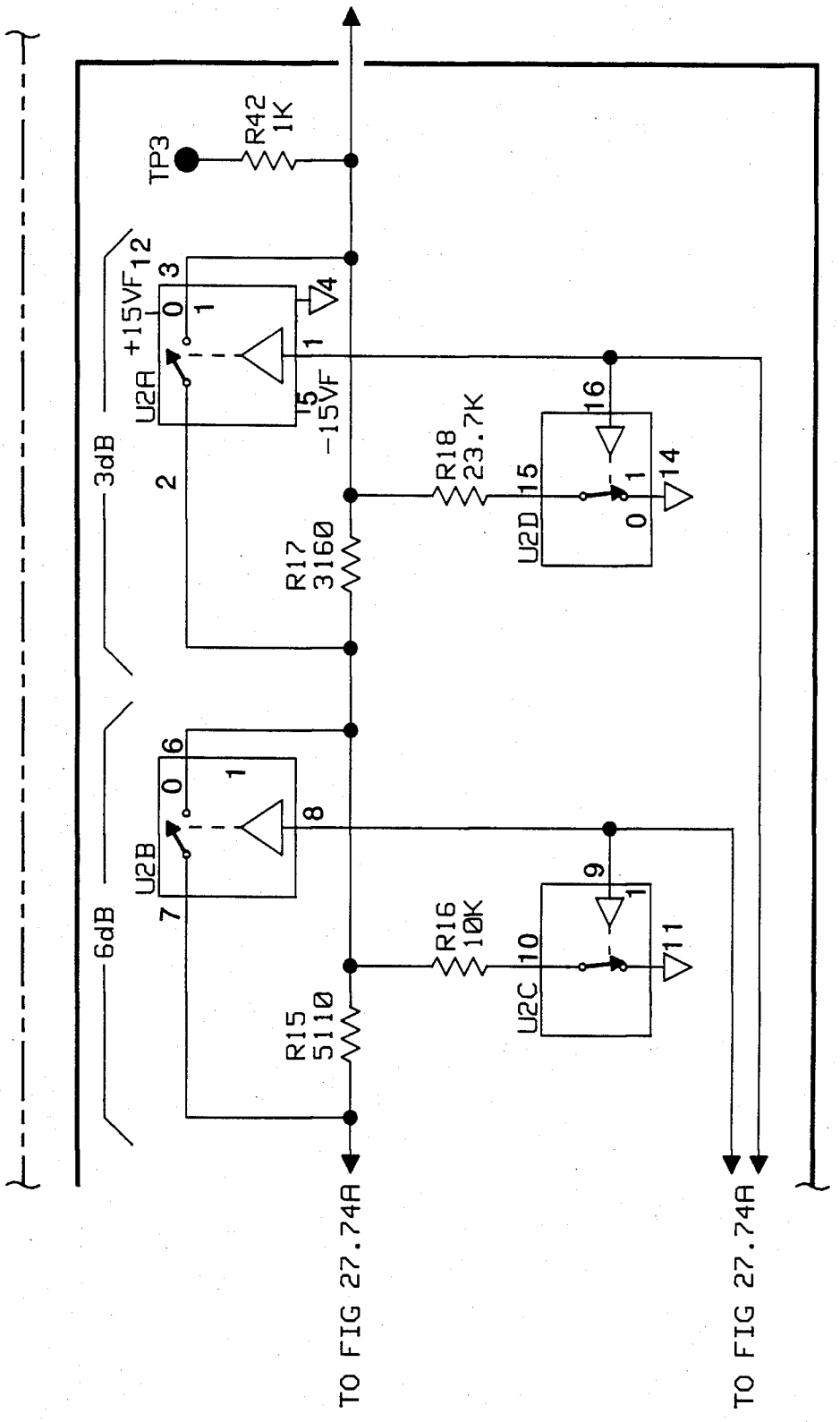

TP3
R42
1K
+15VF
12
3
U2A
0
1
4
1
15
-15VF
2
3dB
R17
3160
R18
23.7K
16
U2D
15
1
14
0
6
U2B
0
1
8
7
6dB
R16
10K
9
1
U2C
10
11
R15
5110
TO FIG 27.74A
TO FIG 27.74A

FIG 27.74B

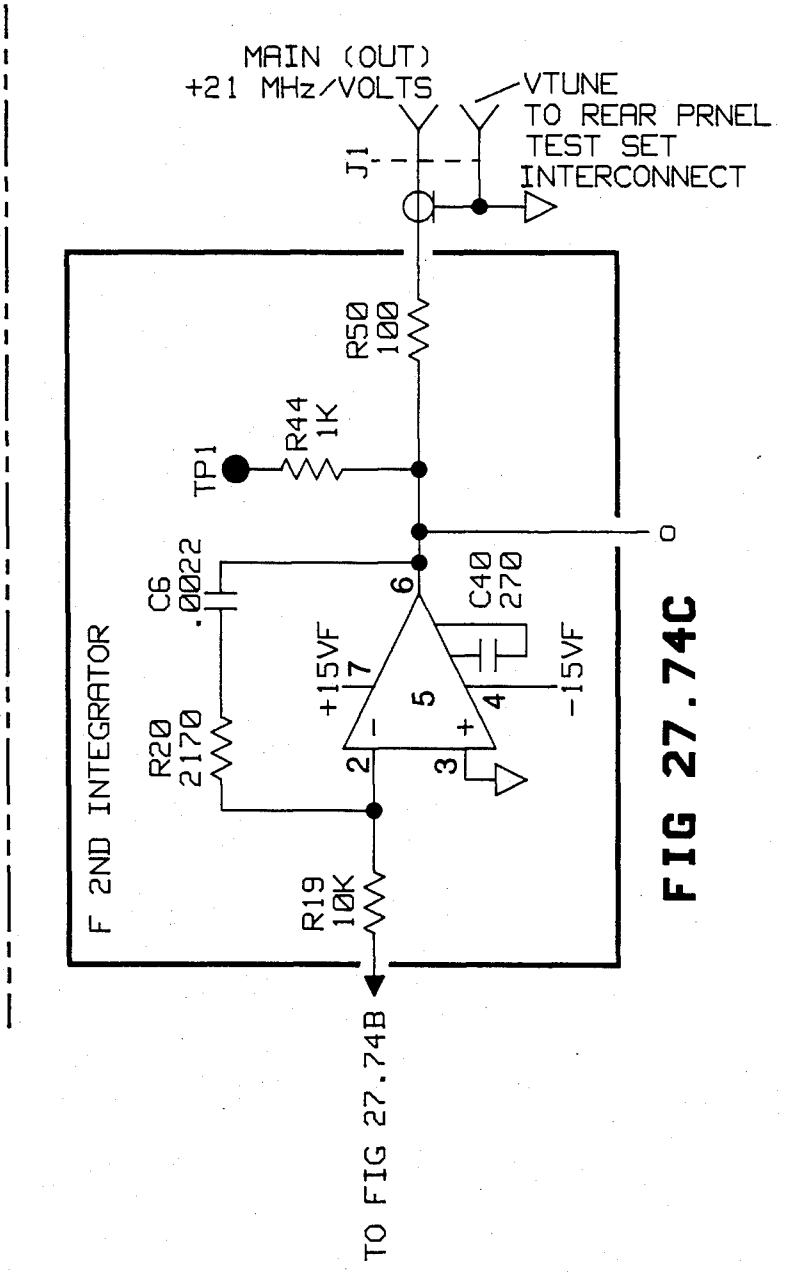

MAIN (OUT)
+21 MHz/VOLTS
VTUNE
TO REAR PRNEL
TEST SET
INTERCONNECT
J1
R50
100
R44
1K
TP1
C6
.0022
C40
270
+15VF
-15VF
R20
2170
R19
10K
F 2ND INTEGRATOR
TO FIG 27.74B

FIG 27.74C

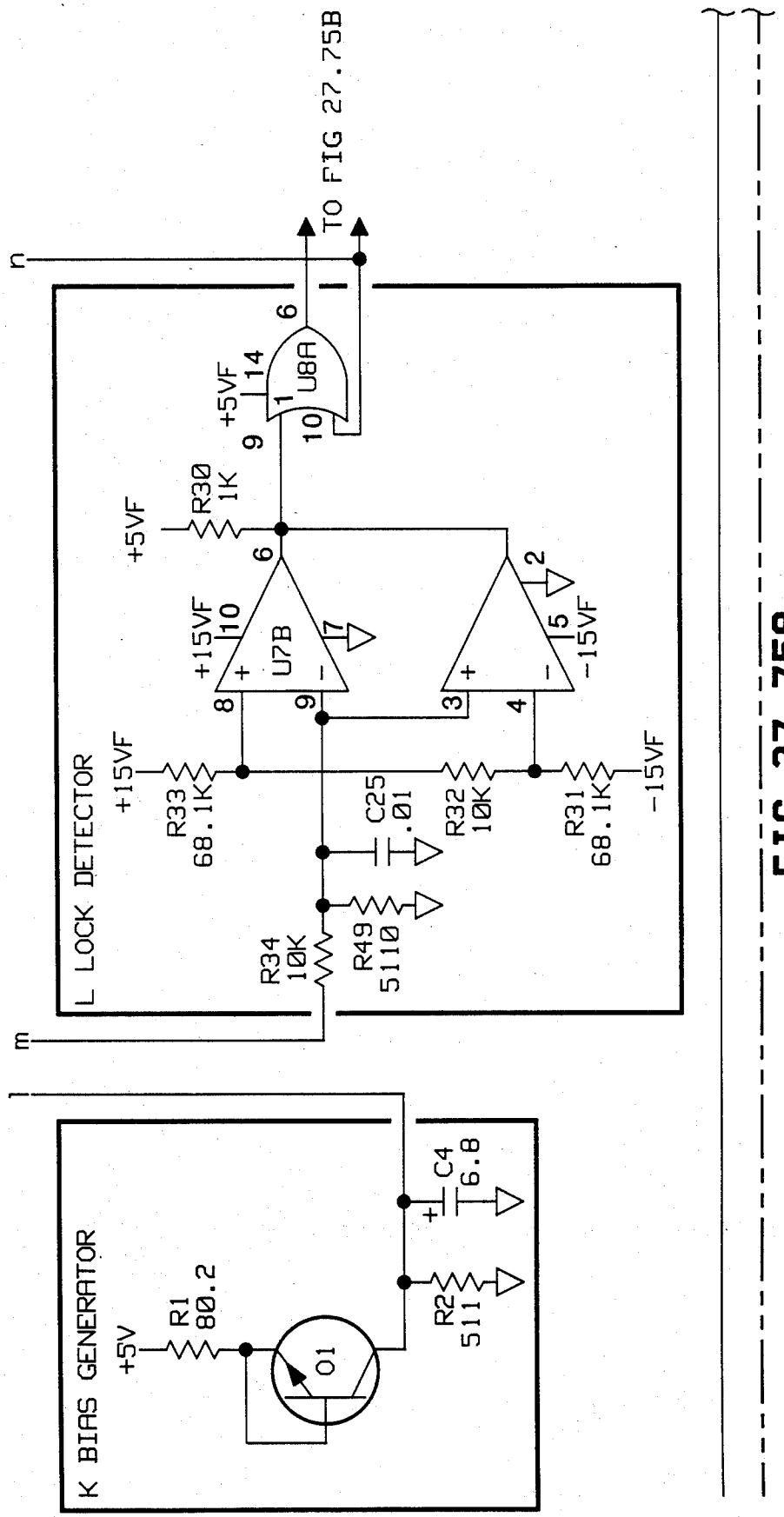

TO FIG 27.75B
n
m
L LOCK DETECTOR
U8A
+5VF
14
1
10
9
6
R30
1K
+5VF
U7B
+15VF
10
8
9
7
6
2
5
3
4
-15VF
+15VF
R33
68.1K
C25
.01
R32
10K
R31
68.1K
-15VF
R34
10K
R49
5110
K BIAS GENERATOR
+5V
R1
80.2
Q1
C4
6.8
R2
511

FIG 27.75A

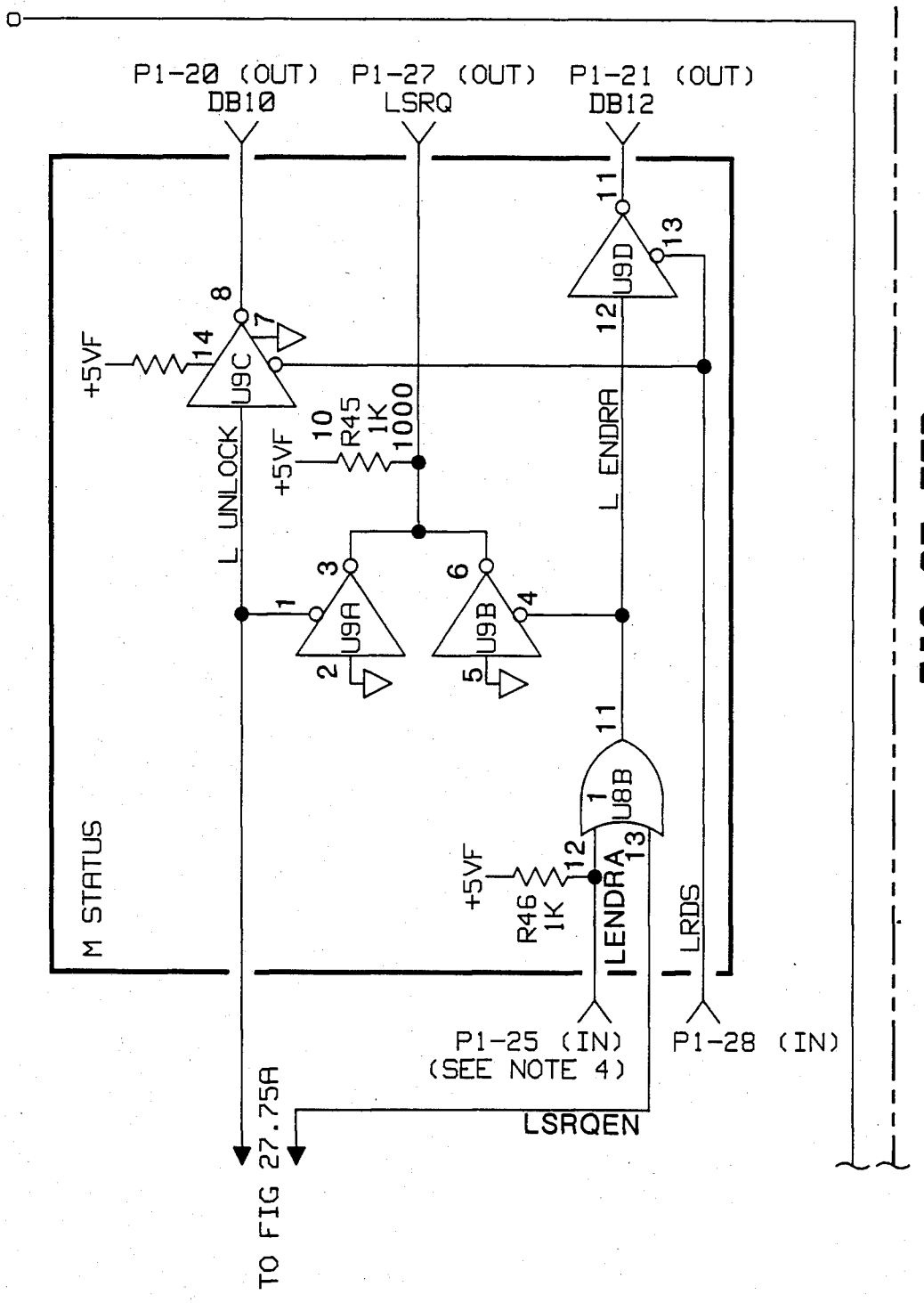

P1-20 (OUT)
DB10
P1-27 (OUT)
LSRQ
P1-21 (OUT)
DB12
+5VF
R45
1K
1000
L UNLOCK
L ENDRA
U9A
U9B
U9C
U9D
U8B
R46
1K
LENDRA
LRDS
M STATUS
P1-25 (IN)
(SEE NOTE 4)
P1-28 (IN)
LSRQEN
TO FIG 27.75A

FIG 27.75B

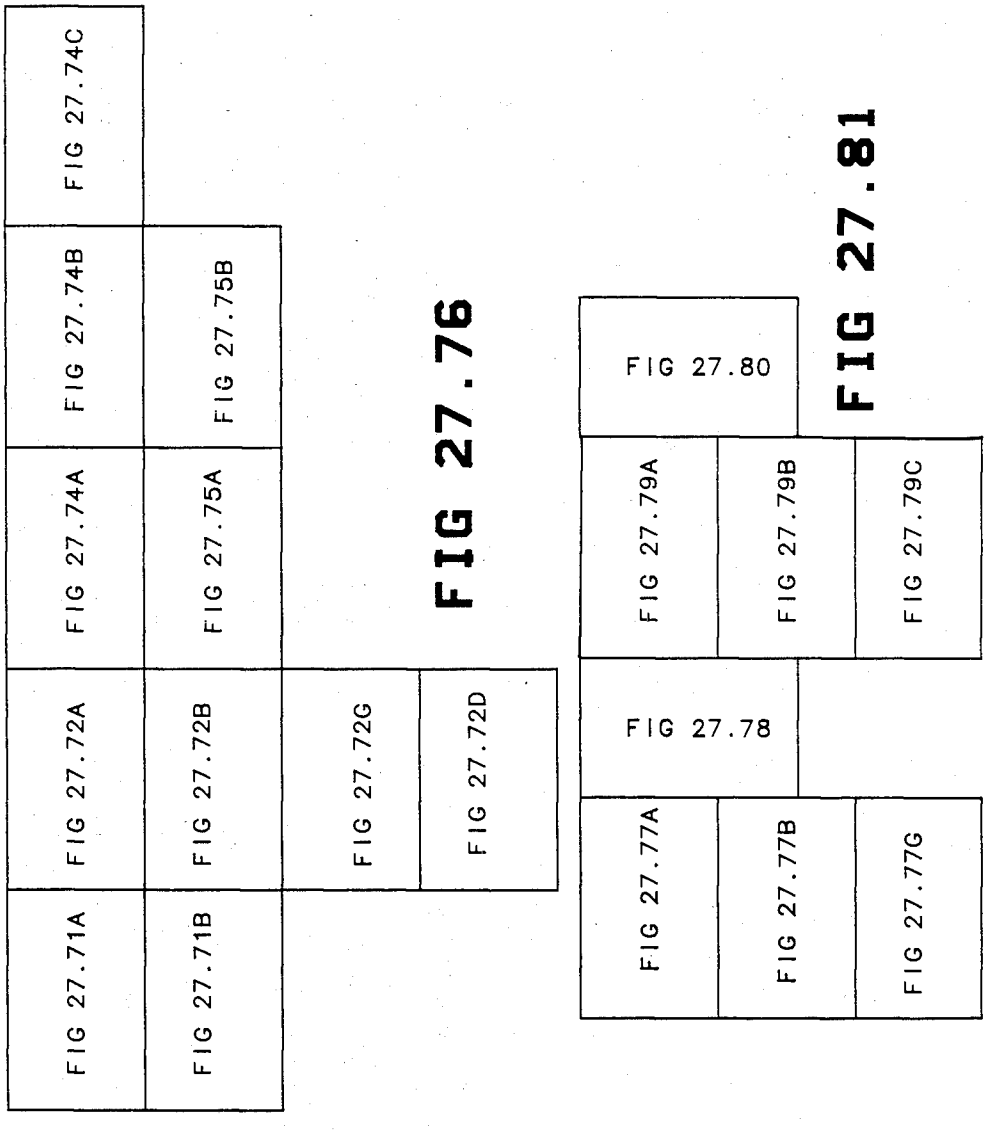


FIG 27.74C
FIG 27.74B
FIG 27.75B
FIG 27.74A
FIG 27.75A
FIG 27.72A
FIG 27.72B
FIG 27.72G
FIG 27.72D
FIG 27.71A
FIG 27.71B
FIG 27.76
FIG 27.80
FIG 27.79A
FIG 27.79B
FIG 27.79C
FIG 27.78
FIG 27.77A
FIG 27.77B
FIG 27.77G
FIG 27.81

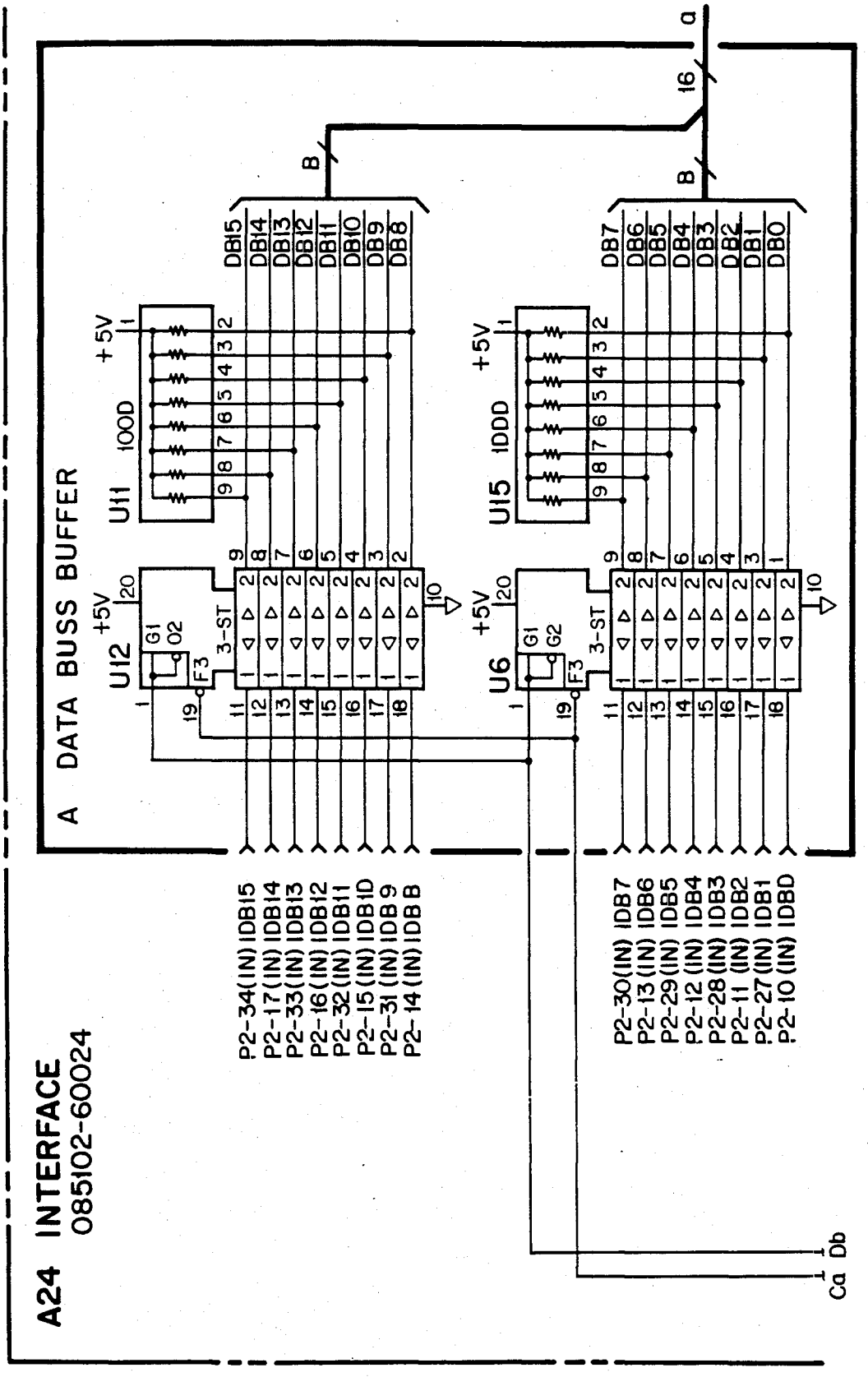

A24 INTERFACE
085102-60024
A DATA BUSS BUFFER
U11
100D
U15
1DDD
U12
U6
3-ST
+5V
G1
G2
F3
B
16
a
Ca
Db
DB15
DB14
DB13
DB12
DB11
DB10
DB9
DB8
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
P2-34(IN) IDB15
P2-17(IN) IDB14
P2-33(IN) IDB13
P2-16(IN) IDB12
P2-32(IN) IDB11
P2-15(IN) IDB1D
P2-31(IN) IDB9
P2-14(IN) IDB8
P2-30(IN) IDB7
P2-13(IN) IDB6
P2-29(IN) IDB5
P2-12(IN) IDB4
P2-28(IN) IDB3
P2-11(IN) IDB2
P2-27(IN) IDB1
P2-10(IN) IDB0

FIG 27.77A

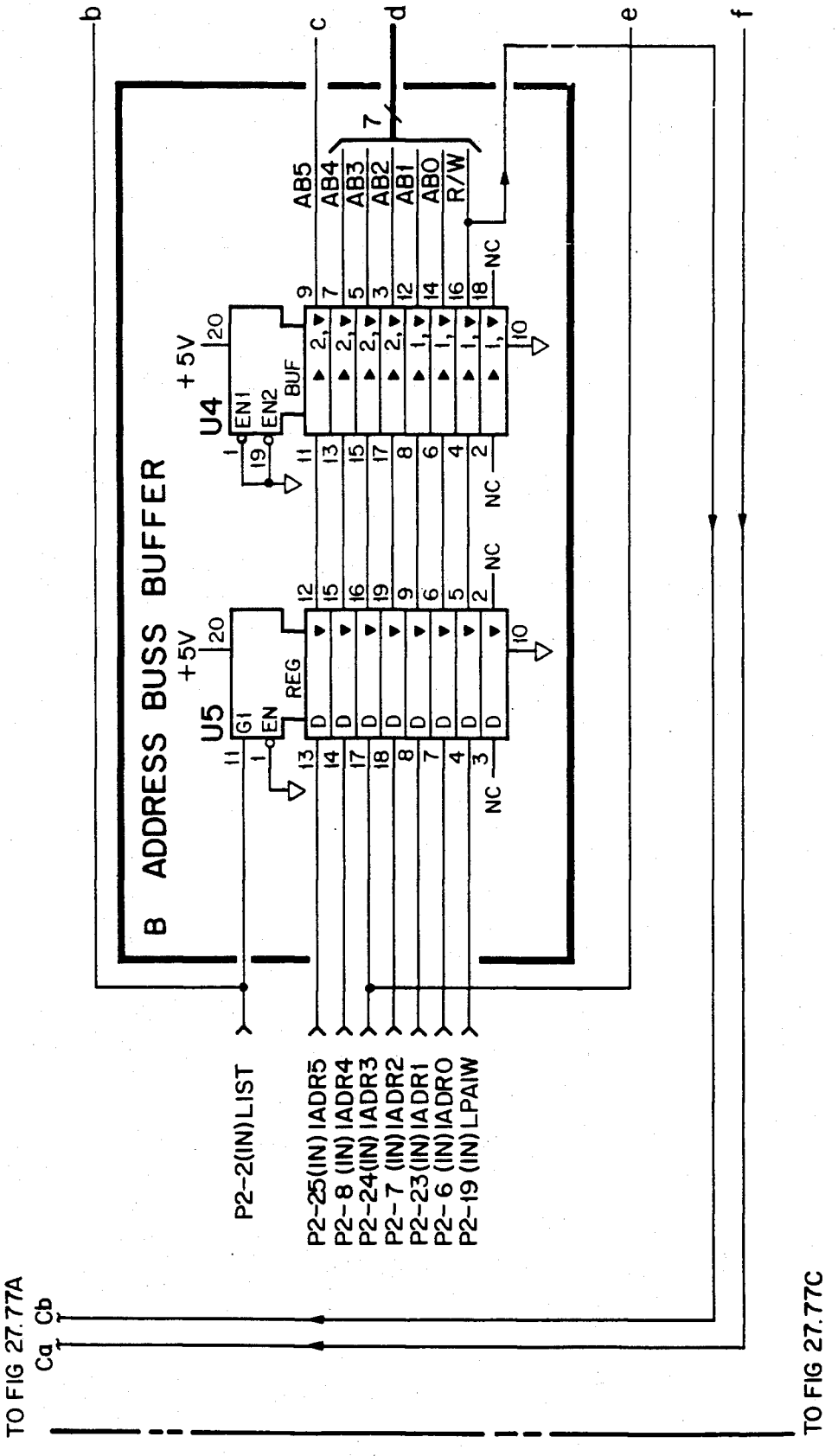

B ADDRESS BUSS BUFFER
U4
U5
+5V
BUF
REG
EN1
EN2
G1
EN
AB5
AB4
AB3
AB2
AB1
AB0
R/W
NC
P2-2(IN) LIST
P2-25(IN) IADR5
P2-8 (IN) IADR4
P2-24(IN) IADR3
P2-7 (IN) IADR2
P2-23(IN) IADR1
P2-6 (IN) IADR0
P2-19 (IN) LPAIW
TO FIG 27.77A
TO FIG 27.77C

FIG 27.77B

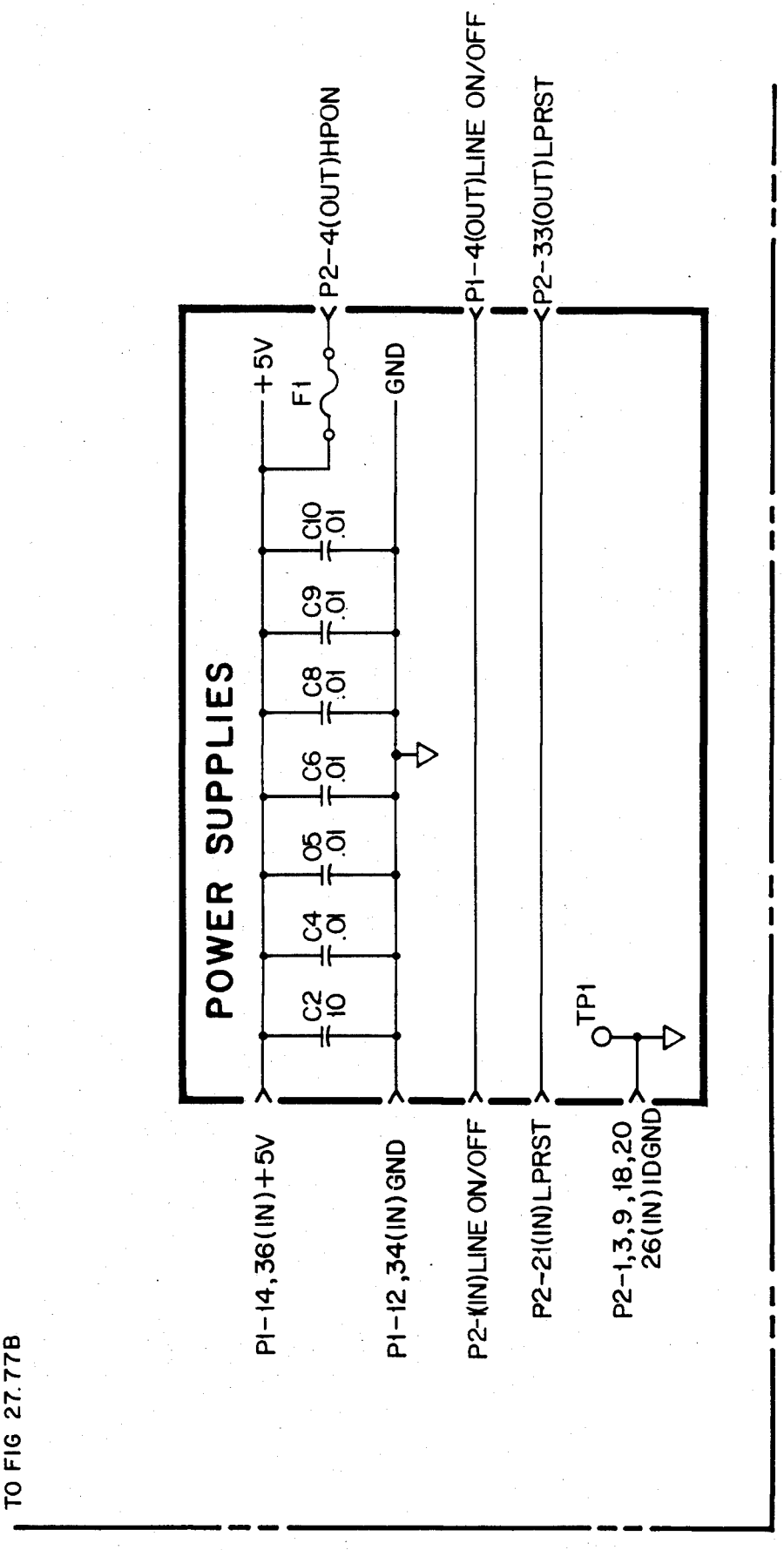

TO FIG 27.77B
POWER SUPPLIES
+5V
GND
F1
C2 10
C4 .01
C5 .01
C6 .01
C8 .01
C9 .01
C10 .01
TP1
P1-14,36(IN)+5V
P1-12,34(IN)GND
P2-1(IN)LINE ON/OFF
P2-21(IN)LPRST
P2-1,3,9,18,20 26(IN)IDGND
P2-4(OUT)HPON
P1-4(OUT)LINE ON/OFF
P2-33(OUT)LPRST

FIG 27.77C

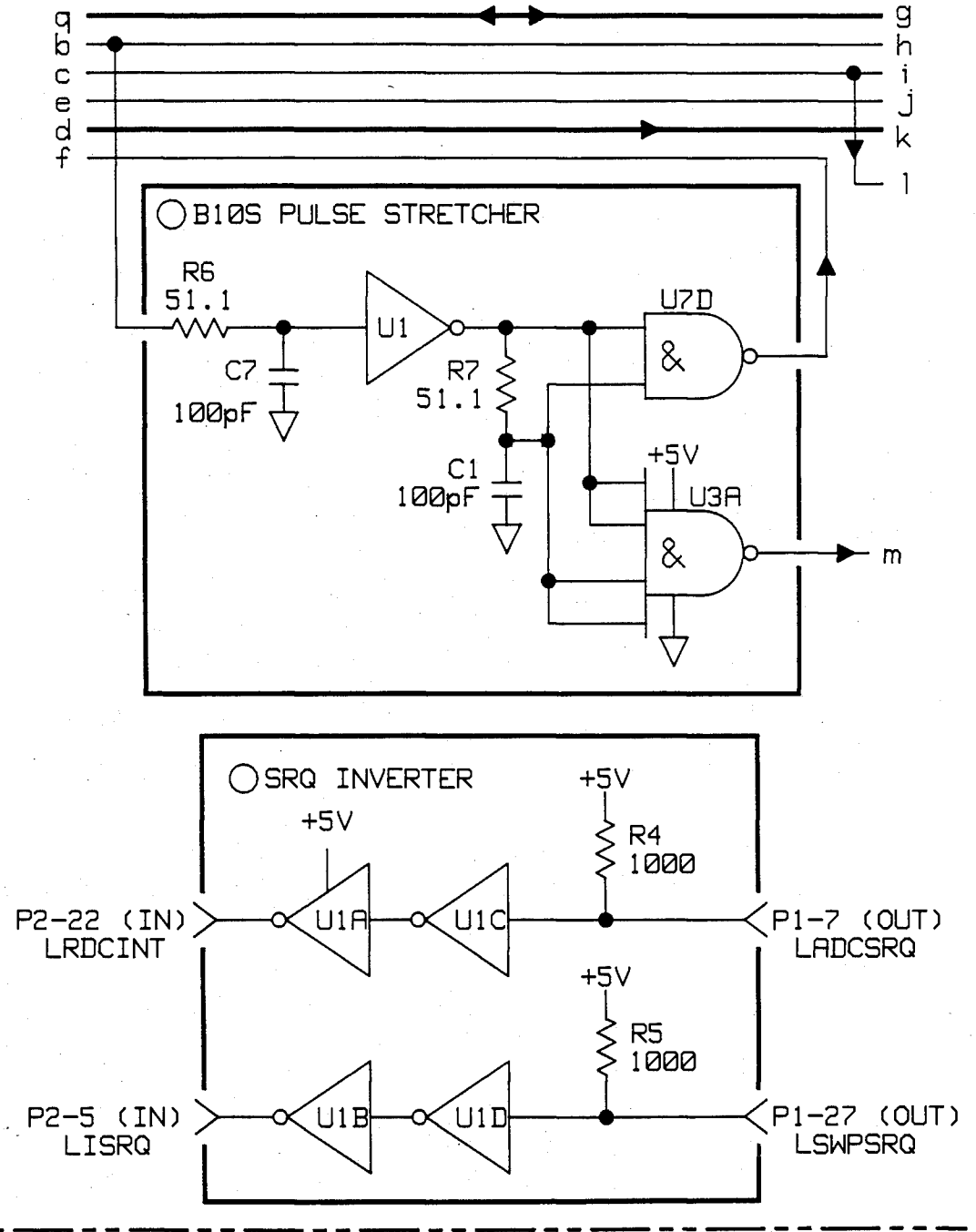

a
b
c
e
d
f
g
h
i
j
k
l
B10S PULSE STRETCHER
R6
51.1
C7
100pF
U1
R7
51.1
C1
100pF
U7D
&
+5V
U3A
&
m
SRQ INVERTER
+5V
+5V
R4
1000
P2-22 (IN)
LRDCINT
U1A
U1C
P1-7 (OUT)
LADCSRQ
+5V
R5
1000
P2-5 (IN)
LISRQ
U1B
U1D
P1-27 (OUT)
LSWPSRQ

FIG 27.78

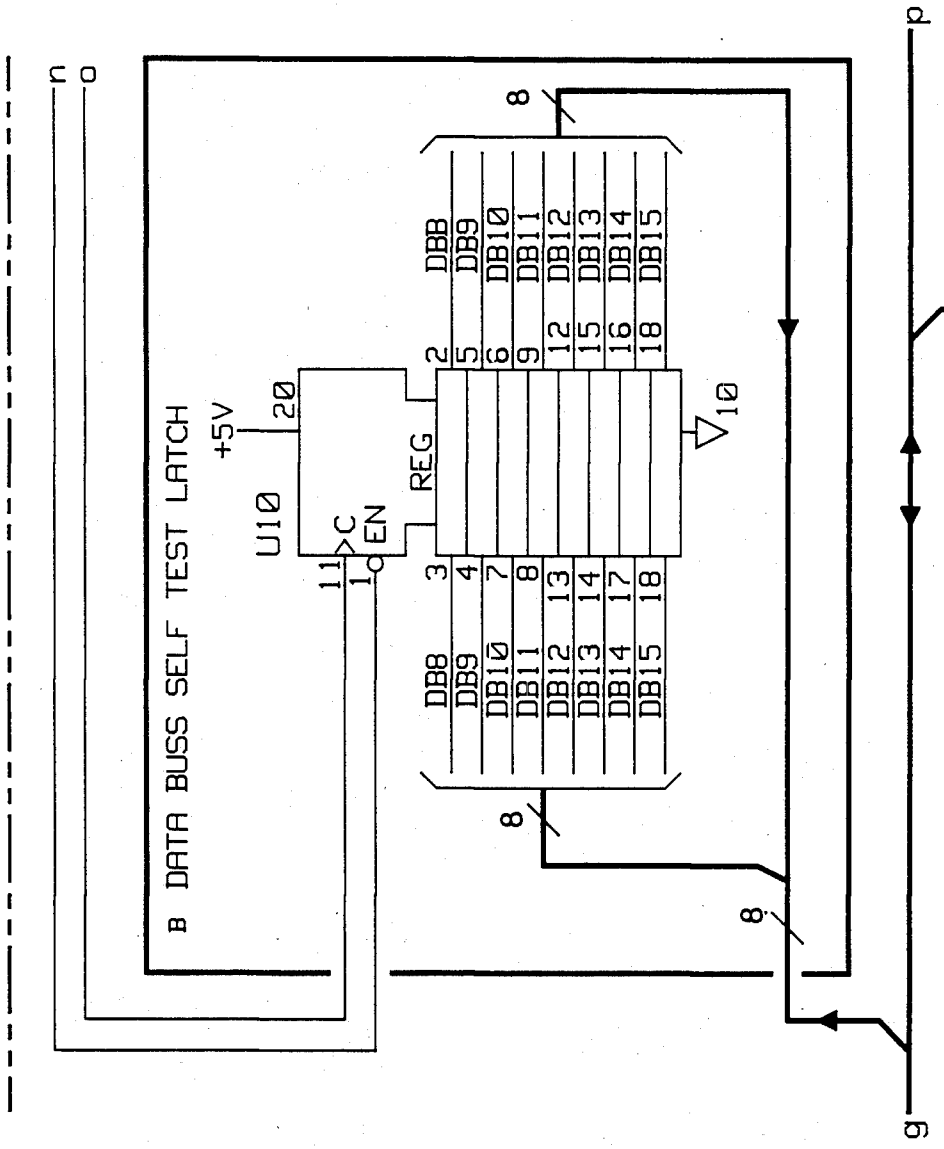

n
o
B DATA BUSS SELF TEST LATCH
+5V
20
U10
11
C
1
EN
REG
2
3
8
DB8
DB9
DB10
DB11
DB12
DB13
DB14
DB15
5
6
9
12
15
16
18
4
7
8
13
14
17
18
10
p
q
TO FIG 27.79B

FIG 27.79A

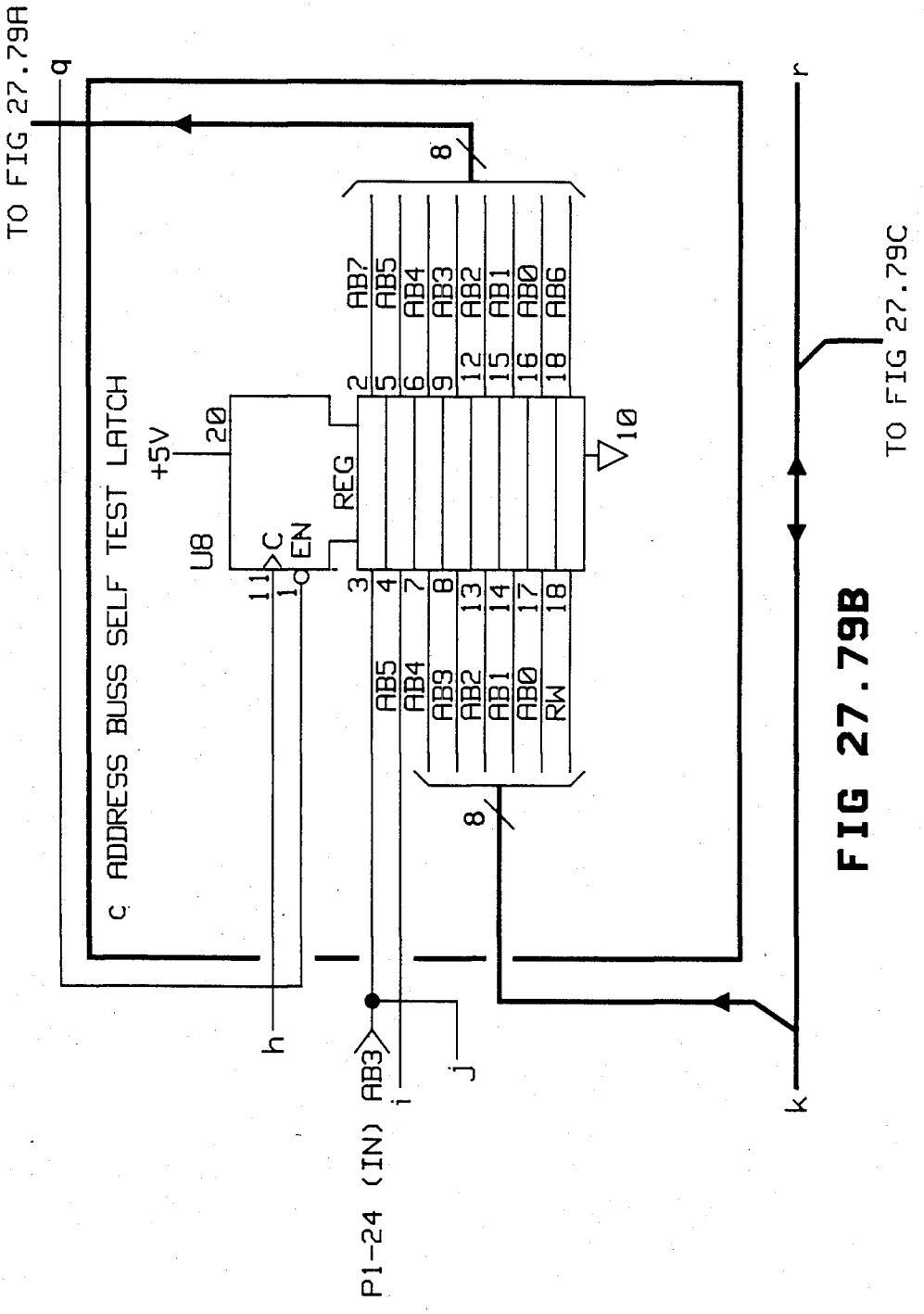

TO FIG 27.79A
q
c ADDRESS BUSS SELF TEST LATCH
+5V
20
U8
C
EN
REG
11
1
3
4
7
8
13
14
17
18
AB5
AB4
AB3
AB2
AB1
AB0
RW
8
2
5
6
9
12
15
16
18
AB7
AB5
AB4
AB3
AB2
AB1
AB0
AB6
10
h
i
j
k
r
P1-24 (IN) AB3
TO FIG 27.79C

FIG 27.79B

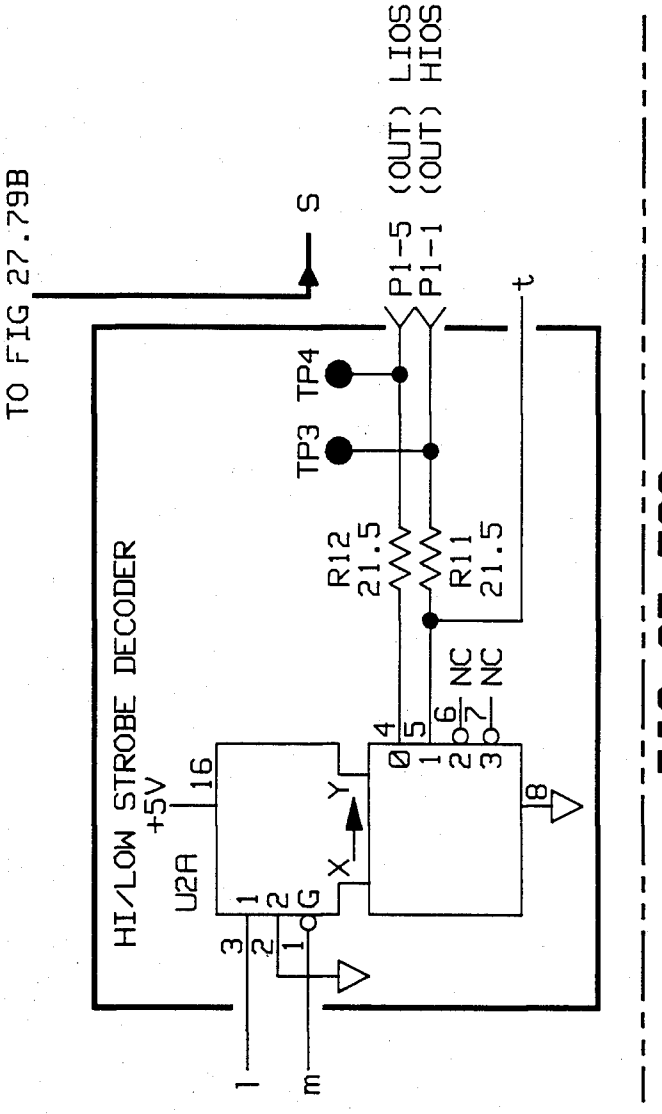

TO FIG 27.79B
S
P1-5 (OUT) LIOS
P1-1 (OUT) HIOS
t
TP4
TP3
R12
21.5
R11
21.5
NC
NC
HI/LOW STROBE DECODER
+5V
16
U2A
Y
X
G
1
2
3
4
5
6
7
8
l
m

FIG 27.79C

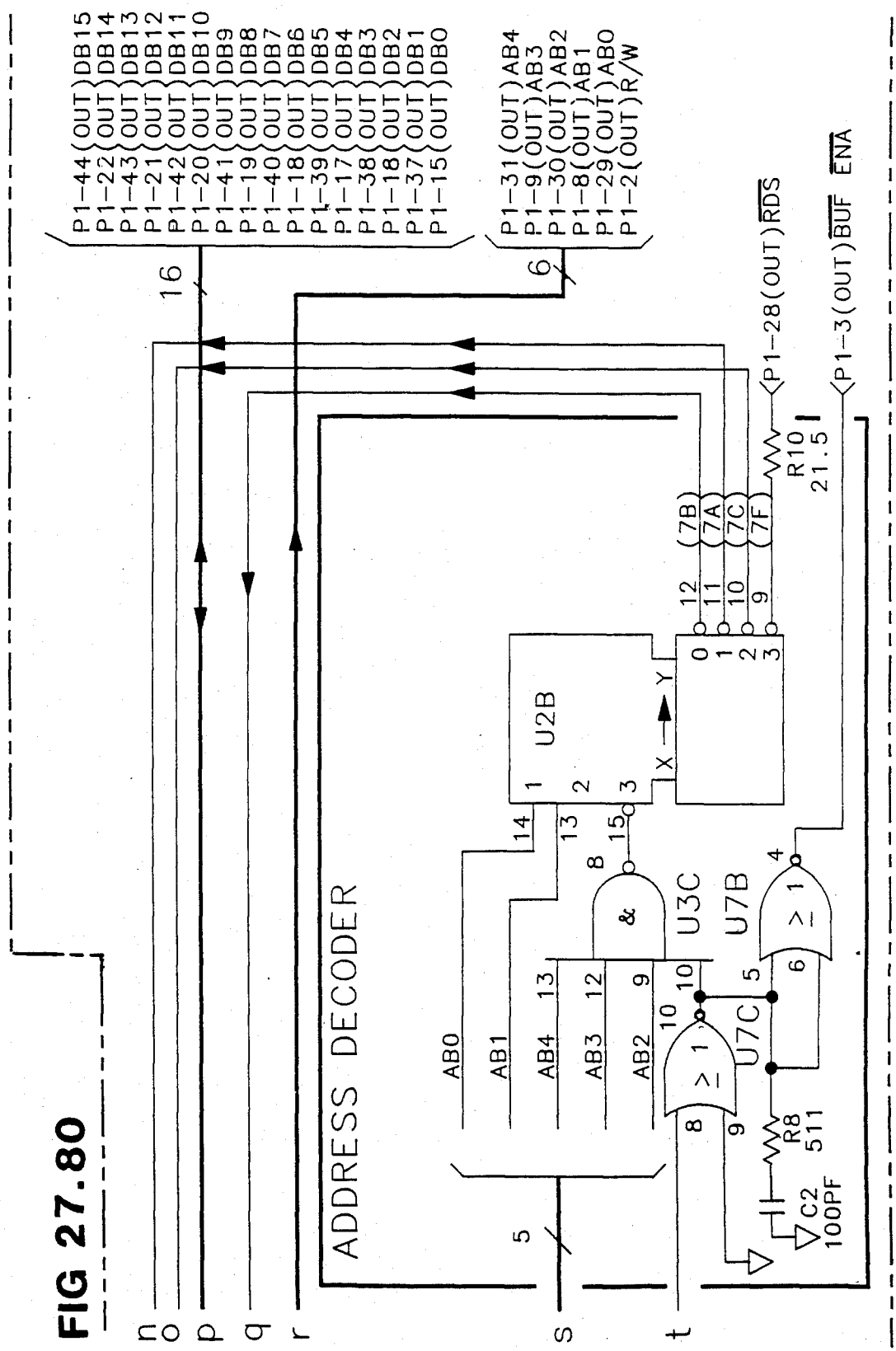

P1-44(OUT)DB15
P1-22(OUT)DB14
P1-43(OUT)DB13
P1-21(OUT)DB12
P1-42(OUT)DB11
P1-20(OUT)DB10
P1-41(OUT)DB9
P1-19(OUT)DB8
P1-40(OUT)DB7
P1-18(OUT)DB6
P1-39(OUT)DB5
P1-17(OUT)DB4
P1-38(OUT)DB3
P1-18(OUT)DB2
P1-37(OUT)DB1
P1-15(OUT)DB0
16
P1-31(OUT)AB4
P1-9(OUT)AB3
P1-30(OUT)AB2
P1-8(OUT)AB1
P1-29(OUT)AB0
P1-2(OUT)R/W
6
P1-28(OUT)RDS
P1-3(OUT)BUF ENA
R10
21.5
(7B)
(7A)
(7C)
(7F)
12
11
10
9
0
1
2
3
Y
X
U2B
1
2
3
14
13
15
8
&
U3C
U7B
≥ 1
4
6
5
AB0
AB1
AB4
AB3
AB2
13
12
9
10
10
≥ 1
U7C
8
9
R8
511
C2
100PF
5
ADDRESS DECODER
n
o
p
q
r
s
t

FIG 27.80

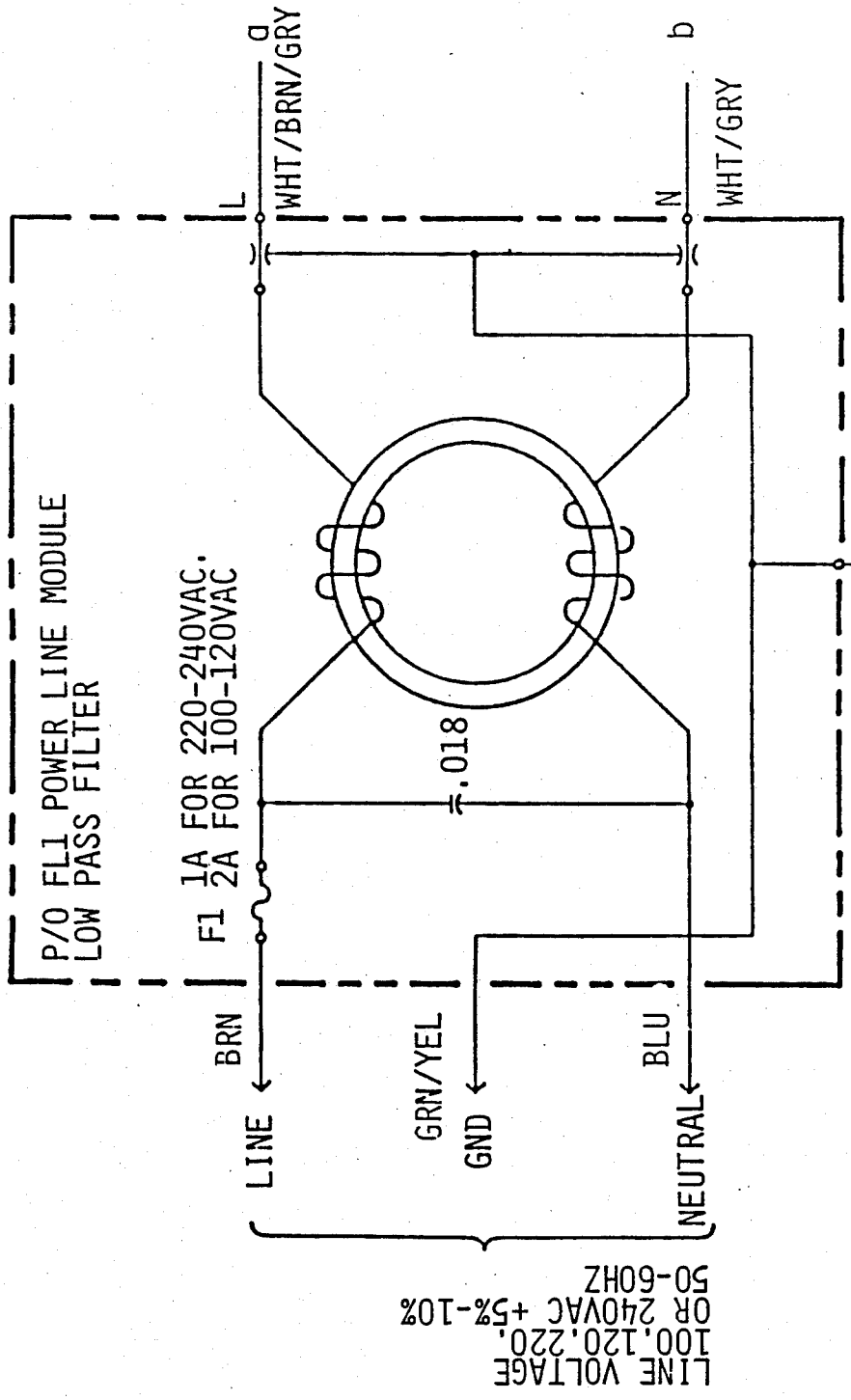

P/O FL1 POWER LINE MODULE
LOW PASS FILTER
F1 1A FOR 220-240VAC.
2A FOR 100-120VAC
.018
L
WHT/BRN/GRY
a
N
WHT/GRY
b
54
m
BRN
LINE
GRN/YEL
GND
BLU
NEUTRAL
LINE VOLTAGE
100,120,220,
OR 240VAC +5%-10%
50-60HZ

FIG 27.82A

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	18VAC	T1	A
2	18VAC	T1	A
3	9.7VAC	T1	B
4	18VAC CENTER TAP	T1	A
5	9.7VAC CENTER TAP	T1	B
6	9.7VAC	T1	B

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
E1	+5V RAM	A25R1: A25C1	B
E2	+5V UNREG	A25Q1	B
E3	-5V RAM	A25R2. A25C2	B
E4	GND	GND BUS	A
E5	-5V UNREG	A25Q2	B
E6	+15V UNREG	A15P1-40 A25Q3	A
E7	+15V RAM	A25R3 A25C3	A
E8	-15V UNREG	A15P1-17. A25Q4	A
E9	-15V RAM	A25R4 A25C4	A

SEMICONDUCTOR COMPONENTS
PARTS LIST (U'S AND Q'S)

REF. DESIG.	PART NO.	MFR. PART NO.
CR1-CR8	1901-0662	MR-751
DS1-DS4	1990-0485	5082-4984
VR1-VR2	1902-0025	
VR3-VR4	1902-0049	

FIG 27.82B

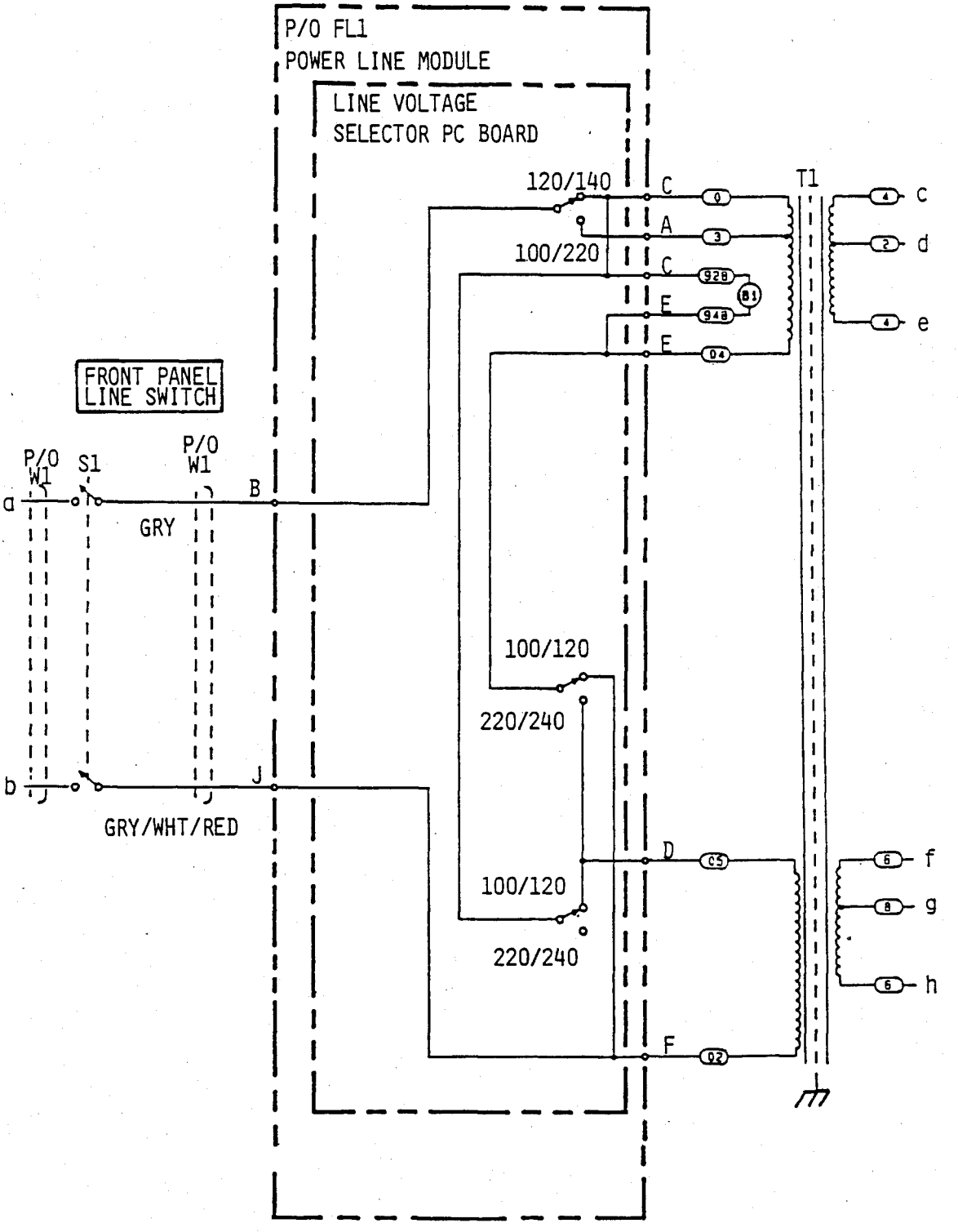

P/O FL1
POWER LINE MODULE
LINE VOLTAGE
SELECTOR PC BOARD
120/140
100/220
100/120
220/240
100/120
220/240
C
A
C
E
E
D
F
T1
FRONT PANEL
LINE SWITCH
P/O W1
S1
P/O W1
B
J
a
b
GRY
GRY/WHT/RED
Q
3
928
948
Q4
B1
Q5
Q2
4
2
4
6
8
6
c
d
e
f
g
h

FIG 27.83

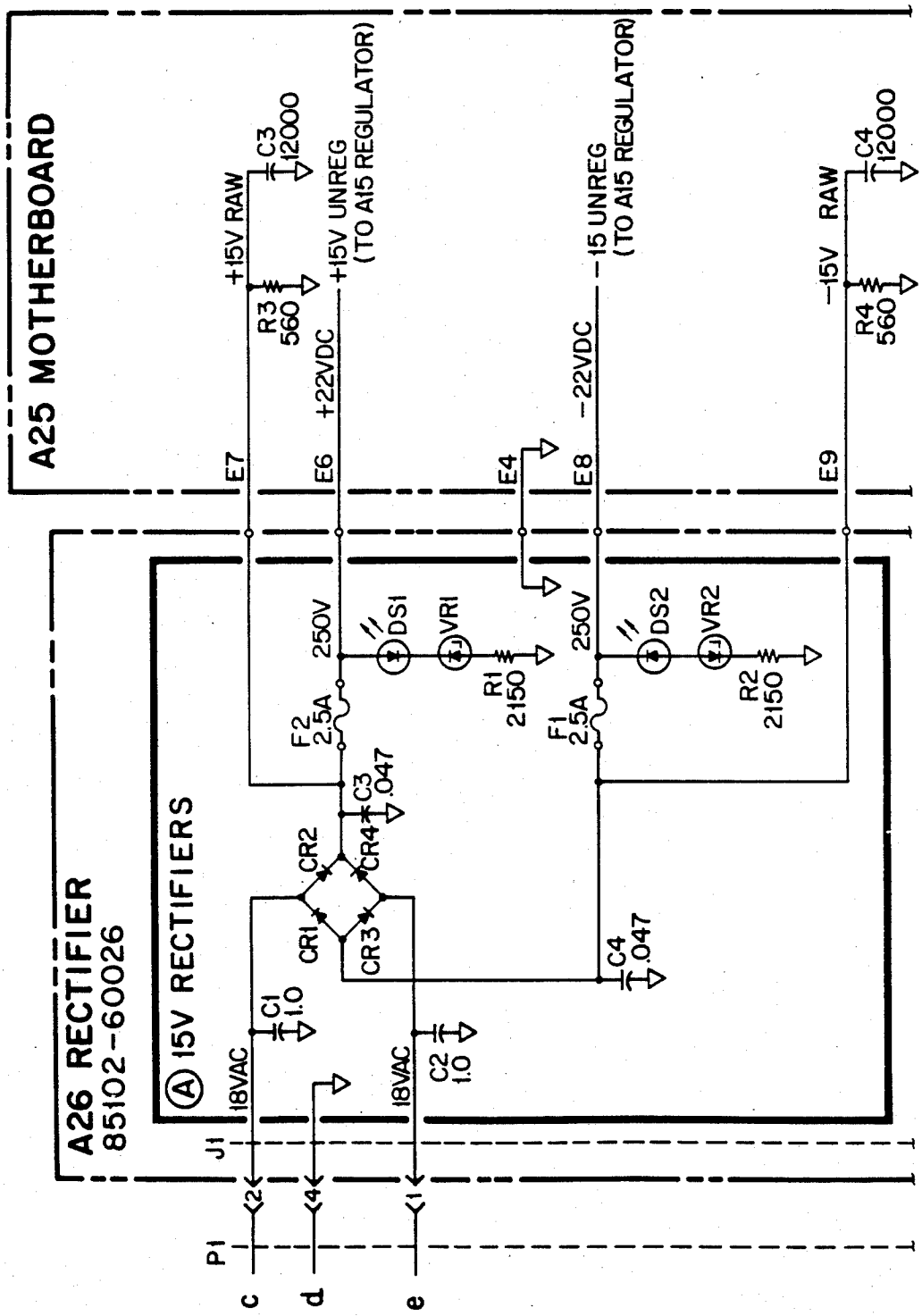

A25 MOTHERBOARD
A26 RECTIFIER
85102-60026
Ⓐ 15V RECTIFIERS
+15V RAW
C3
12000
R3
560
+15V UNREG
(TO A15 REGULATOR)
+22VDC
-22VDC
-15 UNREG
(TO A15 REGULATOR)
-15V RAW
C4
12000
R4
560
E7
E6
E4
E8
E9
250V
DS1
VR1
R1
2150
F2
2.5A
F1
2.5A
DS2
VR2
R2
2150
C3
.047
C4
.047
CR1
CR2
CR3
CR4
C1
1.0
C2
1.0
18VAC
18VAC
J1
P1
c
d
e
TO FIG 27.84B
TO FIG 27.84B

FIG 27.84A

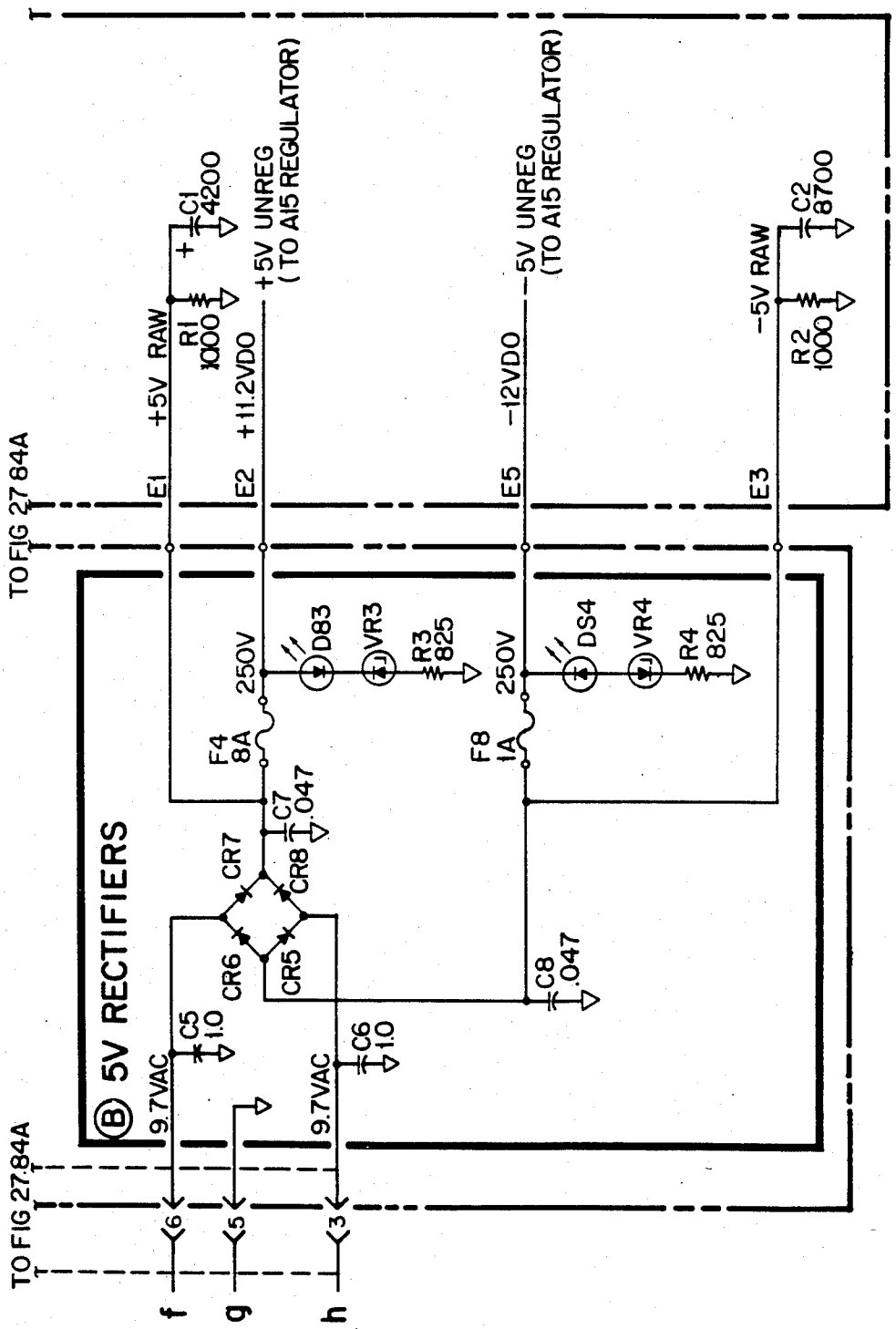

TO FIG 27.84A
E1
+5V RAW
R1 1000
C1 4200
+5V UNREG (TO A15 REGULATOR)
E2
+11.2VDO
250V
D83
VR3
R3 825
F4 8A
C7 .047
CR7
CR8
CR6
CR5
C5 1.0
C6 1.0
9.7VAC
9.7VAC
Ⓑ 5V RECTIFIERS
C8 .047
E5
-12VDO
-5V UNREG (TO A15 REGULATOR)
250V
DS4
VR4
R4 825
F8 1A
E3
-5V RAW
R2 1000
C2 8700
TO FIG 27.84A
6
5
3
f
g
h

FIG 27.84B

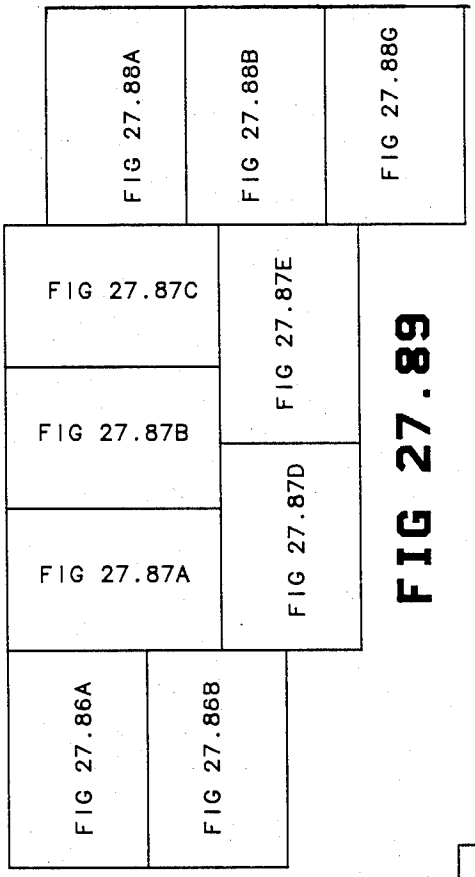


FIG 27.89

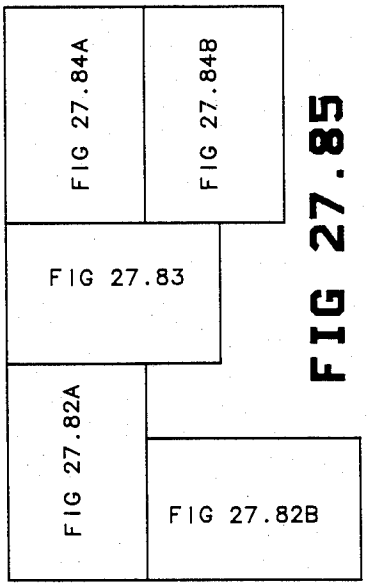


FIG 27.85

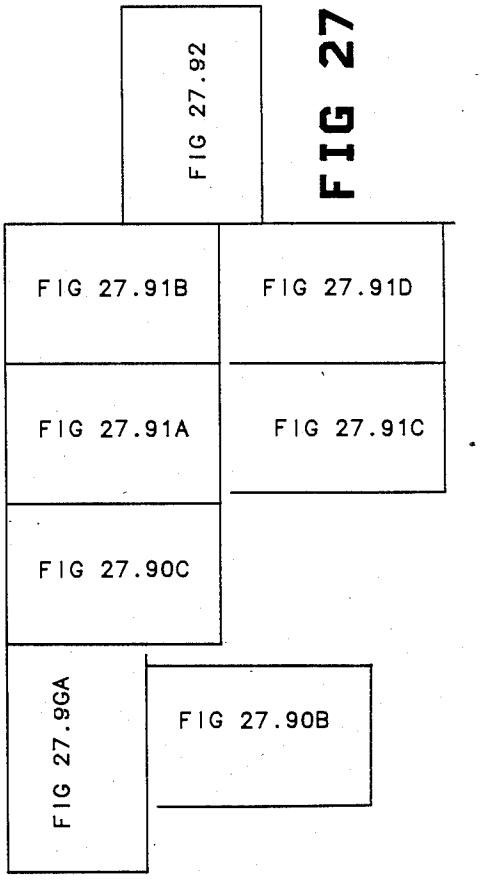


FIG 27.93

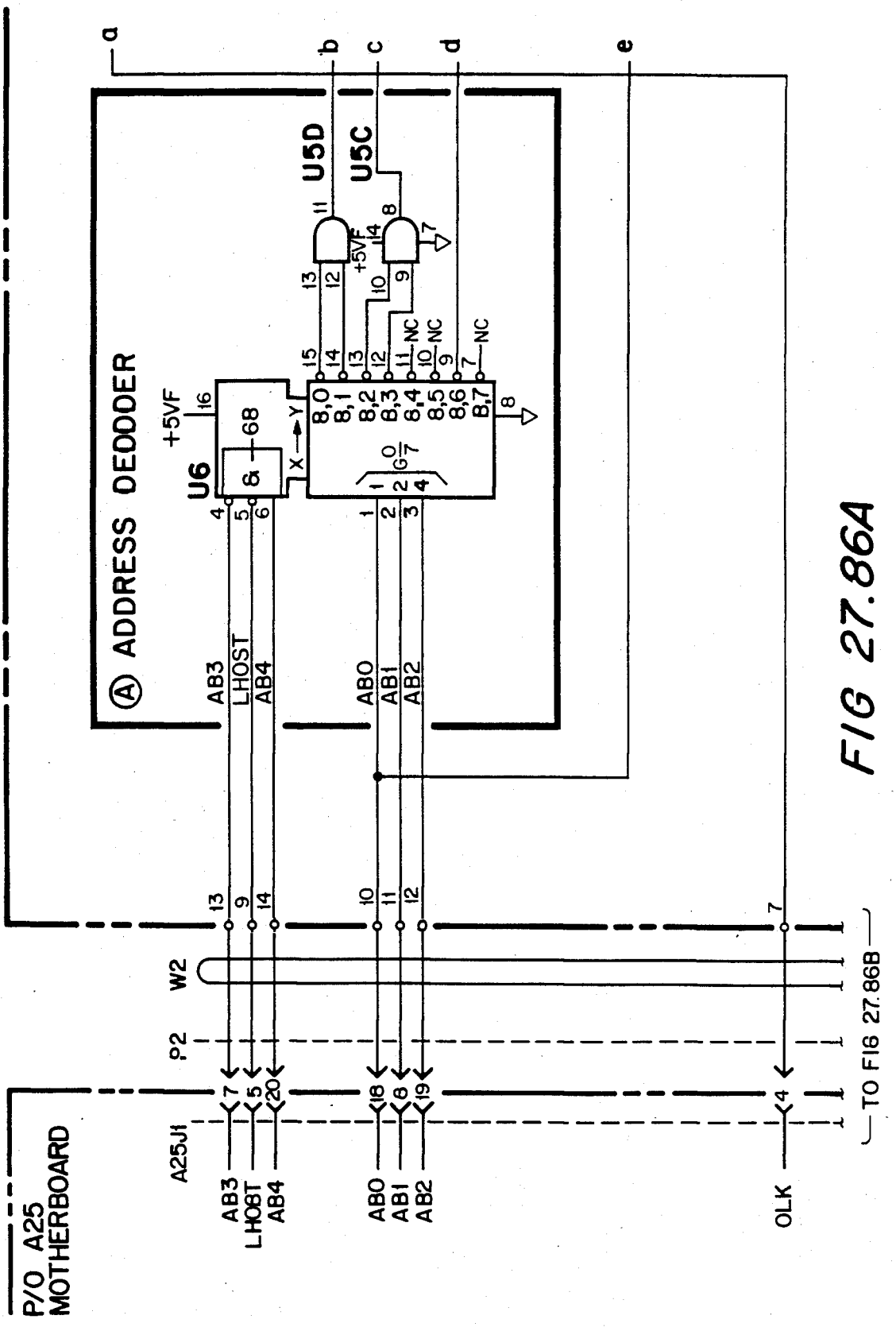

P/O A25
MOTHERBOARD
A25J1
P2
W2
AB3
LHOST
AB4
AB0
AB1
AB2
OLK
TO F16 27.86B
A ADDRESS DEODER
U6
U5D
U5C
+5VF
LHOST
AB3
AB4
AB0
AB1
AB2
NC

FIG 27.864

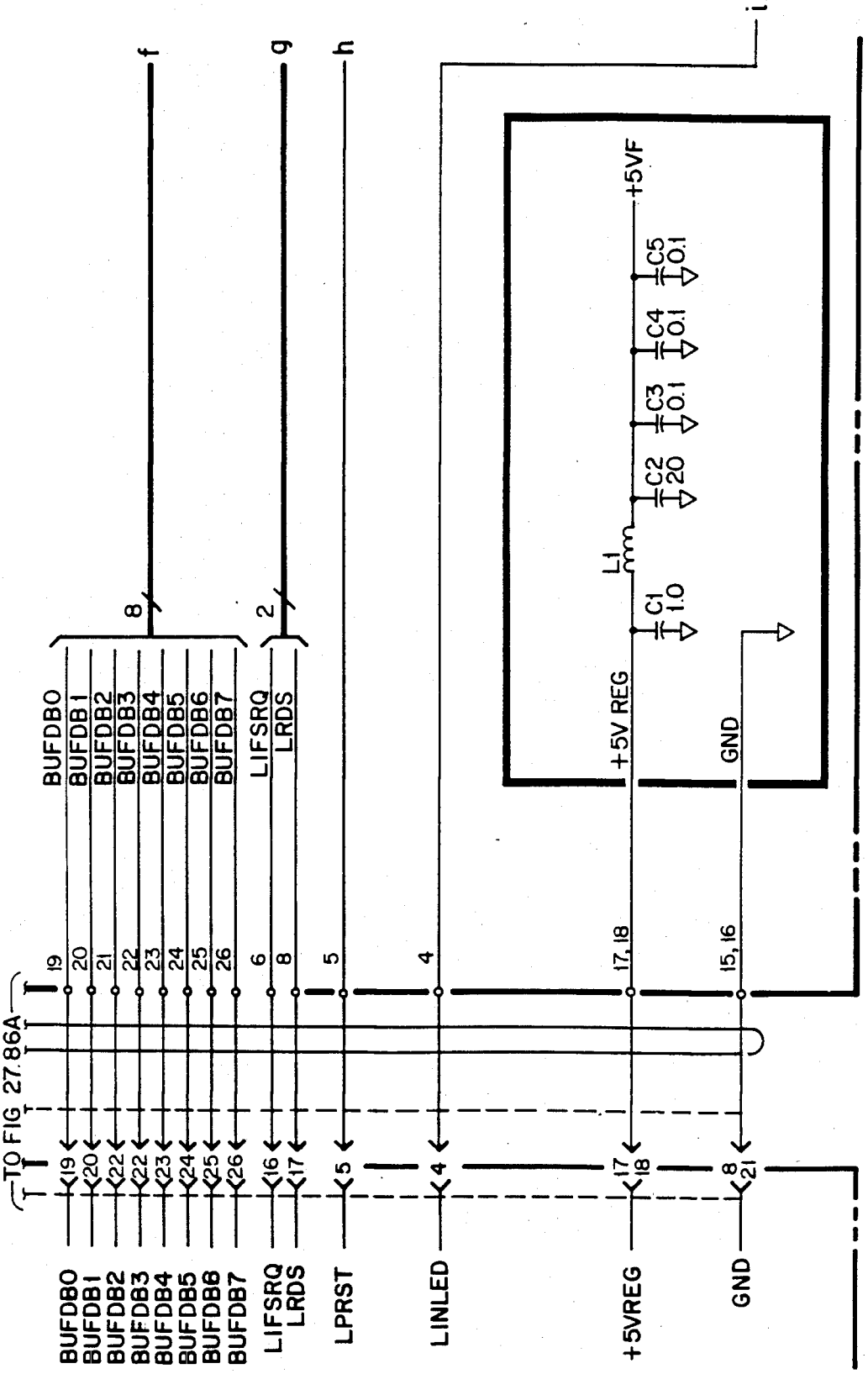

TO FIG 27.86A
BUFDB0
BUFDB1
BUFDB2
BUFDB3
BUFDB4
BUFDB5
BUFDB6
BUFDB7
LIFSRQ
LRDS
LPRST
LINLED
+5VREG
GND
+5V REG
GND
+5VF
L1
C1 1.0
C2 20
C3 0.1
C4 0.1
C5 0.1
f
g
h
i
8
2

FIG 27.86B

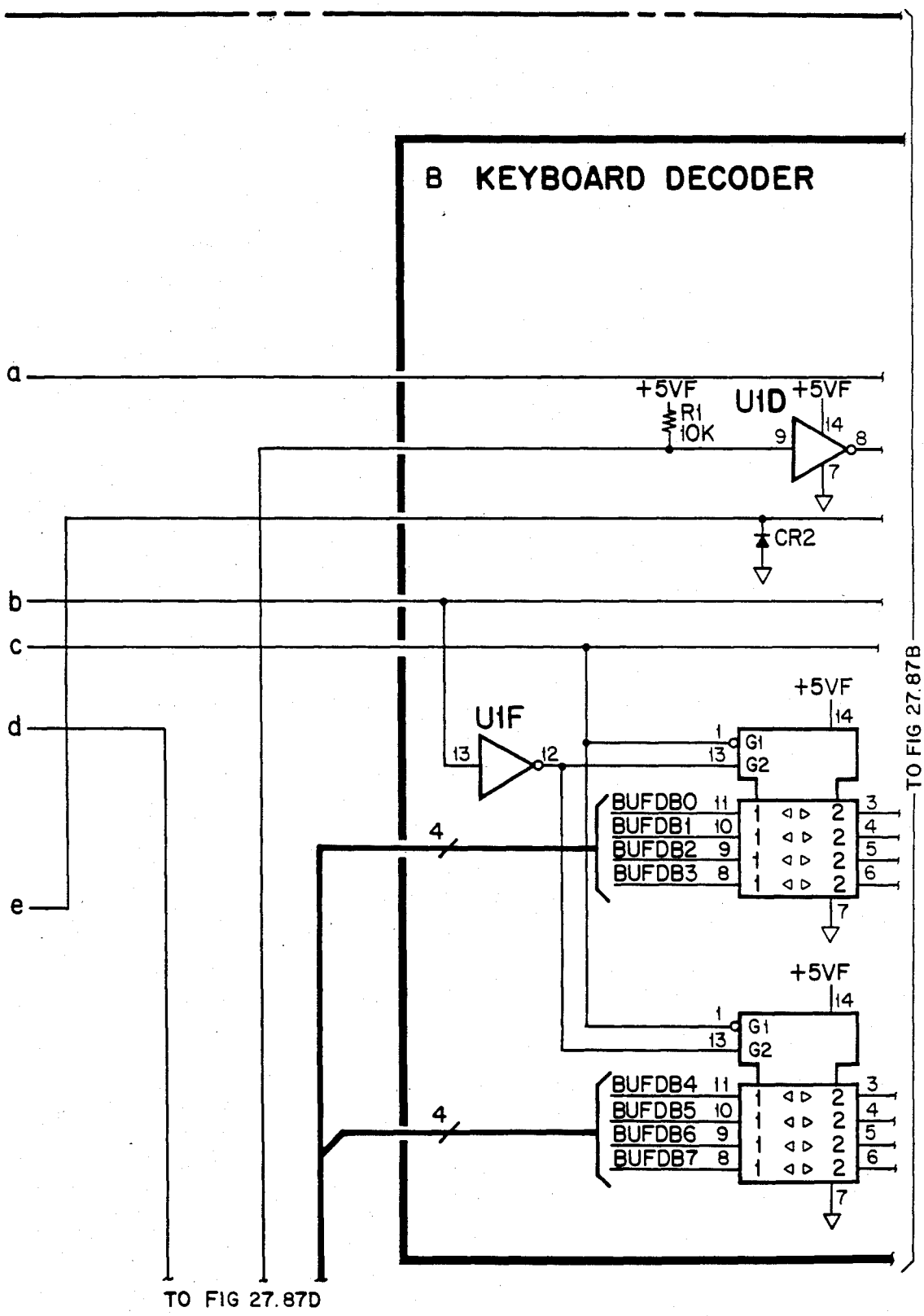

8 KEYBOARD DECODER
a
b
c
d
e
+5VF
R1
10K
U1D
9
14
8
7
CR2
U1F
13
12
1
13
G1
G2
+5VF
14
BUFDB0 11
BUFDB1 10
BUFDB2 9
BUFDB3 8
1
2
3
4
5
6
7
4
BUFDB4 11
BUFDB5 10
BUFDB6 9
BUFDB7 8
TO FIG 27.87B
TO FIG 27.87D

FIG 27.87A

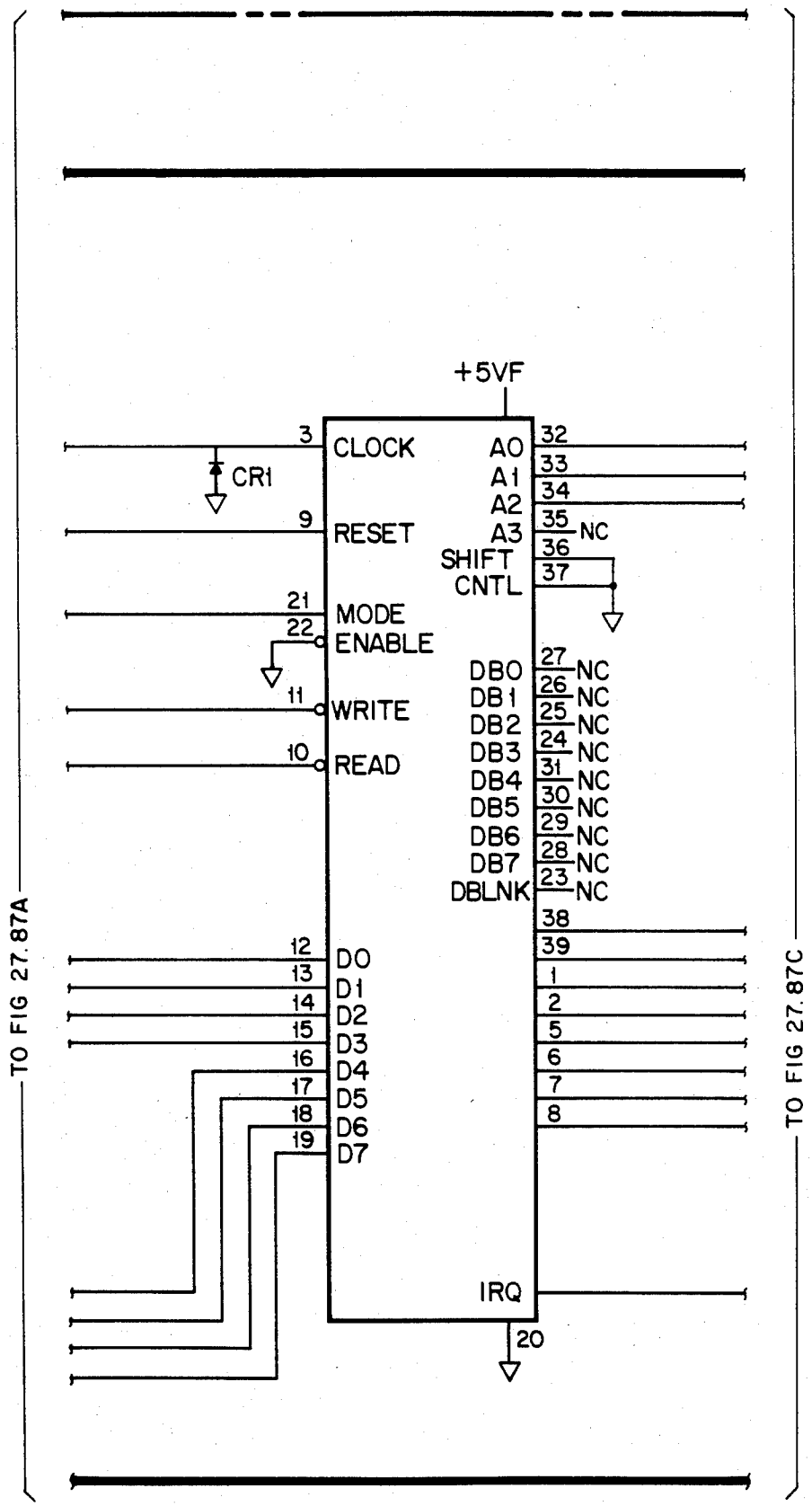

+5VF
3
CLOCK
CR1
9
RESET
21
MODE
22
ENABLE
11
WRITE
10
READ
12
DO
13
D1
14
D2
15
D3
16
D4
17
D5
18
D6
19
D7
AO
A1
A2
A3
SHIFT
CNTL
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
DBLNK
IRQ
20
32
33
34
35
NC
36
37
27
NC
26
NC
25
NC
24
NC
31
NC
30
NC
29
NC
28
NC
23
NC
38
39
1
2
5
6
7
8
TO FIG 27.87A
TO FIG 27.87C

FIG 27.87B

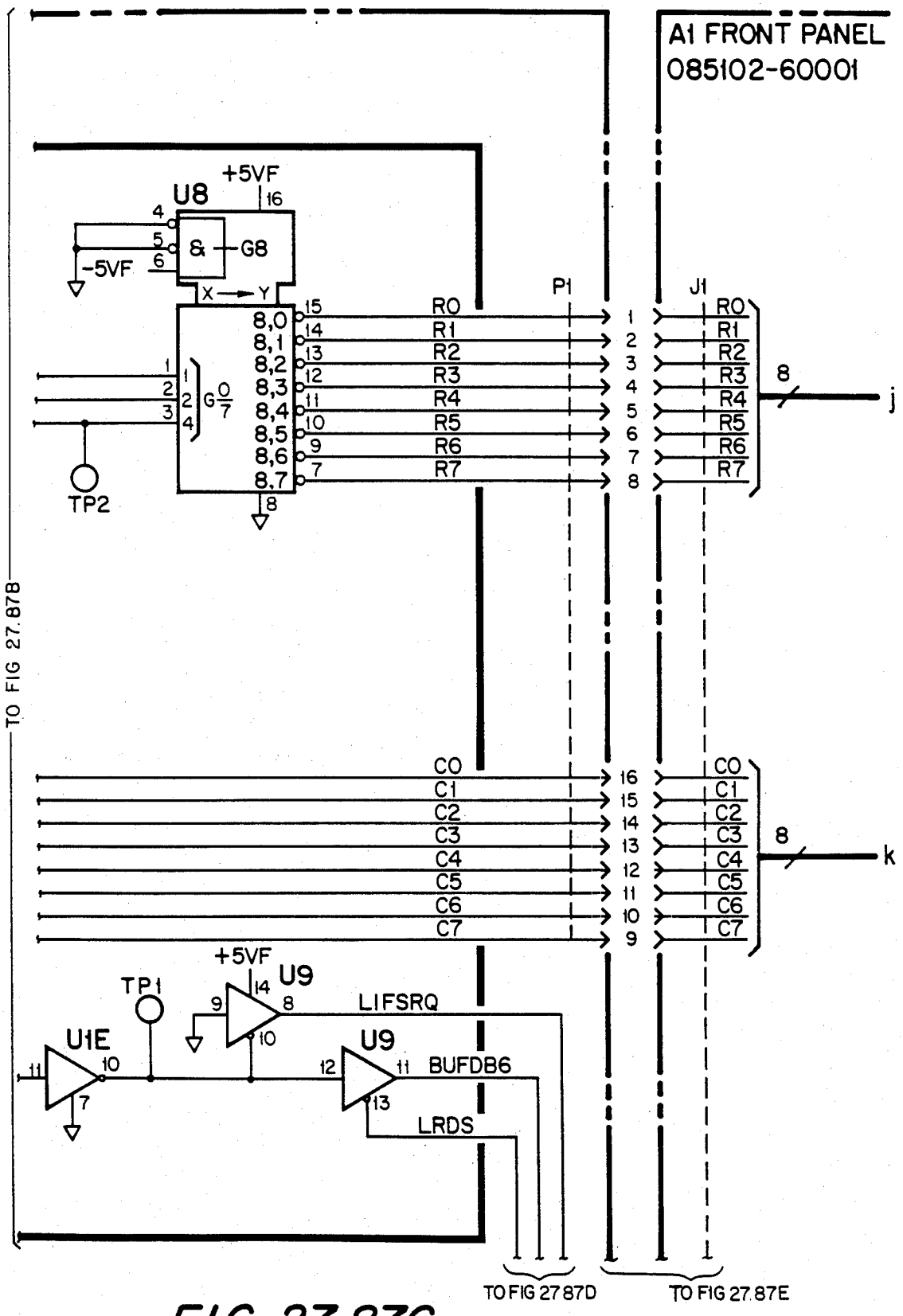

A1 FRONT PANEL
085102-60001
+5VF
U8
16
4
5
6
&
G8
-5VF
X
Y
15
14
13
12
11
10
9
7
8,0
8,1
8,2
8,3
8,4
8,5
8,6
8,7
8
1
2
3
4
G 0/7
TP2
P1
J1
R0
R1
R2
R3
R4
R5
R6
R7
1
2
3
4
5
6
7
8
8
j
C0
C1
C2
C3
C4
C5
C6
C7
16
15
14
13
12
11
10
9
k
+5VF
U9
14
9
8
10
TP1
LIFSRQ
U1E
11
10
7
U9
12
11
13
BUFDB6
LRDS
TO FIG 27.87B
TO FIG 27.87D
TO FIG 27.87E

FIG 27.87C

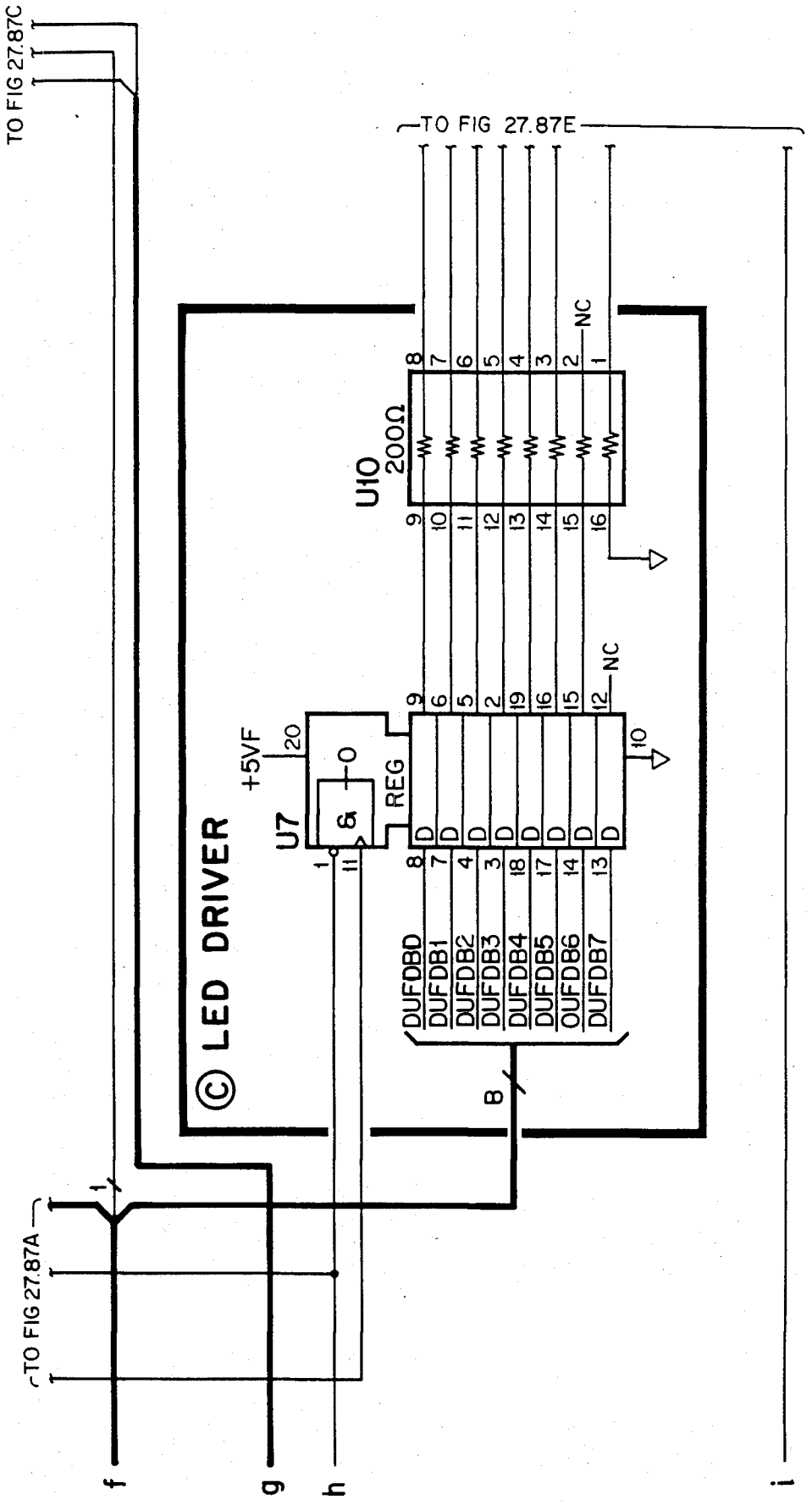

TO FIG 27.87C
TO FIG 27.87E
TO FIG 27.87A
© LED DRIVER
U10
200Ω
NC
U7
+5VF
REG
DUFDB0
DUFDB1
DUFDB2
DUFDB3
DUFDB4
DUFDB5
DUFDB6
DUFDB7
8
f
g
h
i

FIG 27.87D

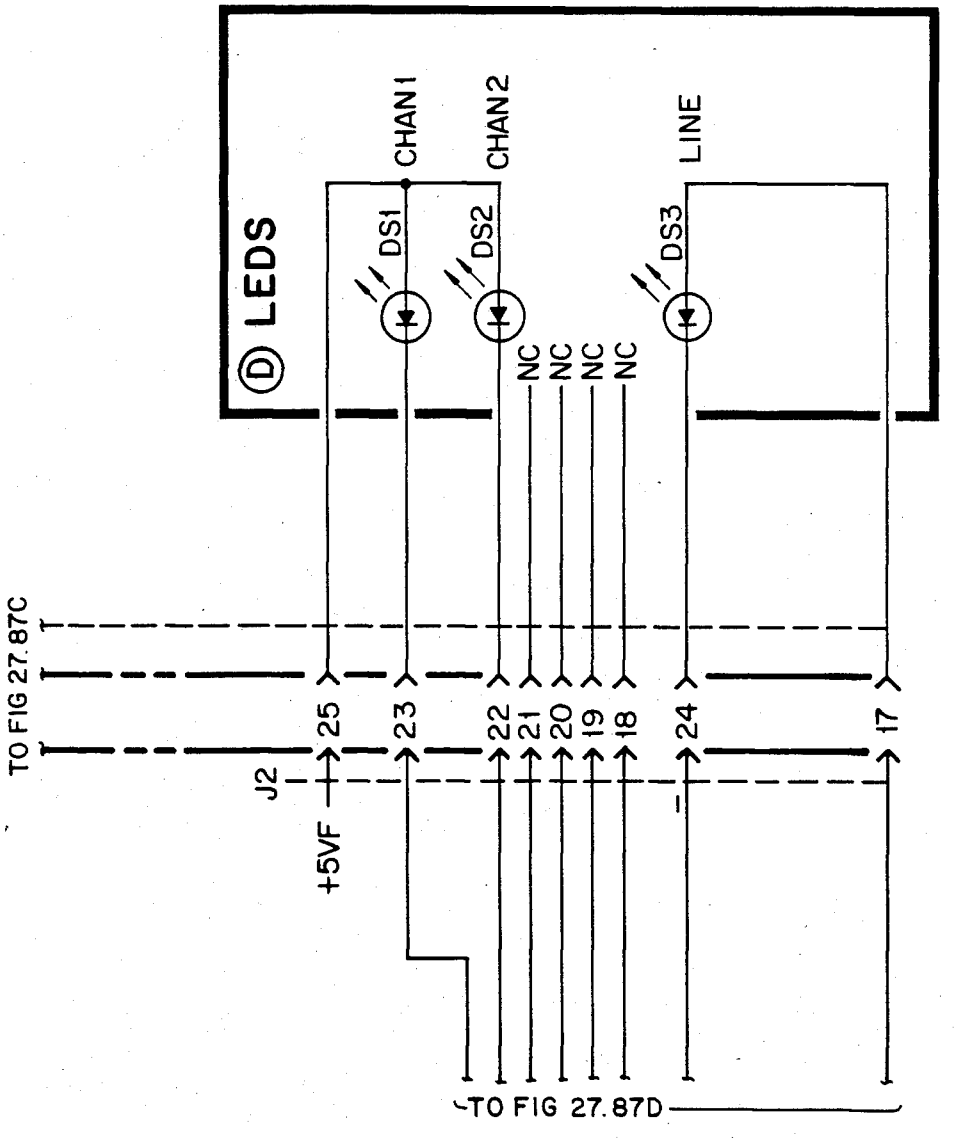

D LEDS
CHAN1
CHAN2
LINE
DS1
DS2
DS3
NC
NC
NC
NC
TO FIG 27.87C
J2
+5VF
25
23
22
21
20
19
18
24
17
TO FIG 27.87D

FIG 27.87E

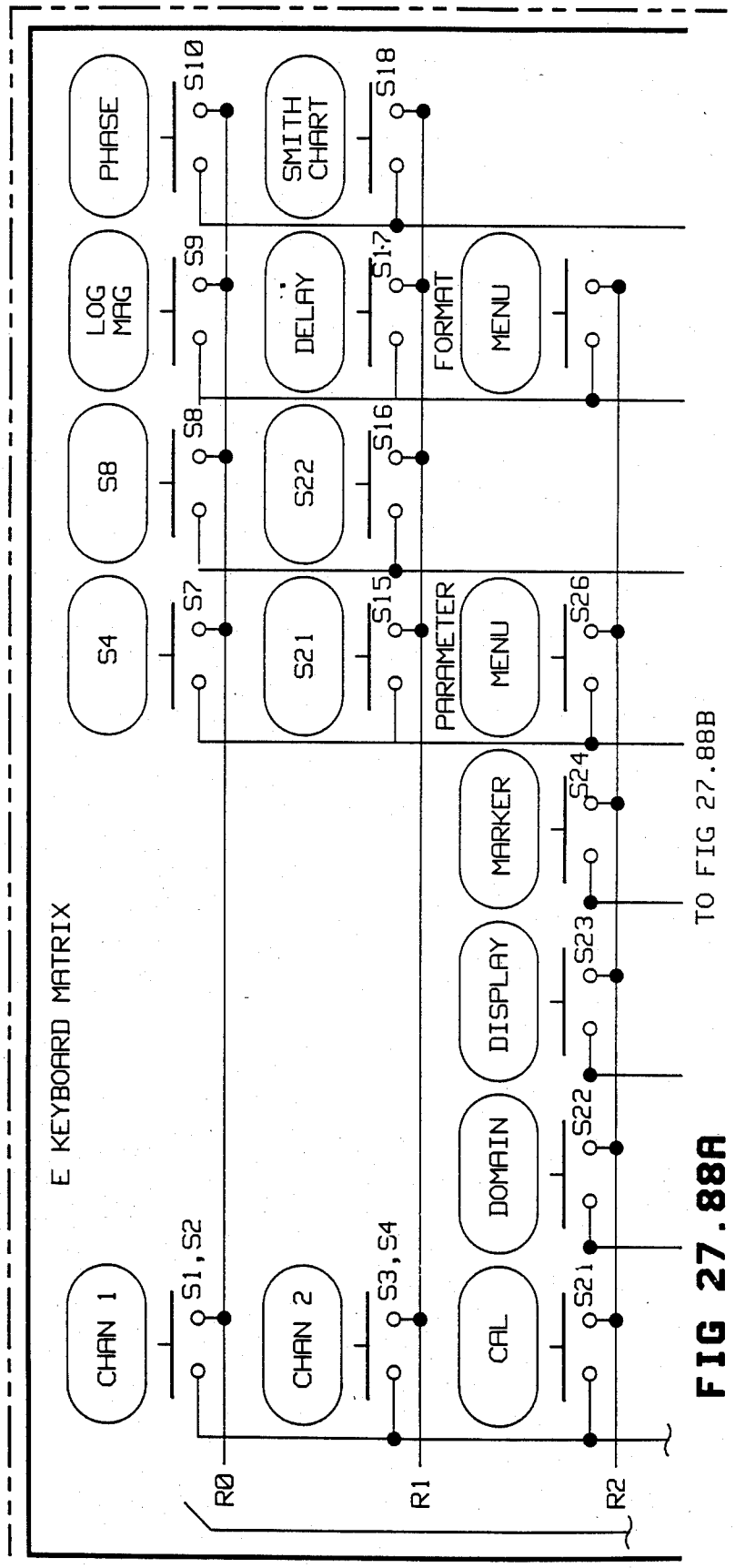

E KEYBOARD MATRIX
CHAN 1
CHAN 2
CAL
DOMAIN
DISPLAY
MARKER
S4
S8
LOG MAG
PHASE
S21
S22
DELAY
SMITH CHART
PARAMETER
MENU
FORMAT
MENU
S1,S2
S3,S4
S21
S22
S23
S24
S7
S8
S9
S10
S15
S16
S17
S18
S26
R0
R1
R2
TO FIG 27.88B

FIG 27.88A

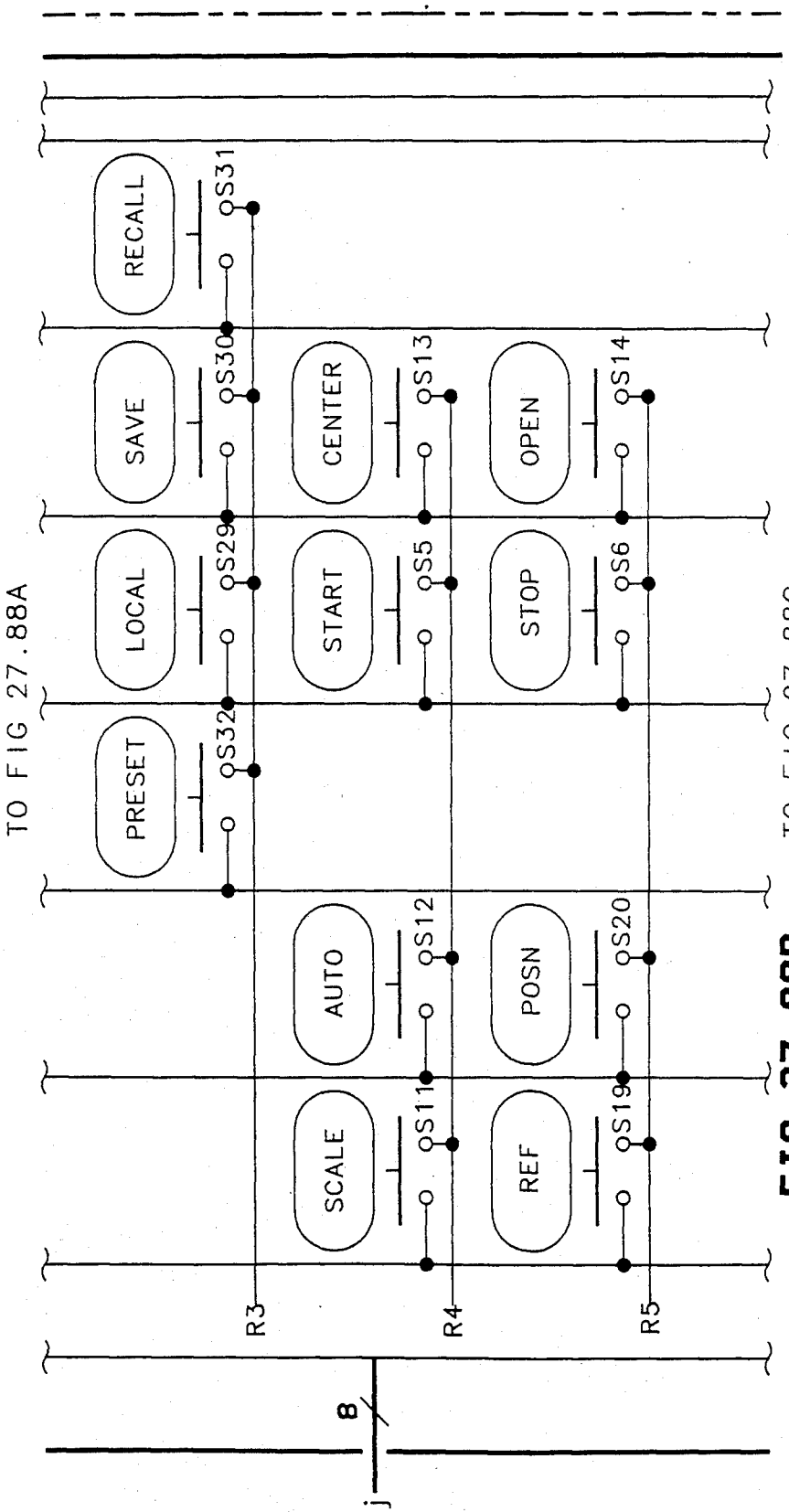

TO FIG 27.88A
TO FIG 27.88C
PRESET
LOCAL
SAVE
RECALL
START
CENTER
STOP
OPEN
AUTO
POSN
SCALE
REF
S32
S29
S30
S31
S5
S13
S6
S14
S12
S20
S11
S19
R3
R4
R5
8
j

FIG 27.88B

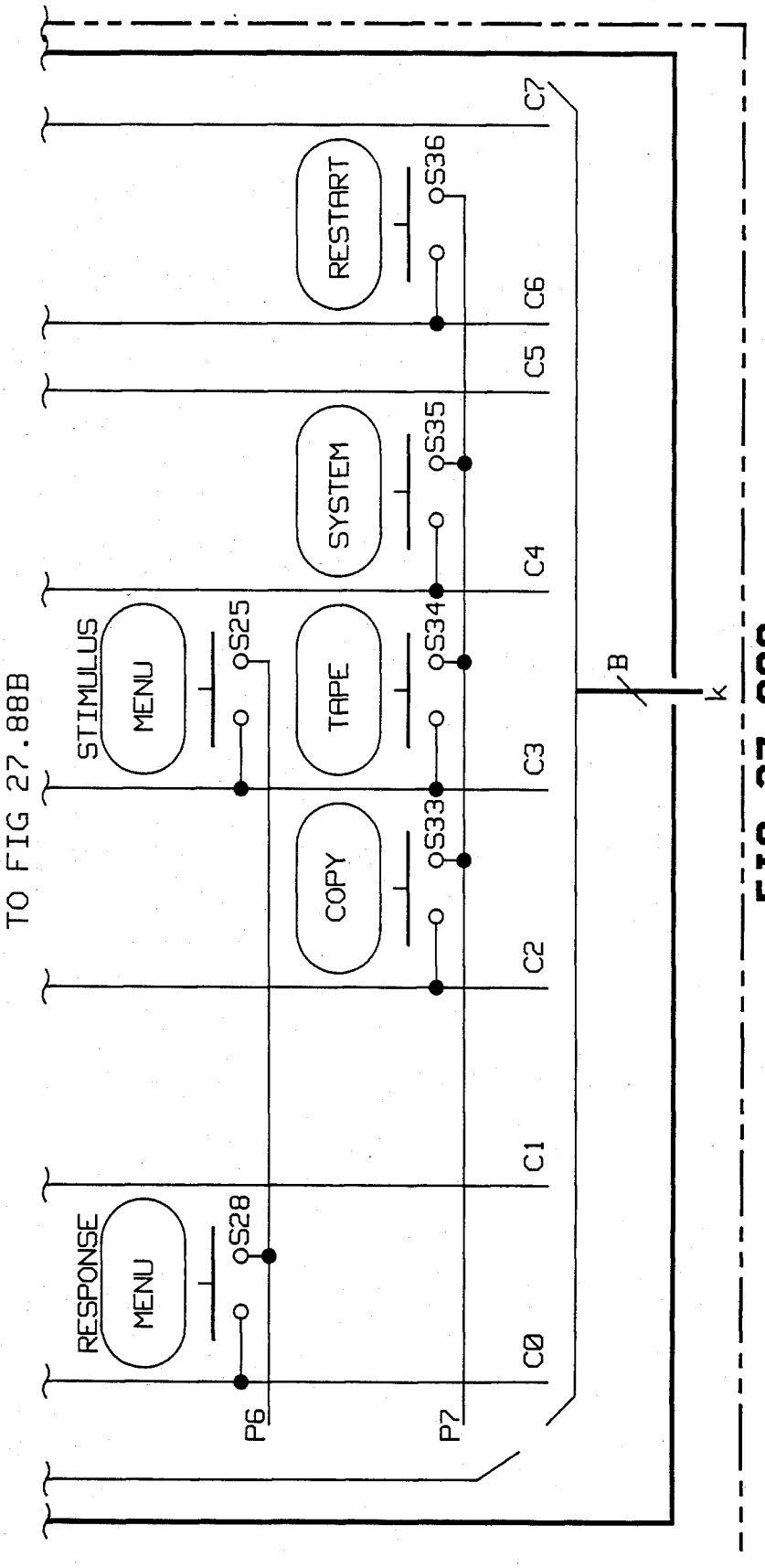

TO FIG 27.88B
RESPONSE
MENU
S28
STIMULUS
MENU
S25
COPY
S33
TAPE
S34
SYSTEM
S35
RESTART
S36
P6
P7
C0
C1
C2
C3
C4
C5
C6
C7
B
k

FIG 27.88C

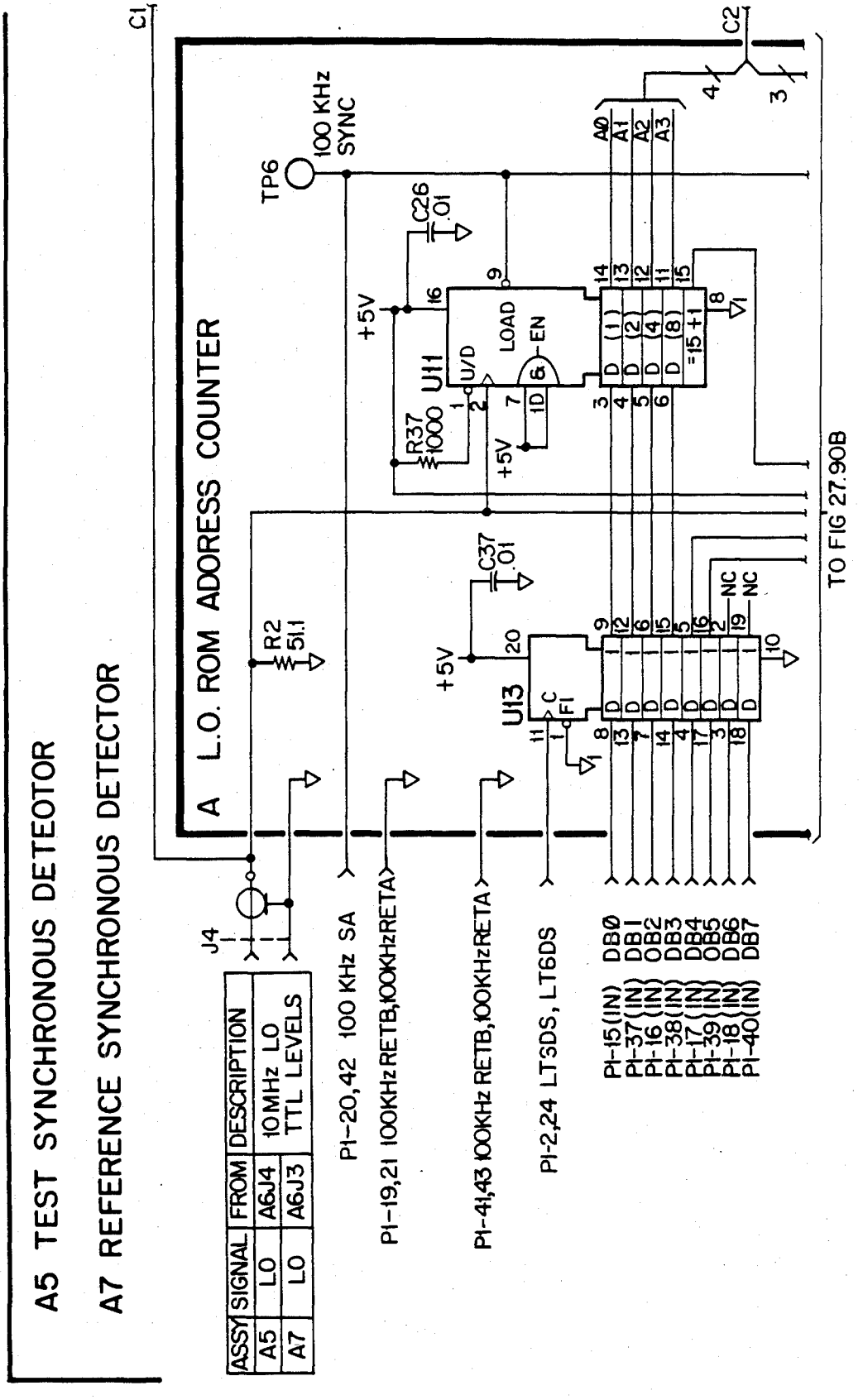

A5 TEST SYNCHRONOUS DETEOTOR
A7 REFERENCE SYNCHRONOUS DETECTOR
A L.O. ROM ADORESS COUNTER
C1
C2
TP6
100 KHz SYNC
+5V
C26 .01
U11
U/D
LOAD
EN
R37 1000
R2 51.1
C37 .01
U13
J4
ASSY | SIGNAL | FROM | DESCRIPTION
A5 | LO | A6J4 | 10 MHz LO
A7 | LO | A6J3 | TTL LEVELS
P1-20,42 100 KHz SA
P1-19,21 100KHz RETB,100KHzRETA
P1-41,43 100KHz RETB,100KHzRETA
P1-2,24 LT5DS, LT6DS
P1-15(IN) DB0
P1-37(IN) DB1
P1-16(IN) DB2
P1-38(IN) DB3
P1-17(IN) DB4
P1-39(IN) DB5
P1-18(IN) DB6
P1-40(IN) DB7
TO FIG 27.90B

FIG 27.90A

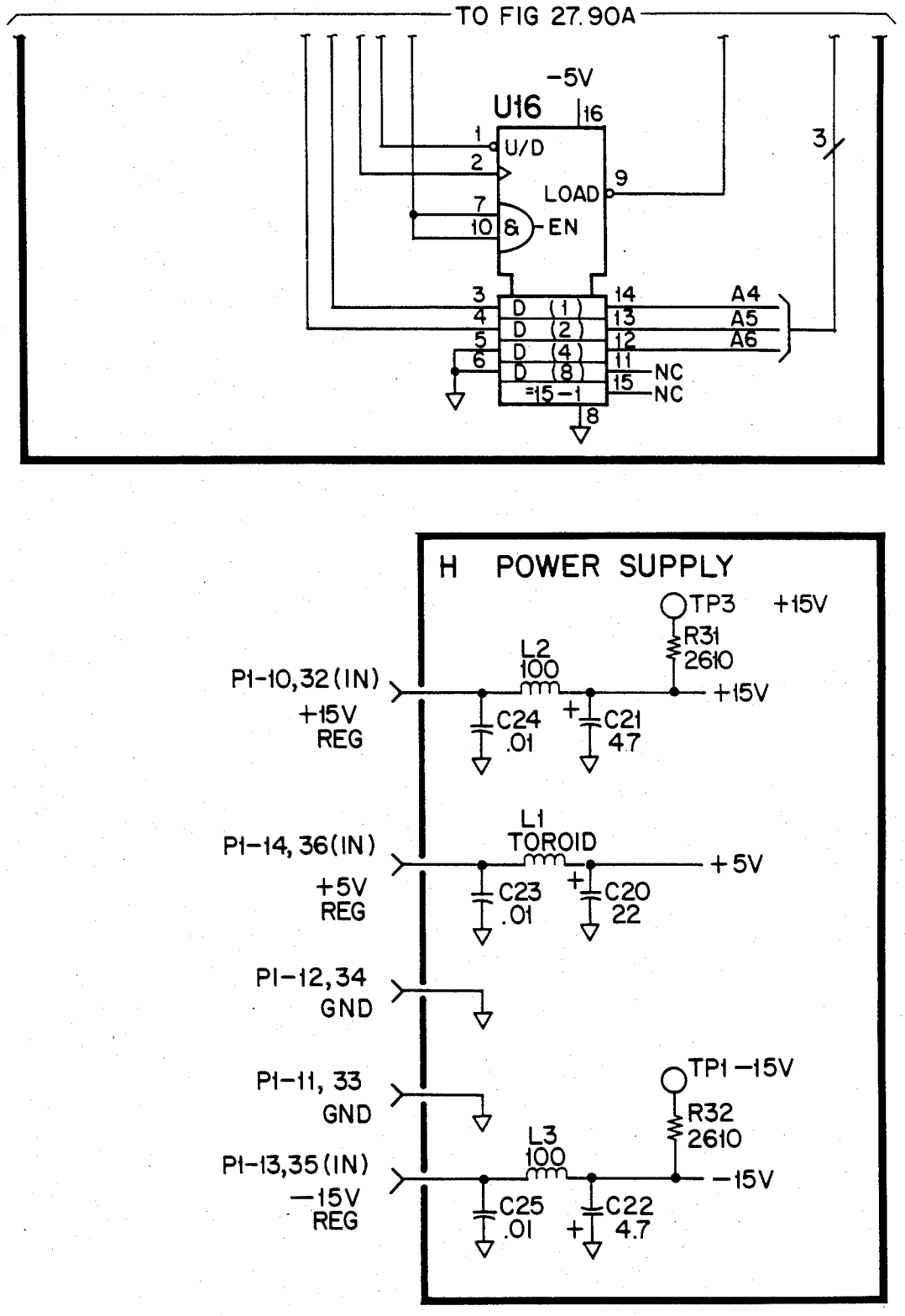

TO FIG 27.90A
-5V
U16
16
1
U/D
2
LOAD
9
7
10
&
EN
3
3
D (1)
14
A4
4
D (2)
13
A5
5
D (4)
12
A6
6
D (8)
11
NC
=15-1
15
NC
8
H POWER SUPPLY
TP3 +15V
R31
2610
L2
100
P1-10,32(IN)
+15V
REG
+15V
C24
.01
C21
47
L1
TOROID
P1-14,36(IN)
+5V
REG
+5V
C23
.01
C20
22
P1-12,34
GND
P1-11,33
GND
TP1 -15V
R32
2610
L3
100
P1-13,35(IN)
-15V
REG
-15V
C25
.01
C22
4.7

FIG 27.90B

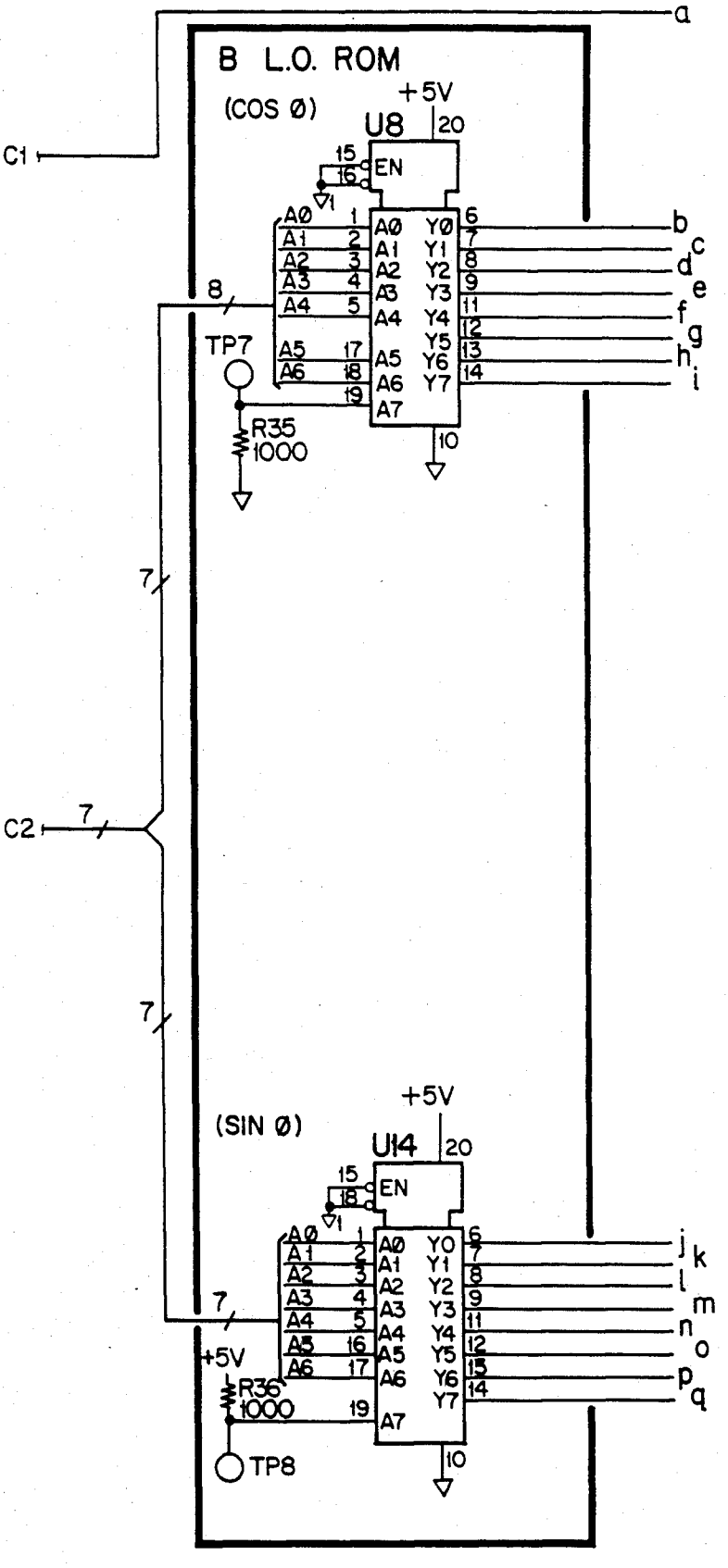

B L.O. ROM
(COS Ø)
+5V
U8
20
EN
15
16
1
A0
A1
A2
A3
A4
A5
A6
A7
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
10
C1
a
b
c
d
e
f
g
h
i
8
TP7
R35
1000
7
C2
7
7
(SIN Ø)
+5V
U14
20
EN
15
18
1
A0
A1
A2
A3
A4
A5
A6
A7
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
10
j
k
l
m
n
o
p
q
7
+5V
R36
1000
TP8

FIG 27.90C

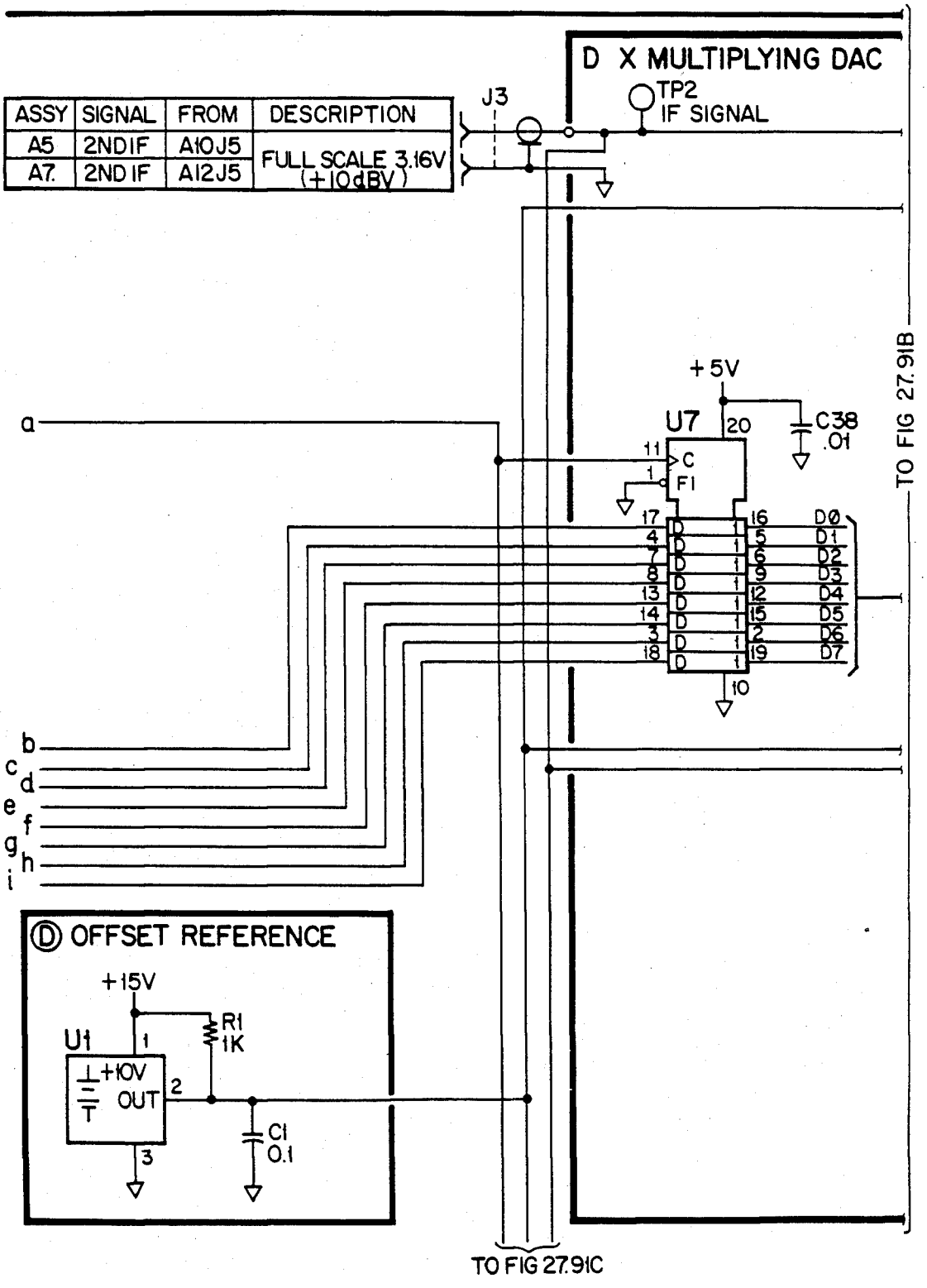

D X MULTIPLYING DAC
ASSY | SIGNAL | FROM | DESCRIPTION
A5 | 2NDIF | A10J5 | FULL SCALE 3.16V (+10dBV)
A7 | 2ND IF | A12J5
J3
TP2
IF SIGNAL
+5V
U7
20
C38
.01
11
C
1
F1
17
16
D0
D1
D2
D3
D4
D5
D6
D7
10
a
b
c
d
e
f
g
h
i
TO FIG 27.91B
Ⓓ OFFSET REFERENCE
+15V
U1
1
R1
1K
+10V
OUT
2
T
3
C1
0.1
TO FIG 27.91C

FIG 27.91A

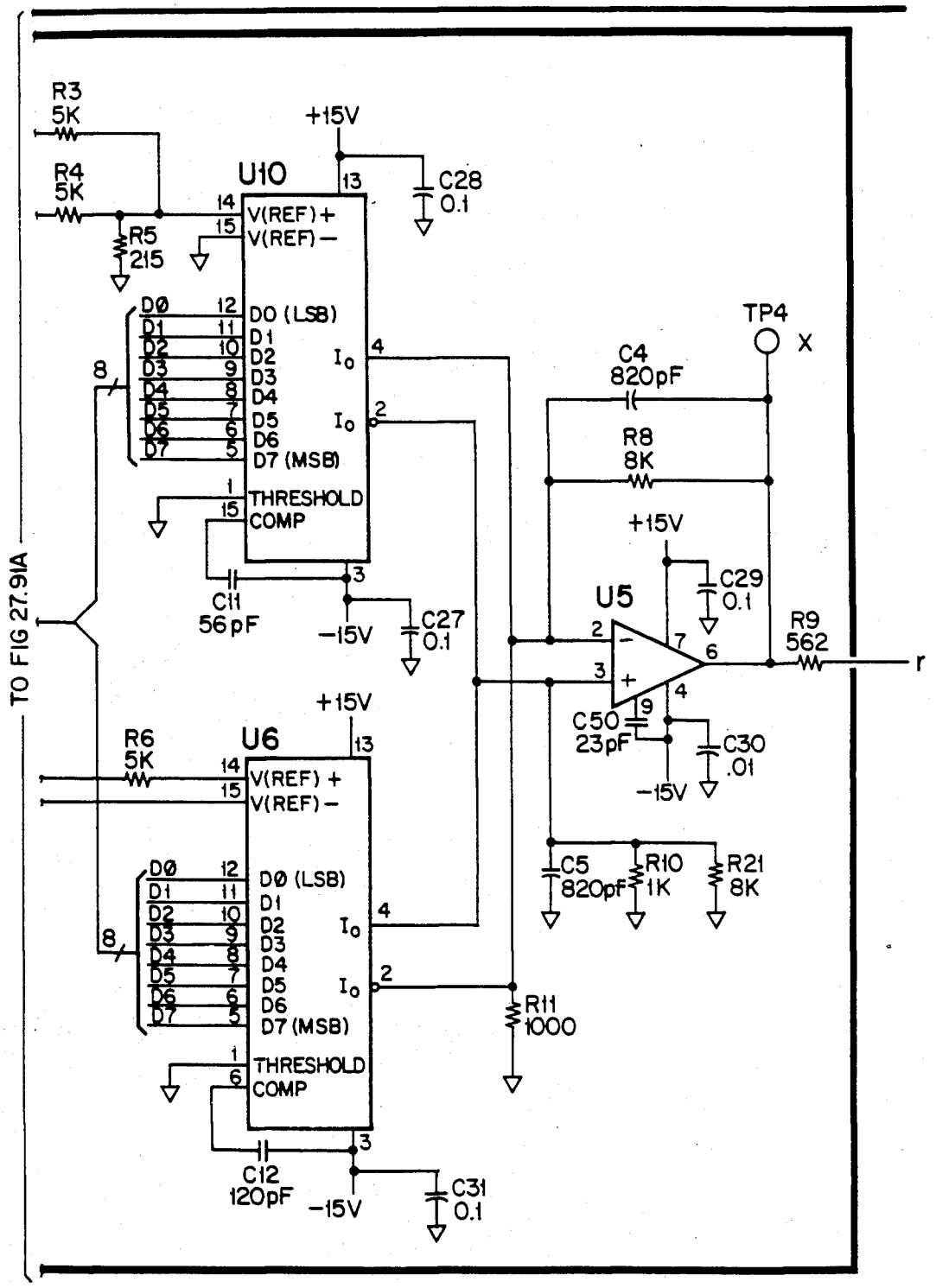

TO FIG 27.91A
R3
5K
R4
5K
R5
215
+15V
U10
C28
0.1
V(REF)+
V(REF)−
D0 (LSB)
D1
D2
D3
D4
D5
D6
D7 (MSB)
THRESHOLD
COMP
C11
56pF
−15V
C27
0.1
TP4
X
C4
820pF
R8
8K
+15V
C29
0.1
U5
R9
562
r
C50
23pF
C30
.01
−15V
R6
5K
+15V
U6
C5
820pF
R10
1K
R21
8K
R11
1000
C12
120pF
−15V
C31
0.1

FIG 27.91B

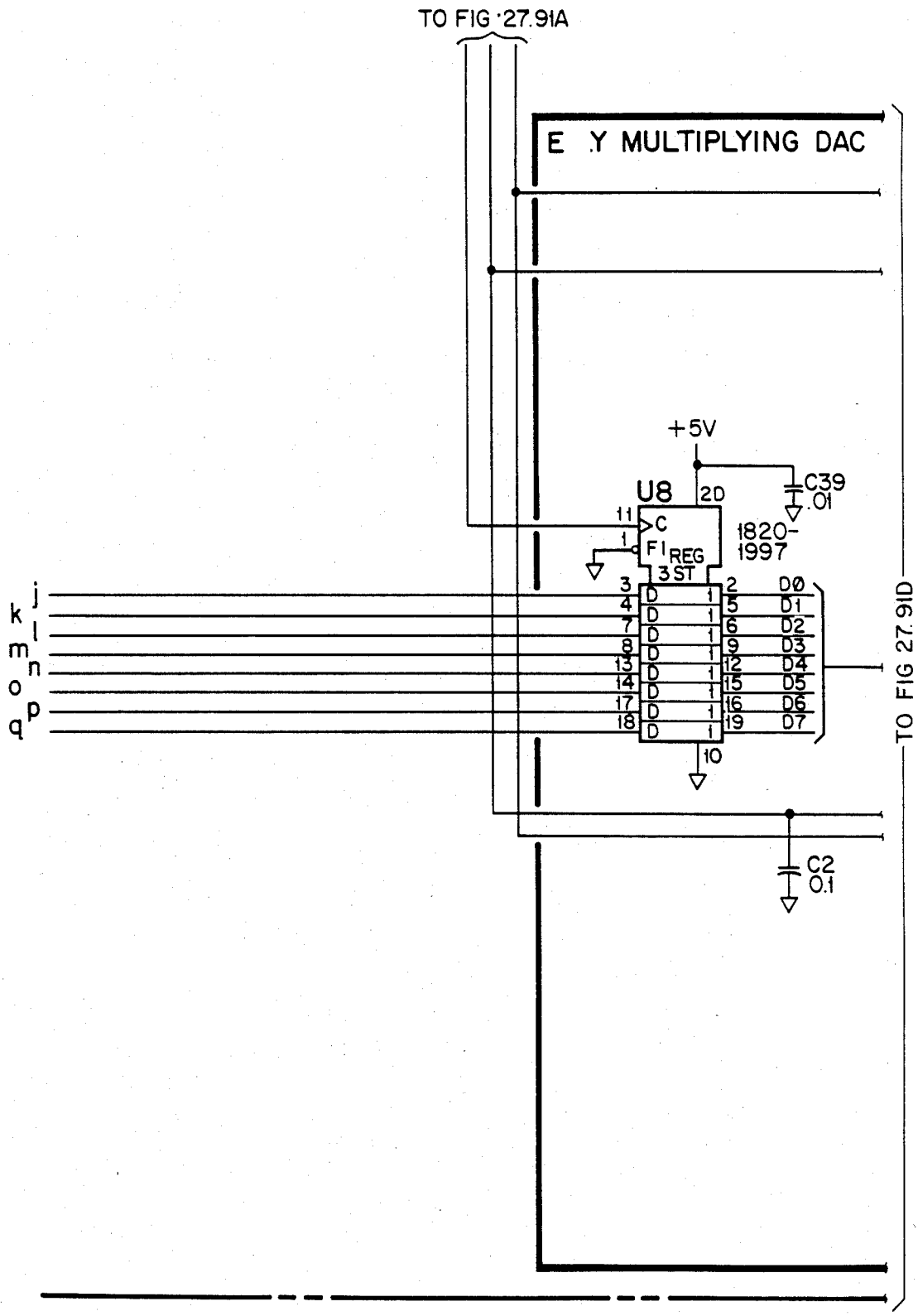

TO FIG 27.91A
E .Y MULTIPLYING DAC
+5V
U8
2D
C39
.01
1820-
1997
C
F1
REG
3ST
j
k
l
m
n
o
p
q
D0
D1
D2
D3
D4
D5
D6
D7
C2
0.1
TO FIG 27.91D

FIG 27.91C

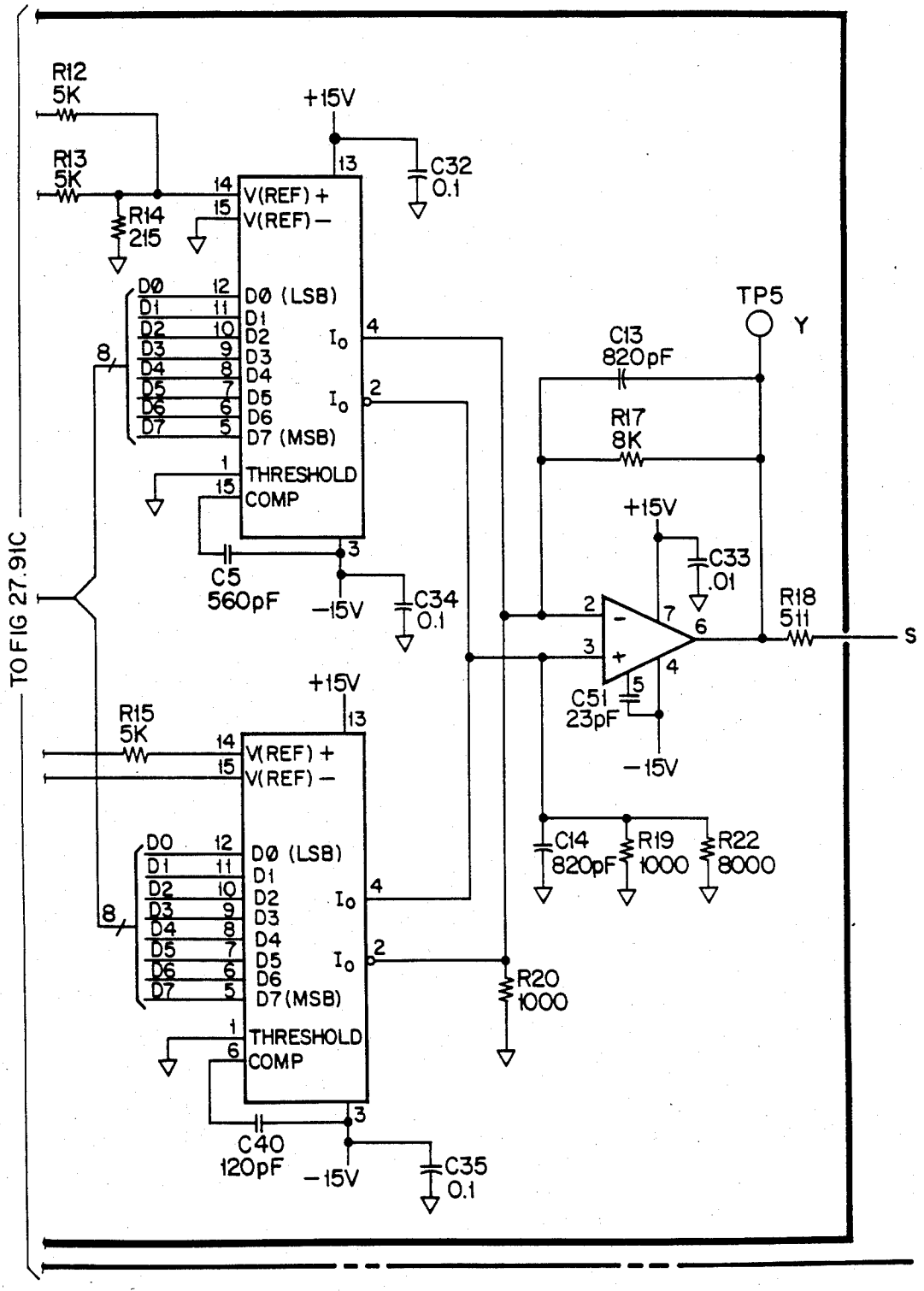
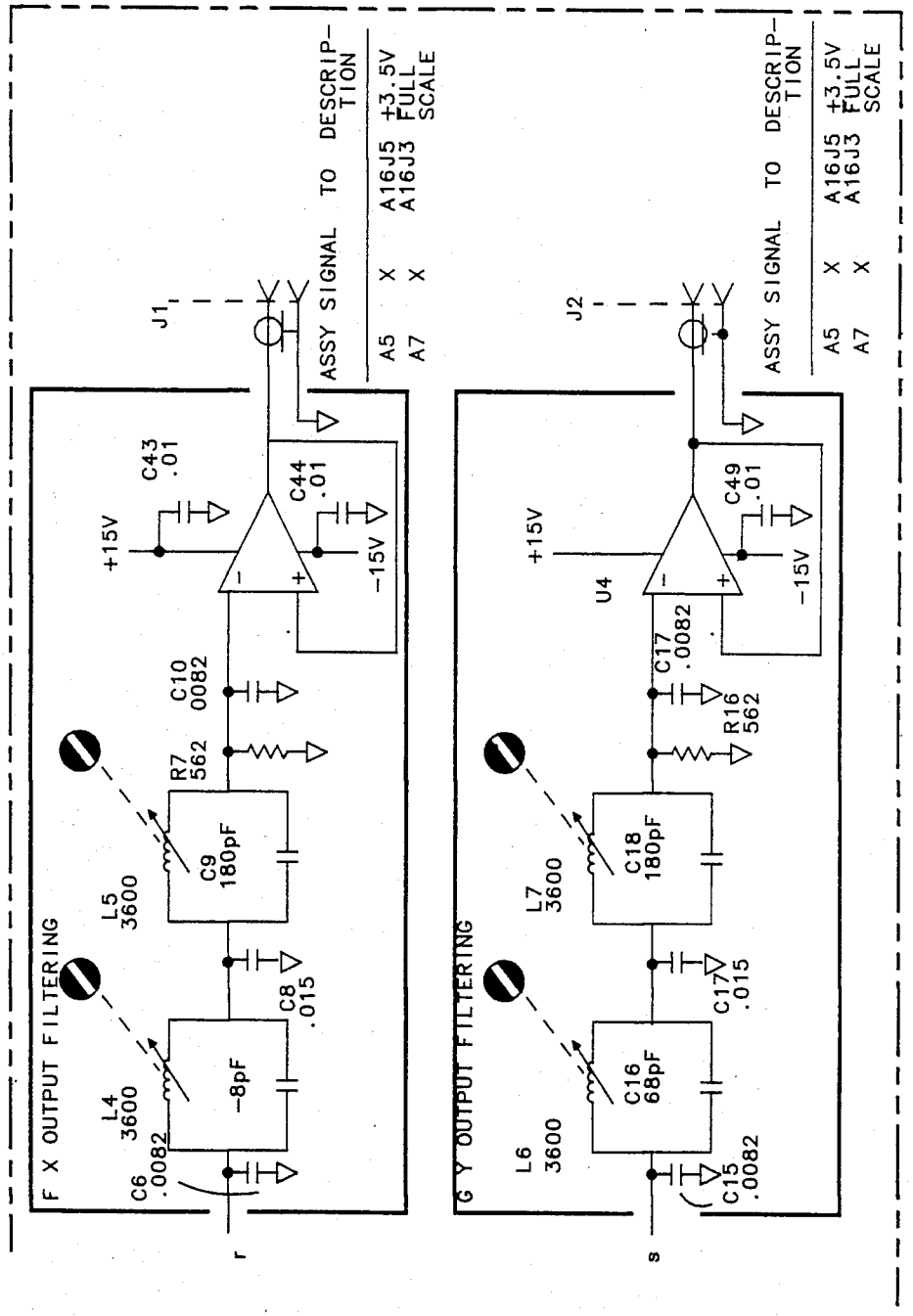

R12
5K
R13
5K
R14
215
+15V
C32
0.1
V(REF) +
V(REF) −
D0 (LSB)
D7 (MSB)
THRESHOLD
COMP
C5
560pF
−15V
C34
0.1
TO FIG 27.91C
TP5
Y
C13
820pF
R17
8K
+15V
C33
.01
R18
511
S
C51
23pF
−15V
R15
5K
C14
820pF
R19
1000
R22
8000
R20
1000
C40
120pF
C35
0.1

FIG 27.91D

FIG 27.92


J1
J2
ASSY SIGNAL TO DESCRIPTION
A5 X A16J5 +3.5V FULL SCALE
A7 X A16J3
F X OUTPUT FILTERING
G Y OUTPUT FILTERING
+15V
-15V
U4
C43 .01
C44 .01
C49 .01
C10 0082
C17 .0082
R7 562
R16 562
L5 3600
L7 3600
L4 3600
L6 3600
C9 180pF
C18 180pF
C16 68pF
-8pF
C8 .015
C17 .015
C6 .0082
C15 .0082
r
s

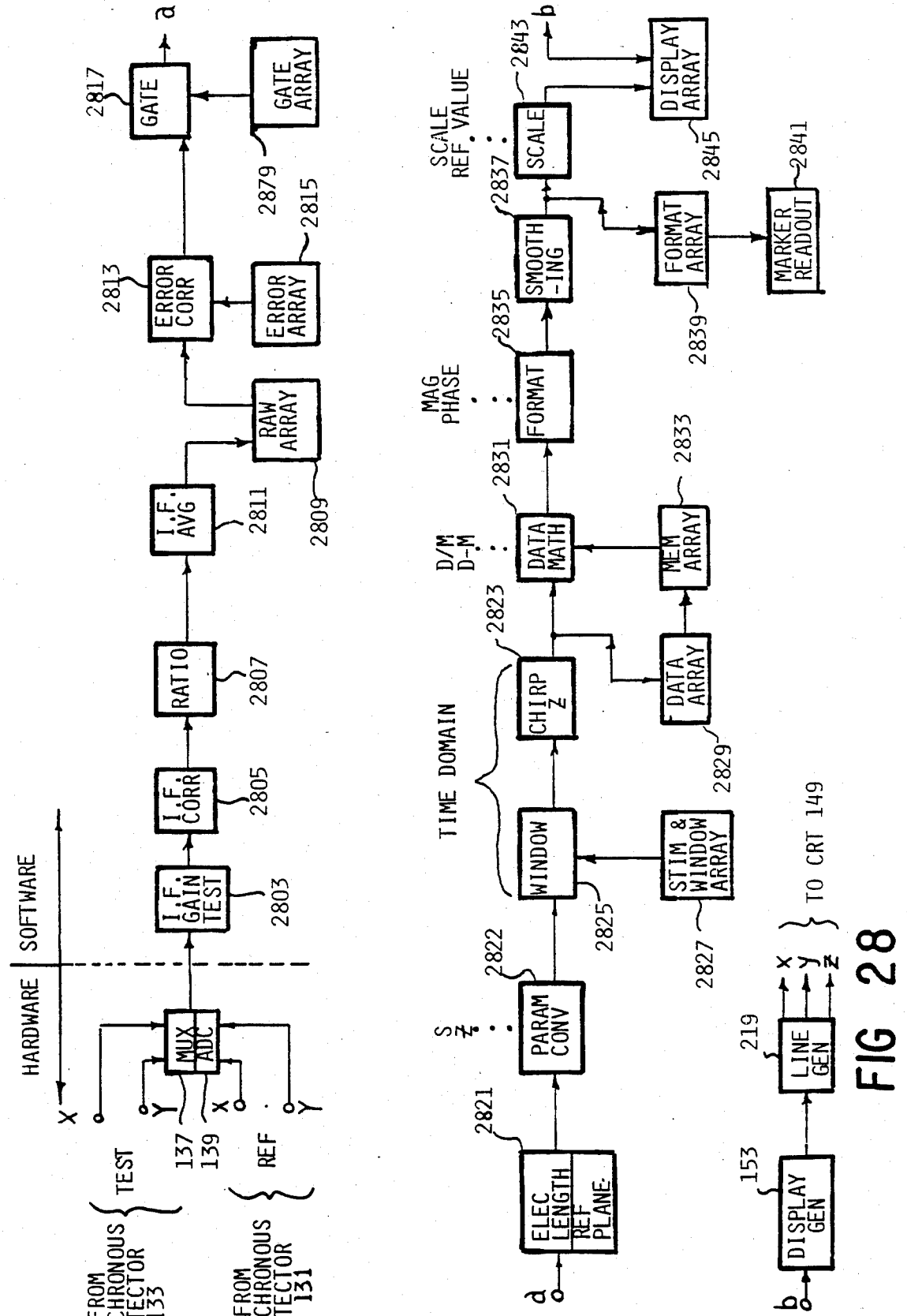

HARDWARE
SOFTWARE
FROM SYNCHRONOUS DETECTOR 133
FROM SYNCHRONOUS DETECTOR 131
TEST
REF
137
139
MUX ADC
I.F. GAIN TEST
2803
I.F. CORR
2805
RATIO
2807
I.F. AVG
2811
RAW ARRAY
2809
ERROR CORR
2813
ERROR ARRAY
2815
GATE
2817
GATE ARRAY
2879
a
TIME DOMAIN
S
Z
PARAM CONV
2822
2821
ELEC LENGTH REF PLANE
d
WINDOW
2825
CHIRP Z
2823
STIM & WINDOW ARRAY
2827
DATA ARRAY
2829
D/M
D-M
DATA MATH
2831
MEM ARRAY
2833
MAG
PHASE
FORMAT
2835
SMOOTH -ING
2837
SCALE
REF. VALUE
SCALE
2843
b
DISPLAY ARRAY
2845
FORMAT ARRAY
2839
MARKER READOUT
2841
TO CRT 149
x
y
z
219
LINE GEN
153
DISPLAY GEN
b

FIG 28

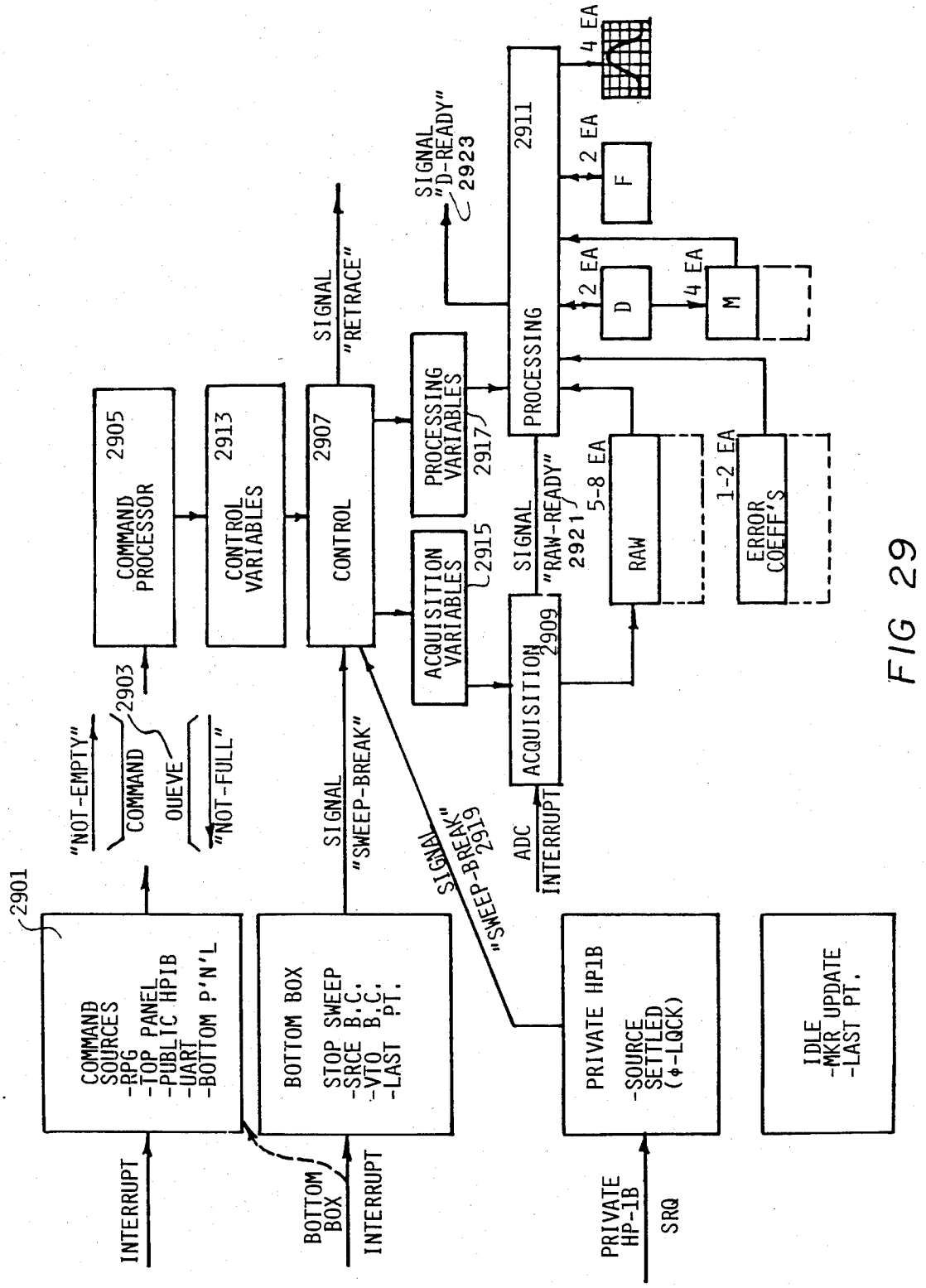

2901
COMMAND SOURCES
-RPG
-TOP PANEL
-PUBLIC HPIB
-UART
-BOTTOM P'N'L
INTERRUPT
BOTTOM BOX
STOP SWEEP
-SRCE B.C.
-VTO B.C.
-LAST PT.
BOTTOM BOX INTERRUPT
PRIVATE HP-1B SRQ
PRIVATE HP1B
-SOURCE SETTLED (φ-LOCK)
IDLE
-MKR UPDATE
-LAST PT.
"NOT-EMPTY"
COMMAND
2903
QUEVE
"NOT-FULL"
COMMAND PROCESSOR 2905
CONTROL VARIABLES 2913
SIGNAL "SWEEP-BREAK"
CONTROL 2907
SIGNAL "RETRACE"
SIGNAL "SWEEP-BREAK" 2919
ADC INTERRUPT
ACQUISITION 2909
ACQUISITION VARIABLES 2915
PROCESSING VARIABLES 2917
SIGNAL "RAW-READY" 2921
PROCESSING 2911
SIGNAL "D-READY" 2923
5-8 EA
RAW
1-2 EA
ERROR COEFF'S
2 EA
D
4 EA
M
2 EA
F
4 EA

FIG 29

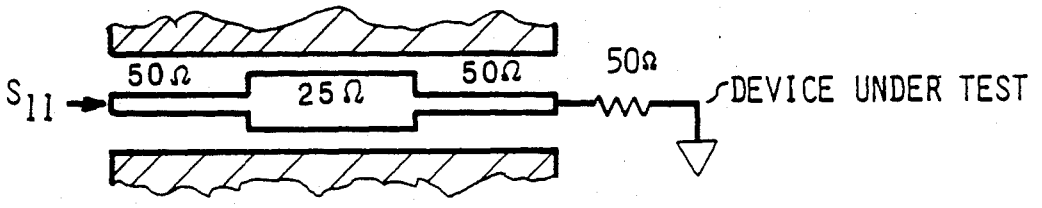


FIG 30A

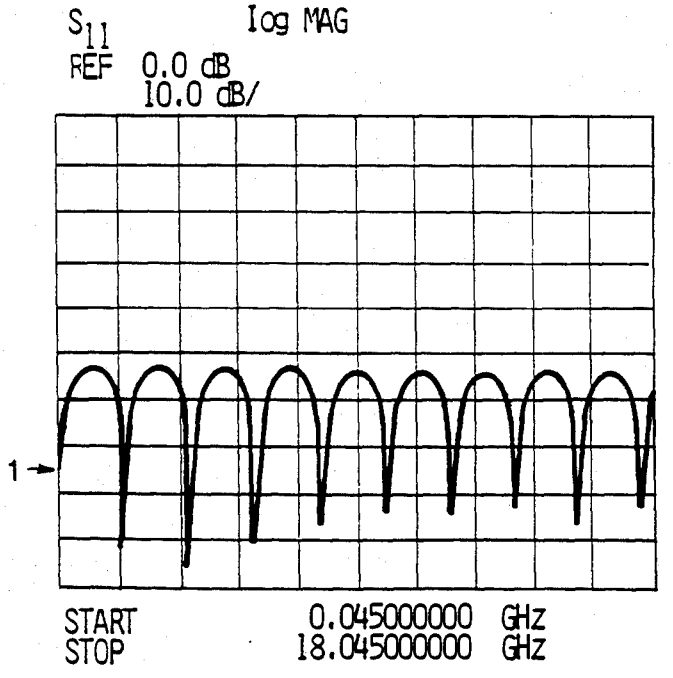


FIG 30B

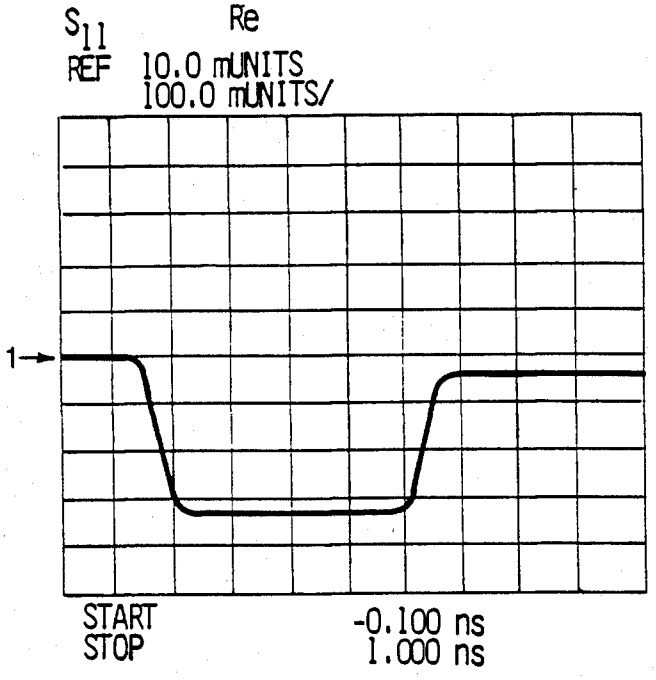


FIG 30C

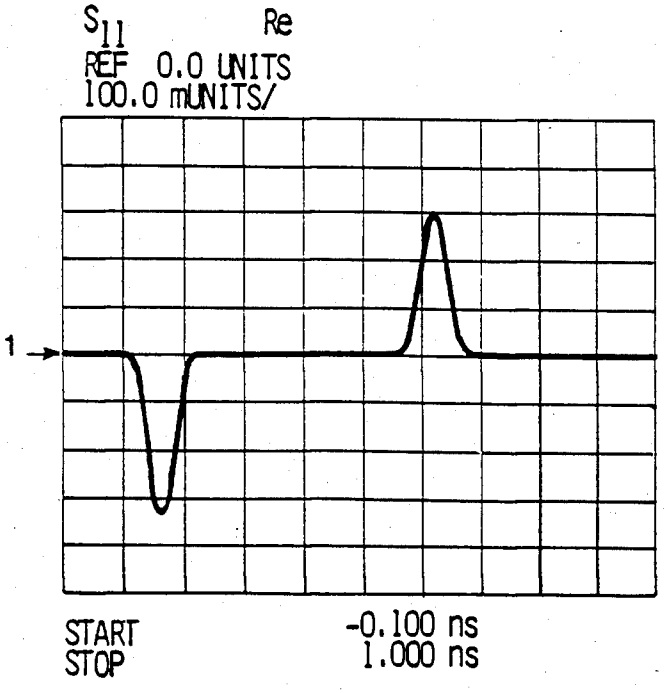


FIG 30D

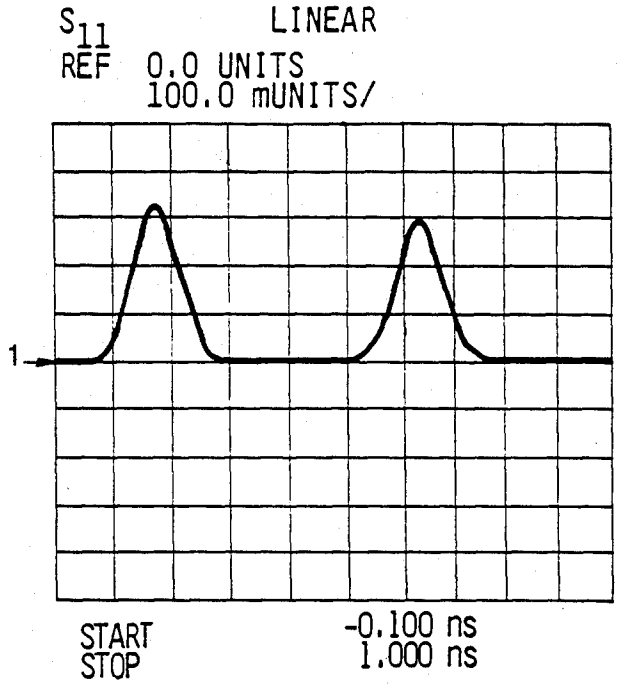

S11
LINEAR
REF 0.0 UNITS
100.0 mUNITS/
1
START
-0.100 ns
STOP
1.000 ns

FIG 30E

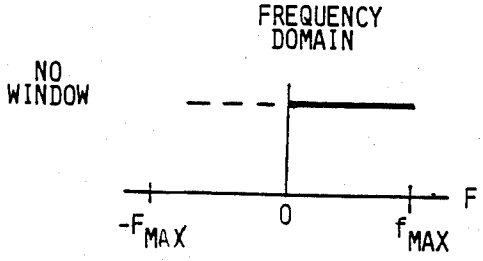


FIG 31A

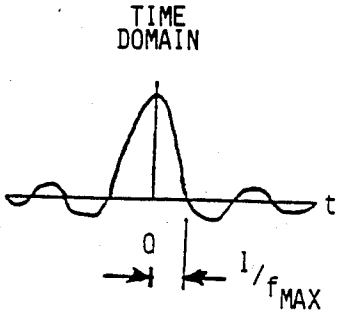


FIG 31B

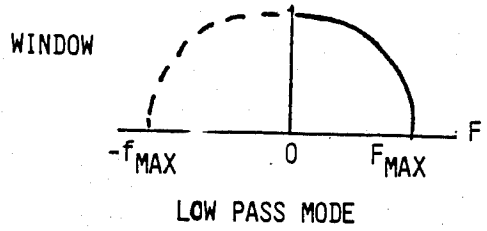


FIG 31C

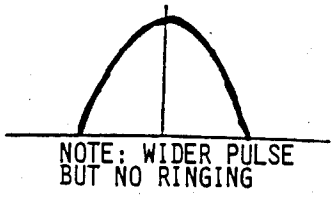


FIG 31D

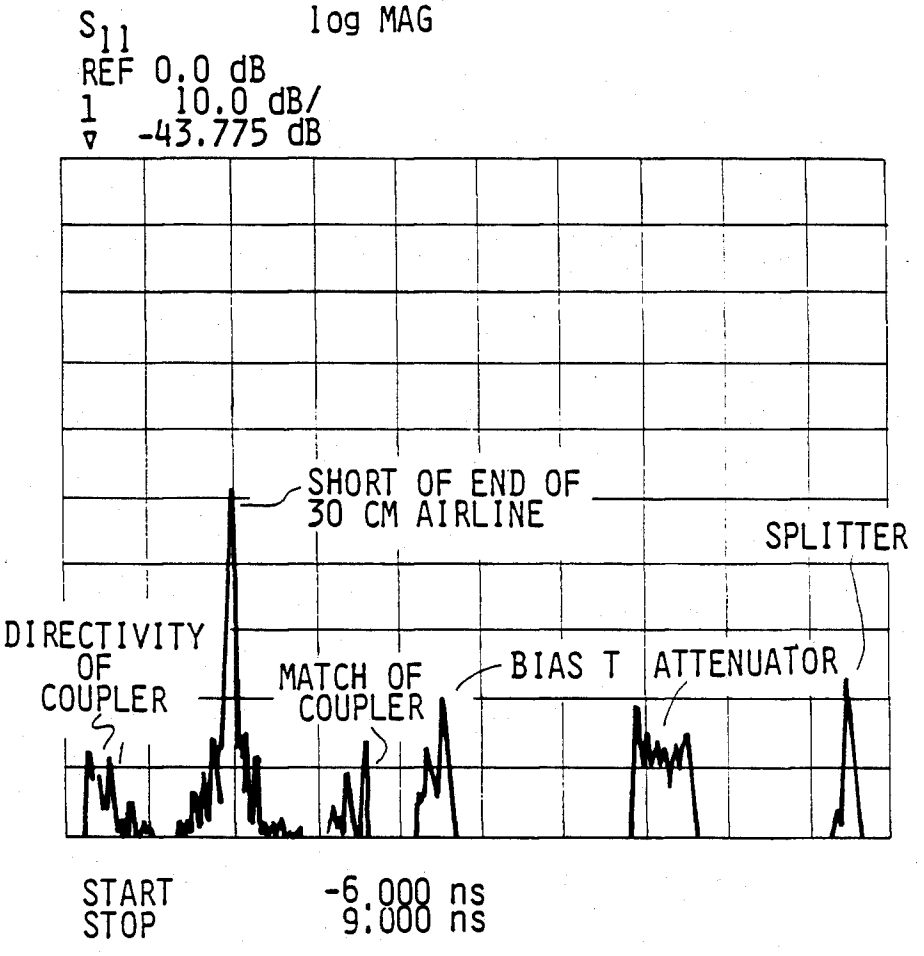

S11
log MAG
REF 0.0 dB
1 10.0 dB/
-43.775 dB
SHORT OF END OF
30 CM AIRLINE
SPLITTER
DIRECTIVITY
OF
COUPLER
MATCH OF
COUPLER
BIAS T
ATTENUATOR
START
-6.000 ns
STOP
9.000 ns

FIG 32A

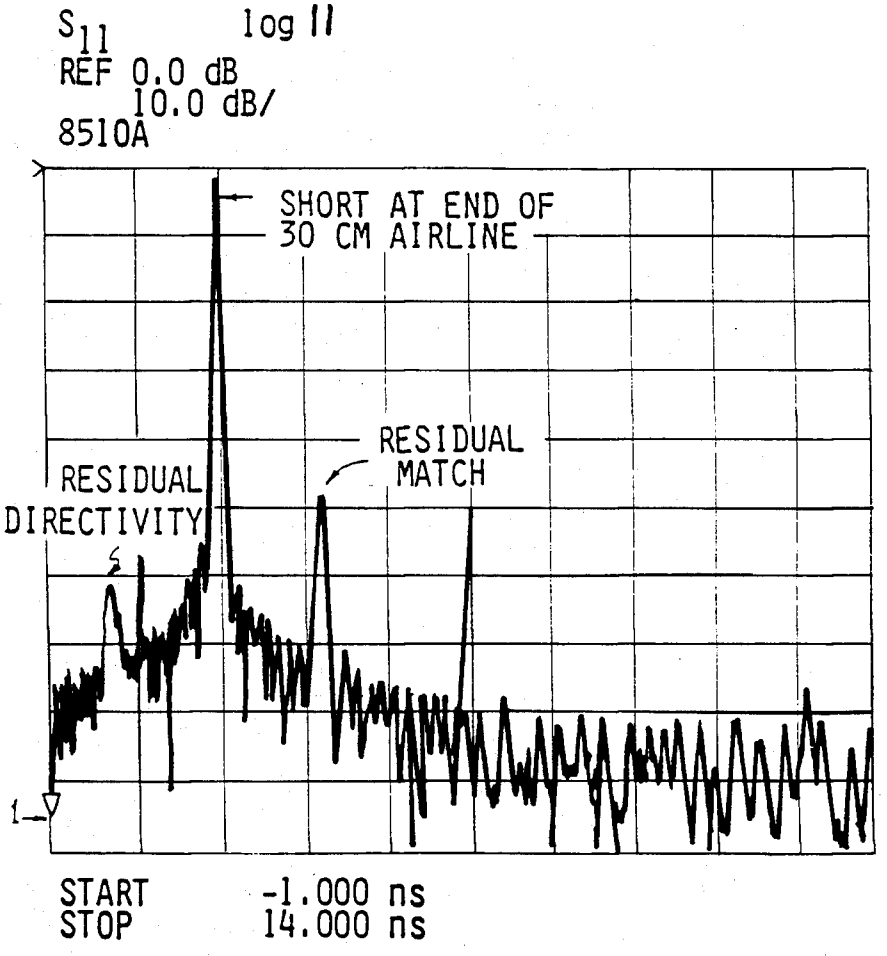

S11 log 11
REF 0.0 dB
10.0 dB/
8510A
SHORT AT END OF
30 CM AIRLINE
RESIDUAL
MATCH
RESIDUAL
DIRECTIVITY
START -1.000 ns
STOP 14.000 ns

FIG 32B

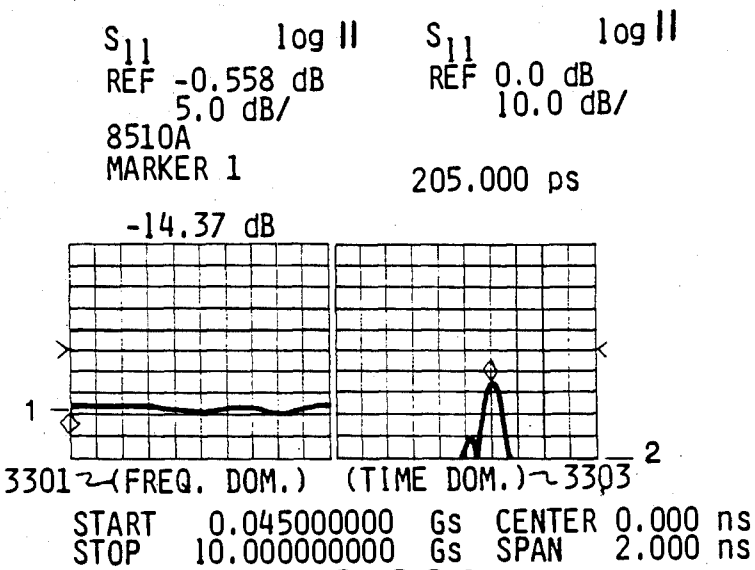


FIG 33A

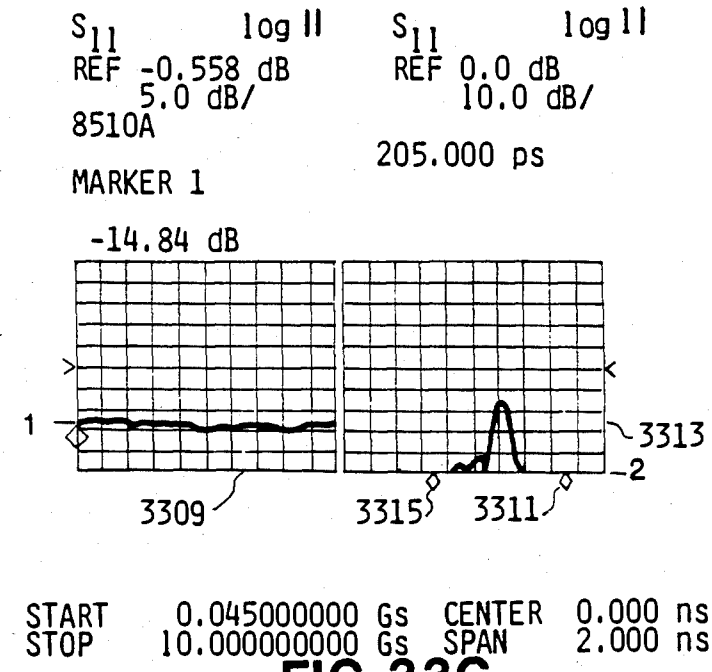


FIG 33C

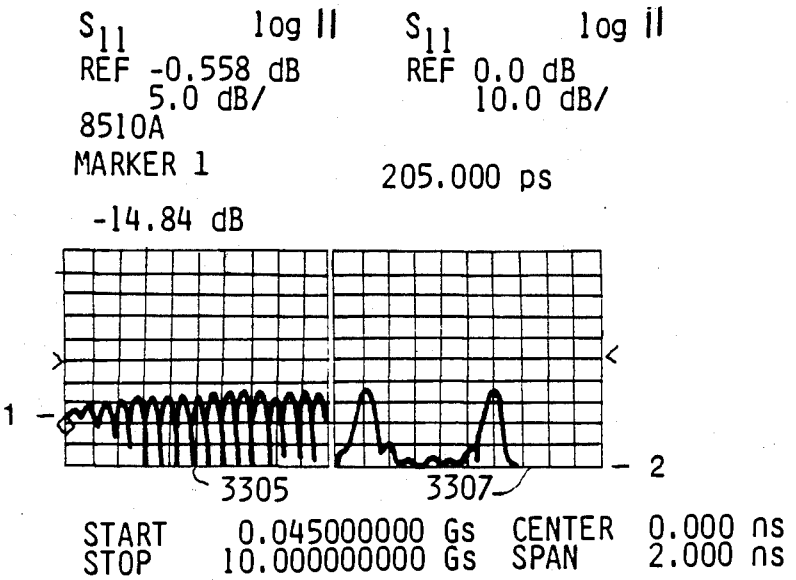


FIG 33B

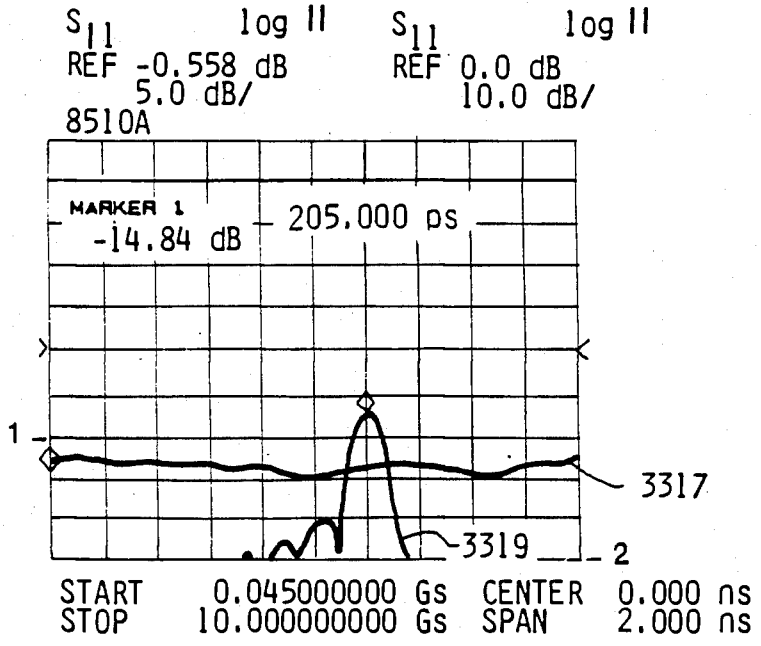


FIG 33D

VECTOR NETWORK ANALYZER WITH INTEGRAL PROCESSOR

BACKGROUND OF THE INVENTION

Formerly, most magnitude and phase vector measurements at microwave frequencies have been performed by network analyzers using techniques such as those described in "Automatic Network Analyzer 8542A, Section IV Network Analyzer Fundamentals", Hewlett-Packard Co. 1969 and in U.S. Pat. No. 4,244,024 issued Jan. 6, 1981 by Marzalek et al. Such vector network analyzers characterize networks, including devices, components, and systems by measuring the magnitude and phase of the network's transmission and reflection coefficients versus frequency. The capability to measure group delay, a special form of transmission and also usable in reflection, is also often incorporated in a vector network analyzer.

In general, a vector network analysis measurement system contains several separate modules. First is an RF source to provide the stimulus to the device under test (DUT). The stimulus normally covers a limited range of frequencies, either in a continuous analog sweep, referred to as the swept mode, in discrete steps, referred to as the step mode, or a single point mode. Second is a signal separation network to route the stimulus to the DUT and provide a means for sampling the energy that is reflected from, or transmitted through, the DUT. Also, energy is sampled from the signal that is incident upon the DUT in order to provide a reference for all relative measurements. Third is a tuned receiver to convert the resulting signals to an intermediate frequency (IF) for further processing. The magnitude and phase relationships of the original signals must be maintained through the frequency conversion to IF to provide usable measurements. Fourth is a detector to detect the magnitude ahd phase characteristics of the IF signals, and fifth is a display on which to present the measurement results.

To improve measurement accuracy, a set of "standard" devices with known characteristics can be measured by a computer controlled system. From this data, a set of complex equations can be solved to determine a model representing many of the errors associated with the network analyzer process. This model is then stored in the computer and later when unknown devices are measured, the model can be used to separate the actual data from the "raw" measured data to provide enhanced accuracy in the microwave measurement by a process known as vector error correction.

Accuracy enhancement is very important in microwave measurements because even with the best signal generating and separating devices manufactured to state of the art tolerances, relatively large errors still occur as compared to low frequency measurements. For example, without vector error correction, a typical vector measuring system will yield errors of 30 percent. If one is willing to forego either the phase of impedance measurement of the unknown device, a modern scalar network analyzer is still only able to reduce the errors to 10 percent. On the other hand with prior implementations of vector error correction, errors can be reduced to about one percent.

Unfortunately, several significant problems remain with prior "automatic" network analyzers: they are very slow in the error correction mode; the systems are often quite awkward to use; they are unable to automatically perform a fully error-corrected measurement of forward and reverse reflection and transmission parameters (e.g., S_{11}, S_{12}, S_{21}, and S_{22}); and, broadband vector testing from RF to millimeter bands (e.g., 45 MHz to 26.5 GHz) cannot be performed with high accuracy and resolution without multiple manual reconnections.

Finally, in prior systems the data is usually displayed and analyzed only in the frequency domain, requiring either the use of a separate instrument such as a time domain reflectometer (TDR) in order to directly measure the response of the DUT as a function of time, or a powerful external computer coupled to the network analyzer to take data in the frequency domain and then perform an inverse Fourier conversion using either a truncated Fourier series or the faster Cooley-Tukey algorithm or others. Although the traditional TDR approach is fairly fast, the signal to noise ratio is low and the method is susceptible to both jitter and baseline drift. Conversely, although former computer coupled network analyzers exhibit significant improvements over the TDR method in signal to noise ratio, jitter, and drift, these systems are very slow, requiring several minutes to provide a time domain analysis and display of a DUT.

SUMMARY OF THE INVENTION

The present invention overcomes many of the limitations of the prior art by permitting automatic, high speed, and accurate measurement of the device characteristics of a DUT across a broadband of microwave frequencies. A fully error corrected measurement of four vector transmission and reflection parameters is accomplished in "real time" with the ability to analyze and display over 400 frequency points in less than one second. This speed permits the operator for the first time to view the effects of adjustments on the network under test while performing measurements with high precision. At the same time, measurement accuracies are achieved that are more than ten times as precise than have previously been attainable with commercially available instrumentation. In addition, vector testing using a single set up of a DUT can for the first time be performed across a broadband frequency range from RF to millimeter bands. Although many factors affect overall measurement accuracy, including operator technique, dynamic accuracies of 0.05 dB in magnitude and 0.3 degrees in phase can be accomplished for a device with 50 dB of insertion loss. An overall dynamic range of 100 dB, resolutions of 0.001 dB in magnitude, 0.01 degrees in phase, and 10 picoseconds in group delay, and corresponding measurement stabilities are attained depending on the particular frequency range and test set used. Further, error corrected data can be transformed between the frequency and time domains in real time without sacrificing accuracy or resolution, and can be displayed on a single cathode ray tube (CRT), plotter or other display either in the frequency domain, the time domain, or in both domains at the same time.

The time domain Fourier transforms in the present invention permit the operator to see the response of the DUT as a function of time from the application of the stimulus. While the frequency domain response of the DUT is the integrated response over the test frequency range, the time domain response presents the individual responses as a function of distance, permitting identification of specific discontinuities within the DUT and/or the test set. Responses can then be isolated within

settable "gates", making it possible to virtually ignore responses outside of the gates. A response within the gate can then be transformed back into the frequency domain if so desired. It thus is possible to "gate out" measurement system responses from cables, connectors, and fixtures to measure the DUT alone. In addition, time domain data are computed at speeds similar to those of frequency domain measurements, providing the same "real time" capability, flexibility, and convenience. Also, since the time domain data are computed from the error corrected S-parameter measurements, the result is that both time and frequency data have similar accuracies.

Major elements of the present invention are the main analyzer containing the IF, signal processing, internal computing, the display circuitry, plus the operating panel used to select functions and control the entire measurement system; an RF test set and microwave to IF frequency conversion unit; and a source for test signals, such as a synthesized or swept oscillator with the desired frequency coverage. A dedicated interface between the main analyzer and the source is provided to facilitate the necessary control functions and data exchanges (handshakes) so that all source controls and monitoring can be performed from the main analyzer. Several test sets which incorporate broadband signal separation devices, balanced broadband power splitters, and high conversion efficiency samplers with flat frequency response and low crosstalk, are provided for optimized performance for different frequency ranges and connector types. A dedicated interface provides control from the main analyzer.

The main analyzer is a microprocessor based instrument that performs the signal processing and all computation associated with error correction, data formatting, and transformations. A variety of display modes are provided including log and linear magnitude versus either frequency or time, linear phase, deviation from linear phase, group delay versus frequency, standard Smith Chart, compressed Smith Chart, expanded Smith Chart, inverted Smith Charts, and "Bull's Eye" polar chart. A variety of marker read out formats are also provided. Examples of the display flexibility provided include a split screen CRT with two independent formats or two responses overlaid on a common format. In addition, any or all of the CRT displays can be directly transferred to a digital printer or plotter without need of an external computer.

The main analyzer's control panel uses a number of buttons arranged in a unique hierarchal structure to specify the complete measurement process. Several control buttons are dedicated for functions most commonly used in typical measurement applications, while less common functions are available through a series of logical menus which are accessed via several "softkeys" under control of inernal firmware. Altogether, over 70 minus with over 320 functions can be reached by means of the softkeys to provide a wide range of microwave network measurements.

DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a simplified block diagram of the preferred embodiment of the present invention.

FIG. **2** shows a detailed block diagram of a portion of the preferred embodiment shown in FIG. **1**.

FIGS. **3.1** through **3.102** show the schematics for the detailed block diagram as shown in FIG. **2**.

FIG. **4** shows the front panel controls of the preferred embodiment of the present invention.

FIG. **5** shows a hierarchal SPFR structure used in the preferred embodiment of the present invention.

FIGS. **6** through **I5**, **17**, and **18** show several of the measurements which can be performed with the preferred embodiment of the present invention.

FIG. **16** shows a coaxial line as measured and displayed in FIG. **15**.

FIGS. **19***a* and **19***b* show a schematic and a cross sectional view respectively of a wideband RF directional bridge for use in a preferred embodiment of the present invention.

FIGS. **20** through **23** show detailed block diagrams of four test sets as shown in FIG. **1**.

FIGS. **24.1** through **24.33** show detailed schematics for the block diagrams shown in FIGS. **20** through **23**.

FIGS. **25.1** through **25.6** show a detailed block diagram a section of the present invention as shown in FIG. **1**.

FIGS. **26.1** through **26.6** show a block diagram and the related equations used for adjusting offset and gain errors in the IF section of the present invention.

FIGS. **27.1** through **27.93** show the detailed schematics for FIGS. **25.1** through **25.6**.

FIG. **28** shows the software signal processing flow used in the present invention.

FIG. **29** shows the software process controller for use in the preferred embodiment of the present invention.

FIGS. **30***a* through **30***e* show the time domain modes used in the present invention.

FIGS. **31***a* through **31***d* show the effect of windowing on time domain data.

FIGS. **32***a* and **32***b* show a time domain response without and with vector error correction.

FIGS. **33***a* through **33***d* show the effect of gating on time domain data in the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Description of the Block Diagram

Referring to FIG. **1**, there is shown a block diagram of the preferred embodiment. The measurement system consists first of a main network analyzer **101** with a second IF/detector section **103** and a data processor/-display section **105**. The main network analyzer **101** is fed by one of four configured test sets **17** which provide the signal separation circuitry **108** and first IF frequency conversion circuitry **113** for reflection/transmission (one incident signal) or S-parameter (two incident signals) measurements up to either **18** or **26.5** GHz. The frequency converter **113** alone is also available to permit the addition of user supplied signal separation devices **108** for specially configured test needs. The third main component of the measurement system is a compatible RF source **109** such as an HP 8340A synthesized sweeper, available from the Hewlett-Packard Co., Palo Alto, Calif., which can be used in either a stepped frequency mode, in which synthesizer class frequency accuracy and repeatability can be obtained by phase locking the source **109** at each of the over **400** frequency steps over the frequency range selected by the main analyzer **101** or the swept frequency mode for applications where extreme frequency range, high stability, and spectral purity are important such as in narrow band measurements over sweeps of less than 5 MHz. An HP 8350B sweeper with HP **83500** series RF

plug-ins covering the entire desired frequency range or with lesser spans can also be used in applications where a more economical source is sufficient. Both the HP 8340A and the HP 8350B include the necessary analog interface signals as well as full digital handshake compatibility with the main analyzer **101**. This digital handshake compatibility allows the main analyzer **101** to act as the controller for the entire system by directly managing the source **109** to provide all of the inputs such as start frequency, stop frequency, centering, span, and modulation, as well as constraints that the source **109** normally places on itself internally. For example, if a user by means of the main analyzer **101** requests the source **109** to sweep to an incompatible frequency such as 50 GHz, the source **109** will respond to the main analyzer **101** that such a frequency cannot be accommodated and the main analyzer **101** in turn informs the user of the situation. Therefore, the user need not only be concerned with his interface to the main analyzer **101** and can use any source **109** that has implemented that required handshake protocols. Because the main analyzer **101** is in control of the source **109**, it is also possible to automatically select a different frequency range or mode (stepped or swept) to be applied to each of the ports **1** and **2**.

Integrated within each test set **107** is the first IF frequency converter **113** with three channels **113***a*, **113***b*, and **113***c* for reflection/transmission measurements and four channels **113***a*, **113***b*, **113***c*, and **113***d* for S-parameter measurements. RF to IF conversion is achieved through a sampling technique equivalent to harmonic mixing. An harmonic of a tunable local oscillator **115** is produced by an harmonic generator **116** to mix with the incoming RF signal to provide the first IF signal at 20 MHz for the incident signal a1 on the input port **1**, the incident signal a2 on the output port **2**, the reflected or transmitted signal b1 on the input port **1**, and the reflected or transmitted signal b2 on the output port **2**. Frequency tuning for the local oscillator **115** is controlled by a phase lock loop **117** that compares the signal a1 or a2 in the reference channel first IF to an IF reference oscillator **119** in the IF/detector section **103**. Any difference between the frequency of the signal a1 or a2 in the reference channel first IF and the IF reference oscillator **119** results in an error voltage on the error voltage signal line **121** via switch **123** that tunes the local oscillator **115** to the frequency that produces the desired first IF. Switch **123** is toggled to select the most appropriate signal a1 or a2 to lock on to based either on internal criteria within the system or as defined by the user. When using the internal criteria, if the incident signal port is port **1**, a1 is selected by switch **123**, and if the incident signal port is port **2**, a2 is selected by switch **123**. This scheme allows the local oscillator **115** to track the incoming RF when the RF frequency is changing with time as in the swept mode. The integrated test set **107** permits high RF to first IF conversion efficiency even at 26.5 GHz, making possible both high sensitivity and wide dynamic range measurements. The test set architecture eliminates the extensive RF switching needed in previous test sets, removing the significant uncertainties caused by the lack of repeatability of mechanical switches. The reflection/transmission test sets **107** require no internal switching since the fourth channel **113***d* is not required, and the S-parameter test sets **107** used only one electronic PIN diode switch located inside of the test set **108** such that it cannot contribute to uncertainties as it is switched prior to the ratio node of the power splitter.

Several new concepts have been incorporated in the IF/detector section **103** of the main analyzer **101** to increase the precision of IF processing and signal detection. Most of the phase lock hardware **125** in the phase lock loop resides in this section **103**. Harmonic mixing number and local oscillator pretuning are controlled digitally via lines **127** and **129** and offer phase lock and tracking performance that is precisely repeatable from sweep to sweep. Before the first IF signals proportional to a1, a2, b1, and b2 are sent to the synchronous detectors **131** and **133**, they are down converted to a second IF at 100 KHz by mixers **138** and go through a pair of multiplexers **136** and variable gain amplifiers **134** in the second IF section **135**. Amplifier gain is controlled and calibrated digitally and is varied by autoranging to optimize the second IF signal levels **130** and **132** available to the synchronous detectors **131** and **133** resulting in an order of magnitude improvement in signal to noise performance and dynamic accuracy for the detector output signals x1, y1, x2, and y2. Likewise, the synchronous detectors **131** and **133** employ a digital architecture that allows for precise control of their 90 degree phase shift function which results in improved accuracy as well as common mode rejection of local oscillator phase noise effects. Finally, the detected signals x1, y1, x2, and y2 are multiplexed with a sample-and-hold/multiplexer (MUX) **137** and then digitized by an analog-to-digital converter (ADC) **139** with 19 bits of resolution. Each ADC conversion takes approximately 40 microseconds and four readings are made for each RF frequency data point to provide the real and imaginary data for both the reference signal **130** and test signal **132**.

The output of the ADC **139** is then passed on a 16 bit bus **141** to a high speed central processor (CPU) **143** which includes a microprocessor such as a Motorola 68000 as well as the associated microprocessor system interupt and I/O control circuitry. Because the CPU **143** is integrated into the main network analyzer **101** it is possible to utilize a multi-tasking architecture to make more efficient use of time than has previously been possible. This architectural integration also permits substantial increases in data processing flexibility and system control performance. Via a dedicated system interface and bus **145**, the CPU **143** controls the RF source **109**, the test set **107**, and, along with the sample selection and timing circuitry **146**, all of the IF processing functions including the phase lock hardware **125**, autoranging in the IF amplifiers **134**, detection by the synchronous detectors **131** and **133**, and digitization by the ADC **139**. The CPU **143** periodically initiates a self calibration sequence for the IF amplifiers **134**, synchronous detectors **131** and **133**, and the ADC **139** and the resulting gain, offset, and circularity changes are stored in memory **147**, so that the changes in the IF amplifiers **134** can be subtracted from measured results. The CPU **143** also performs all data processing functions for the system. The signals in the IF section **103** are detected as linear real and imaginary components of a vector quantity and the CPU **143** processes the detected data into a variety of formats for presentation on the CRT display **149**. By digitally computing the various measurement formats, improvements in dynamic range and meaningful resolution are gained over traditional analog circuit processing techniques.

With past network analyzer systems, an external computer was required in order to characterize and

remove systematic errors. With the present invention, this capability exists internally with enough storage capacity (i.e., 256K bytes of random access memory (RAM) and 256K bytes of bubble memory) in the memory **147** to retain up to two **401** points 12-term error corrected traces of data. (Note: each byte of memory consists of eight bits of data storage.) In addition, the measured data can be converted to show the response of the DUT **111** as a function of time (time domain) using an internal Fourier transform process. All data processing takes place virtually in real time by means of parallel data processing in the CPU **143** aided by the incorporation of a dedicated, floating point, complex number, vector math processor **151** designed specifically for fast vector computations. The multiplication of two complex mumbers by the vector math processor **151** requires only one operation with the product available within **20** microseconds, so that error corrected measurement results are available **1000** times faster than in the prior art. By means of an internal vector graphics generator **153**, the real time processed data is then immediately presented on the CRT **149**, on a digital printer/plotter **155**, or via an IEEE-488 (HP-IB) interface and bus **157** to external devices. Present as well as past states of front panel controls **159**, past and present traces of data, and entire system calibrations can also be stored in and recalled from the memory **147** or loaded and read from a built-in tape drive **161** by means of the system interface and bus **157** under control of the CPU **143**.

Integrated Processor

As explained previously and shown in more detail in FIG. **2**, the built-in CPU **143** with its 16-bit multi-tasking microprocessor **201**, I/O interface circuitry **203**, and interrupt system and I/O control circuitry **205**, and the vector math processor **151** with its math processor circuitry **207** and math controller **209** are key to the high speed performance of the present invention. The variable precision and variable function architecture of the vector math processor **151** make it adaptable to perform both floating point and complex number math operations. The vector math processor **151** operates on a 16 MHz clock **208** generated within microprocessor **201** and is controlled by a state machine **210** with IK byte of read only memory (ROM) for storage of microcode as shown in Appendix C.

To insure maximum processing speed, processing power is distributed among several internal controllers in addition to the microprocessor **201** and the math processor **207**. An additional state machine with IK byte of microcode is used by the display generator **153** to create the display of both data and display formats from a list in the dislay RAM **217** which drives the CRT **149** in the display section **218** from a line generator **219** which positions a new X-Y point pair approximately every four microseconds. Likewise both the system bus **145** and the external HP-IB bus **157** have their own internal processors **221** and **223**. Finally, controllers **225**, **227**, and **229** are dedicated to the tape drive **161**, the bubble memory **231** within memory **147**, and the front panel **159** respectively.

Memory is also distributed according to functional need. 16K bytes of ROM **233** within memory **147** are used for internal test software and boot-up of the system. The main system software is taken from a first 128K bytes of non-volatile bubble memory **235** within memory **147** and placed into 128K bytes of main RAM **237** also within memory **147**. 8K bytes of ROM **239** are dedicated to the bubble memory **231** for use in test and boot-up. 60K bytes from the second 128K bytes of bubble memory **235** are used to store equation coefficients used in vector error correction. The remaining 68K bytes of bubble memory **235** contain recallable instrument states, measurement memory data and additional system software. The contents of the CRT display are stored in 32K bytes of dislay RAM **217**. The remaining 96K bytes of display RAM **217** are used for data, coefficients, and control tables. Personal back-up storage, test software, additional system software, and data can be stored and accessed as desired on cartridges in the tape drive **241**.

FIGS. **3.1** through **3.102** show the detailed schematics of the block diagram shown in FIG. **2**. The CPU **143** is shown in FIGS. **3.1–3.12** and **3.49–3.54**, with the microprocessor **201** at FIGS. **3.2** and the I/O interface and Interrupt **203** and **205** at FIGS. **3.49–3.54**. The ROM **233** is shown at FIG. **3.5**, RAM **237** is at FIGS. **3.9–3.11**, and bubble memory **147** is at FIGS. **3.24–3.32**. The display generator **153** is shown on FIGS. **3.33–3.48**, the display section **218** is shown on FIGS. **3.64–3.90** with the line generator **219** at FIGS. **3.79–3.90**. Interface **141** is shown on FIG. **3.51** and the external HP-IB interface **233** and the system interface **221** are shown on FIG. **3.58**. The timers **211** are shown on FIG. **3.52**. The front panel interface **229** is shown on FIGS. **3.55–3.56** and the remainder of the front panel **159** is shown on FIG. **3.60–3.63**. The tape drive **161** is shown on FIG. **3.57**. Finally, the various low voltage power supplies **250** for the data processor/display section **105** are shown in FIGS. **3.91–3.102**.

The vector math processor **151** as shown in FIG. **3.13–3.22** is constructed from a series of commercially available medium scale integrated circuits as follows: U56, U74, and U97 are 74S153 multiplexers, U37 is a 74S175 D-type flip flop, U91 is a 74LS385 adder, U65-68 and U82-85 are 25LS14 multipliers, and U69-72 and U86-89 are 25LS299 shift registers. The 16 MHz clock **208** is shown in detail in FIG. **3.1** and the state machine **210** is shown in detail in FIGS. **3.13–3.14**.

Description of the Front Panel, Menus, and Displays

FIG. **4** shows the front panel **159** of the present invention with capability to set up and control two independent measurements with two measurement channels selected by channel buttons **405** and **407**. When the indicator **401** or **403** above the channel buttons **405** and **407** is lit, the respective channel is selected as the channel controlled by the front panel **159**. The CRT **149** is also available for viewing on the front panel **159**. Annotation on the CRT **149** include graticules if desired, labels for one or two data side by side or overlaid data traces, reference line position symbols, and channel labels for the parameter being shown, the format of the display, reference line value, horizontal and vertical scales, and the value of any markers being used. Source frequency or other stimulus information is shown on the CRT **149**. An active entry menu area **409** in which no data traces are displayed is also provided on the CRT **149** for identification of the current active functions which may be selected via the CRT softkeys **411**. The softkeys **411** therefore extend the accessible instrument capabilities by adding selectable functions without adding to front panel complexity. An Entry Off key **413** clears the active entry state. Prompts, indications of instrument functions, procedural instructions, error messages, and procedural advisories also appear on the

CRT **149**. If a message is important to the measurement, a beep sound signals the operator to look at the message.A title area **415** is also provided for up to 50 characters of information about the measurement being viewed. To use the title function, the Auxiliary Menus System button **417** is pressed, followed by one of the softkeys **411** which will be labeled Title. The RPG knob **419** is then rotated to position an arrow symbol below the first letter desired and displayed on the CRT **149**. The user then presses a Select Letter softkey **411** and the selected letter will appear in the title area **415**. This process is repeated as desired along with desired Space softkeys **411** and Backspace keys **411**, terminated with the Done softkey **411** and cleared with the Clear Softkey **411**.

All basic measurement functions are controlled by the four groups of keys (SPFR) labeled Stimulus **423**, Parameter **425**, Format **427**, and Response **429** which respectively are used to set the stimulus, select the parameter, select the format, and adjust the response for the desired measurement. The Stimulus keys **423** provide direct control of the source **109** to set the frequencies, source power, sweep time, and other related functions. The Parameter keys **425** select the parameter to be measured. With the source **109** applied to port **1**, S_{11} is selected for reflection (return loss) and S_{21} is selected for transmission (insertion loss or gain). Likewise, with the source **109** applied to port **2**, S_{22} is selected for reflection and S_{12} is selected for transmission. Appropriate control of the test set **107** is enabled automatically depending on the parameter selected. The Format keys **427** place measured parameter data in the desired format: logarithmic (dB), phase, group delay, and Smith Chart, or, alternatively, SWR, linear magnitude, R+jX impedance, and others. The Response keys **429** set the scale per division, reference value, or reference position, or let the AUTO function via the Auto key **430** automatically place all the measured data on the entire display **149** with pleasing values for a reference value and scale. Additional Response functions include averaging, smoothing, and an electronic line stretcher.

The hierarchal Channel-Parameter-Format-Response (CPFR) structure used in the present invention is shown in FIG. **5**. Once a particular path through the CPFR structure has been chosen, this path is stored in the memory **147** for latter reference. Then, when one of the CPFR structure items is changed, such as changing the Parameter from S_{11} to S_{22}, the entire path previously associated with the new item is automatically reestablished for use by the entire system. Thus, for example, if Channel **1** is presently being used to measure the Parameter S_{11} with the display in log magnitude Format and a 0.2 dB/division vertical Scale, and if Channel **1** was previously used to measure the Parameter S_{22} with the display in linear magnitude Format and a 5 milliunits/-division vertical Scale, then when the Parameter is changed from S_{11} to S_{22} the Format automatically changes from log magnitude to linear magnitude and the Scale automatically changes from 0.2 dB/division to 5 milliunits/division. In addition, since the CPFR structure is an hierarchal tree and since Parameters are lower in the hierarchy than Channels, the Channel number will not be changed when the Parameter is changed as in the present example. Similarly, if the Channel is changed, the Parameter, Format, and Response are all subject to automatic reestablishment, and if only the Format is changed, only the Response is subject to automatic reestablishment. Naturally, any of the SPFR values may be altered from the front panel **159** as desired by the user. The result of this hierarchal SPFR structure is a substantial added degree of speed and convenience for the user.

The numeric Entry keys **431** are used when a numeric value is to be entered, which entered value is terminated by one of the four terminator keys G/n **433**, M/u **435**, k/m **437**, and xl **439**. The four terminator keys **433-439** are used when the entered value being terminated has the order of magnitude respectively of either Giga (10^{+9}) or nano (10^{-9}), Mega (10^{+6}) or micro (10^{-6}), kilo (10^{+3}) or milli (10^{-3}), or a basic unit (10^{0}), such as dB, degree, second or hertz. The four terminator keys **433-439** are therefore unique in that no particular set of measurement units is permanently assigned to any of the keys, so that substantially fewer terminator keys are required than in the prior art.

Pressing the Save key **441** followed by one of the CRT softkeys **411** saves the current complete state of the network analyzer **101**, and the controlled functions of the source **109** and the test set **107**. The Recall key **443** followed by a CRT softkey **411** is used to recall the previously stored instrument state. The hierarchal SPFR structure is an integral part of the instrument state.

The Tape key **469** in the Auxiliary Menu Block **471** displays soft keys **409** for controlling the internal tape drive **241**. The tape functions allow initialization of cassette tapes, storing data to tape, loading data from tape, deleting data on tape, erasing the last deletion of data, and display of a directory of tape contents on the CRT **149**. Tape data can be a combination of any of the following:

1. Measurement data after second IF and detector correction (raw data), after error correction and/or time domain conversion (data), or after formatting (formatted data) for either or both measurement channel.

2. Memory data stored after time domain conversion and before formatting from an earlier measurement, individually or all at once.

3. Graphics that the user has created on the CRT **149** FIG. **4**.

4. One or all sets of machine states stored by pressing the Save key **441** FIG. **4**.

5. One or all sets of error coefficients measured and stored by pressing the CAL key **457**, and the subsequent Calibrate soft keys **411** labeled in the area **409**.

6. One or all sets of calibration standard descriptions (Cal Kits).

7. A complete machine dump consisting of all sets of all data described in 1 through 6.

8. System, service, or demo software, including options, revised versions, and new software.

When measurement data is loaded from tape to any point in the Data Processing path, the display on the CRT **149** is updated to show the loaded data with subsequent data processing.

If an external device has control of the system using the HP-IB interface **157**, pressing the Local key **445** returns control of the system to the front panel **159**.

The Restart key **447** is used to restart any previously started measurement or data handling operation such as sweeping or averaging.

Three blocks of the front panel keys along with the softkeys **411** provide an additional feature called MENUS for functions which are used less frequently than the functions to which dedicated keys are assigned. The four Menu keys **449**, **451**, **453**, and **455** provide

extensions of the SPFR keys **423**, **425**, **247** and **429**; the keys labeled Cal **457**, Domain **459**, Display **461**, and Marker **463** in the Menus block **465** allow selection of various measurement and display modes; and the keys labeled Copy **467**, Tape **469**, and System **417** under the Auxiliary Menus block **471** provide measurement related input and output operations. Shown in Appendix A is a list of the various MENUS along with the softkey labels, shown in quotation marks, as displayed in the menu area **409** of the CRT **149** opposite the related softkeys **411**. Also shown for the softkey labels in Appendix A are the names of the constants assigned to the softkey labels as found in the system source code in Appendix B.

When a MENU is displayed on the CRT **149** any current choices are indicated by a line under the labels and mutually exclusive and/or closely related choices are connected by dots. Pressing the sofkey **411** beside any label in area **409** either executes the function or presents another set of MENU labels. If the selected function requests an input, the RPG knob **419** and Entry keys **431** are used to respond. Additional functions are selected by pressing another key. A Prior Menu key **473** is used to return to the previously displayed MENU in a series of menus. If the previously displayed MENU was the first in a series of MENUS, the MENU is cleared from the CRT **149**.

Several of the wide variety of displays available either on the CRT **149** or on the printer/plotter **155** are shown in FIGS. **6** through **15**, **17** and **18**. FIG. **6** shows a typical dual trace measurement of two different parameter S_{11} and S_{12} signified by trace number **601** and **602** respectively with the same log magnitude format used for example to adjust a circulator's impedance and isolation simultaneously in real time. FIG. **7** shows two overlaid traces **701** and **702** for ports **2** and **3** respectively of a three port multiphase filter. FIG. **8** shows a single trace of an amplifier and an attenuator combined to show the total closed loop response of the active circuit. FIG. **9** shows a measurement trace of the same active amplifier as in FIG. **8** calibrated in a user defined reference plane with an electrical delay of **6.0421** nanoseconds making use of the electronic line stretcher. FIG. **10** shows a unique split screen of two simultaneous measurements of two different parameters S_{11} and S_{21} as displayed on the CRT **149**. FIG. **11** shows another version of the split screen display, split to simultaneously show the response of a surface acoustical wave filter (SAW device) in both the frequency and time domains. Note the appearance of the triple travel peak **1101** on the time domain response. FIG. **12** shows two different parameters displayed with two different formats (i.e., SWR and deviation from linear phase) for traces **1201** and **1202**. FIG. **13** shows a previous measured trace **1301** from "memory" and the current measurement trace **1302** of the same parameter S_{21} which can be used for matching transmission lines to within **0.01** degrees. FIG. **14** shows the display of group delay for a typical RF communications filter which with the present invention can be viewed and adjusted for optimum group delay flatness in real time. FIG. **15** shows a linear display of an RF circuit in the transformed time domain along with a series of five markers **1501–1505** to mark the five different corresponding discontinuities respectively (i.e., connector **1601**, connector **1602**, adapter **1603**, connector **1604**, and termination **1606**) of a coaxial line **1610** as shown in FIG. **16**. FIG. **17** shows a split screen of two polar plots as displayed simultaneously on the CRT **149**. Each of the FIGS. **6** through **15** and **17** are displays of actual RF devices as shown in real time on the CRT **149**. These same displays can also be printed on the printer/plotter **155** as they are shown on the CRT **149** with whatever size change is desired and in a variety of colors. If desired, various of the CRT displays can also be combined on the printer/plotter **155** as a four quadrant plot as shown in FIG. **18**.

Up to five different markers for the traces on the CRT **149** are accessed via the Marker key **463** along with the softkeys **411** as shown in FIG. **15** by markers **1501–1505**. The markers are controlled in a number of different ways. The numeric entry keys **431** are used to set the markers to an exact numeric position, the RPG knob **419** is used to move the markers along the traces on the CRT **149**, the Up Step key **475** and the Down Step key **477** move the markers right and left one horizontal division. The precise value of the marker position is also immediately displayed on the CRT **149** as shown in FIG. **8** by marker **801** and the displayed value **802**. The marker annotation **803** is displayed adjacent to the marker **801**. In addition, as the markers are moved along the traces, the marker annotation moves with the markers so that the user can always immediately identify which marker and related annotation is which. A further function available through the softkeys **411** is Delta Markers for reading the difference in the trace value between an Reference Marker and a Delta Marker as shown by markers **703** and **706** in FIG. **7**. The RPG knob **419** is used to sequentially position the Reference Marker and the Delta Marker and the difference in trace value is immediately displayed on the CRT **149**. Also available with the aid of the softkeys **411** are Marker to Minimum and Marker to Maximum functions to move a selected marker to the minimum or maximum value of the displayed trace as shown by markers **1001** and **1002** in FIG. **10**. A further function is the display of marker frequency, as shown by **1003** in FIG. **10**, or other stimulus value, as shown by **1507** and **1406** in FIG. **15**.

The equal marker key **479** enters the current stimulus or amplitude value, as appropriate, of the most recently active marker for the current active function. For exampie, selecting the reference value key (**429** FIG. **4**) followed by the equal marker key **479** causes the amplitude of the marker to be entered for the reference value. Similarly, selecting the stimulus start key (**423** FIG. **4**) followed by the equal marker key **479** causes the frequency, or other stimulus value, of the marker to be entered for the start function.

Description of the Test Sets

The wideband test sets **107** to **26.5** GHz include a high performance RF triaxial directional bridge **1901** as described in U.S. patent application Ser. No. **06/568,986** entitled "RF Triaxial Directional Bridge" filed Jan. **9**, **1984** by Botka et al. and shown in FIGS. **19***a* and **19***b* coupled to each of the DUT ports **1** and **2** as shown in FIGS. **20** and **21**. The directional bridge **1901** is a balanced Wheatstone bridge **1903** that extracts a floating vector signal for measurement in a single-ended detector system without disturbing the balanced configuration. Included in this high performance RF directional bridge **1901** is a combination reference load and balun **1905** which provides signal separation over the entire frequency range from **45** MHz to **26.5** GHz, and also permits the application of a DC bias as part the RF input V_{in} to the DUT **111** via a conventional RF bias tee

2105. In contrast, the narrower band test sets 107 as shown in FIGS. 22 and 23 utilize a conventional directional coupler 2101 for each port to cover the frequency range of 0.5 to 18 GHz. By incorporating the signal separation devices 108 in the test sets 107, broadband vector measurements are made possible with just one connection of the DUT 111 between port 1 and port 2.

Each of the test sets 107 contains its own built in power supplies 2001, to simplify various system configurations and each of the test sets 107 has its own HP-IB interface 2003, coupled to the system bus 145 in order to provide control and identification to the main analyzer 101. Each of the test sets 107 is connected respectively to section 103 via a first IF multiplexer 2002 or 2102 to provide daisy chaining of several test sets. The first IF multiplexer 2002 and 2102 are in turn connected respectively to the a1, b1 and b2 connections for the reflection/transmission test sets in FIGS. 20 and 22, and the a1, a2, b1, and b2 connections for the S-parameter test sets in FIGS. 21 and 23. The S-parameter test sets also include: front panel indicators 2104 (i.e., lights 490 and 492 in FIG. 4) to signal the active test port, a conventional bias tee 2105 on each of the test channels to provide voltage bias 2107 needed in the testing of active devices, PIN diode transfer switches 2109 under control of the main analyzer 101 via the system bus 145 and a switch interface 2110 for switching the RF input between the ports 1 and 2, and variable attenuators 2111 under control of the main analyzer 101 via the system bus 145 and an attenuator interface 2113. Various RF pads 2015 and test and reference extentions 2117 are provided to adjust and balance the RF power levels.

Each of the test sets has a frequency converter 113 to provide the first IF conversion of the RF signals in immediate proximity to the RF input and the test ports. Within the frequency converters 113 are the VTOs 115, the first IF samplers 2019, pulse generators 2021 to drive the first IF samplers 2019, and first IF amplifiers 2023 and 2123. The first IF amplifiers 2123 also include an input band pass filter 2131, a filter amplifier 2133, and an output low pass filter 2135 to provide additional signal shaping. Each of the VTOs 115 is driven by a sample/hold circuit 2025, a summing node 2027, and a buffer amplifier 2029 coupled to the phase lock circuitry 125 in section 103.

FIGS. 24.1 through 24.33 show the detailed schematics for the circuitry associated with the test sets 107 as shown in FIGS. 20 through 23. FIGS. 24.1 through 24.4 show the front panel indicators 2104, FIGS. 24.5 through 24.8 show the first IF multiplexers 2002 and 2102, FIGS. 24.9 through 24.14 show the VTO 115 and related drivers, FIGS. 24.15 through 24.20 show the HP-IB interface 2003, FIGS. 24.21 through 24.25 show the attenuators 2111 and the PIN diode switch 2109, FIGS. 24.26 through 24.28 show the first IF samplers 2019 and the first IF amplifiers 2023 and 2123, and FIGS. 24.29 through 24.33 show the test set power supplies 2001.

Second IF

A detailed block diagram of the second IF/detector section 103 as shown in FIG. 1 is illustrated in FIGS. 25.1 through 25.6. After the signals a_1, a_2, b_1, and b_2 have been converted to the second IF frequency by the second IF mixers 138, the resulting signals a_1', a_2', b_1', b_2' are sent to the second IF MUXs 136 as shown in FIG. 25.2. A 100 KHz calibration frequency 2501 produced by clock 119 and a ground input 2502 are also sent to the second IF MUXs 136 so that the second IF channels can be automatically calibrated for both gain and offset errors. This automatic calibration is performed by individually measuring the vector gains of the four cascaded 12 dB amplifiers that make up the amplifiers 2503 each to within 0.001 dB with the help of the ADC 139. Offset errors are removed by applying the ground input 2502 to the MUXs 136, turning off all gain in the amplifiers 2503, and measuring the resulting signal with the ADC 139 for each of four phase offsets (i.e., 0, 90, 180, and 270 degrees) of the synchronous detectors 131 and 133, thus rotating the measurement plane used in the synchronous detectors 131 and 133. This change in phase offset and rotation of the measurement plane in the synchronous detectors 131 and 133 is accomplished by adjusting the phase angle of the demodulating signal used for synchronous detection by means of the adjustable phase shifters 2505 as shown in FIG. 25.3.

Referring to FIGS. 26.1 through 26.6 it can be seen that the true values of X and Y can be determined from the measured values of X_m and Y_m from the equation shown in FIG. 26.2. First, the offsets X_0 and Y_0 are determined by grounding the input of MUX 136 as shown in FIG. 26.1, turning off all gains G_1, G_2, G_3, and G_4, and measuring X_m and Y_m for each of four phase offsets 0, 90, 180, and 270 degrees. X_0 and Y_0 are then calculated by the relationship shown in FIG. 26.3 H is determined by selecting the calibration signal 2501 and turning on the gain G_4. X_m and Y_m are then measured for each of the four phase offsets and the offsets X_0 and Y_0 are subtracted. H can then be calculated using the four quadrature relationships shown in FIG. 26.4 and performing a least squares error fit to each of the four measured data points as shown in FIG. 26.5, where A is the level of the calibration signal 2501, the X and Y terms correspond to X_m-X_0 and Y_m-Y_0, and Sigma is the summation of the four quadrature measurements. Determining the gain and phase of the four amplifiers G_1 through G_4 requires that each be independent of one another since $H=G_1*G_2*G_3*G_4$. First with only G_1 on, X_m and Y_m are measured for each of the four phase offsets and a corrected X' and Y' are calculated using the correction coefficients previously determined during the offset correction. Using the equations shown in FIG. 26.6 the complex gain (a+jb) can be calculated that will best translate the four X' and Y' data points into the quadrature relationships shown in FIG. 26.4. The measurement of X_m and Y_m and calculation of a_1 and b_1 as above is repeated sequentially with each of the amplifiers G_2, G_3, and G_4 on one at a time.

FIGS. 27.1 through 27.93 show the detailed schematics for the block diagrams shown in FIGS. 25.1 through 25.6. FIGS. 27.1 through 27.7 show the clock 119, FIGS. 27.8 through 27.12 show the 19.9 MHz local oscillator 2511, FIGS. 27.13 through 27.16 show the second IF mixer 138, FIG. 27.17 through FIG. 27.27 show the second IF amplifiers 134, FIGS. 27.29 through 27.33 and FIGS. 27.82 through 27.85 show the regulators used in section 103, FIGS. 27.34 through 27.39 show the sample/hold amplifiers 137, FIGS. 27.40 through 27.57 show the ADC 139, FIGS. 27.58 through 27.64 show the IF counter 2513, FIGS. 27.65 through 27.70 show the VTO pretune circuitry 2515, FIGS. 27.71 through 27.76 show the main phase lock circuitry 2517, FIGS. 27.77 through 27.81 show the processor interface 145 to section 103, FIGS. 27.86 through 27.89 show the front panel circuitry 159 for section 103, and

FIGS. 27.90 through 27.93 show the synchronous detectors 131 and 133.

Software Signal Processing

As shown in the software listing in Appendix B and in FIG. 28, signal processing in the present invention begins at the output of the synchronous detector pair 131 and 133 which provide the real (X) and imaginary (Y) parts of the test and reference signals. As explained previously, offset, gain, and quadrature errors are corrected for both of the IF/detector chains via software which is arranged as blocks IF gain test 2803 and IF Correction 2805. The resulting test and reference data is then ratioed in block 2807 to produce the appropriate S-parameters and stored in the Raw Array 2809. If requested by the user, subsequent data taken at the same frequency are averaged together in the IF Averaging block 2811 to lower system noise and thus enhance dynamic range.

While the Raw Array 2809 is continually filled under control of the data acquisition software which will be discussed shortly, the data processing software concurrently rremoves data from the Raw Array 2809 and performs additional signal processing. Using a one term model (vector frequency response normalization), a three term model (one port model), and up to a twelve term error correction model (comprehensive two port) of the microwave measurement hardware, the Vector Error Correction software 2813 in conjunction with the Vector Math Processor 151 provides corrected data through application of the Error Array 2815 to the Raw Array. Further data manipulation are provided as desired by the user through Gating 2817 along with the separate Gate Array 2819, Electrical Length/Reference Plane Extension 2821, and Parameter Conversion 2822. The corrected data may also be converted from the frequency domain to the time domain using Chirp Z transforms. Windows 2825 and Window Array 2827 are used to remove the ringing in time domain due to band limited frequency domain input signals and then using the Chirp Z transforms 2823 to transform into the time domain. The data in the Data Array 2829 may be stored into memory in the Memory Array 2833 and used in vector computations with data from a second device. Comparisons of present data (D) and memory data (M) is accomplished through vector computations to provide all four mathematical functions of D*M, D/M, D+M, and D−M. Storage of the corrected and processed data D in the Data Array 2829 and the trace math data M in the Memory Array 2833 allows rapid response to the user when making format or trace math changes.

The vector data is then formatted in the Format block 2835 into magnitude, phase, group delay, or other formats as desired. Adjacent formatted points can then be combined if desired in the Smoothing block 2837. The resulting formatted data is stored into the Format Array 2839 which provides convenient access for scale and offset changes provided by the Scale block 2843. Markers are also applied as desired to the formatted data via the Marker Readout block 2841. Scaled data is stored in a Display Array 2845 in the Display Ram 217 from which the display generator 153 hardware repetitively creates a plot on the CRT 149 for a flicker-free display.

Input and output access is provided to and from all of the arrays via the HP-IB interface 157 and via tape 161 with S-parameters available from the Data Array 2829 in addition to other applicable arrays. Direct printer output for the printer 155 is made from the Format Array 2839. Direct plotter output for plotter 155 is made from the Display Array 2845. The user may also trade off the data update rate against the number of data points used by selecting resolutions from 51 to 401 points.

The software is structured as a multi-tasking system to provide a rapid data update rate by allowing data processing to take place when the data acquisition software is not busy. Overlying command and control tasks interleave data processing with data acquisition cycles to provide both two port error correction and dual channel display modes.

The software signal process discussed previously is controlled by a process structure as shown in FIG. 29. This process structure is one of the reasons the present invention can process RF data essentially in real time. For example, low priority processes such as controlling the source 109, controlling the test set 107, and formatting the display 149 are only performed when the data acquisition process is not busy. Previous systems would take data, process it completely through to the display and when the end of each sweep is reached, the processor had to wait for the hardware to reset. Instead, the present invention actually performs processing while the control functions such as resetting for a subsequent sweep or while switching S-parameter are proceeding. The Command Sources 2901 accept user commands via the front panels 159 and the HP-IB interface 157, parses and converts the commands to a common internal command token regardless of source and puts the commands into a command queue 2903. The Command Processor 2905 takes the commands from the command queue 2903 and implements them. Any one time precomputation that will later improve run time efficiency is done at this time. The Command Processor 2905 modifies the instrument state and performs one time operations, such as updating a trace after a scale change, outputting an array of data, and copying the Data Array into the Memory Array. Based on the instrument state, Control 2907 is responsible for insuring that the desired data is acquired in the specified manner and conditions. This includes control of source 109, test set 107, phase lock 125, IF multiplexers 136, ADC 139, and set up of the data acquisition and processing. Swept and stepped, alternate and chopped, single and continuous signal sweeps are implemented within Control 2907. Sweep maintenance is also managed in the Control 2907 to keep track of bandcrossings and frequency stepping. Acquisition 2909 services the ADC 139 interrupt, IF gain autoranging, ratioing, averaging and storing data into the Raw Array 2809. Processing 2911 processes data from the Raw Array 2809 until the data is displayed on the CRT 149 including vector error correction of external errors, parameter conversion, time domain processing (gating, windowing, and transformation), trace math (D*M, D/M, D+M, D−M), formatting (log, linear, and delay), and response (scale, reference value, and split screen).

The machine state variables that are used to derive control variables 2913 include: parameter descriptions such as test set set-up, receiver set-up, and ratio/nonratio; user selections for frequency, power, sweep time, formats, scale per division, averaging information, number of points to be taken, error correction type, and time domain factors; and, internal housekeeping pointers to the data, raw, error coefficients, corrected data, format-

ted data, memory data, and display data arrays. Acquisition variables **2915** provide data reduced from the control variables **2913** for efficiency that are related to controlling the ADC **139** until the data is stored in the raw array. The Acquisition variables **2915** include: IF gain, receiver error, ratioing, averaging, and current pointer position in the raw array. The Processing variables **2917** provide data reduced from the group control variables for efficiency that are related to controlling the processing of data from the raw array through the display. The Processing variables **2917** include: current position pointers for the arrays, error correction type, time domain information, trace math, format, and response. The Signals **2919** provide synchronization between programs that otherwise function independently of one another.

Several of the software functions previously mentioned will now be discussed. In stepped sweep, Averaging **2811** computes the linear average of a block of data points taken while the frequency is held fixed. This is repeated for each frequency in the stepped sweep. In swept frequency sweeps Averaging **2811** computes the weighted exponential running average of the synchronous incoming data, and therefore decreases the input noise bandwidth, thereby reducing noise and extending dynamic range. Each time Averaging is restarted the averaging starts with a small averaging factor, increasing it every one to eight sweeps to the selected averaging factor, thus allowing fast convergence to the final value. Smoothing **2837** on the other hand operates on processed data by providing a linear moving average of adjacent data points as a percentage of the display. The result is like a video filter, reducing peak to peak noise such as on a baseline trace, but not improving the dynamic range of the signal. In addition, smoothing in the present invention has a novel use for group delay measurements. Group delay (i.e. t_g=change in phase in degrees/(360 degrees * change in frequency in Hertz) is a differential measurement and unfortunately noise is therefore emphasized. Classically the frequency over which the group delay measurement is made, called aperture, is therefore increased to provide a more useful group delay measurement. In the present invention, this same result is achieved by smoothing the processed group delay data. Thus, smoothing (i.e., averaging of adjacent data points) of group delay data achieves the same effect as is achieved by utilizing a classical variable group delay aperture. This also allows a phase change greater than 180 degrees across the aperture when smoothing is applied to 3 or more adjacent data points.

The RF vector error correction in the present invention also is adapted to speed and facilitate calibration. Measurements are made on a series of calibration standards and then the Raw Array data **2809** is stored in the Error Array **2815**. Many different types of calibration standards can be used including the open-load-short approach as used in coaxial connectors, offset-short-load approach as used in waveguide technologies, and multiple offset shorts as used in microstrip devices. The calibration standards need not be used in any particular order since all data is stored digitally, and the display format which is updated in real time even during calibration, can be changed at any time without effecting the calibration itself. IF Averaging can also be used during calibration since Averaging operates on the Raw Array **2809**. Multiple fixed and sliding loads as desired can also be utilized. Since the correction data sets themselves are stored in memory, several correction data sets can be stored in the machine at one time (e.g., different correction data sets can be stored for different S-parameters and correction data sets over different frequency ranges can be stored for the same S-parameter). Because of the trace math **2831** and the memory array **2833**, both corrected and uncorrected traces can be viewed and used at the same time.

Gating **2817** is used to look at certain portions of the display as specified by the user. Gating can be used either in the time or frequency domains and provides a gate through which the data can be viewed. This gate is selected by setting a center time and a span (or a start time and a stop time) about which to view the displayed data. When gates are desired, rather than removing time domain data outside of the gate from the data being used to calculate the displayed data, in the present invention the frequency domain shape of the gate is calculated and convolved directly with the incoming frequency data as a frequency operation. The result is that no data is eliminated from within the gated region, and when the frequency to time transformation is performed there is no problem with undersampling of the bandlimited time data. The result is that the gated time domain data maintains its full spectrum of information and can be transformed back into the frequency domain if so desired, without loss of information. Thus, even though the user can perform the setting of gates while viewing the time domain data, the actual gating is performed in the frequency domain by means of convolution.

Electrical delay and reference plane extension **2821** are used, respectively, to change the electrical delay, for example in order to measure the electrical delay of an air line or to move the measurement plane used in S-parameter measurements to other than the physical plane of the test set ports **1** or **2**. Although both electrical delay and reference plane extension are both defined in units of time (i.e., plus or minus up to 100 seconds) and both use the same mathematical formula, electrical delay varies per parameter while reference plane extension varies per port. An equivalent readout in distance is made along with the electrical delay.

Time Domain Processing

The usual microwave DUT **111** consists of multiple elements with transmission line sections in between. When tested using conventional frequency domain techniques, a composite response is generated. The specific discontinuities cannot be examined individually. In the time domain, the present invention takes its normal frequency domain data and applies for the first time the little known Chirp Z transform, as described by Rabiner and Gold in "Theory and Application of Digital Signal Processing", pages 393–398, 1975, to convert from the frequency to the time domain. Prior time transform methods have usually used a conventional fast Fourier technique which required the application of harmonically related frequency inputs and in which the entire frequency window is transformed into the entire time window. For example, when a 10 nanosecond wide time window is viewed with 101 data points, each data point is separated by only 0.1 nanoseconds and any attempt to view only a portion of the data in the 10 nanosecond wide time window suffers from the availability of only a few data points. This can be overcome by taking more data points, but at a drastic reduction in speed. Other workers have instead used the classical complete Fourier series expansion of the frequency data

to achieve an arbitrary number of viewable data points, but such a method is extremely slow, requiring several minutes to do the necessary calculations. As with the complete Fourier series expansion, the Chirp Z transform also provides an arbitrary number of data points for viewing in any given time window, but this transform can be calculated in less than one second.

The present system provides two time domain operating modes. The first is called low pass and is used to simulate the traditional time domain reflectometer (TDR) but using the Chirp Z transform. Like the traditional TDR, low pass requires harmonically related frequency data from DC, which is extrapolated from the lowest available frequency data point to the maximum frequency available. Low pass provides the fastest rise time and best time domain resolution and may be used with either step or impulse excitation. By taking the integral of the low pass impulse response, the response of stimulating the DUT with a step is generated. The second time domain operating mode is called band pass and may be used in any frequency span without the need to include DC. Because of the use of the Chirp Z transform, band pass mode does not require harmonically related frequency data, but only requires excitation frequency steps of equal size (e.g., 10 MHz steps across a span of 1 to 2 GHz). Band pass mode is used for either reflection or transmission measurements, typically on bandlimited devices and only impulse excitation may be used.

An illustration of the low pass and band pass modes and the excitations used is shown in FIGS. **30***a*–**30***e*. The frequency domain response for the DUT as shown in FIG. **30***a* is shown in FIG. **30***b*, while a time domain low pass mode step excitation is shown in FIG. **30***c*, a time domain low pass mode impulse excitation is shown in FIG. **30***d*, and a time domain band pass mode impulse excitation is shown in FIG. **30***e*. Since there is an upper frequency limit to the data, and at that limit, an abrupt transition occurs from data to no data, time domain responses are subject to ringing and overshoot called the Gibbs phenomena. Ringing interferes with a user's ability to distinguish between two closely spaced real device responses and also creates confusion in separating actual and data reduction produced responses. The present invention provides a window capability (not to be confused with gating) to modify and filter the frequency domain data to reduce this ringing in a controlled way as shown in FIGS. **31***a*–**31***d*. A Kaiser-Bessel window with three different levels of windowing, for three levels 0, 6, and 13 of the Kaiser-Bessel parameter, may be used to attenuate and roll off the higher frequency data, thereby trading resolution for ringing reduction, since the best rise time occurs at minimum (i.e., zero) windowing and the best sidelobe suppression occurs at maximum windowing. The minimum windowing provides sidelobes of −14 dB for minimum impulse stimulus width, the normal amount of windowing provides side lobes of −50 dB with an increase of a factor of two in the width of the primary response, while the maximum windowing provides side lobes of −90 dB with an increase of a factor of four in the width of the primary response.

The ability to make vector error corrected measurements has a significant effect on the quality of the time domain presentation. An example of this is shown in FIGS. **32***a* and **32***b*, contrasting time domain measurements of a short at the end of thirty centimeters of airline without and with correction, respectively. Equivalent source match of the coupler is increased to 40 dB and equivalent coupler directivity is raised to well over 50 dB.

As mentioned previously, gating is a further powerful feature of the time domain capability in the present invention and is illustrated in FIGS. **33***a*–**33***d*. FIG. **33***a* shows a split screen view of the frequency and time display **3301** and **3303** with gating for a 1.5 standing wave ratio (SWR) load. FIG. **33***b* shows the effect of adding in a reactive mismatch of 12 dB creating a large ripple effect in the frequency domain **3305**. FIG. **33***c* shows the effect of gating around the load, highlighted with markers **3311** and **3315**. Note the high degree of comparison between the frequency domain data **3309** in FIG. **33***c* with the data **3301** in FIG. **33***a*. FIG. **33***d* shows this same data from FIG. **33***c* with the traces **3309** and **3313** overlaid as traces **3317** and **3319** respectively.

APPENDIX A

SOFTKEY MENUS AND RELATED SOFTWARE CONSTANTS

```
>>>  TAPE_MENU  <<<

          ==========

          "DIRECTORY"

          cmd_directory

          ==========

          "RECORD"

          ==========

          "RESTORE"

          ==========

          "DELETE"

          ==========

          "UN-DELETE"

          ==========

          ==========

          ==========

          "INITIALIZE"
          "TAPE"
```

```
==========

>>> INIT_TAPE_MENU <<<

==========

"INIT TAPE?"
"YES"

==========

"NO"

==========

==========

==========

==========

==========

==========

>>> DIRECTORY_MENU <<<

==========

"RESCAN"
"DISPLAY"

cmd_directory_off

==========

==========

==========

==========

"NEXT"
"PAGE"

cmd_next_page

==========

"PREVIOUS"
"PAGE"

cmd_prev_page

==========

==========

"FIRST"
"PAGE"

cmd_first_page

==========

"LAST"
"PAGE"

cmd_last_page

==========

>>> DATA2_MENU <<<

==========

"DATA"

==========

"FORMATTED"
"DATA"

==========

"RAW"
"DATA"

==========

==========

"USER"
"DISPLAY"

==========

==========
```

```
==========

"MACHINE"
"DUMP"

cmd_machine_dump

==========

>>> DATA1_MENU <<<

==========

"INSTRUMENT"
"STATE"

==========

"INSTRUMENT"
"STATES 1-5"

==========

"MEMORY"
"TRACE"

==========

"MEMORY"
"TRACES 1-4"

==========

"CAL SET"

==========

"CAL SETS"
"1-8"

==========

"CAL KIT"

==========

"MORE"

cmd_more

==========

>>> FILE_MENU <<<

==========

"DATA TYPE "
"* FILE 1"

cmd_file_1

==========

" "
"* FILE 2"

cmd_file_2

==========

" "
"* FILE 3"

==========

" "
"* FILE 4"

==========

" "
"* FILE 5"

==========

" "
"* FILE 6"

==========

" "
"* FILE 7"

==========

" "
"* FILE 8"

cmd_file8

==========

>>> REG_MENU <<<

==========

"DATA TYPE "
"* 1 "

cmd_reg_1

==========
```

```
" "
"* 2 "

cmd_reg_2

==========

" "
"* 3 "

cmd_reg_3

==========

" "
"* 4 "

cmd_reg_4

==========

"(POWER UP)"
"* 5 "

cmd_reg_5

==========

" "
"* 6 "

cmd_reg_6

==========

" "
"* 7 "

cmd_reg_7

==========

" "
"LAST STATE"

cmd_reg_8

==========

>>> RESPONSE_MENU <<<

==========

"ELECTRICAL"+sk_bracket_2
"DELAY"

cmd_elect_delay

==========

"AUTO DELAY"

cmd_auto_delay

==========

"PHASE"
"OFFSET"

cmd_phase_offset

==========

"MAGNITUDE"
"OFFSET"

==========

"AVERAGING"+sk_bracket_2
"ON/RESTART"

cmd_if_avg_on

==========

"OFF"

cmd_if_avg_off

==========

"SMOOTHING"+sk_bracket_2
"ON "

cmd_smoothing_on

==========

"OFF"

cmd_smoothing_off

==========

>>> IF_GAIN_MENU <<<

==========

"TEST"+sk_bracket_2
"AMP. GAIN"

cmd_if_test_port

==========
```

```
"REFERENCE"
"AMP. GAIN"

cmd_if_ref_port

==========

>>>  IF_GAIN_MENU2  <<<

==========

"GAIN"+sk_brecket_6
"0 (MIN.)"

cmd_if_no_gain

==========

" 1 "

cmd_if_12db_gain

==========

" 2 "

cmd_if_24db_gain

==========

" 3 "

cmd_if_36db_gain

==========

"4 (MAX.)"

cmd_if_48db_gain

==========

"AUTO"

cmd_if_gain_auto

==========

>>>  STIMULUS_MENU  <<<

==========

"POWER"
"MENU"

cmd_power_menu

==========

"SWEEP"
"TIME"

cmd_sweep_time

==========

"NUMBER of"
"POINTS"

cmd_n_points_menu

==========

==========

"SINGLE"+sk_bracket_3
"POINT"

cmd_cw

==========

"RAMP"

cmd_swept

==========

"STEP"

cmd_stepped

==========

"MORE"

cmd_more

==========

>>>  N_POINTS_MENU  <<<

==========

"POINTS:"+sk_bracket_4
"51 "

cmd_51_points

==========
```

```
"101"

cmd_101_points

==========

"201"

cmd_201_points

==========

"401"

cmd_401_points

==========

>>> POWER_MENU <<<

==========

"POWER"

cmd_source_power

==========

==========

"SLOPE"+sk_bracket_2
"ON "

cmd_power_slope

==========

"OFF"

cmd_power_slope_off

==========

==========

"ATTENUATOR"+sk_bracket_2
"PORT 1"

cmd_atten_port1

==========

"PORT 2"

cmd_atten_port2

==========

>>> STIMULUS2_MENU <<<

==========

sk_tracket_4
half_vt+"HOLD"

cmd_noid

==========

"SINGLE"

cmd_single

==========

"NUMBER of"
"GROUPS"

cmd_n_groups_kbd

==========

"CONTINUAL"

cmd_continuous

==========

"STIMULUS"
"OFFSET"

==========

==========

sk_bracket_2
half_vt+"Ch1 = Ch2"

cmd_couple_stimulus

==========

"Ch1 "+163+" Ch2"

cmd_uncouple_stimulus

==========
```

```
>>> DEVICE_REALY_MENU <<<

==========

==========

"PRESS TO"
"CONTINUE"

==========

>>> PARAM_MENU <<<

==========

"a"+177+sk_bracket_4

cmo_user1

==========

"b"+178

cmd_user2

==========

"a"+178

cmo_user3

==========

"b"+177

cmo_user4

==========

==========

==========

"REDEFINE"
"PARAMETER"

cmo_redefine_param

==========
```

```
>>> RELEF_MENU <<<

==========

"REDEFINE"+sk_brecket_6
"DRIVE"

==========

"PHASE LOCK"

==========

"NUMERATOR"

==========

"DENOMI-"
"NATOR"

==========

"CONVERSION"

==========

"PARAMETER"
"LABEL"

cmd_label_parameter

==========

==========

"REDEFINE"
"DONE"

cmo_redefine_done

==========

>>> RELEF_DRIVE_MENU <<<

==========

"DRIVE"+sk_bracket_3
"PORT 1"

==========

"PORT 2"

==========
```

```
"NONE"

==========

>>> REDEF_LOCK_MENU <<<

==========

"LOCK to"+sk_bracket_3
"a1 "

==========

"a2 "

==========

"NONE"

==========

>>> REDEF_NUM_MENU <<<

==========

"NUMERATOR"+sk_bracket_5
"b1 "

==========

"b2 "

==========

"a1 "

==========

"a2 "

==========

"SERVICE"
"SELECTIONS"

==========

>>> REDEF_NUM2_MENU <<<

==========

"100 kHz"+sk_bracket_8
"TEST CAL"

==========

"100 kHz"
"REF CAL"

==========

"DETECTOR"
"GROUND"

==========

"ADC GROUND"

==========

"VCAL"

==========

"VREF"

==========

"TEMP. 1"

==========

"TEMP. 2"

==========

>>> REDEF_DENOM_MENU <<<

==========

"DENOM."+sk_bracket_4
"a1 "

==========

"a2 "

==========

"b1 "

==========

"NC RATIO"

==========

>>> REDEF_CONV_MENU <<<

==========
```

```
"CONVERT"+sk_brecket_4
"to   S"

==========

"to 1/S"

==========

"to   Z"

==========

"to   Y"

==========


>>>  FORMAT_MENU  <<<

==========

sk_bracket_8
half_vt+"SWR"

cmd_swr

==========

"LINEAR"
"MAGNITUDE"

cmd_linear_mag

==========

"POLAR w/"
"LIN MKR"

cmd_linear_polar

==========

"POLAR w/"
"LOG MKR"

cmd_log_polar

==========

"POLAR w/"
"Re/Im MKR"

cmd_imag_vs_real

==========
```

```
"INVERTED"
"SMITH"

cmd_y_smith

==========

"IMAGINARY"

cmd_imaginary

==========

"REAL"

cmd_real

==========


>>>  DOMAIN_MENU  <<<

==========

sk_bracket_4
half_vt+"FREQUENCY"

cmd_freq_domain

==========

"TIME"
"LOW PASS"

cmd_low_pass_request

==========

"TIME"
"BAND PASS"

cmd_time_domain

==========

"AUX. VOLT"
"OUTPUT"

cmd_aux_domain

==========


==========

"SPECIFY"+sk_bracket_2
"TIME"
```

```
cmd_setup_time_domain

==========

"GATE"

cmd_setup_gate_domain

==========

==========

==========

>>>  LOW_PASS_FREQ  <<<

==========


==========

"SET FREQ."
"(LOW PASS)"

cmd_tdr_domain

==========

>>>  TIME_SETUP_MENU  <<<

==========

"LOW PASS:"+sk_bracket_2
"STEP"

cmd_tdr_step

==========

"IMPULSE"

cmd_tdr_impulse

==========

==========

==========

"WINDOW:"+sk_bracket_3
"MINIMUM"

cmd_min_time_window

==========

"NORMAL"

cmd_normal_time_window

==========

"MAXIMUM"

cmd_max_time_window

==========

==========

>>>  GATE_SETUP_MENU  <<<

==========

"GATE"+sk_bracket_2
"ON"

cmd_gate_on

==========

"OFF"

cmd_gate_off

==========

"GATE"+sk_bracket_4
"START"

cmd_gate_start

==========

"STOP"

cmd_gate_stop

==========

"CENTER"

cmd_gate_center

==========
```

```
"SPAN"

cmd_gate_span

==========

"GATE SHAPE"

==========

==========

>>> GATE_SHAPE_MENU <<<

==========

==========

==========

==========

==========

"GATE SHAPE"+sk_bracket_3
"MINIMUM"

cmd_min_gate_window

==========

"NORMAL"

cmd_normal_gate_window

==========

"MAXIMUM"

cmd_max_gate_window

==========
```

```
>>> CAL_MENU <<<

==========

"CORRECTION"+sk_bracket_3
"CA"

cmd_correction_on

==========

"OFF"

cmd_correction_off

==========

"SELECT"
"CAL SET"

cmd_correction_default

==========

"CALIBRATE"+sk_bracket_3
"( KIT #1 )"

cmd_cal_kit_1

==========

"CALIBRATE"
"( KIT #2 )"

cmd_cal_kit_2

==========

"RESUME CAL"
"SEQUENCE"

==========

==========

"MORE"

cmd_more

==========

>>> MORE_CAL <<<

==========
```

```
"PEFEPENCE"
"PLANES"

cmd_ret_plane_menu

==========

"SET Z"+176

==========

"CAL SWEEP"
"VOLTAGE"

==========


==========

"MODIFY KIT"
"( KIT #1 )"

cmd_modify_cal_kit_1

==========

"MODIFY KIT"
"( KIT #2 )"

cmd_modify_cal_kit_2

==========


==========

"DELETE A"
"CAL SET"

cmd_delete_cal

==========

>>>  REF_PLANE_MENU  <<<

==========


==========


==========

sk_bracket_2
half_vt+"PLANE 1"

cmd_ref_plane_1

==========

"PLANE 2"

cmd_ref_plane_2

==========


==========


==========


==========

>>>  CAL_TYPE_MENU  <<<

==========


==========

"SET FREQ."
"(LOW PASS)"

cmd_freq_setup

==========


==========

"FREQUENCY"+sk_bracket_5
"RESPONSE"

cmd_response_type

==========

"S"+177+177+"   "
"1-PORT"
```

```
cmd_1_port_1_type

==========

"S"+178+176+"  "
"1-PORT"

cmd_1_port_2_type

==========

"SIMPLE"
"2-PORT"

cmd_simple_2_port_type

==========

"FULL"
"2-PORT"

cmd_2_port_type

==========


>>>  PORT_ONE_REPL  <<<


==========

"S"+177+177+"  "+sk_bracket_3
"PORT1 S1D1"

cmd_port1_std1

==========

"PORT1 S1D2"

cmd_port1_std2

==========

"PORT1 S1D3"

cmd_port1_std3

==========


==========


==========
```

```
==========

==========

"SAVE"
"S"+177+177+" CAL"

cmd_done_1_port_on_1

==========

>>>  PORT_TWO_REPL  <<<

==========

"S"+176+176+"  "+sk_bracket_3
"PORT2 S1D1"

cmd_port2_std1

==========

"PORT2 S1D2"

cmd_port2_std2

==========

"PORT2 S1D3"

cmd_port2_std3

==========


==========


==========

==========

"SAVE"
"S"+178+176+" CAL"

cmd_done_1_port_on_2

==========
```

```
>>>  CAL_MENU2  <<<

  ==========

  sk_brecket_3
  half_vt+"REFLECTION"

  cmd_cal_reflection

  ==========

  "TRANS-"
  "MISSION"

  cmd_cal_thru

  ==========

  "ISOLATION"

  cmd_cal_isolation

  ==========



  ==========



  ==========



  ==========

  "SAVE"
  "2-PORT CAL"

  cmd_done_2_port

  ==========

>>>  REFLECTION_MENU  <<<

  ==========

  "S"+177+177+"  "+sk_bracket_3
  "FOR11 SID1"

  cmd_port1_std1

  ==========

  "FOR11 S1D2"

  cmd_port1_sto2

  ==========

  "PORT1 S1D3"

  cmd_port1_std3

  ==========

  "S"+178+178+"  "+sk_bracket_3
  "FCR12 S1D1"

  cmd_port2_std1

  ==========

  "POR12 S1D2"

  cmd_port2_std2

  ==========

  "FCR12 S1D3"

  cmd_port2_std3

  ==========



  ==========

  "REFLECTION"
  "DONE"

  cmd_done_reflection

  ==========

>>>  TRANSMISSION_MENU  <<<

  ==========



  ==========

  "FWD.TRANS."
  "FWD_TRANS_"

  cmd_fwd_transmission
```

```
==========

"FWD.MATCH"
"FWD_MATCH_"

cmo_fwd_match

==========

"REV.TRANS."
"FEV_TRANS_"

cmd_rev_transmission

==========

"REV.MATCH"
"REV_MATCH_"

cmd_rev_match

==========

==========

"TRANS."
"DONE"

cmd_done_trans

==========

>>> ISOLATION_MENU <<<

==========

==========

==========

"OMIT"
"ISOLATION"

cmd_omit_isolation

==========

==========

"FWD ISOL'N"
"FWD_ISOLN_"

cmo_two_isolation

==========

"REV ISOL'N"
"FEV_ISOLN_"

cmd_rev_isolation

==========

==========

"ISOLATION"
"DONE"

cmd_done_isolation

==========

>>> CAL_MENU3 <<<

==========

sk_brecket_3
half_vt+"REFLECT'N"

cmd_cal_simple_reflection

==========

"TRANS-"
"MISSION"

cmd_cal_simple_thru

==========

"ISOLATION"

cmd_cal_simple_isolation

==========

==========

==========
```

```
==========

"SAVE"
"2-PORT CAL"

cmd_done_2_port

==========

>>> SIMPLE_REFLECTION_MENU <<<

==========

"S"+177+177+sk_bracket_3
"PORT1 STD1"

cmd_port1_std1

==========

"PORT1 STD2"

cmd_port1_std2

==========

"PORT1 STD3"

cmd_port1_std3

==========

==========

==========

 \

==========

"REFLECTION"
"DONE"

cmd_done_simple_reflection
```

```
==========

>>> SIMPLE_TRANSMISSION_MENU <<<

==========

==========

"FWD.TRANS."
"FWD_TRANS_"

cmd_fwd_transmission

==========

"FWD.MATCH"
"FWD_MATCH_"

cmd_fwd_match

==========

==========

==========

==========

 \

==========

"TRANS."
"DONE"

cmd_done_trans

==========

>>> SIMPLE_ISOLATION_MENU <<<

==========

==========
```

```
==========

"OMII"
"ISOLATION"

cmd_omit_isolation

==========

==========

"FWD ISOLATION"
"FWD_ISOLN_"

cmd_fwd_isolation

==========

==========

==========

"ISOLATION"
"DONE"

cmd_done_Isolation

==========

>>>  STD_CLASS_MENU  <<<

==========

"STANDARD 1"

cmd_class_std1

==========

"STANDARD 2"

cmd_class_std2

==========

"STANDARD 3"

cmd_class_std3

==========

"STANDARD 4"

cmd_class_std4

==========

"STANDARD 5"

cmd_class_std5

==========

"STANDARD 6"

cmd_class_std6

==========

"STANDARD 7"

cmd_class_std7

==========

"STANDARDS "
"DONE"

cmd_class_done

==========

>>>  SLIDING_LOAD_MENU  <<<

==========

"SLIDE IS"
"SET"

==========

==========

==========

==========
```

```
==========

==========

"SLIDING"
"LOAD DONE"

==========

>>> MODIFY_CAL_KIT_MENU <<<

==========

"SELECT"
"STANDARD"

cmd_select_std

==========

==========

"SPECIFY"
"SID CLASS"

cmd_specify_classes

==========

"LABEL"
"SID CLASS"

cmd_label_classes

==========

==========

"LABEL"
"CAL KIT"

cmd_label_cal_kit

==========

==========

"DONE"
"(DEFINED)"

cmd_cal_kit_defined

==========

>>> MODIFY_SIDS_MENU <<<

==========

"SID TYPE"+sk_bracket_5
"OPEN"

cmd_define_open

==========

"SHORT"

cmd_define_short

==========

"LOAD"

cmd_define_load

==========

"DELAY/"
"THRU"

cmd_define_air_line

==========

"ARBITRARY"
"IMPEDANCE"

cmd_define_z

==========

==========

==========
```

```
>>>  DEFINE_OPEN_MENU  <<<

     ==========

     " C"+176+" "

     cmd_open_c0
     ==========

     " C"+177+" "

     cmd_open_c1
     ==========

     " C"+178+" "

     cmd_open_c2
     ==========


     ==========

     ==========

     "SPECIFY"
     "OFFSET"

     cmd_specify_offset
     ==========

     "LABEL STD"

     cmd_label_cal_std
     ==========

     "DONE"
     "(DEFINED)"

     cmd_cal_std_defined
     ==========

>>>  DEFINE_SHORT_MENU  <<<
     ==========


     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

     ==========

>>>  DEFINE_LOAD_MENU  <<<

     ==========

     ==========

     ==========

     ==========

     sk_bracket_2
     half_vt+"FIXED"

     cmd_fixed_load
     ==========
```

```
"SLIDING"

cmd_sliding_load

==========

"SPECIFY"
"OFFSET"

cmd_specify_offset

==========

"LABEL SID"

cmd_label_cal_std

==========

"DONE"
"(DEFINED)"

cmd_cal_std_defined

==========

>>> SPECIFY_Z_MENU <<<

==========

" C"+176+" "

cmd_open_c0

==========

" C"+177+" "

cmd_open_c1

==========

" C"+178+" "

cmd_open_c2

==========

sk_bracket_2
half_vt+"FIXED"

cmd_fixed_load

==========

"SLIDING"

cmd_sliding_load

==========

"SPECIFY"
"OFFSET"

cmd_specify_offset

==========

"LABEL SID"

cmd_label_cal_std

==========

"DONE"
"(DEFINED)"

cmd_cal_std_defined

==========

>>> SPECIFY_OFFSET_MENU <<<

==========

"OFFSET"
"DELAY"

cmd_offset_delay

==========

"OFFSET"
"LOSS"

cmd_offset_loss

==========

"OFFSET"
" Z"+176+" "

cmd_offset_z0

==========

"LOWER"
"FREQUENCY"

cmd_offset_min_f

==========
```

```
"UPPER"
"FREQUENCY"

cmd_offset_max_f

==========

sk_bracket_2
half_vt+"COAX"

cmd_coax

==========

"WAVEGUIDE"

cmd_weveguide

==========

"DONE"
"(DEFINED)"

==========

>>>  SPECIFY_CLASS_MENU  <<<

==========

"S"+177+177+":  "
"1st SID"

cmd_port1_1st_std

==========

"2nd SID"

cmd_port1_2nd_std

==========

"3rd SID"

cmd_port1_3rd_std

==========

"S"+178+178+":  "
"1st SID"

cmd_port2_1st_std

==========

"2nd SID"

cmd_port2_2nd_std

==========

"3rd SID"

cmd_port2_3rd_std

==========

"MORE"

==========

"DONE"
"(SPEC'D)"

cmd_std_class_specified

==========

>>>  SPECIFY_CLASS_MENU2  <<<

==========

"TRANS.:"
"FWD SID"

cmd_trans_fwd_std

==========

"REV SID"

cmd_trans_rev_std

==========

==========

"FREQUENCY"
"RESP. SID"

cmd_freq_resp_std

==========

==========

==========
```

```
==========

"DONE"
"(SPEC'D)"

cmd_std_class_specified

==========



==========

"SINGLE "+sk_bracket_2
"CHANNEL"

cmd_single_cn

==========

"DUAL    "
"CHANNEL"

cmd_dual_ch

==========

sk_bracket_4
half_vt+"DATA"

cmd_data

==========

"MEMORY"

cmd_mem

==========

"DATA "+38
"MEMORY"

cmd_d_and_m

==========

"MATH"
"(...)"

cmd_math

==========

"SELECT"
"DEFAULTS"

==========
```

```
"DATA "+169
"MEMORY"

cmd_d_into_m

==========



==========

"2 CHANNEL"+sk_bracket_2
"OVERLAY"

cmd_overlay

==========

"2 CHANNEL"
"SPLIT"

cmd_split

==========

==========

==========

==========

==========

==========

==========
```

>>> DISPLAY_DEFAULT_MENU <<<

```
==========

"MEMORY"+sk_bracket_5
" 1 "
```

```
cmd_memory1

==========

" 2 "

cmd_memory2

==========

" 3 "

cmd_memory3

==========

" 4 "

cmd_memory4

==========

"MORE"

==========


==========

"MATH"
"OPERATIONS"

==========


==========

>>>  MEMORY_MENU  <<<

==========


==========


==========


==========


==========

"DATA from"+sk_bracket_3
"CHANNEL 1"

cmd_memory_ch1

==========

"DATA from"
"CHANNEL 2"

cmd_memory_ch2

==========

"JOHN'S"
"PLAYGROUND"

==========


==========

>>>  MEMORY2_MENU  <<<

==========

"CAL DATA"+sk_bracket_7
" 0 "

cmd_cal0

==========

"CAL DATA"
" 1 "

cmd_cal1

==========

"CAL DATA"
" 2 "

cmd_cal2

==========

"CAL DATA"
" 3 "

cmd_cal3

==========

"CAL DATA"
" 4 "
```

```
cmd_cal4

==========

"CAL DATA"
" 5 "

cmd_cal5

==========

"CAL DATA"
" 6 "

cmd_cal6

==========

"CAL DATA"
" 7 "

==========


>>> MATH_MENU  <<<

==========


==========


==========

"DATA"+sk_bracket_4
"+ MEMORY"

cmd_d_plus_m

==========

"DATA"
"- MEMORY"

cmd_d_minus_m

==========

"DATA"
mpy_char+" MEMORY"

cmd_d_mpy_m

==========

"DATA"
"/ MEMORY"

cmd_d_div_m

==========


==========

>>> COPY_MENU  <<<

==========

"PLOT"+sk_bracket_5
"ALL"

cmd_plot_all

==========

"TRACE"

cmd_plot_trace

==========

"GRATICULE"

cmd_plot_graticule

==========

"MARKER(S)"

cmd_plot_marker

==========

"TEXT"

cmd_plot_text

==========

"SELECT"
"QUADRANT"

==========

"SELECT"
"PEN COLOR"
```

```
cmd_ch1_pen

==========

"MORE"

==========

>>> PLOTPARM_MENU <<<

==========

"LIST TRACE"
"VALUES"

cmd_list_trace

==========

==========

==========

==========

==========

==========

==========

"SYSTEM"+sk_bracket_2
"PARAMETERS"

cmd_system_params

==========

"OPERATING"
"PARAMETERS"

cmd_op_params

==========

==========

==========

"X -  LEFT"
"- -  UPPER"

cmd_quadrant_11

==========

"- -  LEFT"
"X -  LOWER"

cmo_quadrant_21

==========

"- X  RIGHT"
"- -  UPPER"

cmd_quadrant_12

==========

"- -  RIGHT"
"- X  LOWER"

cmo_quadrant_22

==========

"X X  FULL"+sk_bracket_5
"X X  PAGE"

cmd_quadrant_full

==========

==========

==========

>>> PEN_MENU <<<

==========

"PEN"+sk_bracket_8
" 1 "

cmd_pen1

==========
```

```
" 2 "
cmd_pen2
==========
" 3 "
cmd_pen3
==========
" 4 "
cmd_pen4
==========
" 5 "
cmd_pen5
==========
" 6 "
cmd_pen6
==========
" 7 "
cmd_pen7
==========
" 8 "
cmd_pen8
==========

>>> COPY2_MENU <<<

  ==========
  "RESTORE"
  "DISPLAY"
  cmd_directory_off
  ==========
  sk_bracket_2
  half_vt+"PRINT"
  cmd_print_parems
  ==========
  "PLOT"
  cmd_plot_params
  ==========

  ==========

  ==========

  ==========

  ==========
  "NEXT PAGE"
  cmd_next_op_param
  ==========

>>> MARKER_MENU <<<

  ==========
  "MARKER"+sk_bracket_6
  "       1 "
  cmd_marker_1
  ==========
  "       2 "
  cmd_marker_2
  ==========
  "       3 "
  cmd_marker_3
  ==========
  "       4 "
```

```
cmd_merker_4

==========

"        5 "

cmc_marker_5

==========

"ALL"
"OFF"

cmd_marker_off

==========

delta_char+" MODE"
"MENU"

cmd_delta_marker

==========

"MORE"

cmd_more

==========


>>>  DELTA_MARKER_MENU  <<<


==========

sk_bracket_6
half_vt+delta_char+" REF = 1"

cmd_ref_mkr1

==========

delta_char+" REF = 2"

cmd_ref_mkr2

==========

delta_char+" REF = 3"

cmc_ref_mkr3

==========

delta_char+" REF = 4"

cmd_ref_mkr4

==========

delta_char+" REF = 5"

cmd_ref_mkr5

==========

delta_char+" MODE"
"OFF"

cmd_no_ref_mkr

==========


==========


==========


>>>  MARKER_MENU  <<<

==========


==========


==========


==========


==========


==========


==========

"MARKER to"+sk_bracket_2
"MINIMUM"

cmd_mkr_to_min

==========
```

```
"MAXIMUM"

cmc_mkr_to_max

==========

>>>  SYSTEM_MENU  <<<

==========

"TITLE"

cmd_title

==========

"HP-IB"
"ADDRESSES"

cmd_hpib_Info

==========

"CRT"
"OFF"

cmd_crt_off

==========


==========


==========


==========


==========

"SERVICE"
"FUNCTIONS"

cmd_service_menu

==========

>>>  TITLE_MENU  <<<

==========

"SELECT"
"LETTER"

==========


==========

"SPACE"

==========

"BACKSPACE"

==========


==========


==========

"DONE"

cmd_title_done

==========


>>>  HPIB_MENU  <<<

==========

"8510 HP-IB"+sk_bracket_6
"ADDRESS"

cmd_8510_addr

==========

"SYSTEM BUS"

cmd_system_bus_addr

==========

"SOURCE"

cmc_source_addr
```

```
==========

"TEST SET"

cmd_test_set_addr

==========

"PLOTTER"

cmd_plotter_addr

==========

"PRINTER"

cmd_printer_addr

==========

"AUTO CMD"

cmd_auto_cmd_addr

==========

"PASS THRU"

cmd_pass_thru_addr

==========

>>>  SERVICE_MENU  <<<

==========

"SOFTWARE"
"REVISION"

cmd_revision

==========

"SYSTEM BUS"+sk_bracket_2
"'LOCAL'"

cmd_privlb_local

==========

"'REMOTE'"

cmd_privlb_remote

==========

"IF GAIN"

cmd_if_gain_menu

==========

sk_bracket_3
half_vtt"LOCATION"

cmd_peek_poke_addr

==========

"PEEK"

cmd_peek

==========

"POKE"

cmd_poke

==========

"TEST MENU"

cmd_test_menu

==========
```

APPENDIX B

SOURCE CODE LISTING WRITTEN IN

ALGOL AND ASSEMBLY LANGUAGE

F68.WORK.PD8510 THU, DEC 22, 191 21 AM PAGE 1

```
kp active
kp asttbl
kp actv0
kp actv2
kp alabel,,21
kp alpkam,,21
kp amoot
kp array
kp atables,,21
kp average
kp break
kp cal
kp cal0
kp ckdata,,21
kp cktable
kp circle
kp cmds
ap computc
kp command
kp control
kp cmntvar
ap coreect
kp couple
kp spltbl,,21
kp datap
kp delay
kp dgtop
kp dguser
kp display
kp disptbl
kp domain
kp dtmgr
ap fft
kp fifo
kp format
ap fstnath
kp gratic
kp ibtree,,21
kp ifgain
kp junk
kp kernel
kp keys.,21
kp lumplus,,21
kp main
kp mark0
kp mark1
kp mark3
kp markdg
kp marker
kp marks
kp marknen
kp mbngr
kp mbnload
kp menngr
kp mcnu
```

F68.WORK.PD8510 THU, DEC 22, 1983, 10:21 AM PAGE 2

```
kp outib
kp output
kp param
kp parntbl
kp parmer
kp pfr
kp plot
kp privib
kp pubib
kp recall
kp respons
kp retrace
kp screen,,21
kp screen2
kp size
kp skey,,21
kp skpes,,21
kp stack
kp stddata
kp stds
kp stinuli
kp stinul2
kp stinui3
kp syoten
kp tmtmet
kp tins
kp timemau
kp title
kp tpngr
kp trace
kp trace2
kp trigtbl
kp util
kp xadc
kp xmbm
kp xtaco
kp yadc
```

J68.WORK.PD8510 THU, DEC 22, 1983, 10:21 AM PAGE 1

```
!jab j68prep,librm.pd8510,work;outclass=,1;pri=cs
!purge j68temp.work
!ed
)p off
)r off
e f68.work
)u u68.work
u j68temp.work
c j68model.work
/substitute kern/ka
'ar j68temp.work
'ed
w j68temp.work
q
!stream j68temp.work
!eoj
```

U68.WORK.PD8510 THU, DEC 22, 1983, 10:21 AM PAGE 1

```
1,$e/^.*$/\UL/
1,$s/\([^ ]*  *\)\([^.^.^ ]*\)\(.*\)$/!setjcw jcu,0\n!message
      "\2"\n!continue\n!\! \2.work
n!  setjcw \2,9999\n!  endif/
1,$g/\.work\./s/\.work//
1,$g/setjcu.*\.[^.]*,/e/\.[^.]*,/,/
```

```
J68MODEL.WORK.PD8510          THU, DEC 22, 19[illegible]21 RM    PAGE  1

!job j68,librn.pd8510,work;pri=C8;curtclass=,1
!shoutine
!continue
!purgeepook
!setjcu j68error,0
!
!continue
!setjcu jcu,0
!message "DENSK"
!continue
!run gensk.lani.pd8510
!continue
!if jcu<>0 then
!  setjcu j68error,1
!  setjcu gensk,9999
!  endif
!continue
!comment Using files declared in akinfo.work, build ccnddecl.work
!ed
)u ink.work
!
!continue
!setjcu jcu,0
!message "GENSTR"
!continue
!run genstr.lani.pd8510
!continue
!if jcu<>0 then
!  setjcu j68error,1
!  setjcu genstr,9999
!  endif
!
!COMMENT this following job's output will be used later by COMPUTE
!stream jcompute.work
!COMMENT this job recompiles the library routines.
!stream jlibrary.work
!COMMENT this job recompiles the io library routines.
!stream jiolib.work
!
!setjcu jcu,0
!message "CHARSET"
!continue
!charset
!if jcu<>0 then
!  setjcu j68error,1
!  setjcu charset,9999
!  endif
!
!setjcu jcu,0
!message "IBGEN"
!continue
!ibgen
!if jcu<>0 then
!  setjcu j68error,1
!  setjcu ibgen,9999
```

```
J68MODEL.WORK.PD8510          THU, DEC 22, 1983, 10:21 RM    PAGE  2

!  endif
!
!message "substitute here"
!
!purge j68temp.work
!if j68error=0 then
!  stream jlink.work
!  message "============================== done =========================="
!  tell librn.pd8510; ================== j68 done ======================
!  tell ucc.pd8510; ==================== j68 done ======================
!  tell jtb.pd8510; ==================== j68 done ======================
!  tell lani.pd8510; =================== j68 done ======================
!else
!  message "============================== failed ========================"
!  tell librn.pd8510; ================== j69 failed ====================
!  tell ucc.pd8510; ==================== j68 failed ====================
!  tell jtb.pd8510; ==================== j68 failed ====================
!  tell lani.pd8510; =================== j68 failed ====================
!  run hpmail.hpmail.sys;lib=g;stdin=hpmail1.uerk.pd8510
!  message "compile failures have JCUs with value = 9999"
!  showjcu
!  endif
!
!COMMENT this job creates dscreen, a list of the screen constant values.
!stream jscreen.work
!COMMENT this creates dchtable, a list of the chtable constant values.
!stream jchtable.uerk
!COMMENT this job creates dcnddecl, a list of the cennand token values.
!stream jcnddecl.work
!
!shoutine
!eoj
```

```
CACTIVE.WORK.PD8510           THU, DEC 22, 1983, 10:21 RM    PAGE  1

COMMENT  These constants must correspond with the active function
         display annotation in SACTIVE.
;
INTEGER CONSTANT  active_off                  := 0,    & * see below &
                  active_start                := 1,
                  active_stop                 := 2,
                  active_center               := 3,
                  active_span                 := 4,    & * see below &
                  active_cw                   := 5,
                  active_sweep_time           := 6,
                  active_source_power         := 7,
                  active_power_slope          := 8,
                  active_atten_port1          := 9,
                  active_atten_port2          := 10,
                                             & end of source functions &
                  last_source_function        := 10,

                  active_ref_pos              := 11,
                  active_scale                := 12,   & * see below &
                  active_ref_value            := 13,   & * see below &
                  active_unused_2             := 14,
                  active_title                := 15,   & * see below &
                  active_n_groups_hpib        := 16,
                  active_if_avg_factor        := 17,
                  active_smoothing_aperture   := 18,   & * see below &
                  active_srq_mask_primary     := 19,
                  active_srq_mask_secondary   := 20,
                  active_revision             := 21,   & * see below &
                  active_aux_out              := 22,
                  activt_keycode              := 23,
                  active_electrical_length    := 24,
                  active_phase_offset         := 25,
                  active_marker1              := 26,
                  active_marker2              := 27,
                  active_marker3              := 28,
                  active_marker4              := 29,
                  active_marker5              := 30,
                  active_address              := 31,
                  active_peek                 := 32,
                  active_poke                 := 33,
                  active_open_c0              := 34,
                  active_open_c1              := 35,
                  active_open_c2              := 36,
                  active_gate_start           := 37,
                  active_gate_stop            := 38,
                  active_gate_center          := 39,
                  active_gate_span            := 40,
                  active_magnitude_slope      := 41,
                  active_magnitude_offset     := 42,
                  active_stimulus_slope       := 43,
                  active_stimulus_offset      := 44,
                  active_ref_plane_1          := 45,
                  active_ref_plane_2          := 46,
                  active_system_z0            := 47,
                  active_8510_hpib_addr       := 48,
```

```
CACTIVE.WORK.PD8510           THU, DEC 22, 1983, 10:21 RM    PAGE  2

                  active_system_bus_hpib_addr  := 49,
                  active_pass_thru_hpib_addr   := 50,
                  active_source_hpib_addr      := 51,
                  active_testset_hpib_addr     := 52,
                  active_plotter_hpib_addr     := 53,
                  active_printer_hpib_addr     := 54,
                  active_ch_cnd_hpib_addr      := 55,
                  active_offset_delay          := 56,
                  active_offset_loss           := 57,
                  active_offset_z0             := 58,
                  active_offset_min_freq       := 59,
                  active_offset_max_freq       := 60,
                  active_std_id                  61,
                  active_std_class             := 62,
                  active_n_groups_kbd          := 63,
                  active_previous              := -1;   & * see below &

& * These constants also appear in cactvl.work and should be changed  &
&   there if they are changed here. &
```

```
FACTIVE.WORK.PD851e          THU, DEC 22, 198  21 AM    PAGE  1

@FILE eactive.work;
@FILE factvl.work;
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE  1

MSBKL,P,"active"
BEGIN

@FILE cchtable.work;                          & for ch_... constants &
@FILE fchtable.work;                     & far set_entry_ch_... ttc. &
@FILE fannot.work;          & for annotate_rtf_value and update scale &
@FILE fmarker.work;                                & for mkr_... &
@FILE fkernel.work;                      & for acquire and release &
@FILE crins.work;                        & for active_function_rin &
@FILE futil.work;                                    & for tell &
@FILE fprivib.work;          & for urt_priv_ib and urt_priv_ib_source &
@FILE foutib.work;                       & for urt_pubib_string &
@FILE ffnt.work;                                & for format_quad &
@FILE ccontvar.work;                       & for max_parameter &
@FILE fdatap.work;                              & for min_max &
@FILE fcMData.work;                           & for step_size &
@FILE febpfr.work;                          & for scale[], ttc. &
@FILE cactive2.work;        & for step_up, _down, e0, ..., mkr_to_min &
@FILE factv0.work;
@FILE eactvl.work;          & for active_scale, _rtf_value, _revision &
@FILE factvl.work;
@FILE fectv&.work;                                   & for entry &
@FILE facttbl.work;              & for get_active [make_positive] &
@FILE fstring.work;                 & for append_string and _ch &
@FILE fstimuli.work;              & for entry_otimulus_at_point &
@FILE fcnv9x.work;                                 & for CNV9R &
@FILE cneuline.work;                             & for neuline &
@FILE fgratic.work;          & for graticule_type and type_of_grat &
@FILE f&isopran.work;                        & for urt_disp_real &
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE  2

&FJECT;
BYTE    TABLE    revision_array := 22,'R,'E,'V,' ,'R,'.,'x,':,' ,
                                   'J,'A,'N,' ,'9,'9,':,' ,'1,'9,'9,'9,
                                   ' ;          & to look like an HLPHA &
                          & 2nd line at $ORTI& and is filled by linker &
SUBROUTINE dunny;    & to allou assenble statement in declaration area &
   BECIH
      RSSEMBLE( "&DATE&  EQU    10+trevision_array";  & offset must be &
                         EHI    &DATE1                &    an even no. &
              );
   END;
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE  3

@EJECT;
HLPHA TABLE keypad_suffix :=            & used by keypad_entry routine &
   & 0 &   "E-9",
   & 1 &   "E-6",
   & 2 &   "E-3",
   & 3 &   "",    & same as "E0" but faster to process &
   & 4 &   "E3",
   & 5 &   "E6",
   & 6 &   "E9",
   & 7 &   "E12",
   & 8 &   "E15",
   & 9 &   "E12",
   &10 &   "E21";

INTEGER TABLE    ch_active_nerker :=
                 0,
                 ch_narker1,
                 ch_narker2,
                 ch_narker3,
                 cb_narker4,
                 eh_narker5; ——

BYTE    CONSTANT hpib_function := 1,
                 step_function := 2;

DOUBLE  CONSTANT initial_peek_n_poke_addr := X00000100;
```

```
SRCTIVE.WORK.PD8510          THU, DEC 22, 19[illegible]21 AM    PAGE  4

%EJECT;
COMMENT                                                          rpg_entry
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
% RPG ALGORITHMS:
%   0 - rpg disabled
%   1 - hpib source update protocol
%   2 - .1% of stimulus span       value = rpg_count*span/1000
%   3 - count                      value = rpg_count
%   4 - 1                          value = 1*(sign of rpg_count)
%   5 - count/20      [scaled]     value = rpg_count/20
%   6 - .1% scale/div [scaled]     value = rpg_count*scale/1000
%   7 - .1% value     [scaled]     value = rpg_count*value/1000
%   8 - count/10                   value = rpg_count/10
%   9 - count/100     [scaled]     value = rpg_count/100
%   A - count*count*count          value = rpg_count*rpg_count*rpg_count
%   B-F undefined
%
% (scaled] algorithms apply to active functions that are scaled (see
%    "scale_factor").
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
PROCEDURE  rpg_entry( rpg_word );
   %VALUE  rpg_word;
   INTEGER rpg_word;                                             ENTRY;
   BEGIN & rpg_entry &
      ALPHA          rpg_cnd:
      INTEGER        rpg_count;
      DOUBLE         tenp_double;
      %QUAD          quad_rpg_count,
                     active_increnent;
      BYTE  PRINTER  rpg_ptr = rpg_cnd;

      acquire( active_function_rin );

      IF rpg_algorithn <> 0 THEN
         BEGIN & if &

            & nask off rpg count and sign extend &
            rpg_word := INTEGER( BYTE(rpg_word AND %OOFF) );

            IF rpg_algorithn <> hpib_function THEN     & rate multiply &
               BEGIN & if not hpib_function &
                  rpg_count := rpg_word * (1 + RIGHT(ABS(rpg_word), 2));
                  quad_rpg_count := QUAD(rpg_count);
               END  & if not hpib_function &
            ELSE & hp-ib function &
               BEGIN & else &
                  rpg_cnd := "R0x";          & the x is a placeholder &
                  rpg_ptr[3] := rpg_word;    &       for the rpg word &
               END;  & else &

            CASE (rpg_algorithn - 1) OF
               BEGIN & case &
&  1 HP-IB     &  CASE (active_function - 1) OF
```

```
SRCTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE  5

                  BEGIN & case &
   &  1 start     &  urt_priv_ib_source( fa, rpg_cnd );
   &  2 stop      &  urt_priv_ib_source( fb, rpg_cnd );
   &  3 center    &  urt_priv_ib_source( af, rpg_cnd );
   &  4 span      &  urt_priv_ib_source( df, rpg_cnd );
   &  5 cu        &  urt_priv_ib_source( cu, rpg_cnd );
   &  6 sweep time  &  urt_priv_ib_source( st, rpg_cnd );
   &  7 source power &  ; & not used (plug-in RPG requires GET) &
   &  & power slope  &  ; & not used (plug_in RPG requires GET) &
   &  9 atten port 1 &  ; & not used (not RPG compatible) &
   & 10 atten port 2 &  ; & not used (not RPG compatible) &
                  END;  & case &
&  2 .1% span    &  active_increnent :=
                                 ( quad_rpg_count *
                                   entry_ch_quad(ch_span_stimulus) /
                                   quad_thousand
                                 );
&  3 direct      &  active_increnent := quad_rpg_count;
&  4 +/- 1       &  active_increnent := SIGN( 1, rpg_count );
&  5 +/- count/20 &  active_increnent :=
&       scaled   &       ( quad_rpg_count * quad_scaled_twentieth );
&  6 .1% scale   &  active_increnent := ( quad_rpg_count *
                                          QUAD( ABS( entry_ch_real(
                                                       ch_scale
                                                     )
                                                   ) *
                                                scaled_thousandth
                                              )
                                          );
&  7 .1% value   &  active_increnent := ( quad_rpg_count *
                                          ABS(active_fcn_valuc)
                                        ) / quad_thousand;
&  8 +/- count/10 &  active_increnent := QUAD(
                                          SIGN(1,rpg_count) * rpg_count/10
                                        );
&  9 +/- count/100&  active_increnent :=
&       scaled   &       ( quad_rpg_count * quad_scaled_hundreth );
&  A for time    &  BEGIN
                     rpg_word := rpg_word + rpg_word;     & times 2 &
                     IF rpg_word > 30 THEN
                        rpg_word := 30;
                     tenp_double := SBIT( 0, rpg_word );
                     active_increnent := active_fcn_value    *
                                         QUAD( tenp_double ) /
                                         2QAOOOOOO;
                  END;
               END;  & case &

            IF rpg_algorithn <> hpib_function THEN
               BEGIN & if &
                  IF active_increnent = 0 THEN
                     active_increnent := quad_rpg_count;
                  ective_fcn_value := active_fcn_value +
                                                      active_increnent;
                  enter_active_function;
               END;  & if &
```

```
SRCTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE  6

         END;  & if &

      release( active_function_rin );

   END;  & rpg_entry &
```

```
SRCTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE  7

%EJECT;
COMMENT                                                          step_125
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
% INITIAL REFINEMENT:
%
%    take absolute value -- save sign.
%
%    { find power of ten -- actually 4*10^n to ease later computations }
%    find "floor" (4*10^n immediately <= number).
%    { note that table fails for values of +1, 0, and -1, so a special
%      case handles those situations. }
%
%    { determine whether one, two, or five is nearest ordinal value }
%    IF number < 2*floor THEN   ( number < 8*10^n )
%       one_two_five := five
%    ELSE IF number < 4*floor THEN   ( number < 16*10^n }
%       one_two_five := one
%    ELSE {number < floor*10}        ( number < 40*10^n }
%       one_two_five := two.
%
%    { do step-up and step-down stuff }
%    IF direction = up THEN
%       CASE one_two_five OF
% five:    one_two_five := one.
% one:     one_two_five := two.
% two:     BEGIN
%             one_two_five := five.
%             floor := floor * 10.
%          END
%    ELSE IF direction = down THEN
%       CASE one_two_five OF
% five:    BEGIN
%             one_two_five := two.
%             floor := floor / 10.
%          END.
% one:     one_two_five := five.
% two:     one_two_five := one
%    ELSE (no direction -- just find nearest one-two-five value}
%       do nothing here.
%
%    { compute actual one-two-five values from the table }
%    IF one_two_five = two THEN
%       number := (floor*10)/2
%    ELSE IF one_two_five = one THEN
%       number := (floor*10)/4
%    ELSE (one_two_five = five}
%       number := (floor*10)/8.
%
%    restore sign of number.
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
     INTEGER CONSTANT  small_offset := 10,     & 1st entry <= 32-bits &
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 198  21 AM    PAGE  8

                    half_quad    :=  4,
                    quad_size    :=  8;

      @UAD TABLE fours_table :=
& 8.22E18 & &7FFFFFFFFFFFFFFF,                & top end buffer entry &
& 4E18 &    4000000000000000,
& 4E17 &    2000000000000000,
& 4E16 &    4000000000000000,
& 4E15 &    4000000000000000,
& 4E14 &    2000000000000000,
& 4E13 &    4000000000000,
& 4E12 &    4000000000000,
& 4E11 &    4000000000,
& 4E10 &    4000000000,
& 4E9  &    4000000000,
& 4E8  &    400000000,
& 4E7  &    40000000,
& 4E6  &    4000000,
& 4E5  &    400000,
& 4E4  &    40000,
& 4E3  &    4000,
& 4E2  &    400,
& 4E1  &    40,
& 4E0  &    4,
& 0    &    0;                              & botton end buffer entry &
      @UAD small_table = foure_table +
                         small_offset*quad_size + half_quad;

@MO PROCEDURE step_125(number, direction);
   VALUE   number,direction;
   @UAD    number;
   INTEGER direction;
   BEGIN & step_125 &
      LABEL end_abs,
            large_loop,
            small_num,
            bigger_than_1,
            small_loop,
            floor_found,
            f1,
            f2,
            found_125,
            up_step,
            down_step,
            up_dn_done,
            div_8,
            div_4,
            div_2,
            restore_sign,
            sign_restored;

& rearrange things -- should have planned ahead &
      ASSEMBLE(
            - ROVE     direction, R5       step direction
              );
```

```
SBCTIVE.WORK.PD8510          THU, DCC 22, 1983, 10:21 AM    PACE  9

& take absolute value and save sign &
      RSSEMBLE(
            CLR      &6                  R6 remembers sign, 0=+ ;
            1ST.L    R0                  ;
            BGE      end_abs             ;
            NOT      &6                  remember sign -- -1=minus ;
            NEC      R5                  reverse direction for neg.;
            NEC.L    &1                  negate number ;
            NEGX.L   R0
           );
end_abs:

& find "floor" (number >= table entry) &
      ASSEMBLE(
            TST.L    R0                  is most sig. half = 0? ;
            BEQ      small_num           ;
            LEA      fours_table, &&     ;
large_loop: RDDQ.W   =D8,     &&         quad_size ;
            CMP.L    (A&),    &0         compare most sig. halves ;
            BCS      large_loop          BCS = BLO = logical BLT ;
            BRA      floor_found         ;
small_num:  CMPI.L   #01,     R1         is least sig. half > 1? ;
            BHI      bigger_than_1       ;
            RDD      &5,      &1         handles 0 and 1 values ;
            BGE      restore_sign        quick if result is 0 or 1 ;
            MOVEQ    #0-1,    &1         crossed 0 to become -1 ;
            MOVEQ    #0-1,    R0         ;
            BRA      restore_sign        ;
bigger_than_1: LEA   small_table, &&     ;
small_loop: RDDQ.M   =DS,     R&         quad_size ;
            CMP.L    (R&),    &1         compare least sig. half ;
            BCS      small_loop          bCS = BLO = unsigned &L1 ;
            SUBQ.W   #04,     &&         back up to most sig. half
            );
floor_found:

& find 1-2-5 &
      ASSEMBLE(
            MOVEM.L  (RS)+,   &2-R3       get "floor" ;
            SUB.W    #D16,    &S         twice_quad, now "ceiling" ;
            MOVED    #D-1,    R7         five = returned result ;
            BSL.L    &1,      R3         2 x floor ;
            ROXL.L   &1,      &2         ;
            CMP.L    &2,      R0         ;
            bCS      found_125           bCS = bLO = logical bLT ;
            BHI      f1                  BHI = logical bGT ;
            CMP.L    R3,      R1         ;
            bCS      found_125           bCS = bLO = logical bLT ;
f1:         MOVEQ    #D0,     R7         one = returned result ;
            ASL.L    &1,      &3         4 x floor ;
            ROXL.L   &1,      &2         ;
            CMP.L    &2,      R0         ;
            bCS      found_125           bCS = bLO = logical bLT ;
            bhI      f2                  bhI = logical bGT ;
            CMP.L    &3,      R1         ;
            bCS      found_125           bCS = bLO = logical bLT ;
```

```
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f2:         MOVEQ    #D1,     R7         two = returned result
           );
found_125:

& inplenent step-up and step-down &
      ASSEMBLE(
            TST      R5                  1=up, -1=down, 0=same ;
            BEQ      up_dn_done          ;
            BLT      down_step           ;
up_stcp:    RODQ     #1,      R7         ;
            CMP      #D1,     R7         two ;
            BLE      up_dn_done          ;
            MOVEQ    #D-1,    R7         five,crossed 10^n boundary ;
            SUBQ.W   #DS,     R8         quad_size ;
            ERR      up_dn_done          ;
down_step:  SUBQ     &1,      R7         ;
            CMP      #D-1,    R7         five ;
            BGE      up_dn_done          ;
            MOVEQ    #D1,     R7         two, crossed 10^n boundary ;
            RDDQ.W   #DS,     R8         quad_size
           );
up_dn_done:


& calculate 1-2-5 value &
      ASSEMBLE(
            MOVEM.L  (R8)+,   R0-R1       get "ceiling" ;
            1ST      R7                   -1=five, 0=one, 1=two ;
            BGT      div_2                conpute "two" ;
            BED      div_4                conpute "one" ;
div_8:      ASR.L    &1,      R0          conpute "five" ;
            ROXR.L   &1,      R1          ;
div_4:      ASR.L    &1,      R0          ;
            ROXR.L   &1,      R1          ;
div_2:      ASR.L    &1,      R0          ;
            ROXR.L   &1,      R1
           );

restore_sign:
      ASSEMBLE(
            TST      R6                   ;
            BPL      sign_restored        ;
            NEG.L    R1                   ;
            NEGX.L   R0
           );
sign_restored:

& return -- result is in R0-R1 &

   END;  & step_125 &
```

```
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@EJECT;
COMMENT                                                          step_entry
*****************************************************************************
*
* STEP KEY ALGORITHMS:
*   0 - step keys disabled
*   1 - hpib source update protocol
*   2 - 1-2-5 sequence  [scaled or unscaled]
*   3 - 10% of span                    value = step_sign*span/10
*   4 - 1               [scaled]       value = 1*step_sign
*   5 - 1 division      [scaled]       value = step_sign*scale/div
*   6 - undefined
*   7 - 1 division                     value = step_sign*scale/div
*   8 - 10% of value    [scaled]       value = step_sign*value/10
*   9 - 1                              value = 1*step_sign
*   A - 10              [scaled]       value = 10*step_sign
*   B-F undefined
*
* [scaled] algorithms apply to active functions that are scaled (see
*    "scale_factor").
*
*****************************************************************************
;
PROCEDURE  step_entry( direction );
   VALUE   direction;
   INTEGER direction;                                              ENTRY;
   BEGIN & step_entry &
      INTEGER index;
      RLPHP   step_cnd;
      @UAD    active_increment;

      acquire( active_function_rin );

      IF step_algorithm <> 0 THEN
         BEGIN & if &

            CASE (step_algorithm - 1] OF
               BEGIN & case &
& 1 HP-IB         & BEGIN & hpib &
                     step_end := IF direction = step_down THEN
                                    "DN"
                                 ELSE
                                    "UP";
                     CASE (active_function - 1) OF
                        BEGIN & case &
      & 1 start      &     urt_priv_ib_source( fa, step_cnd );
      & 2 stop       &     urt_priv_ib_source( fb, step_cnd );
      & 3 center     &     urt_priv_ib_source( cf, step_cnd );
      & 4 span       &     urt_priv_ib_source( df, step_cnd );
      & 5 cw         &     urt_priv_ib_source( cw, step_cnd );
      & 6 sweep time &     urt_priv_ib_source( st, step_cnd );
      & 7 source power &   ; & not used &
      & 8 power slope &    urt_priv_ib_source( sl1, step_end );
      & 9 atten port 1 &   BEGIN & atten port 1 &
                              urt_priv_ib(test_set,atten1,step_cnd);
                              enter_active_function;
```

```
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                          END;  & atten port 1 &
     & 10 atten port 2 &  BEGIN & atten port 2 &
                            urt_priv_ib(test_set,atten2,etep_cnd);
                            enter_active_function;
                          END;  & atten port 2 &
                        END;  & case &
                    END;  & hpib &
&  2 1-2-5  &        active_fcn_value := step_125( active_fcn_value,
                                                  direction
                                                );
&  3 10% of span &   active_increment :=
                        SIGN( ( entry_ch_quad(eh_span_stimulus) /
                                quad_ten
                              ),
                              direction
                            );
&  4 +/- 1  &        active_increment :=
&  scaled   &           SIGN( quad_scaled_one, direction );
&  5 +/1 scale/div & BEGIN
&  scaled   &          index := get_active( get_log_scale_div_3,
                                            active_scale
                                          );
                        active_increment :=
                             SIGN( QURD( entry_ch_real(ch_scale) *
                                   scale_factors[ index ]
                                 ),
                               direction
                             );
                    END;
&  6 undefined     & ;
&  7 +/- scale/div & active_increment :=
&       unsealed  &       SIGN( QURD( entry_ch_reai(ch_scale) ),
                            direction
                          );
&  8   10% of valum& active_increment :=
&         scaled  &       SIGN( ( active_fcn_value / quad_ten ),
                            direction
                          );
&  9       +/- 1  & active_increment :=
&       unsealed  &       SIGN( 1, direction );
&  10      +/- 10  & active_increment :=
&         scaled  &       SIGN( quad_ten_ecaled, direction );
                END;  & case &


            IF step_algorithn <> hpib_function THEN
               BEGIN & if <> hpib_function &
                  IF steo_algorithn <> step_function THEN
                     BEGIN & if &
                        IF active_increnent = 0 THEN
                           active_inerenent := SIGN( 1, direction );
                        active_fcn_value := active_fen_value +
                                            active_increnent;
                     END;  & if &
                  enter_active_function;
               END;  & if <> hpib_function &
```

```
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            END;  & if &
         release( active_function_rin );
      END;  & etep_entry &
```

```
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REJECT;
COMMENT                                                    keypad_entry
*************************************************************************
*
* KEYPAD ALGORITHMS:
*   0 - keypad disabled
*   1 - terminator keys represent positive exponents
*   2 - terminator keys represent negative exponents
*   3-7 undefined
*
*************************************************************************
;
PROCEDURE  keypad_entry( terminator );
   VALUE   terminator;
   INTEGER terminator;                                          ENTRY;
   BEGIN & keypad_entry &
      INTEGER position;

      IF keypad_algorithn <> 0 THEN              & 0 = keypad disabled &
         BEGIN & if &
            acquire( active_function_rin );

            & 0 <= terminator <= 3 &

            CPSE keypad_algorithn OF
               BEGIN & case &
& 0 keypad disabled    &   ;
& 1 positive exponent  &   terminator := 3 + terminator; & 3 <= t <= 6 &
& 2 negative exponent  &   terminator := 3 - terminator; & -3<= 1 <= 0 &
               END;  & case &

                                  & log_scale_factor_div_3 * 4 for 1012 &
            terminator := terminator + log_scale_factor_div_3;
                                               & 0 <= terminator <= 10 &

            entry_array[-1] := entry_array[-1] + keypad_suffix_size;
            append_string( entry, keypad_suffix[terminator] );
            positicn := 1;
            active_fcn_value := CNV9A( entry, position );
            entry_array[-1] := entry_array[-1] - keypad_suffix_size;

            enter_active_function;

            release( active_function_rin );
         END;  & if &

      send( entry_string_ready );              & finished uith string &
                                  & cones after enter_active_function &
                                  & to hold off parser for "TSn" end. &
                                  & Prefer placing it before.        &

   END;  & keypad_entry &
```

```
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REJECT;
COMMENT                                                   narker_value_entry
*************************************************************************
*
* "=MRRKER" RLGORITHMS:
*   0 - "=MARKER" is inconsistent for current active function
*   1 - use narker stinulus value (e.g. for center frequency)
*   2 - use narker anplitude (e.g. for reference value)
*   3 - use narker nagnitude (e.g. for nagnitude offset)
*   4 - use narker phase     (e.g. for phase offset)
*   5-F undefined
*
*************************************************************************
;
QURD PROCEDURE quad_nkr_anplitude;
   BEGIN & quad_nkr_anplitude &
      USER3 tenp_user3;
      REAL  tenp_real * tenp_user3 + 2;

      tenp_user3 := narker_value( active_narker );
      IF scaled THEN
         BEGIN & if scaled &
            tenp_real := tenp_real * ecale_factor;
            IF log_scale_factor_div_3 <> 4 THEN
               tenp_real := tenp_real *
                                  1000.0 * REBL(log_scale_factor_div_3 - 4);
         END;  & if scaled &
      quad_nkr_anplitude := QURD( tenp_real + 0.5 );
   END;  & quad_nkr_anplitude &


SUBROUTINE narker_value_entry;                                   ENTRY;
   BEGIN & narker_value_entry &

      COMMENT   anplitude, nagnitude, and phase are aluayt scaled reals,
                stinulus value is aluays a quad.
      ;
      acquire( active_function_rin );

      CASE nkr_algorithn OF
         BEGIN & case &
& 0 &       tell( inconeistent_operation );
& 1 stin &  active_fen_value := nkr_stinulus_at_pt(active_narker);
& 2 anpl &  active_fen_value := quad_nkr_anplitude;
& 3 nag  &  active_fcn_value := quad_nkr_anplitude;
& 4 phase&  active_fen_value := quad_nkr_anplitude;
         END;  & case &

      IF get_active(get_nust_be_positive, active_function) =
            nake_positive THEN
         active_fcn_value := ABS(active_fcn_value);

      enter_active_function;

      release( active_function_rin );
```

```
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   END;  & marker_value_entry &
```

```
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REJECT;
COMMENT                                                          marker_to
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  marker_to( to_min_max );
   VALUE   to_min_max;
   INTEGER to_min_max;                                              ENTRY;
   BEGIN & marker_to &
      INTEGER min_pt,
              max_pt,
              point_number;
      REAL    min,
              max;

      min_max( entry_ch_double(ch_f_base),
               step_size,
               graticule_type(current_entry_ch) <> rectangular,
               min,
               min_pt,
               max,
               max_pt
             );

      point_number := IF to_min_max = mkr_to_min THEN min_pt
                                                 ELSE max_pt;
      set_entry_ch_quad( entry_stimulus_at_point( point_number ),
                         ch_active_marker[ active_marker ]
                       );
      select_marker( active_marker );

   END;  & marker_to &
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 RR    PAGE  18

REJECT;
COMMENT                                                          auto_scale
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  auto_scale;                                             ENTRY;
   BEGIN & auto_scale &
      BOOLEAN grat_type;
      INTEGER min_pt,
              max_pt,
              param_index,
              format_index;
      REAL    min,
              max,
              reference_value,
              reference_offset,
              center_value,
              scale_value,
              temp_real;
      QUAD    temp_quad;
      INTEGER POINTER src,
                      dst;

      SUBROUTINE compute_scale; `    & centralized multiple-usage code &
         BEGIN & compute_scale &
            scale_value  := max - center_value;          & scale * 5 &
            temp_real    := center_value - min;          & scale * 5 &
            IF temp_real > scale_value  THEN
               scale_value := temp_real/5
            ELSE
               scale_value := scale_value/5;
            temp_quad  := QUADf( scale_factor * scale_value );
            temp_quad  := step_125( temp_quad, step_up );
            temp_quad  := limit_quad( temp_quad, active_scale );
            scale_value := REAL( temp_quad ) * unscale;
         END;  & compute_scale &

      grat_type := graticule_type(current_entry_ch);

      min_max( entry_ch_double(ch_f_base),
               step_size,
               grat_type <> rectangular,
               min,
               min_pt,
               max,
               max_pt
             );

      IF grat_type = rectangular THEN
         BEGIN & if rectangular &

            & find a nice number near the center-line of the data &

            center_value := (max + min) / 2;
            temp_quad := QUAD( scale_factor * center_value );
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 RR    PAGE  19

            temp_quad := step_125( temp_quad, 0 );  & 0 = no direction &
            center_value := REAL(temp_quad) * unscale;

            compute_scale; & best guess before knowing actual ref.val. &

            & center_value was the initial guess, reference position   &
            & can cause limiting or a non-nice value, so fix things up.&

            reference_offset := scale_value *
                                (entry_ch_real(ch_ref_position) - 5.0);
            reference_value := center_value + reference_offset;
            temp_quad := QUAD( scale_factor * reference_value );
            temp_quad := step_125( temp_quad, 0 );  & 0 = no direction &
            temp_quad := limit_quad( temp_quad, active_ref_value );
            reference_value := REAL(temp_quad) * unscale;

            & Limiting and/or 1-2-5 roundoff can move reference value  &
            & significantly, so recompute scale for the new ref value. &

            center_value := reference_value - reference_offset;
            compute_scale;

         END   & if rectangular &
      ELSE
         BEGIN & else polar &
            temp_quad := QUAD( scale_factor * max );
            temp_quad := step_125( temp_quad, step_up );
            reference_value := REAL( limit_quad( temp_quad,
                                                 active_ref_value
                                               )
                                   )
                               * unscale;
            scale_value := 0.2 * reference_value;
         END;  & else polar &

      param_index  := entry_ch_integer(ch_param);
      format_index := entry_ch_integer(ch_format);
      IF type_of_grat( format_index ] <> rectangular THEN
         format_index := fmt_log_polar;   & all polars use same values &

      set_entry_ch_real( reference_value, ch_ref_value );
      wrt_disp_real( RDRS( ref_value[ format_index,
                                       entry_ch_integer(ch_param),
                                       current_entry_ch
                                     ]
                         ),
                     reference_value
                   );
      annotate_ref_value;

      set_entry_ch_real( scale_value, ch_scale );
      wrt_disp_real( RDRS( scale[ format_index,
                                  entry_ch_integer(ch_param),
                                  current_entry_ch
                                ]
                         ),
                     scale_value
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 15f     21 AM    PAGE 20

            );
    update_scale;                  & includes partial( update_f ) &

    select_active_function( active_previous );

END;  & auto_scale &
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE 21

REJECT;
COMMENT                                                    output_active
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  output_active;                                          ENTRY;
  BEGIN & output_active &
    BYTE ARRAY output_array[-1:string_size];
    RLPNA      output_string;
    DOUBLE     fnt;

    acquire( active_function_rin );

    & initialize string &
    output_string := BDRS( output_array );
    output_string := init_string( output_string, string_size );

    IF display_format <> 0 THEN
      BEGIN & if &
        fnt := format_table[ output_format ];
        & enter format bias (scale factor) &
        fnt := fnt + (log_scale_factor_div_3 * 48);   & 48 <= 3*16 &
        output_string := format_quad( active_fen_value,
                                      output_string,
                                      fnt
                                    );
      END;  & if &

    urt_pubib_string( append_ch(output_string, newline) );

    release( active_function_rin );

  END;  & output_active &
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE 22

REJECT;
COMMENT                                                 output_identifier
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  output_identifier;                                      ENTRY;
  BEGIN & output_identifier &
    BYTE ARRAY output_array[-1:string_size];
    RLPNA      output_string;

    & initialize string &
    output_string := ADRS( output_array );
    output_string := init_string( output_string, string_size );

    append_string( output_string, "KP8510R, " );
    append_string( output_string,
                   active_function_label[ active_revision ]
                 );

    urt_pubib_string( append_ch(output_string, newline) );

  END;  & output_identifier &
```

```
SACTIVE.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM    PAGE 23

REJECT;
COMMENT                                                       init_active
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  init_active;                                            ENTRY;
  BEGIN & init_active &
    INTEGER POINTER int_ptr;
    DOUBLE  temp_dbl;
    INTEGER temp_dbl_upper = temp_dbl,
            temp_dbl_lower = temp_dbl+2;

    & use INTEGERs -- label may be in display &
    STPNTR( int_ptr, RDRS( active_function_label[active_revision] ) );
    temp_dbl := RDRS(revision_array);
    int_ptr := temp_dbl_upper;
    STPNTR( int_ptr, ADRS(int_ptr)+2 );
    int_ptr := temp_dbl_lower;

    STPNTR( peek_n_poke, initial_peek_n_poke_addr );

  END;  & init_active &

END$
```

```
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INTEGER CONSTANT  istep_up          := 1,              & cannot change &
                  istep_doun        := -1;             & built into fcn&
INTEGER CONSTANT  e0                := 0,
                  e3                := 1,
                  e6                := 2,
                  e9                := 3;
INTEGER CONSTANT  nkr_to_nin        := 0,
                  nkr_to_nax        := 1;
INTEGER CONSTANT  keypad_suffix_size := 5;     & nax keypad suffix + 1 &
```

```
FACTIVE2.UORK.PDS510          THU, DEC 22, 1983, 10:21 AM     PAGE   1

#FILE cactive2.uork;

EXTERNAL INTEGER active_function;

PROCEDURE  select_active_off( uhich_function );
   VALUE   uhich_function;
   INTEGER uhich_function;                                    EXTERNAL;
PROCEDURE  rpg_entry( rpg_value );
   VALUE   rpg_value;
   INTEGER rpg_value;                                         EXTERNAL;
PROCEDURE  step_entryf direction );
   VALUE   direction;
   INTEGER direction;                                         EXTERNAL;
PROCEDURE  keypad_entry(terminator);
   VALUE   terminator;
   INTEGER terminator;                                        EXTERNAL;
SUBROUTINE narker_value_entry;                                EXTERNAL;
PROCEDURE  narker_to( nin_nax );
   VALUE   nin_nax;
   INTEGER nin_nax;                                           EXTERNAL;
PROCEDURE  auto_scale;                                        EXTERNAL;
PROCEDURE  output_active;                                     EXTERNAL;
PROCEDURE  output_identifier;                                 EXTERNAL;
PROCEDURE  init_active;                                       EXTERNAL;
```

```
FACTTBL.UORK.PD8510          THU, DEC 22, 1983, 10:21 AM     PAGE   1

#FILE catable2.uork;
#FILE fatables.uork;
#FILE falabel.uork;                          & for active_function_label &

INTEGER PROCEDURE get_active( source, function );
   VALUE   source, function;
   INTEGER source, function;                                  EXTERNRL;
ALPHA PROCEDURE ch_active_suffix( function, ch );
   VALUE   function, ch;
   INTEGER function, ch;                                      EXTERNAL;
ALPHA PROCEDURE active_suffix( function );
   VALUE   function;
   INTEGER function;                                          EXTERNAL;
DOUBLE PROCEDURE active_format( function );
   VALUE   function;
   INTEGER function;                                          EXTERNAL;
DOUBLE PROCEDURE ch_active_format( function, ch );
   VALUE   function, ch;
   INTEGER function, ch;                                      EXTERNAL;
BOOLEAN PROCEDURE active_linits( nin, nax, function );
   VALUE   function;
   QUAD    nin, nax;
   INTEGER function;                                          EXTERNAL;
PROCEDURE  ch_set_active_linits( nin, nax, function, ch );
   VALUE   nin, nax, function, ch;
   QUAD    nin, nax;
   INTEGER function, ch;                                      EXTERNAL;
PROCEDURE  set_active_linits( nin, nax, function );
   VALUE   nin, nax, function;
   QUAD    nin, nax;
   INTEGER function;                                          EXTERNAL;
```

```
SACTTBL.UORK.PD8510          THU, DEC 22, 1983, 10:21 AM     PAGE   1

%68KL,P,"acttbl"
BEGIN

#FILE catable2.uork;
#FILE fatables.uork;
#FILE cchtable.uork;
#FILE fchtable.uork;
#FILE fchtab2.uork;
#FILE cdatap.uork;                                  & for nax_fornat &
```

```
SRCTTBL.WORK.PD8510          THU, DEC 22, 191      21 AM     PAGE   2


#EJECT;
COMMENT                                                          ch_get_active
*****************************************************************************
*
*****************************************************************************
;
INTEGER PROCEDURE ch_get_active( source, function, ch );
   VALUE   source, function, ch;
   INTEGER source, function, ch;
   BEGIN & ch_get_active &
      INTEGER POINTER integer_table;
      BYTE    POINTER byte_table = integer_table;
      INTEGER         index,
                      dependency;
      BYTE            type;

      STPNTR( integer_table, active_tables[source] );
      type := active_table_type[source];

      If type = byte_type THEN
         BEGIN
            index := byte_table[ function ];
            IF index < 0 THEN
               dependency := byte_table[index];
         END
      ELSE & type = integer_type &
         BEGIN
            index := integer_table[ function ];
            IF index < 0 THEN
               dependency := integer_table[index];
         END;

      IF index < 0 THEN
         BEGIN & if &
            IF dependency = format_dependent THEN
               index := index + ch_integer( ch_format, ch )
            ELSE IF dependency = domain_dependent THEN
               index := index + ch_integer( ch_domain, ch ) + 1
            ELSE
               index := index + ch_integer( ch_format, ch ) +
                        ch_integer( ch_domain, ch ) * max_format;

            IF type = byte_type THEN
               index := byte_table[index]
            ELSE & type = integer_type &
               index := integer_table[index];
         END;  & if &

      ch_get_active := index;

   END;  & ch_get_active &
```

```
SRCTTBL.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM     PAGE   3


REJECT;
COMMENT                                                          get_active
*****************************************************************************
*
*****************************************************************************
;
INTEGER PROCEDURE get_active( source, function );
   VALUE   source, function;
   INTEGER source, function;                                        ENTRY;
   BEGIN & get_active &

      get_active := ch_get_active( source, function, current_entry_ch );

   END;  & get_active &
```

```
SRCTTBL.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM     PAGE   4


REJECT;
COMMENT                                                    ch_active_suffix
*****************************************************************************
*
*****************************************************************************
;
ALPHA PROCEDURE ch_active_suffix( Function, ch );
   VALUE   function, ch;
   INTEGER function, ch;                                            ENTRY;
   BEGIN & ch_active_suffix &
      ch_active_suffix := suffix[ ch_get_active( get_suffix_index,
                                                 function,
                                                 ch
                                               )
                                ];
   END;  & ch_active_suffix &
```

```
SRCTTBL.WORK.PD8510          THU, DEC 22, 1983, 10:21 AM     PAGE   5


REJECT;
COMMENT                                                        active_suffix
*****************************************************************************
*
*****************************************************************************
;
ALPHA PROCEDURE active_suffix( function );
   VALUE   function;
   INTEGER function;                                                ENTRY;
   BEGIN & active_suffix &
      active_suffix := ch_active_suffix( function, current_entry_ch );
   END;  & active_suffix &
```

```
SRCTT&L.WORK.PD&S10          THU, DEC 22, 1983, 10:21 AM    PAGE  6

%EJECT;
COMMENT                                                ch_active_format
*****************************************************************
*
*****************************************************************
;
DOUBLE PROCEDURE ch_active_format( function, ch );
   VALUE  function, ch;
   INTEGER function, ch;                                        ENTRY;
   BEGIN & ch_active_format &
      INTEGER index;
      DOUBLE  fmt;

      index := ch_get_active( get_format_index, function, ch );
      fmt := format_table[ index ];
      IF index < 2 THEN          & value is stored in scaled form &
         BEGIN & if stored scaled &
            index := ch_get_active( get_log_scale_div_3, function, ch );
            fmt := fmt OR (index * 4&);                  & 4** x 3**16 &
         END;  & of stored scaled &
      ch_active_format := fmt;

   END;  & ch_active_format &
```

```
SRCTT&L.WORK.PD&S10          THU, DEC 22, 1983, 10:21 AM    PAGE  7

%EJECT;
COMMENT                                                active_format
*****************************************************************
*
*****************************************************************
;
DOUBLE PROCEDURE active_format[ function );
   VALUE  function;
   INTEGER function;                                            ENTRY;
   BEGIN & active_format &
      active_format := ch_active_format( function, current_entry_ch );
   END;  & active_format &
```

```
SRCTTBL.WORK.PD&S10          THU, DEC 22, 1983, 10:21 AM    PAGE  8

%EJECT;
COMMENT                                                active_limits
*****************************************************************
*
*****************************************************************
;
BOOLEAN PROCEDURE active_limits( min, max, function );
   VALUE  function;
   OWRD   min, max;
   INTEGER function;                                            ENTRY;
   BEGIN & active_limits &
      INTEGER index;

      index := get_active(get_min_limit_index, function);

      IF index <> 0 THEN
         BEGIN & if &
            min := limit[ index ];
            max := limit[ get_active( get_max_limit_index, function ) ];
         END;  & if &

      active_limits := (index <> 0);

   END;  & active_limits &
```

```
SRCTTBL.WORK.PD&S10          THU, DEC 22, 1983, 10:22 AM    PAGE  9

%EJECT;
COMMENT                                                ch_set_active_limits
*****************************************************************
*
*****************************************************************
;
PROCEDURE  ch_set_active_limits( min, max, function, ch );
   VALUE   min, max, function, ch;
   OWRD    min, max;
   INTEGER function, ch;                                        ENTRY;
   BEGIN & ch_set_active_limits &
      INTEGER index;
      INTEGER POINTER source,
                      dest;
      DOUBLE  address;

      index := ch_get_active( get_min_limit_index, function, ch );

      IF index <> 0 THEN
         BEGIN & if &
            address := RORS(limit) + RLEFT(index,3);
            STPNTR( source, RORS(min) );
            STPNTR( dest,   address );
            MOVE dest := source, *(4);

            index := ch_get_active( get_max_limit_index, function, ch );
            address := RORS(limit) + RLEFT(index,3);
            STPNTR( source, RORS(max) );
            STPNTR( dest,   address );
            MOVE dest := source, *(4);
         END;  & if &

   END;  & ch_set_active_limits &
```

```
SRCTTBL.UORK.PD8510          THU, DEC 22, 1983, 10:22 RM     PAGE  10


%EJECT;
COMMENT                                                 set_active_limits
**************************************************************************
#
**************************************************************************
;
PROCEDURE  set_active_limits( min, max, function );
   VALUE   min, max, function;
   QUAD    min, max;
   INTEGER function;                                              ENTRY;
   BEGIN & set_active_limits &

      ch_set_active_limits( min, max, function, current_entry_ch );

   END;  & set_active_limits &

END$
```

```
CRCTVO.UORK.PD8510           THU, DEC 22, 1983, 10:22 RM     PAGE  1


REAL    CONSTANT scale_factor           := 1.0%12,
                 elec_delay_feetor      := 1.0%15,
                 unscale                := 1.0%-12,    & 1/scale     &
                 unscale_elec_delay     := 1.0%-15,
                 scaled_hundredth       := 1.0%10,     & scale/100   &
                 scaled_thnuaandth      := 1.0%9;      & scale/1000  &
QUAD    CONSTANT quad_scaled_one        := 1000000000000,
                 quad_aux_out_scaled    := 4882812500, &scaled 10/2048&
                 quad_ten               := 10,
                 quad_ten_scaled        := 10000000000000,
                 quad_hundred           := 100,
                 quad_thousand          := 1000,
                 quad_scaled_hundreth   := 10000000000,
                 quad_scaled_tuentieth  := 50000000000;
INTEGER CONSTANT string_size            := 64;
```

```
FRCTVO.UORK.PDS510           THU, DEC 22, 1983, 10:22 RM     PAGE  1


%FILE cactv0.work;

EXTERNAL INTEGER log_scale_factor_div_3;
EXTERNAL INTEGER POINTER peek_n_poke;
EXTERNAL INTEGER active_function;
EXTERNAL QUAD    active_fcn_value;
EXTERNAL BYTE    rpg_algorithm;
EXTERNAL BYTE    atep_algorithm;
EXTERNAL BYTE    nhr_algorithm;
EXTERNAL BYTE    keypad_algorithm;
EXTERNAL BOOLEAN scaled;
EXTERNAL BYTE    display_format;

PROCEDURE  enter_active_function;                               EXTERNAL;
QUAD PROCEDURE limit_quad(number, function);
   VALUE   number, function;
   QUAD    number;
   INTEGER function;                                            EXTERNAL;
```

```
SRCTVO.UORK.PDS510           THU, DEC 22, 1983, 10:22 RM     PAGE  1


%6SKL,P,"actv0"
BEGIN

%FILE fchtable.work;
%FILE fchtab2.work;                                & for ch_integer &
%FILE cchtable.work;
%FILE fmarker.work;
%FILE fkernel.work;                          & for acquire and release &
%FILE crime.work;                            & for active_function_rin &
%FILE fcontrol.work;                                    & for n_sweep &
%FILE fpubib.work;                 & for request_mask and set_..._address &
%FILE cactv0.work;                              & for scale constants &
%FILE cactv1.work;                                  & for active_... &
%FILE factv2.work;
%FILE ffnt.work;                       & for format_quad and format_real &
%FILE ccontvar.work;                                & for max_parameter &
%FILE fcontv2.work;                                 & for rebuild &
%FILE fdatap1.work;                        & for control_data_proc_freq &
%FILE fchpfr.work;                       & for elec_delay, scale, ref_... &
%FILE facttbl.work;                             & for get_active, etc. &
%FILE fstring.work;
%FILE fconnand.work;
%FILE fstinul1.work;               & for set_stinulus_node and set_sux_out &
%FILE fcnv9x.work;                                          & for CNV92 &
%FILE cneuljne.work;                                      & for neuline &
%FILE Tdonain.work;                           & for update_donain_vars &
%FILE fannot.work;                 & for update_scale and annotate_rev_value &
%FILE ftrace.work;                              & for annotate_ref_position &
%FILE fstds2.work;   & for cal_std_addr, std_id, and std_class_element &
%FILE fprivib.work;                & for urt_priv_ib and urt_priv_ib_source &
%FILE fprivib2.work;                       & for get_ and set_priv_ib_lun &
%FILE ftitle.work;                              & for select_title_char &
%FILE futil.work;                                  & for tell and warn &
%FILE fchdata2.work;                             & for srq_mask, etc. &
%FILE fdispran.work;                               & for urt_disp_... &
%FILE fmathfun.work;                             & for speed_of_light &
%FILE ftestset.work;                             & for build_test_set &
%FILE fgratic.work;                                & for type_of_grat &

QUAD PROCEDURE CNV2R(number);
   VALUE   number;
   REAL    number;                                              EXTERNAL;
REAL PROCEDURE CNVR2(number);
   VALUE   number;
   QUAD    number;                                              EXTERNAL;
PROCEDURE signal_init(signal,count);
   VALUE   signal,count;
   INTEGER signal,count;                                        EXTERNAL;



INTEGER CONSTANT copyright := 215;
ALPHA   CONSTANT copyright_notice :=
                " Copyright "%copyright%" HEWLETT-PACKARD COMPANY 1983";
```

```
SRCTVO.UORK.PD8510              THU, DEC 22, 1983, 10:22 AM     PAGE  2

INTEGER CONSTRKT max_marker := 5;                 & berrowed from smarker &

GLOBAL BOOLEAN scaled;                    & active_fen_value is scales &
GLOBAL INTEGER log_scale_factor_div_3;   & indicates scale factor size &
GLOBAL INTEGER active_function;
GLOBAL QUAD active_fcn_value;       & an "own" variable for this module &
QUAD    active_fcn_alt_value;       & an alternate value for display.   &

GLOBAL INTEGER POINTER peek_n_poke;               & peek and poke address &
GLOBAL BYTE    rpg_algorithm;
GLOBAL BYTE    step_algorithm;
GLOBAL BYTE    mkr_algorithm;
GLOBAL BYTE    keypad_algorithm;
GLOBAL BYTE    display_format;
INTEGER units;
REAL   scale_multiplier,
       unscale_multiplier;
```

```
SRCTVO.UORK.PD8510              THU, DEC 22, 1983, 10:22 AM     PAGE  3

#EJECT;
COMMENT                                                          limit_quad
**********************************************************************
*
**********************************************************************
;
QUAD PROCEDURE limit_quad(number, function);
   VALUE   number, function;
   QUAD    number;
   INTEGER function;                                             ENTRY;
   BEGIN & limit_quad &
      QUAD min,
           max;

      IF active_limits( min, max, function ) THEN
         IF number <= min THEN
            limit_quad := min
         ELSE IF number >= max THEN
            limit_quad := max
         ELSE & min <= number <= max &
            limit_quad := number
      ELSE & do not limit &
         limit_quad := number;

   END;  & limit_quad &
```

```
SRCTVO.UORK.PD8510              THU, DEC 22, 1983, 10:22 AM     PAGE  4

REJECT;
COMMENT                                            disolay_active_fcn_value
**********************************************************************
*
**********************************************************************
;
PROCEDURE  display_active_fcn_value;
   BEGIN & display_active_fcn_value &
      REAL      active_fcn_real;
      DOUBLE    fmt;
      BYTE ARRAY display_array[-1:string_size];
      ALPHA     display_string;
      QUAD POINTER value_ptr;

      & initialize string &
      display_string := ADRS( display_array );
      display_string := init_string( display_string, string_size );

      & get format     see "suffix" table for constant declarations.   &
      IF ( (units=2) OR (units=5) OR (units=15) ) THEN  & suffix is dB &
         display_format := db_format                 & avoid ndB,etc&
      ELSE  & normal (non-dB) suffix &
         display_format := get_active(get_format_index,active_function);

      IF display_format <> 0 THEN
         BEGIN & if &
            fmt := format_table[ display_format ];
            & enter format bias (scale factor) &
            fmt := fmt OR (log_scale_factor_div_3 * 48);  & 48 <= 3*18 &

            append_string( format_quad(
                  IF get_active(get_display_alt_value, active_function)
                        = display_alt THEN
                     active_fcn_alt_value
                  ELSE
                     active_fcn_value,
                  display_string,
                  fmt                ),
                           suffix[ units ]
                        );
            IF active_function = active_scale THEN
               append_string( display_string, "/div" );
         END;  & if &

      & fill new string &
      print_big_string( display_string,
                        entry_size2,
                        IF entry_flip_flop THEN entry_disolay2
                                           ELSE entry2_display2
                      );
      entry_flip_flop := NOT entry_flip_flop;
      & turn off old string &
      print_string( "",
                  entry_size2,
                  IF entry_flip_flop THEN entry_display2
                                     ELSE entry2_display2
```

```
SRCTVO.UORK.PDS510              THU, DEC 22, 1983, 10:22 AM     PAGE  5

                  );

      & print the auxiliary string -- may be blank &
      & active_title does some special formatting itself &
      IF active_function <> active_title THEN
         BEGIN & if &
            IF units = 6 THEN         & seconds -- add distance readout &
               BEGIN & if &
                  active_fcn_real := REAL(active_fcn_value) *
                                     speed_of_light;
                  active_fcn_real := active_fcn_real*unscale_multiplier;
                  append_string( format_real( active_fcn_real,
                                              entry_aux,
                                              format_table[
                                                      distance_format
                                                          ]
                                            ),
                                 suffix[ distance_suffix ]
                               );
                  IF active_function = active_scale THEN
                     append_string( entry_aux, "/div" );
               END;  & if &
            print_string(entry_aux,entry_aux_size2,entry_aux_display2);
         END;  & if &

   END;  & display_active_fcn_value &
```

```
SRCTVO.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  6


%EJECT;
COMMENT                                                  activate_marker
*****************************************************************************
a
*****************************************************************************
;
SUBROUTINE activate_marker;
   BEGIN & activate_marker &
      & limit here for both select_ and enter_ to assure that no      &
      & marker is activated outside of the current stimulus range.    &
      active_fcn_value := limit_quad(active_fcn_value, active_function);
      set_entry_ch_quad( active_fcn_value,
                         get_active(get_chtable_index, active_function)
                       );
      active_fcn_alt_value := mkr_stimulus_value;  & align on a point &
      put_marker( active_marker );
      annotate_mkr_value;
   END;  & activate_marker &
```

```
SRCTVO.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  7


%EJECT;
COMMENT                                                  check_update_domain
*****************************************************************************
a
*****************************************************************************
;
SUBROUTINE check_update_domain;
   BEGIN & check_update_domain &
      INTEGER mkr;

      IF ( (ch_integer(ch_gating,1) = gate_on) OR
           (ch_integer(ch_gating,2) = gate_on)
         ) THEN
         update_domain_vars;

      FOR mkr := max_marker TO (max_marker + 3) DO
         put_marker( mkr );

   END;  & check_update_domain &
```

```
SRCTVO.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  8


%EJECT;
COMMENT                                              select_active_function
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  select_active_function( which_function );
   VALUE   which_function;
   INTEGER which_function;                                          ENTRY;
   BEGIN & select_active_function &
      INTEGER algorithm,
              index,
              addr;
      REAL    active_fcn_real;
      INTEGER POINTER src,
                      dst;
      REAL POINTER    real_ptr = dst;

      acquire( active_function_rin );
      clear_string( entry_aux );

      IF which_function <> active_previous THEN
         active_function := which_function;

      & label the display &
      print_big_string( active_function_label[ active_function ],
                        function_size2,
                        function_display2
                      );

      index     := get_active( get_chtable_index, active_function );
      units     := get_active( get_suffix_index,  active_function );
      algorithm := get_active( get_algorithms,    active_function );

      step_algorithm   := algorithm AND %000F;
      algorithm        := RIGHT( algorithm, 4 );
      rpg_algorithm    := algorithm AND %000F;
      algorithm        := RIGHT( algorithm, 4 );
      mkr_algorithm    := algorithm AND %000F;
      algorithm        := RIGHT( algorithm, 4 );
      keypad_algorithm := algorithm AND %0007;


      log_scale_factor_div_3 := get_active( get_log_scale_div_3,
                                            active_function
                                          );
      scaled := (log_scale_factor_div_3 <> 0);
      scale_multiplier   := scale_factors[log_scale_factor_div_3];
      unscale_multiplier := unscale_factors[log_scale_factor_div_3];

      CASE get_active(get_chtable_type, active_function) OF
         BEGIN & case &
& none        &  ;
& byte        &  ; & bytes are no longer used in the chtable &
& integer     &  active_fcn_value := entry_ch_integer( index );
& user3       &  ; & not currently used &
```

```
SRCTVO.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  9


& real        &  active_fcn_value := entry_ch_real( index ) *
                                                      scale_multiplier;
& double      &  ; & not currently used &
& quad        &  active_fcn_value := entry_ch_quad( index );
         END;  & case &


      & do the unique stuff &
      CASE active_function OF
         BEGIN & case &
&  0 off             &  ;
&  1 start           &  set_stimulus_mode( start_stop );
&  2 stop            &  set_stimulus_mode( start_stop );
&  3 center          &  set_stimulus_mode( center_span );
&  4 span            &  set_stimulus_mode( center_span );
&  5 cw              &  ;
&  6 sweep time      &  ;
&  7 source power    &  ;
&  8 power slope     &  ;
&  9 port 1 atten    &  ;
& 10 port 2 atten    &  ;
& 11 ref pos'n       &  ;
& 12 scale/div       &  ;
& 13 ref value       &  ;
& 14 unused          &  warn( command_not_implemented );
& 15 title           &  BEGIN & title &
                           tell( titling_instructions );
                           active_fcn_value := 48;  & 2 x initial char &
                           select_title_char( 13 );          & 1 + n/4 &
                        END;  & title &
& 16 # groups hpib   &  ;              & must be same as # groups kbd  &
& 17 # avg factor    &  ;
& 18 smoothing aper.&  BEGIN & smoothing aperture &
                           active_fcn_real :=
                              REAL( entry_ch_quad(ch_span_stimulus) ) *
                              entry_ch_real(ch_smoothing_aperture)    /
                              100.0;
                           append_string(
                                 format_real( active_fcn_real,
                                              entry_aux,
                                              format_table[
                                                        aperture_format
                                                        ]
                                            ),
                                 active_suffixf active_span )
                                          );
                        END;  & smoothing aperture &
& 19 src nask prim. &  active_fcn_value :=
                           src_nask_primary;
& 20 src nask secon.&  active_fcn_value :=
                           src_nask_secondary;
& 21 revision       &  entry_aux := append_string( entry_aux,
                                                   copyright_notice
                                                 );
& 22 aux out        &  BEGIN & auxiliary output voltage &
                           active_fcn_value := quad_aux_out_scaled *
```

```
$RETVO.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  10

                        entry_ch_quad( ch_center_pwm_put );
                    ENO;  & auxiliary output voltage &
& 23 keycode        &   ;
& 24 elec delay     &   ;
& 25 phase offset   &   ;
& 26 narker1        &   activate_narker;
& 27 narker2        &   activate_narker;
& 28 narker3        &   activate_narker;
& 29 narker4        &   activate_narker;
& 30 narker5        &   activate_narker;
& 31 address        &   active_fcn_value := AVARS( peek_n_poke );
& 32 peek           &   active_fcn_value := peek_p_poke;
& 33 poke           &   active_fcn_value := 0;
& 34 open c0        &   BEGIN
                        STPKTBI real_ptr,
                              cal_std_addr + c0_offset
                            );
                        active_fcn_value := 9UAD( scale_nultiplier *
                                                  real_ptr
                                                );
                    CNO;
& 35 open c1        &   BEGIN
                        STPNTR( real_ptr,
                              cal_std_addr + c1_offset
                            );
                        active_fcn_value := &UPO( scale_nultiplier *
                                                  real_ptr
                                                );
                    END;
& 36 open c2        &   BEGIN
                        STPNIR( real_ptr,
                              cal_std_addr + c2_offset
                            );
                        active_fcn_value := OUAD( scale_nultiplier *
                                                  real_ptr
                                                );
                    END;
& 37 gate start     &   ;
& 38 gate stop      &   BEGIN
                        active_fcn_value :=
                                    entry_ch_quad(ch_gate_center);
                        active_fcn_value :=
                                    active_fcn_value +
                                    active_fcn_value -
                                    entry_ch_quad(ch_gate_start);
                    END;
& 39 gate center    &   ;
& 40 gate span      &   BEGIN
                        active_fcn_value :=
                                    entry_ch_quad(ch_gate_center) -
                                    entry_ch_quad(ch_gate_start);
                        active_fcn_value := active_fcn_value +
                                                active_fen_value;
                    END;
& 41 nag slope     &   ;
& 42 nag offset    &   ;
```

```
$RETVO.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  11

& 43 stinulus slope &   ;
& 44 stinulus offset&   ;
& 45 ref plane 1    &   ;
& 46 ref plane 2    &   ;
& 47 systcn z0      &   ;
& 45 najor addr     &   active_fcn_value := get_priv_ib_lun(najor);
& 49 ninor addr     &   active_fcn_value := get_priv_ib_lun(ninor);
& 50 pass thru addr &   active_fcn_value :=
                                    get_priv_ib_lun(priv_ib_pass);
& 5I source addr    &   active_fcn_value := get_priv_ib_lun(source);
& 52 test-set addr  &   active_fcn_value := get_priv_ib_lun(test_set);
& 53 plotter addr   &   active_fcn_value := get_priv_ib_lun(plotter);
& 54 printer addr   &   active_fcn_value := get_priv_ib_lun(printer);
& 55 ch cnd addr    &   active_fcn_value :=
                                    get_priv_ib_lon(user_device_1);
& 56 offset delay   &   BEGIN
                        STPNTR( real_ptr,
                              cal_std_pddr + delay_pffset
                            );
                        active_fcn_value := QUAD( ecale_nultiplier *
                                                  real_ptr
                                                );
                    END;
& 57 offset loss    &   BEGIN
                        3TPNTR( real_ptr,
                              cal_std_addr + loss_offset
                            );
                        active_fcn_value := QUAD( scale_nultiplier *
                                                  real_ptr
                                                );
                    END;
& 5S offset z0      &   BEGIN
                        STPNTR( real_ptr,
                              cal_std_addr + z0_offset
                            );
                        active_fcn_value := OUAD( scale_nultiplier *
                                                  real_ptr
                                                );
                    END;
& 59 offset nin f   &   BEGIN
                        STPRTR( real_ptr,
                              cal_std_addr + f_nin_offset
                            );
                        active_fen_value := real_ptr;
                    END;
& GO offset nax f   &   BEGIN
                        3TPRTR( real_ptr,
                              cal_std_addr + f_nax_offset
                            );
                        active_fen_value := real_ptr;
                    END;
& 61 std id         &   BEGIN
                        active_fen_value := current_std_id;
                    END;
& 62 std class      &   BEGIN
                        active_fcn_value := 1;
```

```
SRCTVO.UDRK.PD5510          THU, DEC 22, 1983, 10:22 RM    PAGE  12

                    END;
& 63 # groups kbd   &   ;              & nust be sane as # groups hpib &
        END;  & case &

      display_active_fcn_value;

      release( active_function_rin );

  END;  & select_active_function &
```

```
SRCTVO.UDRK.PD8510          THU, DEC 22, 1983, 10:22 RM    PAGE  13

REJECT;
COMMENT                                                  select_active_off
*****************************************************************************
*
*  Turns off the active function if and only if the specified function
*  (uhich_function) is the current active function.
*
*****************************************************************************
;
PROCEDURE  select_active_off( uhich_function );
   VALUE   uhich_function;
   INTEGER uhich_function;                                          ENTRY;
   BEGIN & select_pctive_pff &
      If uhich_function = active_function THEN
         select_pctive_function( active_pff );
   END;  & select_pctive_pff &
```

```
SRCTVO.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE 14


#EJECT;
COMMENT                                              enter_active_function
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  enter_active_function;                                    EMIRY;
   BEGIN & enter_active_function &
      BYTE   HRRAY  enter_array[-1:string_size];
      ALPHA      enter_string;
      AURD       nin,
                 tenp_quad;
      REAL       active_fcn_real,
                 tenp_real;
      INTEGER    position,
                 atten_nmbr,
                 ch_atten_port,
                 index;
      BYTE   POINTER  ch;

      SUBROUTINE set_atten;
         BEGIN & set_atten &
            abort_sweep;
            read_priv_ib( test_set,
                          atten_nmbr,
                          append_string( format_quad( active_fcn_value,
                                                      enter_string,
                                                      format_table[
                                                   test_set_atten_format
                                                                  ] OR
                                                               %D00000E0
                                                    ),
                                         neuline+"OR"
                                       ),
                          enter_string
                        );
            position := 1;
            active_fcn_real := CHV92( enter_string, position );
            get_entry_ch_real( active_fcn_real, ch_atten_port );
            active_fcn_value := active_fcn_real * scale_multiplier;
            build_test_set;
            restart_sweep;                    & also resets averaging &
         END;  & set_atten &

      & initialize string &
      enter_string := HDRS(enter_array);
      enter_string := init_string(enter_string,
                                  string_size
                                 );
      clear_string( entry_aux );

      active_fcn_value := linit_quad(active_fcn_value, active_function);


      & store value -- done here so chtable values can be used later &
      IF get_active(get_chtable_store, active_function) = store THER
```

```
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         BEGIN & if &
            index := get_active( get_chtable_index, active_function );
            CASE get_active(get_chtable_type, active_function) OF
               BEGIN & case &
& none         &  ;
& byte         &  ; & bytes are no longer used in the chtable &
& integer      &  set_entry_ch_integer( active_fcn_value, index );
& user3        &  ; & not currently used &
& real         &  BEGIN & real &
                     active_fcn_real := REAL(active_fcn_value) *
                                                      unscale_multiplier;
                  set_entry_ch_real( active_fcn_real, index );
               END;  & real &
& double       &  ; & not currently used &
& quad         &  set_entry_ch_quad( active_fcn_value, index );
               END;  & case &
         END;  & if &


      CASE active_function OF
         BEGIN & case &
&  0 off        &  ;
&  1 start      &  IF entry_ch_integer( ch_domain ) =
                        freq_domain THEN
                     wrt_priv_ib_source(
                                 fa,
                                 append_ch(
                                    format_quad(
                                       active_fcn_value,
                                       enter_string,
                                       format_table[
                                                frequency_format
                                                  ]
                                              ),
                                    neuline
                                         )
                                  )
                     ELSE
                        BEGIN & else &
                           set_entry_ch_quad( active_fcn_value,
                                              ch_start_stimulus
                                            );
                           update_center;
                           check_update_domain;
                        END;  & else &
&  2 stop       &  IF entry_ch_integer( ch_domain ) =
                        freq_domain THEN
                     wrt_priv_ib_source(
                                 fb,
                                 eppend_eh(
                                    format_quad(
                                       active_fcn_value,
                                       enter_string,
                                       format_table[
                                                frequency_format
                                                  ]
```

```
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                                              ),
                                    neuline
                                         )
                                  )
                     ELSE
                        BEGIN & else &
                           set_entry_cb_quad( active_fcn_value,
                                              ch_stop_stimulus
                                            );
                           update_center;
                           check_update_domain;
                        END;  & else &
&  3 center     &  IF entry_ch_integer( ch_domain ) =
                        freq_domain THEN
                     wrt_priv_ib_source(
                                 cf,
                                 append_eh(
                                    format_quad(
                                       active_fcn_value,
                                       enter_string,
                                       format_table[
                                                frequency_format
                                                  ]
                                              ),
                                    neuline
                                         )
                                  )
                     ELSE
                        BEGIN & else &
                           set_entry_ch_quad( active_fcn_value,
                                              ch_center_stimulus
                                            );
                           update_start;
                           check_update_domain;
                        END;  & else &
&  4 span       &  IF entry_ch_integer( ch_domain ) =
                        freq_domain THEN
                     wrt_priv_ib_source(
                                 df,
                                 append_ch(
                                    format_quad(
                                       active_fcn_value,
                                       enter_string,
                                       format_table[
                                                frequency_format
                                                  ]
                                              ),
                                    neuline
                                         )
                                  )
                     ELSE
                        BEGIN & else &
                           set_entry_ch_quad( active_fcn_value,
                                              ch_span_stimulus
                                            );
                           update_start;
```

```
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                           check_update_domain;
                        END;  & else &
&  5 cw         &  IF entry_ch_integer( ch_domain ) =
                        freq_domain THEN
                     wrt_priv_ib_source(
                                 cw,
                                 append_ch(
                                    format_quad(
                                       active_fcn_value,
                                       enter_string,
                                       format_table[
                                                frequency_format
                                                  ]
                                              ),
                                    neuline
                                         )
                                  )
                     ELSE
                        BEGIN & else &
                           set_entry_ch_quad( active_fcn_value,
                                              ch_center_stimulus
                                            );
                           update_start;
                           check_update_domain;
                        END;  & else &
&  6 sweep time  &  BEGIN & sweep time &
                     wrt_priv_ib_source(
                                 st,
                                 append_ch(
                                    format_quad(
                                       active_fcn_value,
                                       enter_string,
                                       format_table[
                                                sweep_time_format
                                                  ] OR
                                               %O00000E0
                                              ),
                                    neuline
                                         )
                                  );
                     END;  & sweep time &
&  7 source power  &  BEGIN & source power &
                     read_priv_ib( source,
                                   pi,
                                   append_string(
                                      format_quad(
                                         active_fcn_value,
                                         enter_string,
                                         format_table[
                                                source_pwr_format
                                                  ] OR
                                               %O00000E0
                                              ),
                                      neuline+"OR"
                                            ),
                                   enter_string
```

```
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                                    );
                              position := 1;
                              active_fcn_real := CNV92( enter_string,
                                                        position
                                                      );
                              set_entry_ch_real( active_fcn_real,
                                                 ch_source_power
                                               );
                              active_fcn_value := active_fcn_real *
                                                  scale_multiplier;
                           END;  & source power &
&  8 power slope     &    BEGIN & power slope &
                           read_priv_ib( source,
                                         ill,
                                         append_string(
                                            format_quad(
                                               active_fcn_value,
                                               enter_string,
                                               format_table(
                                                     source_our_format
                                                     ] OR
                                                  XOOOOOOOO
                                                  ),
                                               newline+"OR"
                                                  ),
                                            ontor_string
                                           );
                              position := 1;
                              active_fcn_real := CNV92( enter_string,
                                                        position
                                                      );
                              set_entry_ch_real( active_fcn_real,
                                                 ch_power_slope
                                               );
                              active_fcn_value := active_fcn_real *
                                                  scale_multiplier;
                           END;  & power slope &
&  9 port 1 atten    &    BEGIN & port 1 atten &
                           atten_nnbr := attn1;
                           ch_atten_port := ch_atten_port1;
                           set_atten;
                           END;  & port 1 atten &
& 10 port 2 atten    &    BEGIN & port 2 atten &
                           atten_nnbr := atten2;
                           ch_atten_port := ch_atten_port2;
                           set_atten;
                           END;  & port 2 atten &
& 11 ref pos'n       &    BEGIN & ref pos'n &
                           index := entry_ch_integer(ch_format);
                           IF type_of_grat[ index ] <> rectangular THEN
                              index := fnt_log_polar;
                           urt_disp_real( ADRS(
                              ref_position( index,
                                            entry_ch_integer(ch_param),
                                            current_entry_ch
                                          ]
```

```
SRCTVO.UORK.PDS510          THU, DEC 22, 1983, 10:22 RM    PAGE  19

                                       ),
                                    active_fcn_real
                                  );
                           annotate_ref_position;
                           partial( update_f );
                        END;  & ref pos'n &
& 12 scale/div       &    BEGIN & scale/div &
                           index := entry_ch_integer(ch_format);
                           IF type_of_grat[ index ] <> rectangular THEN
                              BEGIN & if polar &
                                 index := fnt_log_polar;
                                 temp_real := active_fcn_real * 5.0;
                                 set_entry_ch_real( temp_rtal,
                                                    ch_ref_value
                                                  );
                                 urt_disp_rtal( ADRS( ref_value(
                                                index,
                                                entry_ch_integer(ch_param),
                                                current_entry_ch
                                                                 ]
                                                ),
                                              temp_real
                                            );
                                 annotate_ref_value;
                              END;  & if polar &
                           urt_disp_real( ADRS(
                                  scale[ index,
                                         entry_ch_integer(ch_param),
                                         current_entry_ch
                                       ]
                                  ),
                                 active_fcn_real
                               );
                           update_scale;
                        END;  & scale/div &
& 13 ref value       &    BEGIN & ref value &
                           index := entry_ch_integer(ch_format);
                           IF type_of_grat[ index ] <> rectangular THEN
                              BEGIN & if polar &
                                 index := fnt_log_polar;
                                 temp_rtal := active_fcn_real * 0.2;
                                 set_entry_ch_real(temp_real, ch_scale);
                                 urt_disp_real( RORS( scale[
                                                index,
                                                entry_ch_integer(ch_param),
                                                current_entry_ch
                                                                 ]
                                                ),
                                              temp_ceal
                                            );
                              annotate_scale;
                           END;  & if polar &
                        urt_disp_real( RORS(
                              ref_value[ index,
                                         entry_ch_integer(ch_param),
                                         current_entry_ch
```

```
SRCTVO.UORK.PDS510          THU, DEC 22, 1983, 10:22 RM    PAGE  20

                                       ]
                                    ),
                                 active_fcn_real
                               );
                           update_ref_value;
                        END;  & ref value &
& 14 unused          &    ;
& 15 title           &    select_title_char(
                              1 + BRIGHT(-INTEGER(active_fcn_value), 2 )
                            );
& 16 # groups hpib   &    BEGIN          & must be same as # groups bbd  &
                                         & except for hold-off.          &
                           n_sweep( active_fcn_value );  & initiallies &
                                                         & take_sweep_done &
                           release( active_function_rin );
                           wait( take_sweep_done );
                           acquire( active_function_rin );
                        END;  & R groups &
& 17 if avg factor   &    BEGIN & if averaging factor &
                           rebuild := TRUE;
                           group_number := 0; & reset averaging number &
                        END;  & if averaging factor &
& 18 smoothing aper.&     BEGIN & smoothing aperture &
                           active_fcn_real :=
                              REAL( entry_ch_quad(ch_span_stimulus) ) *
                              entry_ch_real(ch_smoothing_aperture)    /
                              100.0;
                           append_string(
                                 format_real( active_fcn_real,
                                              entry_aux,
                                              format_table(
                                                    aperture_format
                                                    ]
                                              ),
                                 active_suffix( active_span )
                               );
                           partial( update_d );
                        END;  & smoothing aperture &
& 19 srq nask prin. &     BEGIN & srq nask prin. &
                           srq_mask_primary := active_fcn_value;
                           request_nask( irq_nask_primary );   & DEBUG &
                           COMMENT                             & DEBUG &
                           request_nask( LEFT(srq_nask_primary,8) OR
                                         (srq_nask_secondary AND XOOFF)
                                       );
                        END;  & srq nask prin. &
& 20 srq nask secon.&     BEGIN & srq nask secon.&
                           srq_nask_secondary := active_fcn_value;
                           request_nask( LEFT(srq_nask_primary,8) OR
                                         (srq_nask_secondary AND XOOFF)
                                       );
                        END;  & srq nask secon.&
& 21 revision        &    ;
& 22 aux out         &    BEGIN & auxiliary output voltage &
                           set_entry_ch_quad( active_fcn_value /
                                              quad_aux_out_scaled,
```

```
SRCTVO.UORK.PDS510          THU, DEC 22, 1983, 10:22 RM    PAGE  21

                                              ch_center_aux_out
                                            );
                           set_aux_out;
                        END;  & auxiliary output voltage &
& 23 keycade         &    BEGIN & keycode &
                              & pass value back as next command &
                           command_token := active_fcn_value;
                           command_sending := TRUE;
                        END;  & keycode &
& 24 elec delay      &    BEGIN & electrical delay &
                           urt_disp_real( ADRS(
                                 elec_delay[ entry_ch_integer(ch_param),
                                             current_entry_ch
                                           ]
                                 ),
                                active_fcn_real
                              );
                           control_data_proc_freq(1);       & delay is &
                           control_data_proc_freq(2);       & coupled. &
                        END;  & electrical delay &
& 25 phase offset    &    BEGIN & phase offset &
                           control_data_proc_freq(1);
                           control_data_proc_freq(2);
                        END;  & phase offset &
& 26 marker1         &    activate_marker;
& 27 marker2         &    activate_marker;
& 28 marker3         &    activate_marker;
& 29 marker4         &    activate_marker;
& 30 marker5         &    activate_marker;
& 31 address         &    STPNTR( peek_n_poke,
                                 DOUBLE( active_fcn_value ) AND XFFFFFFFE
                               );
& 32 peek            &    active_fcn_value := peek_o_poke;
& 33 poke            &    peek_n_poke := INTEGER(active_fcn_value);
& 34 open c0         &    BEGIN
                           active_fcn_real := unscale_multiplier *
                                              REAL(active_fcn_value);
                           urt_disp_real( cal_std_addr + c0_offset,
                                          active_fcn_real
                                        );
                        END;
& 35 open c1         &    BEGIN
                           active_fcn_real := unscale_multiplier *
                                              REAL(active_fcn_value);
                           urt_disp_rtal( cal_std_mddr + c1_offset,
                                          active_fcn_real
                                        );
                        END;
& 36 open c2         &    BEGIN
                           active_fcn_real := unscale_multiplier *
                                              REAL(active_fcn_value);
                           urt_disp_real( cal_std_eddr + c2_offset,
                                          active_fcn_real
                                        );
                        END;
& 37 gate start      &    BEGIN
```

```
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                        set_entry_ch_quad(
                                    entry_ch_quad(ch_gate_center) +
                                    ( active_fcn_value -
                                      entry_ch_quad(ch_gate_start)
                                    ) / 2,
                                    ch_gate_center
                                        );
                        set_entry_ch_quad( active_fcn_value,
                                           ch_gate_start
                                         );
                        check_update_domain;
                      END;
& 38 gate stop      &   BEGIN
                        set_entry_ch_quad(
                                    ( entry_ch_quad(ch_gate_start) +
                                      active_fcn_value
                                    ) / 2,
                                    ch_gate_center
                                        );
                        set_entry_ch_quad( active_fcn_value,
                                           ch_gate_stop
                                         ); & only for gate markers &
                        check_update_domain;
                      END;
& 39 gate center    &   BEGIN
                        set_entry_ch_quad(
                                    entry_ch_quad(ch_gate_start) +
                                    active_fcn_value -
                                    entry_ch_quad(ch_gate_center),
                                    ch_gate_start
                                        );
                        set_entry_ch_quad( active_fcn_value,
                                           ch_gate_center
                                         );
                        temp_quad := active_fcn_value -
                                     entry_ch_quad( ch_gate_start );
                        set_entry_ch_quad(
                                    entry_ch_quad(ch_gate_start) +
                                      temp_quad + temp_quad,
                                    ch_gate_stop
                                        ); & only for gate markers &
                        check_update_domain;
                      END;
& 40 gate span      &   BEGIN
                        temp_quad := active_fcn_value / 2;
                        set_entry_ch_quad(
                                    entry_ch_quad(ch_gate_center) -
                                      temp_oued,
                                    ch_gate_start
                                        );
                        set_entry_ch_quad(
                                    entry_ch_quad(ch_gate_center) +
                                      temp_quad,
                                    ch_gate_stop
                                        ); & only for gate markers &
                        check_update_domain;
```

```
SRCTVO.WORK.PD8510              THU, DEC 22, 1983, 10:22 AM     PAGE  23

                      END;
& 41 mag slope      &   warn( command_not_implemented );
& 42 mag offset     &   warn( command_not_implemented );
& 43 stimulus slope &   warn( command_not_implemented );
& 44 stimulus offset&   warn( command_not_implemented );
& 45 ref plane 1    &   BEGIN
                        control_data_proc_freq(1);      & plane is &
                        control_data_proc_freq(2);      & coupled. &
                      END;
& 46 ref plane 2    &   BEGIN
                        control_data_proc_freq(1);      & plane is &
                        control_data_proc_freq(2);      & coupled. &
                      END;
& 47 system z0      &   ;
& 48 major addr     &   BEGIN
                        set_priv_ib_lun(major,     active_fcn_value);
                        set_major_address(active_fcn_value);
                      END;
& 49 minor addr     &   BEGIN
                        set_priv_ib_lun(minor,     active_fcn_value);
                        set_minor_address(active_fcn_value);
                      END;
& 50 pass thru addr &   set_priv_ib_lun(priv_ib_pass, active_fcn_value);
& 51 source addr    &   set_priv_ib_lun(source,      active_fcn_value);
& 52 test-set addr  &   set_priv_ib_lun(test_set,    active_fcn_value);
& 53 plotter addr   &   set_priv_ib_lun(plotter,     active_fcn_value);
& 54 printer addr   &   set_priv_ib_lun(printer,     active_fcn_value);
& 55 eh end addr    &   set_priv_ib_lun(user_device_1,active_fcn_value);
& 56 offset delay   &   BEGIN
                        active_fcn_real := REAL(active_fcn_value) *
                                                   unscale_multiplier;
                        wrt_disp_real( cal_std_addr + delay_offset,
                                       active_fcn_real
                                     );
                      END;
& 57 offset loss    &   BEGIN
                        active_fcn_real := REAL(active_fcn_value) *
                                                   unscale_multiplier;
                        wrt_disp_real( cal_std_addr + loss_offset,
                                       active_fcn_real
                                     );
                      END;
& 58 offset z0      &   BEGIN
                        active_fcn_real := REAL(active_fcn_value) *
                                                   unscale_multiplier;
                        wrt_disp_real( cal_std_addr + z0_offset,
                                       active_fcn_real
                                     );
                      END;
& 59 offset min f   &   BEGIN
                        active_fcn_real := REAL( active_fcn_value );
                        wrt_disp_real( cal_std_addr + f_min_offset,
                                       active_fcn_real
                                     );
                      END;
& 60 offset max f   &   BEGIN
```

```
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                        active_fcn_real := REAL( active_fcn_value );
                        wrt_disp_real( cal_std_addr + f_max_offset,
                                       active_fcn_real
                                     );
                      END;
& 61 std id         &   BEGIN
                        std_id(INTEGER(active_fcn_value));
                      END;
& 62 std class      &   BEGIN
                        std_class_element(INTEGER(active_fcn_value));
                      END;
& 63 H groups hpib  &   n_sweep( active_fcn_value ); & must be same as &
                            & H groups hpib except for hold-off &
        END;  & case &

    display_active_fcn_value;

  END; & enter_active_function &

END$
```

```
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COMMENT    These constants are duplicated from cactive.work.
;
INTEGER CONSTANT  active_off                  := 0,
                  active_span                 := 4,
                  active_scale                := 12,
                  active_ref_value            := 13,
                  active_title                := 15,
                  active_smoothing_aperture   := 18,
                  active_revision             := 21,
                  active_previous             := -1;
```

```
FACTV1.UORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  1


PROCEDURE select_active_function(which_function);
   VALUE  which_function;
   INTEGER which_function;                                  EXTERNAL;
```

```
FACTV2.UORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  1


EXTERNAL INTEGER CONSTANT
      title_size2       ,
      entry_size2       ,
      function_size2    ,
      entry_aux_size2   ,
      title_display2    ,
      entry_display2    ,
      entry2_display2   ,
      function_display2 ,
      entry_aux_display2;

EXTERNAL ALPHA function;
EXTERNAL BYTE ARRAY entry_array[-1:1];                      & dummy size &
EXTERNAL ALPHA entry;
EXTERNAL BYTE ARRAY title_array[-1:1];                      & dummy size &
EXTERNAL ALPHA title;
EXTERNAL BOOLEAN entry_flip_flop;
EXTERNAL ALPHA entry_aux;

PROCEDURE print_string(string,klocklength,block);
   VALUE string,blecklength,bleck;
   INTEGER klocklength,block;
   ALPHA string;                                            EXTERNAL.L;
PROCEDURE print_big_string(strtng,blecklength,block);
   VALUE string,klocklength,bleck;
   INTEGER blocklength,block;
   ALPHA string;                                            EXTERNAL.L;
```

```
SRCTV2.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  1


%68KL,P,"actv2"
BEGIN

%FILE cscreen.work;

GLOBAL INTEGER CONSTANT
      title_size2       := title_size,
      entry_size2       := entry_size,
      function_size2    := function_size,
      entry_aux_size2   := entry_aux_size,
      title_display2    := title_display,
      entry_display2    := entry_display,
      entry2_display2   := entry2_display,
      function_display2 := function_display,
      entry_aux_display2 := entry_aux_display;

END$
```

```
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EXTERNAL ALPHA TABLE active_function_label.L;
```

```
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%GSKL,P,"alebel"
%ECIM

%FILE cchars.work;

GLOBAL ALPHA TABLE active_function_label := & update CACTIVE file also &
   & 0 & "",                                  & no active function (off) &
   & 1 & "START",
   & 2 & "STOP",
   & 3 & "CENTER",
   & 4 & "SPAN",
   & 5 & "C.U.",
   & 6 & "SWEEP TIME",
   & 7 & "SOURCE POWER",
   & 8 & "POWER SLOPE",                       & end of source functions &
   & 9 & "PORT 1 RITEN.",
   & 10 & "PORT 2 RITEN.",
   & 11 & "REFERENCE LINE POSITION",
   & 12 & "SCALE",
   & 13 & "REFERENCE VALUE",
   & 14 & "",                                                & unused   &
   & 15 & "TITLE",
   & 16 & "NUMBER OF GROUPS",
   & 17 & "IF AVERAGING FACTOR",
   & 18 & "SMOOTHING APERTURE",
   & 19 & "SRQ MASK (PRIMARY)",
   & 20 & "SRQ MASK (SECONDARY)",
   & 21 & "",          & place holder for revision string address &
   & 22 & "AUX. OUTPUT",
   & 23 & "KEYCODE",
   & 24 & "ELECTRICAL DELAY",
   & 25 & "PURSE OFFSET",
   & 25 & "MARKER 1    ",
   & 27 & "MARKER 2    ",
   & 28 & "MARKER 3    ",
   & 29 & "MARKER 4    ",
   & 30 & "MARKER 5    ",
   & 31 & "PEEK/POKE ADDRESS",
   & 32 & "PEEK",
   & 33 & "POKE",
   & 34 & half_vt+"C"+176+" (x10"+139+"-15"+138+" F)",
   & 35 & half_vt+"C"+177+" (x10"+139+"-27"+138+" F/Hz)",
   & 36 & half_vt+"C"+178+" (x10"+139+"-36"+138+" F/Hz"+181+")",
   & 37 & "GATE START",
   & 38 & "GATE STOP",
   & 39 & "GATE CENTER",
   & 40 & "GATE SPAN",
   & 41 & "MAGNITUDE SLOPE",
   & 42 & "MAGNITUDE OFFSET",
   & 43 & "STIMULUS SLOPE",
   & 44 & "STIMULUS OFFSET",
   & 45 & "PORT 1 REF. PLANE",
   & 46 & "PORT 2 REF. PLANE",
   & 47 & "Z"+176,
   & 48 & "8510 HP-IB ADDRESS",
```

```
SALMAEL.UORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  2

   & 49 & "8510 HP-IB MINOR ADDRESS",
   & 50 & "PASS-THRU HP-IB ADDRESS",
   & 51 & "SOURCE HP-IB ADDRESS",
   & 52 & "TEST-SET HP-IB ADDRESS",
   & 53 & "PLOTTER HP-IB ADDRESS",
   & 54 & "PRINTER HP-IB ADDRESS",
   & 55 & "RU10 COMMAND HP-IB ADDRESS",
   & 56 & "OFFSET DELAY",
   & 57 & "OFFSET LOSS",
   & 58 & "OFFSET Z"+176,
   & 59 & "MIN. USABLE FREQUENCY",
   & 60 & "MAX. USABLE FREQUENCY",
   & 61 & "CALIBRATION STANDARD R",
   & 62 & "CALIBRATION STANDARD #",
   & 63 & "NUMBER OF GROUPS",
   & 99 & "";                                & simply a place holder &

END%
```

```
CALPMAS.UORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  1


%FILE cnemsg0.work;
%FILE cnsgpriv.work;
%FILE cnsgtape.work;
%FILE cnsgnbn.work;
%FILE cnsgplot.work;
%FILE cnsgib.work;
%FILE cnemsg1.work;
%FILE cnsgcal.work;
%FILE cnsgtime.work;
%FILE cprtdata.work;
```

```
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null_message = 0
" "

command_not_implemented = 2
"COMMAND NOT IMPLEMENTED"

option_omitted = 26
"SOFTWARE OPTION NOT INCLUDED"

invalid_command = 55
"INVALID COMMAND"

exceeded_available_memory = 71
"UNABLE TO ALLOCATE REQUESTED MEMORY"

source_ib_err = 107
"SOURCE SYNTAX ERROR"

test_set_ib_err = 127
"TEST-SET SYNTAX ERROR"

priv_ib_add_err = 149
"SYSTEM bUS ADDRESS ERROR"

priv_ib_srq_err = 174
"SYSTEM BUS SRQ ERROR"

no_tape = 195
"NO TAPE IN DRIVE"

loading_tape = 212
"LORDING TAPE"

no_file_found = 225
"FILE NOT FOUND"

initializing_tape = 240
"INITIALIZING TAPE"

tape_init = 258
"TAPE IhITIALIIED"

init_aborted = 275
"TAPE INIT ABORTED"

using_backup = 293
"USING BACKUP DIRECTORY"

load_aborted = 316
"TAPE LOAD ABORTED"

select_tape_data = 334
"SELECT DATA TO ?"

file_error = 351
```

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"FILE ? ERROR"

file_aborted = 364
"FILE ? ABORTED"

record_macro = 379
"RECORD"

restore_macro = 356
"RESTORE"

delete_macro = 394
"DELETE"

undelete_macro = 401
"UNDELETE"

select_record = 410
"SELECT ? TO BE RECORDED"

select_restore = 434
"SELECT ? TO BE RESTORED"

select_file_record = 458
"SELECT ? FILE TO RECORD"

select_file_restore = 482
"SELECT ? FILE TO RESTORE"

select_file_delete = 507
"SELECT ? FILE TO DELETE"

abort_restore = 531
"RESTORE ABORTED. ? MAY BE BAD."

recording_file = 562
"RECORDING FILE"

file_recorded = 577
"FILE RECORDED"

no_tape_room = 591
"NOT ENOUGH ROOM ON TAPE"

deleting_file = 615
"DELETING FILE"

file_deleted = 623
"FILE DELETED"

file_undeleted = 642
"FILE UNDELETED"

undeleting_file = 657
"UNDELETING FILE"

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restoring_file = 673
"RESTORING FILE"

file_restored = 688
"FILE RESTORED"

restore_pts_error = 702
"UNABLE TO RESTORE ? POINTS"

restore_401_macro = 729
"401"

restore_201_macro = 733
"201"

restore_101_macro = 737
"101"

restore_51_macro = 741
"51"

tape_errors = 744
"? ERROR"

format_macro = 752
"IMPE FORMAT"

tape_drive_macro = 764
"IRPE DRIVE"

write_protect_macro = 775
"WRITE PROTECT"

checksum_macro = 789
"CHECKSUM"

parity_macro = 798
"PARITY"

unknown_macro = 805
"UNKNOWN"

save_prompt = 813
"SELECT ? TO SAVE"

saving_data = 830
"SAVING ?"

data_saved = 839
"? SAVED"

save_error = 847
"ERROR IN SAVING ?"

recall_prompt = 865
"SELECT ? TO RECALL"

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recalling_data = 884
"RECALLING ?"

data_recalled = 896
"? RECALLED"

recall_error = 907
"ERROR IN RECALLING ?"

no_req_data = 928
"NO ? FOUND"

preset_macro = 939
"PRESET STATE"

last_state_macro = 952
"LAST STATE"

data_overflow = 963
"DATA OVERFLOW"

no_last_state = 977
"NO LAST STATE"

delete_prompt = 991
"SELECT ? TO DELETE"

deleting_data = 1010
"DELETING ?"

cal_reg_cleared = 1021
"CAL DELETED"

cal_clear_error = 1033
"ERROR IN DELETING CAL"

on_init_nbn = 1055
""

bubble_init_error = 1056
""

loading_data = 1057
"LOADING DATA"

invalid_nbn_data = 1070
"INVALID NBN DATA"

no_printer = 1087
"NO PRINTER CONNECTED"

plot_aborted = 1108
"PLOT ABORTED"

no_plotter = 1121

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"NO PLOTTER CONNECTED"

no_output_selection = 1142
"READ ATTEMPTED WITHOUT SELECTING OUTPUT TYPE"

illegal_output_selection = 1187
"READ ATTEMPTED WITH ILLEGAL OUTPUT TYPE"

no_input_selection = 1227
"WRITE ATTEMPTED WITHOUT SELECTING INPUT TYPE"

pass_thru_disabled = 1272
"PASS THRU ADDRESS NOT SET"

pass_thru_invalid = 1298
"PASS THRU ADDRESS INVALID"

block_input_error = 1324
"BLOCK INPUT ERROR"

block_input_length_error = 1342
"BLOCK INPUT LENGTH ERROR"

array_unavailable = 1367
"REQUESTED DATA NOT CURRENTLY AVAILABLE"

too_many_characters = 1406
"TOO MANY CHARACTERS IN NUMBER"

syntax_error = 1436
"SYNTAX ERROR"

deadlock = 1449
"RESOURCE DEADLOCK"

process_creation_error = 1467
"PROCESS CREATION ERROR"

no_pretune_lock = 1490
"VTO FAILURE"

pretune_fail = 1502
"NO IF FOUND"

phase_lock_fail = 1514
"PHASE LOCK FAILURE"

phase_lock_lost = 1533
"PHASE LOCK LOST"

vto_over_range = 1549
"VTO OVER-RANGE"

sup_sync_err = 1564
"SOURCE SWEEP SYNC ERROR"

```
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if_overload = 1558
"IF OVERLOAD"

bad_bc_value = 1600
"PRES > BC OF SOURCE"

no_active_marker = 1620
"NO MARKER CURRENTLY ACTIVE"

inconsistent_operation = 1647
"INCONSISTENT WITH CURRENT ACTIVE FUNCTION"

titling_instructions = 1689
"POINT WITH MOUSE; THEN PRESS 'SELECT LETTER'"

title_function_not_active = 1733
"'TITLE' FUNCTION IS INACTIVE"

test_set_overtemp = 1762
"TEST SET IS TOO HOT!!"

forward_device = 1784
"CONNECT DEVICE FOR "+blink_on+"FORWARD"+blink_off+" MEASUREMENT"

reverse_device = 1825
"CONNECT DEVICE FOR "+blink_on+"REVERSE"+blink_off+" MEASUREMENT"

illegal_test_set_operation = 1866
"ATTEMPTED ILLEGAL TEST SET OPERATION"

adc_cal_failed = 1903
"ADC CAL FAILED"

if_cal_failed = 1918
"IF CAL FAILED"

adc_not_responding = 1932
"ADC NOT RESPONDING"

autorange_cal_failed = 1951
"AUTORANGE CAL FAILED"

sup_too_fast = 1972
"SWEEP TIME TOO FAST"

ext_ref_unlocked = 1992
"UNABLE TO LOCK TO EXT 10Mhz REF"

no_e_coeffs = 2024
"'NEW CAL' OR 'STORED CAL' REQUIRED"

cal_not_for_param = 2059
"THIS PARAMETER NOT IN COEFFICIENT SET"

not_finished_caling = 2097
"ADDITIONAL STANDARDS NEEDED"
```

```
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turn_correct_off = 2125
"TURN CORRECTION OFF TO CALIBRATE"

no_cal_in_progress = 2158
"NO CALIBRATION CURRENTLY IN PROGRESS"

connect_std = 2195
blink_on+"CONNECT STD THEN PRESS KEY TO MEASURE"+blink_off

slide_load = 2235
blink_on+"POSITION SLIDE THEN PRESS KEY TO MEASURE"+blink_off

connect_thru = 2278
blink_on+"CONNECT THRU THEN PRESS EACH KEY TO MEASURE"+blink_off

isolate_ports = 2324
blink_on+"ISOLATE PORTS THEN PRESS EACH KEY TO MEASURE"+blink_off

press_done = 2371
blink_on+"PRESS 'DONE' IF FINISHED WITH 3ID(s)"+blink_off

press_save = 2410
blink_on+"PRESS 'SAVE' IF FINISHED WITH CAL"+blink_off

cal_aborted = 2446
"CALIBRATION/CORRECTION ABORTED"

comp_cal_coeff = 2477
"COMPUTING CAL COEFFICIENTS"

measuring_std = 2504
blink_on+"UNIT--MEASURING CAL STANDARD"+blink_off

select_cal_set = 2535
blink_on+"SELECT CALIBRATION SET"+blink_off

select_delete_cal_set = 2560
"NO SPACE FOR NEW CAL;  DELETE A CAL SET."

more_slides_needed = 2601
"MORE SLIDES NEEDED"

specify_std = 2620
"SPECIFY CAL STANDARD TYPE"

exceeded_std_class_limit = 2646
"EXCEEDED 7 STANDARDS PER CLASS"

specify_std_class = 2677
"SPECIFY SIDS FOR THIS CLASS, SEPARATED BY 'x1'"

select_std_class = 2724
"SELECT STANDARDS CLASS TO MODIFY"

comp_time_coeff = 2757
```

```
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"COMPUTING TIME COEFFICIENTS"

comp_gate_coeff = 2785
"COMPUTING GATE COEFFICIENTS"

tdr_freq_change = 2813
"LOW-PASS TIME DOMAIN DAY CHANGE FREQ LIMITS"

print_freq = 2857
"  FREQUENCY ("

print_time = 2871
"  TIME ("

print_aux = 2880
"  AUX ("
```

```
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EXTERNAL ALPHA TABLE byte_list.t;
```

```
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;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;                                                                     ;
;  This is the input file for generating a single byte table and      ;
;  offsets into the corresponding tables which points to an alpha     ;
;  string.  This eliminates the intermediate double (alpha address)   ;
;  generated for an alpha table.  All strings will be in this byte    ;
;  table, byte_list, and offset files (C<filename>) will be created   ;
;  as dictated by the input file.                                     ;
;                                                                     ;
;  The input file is configured as foilous according to the first     ;
;  character of each line:                                            ;
;                                                                     ;
;    @ - the nanes of include files (NFILES) that are generated       ;
;        with then prefix of 'C' for offsets into the byte table.     ;
;    . - is the name for the offset constant into a string entry of the;
;        byte table.  An offset constant without a string entry will  ;
;        generate a null string entry.                                ;
;    ; - or a apace will be ignored and reagrded as a cement.         ;
;                                                                     ;
;    All other characters will be considered as part of a string entry.;
;    This means that all string literals are to be oneleed in quotes  ;
;    and the syntax +"<string>" or "<string>"+ or +<sonetant> or      ;
;    <conotant>+ will also be accepted (with no space before and after ;
;    "+" character.  String entries can also be on nore than one line ;
;    prowiood that the "+" character is not the first character.      ;
;                                                                     ;
;    NOTE: sIngle characters should also be enclosed in suctes " ".   ;
;                                                                     ;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

;  The following files contains error and informational neesages
;  that are displayed on the nessage line.

@messag0.work

.null_neasege
" "

.connand_not_inplenented
"CONMAND NOT IMPLEMENTED"
.option_onitted
"SOFTWARE OPTION NOT INCLUDED"
.invalid_connand
"INVALID COMMAND"
.exceeded_available_nenory
"UNABLE TO ALLOCATE REQUESTED MEMORY"

@nsgpriv.work
;  private HP-IB nessages

.source_ib_err
"SOURCE SYNTAX ERROR"
.test_set_ib_err
"TEST-SET SYNTAX ERROR"
.priv_ib_add_err
"SYSTEM BUS ADDRESS ERROR"
```

```
IALPHAS.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  2

.priv_ib_srq_err
"SYSTEM BUS SRQ ERROR"

@nsgtape.work
;  tape errors/nessages

.no_tape
"NO TAPE IN DRIVE"
.loading_tape
"LOADING TAPE"
.no_file_found
"FILE NOT FOUND"
.initializing_tape
"INITIALIZING TAPE"
.tape_init
"TAPE INITIALIZED"
.init_aborted
"TAPE INIT ABORTED"
.using_backup
"USING BACKUP DIRECTORY"
.load_aborted
"TAPE LOAD ABORTED"

.select_tape_data
"SELECT DATA TO ?"
.file_error
"FILE ? ERROR"
.file_aborted
"FILE ? ABORTED"
.record_nacro
"RECORD"
.restore_nacro
"RESTORE"
.delete_nacro
"DELETE"
.undelete_nacro
"UNDELETE"
;
; The following nessages will be filled with appropriate data types
; to be recorded, restored, or deleted
;
.select_record
"SELECT ? TO BE RECORDED"
.select_restore
"SELECT ? TO BE RESTORED"
.select_file_record
"SELECT ? FILE TO RECORD"
.select_file_restore
"SELECT ? FILE TO RESTORE"
.select_file_delete
"SELECT ? FILE TO DELETE"
.abort_restore
"RESTORE ABORTED. ? MAY BE BAD."

.recording_file
"RECORDING FILE"
```

```
IALPHAS.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  3

.file_recorded
"FILE RECORDED"
.no_tape_roon
"NOT ENOUGH ROOM ON TAPE"

.deleting_file
"DELETING FILE"
.file_deleted
"FILE DELETED"

.file_undeleted
"FILE UNDELETED"
.undeleting_file
"UNDELETING FILE"

.restoring_file
"RESTORING FILE"
.file_restored
"FILE RESTORED"

.restore_pts_error
"UNABLE TO RESTORE ? POINTS"
.restore_401_nacro
"401"
.restore_201_nacro
"201"
.restore_101_nacro
"101"
.restore_51_nacro
"51"

.tape_errors
"? ERROR"
.fornat_nacro
"TAPE FORMAT"
.tape_drive_nacro
"TAPE DRIVE"
.write_protect_nacro
"WRITE PROTECT"
.checksun_nacro
"CHECKSUM"
.parity_nacro
"PARITY"
.unknown_nacro
"UNKNOWN"

@msgnbn.work
; bubble errors/nessages

.save_prompt
"SELECT ? TO SAVE"
.saving_data
"SAVING ?"
.data_saved
"? SAVED"
.save_error
```

```
IALPHAS.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  4

"ERROR IN SAVING ?"

.recall_prompt
"SELECT ? TO RECALL"
.recalling_data
"RECALLING ?"
.data_recalled
"? RECALLED"
.recall_error
"ERROR IN RECALLING ?"
.no_reg_data
"NO ? FOUND"
.preset_nacro
"PRESET STATE"
.last_state_nacro
"LAST STATE"
.data_overflow
"DATA OVERFLOW"
.no_last_state
"NO LAST STATE"

.delete_prompt
"SELECT ? TO DELETE"
.deleting_data
"DELETING ?"
.cal_reg_cleared
"CAL DELETED"
.cal_clear_error
"ERROR IN DELETING CAL"

.un_init_nbn
""

.bubble_init_error
""

.loading_data
"LOADING DATA"
;
; software debug trap
;
.invalid_nbn_data
"INVALID MBM DATA"

@nsgplot.work
; plotter error nessages

.no_printer
"NO PRINTER CONNECTED"
.plot_aborted
"PLOT ABORTED"
.no_plotter
"NO PLOTTER CONNECTED"

@nsgib.work
; public HP-IB I/O nessages

.no_output_selection
```

```
IKLPMRS.UORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  5


"READ ATTEMPTED WITHOUT SELECTING OUTPUT TYPE"
.illegal_output_selection
"READ ATTEMPTED WITH ILLEGAL OUTPUT TYPE"
.no_input_selection
"URITE ATTEMPTED WITHOUT SELECTING INPUT TYPE"
.pass_thru_disabled
"PASS THRU ADDRESS NOT SET"
.pass_thru_invalid
"PASS THRU ADDRESS INVALID"
.block_input_error
"BLOCK INPUT ERROR"
.block_input_length_error
"BLOCK INPUT LENGTH ERROR"
.array_unavailable
"REQUESTED DATA NOT CURRENTLY AVAILABLE"

@useeeag1.work

;  syntax errors

.too_many_characters
"TOO MANY CHARACTERS IN NUMBER"
.syntax_error
"SYNTAX ERROR"

;  kernel

.deadlock
"RESOURCE DEADLOCK"
.process_creation_error
"PROCESS CREATION ERROR"

;  break messages

.no_pretune_lock
"VTO FAILURE"
.pretune_fail
"NO IF FOUND"
.phase_lock_fail
"PHASE LOCK FAILURE"
.phase_lock_lost
"PHASE LOCK LOST"
.vto_over_range
"VTO OVER-RANGE"
.sup_sync_err
"SOURCE SWEEP SYNC ERROR"
.if_overload
"IF OVERLOAD"
;  temporary
.bad_bc_value
"PRES > BC OF SOURCE"

;  active function messages

.no_active_marker
"NO MARKER CURRENTLY ACTIVE"
```

```
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.inconsistent_operation
"INCONSISTENT WITH CURRENT ACTIVE FUNCTION"
.tilting_instructions
"POINT WITH KNOB; THEN PRESS 'SELECT LETTER'"
.title_function_not_active
"'TITLE' FUNCTION IS INACTIVE"

;  test set

.test_set_overtemp
"TEST SET IS TOO HOT!!"
.forward_device
"CONNECT DEVICE FOR "+blink_on+"FORWARD"+blink_off+" MEASUREMENT"
.reverse_device
"CONNECT DEVICE FOR "+blink_on+"REVERSE"+blink_off+" MEASUREMENT"
.illegal_test_set_operation
"ATTEMPTED ILLEGAL TEST SET OPERATION"

; calibration error messages (yedc)

.adc_cal_failed
"ADC CAL FAILED"
.if_cal_failed
"IF CAL FAILED"
.adc_not_responding
"ADC NOT RESPONDING"
.autorange_cal_failed
"AUTORANGE CAL FAILED"

;  button box

.swp_too_fast
"SWEEP TIME TOO FAST"
.ext_ref_unlocked
"UNABLE TO LOCK TO EXT 10Mhz REF"

; calibration and correction messages

@msgcal.work
.no_e_coeffs
"'NEW CAL' OR 'STORED CAL' REQUIRED"
.cal_not_for_param
"THIS PARAMETER NOT IN COEFFICIENT SET"
.not_finished_caling
"ADDITIONAL STANDARDS NEEDED"
.turn_correct_off
"TURN CORRECTION OFF TO CALIBRATE"
.no_cal_in_progress
"NO CALIBRATION CURRENTLY IN PROGRESS"
.connect_std
blink_on+"CONNECT STD THEN PRESS KEY TO MEASURE"+blink_off
.slide_load
blink_on+"POSITION SLIDE THEN PRESS KEY TO MEASURE"+blink_off
.connect_thru
blink_on+"CONNECT THRU THEN PRESS EACH KEY TO MEASURE"+blink_off
.isolate_ports
```

```
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blink_on+"ISOLATE PORTS THEN PRESS EACH KEY TO MEASURE"+blink_off
.press_done
blink_on+"PRESS 'DONE' IF FINISHED WITH SIG(s)"+blink_off
.press_save
blink_on+"PRESS 'SAVE' IF FINISHED WITH CAL"+blink_off
.cal_aborted
"CALIBRATION/CORRECTION ABORTED"
.comp_cal_coeff
"COMPUTING CAL COEFFICIENTS"
.measuring_std
blink_on+"UNIT-->MEASURING CAL STANDARD"+blink_off
.select_cal_set
blink_on+"SELECT CALIBRATION SET"+blink_off
.select_delete_cal_set
"NO SPACE FOR NEW CAL;  DELETE A CAL SET."
.more_slides_needed
"MORE SLIDES NEEDED"
.specify_std
"SPECIFY CAL STANDARD TYPE"
.exceeded_std_class_limit
"EXCEEDED 7 STANDARDS PER CLASS"
.specify_std_class
"SPECIFY STDS FOR THIS CLASS, SEPARATED BY 'x1'"
.select_std_class
"SELECT STANDARDS CLASS TO MODIFY"

;  domain messages -- line, TDR, gate, aux

@msgline.work
.comp_line_coeff
"COMPUTING LINE COEFFICIENTS"
.comp_gate_coeff
"COMPUTING GATE COEFFICIENTS"
.tdr_freq_change
"LOW-PASS TIME DOMAIN MAY CHANGE FREQ LIMITS"

@prtdata.work

;  headers for listing data trace info.

.print_freq
"  FREQUENCY ("
.print_time
"  TIME ("
.print_aux
"  AUX ("
```

```
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MGSKL,P,"alphas" BEGIN

RFILE cchars.work;

GLOBAL BYTE TABLE byte_list :=
  1,    & length byte &
  & " " &
  '
  23,    & length byte &
  & "COMMAND NOT IMPLEMENTED" &
  'C,'O,'M,'M,'A,'N,'D,' ,'M,'O,'T,' ,'I,'M,'P,'L,'E,'M,'E,'N,'T,'E,'D,

  28,    & length byte &
  & "SOFTWARE OPTION NOT INCLUDED" &
  'S,'O,'F,'T,'U,'R,'R,'E,' ,'O,'P,'T,'I,'O,'N,' ,'M,'O,'T,' ,'I,'M,'C,
  'L,'U,'D,'E,'D,
  15,    & length byte &
  & "INVALID COMMAND" &
  'I,'N,'V,'A,'L,'I,'D,' ,'C,'O,'M,'M,'A,'N,'D,
  35,    & length byte &
  & "UNABLE TO ALLOCATE REQUESTED MEMORY" &
  'U,'N,'A,'B,'L,'E,' ,'T,'O,' ,'A,'L,'L,'O,'C,'A,'T,'E,' ,'R,'E,'Q,'U,
  'E,'S,'T,'E,'D,' ,'M,'E,'M,'O,'R,'Y,
  15,    & length byte &
  & "SOURCE SYNTAX ERROR" &
  'S,'O,'U,'R,'C,'E,' ,'S,'Y,'N,'T,'A,'X,' ,'E,'R,'R,'O,'R,
  21,    & length byte &
  & "TEST-SET SYNTAX ERROR" &
  'T,'E,'S,'T,'-,'S,'E,'T,' ,'S,'Y,'N,'T,'A,'X,' ,'E,'R,'R,'D,'R,
  24,    & length byte &
  & "SYSTEM BUS ADDRESS ERROR" &
  'S,'Y,'S,'T,'E,'M,' ,'B,'U,'S,' ,'A,'D,'D,'R,'E,'S,'S,' ,'E,'R,'R,'O,
  'R,
  20,    & length byte &
  & "SYSTEM BUS SRQ ERROR" &
  'S,'Y,'S,'T,'E,'M,' ,'B,'U,'S,' ,'S,'R,'Q,' ,'E,'R,'R,'O,'R,
  16,    & length byte &
  & "NO TAPE IN DRIVE" &
  'N,'O,' ,'I,'N,'P,'E,' ,'I,'N,' ,'D,'R,'I,'V,'E,
  12,    & length byte &
  & "LOADING TAPE" &
  'L,'O,'A,'D,'I,'N,'G,' ,'I,'A,'P,'E,
  14,    & length byte &
  & "FILE NOT FOUND" &
  'F,'I,'L,'E,' ,'N,'O,'T,' ,'F,'O,'U,'N,'D,
  17,    & length byte &
  & "INIIIIRLIZING TAPE" &
  'I,'N,'I,'T,'I,'A,'L,'I,'Z,'I,'N,'G,' ,'T,'A,'P,'E,
  16,    & length byte &
  & "TAPE INITIALIZED" &
  'T,'A,'P,'E,' ,'I,'N,'I,'T,'I,'A,'L,'I,'Z,'E,'D,
  17,    & length byte &
  & "TAPE INII ABORTED" &
  'T,'A,'P,'E,' ,'I,'N,'I,'T,' ,'A,'b,'O,'R,'T,'E,'D,
  22,    & length byte &
```

```
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 & "USING BACKUP DIRECTORY" &
 'U,'S,'I,'N,'G,' ,'B,'R,'C,'K,'U,'P,' ,'D,'I,'R,'E,'C,'T,'O,'R,'Y,
 17,    & length byte &
 & "TAPE LORD ABORTED" &
 'T,'R,'P,'E,' ,'L,'O,'R,'D,' ,'R,'B,'O,'R,'T,'E,'D,
 16,    & length byte &
 & "SELECT DAIR TO ?" &
 'S,'E,'L,'E,'C,'T,' ,'D,'B,'I,'R,' ,'I,'O,' ,'?,
 12,    & length byte &
 & "FILE ? ERROR" &
 'F,'I,'L,'E,' ,'?,' ,'E,'R,'R,'O,'R,
 14,    & length byte &
 & "FILE ? RBORIED" &
 'F,'I,'L,'E,' ,'?,' ,'R,'B,'O,'R,'T,'E,'D,
 6,     & length byte &
 & "RECORD" &
 'R,'E,'C,'O,'R,'D,
 7,     & length byte &
 & "RESTORE" &
 'R,'E,'S,'T,'O,'R,'E,
 6,     & length byte &
 & "DELETE" &
 'D,'E,'L,'E,'T,'E,
 S,     & length byte &
 & "@NDELETE" &
 'U,'N,'D,'E,'L,'E,'T,'E,
 23,    & length byte &
 & "SELECT ? TO HE RECORDED" &
 'B,'E,'L,'E,'C,'T,' ,'?,' ,'T,'O,' ,'B,'E,' ,'R,'E,'C,'B,'R,'O,'E,'D,

 23,    & length byte &
 & "SELECT ? TO BE RESTORED" &
 'S,'E,'L,'E,'C,'T,' ,'?,' ,'T,'O,' ,'B,'E,' ,'R,'E,'S,'T,'O,'R,'E,'D,

 23,    & length byte &
 & "SELECT ? FILE TO RECORD" &
 'S,'E,'L,'E,'C,'T,' ,'?,' ,'F,'I,'L,'E,' ,'T,'O,' ,'R,'E,'C,'O,'R,'D,

 24,    & length byte &
 & "SELECT ? FILE TO RESTORE" &
 'S,'E,'L,'E,'C,'T,' ,'?,' ,'F,'I,'L,'E,' ,'T,'O,' ,'R,'E,'S,'T,'O,'R,
 'E,
 23,    & length byte &
 & "SELECT ? FILE TO DELETE" &
 'S,'E,'L,'E,'C,'T,' ,'?,' ,'F,'I,'L,'E,' ,'T,'O,' ,'D,'E,'L,'E,'T,'E,

 3D,    & length byte &
 & "RESTORE RBORTED. ? MAY BE BAD." &
 'R,'E,'S,'T,'O,'R,'E,' ,'R,'B,'O,'R,'T,'E,'D,'.,' ,'?,' ,'M,'R,'Y,' ,
 '8,'E,' ,'B,'R,'D,'.,
 14,    & length byte &
 & "RECORDING FILE" &
 'R,'E,'C,'O,'R,'D,'I,'K,'G,' ,'F,'I,'L,'E,
 13,    & length byte &
 & "FILE RECORDED" &
 'F,'I,'L,'E,' ,'R,'E,'C,'O,'R,'D,'E,'D,
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 23,    & length byte &
 & "NOT ENOUGH ROOM ON IBPE" &
 'N,'O,'T,' ,'E,'N,'O,'U,'G,'H,' ,'R,'O,'O,'M,' ,'O,'N,' ,'T,'A,'P,'E,

 13,    & length byte &
 & "DELETING FILE" &
 'D,'E,'L,'E,'T,'I,'N,'G,' ,'F,'I,'L,'E,
 12,    & length byte &
 & "FILE DELETED" &
 'F,'I,'L,'E,' ,'D,'E,'L,'E,'T,'E,'D,
 14,    & length byte &
 & "FILE UNDELETED" &
 'F,'I,'L,'E,' ,'U,'R,'D,'E,'L,'E,'T,'E,'D,
 15,    & length byte &
 & "UNDELEIING FILE" &
 'U,'N,'N,'E,'L,'E,'I,'N,'&,' ,'F,'I,'L,'E,
 14,    & length byte &
 & "RESTORING FILE" &
 'R,'E,'S,'T,'O,'R,'I,'R,'G,' ,'F,'I,'L,'E,
 13,    & length byte &
 & "FILE RESTORED" &
 'F,'I,'L,'E,' ,'R,'E,'S,'T,'B,'R,'E,'D,
 26,    & length byte &
 & "UNABLE TO RESTORE ? PBINTS" &
 'U,'N,'R,'B,'L,'E,' ,'T,'B,' ,'R,'E,'S,'T,'O,'R,'E,' ,'?,' ,'P,'O,'I,
 'N,'T,'S,
 3,     & length byte &
 & "401" &
 '4,'0,'1,
 3,     & length byte &
 & "201" &
 '2,'0,'1,
 3,     & length byte &
 & "101" &
 '1,'0,'1,
 2,     & length byte &
 & "51" &
 '5,'1,
 7,     & length byte &
 & "? ERROR" &
 '?,' ,'E,'R,'R,'O,'R,
 11,    & length byte &
 & "TAPE FORMAT" &
 'T,'A,'P,'E,' ,'F,'O,'R,'M,'R,'T,
 10,    & length byte &
 & "TAPE DRIVE" &
 'T,'A,'P,'E,' ,'D,'R,'I,'V,'E,
 13,    & length byte &
 & "URITE PROTECT" &
 'U,'R,'I,'T,'E,' ,'P,'R,'O,'I,'E,'C,'T,
 8,     & length byte &
 & "CHECKSUM" &
 'C,'H,'E,'C,'K,'S,'U,'R,
 6,     & length byte &
 & "PARITY" &
 'P,'A,'R,'I,'T,'Y,
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 7,     & length byte &
 & "UNKNOUN" &
 'U,'N,'K,'N,'O,'U,'N,
 16,    & length byte &
 & "SELECT ? TO SAVE" &
 'S,'E,'L,'E,'C,'T,' ,'?,' ,'T,'O,' ,'S,'A,'V,'E,
 8,     & length byte &
 & "SAVING ?" &
 'S,'A,'V,'I,'N,'G,' ,'?,
 7,     & length byte &
 & "? SAVED" &
 '?,' ,'S,'A,'V,'E,'D,
 17,    & length byte &
 & "ERROR IN SAVING ?" &
 'E,'R,'R,'O,'R,' ,'I,'N,' ,'S,'A,'V,'I,'N,'G,' ,'?,
 18,    & length byte &
 & "SELECT ? TO RECALL" &
 'S,'E,'L,'E,'C,'T,' ,'?,' ,'T,'O,' ,'R,'E,'C,'A,'L,'L,
 11,    & length byte &
 & "RECALLING ?" &
 'R,'E,'C,'A,'L,'L,'I,'N,'G,' ,'?,
 10,    & length byte &
 & "? RECALLED" &
 '?,' ,'R,'E,'C,'A,'L,'L,'E,'D,
 20,    & length byte &
 & "ERROR IN RECALLING ?" &
 'E,'R,'R,'O,'R,' ,'I,'N,' ,'R,'E,'C,'A,'L,'L,'I,'N,'G,' ,'?,
 10,    & length byte &
 & "NO ? FOUND" &
 'N,'O,' ,'?,' ,'F,'O,'U,'N,'D,
 12,    & length byte &
 & "PRESET STATE" &
 'P,'R,'E,'S,'E,'T,' ,'S,'T,'A,'T,'E,
 10,    & length byte &
 & "LAST STATE" &
 'L,'A,'S,'T,' ,'S,'T,'A,'T,'E,
 13,    & length byte &
 & "DATA OVERFLOW" &
 'D,'A,'T,'A,' ,'O,'V,'E,'R,'F,'L,'O,'U,
 13,    & length byte &
 & "NO LAST STATE" &
 'N,'O,' ,'L,'A,'S,'T,' ,'S,'T,'A,'I,'E,
 18,    & length byte &
 & "SELECT ? TO DELETE" &
 'S,'E,'L,'E,'C,'T,' ,'?,' ,'T,'O,' ,'O,'E,'L,'E,'T,'E,
 10,    & length byte &
 & "DELETING ?" &
 'D,'E,'L,'E,'T,'I,'N,'G,' ,'?,
 11,    & length byte &
 & "CAL DELETED" &
 'C,'A,'L,' ,'D,'E,'L,'E,'T,'E,'D,
 21,    & length byte &
 & "ERROR IN DELETING CAL" &
 'E,'R,'R,'O,'R,' ,'I,'R,' ,'D,'E,'L,'E,'T,'I,'N,'G,' ,'C,'R,'L,
 0,     & length byte &
 & "" &
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 0,     & length byte &
 & "" &
 12,    & length byte &
 & "LORDING DATA" &
 'L,'O,'R,'D,'I,'N,'G,' ,'D,'A,'T,'R,
 16,    & length byte &
 & "INVALID NAM DATA" &
 'I,'K,'V,'R,'L,'I,'D,' ,'R,'B,'B,' ,'D,'R,'T,'A,
 20,    & length byte &
 & "NO PRINIER CONNECTED" &
 'N,'O,' ,'P,'R,'I,'N,'T,'E,'R,' ,'C,'O,'N,'N,'E,'C,'T,'E,'D,
 12,    & length byte &
 & "PLOT ABORTED" &
 'P,'L,'O,'T,' ,'R,'B,'O,'R,'T,'E,'D,
 20,    & length byte &
 & "NO PLOTTER CONNECTED" &
 'N,'O,' ,'P,'L,'O,'T,'T,'E,'R,' ,'C,'O,'N,'N,'E,'C,'T,'E,'D,
 44,    & length byte &
 & "READ ATTEMPTED UITHOUT SELECTING OUTPUT TYPE" &
 'R,'E,'A,'D,' ,'A,'T,'T,'E,'B,'P,'T,'E,'D,' ,'U,'I,'T,'H,'O,'U,'T,' ,
 'S,'E,'L,'E,'C,'T,'I,'N,'G,' ,'O,'U,'T,'P,'U,'T,' ,'T,'Y,'P,'E,
 39,    & length byte &
 & "READ ATTEMPTED UITH ILLEGAL OUTPUT TYPE" &
 'R,'E,'A,'D,' ,'A,'T,'T,'E,'M,'P,'T,'E,'D,' ,'U,'I,'T,'H,' ,'I,'L,'L,
 'E,'G,'A,'L,' ,'O,'U,'T,'P,'U,'T,' ,'T,'Y,'P,'E,
 44,    & length byte &
 & "URITE ATTEMPTED UITHOUT SELECTING INPUT TYPE" &
 'U,'R,'I,'T,'E,' ,'A,'T,'T,'E,'M,'P,'T,'E,'D,' ,'U,'I,'T,'H,'O,'U,'T,
 ' ,'S,'E,'L,'E,'C,'T,'I,'N,'G,' ,'I,'K,'P,'U,'I,' ,'T,'Y,'P,'E,
 25,    & length byte &
 & "PASS THRU ADDRESS NOT SET" &
 'P,'A,'S,'S,' ,'T,'H,'R,'U,' ,'A,'D,'D,'R,'E,'S,'S,' ,'N,'O,'T,' ,'S,
 'E,'I,
 25,    & length byte &
 & "PASS THRU ADDRESS INVALID" &
 'P,'A,'S,'S,' ,'T,'H,'R,'U,' ,'A,'D,'D,'R,'E,'S,'S,' ,'I,'N,'V,'A,'L,
 'I,'D,
 17,    & length byte &
 & "BLOCK INPUT ERROR" &
 'B,'L,'O,'C,'K,' ,'I,'N,'P,'U,'T,' ,'E,'R,'R,'O,'R,
 24,    & length byte &
 & "BLOCK INPUT LENGTH ERROR" &
 'B,'L,'O,'C,'K,' ,'I,'N,'P,'U,'T,' ,'L,'E,'N,'G,'T,'H,' ,'E,'R,'R,'O,
 'R,
 38,    & length byte &
 & "REQUESTED DATA NOT CURRENTLY AVAILABLE" &
 'R,'E,'B,'U,'E,'S,'T,'E,'O,' ,'O,'R,'T,'A,' ,'N,'O,'T,' ,'C,'U,'R,'R,
 'E,'N,'T,'L,'Y,' ,'A,'V,'R,'I,'L,'R,'B,'L,'E,
 29,    & length byte &
 & "TOO MANY CHARACTERS IN NUMBER" &
 'T,'O,'O,' ,'M,'B,'N,'Y,' ,'C,'H,'R,'R,'R,'C,'T,'E,'R,'S,' ,'I,'N,' ,
 'N,'U,'M,'B,'E,'R,
 12,    & length byte &
 & "SYNTAX ERROR" &
 'S,'Y,'N,'T,'R,'X,' ,'E,'R,'R,'O,'R,
 17,    & length byte &
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  & "RESOURCE DEADLOCK" &
  'R,'E,'S,'O,'U,'R,'C,'E,' ,'O,'E,'R,'D,'1,'O,'C,'K,
  22,    & length byte &
  & "PROCESS CREATION ERROR" &
  'P,'R,'O,'C,'E,'S,'S,' ,'C,'R,'E,'R,'T,'I,'O,'N,' ,'E,'R,'R,'O,'R,
  11,    & length byte &
  & "VTO FAILURE" &
  'V,'I,'O,' ,'F,'A,'I,'L,'U,'R,'E,
  11,    & length byte &
  & "NO IF FOUND" &
  'R,'O,' ,'I,'F,' ,'F,'O,'U,'N,'D,
  18,    & length byte &
  & "PHASE LOCK FAILURE" &
  'P,'H,'A,'S,'E,' ,'L,'O,'C,'K,' ,'F,'A,'I,'L,'U,'R,'E,
  15,    & length byte &
  & "PHASE LOCK LOST" &
  'F,'A,'N,'S,'E,' ,'L,'O,'C,'K,' ,'L,'O,'S,'I,
  14,    & length byte &
  & "VTO OVER-RANGE" &
  'V,'T,'O,' ,'O,'V,'E,'R,'-,'R,'A,'N,'G,'E,
  23,    & length byte &
  & "SOURCE SWEEP SYNC ERROR" &
  'S,'O,'U,'R,'C,'E,' ,'S,'U,'E,'E,'P,' ,'S,'Y,'N,'C,' ,'E,'R,'R,'O,'R,

  11,    & length byte &
  & "IF OVERLOAD" &
  '1,'F,' ,'O,'V,'E,'R,'L,'O,'A,'D,
  19,    & length byte &
  & "PRES > BC OF SOURCE" &
  'P,'R,'E,'S,' ,'>,' ,'B,'C,' ,'O,'F,' ,'S,'O,'U,'R,'C,'E,
  26,    & length byte &
  & "NO MARKER CURRENTLY ACTIVE" &
  'N,'O,' ,'M,'A,'R,'K,'E,'R,' ,'C,'U,'R,'R,'E,'N,'T,'L,'Y,' ,'R,'C,'I,
  'I,'V,'E,
  41,    & length byte &
  & "INCONSISTENT WITH CURRENT ACTIVE FUNCTION" &
  'I,'N,'C,'O,'N,'S,'I,'S,'T,'E,'N,'I,' ,'U,'I,'T,'H,' ,'C,'U,'R,'R,'E,
  'N,'T,' ,'R,'C,'I,'I,'V,'E,' ,'F,'U,'N,'C,'I,'O,'N,
  43,    & length byte &
  & "POINT WITH KNOB; THEN PRESS 'SELECT LETTER'" &
  'P,'O,'I,'N,'T,' ,'U,'I,'T,'H,' ,'K,'N,'O,'B,';,' ,'T,'H,'E,'N,' ,'P,
  'R,'E,'S,'S,' ,'',S,'E,'L,'E,'C,'T,' ,'L,'E,'T,'T,'E,'R,'',
  28,    & length byte &
  & "'TITLE' FUNCTION IS INACTIVE" &
  '',T,'I,T,'L,'E,'',' ,'F,'U,'N,'C,'T,'I,'O,'N,' ,'I,'S,' ,'I,'N,'R,
  'C,'T,'I,'V,'E,
  21,    & length byte &
  & "TEST SET IS TOO HOT!!" &
  'T,'E,'S,'T,' ,'S,'E,'T,' ,'I,'S,' ,'T,'O,'O,' ,'H,'O,'T,'!,'!,
  40,    & length byte &
  & "CONNECT DEVICE FOR "+blink_on+"FORWARD"+blink_off+" MEASUREMENT" &
  'C,'O,'N,'N,'E,'C,'T,' ,'D,'E,'V,'I,'C,'E,' ,'F,'O,'R,' ,
  blink_on,
  'F,'O,'R,'U,'R,'R,'D,
  blink_off,
  ' ,'M,'E,'R,'S,'U,'R,'E,'M,'E,'N,'T,
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  40,    & length byte &
  & "CONNECT DEVICE FOR "+blink_on+"REVERSE"+blink_off+" MEASUREMENT" &
  'C,'O,'N,'N,'E,'C,'T,' ,'O,'E,'V,'I,'C,'E,' ,'F,'O,'R,' ,
  blink_on,
  'R,'E,'V,'E,'R,'S,'E,
  blink_off,
  ' ,'M,'E,'R,'S,'U,'R,'C,'M,'C,'N,'T,
  36,    & length byte &
  & "ATTEMPTED ILLEGAL TEST SET OPERATION" &
  'A,'T,'I,'E,'M,'P,'T,'E,'D,' ,'I,'L,'L,'C,'G,'A,'L,' ,'T,'E,'S,'T,' ,
  'S,'E,'T,' ,'O,'P,'E,'R,'A,'T,'I,'O,'N,
  14,    & length byte &
  & "ADC CAL FAILED" &
  'A,'D,'C,' ,'C,'A,'L,' ,'F,'A,'I,'L,'E,'D,
  13,    & length byte &
  & "IF CAL FAILED" &
  'I,'F,' ,'C,'A,'L,' ,'F,'A,'I,'L,'E,'D,
  18,    & length byte &
  & "ADC NOT RESPONDING" &
  'A,'D,'C,' ,'N,'O,'T,' ,'R,'E,'S,'P,'O,'N,'D,'I,'N,'G,
  20,    & length byte &
  & "MONITORRANGE CAL FAILED" &
  'M,'O,'N,'I,'T,'O,'R,'A,'N,'G,'E,' ,'C,'A,'L,' ,'F,'A,'I,'L,'E,'D,
  19,    & length byte &
  & "SWEEP TIME TOO FAST" &
  'S,'W,'E,'E,'P,' ,'T,'I,'M,'E,' ,'T,'O,'O,' ,'F,'A,'S,'T,
  51,    & length byte &
  & "UNABLE TO LOCK 10 EXT 10Mhz REF" &
  'U,'N,'A,'B,'L,'E,' ,'I,'O,' ,'L,'O,'C,'K,' ,'T,'O,' ,'E,'X,'T,' ,'1,
  '0,'M,'h,'z,' ,'R,'E,'F,
  34,    & length byte &
  & "'NEW CAL' OR 'STORED CAL' REQUIRED" &
  '','N,'E,'U,' ,'C,'R,'L,'',' ,'O,'R,' ,'','S,'T,'O,'R,'E,'D,' ,'C,'A,
  'L,'',' ,'R,'E,'Q,'U,'I,'R,'E,'D,
  37,    & length byte &
  & "THIS PARAMETER NOT IN COEFFICIENT SET" &
  'T,'H,'I,'S,' ,'P,'A,'R,'A,'M,'E,'T,'E,'R,' ,'N,'O,'T,' ,'I,'N,' ,'C,
  'O,'E,'F,'F,'I,'C,'I,'E,'N,'T,' ,'S,'E,'T,
  27,    & length byte &
  & "ADDITIONAL STANDARDS NEEDED" &
  'A,'D,'D,'I,'T,'I,'O,'N,'A,'L,' ,'S,'T,'A,'N,'D,'A,'R,'D,'S,' ,'N,'E,
  'E,'D,'E,'D,
  32,    & length byte &
  & "TURN CORRECTION OFF TO CALIBRATE" &
  'T,'U,'R,'N,' ,'C,'O,'R,'R,'E,'C,'T,'I,'O,'N,' ,'O,'F,'F,' ,'T,'O,' ,
  'C,'A,'L,'I,'B,'R,'A,'T,'E,
  36,    & length byte &
  & "NO CALIBRATION CURRENTLY IN PROGRESS" &
  'N,'O,' ,'C,'A,'L,'I,'B,'R,'A,'T,'I,'O,'N,' ,'C,'U,'R,'R,'E,'N,'T,'L,
  'Y,' ,'I,'N,' ,'P,'R,'O,'G,'R,'E,'S,'S,
  39,    & length byte &
  & blink_on+"CONNECT STD THEN PRESS KEY TO MEASURE"+blink_off &
  blink_on,
  'C,'O,'K,'N,'E,'C,'T,' ,'S,'T,'D,' ,'T,'H,'E,'N,' ,'P,'R,'E,'S,'S,' ,
  'K,'E,'Y,' ,'T,'O,' ,'M,'E,'M,'S,'U,'R,'E,
  blink_off,
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  42,    & length byte &
  & blink_on+"POSITION SLIDE THEN PRESS KEY TO MEASURE"+blink_off &
  blink_on,
  'P,'O,'S,'I,'T,'I,'O,'N,' ,'S,'L,'I,'D,'E,' ,'T,'H,'E,'N,' ,'P,'R,'E,
  'S,'S,' ,'K,'E,'Y,' ,'T,'O,' ,'M,'E,'A,'S,'U,'R,'E,
  blink_off,
  45,    & length byte &
  & blink_on+"CONNECT THRU THEN PRESS ERCN KEY TO MEASURE"+blink_off &
  blink_on,
  'C,'O,'N,'N,'C,'C,'T,' ,'T,'H,'R,'U,' ,'T,'H,'E,'N,' ,'P,'R,'E,'S,'S,
  ' ,'E,'R,'C,'N,' ,'K,'E,'Y,' ,'T,'O,' ,'M,'E,'A,'S,'U,'R,'E,
  blink_off,
  46,    & length byte &
  & blink_on+"ISOLATE PORTS THEN PRESS ERCN KEY TO MEASURE"+blink_off &
  blink_on,
  'I,'S,'O,'L,'A,'T,'E,' ,'P,'O,'R,'T,'S,' ,'T,'H,'E,'N,' ,'P,'R,'E,'S,
  'S,' ,'E,'R,'C,'N,' ,'K,'E,'Y,' ,'T,'O,' ,'M,'E,'A,'S,'U,'R,'E,
  blink_off,
  38,    & length byte &
  & blink_on+"PRESS 'DONE' IF FINISHED WITH STD(e)"+blink_off &
  blink_on,
  'P,'R,'E,'S,'S,' ,'','D,'O,'N,'E,'',' ,'1,'F,' ,'F,'1,'N,'I,'S,'K,'E,
  'D,' ,'U,'I,'I,'N,' ,'S,'T,'D,'(,'e,'),
  blink_off,
  35,    & length byte &
  & blink_on+"PRESS 'SAVE' IF FINISHED WITH CAL"+blink_off &
  blink_on,
  'P,'R,'E,'S,'S,' ,'','S,'A,'V,'E,'',' ,'I,'F,' ,'F,'I,'N,'I,'S,'H,'E,
  'D,' ,'U,'I,'T,'H,' ,'C,'A,'L,
  blink_off,
  30,    & length byte &
  & "CALIBRATION/CORRECTION ABORTED" &
  'C,'A,'L,'I,'B,'R,'A,'T,'I,'O,'N,'/,'C,'O,'R,'R,'E,'C,'T,'I,'O,'N,' ,
  'A,'B,'O,'R,'T,'C,'D,
  26,    & length byte &
  & "COMPUTING CAL COEFFICIENTS" &
  'C,'O,'M,'P,'U,'I,'I,'N,'G,' ,'C,'A,'L,' ,'C,'O,'C,'F,'F,'I,'C,'I,'E,
  'N,'T,'S,
  30,    & length byte &
  & blink_on+"WRIT--MEASURING CAL STANDARD"+blink_off &
  blink_on,
  'W,'R,'I,'T,'-,'-,'M,'E,'A,'S,'U,'R,'I,'N,'G,' ,'C,'A,'L,' ,'S,'T,'A,
  'N,'D,'A,'R,'D,
  blink_off,
  24,    & length byte &
  & blink_on+"SELECT CALIBRATION SET"+blink_off &
  blink_on,
  'S,'E,'L,'E,'C,'T,' ,'C,'A,'L,'I,'B,'R,'A,'T,'I,'O,'N,' ,'S,'E,'T,
  blink_off,
  40,    & length byte &
  & "NO SPACE FOR NEW CAL;  DELETE A CAL SET." &
  'N,'O,' ,'S,'P,'A,'C,'E,' ,'F,'O,'R,' ,'N,'E,'U,' ,'C,'A,'L,';,' ,' ,
  'D,'E,'L,'E,'T,'E,' ,'A,' ,'C,'A,'L,' ,'S,'E,'T,'.,
  18,    & length byte &
  & "MORE SLIDES NEEDED" &
  'M,'O,'R,'E,' ,'S,'L,'I,'D,'E,'S,' ,'N,'E,'E,'D,'E,'D,
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  25,    & length byte &
  & "SPECIFY CAL STANDARD TYPE" &
  'S,'P,'E,'C,'I,'F,'Y,' ,'C,'A,'L,' ,'S,'T,'A,'N,'D,'A,'R,'D,' ,'I,'Y,
  'P,'E,
  30,    & length byte &
  & "EXCEEDED 7 STANDARDS PER CLASS" &
  'E,'X,'C,'E,'E,'D,'E,'D,' ,'7,' ,'S,'T,'A,'N,'D,'A,'R,'D,'S,' ,'P,'E,
  'R,' ,'C,'L,'A,'S,'S,
  46,    & length byte &
  & "SPECIFY STDS FOR THIS CLASS, SEPARATED BY 'x1'" &
  'S,'P,'E,'C,'I,'F,'Y,' ,'S,'T,'D,'S,' ,'F,'O,'R,' ,'T,'H,'I,'S,' ,'C,
  'L,'A,'S,'S,',' ,'S,'E,'P,'A,'R,'A,'T,'E,'D,' ,'B,'Y,' ,'','x,'1,'',

  32,    & length byte &
  & "SELECT STANDARDS CLASS TO MODIFY" &
  'S,'E,'L,'E,'C,'T,' ,'S,'T,'A,'N,'D,'A,'R,'D,'S,' ,'C,'L,'A,'S,'S,' ,
  'T,'O,' ,'M,'O,'D,'I,'F,'Y,
  27,    & length byte &
  & "COMPUTING TIME COEFFICIENTS" &
  'C,'O,'M,'P,'U,'T,'I,'N,'G,' ,'T,'I,'M,'E,' ,'C,'O,'E,'F,'F,'I,'C,'I,
  'E,'N,'T,'S,
  27,    & length byte &
  & "COMPUTING GATE COEFFICIENTS" &
  'C,'O,'M,'P,'U,'T,'I,'N,'G,' ,'G,'A,'T,'E,' ,'C,'O,'E,'F,'F,'I,'C,'I,
  'E,'N,'T,'S,
  43,    & length byte &
  & "LOW-PASS TIME DOMAIN MAY CHANGE FREQ LIMITS" &
  'L,'O,'U,'-,'P,'A,'S,'S,' ,'T,'I,'M,'E,' ,'D,'O,'M,'A,'I,'N,' ,'M,'A,
  'Y,' ,'C,'H,'A,'N,'G,'E,' ,'F,'R,'E,'Q,' ,'L,'I,'M,'I,'T,'S,
  13,    & length byte &
  & "  FREQUENCY (" &
  ' ,' ,'F,'R,'E,'Q,'U,'E,'N,'C,'Y,' ,'(,
  8,     & length byte &
  & "  TIME (" &
  ' ,' ,'I,'I,'M,'E,' ,'(,
  7,     & length byte &
  & "  MUX (" &
  ' ,' ,'A,'U,'X,' ,'(,
  0;

END$
```

```
CANNOT.WORK.PDS51D          THU, DEC 22, 1983, 10:22 AM    PAGE  1

INTEGER CONSTANT
   ecalar_mkr  := 0,
   log_ang_mkr := 1,
   lin_ang_mkr := 2,
   lin_lin_mkr := 3,
   z_mkr       := 4,
   y_mkr       := 5;
```

```
FANNOT.WORK.PD851D          THU, DEC 22, 1983, 10:22 AM    PAGE  1

PROCEDURE  annotate_parameter;                          EXTERNAL.L;
PROCEDURE  annotate_mkr_value;                          EXTERNAL.L;
PROCEDURE  output_marker_value;                         EXTERNAL.L;
PROCEDURE  annotate_ref_value;                          EXTERNAL.L;
PROCEDURE  annotate_scale;                              EXTERNAL.L;
SUBROUTINE update_scale;                                EXTERNAL.L;
SUBROUTINE update_ref_value;                            EXTERNAL.L;
SUBROUTINE annotate_enhancements;                       EXTERNAL.L;
```

```
SANNOT.WORK.PD851D          THU, DEC 22, 1983, 10:22 AM    PAGE  1

MODULE P,"annotation"
BEGIN

TYPELENGTH USER3 : 6;

#FILE ftern.work;                                       & DEBUG &
#FILE ftern3.work;                                      & DEBUG &
#FILE cannot.work;
#FILE fscreen.work;
#FILE fstring.work;
#FILE cactive.work;
#FILE factivc2.work;
#FILE facttbl.work;
#FILE cchtable.work;                        & for ch_ constants &
#FILE fchtable.work;
#FILE fchtab2.work;                  & for ch_integer and ch_double &
#FILE fchdata.work;                             & for marker_state &
#FILE ffnt.work;
#FILE fmarker.work;
#FILE ftrace.work;                          & for partial and d_on &
#FILE fgratic.work;     & for graticule_type and trace_and_graticule &
#FILE fdisplay.work;                          & for jmp and printch &
#FILE fcompute.work;                  & for conv_to_z and _to_y &
#FILE ccal.work;                              & for correct_off &
#FILE caverage.work;                            & for avg_off &
#FILE fdatap.work;          & for gate_, smoothing_, and log_lin_ang &
                            & and contains ctrace0.work for update_f &
```

```
SANNOT.WORK.PD851D          THU, DEC 22, 1953, 10:22 AM    PAGE  2

#EJECT;
DOUBLE CONSTANT  db_annot_mask          := %01000000,
                 ref_annot_format       := %06040A03;
DOUBLE           mkr_annot_format       = ref_annot_format,
                 scale_annot_format     = ref_annot_format;

ALPHA TABLE param_annotation :=          & Must agree with ccontvar &
      "",          & unused  &           & Maximum size is        &
      'S+177+177,  & s11     &           & param_size from cscreen. &
      'S+178+177,  & s21     &
      'S+177+17S,  & s12     &
      'S+178+178,  & s22     &
      'Z+177,      & z1      &
      'Z+178,      & z2      &
      'Y+177,      & y1      &
      'Y+178,      & y2      &
      "User1",     & user1   &
      "User2",     & user2   &
      "User3",     & user3   &
      "User4";     & user4   &
```

```
SRNNOT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  3


#EJECT;
ALPHA TABLE mkr_label :=
      half_vt*primary_marker*"1",
      half_vt*primary_marker*"2",
      half_vt*primary_marker*"3",
      half_vt*primary_marker*"4",
      half_vt*primary_marker*"5",
            vt*vt*marker*"1",
            vt*vt*marker*"2",
            vt*vt*marker*"3",
            vt*vt*marker*"4",
            vt*vt*marker*"5";

INTEGER TABLE mkr_label_display :=                  & indexed by ch &
      0,
      mkr1_label_display,
      mkr2_label_display;

INTEGER TABLE mkr_real_display :=
      0,
      mkr1_real_display,
      mkr2_real_display;

INTEGER TABLE mkr_imag_display :=
      0,
      mkr1_imag_display,
      mkr2_imag_display;

INTEGER TABLE mkr_display_algorithm :=          & indexed by format &
      0,
      scalar_mkr,  &  1 log mag      &
      scalar_mkr,  &  2 lin mag      &
      scalar_mkr,  &  3 phase        &
      scalar_mkr,  &  4 delay        &
      scalar_mkr,  &  5 real         &
      scalar_mkr,  &  6 imaginary    &
      log_ang_mkr, &  7 log polar    &
      lin_ang_mkr, &  8 lin_polar    &
      lin_lin_mkr, &  9 imag vs real &
      z_mkr,       & 10 z-Smith      &
      y_mkr,       & 11 y-Smith      &
      scalar_mkr;  & 12 eur          &
```

```
SRNNOT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  4


#EJECT;
COMMENT                                                annotate_parameter
**************************************************************************
*
**************************************************************************
;
PROCEDURE  annotate_paraneter:                                      ENTRY;
  BEGIN & annotate_parameter &
    INTEGER paran_displa;
    INTEGER annot_index;

    If entry_ch_integer(ch_d_etate) = d_on THEN
      annot_index := entry_ch_integer(ch_paran)
    ELSE
      annot_index := 0;

    IF current_entry_ch = 1 THEN
      paran_display := param1_display
    ELSE & current_entry_ch = 2 &
      paran_display := param2_diaplay;

    print_etring( paran_annotatien[ annot_index ],
                  paran_size, peran_dispiey);

  END;  & annotate_parameter &
```

```
SRNNOT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  5


#EJECT;
COMMENT                                                annctate_nkr_value
**************************************************************************
*
**************************************************************************
;
PROCEDURE  annotate_nkr_value;                                      ENTRY;
  BEGIN & annotate_nkr_value &
    INTEGER d_itate,
            n_atate,
            index,
            ch,
            fnt,
            dg_addr;
    USER3   nkr_user3;                                      & DEBUG &
    COMPLEX nkr_conplex;                                    & DEBUG &
    REAL    nkr_real,
            nkr_inag,
            tenp_real;
    BYTE ARRAY annot_array[-1:nkr_display_size];
    ALPHA       annot_string;

    & initialize string &
    annot_string := ADRS( annot_array );
    annot_string := init_string( annot_string, nkr_display_size );


    FOR ch := 1 UNTIL max_ch DO
      BEGIN & for &
        d_state := ch_integer( ch_d_state, ch );
        n_state := ch_integer( ch_n_itatc, ch );
        IF [ ([narker_state AND X003F) <> 0) AND
             ((d_state=d_on) OR (n_state=n_on))
           ) THEN
          BEGIN & if &
            fnt := ch_integer( ch_format, ch );
            nkr_user3 := ch_nkr_value(ch);                  & DEBUG &
            CASE nkr_display_algorithn[fnt] OF
              BEGIN & case &
& 0 scalar_nkr  &       BEGIN & scalar &
                          nkr_conplex := nkr_user3;
                          nkr_real := REAL( nkr_conplex );
                          nkr_inag := IMAG( nkr_conplex );
                        END;  & scalar &
& 1 log_ang_nkr &       BEGIN & log_ang_nkr &
                          nkr_real := lcg_lin_ang(          & log &
                                      ch_double(ch_f_base,ch),
                                      marker_point(
                                                  active_narker,
                                                  ch
                                      ) * step_size,
                                      TRUE,           & polar &
                                      tenp_real,        & lin &
                                      nkr_inag          & ang &
                                          );
                        END;  & log_ang_nkr &
```

```
SRNNOT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM    PAGE  6


& 2 lin_ang_nkr &       BEGIN & lin_ang_nkr &
                          tenp_real := log_lin_ang(         & log &
                                       ch_double(ch_f_base,ch),
                                       narker_point(
                                                  active_narker,
                                                  ch
                                       ) * step_aize,
                                       TRUE,          & polar &
                                       nkr_real,        & lin &
                                       nkr_inag         & ang &
                                           );
                        END;  & lin_lin_nkr &
& 3 lin_lin_nkr &       BEGIN & lin_lin_nkr &
                          nkr_complex := nkr_user3;
                          nkr_real := REAL( nkr_complex );
                          nkr_inag := IMAG( nkr_complex );
                        END;  & lin_lin_nkr &
& 4 z_nkr       &       BEGIN & z_nkr &
                          ASSEMBLE( MOVEM.L nkr_user3, R0/R1; SURP R1;
                                    JSR     conv_to_z.L;      SURP R1;
                                    MOVEM.L R0/R1, nkr_user3          );
                          nkr_complex := nkr_user3;
                          nkr_real := REAL( nkr_complex );
                          nkr_inag := IMAG( nkr_complex );
                        END;  & z_nkr &
& 5 y_nkr       &       BEGIN & y_nkr &
                          ASSEMBLE( MOVEM.L nkr_user3, R0/R1; SURP R1;
                                    JSR     conv_to_y.L;      SURP R1;
                                    MOVEM.L R0/R1, nkr_user3          );
                          nkr_complex := nkr_user3;
                          nkr_real := REAL( nkr_complex );
                          nkr_inag := IMAG( nkr_complex );
                        END;  & y_nkr &
                    END;  & case &

                  IF ch = current_entry_ch THEN
                    index := active_narker - 1
                  ELSE
                    index := active_marker + 4;
                  print_etring( nkr_label[index],
                                nkr_label_size,
                                nkr_label_display[ch]
                              );
                  print_string( append_string(
                                        format_real(
                                             nkr_real,
                                             annot_string,
                                             format_table[
                                                nkr_real_format[fnt]
                                                         ]
                                             ),
                                        suffix[nkr_real_suffix[fnt]]
                                        ),
                                nkr_display_size,
                                nkr_real_display[ch]
                              );
```

```
SAMNOT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  7

            IF format_table[mkr_imag_format[fnt]] <> 0 THEN
               BEGIN & if &
                  print_string[ append_string[
                                    format_real(
                                       mkr_imag,
                                       annot_string,
                                       format_table[
                                          mkr_imag_format[fnt]
                                                      ]
                                                ),
                                    suffix[mkr_imag_suffix[fnt]]
                                          ),
                                 mkr_display_size,
                                 mkr_imag_display[ch]
                               );
               END   & if &
            ELSE
               dg_eddr := jmp( mkr_imag_display[ch],
                               mkr_imag_display[ch] +
                                  mkr_display_size
                             );
         END   & if &
      ELSE
         dg_eddr := jmp( mkr_label_display[ch],
                         mkr_imag_display[ch] + mkr_display_size
                       );
   END;  & for &

END;  & annotate_mkr_value &
```

```
SAMNOT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  8

REJECT;
COMMENT                                                annotate_ref_value
*************************************************************************
*
*************************************************************************
;
PROCEDURE  annotate_ref_value;                                      ENTRY;
   BEGIN & annotate_ref_value &
      INTEGER ref_display,
              annot_units;
      DOUBLE  annot_format;
      BYTE ARRAY annot_array[-1:ref_size];
      ALPHA       annot_string;

      & initialize string &
      annot_string := ADRS( annot_array );
      annot_string := init_string( annot_string, ref_size );

      IF current_entry_ch = 1 THEN
         ref_display := ref1_display
      ELSE & current_entry_ch = 2 &
         ref_display := ref2_display;
      annot_format := ref_annot_format;
      annot_units := get_active( get_suffix_index, active_ref_value );
      IF ( (annot_units=2) OR (annot_units=5) ) THEN
         annot_format := annot_format OR db_annot_mask;
      print_string( format_real( entry_ch_real( ch_ref_value ),
                                 annot_string,
                                 annot_format
                               ),
                    ref_size,
                    ref_display
                  );

      IF current_entry_ch = 1 THEN
         ref_display := ref1_suffix_display
      ELSE & current_entry_ch = 2 &
         ref_display := ref2_suffix_display;
      print_string( active_suffix( active_ref_value ),
                    ref_suffix_size,
                    ref_display
                  );

   END;  & annotate_ref_value &
```

```
SAMNOT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  9

REJECT;
COMMENT                                                annotate_scale
*************************************************************************
*
*************************************************************************
;
PROCEDURE  annotate_scale;                                          ENTRY;
   BEGIN & annotate_scale &
      INTEGER scale_display,
              annot_units;
      DOUBLE  annot_format;
      BYTE ARRAY annot_array[-1:scale_size];
      ALPHA       annot_string;

      & initialize string &
      annot_string := ADRS( annot_array );
      annot_string := init_string( annot_string, scale_size );

      IF current_entry_ch = 1 THEN
         scale_display := scale1_display
      ELSE & current_entry_ch = 2 &
         scale_display := scale2_display;
      annot_format := scale_annot_format;
      annot_units := get_active( get_suffix_index, active_scale );
      IF ( (annot_units=2) OR (annot_units=5) ) THEN
         annot_format := annot_format OR db_annot_mask;
      print_string( format_real( entry_ch_real( ch_scale ),
                                 annot_string,
                                 annot_format
                               ),
                    scale_size,
                    scale_display
                  );

      IF current_entry_ch = 1 THEN
         scale_display := scale1_suffix_display
      ELSE & current_entry_ch = 2 &
         scale_display := scale2_suffix_display;
      clear_string( annot_string );
      append_string( annot_string, active_suffix( active_scale ) );
      print_string( append_ch( annot_string, ' ' ),
                    scale_suffix_size,
                    scale_display
                  );

   END;  & annotate_scale &
```

```
SAMNOT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE 10

REJECT;
COMMENT                                                update_scale
*************************************************************************
*
*************************************************************************
;
SUBROUTINE update_scale;                                            ENTRY;
   BEGIN & update_scale &

      annotate_scale;
      IF graticule_type(current_entry_ch) = smith THEN
         trace_and_graticule;
      partial( update_f );

   END;  & update_scale &
```

```
SRHHDT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  11


REJECT;
COMMENT                                                  update_ref_value
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE update_ref_value;                                          ENTRY;
   BEGIN & update_ref_value &

      annotate_ref_value;
      IF graticule_type(current_entry_ch) = smith THEN
         trace_and_graticule;
      partial( update_f );

   END;  & update_ref_value &
```

```
SRHHDT.WORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  12


REJECT;
COMMENT                                              annotate_enhancements
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE annotate_enhancements;                                     ENTRY;
   BEGIN & annotate_enhancements &
      LABEL exit;                                                  & DEBUG &
                                                                   & DEBUG &
      GO TO exit;                                                  & DEBUG &

      & display enhancement flags &
      IF ( (ch_integer(ch_average_mode, 1) = avg_off) AND
           (ch_integer(ch_average_mode, 2) = avg_off)
         ) THEN
         printch( averaging_display, ' ' )
      ELSE
         printch( avereging_display, 'A );

      IF ( (ch_integer(ch_correction_mode, 1) = correct_off) AND
           (ch_integer(ch_correction_mode, 2) = correct_off)
         ) THEN
         printch( correction_display, ' ' )
      ELSE
         printch( correction_display, 'C );

      IF ( (ch_integer(ch_gating, 1) = gate_off) AND
           (ch_integer(ch_gating, 2) = gate_off)
         ) THEN
         printch( gating_display, ' ' )
      ELSE
         printch( gating_display, 'G );

      IF ( (ch_integer(ch_smoothing_mode, 1) = smoothing_off) AND
           (ch_integer(ch_smoothing_mode, 2) = smoothing_off)
         ) THEN
         printch( smoothing_display, ' ' )
      ELSE
         printch( smoothing_display, 'S );
                                                                   & DEBUG &
exit:                                                              & DEBUG &

   END;  & annotate_enhancements &

END$
```

```
ZRPPMBM.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM     PAGE   1


#
# Modified for 8510 monitor ROM.
#
#-----------------------------------------------------------------------
# This a software tools script file that will allow
# adding check-sums to data that is to be zapped.
# You will have to create your own copy of this file containing
# addresses, etc. to match your specific setup.
# Note that the shell allows passing parametcrs in if desired (using
# the notation $1 for first parameter, $2 for second, etc.)
# Also, you may use the "?" option of ZRPP to pick up answers.
#
# This basic script file will work with both "cksum8" and "cksum16"
# and may be edited to use whichever is desired.
# With either, specify <MSBits-addr> the same as <LSBits-addr>
# to get it's respective lower resolution check-sum generation.
#
#                          Lewis Newton
#-----------------------------------------------------------------------
#
# Check-sum generation.
#
# First we run ZRPP to load data in the 64K buffer address space file
# that ZRPP will leave behind when we issue a file equation to
# cause it to be saved.  Here we specify only how data is
# to be read by ZRPP.  We ask for no output at this point by asking
# that 0 locations be output.
#
cat - <<Z >tempcmd:temp
*OBJ ;data file name?
1 ;data type?
H ;disable buffering? (buffering on)
  ;start address?
  ;offset?
0 ;locations? (want no output)
  ;width?
1 ;unprogranned state?
4 ;option? (hex dump,no output)
N ;more?
Z
@purge zappscxx,temp
@file zappscxx;temp
@file zappcmd=tempcmd,oldtemp
zapp.pub.upsoft
@reset zappcmd
#
# Now we run the check-sum generation program that will add check-sums
# at the appropriate locations in the 64K buffer address space file.
#
@file zappscxx.oldtemp
cksum16.pub.upsoft;npeio <<Z
2048,4093,4094,4035
Z
@reset zappscxx
R
```

```
ZRPPMBM.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM     PAGE   2


# Now we run zapp and pick up the buffer address space data file
# that now has check-sums in place.  We add no new data, but here
# only specify how data is to be output.
#
cat - <<Z >tempcmd:temp
\$null;data file? (no new data)
      ;data type? (no new data)
OLD   ;disable buffering? (get buffer file)
0     ;start address?
0     ;offset?
4096  ;locations?
      ;width?
1     ;unprogranned state?
1     ;option?
      ;aux zapper ends?
H     ;more?
Z
@file zappscxx,oldtemp
@file zappcmd=tempcmd,oldtemp
zapp.pub.upsoft
@reset zappscxx
@reset zappcmd
```

ZAPPMON.WORK.PUB510 THU, DEC 22, 1983, 10:23 AM PAGE 1

```
#
# Modified for 8510 monitor BOM.
#
#-------------------------------------------------------------------
# This a software tools script file that will allow
# adding check-sums to data that is to be zapped.
# You will have to create your own copy of this file containing
# addresses, etc. to match your specific setup.
# Note that the shell allows passing parameters in if desired (using
# the notation $1 for first parameter, $2 for second, etc.)
# Also, you may use the "?" option of ZAPP to pick up answers.
#
# This basic script file will work with both "cksum8" and "cksum16"
# and may be edited to use whichever is desired.
# With either, specify <A8Bits-addr> the same as <L3Bits-addr>
# to get it's respective lower resolution check-sum generation.
#
#                          Lewis Kenton
#--------------  -  ----------------------------------------------
#
# Check-sum generation.
#
# First we run ZAPP to load data in the 64K buffer address space file
# that ZAPP will leave behind when we issue a file equation to
# cause it to be saved.  Here we specify only how data is
# to be read by ZAPP.  We ask for no output at this point by asking
# that 0 locations be output.
#
cat - <<Z >tempcmd:temp
*OBJ ;dets file none?
1 ;data type?
K ;disable buffering? (buffering on)
  ;start address?
  ;offset?
0 ;locations? (want no output)
  ;width?
1 ;unprogramned state?
4 ;option? (hex dump,no output)
N ;more?
Z
@purge zappscxx,temp
@file zappscxx;temp
@file zappcmd=tempcmd,oldtemp
zapp.pub.upsoft
@reset zappcmd
#
# Now we run the check-sum generation program that will add check-sums
# at the appropriate locations in the 64K buffer address space file.
#
@file zappscxx,oldtemp
cksum16.pub.upsoft:npeio <<Z
6,8191,4,5
Z
@reset zappscxx
#
```

ZAPPMON.WORK.PUB510 THU, DEC 22, 1983, 10:23 AM PAGE 2

```
# Now we run zapp and pick up the buffer address space data file
# that now has check-sums in place.  We add no new data, but here
# only specify how data is to be output.
#
cat - <<Z >tempcmd:temp
\@null;data file? (no new data)
      ;data type? (no new data)
OLD   ;disable buffering? (get buffer file)
0     ;start address?
0     ;offset?
8192  ;locations?
      ;width?
1     ;unprogramned state?
1     ;option?
@31   ;aux zapper ends?
N     ;more?
Z
@file zappscxx,oldtemp
@file zappcmd=tempcmd,oldtemp
zapp.pub.upsoft
@reset zappscxx
@reset zappcmd
```

CHARRAY.WORK.PUB510 THU, DEC 22, 1983, 10:23 AM PAGE 1

```
BYTE CONSTANT array_ch_mask     := %03,
              time_update_mask  := %20,
              array_update_mask := %40,
              array_abort_mask  := %80;
```

FARRAY.WORK.PUB510 THU, DEC 22, 1983, 10:23 AM PAGE 1

```
PROCEDURE  array_update;      & a process &                    EXTERNAL.L;
```

```
SARRRY.WORK.POS510              THU, DEC 22, 1983, 10:23 RM     PAGE   1


%68KL,P,"array"
BEGIN

#FILE ftrace.work;
#FILE ffifo.work;
#FILE ffifoa.work;
#FILE crins.work;           & for processing_variables and fifo "rins" &
#FILE fkerncl.work;                        & for acquire and release &
#FILE fdatap.work;        & for control_data_proc and update_data_proc &
#FILE ccntable.work;
#FILE fchtable.work;
#FILE carray.work;
#FILE ftime.work;                          & for control_data_proc_time &

BYTE time_update_pending;    & pending time-variables update, 1 bit/ch &
```

```
SARRRY.WORK.PD8510              THU, DEC 22, 1983, 10:23 RM     PAGE   2


#EJECT;
COMMENT                                                        array_update
**************************************************************************
*
**************************************************************************
;
PROCEDURE  array_update;       & a process &                        ENTRY;
   BEGIN & array_update &
      LABEL   loop;
      INTEGER fifo_word;
      BYTE    channel,
              fifo_word_upper = fifo_word,
              fifo_word_lower = fifo_word+1,
              ch1_accum,
              ch2_accum;

      time_update_pending := 3;       & first time: update ch1 and ch2 &
      ch1_accum := 0;
      ch2_accum := 0;

loop:

         BEGIN & do &

            fifo_word := read_fifo( array_update_fifo );

            channel := fifo_word_upper AND array_ch_mask;

            IF (channel AND %0001) <> 0 THEN
               ch1_accum := ch1_accum OR fifo_word_lower;
            IF (channel AND %0002) <> 0 THEN
               ch2_accum := ch2_accum OR fifo_word_lower;

            IF (fifo_word_upper AND time_update_mask) <> 0 THEN
               time_update_pending := SBIT(time_update_pending,channel);

            IF (fifo_word_upper AND array_update_mask) <> 0 THEN
               BEGIN & if &
                  acquire( processing_variables );
                  control_data_proc( channel );
                  release( processing_variables );
               END;  & if &

         END;  & do &
            & eventually make this a DO...UNTIL no fifo data pending &


      WHILE (ch1_accum <> 0) DO
         BEGIN & while &
            IF TBIT( time_update_pending, 1 ) THEN
               BEGIN & if &
                  control_data_proc_time( 1 );
                  time_update_pending := RBIT( time_update_pending, 1 );
               END;  & if &

            acquire( processing_variables );
```

```
SARRRY.WORK.PD8510              THU, DEC 22, 1983, 10:23 RM     PAGE   3


            update_data_proc( 1, ch1_accum );
            release( processing_variables );
                                                          & DEBUG &
            ch1_accum := 0;                               & DEBUG &

         END;  & while &


      WHILE (ch2_accum <> 0) DO
         BEGIN & while &
            IF TBIT( time_update_pending, 2 ) THEN
               BEGIN & if &
                  control_data_proc_time( 2 );
                  time_update_pending := RBIT( time_update_pending, 2 );
               END;  & if &

            acquire( processing_variables );
            update_data_proc( 2, ch2_accum );
            release( processing_variables );
                                                          & DEBUG &
            ch2_accum := 0;                               & DEBUG &

         END;  & while &

      GO TO loop;

   END;  & array_update &
```

```
SARRRY.WORK.PD8510              THU, DEC 22, 1983, 10:23 RM     PAGE   4


#EJECT;
COMMENT                                              init_array_update_fifo
**************************************************************************
*
**************************************************************************
;
PROCEDURE  init_array_update_fifo;                                   ENTRY;
   BEGIN & init_array_update_fifo &
      init_fifo( array_update_fifo,
                 array_update_fifo_size,
                 array_fifo,
                 array_fifo_not_full,
                 array_fifo_not_empty );
   END;  & init_array_update_fifo &

EMOS
```

```
CATABLE2.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM    PAGE  1


BYTE CONSTANT    domain_dependent        := 1, & for "active" tables   &
                 format_dependent        := 2,
                 byte_type               := 1, & for active_table_type &
                 integer_type            := 2,
                 domain_n_format_depend  := 3;

BYTE CONSTANT    display_alt             := 0, & for display_alt'_value&
                 dont_display_alt        := 1,
                 make_positive           := 0, & for must_be_positive  &
                 dont_make_positive      := 1,
                 store                   := 0, & for chtable_store     &
                 dont_store              := 1;

INTEGER CONSTANT ch_byte_type     := 1,
                 ch_integer_type  := 2,
                 ch_user3_type    := 3,
                 ch_real_type     := 4,
                 ch_double_type   := 5,
                 ch_quad_type     := 6,
                 ch_none          := 0;
```

```
CBIABLES.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM    PAGE  1

INTEGER CONSTANT get_suffix_index       := 0,       & indices into   &
                 get_format_index       := 1,       & "active_tables"&
                 get_min_limit_index    := 2,
                 get_max_limit_index    := 3,
                 get_chtable_index      := 4,
                 get_chtable_type       := 5,
                 get_chtable_store      := 6,
                 get_algorithm          := 7,
                 get_display_alt_value  := 8,
                 get_must_be_positive   := 9,
                 get_log_scale_div_3    := 10;

INTEGER CONSTANT aperture_format     := 3, & index into format_table &
                 distance_format     := 3,
                 frequency_format    := 5,
                 sweep_time_format   := 6,
                 source_pwr_format   := 6,
                 output_format       := 7,
                 output_integer_format:= 8,
                 db_format           := 10,
                 test_set_atten_format:= 11;

INTEGER CONSTANT distance_suffix     := 17; & index into suffix table &
```

```
FRTABLES.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM    PAGE  1

#FILE catables.work;

EXTERNAL ALPHA  TABLE suffix.L;
EXTERNAL BYTE   TABLE mkr_real_suffix.L;
EXTERNAL BYTE   TABLE mkr_imag_suffix.L;
EXTERNAL DOUBLE TABLE format_table.L;
EXTERNAL BYTE   TABLE mkr_real_format.L;
EXTERNAL BYTE   TABLE mkr_imag_format.L;
EXTERNAL QUAD   TABLE limit.L;
EXTERNAL DOUBLE TABLE active_tables.L;
EXTERNAL BYTE   TABLE active_table_type.L;
EXTERNAL REAL   TABLE scale_factors.L;
EXTERNAL REAL   TABLE unscale_factors.L;
```

```
SRTABLES.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM    PAGE  1

MGBKL,P,"atables"
BEGIN

#FILE catable2.work;
#FILE catables.work;
#FILE cchtable.work;
#FILE cchars.work;
```

```
SATABLES.WORK.PO8510          THU, DEC 22, 1983, 10:23 AM    PAGE  2


#EJECT;
GLOBAL ALPHA TABLE suffix :=                & indexed by suffix_index &
   & 0 &   "",
   & 1 &   "hz",
   & 2 &   "dB",          & change display_active_... if this changes &
   & 3 &   "Div",
   & 4 &   "s",                    & seconds without distance readout &
   & 5 &   "dBm",         & change display_active_... if this changes &
   & 6 &   "s",                     & seconds with distance readout &
   & 7 &   "V",
   & &&   degree,
   & 9 &   omega,
   & 10 &  "S",                                          & Siemen &
   & 11 &  "U.",         & Units for space critical marker annotation &
   & 12 &  "W",
   & 13 &  "Unite",
   & 14 &  "X 3PAM",
   & 15 &  "dB/GHz",
   & 16 &  omega*"/s",
   & 17 &  "m",                                          & meters &
   & XX &  "";

BYTE TABLE suffix_index_neg :=      & BUST BE EVEN LENGTH - PAD AT TOP &
   &-1&          &  format_dependent,
   &-17 log mag  &  2,
   &-16 lin mag  &  13,
   &-15 phase    &  8,
   &-14 delay    &  6,
   &-13 real     &  13,
   &-12 imag     &  13,
   &-11 log polar &  13,
   &-10 lin polar &  13,
   & -9 imag vs real  &  13,
   & -& z smith  &  13,
   & -7 y smith  &  13,
   & -5 vsur     &  0,
   & -5          &  domain_dependent,
   & -4 freq domain   &  1,
   & -3 time band-pass &  6,
   & -2 time low-pass  &  6,
   & -1 aux  domain    &  7;
BYTE TABLE suffix_index :=                  & indexed by active function &
   & 0 off       &  0,
   & 1 start     &  -5,
   & 2 stop      &  -5,
   & 3 center    &  -5,
   & 4 span      &  -5,
   & 5 cw        &  -5,
   & 6 sweep time    &  4,              & end of source functions &
   & 7 source power  &  5,
   & 8 power slope   &  15,
   & 9 port 1 atten  &  2,
   & 10 port 2 atten &  2,
   & 11 ref pos'n    &  3,
   & 12 scale/div    &  -18,
   & 13 ref value    &  -18,
```

```
SBIABLES.UORK.POB510          THU, DEC 22, 1983, 10:23 AM    PAGE  3


   & 14 unused       &  0,
   & 15 title        &  0,
   & 16 # groups hpib &  0,
   & 17 if avg factor &  0,
   & 18 smoothing aper.&  14,
   & 19 orq mask prin. &  0,
   & 20 srq mask secon.&  0,
   & 21 revision     &  0,
   & 22 aux out      &  7,
   & 23 keycode      &  0,
   & 24 electr delay &  6,
   & 25 phase offset &  8,
   & 25 marker 1     &  -5,
   & 27 marker 2     &  -5,
   & 28 marker 3     &  -5,
   & 29 marker 4     &  -5,
   & 30 marker 5     &  -5,
   & 31 address      &  0,
   & 32 peek         &  0,
   & 33 poke         &  0,
   & 34 open c0      &  0,
   & 35 open c1      &  0,
   & 36 open c2      &  0,
   & 37 gate start   &  &,
   & 38 gate stop    &  &,
   & 39 gate center  &  &,
   & 40 gate open    &  6,
   & 41 mag slope    &  0,
   & 42 mag offset   &  13,
   & 43 stimulus slope &  0,
   & 44 stimulus offset&  -5,
   & 45 ref plane 1  &  6,
   & 45 ref plane 2  &  6,
   & 47 system z0    &  9,
   & 48 major addr   &  0,
   & 49 minor addr   &  0,
   & 50 pass thru addr &  0,
   & 51 source addr  &  0,
   & 52 test-set addr &  0,
   & 53 plotter addr &  0,
   & 54 printer addr &  0,
   & 55 ch end addr  &  0,
   & 55 offset delay &  6,
   & 57 offset loss  &  16,
   & 58 offset z0    &  9,
   & 59 offset min f &  1,
   & 60 offset max f &  1,
   & 61 std id       &  0,
   & 62 std class    &  0,
   & 63 # groups kbd &  0,
   & 99 place holder &  0;
GLOBAL BYTE TABLE mkr_real_suffix :=              & indexed by format &
                    0,
   &    log mag     &  2,
   &    lin mag     &  11, & temporary "U," for "Unite" &   & DEBUG &
   &    phase       &  8,
```

```
SATABLES.UORK.POB510          THU, DEC 22, 1983, 10:23 AM    PAGE  4


   &    delay       &  6,
   &    real        &  11, & temporary "U." for "Units" &   & DEBUG &
   &    imag        &  11, & temporary "U." for "Units" &   & DEBUG &
   &    log polar   &  2,
   &    lin polar   &  11, & temporary "U." for "Units" &   & DEBUG &
   &    imag vs real  &  11, & temporary "U." for "Units" &   & DEBUG &
   &    z smith     &  9,
   &    y smith     &  10,
   &    vsur        &  0;
GLOBAL BYTE TABLE mkr_imag_suffix :=              & indexed by format &
                    0,
   &    log mag     &  0,
   &    lin mag     &  0,
   &    phase       &  0,
   &    delay       &  0,
   &    real        &  0,
   &    imag        &  0,
   &    log polar   &  8,
   &    lin polar   &  8,
   &    imag vs real  &  11, & temporary "U." for "Units" &   & DEBUG &
   &    z smith     &  5,
   &    y smith     &  10,
   &    vsur        &  0;
```

```
SATABLES.UORK.POB510          THU, DEC 22, 1983, 10:23 AM    PAGE  5


#EJECT;
& display formats &
GLOBAL DOUBLE TABLE format_table :=   & indexed by active_format_index &
   & 0 &          0,
   & 1 &   X1600140C,  & fixed exponent w/12 decimal digits &
   & 2 &   X1600140C,  & for values stored scaled -- tested by acttbl &
   & 3 &   X16051404,  & general_purpose floating point &
   & 4 &   &17001400,  & fixed integer &
   & 5 &   &1000000F,  & frequency format for private HP-IB &
   & 5 &   X1005000F,  & time and power to source &
   & 7 &   X30001S0F,  & for HP-IB output &
   & 8 &   X37000S00,  & for HP-IB integer output &
   & 9 &          0,  & unused &
   & 10 &  X17051404,  & forced 0 exponent &
   & 11 &  X17051400,  & fixed integer scaled &
   & 12 &  X1700140F;  & unused ? &

BYTE TABLE active_format_neg :=     & BUST BE EVEN LENGTH - PAD AT TOP &
   &-18 <min scale>   & format_dependent,
   &-17 log mag       &  3,
   &-16 lin mag       &  3,
   &-15 phase         &  3,
   &-14 delay         &  3,
   &-13 real          &  3,
   &-12 imag          &  3,
   &-11 log polar     &  3,
   &-10 lin polar     &  3,
   & -5 imag vs real  &  3,
   & -8 a smith       &  3,
   & -7 y smith       &  3,
   & -6 vsur          &  10,
   & -5 <start,...>   & domain_dependent,
   & -4 freq domain   &  1,
   & -3 time band-pass &  2,
   & -2 time low-pass  &  2,
   & -1 aux  domain    &  2;
BYTE    TABLE active_format_index :=        & index into format_table &
   & 0 off       &  0,
   & 1 start     &  -5,
   & 2 stop      &  -5,
   & 3 center    &  -5,
   & 4 span      &  -5,
   & 5 cw        &  -5,
   & 6 sweep time    &  3,
   & 7 source power  &  3,
   & 8 power slope   &  3,
   & 9 port 1 atten  &  3,
   & 10 port 2 atten &  3,
   & 11 ref pos'n    &  3,
   & 12 scale/div    &  -18,
   & 13 ref value    &  -18,
   & 14 unused       &  0,
   & 15 title        &  0,
   & 16 # groups hpib &  0,
   & 17 if avg factor &  3,
   & 18 smoothing aper.&  10,
```

```
SATABLES.WORK.PDS510          THU, DEE 22, 1983, 10:23 AM    PAGE  6


   & 19 srq nask prin. &  4,
   & 20 srq nask secon.&  4,
   & 21 revision       &  0,
   & 22 aux out        &  3,
   & 23 keycode        &  0,
   & 24 electr delay   &  1,
   & 25 phase offset   &  3,
   & 25 narker 1       & -5,
   & 27 narker 2       & -5,
   & 28 narker 3       & -5,
   & 29 narker 4       & -5,
   & 30 narker 5       & -5,
   & 31 address        &  4,
   & 32 peek           &  4,
   & 33 poke           &  4,
   & 34 open c0        &  3,
   & 35 open c1        &  3,
   & 35 open c2        &  3,
   & 37 gate start     &  2,
   & 38 gate stop      &  2,
   & 39 gate center    &  2,
   & 40 gate apan      &  2,
   & 41 nag elope      & -18,
   & 42 nag affeet     & -18,
   & 43 etinuius elope &  3,
   & 44 stinulus off8et& -5,
   & 45 ref plane 1    &  1,
   & 46 ref plane 2    &  1,
   & 47 eysten z0      &  3,
   & 48 major addr     &  4,
   & 49 ninor addr     &  4,
   & 50 paea thru addr &  4,
   & 51 source addr    &  4,
   & 52 test-set addr  &  4,
   & 53 plotter addr   &  4,
   & 54 printer addr   &  4,
   & 55 ch end addr    &  4,
   & 56 offset delay   &  1,
   & 57 offset loss    &  3,
   & 58 offset z0      &  3,
   & 59 offset nin f   &  3,
   & 60 offset nax f   &  3,
   & 61 std id         &  0,
   & 62 std class      &  0,
   & 63 N groups kbd   &  0,
   & 99 place holder   &  0;
GLOBAL BYTE TABLE nkr_real_format :=              & indexed by format &
                                   0,
   &    log nag        & 10,
   &    lin nag        &  3,
   &    phase          &  3,
   &    delay          &  3,
   &    real           &  3,
   &    inag           &  3,
   &    log polar      & 10,
   &    lin polar      &  3,
```

```
SATABLES.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM    PAGE  7


   &    inag vs real   &  3,
   &    z enith        &  3,
   &    y enith        &  3,
   &    vsur           & 10;
GLOBAL BYTE TABLE nkr_inag_format :=              & indexed by format &
                                   0,
   &    log nag        &  0,
   &    lin nag        &  0,
   &    phase          &  0,
   &    delay          &  0,
   &    real           &  0,
   &    inag           &  0,
   &    log polar      &  3,
   &    lin polar      &  3,
   &    inag va real   &  3,
   &    z snith        &  3,
   &    y 8nitb        &  3,
   &    vsur           &  0;
```

```
8RT6BLES.WORK.P08510          THU, DEC 22, 1983, 10:23 AM    PAGE  8


WEJECT;
GLOBAL OURD TABLE limit := & indexed by nin_limit_ and nax_limit_index &
&   /  .  / / /  /  --  / = 10**3   . = 10**12  &
                    0, &  0 no limit operation &
                    0, &  1 zero &
                    1, &  2 &
                   10, &  3 &
                   22, &  4 nax number of cal standards &
                   31, &  5 naximun HP-IB address (31=off) &
                  199, &  6 (4 times nax title eet index) - 1 &
                 4096, &  7 &
                65535, &  8 nax integer     = X00000000000OFFFF &
               -32768, &  9 nin integer     = XFFFFFFFFFFFF8000 &
          -25000000, & 10 nin time (time domain) scaled &
        20000000000, & 11 nax time (time domain) scaled &
                    0, & 12 nin frequency (nodified by test-set limits) &
                    0, & 13 nin narker -- set by update_start_stop_... &
           1000000000, & 14 scaled 0.001 &
         -2147483648, & 15 nin double      = XFFFFFFFF80000000 &
          4294967295, & 16 nix double      = X00000000FFFFFFFF &
           10000000000, & 17 scaled 0.01 &
          100000000000, & 18 scaled 0.1 (nin smoothing aperture only) &
          999000000000, & 19 nax narker -- set by update_start_stop_... &
          999000000000, & 20 nax frequency (nodified by test-set limits) &
          999000000000, & 21 nax frequency (unlinited by eource/testoet) &
        200000000000, & 22 scaled 2 &
       9995117190000, & 23 ecals_factor*10/2048 -- nax aux out &
     -100000000000000, & 24 ecaled  -10 &
      100000000000000, & 25 scaled   10 &
      200000000000000, & 26 scaled 20       = 00000101A94A2000 &
-1000000000000000000, & 27 scaled -100@15 &
 1000000000000000000, & 28 scaled  100@15 &
    127000000000000, & 29 nax byte scaled = X00000B8CF2FD1800 &
   -360000000000000, & 30 scaled -360 &
    360000000000000, & 31 scaled  360 &
   -500000000000000, & 32 scaled -500 &
    500000000000000, & 33 scaled  500 &
       200000000000, & 34 scaled 0.2 tenporary Snith ref_value&& DEBUG &
        40000000000; & 34 scaled 0.04 tenporary Snith scale &  & DEBUG &
&   \  .  \  \  \  \  --  \ = 10**3   . = 10**12  &

BYTE TABLE nin_limit_index_neg :=   & MUST BE EVEN LENGTH - PAD AT TOP &
   &-32 filler         &  0,
   &-31 <nin ref_value>& format_dependent,
   &-30 log nag        & 32,
   &-29 lin nag        & 32,
   &-28 phase          & 32,
   &-27 delay          & 32,
   &-26 real           & 32,
   &-25 inag           & 32,
   &-24 log polar      & 32,
   &-23 lin polar      & 32,
   &-22 inag vs real   & 32,
   &-21 z snith        & 34,
   &-20 y snith        & 34,
   &-19 vsur           & 32,
```

```
SATABLES.WDPK.P08510          THU, DEC 22, 1983, 10:23 AM    PAGE  9


   &-18 <nin scale>    & format_dependent,
   &-17 log nag        & 14,
   &-16 lin nag        &  3,
   &-15 phase          &  3,
   &-14 delay          &  3,
   &-13 real           &  3,
   &-12 inag           &  3,
   &-11 log polar      & 14,
   &-10 lin polar      &  3,
   & -9 inag vs real   &  3,
   & -5 z snith        & 35,
   & -7 y snith        & 35,
   & -6 vsur           &  3,
   & -5 <start...>     & donain_dependent,
   & -4 freq donain    & 12,
   & -3 tine band-pass & 10,
   & -2 tine lou-pass  & 10,
   & -1 aux  donain    & 24;
BYTE TABLE nin_limit_index :=                     & index into limit table &
   &  0 off            &  0,                       &  0 neane no limit      &
   &  1 start          & -5,
   &  2 stop           & -5,
   &  3 center         & -5,
   &  4 epan           &  0,
   &  5 cu             & -5,
   &  6 sueep tine     & 17,
   &  7 source power   &  0,
   &  8 power slope    &  0,
   &  9 port 1 atten   &  1,
   & 10 port 2 atten   &  1,
   & 11 ref pos'n      &  1,
   & 12 scale/div      & -18,
   & 13 ref value      & -31,
   & 14 unused         &  0,
   & 15 title          &  1,
   & 16 4 groups hpib  &  2,
   & 17 if avg factor  &  1,
   & 18 snoothing aper.& 18,
   & 19 srq nask prin. &  1,
   & 20 srq nask secon.&  1,
   & 21 revision       &  0,
   & 22 aux out        & 24,
   & 23 keycode        &  1,
   & 24 electr delay   & 27,
   & 25 phase offset   & 30,
   & 26 narker 1       & 13,   & donain dependence handled by dynemic &
   & 27 narker 2       & 13,   & limit changes uith start_stop_...    &
   & 28 narker 3       & 13,
   & 29 narker 4       & 13,
   & 30 narker 5       & 13,
   & 31 address        & 15,
   & 32 peek           &  0,
   & 33 poke           &  9,
   & 34 open c0        &  0,
   & 35 open c1        &  0,
   & 36 open c2        &  0,
```

```
SRTABLES.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM    PAGE 10

   & 37 gate start     &  10,
   & 38 gate atop      &  10,
   & 39 gate center    &  10,
   & 40 gate span      &  10,
   & 41 nag slope      &   0,
   & &2 nag offset     &   0,
   & 43 stimulus slope &   0,
   & &4 stimulus offset&   0,
   & 45 ref plane 1    &  27,
   & 46 ref plane 2    &  27,
   & 47 system z0      &  22,
   & 48 major addr     &   1,
   & 49 minor addr     &   1,
   & 50 pass thru addr &   1,
   & 51 source addr    &   1,
   & 52 test-set addr  &   1,
   & 53 plotter addr   &   1,
   & 54 printer addr   &   1,
   & 55 ch end addr    &   1,
   & 56 offset delay   &  27,
   & 57 offset loss    &   0,
   & 58 offset z0      &   0,
   & 59 offset min f   &   1,
   & 60 offset max f   &   1,
   & 61 etd id         &   2,
   & &2 etd class      &   2,
   & 63 # groups hbd   &   2,
   & 99 place holder   &   0;

BYTE TABLE max_limit_index_neg :=   & MUST BE EVEN LENGTH - PAD AT TOP &
   &-18 <max_scale>    & format_dependent,
   &-17 log mag        &  33,
   &-16 lin mag        &  33,
   &-15 phase          &  33,
   &-14 delay          &  28,
   &-13 real           &  33,
   &-12 imag           &  33,
   &-11 log polar      &  33,
   &-10 lin polar      &  33,
   & -9 imag vs real   &  33,
   & -8 z smith        &  33,
   & -7 y smith        &  33,
   & -6 vswr           &  33,
   & -5                & domain_dependent,
   & -4 freq domain    &  20,
   & -3 time band-pass &  11,
   & -2 time low-pass  &  11,
   & -1 aux  domain    &  23;
BYTE TABLE max_limit_index :=              & index into limit table &
   &  0 off            &   0,               &  0 means no limit      &
   &  1 start          &  -5,
   &  2 stop           &  -5,
   &  3 center         &  -5,
   &  4 span           &   0,
   &  5 cw             &  -5,
   &  6 sweep time     &  33,
```

```
SRTABLES.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM    PAGE 11

   &  7 source power   &   0,
   &  8 power slope    &   0,
   &  9 port 1 atten   &  29,
   & 10 port 2 atten   &  29,
   & 11 ref pos'n      &  25,
   & 12 scale/div      & -18,
   & 13 ref value      &  33,
   & 14 unused         &   0,
   & 15 title          &   6,
   & 16 # groups hpib  &   7,
   & 17 if avg factor  &   7,
   & 1& smoothing aper.&  26,
   & 19 srq mask prin. &   8,
   & 20 srq mask secon.&   8,
   & 21 revision       &   0,
   & 22 aux out        &  23,
   & 23 keycode        &   8,
   & 24 electr delay   &  28,
   & 25 phase offset   &  31,
   & 26 marker 1       &  19,   & domain dependence handled by dynamic &
   & 27 marker 2       &  19,   & limit changes with start_stop_...    &
   & 2& marker 3       &  19,
   & 29 marker &       &  19,
   & 30 marker 5       &  19,
   & 31 address        &  16,
   & 32 peek           &   0,
   & 33 poke           &   8,
   & 34 open c0        &   0,
   & 35 open c1        &   0,
   & 36 open c2        &   0,
   & 37 gate start     &  11,
   & 3& gate atop      &  11,
   & 39 gate center    &  11,
   & &0 gate span      &  11,
   & 41 nag slope      &   0,
   & 42 nag offset     &  33,
   & 43 stimulus slope &   0,
   & 44 stimulus offset&  -5,
   & 45 ref plane 1    &  28,
   & 46 ref plane 2    &  28,
   & 47 system z0      &  33,
   & 48 major addr     &   5,
   & 49 minor addr     &   5,
   & 50 pass thru addr &   5,
   & 51 source addr    &   5,
   & 52 tect-eet addr  &   5,
   & 53 plotter addr   &   5,
   & 54 printer addr   &   5,
   & 55 ch end addr    &   5,
   & 56 offset delay   &  28,
   & 57 effect loss    &   0,
   & 58 offset z0      &   0,
   & 59 offset min f   &  21,
   & 60 offset max f   &  21,
   & 61 etd id         &   4,
   & 62 etd class      &   4,
```

```
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   & 53 N groups kbd   &   7,
   & 99 place holder   &   0;
```

```
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%EJECT;
INTEGER TABLE chtable_index_neg :=  & MUST BE EVEN LENGTH - PAD AT TOP &
   &-10                &  domain_dependent,
   & -9 freq domain    &  ch_center_stimulus,          & freq via HP-IB &
   & -8 time band-pass &  ch_center_time,
   & -7 time low-pass  &  ch_centtr_time,
   & -6 aux  domain    &  ch_center_aux_out,
   & -5                &  domain_dependent,
   & -4 freq domain    &  ch_start_stimulus,          & freq via HP-IB &
   & -3 time band-pass &  ch_start_time,
   & -2 time low-pass  &  ch_ttart_time,
   & -1 aux  domain    &  ch_start_aux_out;
INTEGER TABLE chtable_index :=             & indexed by active_function &
   &  0 off            &   0,
   &  1 start          &  -5,
   &  2 stop           &  ch_stop_stimulus, & must also be "dont_store"&
   &  3 center         & -10,
   &  4 span           &  ch_span_stimulus, & must also be "dont_store"&
   &  5 cw             & -10,
   &  6 sweep time     &  ch_sweep_time,
   &  7 source power   &  ch_source_power,
   &  8 power slope    &  ch_power_slope,
   &  9 port 1 atten   &  ch_atten_port1,   & must also be "dont_store"&
   & 10 port 2 atten   &  ch_atten_port2,   & must also be "dont_store"&
   & 11 ref pos'n      &  ch_ref_position,
   & 12 scale/div      &  ch_scale,
   & 13 ref value      &  ch_ref_value,
   & 14 unused         &   0,
   & 15 title          &   0,
   & 16 # groups hpib  &   0,
   & 17 if avg factor  &  ch_average_factor,
   & 1& smoothing aper.&  ch_smoothing_aperture,
   & 19 srq mask prin. &   0,
   & 20 srq mask secon.&   0,
   & 21 revision       &   0,
   & 22 aux out        &  ch_center_aux_out,
   & 23 keycode        &   0,
   & 24 electr delay   &  ch_elec_delay,
   & 25 phase offset   &  ch_phase_offset,
   & 26 marker 1       &  ch_marker1,
   & 27 marker 2       &  ch_marker2,
   & 28 marker 3       &  ch_marker3,
   & 29 marker 4       &  ch_marker4,
   & 30 marker 5       &  ch_marker5,
   & 31 address        &   0,
   & 32 peek           &   0,
   & 33 poke           &   0,
   & 34 open c0        &   0,
   & 35 open c1        &   0,
   & 36 open c2        &   0,
   & 37 gate start     &  ch_gate_start,
   & 38 gate stop      &  ch_gate_stop,
   & 39 gate center    &  ch_gate_center,
   & 40 gate span      &   0,
   & 41 nag slope      &  ch_magnitude_slope,
   & 42 nag offset     &  ch_magnitude_offset,
```

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   & 43 stimulus slope &  ch_stimulus_slope,
   & 44 stimulus offset&  ch_stimulus_offset,
   & 45 ref plane 1    &  ch_ref_plane_1,
   & 45 ref plane 2    &  ch_ref_plane_2,
   & 47 system z0      &  ch_eyeten_z0,
   & 48 major addr     &  0,
   & 49 minor addr     &  0,
   & 50 pass thru addr &  0,
   & 51 source addr    &  0,
   & 52 test-set addr  &  0,
   & 53 plotter addr   &  0,
   & 54 printer addr   &  0,
   & 55 ch end addr    &  0,
   & 56 offset delay   &  0,
   & 57 offset loss    &  0,
   & 58 offset z0      &  0,
   & 59 offset min f   &  0,
   & 60 offset max f   &  0,
   & 61 std id         &  0,
   & 62 std class      &  0,
   & 63 # groups hbd   &  0,
   & 99 place holder   &  0;


BYTE TABLE chtable_type :=                  & indexed by active_function &
   &  0 off            &       ch_none,     & select_active_function does&
   &  1 start          &  ch_quad_type,     & chtable_type to determine  &
   &  2 stop           &  ch_qued_type,     & whether to perform an auto-&
   &  3 center         &  ch_qued_type,     & value load.  ch_none == no.&
   &  4 span           &  ch_quad_type,
   &  5 cw             &  ch_qued_type,
   &  6 sweep time     &  ch_real_type,
   &  7 source power   &  ch_real_type,
   &  8 power slope    &  ch_real_type,
   &  9 port 1 atten   &  ch_real_type,
   & 10 port 2 atten   &  ch_real_type,
   & 11 ref pos'n      &  ch_real_type,
   & 12 scale/div      &  ch_real_type,
   & 13 ref value      &  ch_real_type,
   & 14 unused         &       ch_none,
   & 15 title          &       ch_none,
   & 15 # groups hpib  &       ch_none,
   & 17 if avg factor  &  ch_integer_type,
   & 18 smoothing aper.&  ch_real_type,
   & 19 srq mask prin. &       ch_none,
   & 20 srq mask secon.&       ch_none,
   & 21 revision       &       ch_none,
   & 22 aux out        &  ch_quad_type,
   & 23 keycode        &       ch_none,
   & 24 electr delay   &  ch_real_type,
   & 25 phase offset   &  ch_real_type,
   & 26 marker 1       &  ch_quad_type,
   & 27 marker 2       &  ch_quad_type,
   & 28 marker 3       &  ch_quad_type,
   & 29 marker 4       &  ch_quad_type,
```

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   & 30 marker 5       &  ch_quad_type,
   & 31 address        &       ch_none,
   & 32 peek           &       ch_none,
   & 33 poke           &       ch_none,
   & 34 open c0        &       ch_none,
   & 35 open c1        &       ch_none,
   & 36 open c2        &       ch_none,
   & 37 gate start     &  ch_quad_type,
   & 38 gate stop      &  ch_quad_type,
   & 39 gate center    &  ch_quad_type,
   & 40 gate open      &  ch_quad_type,
   & 41 nag slope      &  ch_real_type,
   & 42 nag offset     &  ch_real_type,
   & 43 stimulus slope &  ch_real_type,
   & 44 stimulus offset&  ch_qued_type,
   & 45 ref plane 1    &  ch_real_type,
   & 46 ref plane 2    &  ch_real_type,
   & 47 system z0      &  ch_real_type,
   & 48 major addr     &       ch_none,
   & 49 minor addr     &       ch_none,
   & 50 pass thru addr &       ch_none,
   & 51 source addr    &       ch_none,
   & 52 test-set addr  &       ch_none,
   & 53 plotter addr   &       ch_none,
   & 54 printer addr   &       ch_none,
   & 55 ch end addr    &       ch_none,
   & 56 offset delay   &       ch_none,
   & 57 offset loss    &       ch_none,
   & 58 offset z0      &       ch_none,
   & 59 offset min f   &       ch_none,
   & 60 offset max f   &       ch_none,
   & 61 std id         &       ch_none,
   & 62 std class      &       ch_none,
   & 63 # groups hbd   &       ch_none,
   & 99 place holder   &       ch_none;


GLOBAL REAL TABLE scale_factors :=
   1.0,        & 0 &
   1.0E3,      & 1 &
   1.0E6,      & 2 &
   1.0E9,      & 3 &
   1.0E12,     & 4 &
   1.0E15;     & 5 &
GLOBAL REAL TABLE unscale_factors :=
   1.0,        & 0 &
   1.0E-3,     & 1 &
   1.0E-6,     & 2 &
   1.0E-9,     & 3 &
   1.0E-12,    & 4 &
   1.0E-15;    & 5 &

BYTE TABLE log_scale_div_3_neg :=   & MUST BE EVEN LENGTH - PAD AT TOP &
   &-18 scale/ref value&  format_dependent,
   &-17 log mag        &           4,
```

```
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   &-16 lin mag        &           4,
   &-15 phase          &           4,
   &-14 delay          &           5,
   &-13 real           &           4,
   &-12 imag           &           4,
   &-11 log polar      &           4,
   &-10 lin polar      &           4,
   & -9 imag vs real   &           4,
   & -8 z smith        &           4,
   & -7 y smith        &           4,
   & -6 vswr           &           4,
   & -5 stimulus/mkrs  & domain_dependent,
   & -4 freq domain    &           0,
   & -3 time band-pass &           5,
   & -2 time low-pass  &           5,
   & -1 aux  domain    &           4;
GLOBAL BYTE TABLE log_scale_div_3 :=     & indexed by active_function &
   &  0 off            &           0,     &  limited to 0 to 5 &
   &  1 start          &          -5,
   &  2 stop           &          -5,
   &  3 center         &          -5,
   &  4 span           &          -5,
   &  5 cw             &          -5,
   &  6 sweep time     &           4,
   &  7 source power   &           4,
   &  8 power slope    &           4,
   &  9 port 1 atten   &           4,
   & 10 port 2 atten   &           4,
   & 11 ref pos'n      &           4,
   & 12 scale/div      &         -18,
   & 13 ref value      &         -18,
   & 14 unused         &           0,
   & 15 title          &           0,
   & 16 # groups hpib  &           0,
   & 17 if avg factor  &           0,
   & 18 smoothing aper.&           4,
   & 19 srq mask prin. &           0,
   & 20 srq mask secon.&           0,
   & 21 revision       &           0,
   & 22 aux out        &           4,
   & 23 keycode        &           0,
   & 24 electr delay   &           5,
   & 25 phase offset   &           4,
   & 26 marker 1       &          -5,
   & 27 marker 2       &          -5,
   & 28 marker 3       &          -5,
   & 29 marker 4       &          -5,
   & 30 marker 5       &          -5,
   & 31 address        &           0,
   & 32 peek           &           0,
   & 33 poke           &           0,
   & 34 open c0        &           4,
   & 35 open c1        &           4,
   & 36 open c2        &           4,
   & 37 gate start     &           6,
   & 38 gate stop      &           5,
```

```
$ATTABLES.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM     PAGE 17

   & 39 gate center    &           5,
   & 40 gate span      &           5,
   & 41 nag slope      &           4,
   & 42 nag offset     &           4,
   & 43 stimulus slope &           4,
   & 44 stimulus offset&          -5,
   & 45 ref plane 1    &           5,
   & 46 ref plane 2    &           5,
   & 47 system z0      &           4,
   & 48 major addr     &           0,
   & 49 minor addr     &           0,
   & 50 pass thru addr &           0,
   & 51 source addr    &           0,
   & 52 test-set addr  &           0,
   & 53 plotter addr   &           0,
   & 54 printer addr   &           0,
   & 55 ch end addr    &           0,
   & 56 offset delay   &           5,
   & 57 offset loss    &           4,
   & 58 offset z0      &           4,
   & 59 offset min f   &           0,
   & 60 offset max f   &           0,
   & 61 std id         &           0,
   & 62 std class      &           0,
   & 63 # groups kbd   &           0,
   & 99 place holder   &           0;


BYTE TABLE chtable_store_neg :=     & MUST BE EVEN LENGTH - PAD AT TOP &
   & -6 filler         &           0,
   & -5                & domain_dependent,
   & -4 freq domain    &    dont_store,
   & -3 time band-pass &         store,
   & -2 time low-pass  &         store,
   & -1 aux  domain    &         store;
BYTE TABLE chtable_store :=                 & indexed by active_function &
   &  0 off            &    dont_store,
   &  1 start          &          -5,
   &  2 stop           &    dont_store,
   &  3 center         &          -5,
   &  4 span           &    dont_store,
   &  5 cw             &          -5,
   &  6 sweep time     &    dont_store,
   &  7 source power   &    dont_store,
   &  8 power slope    &    dont_store,
   &  9 port 1 atten   &    dont_store,
   & 10 port 2 atten   &    dont_store,
   & 11 ref pos'n      &         store,
   & 12 scale/div      &         store,
   & 13 ref value      &         store,
   & 14 unused         &         store,
   & 15 title          &    dont_store,
   & 16 # groups hpib  &         store,
   & 17 if avg factor  &         store,
   & 18 smoothing aper.&         store,
```

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   & 19 srq mask prin. &        store,
   & 20 srq mask secon.&        store,
   & 21 revision       &        store,
   & 22 aux out        &        store,
   & 23 keycode        &        store,
   & 24 electr delay   &        store,
   & 25 phase offset   &        store,
   & 25 marker 1       &   dont_store,
   & 27 marker 2       &   dont_store,
   & 28 marker 3       &   dont_store,
   & 29 marker 4       &   dont_store,
   & 30 marker 5       &   dont_store,
   & 31 address        &   dont_store,
   & 32 peek           &   dont_store,
   & 33 poke           &   dont_store,
   & 34 open c0        &   dont_store,
   & 35 open c1        &   dont_store,
   & 36 open c2        &   dont_store,
   & 37 gate start     &   dont_store,
   & 38 gate stop      &   dont_store,
   & 39 gate center    &   dont_store,
   & 40 gate span      &   dont_store,
   & 41 mag slope      &        store,
   & 42 mag offset     &        store,
   & 43 stimulus slope &        store,
   & 44 stimulus offset&        store,
   & 45 ref plane 1    &        store,
   & 46 ref plane 2    &        store,
   & 47 eyeten z0      &        store,
   & 48 major addr     &   dont_store,
   & 49 minor addr     &   dont_store,
   & 50 pass thru addr &   dont_store,
   & 51 source addr    &   dont_store,
   & 52 test-set addr  &   dont_store,
   & 53 plotter addr   &   dont_store,
   & 54 printer addr   &   dont_store,
   & 55 ch end addr    &   dont_store,
   & 56 offset delay   &   dont_store,
   & 57 offset loss    &   dont_store,
   & 58 offset z0      &   dont_store,
   & 59 offset min f   &   dont_store,
   & 60 offset max f   &   dont_store,
   & 61 std id         &   dont_store,
   & 62 std class      &   dont_store,
   & 63 # groups kbd   &        store,
   & 99 place holder   &           0;
```

```
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#EJECT;
CONNEKT                                                    algorithms
#########################################################################
#
# Algorithms are from routines in SABTIVE.WORK
#
# bit 15    = sign
# bits 14-12 = keypad
# bits 11- 8 = marker
# bits  7- 4 = rpg
# bits  3- 0 = step
#
# KEYPAD ALGORITHMS:
#   0 - keypad disabled
#   1 - terminator keys represent positive exponents
#   2 - terminator keys represent negative exponents
#   3-7 undefined
# *MARKER* ALGORITHMS:
#   0 - "*MARKER" is inconsistent for current active function
#   1 - use marker stimulus value (e.g. for center frequency)
#   2 - use marker amplitude (e.g. for reference value)
#   3 - use marker magnitude (e.g. for magnitude offset)
#   4 - use marker phase     (e.g. for phase offset)
#   5-F undefined
# RPG ALGORITHMS:
#   0 - rpg disabled
#   1 - hpib source update protocol
#   2 - .1% of stimulus span        value = rpg_count*span/1000
#   3 - count                       value = rpg_count
#   4 - 1                           value = 1^(sign of rpg_count)
#   5 - count/20      (scaled)      value = rpg_count/20
#   6 - .1% scale/div (scaled)      value = tpg_count*scale/1000
#   7 - .1% value     (scaled)      value = rpg_count*value/1000
#   8 - count/10                    value = rpg_count/10
#   9 - count/100     (scaled)      value = rpg_count/100
#   A - count*count*count           value = rpg_count*rpg_count*rpg_count
#   B-F undefined
# STEP KEY ALGORITHMS:
#   0 - step keys disabled
#   1 - hpib source update protocol
#   2 - 1-2-5 sequence  (scaled or unscaled)
#   3 - 10% of stimulus span          value = step_sign*span/10
#   4 - 1               (scaled)      value = 1*step_sign
#   5 - 1 division      (scaled)      value = step_sign*scale/div
#   6 - undefined
#   7 - 1 division                    value = step_sign*scale/div
#   8 - 10% of value    (scaled)      value = step_sign*value/10
#   9 - 1                             value = 1*step_sign
#   A - 10              (scaled)      value = 10*step_sign
#   B-F undefined
#
# (scaled) algorithms apply to active functions that are scaled (see
#    "scale_factor").
#
#########################################################################
;
```

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INTEGER TABLE algorithms_neg :=     & MUST BE EVEN LENGTH - PAD AT TOP &
   &-20 gate markers   & domain_dependent,
   &-19 freq domain    &   %2072,
   &-18 time band-pass &   %2123,
   &-17 time low-pass  &   %2123,
   &-16 aux  domain    &   %2072,
   &-15 delays         & domain_dependent,
   &-14 freq domain    &   %2232,
   &-13 time band-pass &   %21A2,
   &-12 time low-pass  &   %21A2,
   &-11 aux  domain    &   %20A2,
   &-10 markers        & domain_dependent,
   & -9 freq domain    &   %1123,
   & -8 time band-pass &   %2123,
   & -7 time low-pass  &   %2123,
   & -6 aux  domain    &   %2123,
   & -5 stimuli        & domain_dependent,
   & -4 freq domain    &   %1111,
   & -3 time band-pass &   %2123,
   & -2 time low-pass  &   %2123,
   & -1 aux  domain    &   %2123;
INTEGER TABLE algorithms :=
   &  0 off            &   %0000,
   &  1 start          &     -5,
   &  2 stop           &     -5,
   &  3 center         &     -5,
   &  4 span           &     -5,
   &  5 cw             &     -5,
   &  6 sweep time     &   %2011,       & end of source functions &
   &  7 source power   &   %2054,
   &  8 power slope    &   %2054,
   &  9 port 1 atten   &   %100A,
   & 10 port 2 atten   &   %100A,
   & 11 ref pos'n      &   %2054,
   & 12 scale/div      &   %2062,
   & 13 ref value      &   %2265,
   & 14 unused         &   %0000,
   & 15 title          &   %10B9,
   & 16 4 groups hpib  &   %1000,
   & 17 if avg factor  &   %1082,
   & 18 smoothing aper.&   %1052,
   & 19 srq mask prin. &   %1000,
   & 20 srq mask secon.&   %1000,
   & 21 revision       &   %0000,
   & 22 aux out        &   %2054,
   & 23 keycode        &   %1000,
   & 24 electr delay   &     -15,
   & 25 phase offset   &   %1492,
   & 26 marker 1       &     -10,
   & 27 marker 2       &     -10,
   & 28 marker 3       &     -10,
   & 29 marker 4       &     -10,
   & 30 marker 5       &     -10,
   & 31 address        &   %1039,
   & 32 peek           &   %1000,
   & 33 poke           &   %1039,
```

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   & 34 open c0        &   %1000,
   & 35 open c1        &   %1000,
   & 36 open c2        &   %1000,
   & 37 gate start     &     -20,
   & 38 gate stop      &     -20,
   & 39 gate center    &     -20,
   & 40 gate span      &     -20,
   & 41 mag slope      &   %2072,
   & 42 mag offset     &   %2272,
   & 43 stimulus slope &   %2072,
   & 44 stimulus offset&     -5,
   & 45 ref plane 1    &     -15,
   & 46 ref plane 2    &     -15,
   & 47 eyeten z0      &   %2072,
   & 48 major addr     &   %1049,
   & 49 minor addr     &   %1049,
   & 50 pass thru addr &   %1049,
   & 51 source addr    &   %1049,
   & 52 test-set addr  &   %1049,
   & 53 plotter addr   &   %1049,
   & 54 printer addr   &   %1049,
   & 55 ch end addr    &   %1049,
   & 56 offset delay   &   %21A2,
   & 57 offset loss    &   %2172,
   & 58 offset z0      &   %2072,
   & 59 offset min f   &   %1111,
   & 60 offset max f   &   %1111,
   & 61 std id         &   21000,
   & 62 std class      &   %1000,
   & 63 # groups kbd   &   %1000,
   & 99 place holder   &   %0000;
```

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$EJECT;
GLOBAL                                                    & DEBUG &
BYTE TABLE display_alternate_value :=
   & 0 off           &   dont_display_alt,
   & 1 start         &   dont_display_alt,
   & 2 stop          &   dont_display_alt,
   & 3 center        &   dont_display_alt,
   & 4 span          &   dont_display_alt,
   & 5 cw            &   dont_display_alt,
   & 6 sweep time    &   dont_display_alt,
   & 7 source power  &   dont_display_alt,
   & 8 power slope   &   dont_display_alt,
   & 9 port 1 atten  &   dont_display_alt,
   & 10 port 2 atten &   dont_display_alt,
   & 11 ref pos'n    &   dont_display_alt,
   & 12 scale/div    &   dont_display_alt,
   & 13 ref value    &   dont_display_alt,
   & 14 unused       &   dont_display_alt,
   & 15 title        &   dont_display_alt,
   & 16 # groups hpib &  dont_display_alt,
   & 17 if avg factor &  dont_display_alt,
   & 18 smoothing aper.& dont_display_alt,
   & 19 srq mask prin. & dont_display_alt,
   & 20 srq mask secon.& dont_display_alt,
   & 21 revision     &   dont_display_alt,
   & 22 aux out      &   dont_display_alt,
   & 23 keycode      &   dont_display_alt,
   & 24 electr delay &   dont_display_alt,
   & 25 phase offset &   dont_display_alt,
   & 26 marker 1     &       display_alt,
   & 27 marker 2     &       display_alt,
   & 28 marker 3     &       display_alt,
   & 29 marker 4     &       display_alt,
   & 30 marker 5     &       display_alt,
   & 31 address      &   dont_display_alt,
   & 32 peek         &   dont_display_alt,
   & 33 poke         &   dont_display_alt,
   & 34 open c0      &   dont_display_alt,
   & 35 open c1      &   dont_display_alt,
   & 36 open c2      &   dont_display_alt,
   & 37 gate start   &   dont_display_alt,
   & 38 gate stop    &   dont_display_alt,
   & 39 gate center  &   dont_display_alt,
   & 40 gate span    &   dont_display_alt,
   & 41 mag slope    &   dont_display_alt,
   & 42 mag offset   &   dont_display_alt,
   & 43 stimulus slope & dont_display_alt,
   & 44 stimulus offset& dont_display_alt,
   & 45 ref plane 1  &   dont_display_alt,
   & 46 ref plane 2  &   dont_display_alt,
   & 47 system z0    &   dont_display_alt,
   & 48 major addr   &   dont_display_alt,
   & 49 minor addr   &   dont_display_alt,
   & 50 pass thru addr & dont_display_alt,
   & 51 source addr  &   dont_display_alt,
   & 52 test-set addr &  dont_display_alt,
```

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   & 53 plotter addr  &  dont_display_alt,
   & 54 printer addr  &  dont_display_alt,
   & 55 ch end addr   &  dont_display_alt,
   & 56 offset delay  &  dont_display_alt,
   & 57 offset loss   &  dont_display_alt,
   & 58 offset z0     &  dont_display_alt,
   & 59 offset min f  &  dont_display_alt,
   & 60 offset max f  &  dont_display_alt,
   & 61 std id        &  dont_display_alt,
   & 62 std class     &  dont_display_alt,
   & 63 # groups kbd  &  dont_display_alt,
   & 99 place holder  &  dont_display_alt;


BYTE TABLE must_be_positive_neg :=  & MUST BE EVEN LENGTH - ADD AT TOP &
   & -6 filler       &      0,
   & -5              & domain_dependent,
   & -4 freq domain  &      make_positive,
   & -3 time band-pass &  dont_make_positive,
   & -2 time low-pass &   dont_make_positive,
   & -1 aux  domain  &    dont_make_positive;
BYTE TABLE must_be_positive :=                  & for =marker in delta mode &
   & 0 off           &   dont_make_positive,
   & 1 start         &       -5,
   & 2 stop          &       -5,
   & 3 center        &       -5,
   & 4 span          &       make_positive,
   & 5 cw            &       -5,
   & 6 sweep time    &       make_positive,
   & 7 source power  &   dont_make_positive,
   & 8 power slope   &   dont_make_positive,
   & 9 port 1 atten  &       make_positive,
   & 10 port 2 atten &       make_positive,
   & 11 ref pos'n    &   dont_make_positive,
   & 12 scale/div    &       make_positive,
   & 13 ref value    &   dont_make_positive,
   & 14 unused       &   dont_make_positive,
   & 15 title        &       make_positive,
   & 16 # groups hpib &      make_positive,
   & 17 if avg factor &      make_positive,
   & 18 smoothing aper.&     make_positive,
   & 19 srq mask prin. &     make_positive,
   & 20 srq mask secon.&     make_positive,
   & 21 revision     &   dont_make_positive,
   & 22 aux out      &       make_positive,
   & 23 keycode      &       make_positive,
   & 24 electr delay &   dont_make_positive,
   & 25 phase offset &   dont_make_positive,
   & 26 marker 1     &       make_positive,
   & 27 marker 2     &       make_positive,
   & 28 marker 3     &       make_positive,
   & 29 marker 4     &       make_positive,
   & 30 marker 5     &       make_positive,
   & 31 address      &   dont_make_positive,
   & 32 peek         &   dont_make_positive,
```

```
SRTABLES.WORK.PD8S10           THU, DEC 22, 1983, 10:23 AM    PAGE 24

   & 33 poke         &   dont_make_positive,
   & 34 open c0      &       make_positive,
   & 35 open c1      &       make_positive,
   & 36 open c2      &       make_positive,
   & 37 gate start   &   dont_make_positive,
   & 38 gate stop    &   dont_make_positive,
   & 39 gate center  &   dont_make_positive,
   & 40 gate span    &       make_positive,
   & 41 mag slope    &   dont_make_positive,
   & 42 mag offset   &   dont_make_positive,
   & 43 stimulus slope & dont_make_positive,
   & 44 stimulus offset& dont_make_positive,
   & 45 ref plane 1  &   dont_make_positive,
   & 46 ref plane 2  &   dont_make_positive,
   & 47 system z0    &       make_positive,
   & 48 major addr   &       make_positive,
   & 49 minor addr   &       make_positive,
   & 50 past thru addr &     make_positive,
   & 51 source addr  &       make_positive,
   & 52 test-set addr &      make_positive,
   & 53 plotter addr &       make_positive,
   & 54 printer addr &       make_positive,
   & 55 ch end addr  &       make_positive,
   & 56 offset delay &   dont_make_positive,
   & 57 offset loss  &   dont_make_positive,
   & 58 offset z0    &       make_positive,
   & 59 offset min f &       make_positive,
   & 60 offset max f &       make_positive,
   & 61 std id       &       make_positive,
   & 62 std class    &       make_positive,
   & 63 # groups kbd &       make_positive,
   & 99 place holder &   dont_make_positive;
```

```
SATB6LES.WORK.PD9S10           THU, DEC 22, 1983, 10:23 AM    PAGE 25


$EJECT;
GLOBAL DOUBLE TABLE active_tables :=     & indexed by "get_" constants &
   & get_suffix_index     & ADRS( suffix_index ),
   & get_format_index     & ADRS( active_format_index ),
   & get_min_limit_index  & ADRS( min_limit_index ),
   & get_max_limit_index  & ADRS( max_limit_index ),
   & get_chtable_index    & ADRS( chtable_index ),
   & get_chtable_type     & ADRS( chtable_type ),
   & get_chtable_store    & ADRS( chtable_store ),
   & get_algorithms       & ADRS( algorithms ),
   & get_display_alt_value & ADRS( display_alternate_value ),
   & get_must_be_positive  & ADRS( must_be_positive ),
   & get_log_scale_div_3   & ADRS( log_scale_div_3 );


GLOBAL BYTE TABLE active_table_type :=   & indexed by "get_" constants &
   & get_suffix_index     & byte_type,
   & get_format_index     & byte_type,
   & get_min_limit_index  & byte_type,
   & get_max_limit_index  & byte_type,
   & get_chtable_index    & integer_type,
   & get_chtable_type     & byte_type,
   & get_chtable_store    & byte_type,
   & get_algorithms       & integer_type,
   & get_display_alt_value & byte_type,
   & get_must_be_positive  & byte_type,
   & get_log_scale_div_3   & byte_type;

END$
```

```
CAVERAGE.WORK.PD8510          THU, DEC 22, 1983, 10:23 AM    PAGE  1


& averaging - (ch_avg_type] &
INTEGER CONSTANT avg_off             :=  0,
                 avg_on              :=  1,
                 avg_sweep_to_sweep  :=  1,
                 avg_point_to_point  :=  2;
```

```
FAVERAGE.WORK.PD8510          THU, DEC 22, 1983, 10:24 AM    PAGE  1


SUBROUTINE if_average_on;                                  EXTERNAL.L;
SUBROUTINE if_average_off;                                 EXTERNAL.L;
SUBROUTINE display_smoothing_on;                           EXTERNAL.L;
SUBROUTINE display_smoothing_off;                          EXTERNAL.L;
```

```
SAVERAGE.WORK.PD8510          THU, DEC 22, 1983, 10:24 AM    PAGE  1


M68KL,P,"average"
BEGIN

#FILE ftrace.work;
#FILE fcontv2.work;                                    & rebuild &
#FILE fcontrol.work;
#FILE factive.work;
#FILE factivc2.work;
#FILE fchtable.work;
#FILE cchtable.work;
#FILE caverage.work;
#FILE cdatap.work;                  & for avg_ smoothing_ _on _off &
#FILE cresp.work;                & soft key constants for highlighting &
#FILE fmenu.work;                                  & for hilight_on &


SUBROUTINE if_average_on;                                  ENTRY;
   BEGIN & if_average_on &
      rebuild := TRUE;
      group_number := 0;                    & resets averaging number &
      set_entry_ch_integer( avg_on, ch_average_node );
      hilight_on( cnd_if_avg_on, cnd_if_avg_off );
      select_active_function( active_if_avg_factor );
   END;  & if_average_on &


SUBROUTINE if_average_off;                                 ENTRY;
   BEGIN & if_average_off &
      rebuild := TRUE;
      set_entry_ch_integer( avg_off, ch_average_node );
      hilight_on( cnd_if_avg_on, cnd_if_avg_off );
      select_active_off( active_if_avg_factor );
   END;  & if_average_off &


SUBROUTINE display_smoothing_on;                           ENTRY;
   BEGIN & display_smoothing_on &
      set_entry_ch_integer( smoothing_on, ch_smoothing_node );
      hilight_on( cnd_smoothing_on, cnd_smoothing_off );
      select_active_function( active_smoothing_aperture );
      partial( update_d );
   END;  & display_smoothing_on &


SUBROUTINE display_smoothing_off;                          ENTRY;
   BEGIN & display_smoothing_off &
      set_entry_ch_integer( smoothing_off, ch_smoothing_node );
      hilight_on( cnd_smoothing_on, cnd_smoothing_off );
      partial( update_d );
      select_active_off( active_smoothing_aperture );
   END;  & display_smoothing_off &
```

```
SAVERRGE.WORK.PD8510          THU, DEC 22, 1983, 10:24 AM    PAGE  2


END$
```

```
[illegible].UORK.P08510          THU, DEC 22, 1983, 10:24 AM    PAGE  1


M68XLDR(9.6.S3)    TUE, NOV 22, 1983,  4:23 PM
 NAME   RPIN LIMITS        BASE PAGE          RAM

 IRRM0 000FFE 00101C       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:21 PM  LIBRN   P08510

 IRRM2 0011FC 0012C2       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:21 PM  LIBRN   P08510

 IRRM3 0012FC 0013BC       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:22 PM  LIBRN   P08510

 IRRM4 0013FC 0014D8       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:22 PM  LIBRN   P08510

 IRRM5 0014FE 001816       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:22 PM  LIBRN   P08510

 IRRM6 0015FC 0016BC       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:22 PM  LIBRN   P08510

 IRRM8 0017FE 001B7R       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:22 PM  LIBRN   P08510

 IRRMR 0019FC 001AAC       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:23 PM  LIBRN   P08510

 IRRMC 001BFC 001CCC       000808 000808       000800 000800
       TUE, NOV 22, 1983,  4:23 PM  LIBRN   P08510


       LATEST DATE: TUE, NOV 22, 1983,  4:23 PM

       INITIAL STACK POINTER / GLOBAL REG = 000800


init_nbn    001200  parms_nbn   001300  read_boot_nb001R00  read_nbn    001600
eet_add_nbn 001400  status_nbn  001500  teet_nbn    001000  urt_boot_nbn001C00
wrt_nbn     001800

 KSPMAX=2 MSPMAX=4 SSPMAX=499 BSPMAX=53 ESPMAX=19 FSPMAX=10
 LSPMAX=70 XSPMAX=0
ELAPSED TIME 0:07
CPU TIME 0:01
```

```
SBOT.UORK.P08510          THU, DEC 22, 1983, 10:24 AM    PAGE  1


1%$KL,P,"bot"
BEGIN

#FILE crins.work;
#FILE cids.work;
#FILE fiocnfig.work;
#FILE fkernel2.work;
#FILE fkernel3.work;
#FILE fintrpt.work;
#FILE fbotkbd.work;
#FILE ffifo.work;
#FILE ffifos.work;
#FILE fbreak.work;
#FILE futil.work;
```

```
SBOT.UORK.P08510          THU, DEC 22, 1983, 10:24 AM    PAGE  2


#EJECT;
COMMENT
*************************************************************************
* This is the module for the botton box process which services and
*    sents appropiate information to the others process depending on
*    the type of botton  box interrupt.
*
* A special case is a botton box interrupt with no status word reason
*   This is an interrupt caused by the xadc saying that a systen
*     trigger adc conversion is done ( in step mode ) ( in sweep mode
*     the hardware generated a stop_sweep irq when sweep is done ).
*************************************************************************
;
INTEGER CONSTANT vto_end_of_range := 12,
                 xadc_stop_sweep  := 11,
                 phase_lock_unlock:= 10,
                 ext_ref_unlock   :=  7,
                 kbd              :=  6,
                 status_nask      := X1CC0;   & composite of bits above&
BYTE CONSTANT byte_zero := 0,                 disable_ext_ref_error := 0,
              enable_ext_ref_error :=X80, cal_sig_off := X40;

INTEGER CONSTANT zero      := 0,
                 high_sweep :=15,
                 pause_250nS:= 2;

INTEGER botton_status = botton + X7E,
        adr_check_high_sweep = botton + X78,
        xposctr      = botton + X36;
BYTE    calpha       = botton + X57;
```

```
SBOT.WORK.P08510          THU, DEC 22, 1983, 10:24 AM    PAGE  3


#EJECT;
PROCEDURE botton_box;        & a process &                    ENTRY;
   BEGIN
      INTEGER status;

      init_botton_kbd;
      iradr( ADRS(intrpt_botton), botton_vctr );

loop: waitio(botton_vctr);
      status := ( NOT botton_status )  AND status_nask ;
      DO
         BEGIN

            IF TBIT( status, xadc_stop_sweep) THEN
               BEGIN
                  write_fifo( fifo_sup_brk, xadc_brk );
                  ASSEMBLE( MOVE xposctr,R0 );
               END;  & if xadc_stop_sweep &

            IF last_trigger THEN     & see note &
               BEGIN
                  last_trigger := 0;
                  write_fifs( fifo_sup_brk, xadc_brk );
               END;  & if trig_flag &

            IF IBIT(status, kbd) THEN
               botton_key;


            IF  IBIT(status, ext_ref_unlock )  THEN
               BEGIN
               & this may cuase problems with viewing the 100khz signal&
               calpha :=  cal_sig_off + disable_ext_ref_error;
               calpha :=  cal_sig_off + enable_ext_ref_error;
               warn( ext_ref_unlocked );
               END    ext_ref_unlock;

            IF  TBIT(atatus, vto_end_of_range) OR
                TBIT(statue, phase_lock_unlock ) THEN
               BEGIN
               IF trigger_node  OR
                  IBIT( adr_check_high_sweep, high_sweep ) THEN
                  IF  TBIT(status, vto_end_of_range)   THEN
                        write_fifo( fifo_sup_brk, lost_vto  )
                   ELSE  write_fifo( fifo_sup_brk, lost_lock );
               disable_phase_lock_lost;
               END    vto_end_of_range ;

         END do
      UNTIL ( status := ( NOT botton_status )  AND status_nask ) = 0;

      GO TO loop;

   END botton_box;

END$ bot
```

```
FBOIKBD.WORK.PO&510          THU, DEC 22, 1983, 10:24 AM    PAGE  1

   SUBROUTINE init_botton_kbd;                          EXTERNAL.L;
   SUBROUTINE botton_key;                               EXTERNAL.L;
```

```
SBO1K&O.WORK.PD&510          THU, DEC 22, 1983, 10:24 AM    PAGE  1

M6&KL,P,"botkbd"
BEGIN

RFILE fiocnfig.work;
RFILE crins.work;
RFILE ffifo.work;
RFILE ffifos.work;
WFILE fpubis.work;
RFILE cpubis.work;
WFILE fconnend.work;
WFILE fkeys.work;
WFILE ftopkbd.work;

   BYTE CONSTANT key_clk  := %2C,      & clock presceler := 12       &
                 key_mode := %02,      & n-key rollover, encoded ecen &
                 key_err  := %E0,      & clear error cleg           &
                 key_out  := %40,      & eet output fife mode       &
                 key_clr  := %C1;      & clear key fifo             &
   BYTE CONSTANT key_etat_maek := %0F;
   INTEGER CONSIANI key_nax := %3F;

   BYTE key_end  = botton + %03,
        key_deta = botton + %65,
        key_etat = botton + %67;
   INTEGER key_code;

   SUBROUTINE init_botton_kbd;                                  ENTRY;
      BEGIN
         key_cnd := key_mode;
         key_cnd := key_clk;
         key_cnd := key_err;
         key_cnd := key_out;
         key_end := key_clr;
      END init_bottpn_kbd;


   PROCEDURE  botton_key;                                       ENTRY;
   BEGIN

      UNILE (key_etat AND key_etat_mask) <> 0 DO
         BEGIN  & while key_stat <> 0 &
            abort_connand := TRUE;
            IF TBIT(key_etat,6) THEN
               BEGIN
                  key_cnd := key_clr;
                  IF NOT remote THEN
                     urite_fifo( keyboard_fifo, cnd_illegal );
               END if tbit
            ELSE
               BEGIN
                  key_code := INTEGER(key_data) AND %003F;
                  IF key_code > key_nax THEN
                     BEGIN & if &
                        IF NOT remote THEN
```

```
SBOTKBD.UORK.PO5510          THU, DEC 22, 1983, 10:24 AM    PAGE  2

                        urite_fifo( keyboard_fifo, cnd_illegal );
                     END   & if &
                  ELSE
                     BEGIN & else &
                        key_token := bot_key_table[key_code];
                        set_serial_poll( key_presceo_srq );
                        IF key_token = cnd_local THEN
                           local_key;
                        IF NOT remote THEN
                           urite_fifo( keyboard_fifo, key_token );
                     END;  & else &
               EnD else not tbit;
         END while key_stat <> 0;

   END botton_key;

END$
```

```
FBOTKEYS.WORK.PDS510         THU, DEC 22, 1983, 10:24 AM    PAGE  1

WFILE ccnddecl.uork;

INTEGER TABLE key_table:=
        cnd_ch1,                    & 00 &
        cnd_illegal,                & 01 &
        cnd_illegal,                & 02 &
        cnd_illegal,                & 03 &
        cnd_e11,                    & 04 &
        cnd_e12,                    & 05 &
        cnd_nag,                    & 06 &
        end_phase,                  & 07 &
        cnd_ch2,                    & 08 &
        cnd_illegal,                & 09 &
        cnd_illegal,                & 10 &
        cnd_illegal,                & 11 &
        cnd_s21,                    & 12 &
        cnd_s22,                    & 13 &
        cnd_delay,                  & 14 &
        cnd_polar,                  & 15 &
        cnd_correction_menu,        & 16 &
        cnd_domain_menu,            & 17 &
        cnd_display_menu,           & 18 &
        cnd_narker_menu,            & 19 &
        cnd_paran_menu,             & 20 &
        cnd_illegal,                & 21 &
        cnd_format_menu,            & 22 &
        cnd_illegal,                & 23 &
        cnd_illegal,                & 24 &
        cnd_illegal,                & 25 &
        cnd_preset,  & lab pilot 1  26 &
        cnd_local,                  & 27 &
        cnd_save,                   & 28 &
        cnd_recall,                 & 29 &
        cnd_preset,  & proto M        30 &
        cnd_illegal,                & 31 &
        cnd_scale,                  & 32 &
        cnd_auto_scale,             & 33 &
        cnd_illegal,                & 34 &
        cnd_etart,                  & 35 &
        cnd_center,                 & 36 &
        cnd_illegal,                & 37 &
        cnd_illegal,                & 38 &
        cnd_illegal,                & 39 &
        cnd_ref_value,              & 40 &
        cnd_ref_position,           & 41 &
        cnd_illegal,                & 42 &
        cnd_stop,                   & 43 &
        cnd_span,                   & 44 &
        cnd_illegal,                & 45 &
        cnd_illegal,                & 46 &
        cnd_illegal,                & 47 &
        cnd_response_menu,          & 48 &
        cnd_illegal,                & 49 &
        cnd_illegal,                & 50 &
        cnd_stimulus_menu,          & 51 &
```

```
FBOTKEYS.UORK.PD8510          THU, DEC 22, 1983, 10:24 AM     PAGE  2

        cmd_illegal,            & 52 &
        end_illegal,            & 53 &
        end_illegal,            & 54 &
        end_illegal,            & 55 &
        cmd_illegal,            & 56 &
        cmd_illegal,            & 57 &
        cmd_copy,               & 58 &
        cmd_tape_menu,          & 59 &
        cmd_system_menu,        & 60 &
        cmd_illegal,            & 51 &
        cmd_measurement_restart, & 52 &
        cmd_illegal;            & 63 &
```

```
CBREAK.UORK.PD8510            THU, DEC 22, 1983, 10:25 AM     PAGE  1

COMMENT                                                 sweep-break reasons
   This block of constant declarations is for both
   SBRERK and FBRERK.
;
INTEGER CONSTANT xadc_brk := 0,abort_sup := X100,exit_break_idle:=X200,
                 lost_lock := X400, lost_vto := X800;

& bits of trig_flag &
BYTE trig_flag_dummy = trig_flag;
BYTE BITFIELD trig_flag_bit = trig_flag_dummy:
                              abort_flg,     sync_flg,
                              trigger_mode,
                              last_trigger,  first_trigger;
& bit in botton status word &
INTEGER CONSTANT end_of_trigger := 8, mpl_erq_disable := 4;
```

```
FBKERK.UORK.PD8510            THU, DEC 22, 1983, 10:25 AM     PAGE  1

EXTERNAL BYTE trig_flag.L, mpl_flg.L;

%FILE cbreak.work;

SUBROUTINE check_abort;                                         EXTERNAL.L;
SUBROUTINE  disable_phase_lock_lost;                            EXTERNAL.L;
PROCEDURE get_frequency( effective_now );  VALUE effective_now;
                                  BOOLEAN effective_now;        EXTERNAL.L;
PROCEDURE  break_entry_control(eh); VALUE ch; INTEGER ch;       EXTERNAL.L;
SUBROUTINE break_acq_control;                                   EXTERNAL.L;
PROCEDURE coupled_break(state);
   VALUE  state;
   BOOLEAN state;                                               EXTERNAL.L;
BOOLEAN PROCEDURE  maintain_sweep;                              EXTERNAL.L;
BOOLEAN PROCEDURE  step_source(stimulus_value);
   VALUE   stimulus_value;
   INTEGER stimulus_value;                                      EXTERNAL.L;
BOOLEAN PROCEDURE  phase_lock;                                  EXTERNAL.L;
SUBROUTINE trigger_xadc;                                        EXTERNAL.L;
SUBROUTINE break_idle;                                          EXTERNAL.L;
&OOLEAN SUBROUTINE break_paused;                                EXTERNAL.L;
```

```
SBRERK.UORK.PDSS10            THU, DEC 22, 1983, 10:25 AM     PAGE  1

M68XL,P,"break"
BEGIN
COMMENT
**************************************************************************
*
* This is the sup_break or break module. It is use to control the source
*  and x_adc during measurement taking .
*
* In the sup_break module are
*    0) init_break
*    1) check_abort
*    2) break_entry_control
*    3) break_acq_control
*    4) coupled_break
*    5) maintain_sweep
*    6) step_source
*    7) phase_lock
*    8) trigger_xadc
*    9) break_idle
*
*   active sup_too fast  and main_phase_lost flags  ( no work proto )
**************************************************************************
end of comments;

INTEGER PROCEDURE bcd_of_int(val); VALUE val; INTEGER val;      EXTERNAL;
%FILE fterm.work;                                               & DEBUG &
%FILE fterm2.work;                                              & DEBUG &
%FILE fterm3.work;                                              & DEBUG &
%FILE cdebug.work;                                              & DEBUG &
%FILE fchtable.work;
%FILE fchtab3.work;
%FILE fiocnfig.work;
%FILE crime.work;
%FILE ffifo.work;
%FILE ffifot.work;
%FILE fprivib.work;
%FILE fprivib2.work;
%FILE fkernel.work;
%FILE fkernel3.work;
%FILE futil.work;
%FILE fyadc.work;
%FILE fxadc.work;
%FILE fsize.work;
%FILE fstinul1.work;
%FILE fcnv9x.work;

GLOBAL BYTE trig_flag, mpl_flg ;
EXTERNAL INTEGER  ref_overload,  tat_overload,  xctrl_save;
%FILE cbreak.work;
SUBROUTINE reset_xadc;                                          EXTERNAL.L;

PROCEDURE init_break_sub(base);   VALUE base;  DOUBLE base;    FORURRD;
```

```
SBRERK.WORK.PDS510              THU, DEC 22, 1983, 10:25 AM     PAGE  2


#EJECT;
BYTE    botton_byte = botton + 1;
BYTE    nplctl = botton_byte + Z16, nploff   =botton_byto + Z18,
        ptctl  = botton_byte + Z26;
INTEGER ptfreq = botton + Z20, rdif = botton + Z28, ifcnt =botton + Z2R,
        xcnd1 = botton + Z32, xstp =botton + Z34, xpoctr =botton + Z36,
        xctrl = botton + Z3C,  bbstatus= botton + Z7E;

BITFIELD sup_status:vto_problen, lock_problen, idle_bit, abort_bit ,
                    new_sup_parans_effective, rsv, xxx, nid_sup_update,
                    source_settled, yyy, entry_complete, paran_bumped;
BYTE CONSTRNT nax_source_data := 50; & OC (worse) needs 8350=40,8340=48&
BYTE ARRAY source_data[-1:nax_source_data];

INTEGER CONSTANT zero :# 0,
                 normal := 0, alt_1 := 1, alt_2 := 2,
                 pretune_unlock := 14,  conversion_niss := 9,
                 nin_delay :=   0,  delay_200uS := 6,
                 delay_1nS :=  31,  delay_2_0nS := 62,
                 delay_3nS :=  93,
                 delay_6nS := 186,  delay_10nS  :# 313,
                 delay_50nS:#1560,
                 if_overload_threshold := 100,
                 invalid := -1, nearly_valid := 0, valid :# 1,
                 vto_100Mhz := 1960,           vto_49Mhz := 940,
                 vto_StOMhz := 6160,
                 mpl_garn   := ( (vto_310Mhz - vto_49Mhz)/255 ) + 1;
BYTE CONSTANT hold_nain_loop := Z20,  disable_loch_error :# Z10,
              lock_nain_loop := Z00,   enable_lock_error := Z00,
              lock_pretune   := Z04,   hold_pretune      := Z09;
INTEGER ARRAY debug_data[0:7];                                  &debug&
```

```
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#EJECT;
COMMENT
*****************************************************************
* The following is declarations for the sweep break vto tables.
* There are two tables one for channel 1 and another for channel 2,
* if alternating. These tables contain the needed information for phase
* locking the VTO without having extra HP-IB bus overhead for "OB"o
* and "OC"s. Of course these tables are only valid if there have been
* no changes in sweep parameters. If a change occur a full valid sweep
* must be taken to learn the needed values ( this will naccessary be
* slower sweep -- longer pauses at bandcross,etc ).
*
* The sweep table consists of sweep_table condition flag and nax_bands
* + 1 records fo band info. The band info consists of enough info to
* phase_lock and set up the XADC each sweep ( as explained above ).
*****************************************************************
end of comment;

INTEGER CONSTANT   nax_bands     :=  7;

INTEGER CONSTANT   integer_base  :=  0;
INTEGER CONSTANT   next_x_stp    :=  integer_base + 1;
INTEGER CONSTANT   table_index   :=  integer_base + 2;
INTEGER CONSTANT   vto_freq      :=  integer_base + 3;
INTEGER CONSTANT   next_flag     :=  integer_base + 4;
INTEGER CONSTANT   integer_end   :=  next_flag;

INTEGER CONSTANT   band_size     :=  integer_end;
INTEGER CONSTANT   next_band     :=  band_size;
INTEGER CONSTANT   last_band     :=  band_size;
INTEGER CONSTANT   table_size    :=  band_size * ( nax_bands + 1);
INTEGER CONSTANT   array_length  :=  table_size + 1;

INTEGER CONSTANT   sup_table_condition:# 0;

INTEGER ARRAY   ch1_sup_table[0:table_size],
                ch2_sup_table[0:table_size];
DOUBLE TABLE table_base := 0,
                           RDRS( ch1_sup_table ),
                           RDRS( ch2_sup_table );
DOUBLE          entry_table_base;
INTEGER POINTER entry_table_ptr = entry_table_base ;
DOUBLE          sup_table_base;
INTEGER POINTER sup_table_ptr = sup_table_base ;
INTEGER POINTER sup_table;
BOOLEAN coupled_tables;
INTEGER bandnun;
BYTE    ou0_ch;
```

```
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#EJECT;
COMMENT
*****************************************************************
* The following are tables for computing vto control settings
*     The intent is the for a given RF frequency no natter how reached
*     that the sane VTO settings will be reach.
*
* The bandcross values should be derived from the Source, but for
*     now they are fixed. The linitation of the 8510 vto nust aslo be
*     accounted for -- 4:1 freq sweep -- vto 70 - 300 Mhz.
*
* harmonic values are computed from end of bandcross values, such that
*     end of band vto nax is about 300Mhz. Because of sweep voltage and
*     freq inaccuracies allow bandcrosses to be in error 25Mhz,
*     and a nax VTO of 295 Mhz
*      harm = INT {[( BC * 25 Mhz ) + 20 Mhz (IF)]/ 295 Khz } + 1
*                        (note: in low bands this is fudged a bit)
*
* Loopgain = 15 - 2 * Log base2 ( harmonic )
*                                    log base 2 = 1.44 log base e
*
* The vto_check_step , vto_search_step, and vto_sideband_shift
*  (aka 5, 15, 40 Mhz) tables are the changes of vto needed to cause an
*       IF shift of those amounts
*       NOTE: VTO moves in 50Khz increments
*                  and IF moves in harmonic * VTO shift * 50 Khz
*          5Mhz_shift = INT { [ 5Mhz / (harmonic*50Khz) ] + .5 }
*                     always >= 1
*
*****************************************************************
end of comment;
OWRD TABLE  bandcross_table:= 250000000,  840000000, &8510 VTO bx&
                2400000000, 7000000000,13500000000,  &Source BC&
                20000000000,26500000000,99999999999; &Source BC&
BYTE TABLE harmonic_table  :=   1,  3,
                                9, 25, 47,
                               68, 90,133;
BYTE TABLE loopgain_table  := 15 , 12,
                                9,  6,  4,
                                3,  2,  1;
BYTE TABLE vto_check_step  := 100, 33,
                               11,  4,  2,
                                1,  1,  1;
BYTE TABLE vto_search_step := 200,  67,    &nax 255&  & 10 Mhz search&
                              22,   8,   4,
                               3,   2,   1;
INTEGER TABLE vto_sideband_shift := 800, 267,
                              93, 32,  17,
                              12,  3,   6;
```

```
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NEJECT;
COMMENT
*****************************************************************
* set_bandnun sets up sup_table to point to the correct band entry
*     ( while checking for naxband ).
*****************************************************************
end of comment;
PROCEDURE set_bandnun(band);     VALUE band;      INTEGER band;
BEGIN
  IF band > nax_bands THEN bandnun := nax_bands
     ELSE bandnun := band;
  SIPMTR( sup_table, RDRS( sup_table_ptr[ bandnun * band_size ] ) );
END set_bandnun;

SUBROUTINE reset_bandnun;
           set_bandnun( 0 );

COMMENT
*****************************************************************
* update_frequency_data reads source to update frequency limits, in
*          responds to a new_sup_parans_effective source interrupt.
*       It also handles the "dirtying" of the sup tables
*
*****************************************************************
end of comment;
PROCEDURE get_frequency( effective_now );  VALUE effective_now;
                                           BOOLEAN effective_now;   ENTRY;
BEGIN
    source_data[-1] := nax_source_data;
    IF enter_frequency_n_time(
                read_priv_ib(source,no_fun,"OC",RDRS(source_data)) ,
                effective_now  )
       THEN  init_break_aub( table_base[ 3 - current_entry_ch ] );
END get_frequency;

SUBROUTINE update_frequency_data;
BEGIN
         get_frequency( TRUE );
         init_break_aub( entry_table_base );
         IF nid_sup_update THEN  reset_bandnun;
END update_frequency_data;
```

```
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#EJECT;
COMMENT
*****************************************************************
*****************************************************************
end of comment;
SUBROUTINE  disable_phase_lock_lost;                          ENTRY;
BEGIN
   npl_flg := SBIT( npl_flg , npl_srq_disable );
   nplctl  := npl_flg;
END disable_phase_lock_lost;


SUBROUTINE warn_lock_problen;
BEGIN
   IF vto_preblen THEN   werm( vto_over_range  )
                  ELSE   warn( phase_lock_lost );
END check_loot_lock;
```

```
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#EJECT;
COMMENT
*****************************************************************
*  check_fifo_swp_brk
*
*****************************************************************
end of comment;
SUBROUTINE  check_fifo_swp_brh;
   BEGIN

   swp_etatus := read_fifo(fifo_swo_brk);

   IF new_swp_poraws_effective THEN
      BEGIN & if &
         update_frequency_dato;
         trig_priv_ab(source);
      END   & if &
   ELSE IF mid_swp_update THEN
      BEGIN
         oync_fig := 1;
         warn( owp_sync_err );
      END
   ELSE IF lock_problen THEN
      warn_lock_problen;

   IF owp_otatwe = obort_owp THEN
      abort_flg :* 1;

   END eheck_fifo_ewp_brk;

COMMENT
*****************************************************************
*   check_abort
*
*****************************************************************
end of comment;
SUBROUTINE check_abort;                                       ENTRY;
BEGIN
    If abort_fig THEN
       BEGIN
       abort_flg := 0;
       xeno( aborted );
       END;
END check_abort;
```

```
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#EJECT;
COMMENT
*****************************************************************
*  find_index finds the index to the vto harmonic nunber and gain tables
*     for a given RF freq.
*     See conments about bandcross tables.
*****************************************************************
end of conment;
INTEGER PROCEDURE find_index(freq); VALUE freq; QUAD freq;
BEGIN
   INTEGER index;

   index:=0;
   UMILE ( freq > bandcross_table[ index ] ) RND ( index < max_bands )
         DO index := index + 1;
   find_index := index;
END find_index;
```

```
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#EJECT;
COMMENT
*****************************************************************
* pretune_vto set and locks the the vto to a selected freq
*     it then will wait for the selected delay ( to allow settling )
*
* The order of operations is very important !!
*
* The selected vto is in 50Khz steps and is 2Mhz lower than desired.
*
* Generally the delay is 2mS for small steps and 8mS for large steps.
*****************************************************************
end of conment;
PROCEDURE pretune_vto( freq , time_delay ); VALUE freq, time_delay;
                                            INTEGER freq, time_delay;
BEGIN
INTEGER bcd_freq;

   IF freq < vto_49Mhz  THEN freq :* vto_49Mhz;
   IF freq > vto_310Mhz THEN freq := vto_310Mhz;
   bcd_freq := bcd_of_int( RIGHT( freq , 1 ) );
   IF NOT TBIT( freq, 0 ) THEN bcd_freq := SBIT( bcd_freq , 15 );

   nploff := ( (freq - vto_49Mhz) / npl_gain )  ;
   npl_flg  :=
   nplctl   := hold_main_loop  +  disable_lock_error
                  +  loopgain_table[ swp_table[table_index] ];

   ptfreq := bcd_freq;

   ptctl  := lock_pretune;

   delay( time_delay );

END pretune_vto;
```

```
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!EJECT;
COMMENT
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
! compute_vto_and_pretune  computes and pretunes the vto to the inputted
!   frequency and other previous act sup_table values --i.e. table_index
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
end of connent;
PROCEDURE compute_vto_and_pretune( freq);    VALUE freq;
                                              OUAD freq;
BEGIN
   pretune_vto(
       ( sup_table[ vto_freq ) := -40 +
         INTEGER ( (2.0E-5 * (2.087 + REAL( freq ))/
                   REAL( harmonic_table[sup_table[table_index]] )) +.5)
       ), deley_6nS    );

END compute_vto_and_pretune;

COMMENT
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
! if_count counts the i.f. and returns it with 10Khz resolution.
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
end of connent;
       INTEGER CONSTANT low_signal_level := 13,trigger_if_counter := 1,
                                    sig_lvl_OK_no_evarflow := %3000;
INTEGER SUBROUTINE if_count;
BEGIN
   if_count := 0;
   IF NOT TBIT(rdif,low_signal_level)  THEN
      BEGIN
      ifcnt := trigger_if_counter;
      deley( delay_200uS);
      IF ( rdif AND sig_lvl_OK_no_overflow ) = 0  THEN
           if_count := rdif AND %FFF;
      END;
END if_count;
```

```
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!EJECT;
COMMENT
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
! verify_pretune checks if i.f. is present and on the right sideband,
!    if not it will novo ( search) the vto till it is .
!    After a number of tries it will declare a "pretuna failure".
!
! NOTE: The vto step sizes for checking, searching, etc and the accept-
!       able if freq windows need to checked -- deadlocks, gaps, ?????
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
end of connant;
BOOLEAN PROCEDURE verify_pretune;
BEGIN
BITFIELD search_sts: check_step_pos, if_found, urong_side, drifting;
INTEGER freq, index,
        count, delay,
        vto_search, search_count,
   cnt, first_cnt, sec_cnt, delta;


  index := sup_table[ table_index ];
  freq  := sup_table[ vto_freq ];
  debug_data[3] := freq ;  &                                          debug&
  debug_data[7] := 0;                                                 debug&
  sec_cnt := -1;           &shows if a sec_cnt was ever attempted debug&

  count       := 0;
  search_count:= 0;
  search_sts  := 0;    &clr check_step_pos,if_found,urong_side,drifting&

 & prior to this point a pretune has been called to the sup_table freq
 with a delay of 6nSecs if there was no source delay(invalid sup_table)&

   DO
      BEGIN
      delay  := delay_3nS ;
      IF NOT drifting THEN
         IF urong_side THEN
            BEGIN
            freq := freq + vto_sideband_shift[ index ] ;
            search_count := 0;
            delay  := delay_6nS ;
            END
          ELSE
           BEGIN  & normal search &
           vto_search := search_count *
                         ( INTEGER(vto_search_step[index]) RNO %Off ) ;
           IF TBIT(search_count,0) &i.e. odd&
              THEN freq :=  freq + vto_search
            ELSE   freq :=  freq - vto_search   ;
           search_count := search_count + 1;
           END   normal search ;

      pretune_vto( freq , delay );
      search_sts := 0; &clr check_step_pos,if_found,urong_side,drifting&
```

```
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      IF TBIT(bbstatus, pretune_unlock) THEN
        count := 99                          & terminate search &
       ELSE
         IF RBS( ( first_cnt := if_count) - 2000 ) < 1100 THEN
            BEGIN
            IF first_cnt < 2000 THEN check_step_pos := 1;
 cnt := if_count;                                          & debug&
            pretune_vto ( freq +
                        ( IF check_step_pos THEN vto_check_step[index]
                             ELSE -vto_check_step[index] ) ,
                      delay_3nS );              &!!!changed from 5 nS!&

            IF ( sec_cnt := if_count ) > 0 THEN
              BEGIN & signal present &
              delta :=  ABS( first_cnt - sec_cnt ) ;
              IF delta < 125 THEN
                 drifting  := 1
               ELSE
              IF delta < 800 THEN
                 BEGIN  & OK check step &
                 IF  check_step_pos  NOR  ( first_cnt < sec_cnt ) THEN
                    urong_side :=  1
                  ELSE
                    BEGIN & no sec_cnt problems &
                    if_found := 1;
                    sup_table[ vto_freq ] := freq;
                    END  ;
                 END  OK check step ;
              END  sec_cnt signal present ;
         END check vto loop;

     &debug_data[7] := debug_data[7] OR search_sts;                   debug&
      count := count + 1 ;
      END search loop
   UNTIL if_found OR ( count > 25 ) ;

                debug_data[0] := first_cnt;                          &debug&
                debug_data[1] := sec_cnt;                            &debug&
                debug_data[2] := if_count;                           &debug&
                debug_data[4] := freq ;                              &debug&
                debug_data[5] := index;                              &debug&
                debug_data[6] := count;                              &debug&
   IF NOT if_found THEN
      BEGIN
        IF TBIT(bbstatus, pretune_unlock) THEN warn( no_pretune_lock )
         ELSE warn( pretune_fail );
      END;

   verify_pretune := if_found;

END verify_pretune;
```

```
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!EJECT;
COMMENT
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
! lock_vto_at_pretune verifies the the pretune ( i.f. present and
!   correct sideband) and locks the main phase lock loop. It will delay
!   long enough for main loop to settle.
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
end of connent;
BOOLEAN PROCEDURE lock_vto_at_pretune;
BEGIN
INTEGER tenp,ctn;
  lock_vto_at_pretune := FALSE;
  IF verify_pretune THEN
     BEGIN
     ptctl   := hold_pretune;
     npl_flg  :=
     nplctl    := lock_main_loop  +  disable_lock_error
                       +  loopgain_table[ sup_table[table_index] ];

     delay( delay_2_0nS );
     IF ( ( (ctn:=if_count) + 4 ) RNO %FFF8 ) N 2000 THEN
                                  warn(phase_lock_fail)
      ELSE BEGIN
           npl_flg  := RBIT( npl_flg , npl_srq_disable );
           nplctl   := npl_flg ;
           lock_vto_at_pretune := TRUE;
           END;
     END;

    IF lock_debug THEN BEGIN                                         &debug&
                FOR tenp:=0 TO 6 DO UNUM(debug_data[tenp]);          &debug&
              & WHEX(debug_data[7]);                                  debug&
                UNUM(ctn);                                         &debug&
                CRLF;                                              &debug&
                END:                                               &debug&
END lock_vto_at_pretune;
```

```
SBREAK.WORK.PDBS10              THU, DEC 22, 1983, 10:25 AM     PAGE  14

#EJECT;


ALPHA PROCEDURE retrace_type;
BEGIN
ALPHA sup_command;
   If coupled_tables THEN
      sup_command := "AS"
   ELSE
      IF current_acquisition_ch = current_entry_ch THEN
         sup_command := "AS0"
      ELSE
         sup_command := "AS1";

   retrace_type := sup_command;

END retrace_type;
```

```
SBREAK.WORK.PDBS10              THU, DEC 22, 1983, 10:25 AM     PAGE  15

#EJECT;
COMMENT                                                  break_entry_control
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR break_entry_control                            *
*                                                                           *
* FUNCTION: Inform the sup_break routines of which channel is the           *
*           active entry channel. This is so that the                       *
*           new_sup_param_effective dirtys the correct sup table.           *
*                                                                           *
*           Called only if entry channel has change.                        *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:   none                                                          *
*                                                                           *
*    OUTPUT:  none                                                          *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR break_entry_control                                 *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT: If sup tables are not coupled THEN change             *
*       the entry pointer to point to the apporiate table.                  *
*                                                                           *
*****************************************************************************
end of connent;
PROCEDURE break_entry_control(ch); VALUE ch; INTEGER ch;          ENTRY;
BEGIN
ALPHA sup_command;

   IF NOT coupled_tables THEN
      BEGIN
         entry_table_base := table_base[ current_entry_ch ];

         IF ch = su0_ch THEN
            wrt_prev_sb_source( sw0, "" )
         ELSE
            wrt_prev_sb_source( su1, "" );
      END;

END break_entry_control;
```

```
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#EJECT;
COMMENT                                                  break_acq_control
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR break_acq_control                              *
*                                                                           *
* FUNCTION: Informs the sup_break routines of the channel for which         *
*           data it being acqquired, and therefore the sup_table            *
*           holds the x_adc and vto information.                            *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:   none                                                          *
*                                                                           *
*    OUTPUT:  none                                                          *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR break_acq_control                                   *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT: If sup tables are not coupled THEN change             *
*       the sweep pointer to point to the apporiate table.                  *
*                                                                           *
*****************************************************************************
end of connent;
SUBROUTINE break_acq_control;                                     ENTRY;
BEGIN

   IF NOT coupled_tables THEN
         sup_table_base := table_base[ current_acquisition_ch ];

END break_acq_control;
```

```
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#EJECT;
COMMENT                                                      coupled_break
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR coupled_break                                  *
*                                                                           *
* FUNCTION: To set break into a two or one source state of operation        *
*                                                                           *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:   state    BOOLEAN  true = channels are coupled in source       *
*                                      operation                            *
*                               false= two seperate source states exist     *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                When coupling is set FALSE, the sweep table                *
*          of the selected channel is copied into the other channels        *
*          sweep table. It is assumed that when coupling is set TRUE        *
*          that the sweep will be aborted.                                  *
*                                                                           *
* COMMENTS: The first call must be with coupled state TRUE and              *
*          someone else ( init_break ) must have initailized the            *
*          coupled table flag (FALSE).                                      *
*          Also only calls that change the coupled table flag will          *
*          have any effect.                                                 *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR coupled_break                                       *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
*                                                                           *
*****************************************************************************
end of connent;
```

```
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#EJECT;
PROCEDURE coupled_break(state);                      VALUE state;
                                                     BOOLEAN state;    ENTRY;

BEGIN
INTEGER POINTER other_table;
ALPHA sup_command;

IF coupled_tables # state THEN
   BEGIN
   coupled_tables := state;

   If coupled_tables THEN
      BEGIN
      sup_command :="ALO";
      END
    ELSE
      BEGIN & uncoupled &
      If current_entry_ch = 1 THEN
         BEGIN
            STPNTR( other_table, table_base[ 2 ] );
            sup_command :=  "SV2AL12";
            su0_ch := 1;                          & current_entry_ch &
         END
       ELSE
         BEGIN
            STPNTR( other_table, table_base[ 1 ] );
            sup_command :=  "SV1RL11";
            su0_ch := 2;                          & current_entry_ch &
         END;

      MOVE other_table := sup_table_ptr,+( array_length );
      END;

   urt_priv_ib_source( clr_fun, sup_command );
   entry_table_base := table_base[ current_entry_ch ];
   sup_table_base := entry_table_base;
   END coupled state changed ;
  &ELSE do nothing&

END coupled_break;
```

```
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#EJECT;
COMMENT                                                              init_break
*************************************************************************
*                                                                       *
* EXTERNAL SPECIFICATION FOR init_break                                 *
*                                                                       *
* FUNCTION: Initializes the sweep tables and set the couple flag TRUE.  *
*                                                                       *
*                                                                       *
* DECLARATION INFORMATION:                                              *
*                                                                       *
*    INPUT:   none                                                      *
*                                                                       *
*    OUTPUT:  none                                                      *
*                                                                       *
* EXTERNAL EFFECTS:                                                     *
*                                                                       *
*************************************************************************
*                                                                       *
* LOGIC INFORMATION FOR init_break                                      *
*                                                                       *
* MODULES CALLED:                                                       *
*                                                                       *
* INITIAL REFINEMENT:  Initialize channel 1 and 2 sweep tables, and     *
*        set the coupling true ( with channel 1 as the master ).        *
*                                                                       *
*************************************************************************
end of comment;
        PROCEDURE init_break_sub(base);    VALUE base;  DOUBLE base;
        BEGIN
        INTEGER POINTER ptr = base;
        INTEGER POINTER ptr_band;
        INTEGER index;

        ptr[ sup_table_condition ] := invalid;
        FOR index := 0 TO max_bands DO
          BEGIN
          STPNTR( ptr_band , ADRS( ptr[ index * band_size ] ) );
          ptr_band[ next_x_stp  ] := 0;
          ptr_band[ table_index ] := 0;
          ptr_band[ vto_freq    ] := vto_100Mhz;
          ptr_band[ next_flag   ] := 0;
          END;
        END init_break_sub;

SUBROUTINE init_break;                                               ENTRY;
BEGIN
  init_break_sub( table_base[ 2 ] );
  init_break_sub( table_base[ 1 ] );
  coupled_tables   := TRUE ;
  entry_table_base := table_base[ 1 ];
  sup_table_base   := entry_table_base;
  abort_flg :=   0;
  mpl_flg   := ZFO;
  disable_phase_lock_lost;
END init_break;
```

```
SBREAK.WORK.PD8510              THU, DEC 22, 1983, 10:25 AM      PAGE  20


SUBROUTINE  reset_sup_table;
BEGIN
      sup_table_ptr[ sup_table_condition] := invalid;
      reset_bandnum;
END reset_sup_table;
```

```
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#EJECT;
COMMENT                                                          maintain_sweep
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR maintain_sweep
*
* FUNCTION: initiate a sweep and handle everything necessary to carry
*           the sweep to completion (e.g. reset sweep, phase-lock,
*           source and VTO bandcrossings, stop-sweep LSRQ, and
*           mid-sweep frequency updates of the source).  Returns
*           to the calling routine when the sweep is complete -- last
*           VADC trigger at the last frequency point -- or when an
*           error condition results in an abnormal termination or
*           irrecoverable situation.  Will attempt to recover from any
*           situation that does not affect the rest of the measurement
*           and control sections.  For example, it may retry VTO pretune
*           and phase-lock, but should not reset a sweep.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: maintain_sweep     true  = successful sweep completion.
*                               false = aborted sweep or irrecoverable
*                                       situation.
*
* USAGE:
*    DO
*       set up for another sweep
*    UNTIL maintain_sweep = false.
*    recover_gracefully.
*
* EXTERNAL EFFECTS:
*    Mid-sweep updates of source functions will result in a call to the
* appropriate value updating procedure(s), passing an ALPHA string.
* For mid-sweep updates and normal bandcrossings, the frequency values
* can be obtained in QUAD format by a call to the appropriate
* procedures, passing the current point number (from the XADC).
*
* COMMENTS:
*    The calling process may be suspended awaiting bandcrossings and/or
* the end of the sweep.
*
*************************************************************************
*
* LOGIC INFORMATION FOR maintain_sweep
*
* INTIAL REFINEMENT: At the start of a sweep the vto is pretuned accord-
*        ing to the sweep tables,and the source retraced ( in alternate
*        sweep use AS else RS ).
*        Normally the loop will wait for a source settled from the
*        source, set a xadc stop point, phase lock, and wait till the
*        sup/xadc reaches the proper point. From the sweep table it is
*        determined if this is an end of sweep , and the routine exits,
*        or if a bandcross of the source or 8510 vto, and if so do what
*        is needed and restart the loop.
```

```
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*       The sweep is always stop till it is determined that everything
*       is ready -- phase lock, no source changes have occured, and
*       nothing is pending in the fifo_sup_brk.
*
*       If a source change has occur it will be read and the sweep
*       tables dirtied. A learning process will then begin with the
*       8510 building a sweep tables of bandcross points ( source/8510)
*       and their xadc and vto settings till a complete sweep of no
*       changes has occur. During this "dirty / slow " sweep the 8510
*       will have to compute where it is , and where it is going.
*       It will check to see if a source bandcross occurs first via
*       the "OB" request or if a 8510 vto bandcross occurs first (from
*       8510 bandcross tables) or end of sweep.
*
*       Certain error conditions will be checked for
*         1) A sweep abort passed to maintain sweep from the Control
*            process.
*         2) A Source , 8510 sweep sycn error -- the Source has reached
*            end of sweep and beyond before the 8510.
*         3) A phase lock of the vto to Source failed.
*         4) Commands or data in fifo_sup_brk invalid.
*
*****************************************************************
;
BOOLEAN PROCEDURE maintain_sweep;                               ENTRY;
  BEGIN & maintain_sweep &

  INTEGER CONSTANT normal_sup := X16,stop_sup := X10,clr_stop_sup := 6,
                   stop_sup_reset_xadc := X11,end_xadc_auto_zero :=X16;
  INTEGER CONSTANT start_freq_point := 0;
  BYTE CONSTANT retrace_pending := 0,end_of_sup_pending := 1,
                source_bc_pending := 2,vto_bx_pending := 3;

  INTEGER string_index;
  INTEGER sup_flags,next_stp;
  INTEGER present_pos,present_index,next_index;
  BUAD present_freq,next_stop_freq;
  LABEL maintain_loop,maintain_exit_true,maintain_exit_false;
  INTEGER BITFIELD fig: trigger_source;
  BOOLEAN bool_temp;


      SUBROUTINE print_debug_data;                              &debug&
      BEGIN UHEX(bandnum); WHEX(sup_status);                    &debug&
            UNUM(present_pos); UNUM(next_stp);                  &debug&
            UHEX(sup_flags);                                    &debug&
            UQUAD(present_freq); WQUAD(next_stop_freq);         &debug&
            CRLF;                                               &debug&
      END print_debug_data;                                     &debug&
```

```
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REJECT;
      & clear out FIFO ??? check for abort_sweep???&
      reset_bandnum;
      rtf_ovrload :=
      tst_overload := 0;&-2-(number_of_points / if_overload_threshold)&
      pretune_vto( sup_table[ vto_freq ], min_delay );
      xcnd1 := stop_sup_reset_xadc;
      reset_xedc;

      urt_priv_ib_source( no_fun, rttrace_type );
      sup_flags := retrace_pending;


   maintain_loop:
                sup_status := read_fifo(fifo_sup_brk);
                              &do not check source status til later &


      disable_phase_lock_test;

      IF (sup_status = abort_sup) OR abort_flg  THEN
        BEGIN
        abort_flg := 1;
        xcnd1 := stop_sup;
        delay( delay_1n$ );    & allow stop sweep to take effect &
        GO TO maintain_exit_false;
        END;

      IF sup_status # xadc_brk THEN      & end,.BC, or vto_bx decision &
        BEGIN
        IF sup_flags # end_of_sup_pending THER
            BEGIN
            IF sup_table_ptr[ sup_table_condition] = nearly_valid
             THEN sup_table_ptr[ sup_table_condition] := valid ;
            GO TO maintain_exit_true;
            END;
        set_bandnum ( bandnum + 1 );
        pretune_vto( sup_table[ vto_freq ], min_delay );
        IF sup_flags = source_bc_pending AND empty_fifo(fifo_sup_brk)
           THEN
           BEGIN
           urt_priv_ib_source(no_fun,"BC");
           GO TO maintain_loop;
           END;
         &ELSE must be sup_flag=vto_bx_pending BUT not rttrace_pending&
        END
       ELSE IF lock_problen THEN
          BEGIN
          warn_lock_problen;
          xcnd1 := stop_sup;
          reset_sup_table;
          END lost_lock
       ELSE IF  NOT source_settled  THEN    &fifo_sup_brk invalid code&
                                       GO TO maintain_exit_false;
```

```
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REJECT;         &Must be Source settled or 8510 BX &

      present_pos  := next_stp ;
      present_freq := next_stop_freq;


      trigger_source := 0;
      IF neu_sup_params_effective THEN
         BEGIN
            update_frequency_data;
            trigger_source := 1;
         END
       ELSE IF nid_sup_update THEN
         BEGIN
            reset_sup_table;
            warn(sup_sync_err);
            GO TO maintain_exit_false;
         END lost of sup sync;


      IF sup_flags = retrace_pending AND NOT nid_sup_update THEN
                           &need to verify this is a source_settled?&
         BEGIN
         sup_flags := end_of_sup_pending;
         reset_bandnum;    &probably not needed ??&
         present_pos := -1;
         present_freq := frequency_at_point( start_freq_point );
         IF sup_table_ptr[ sup_table_condition] = invalid
           THEN sup_table_ptr[ sup_table_condition] := nearly_valid ;
         xcnd1 := end_xadc_auto_zero;
         END auto zero xadc;
```

```
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REJECT;
      IF sup_flags N retrace_pending RND empty_fifo( fifo_sup_brk ) THEN
         BEGIN

         IF sup_table_ptr[ sup_table_condition] # valid THEN
            BEGIN
            IF  nid_sup_update OR lock_problen THEN
               BEGIN
               present_pos :# present_pos - 1 -
                        (IF xposctr=-1 THEN -1 ELSE xposctr AND XFFF);
                                    &will clear xadc irq if pending??&
              present_freq := frequency_at_point(present_pos);&use OK?&
               END;

            source_data[-1] := nax_source_data;
            string_index := 1;
            next_stop_freq := CW79A(read_priv_ib
                          (source,no_fun,"OB",ADRS(source_data)),
                               string_index
                              );
          &**&IF next_stop_freq < present_freq THEN
               BEGIN warn(bad_bc_value);                        &debug&
               USTR("*bad bc* ");                               &debug&
               print_debug_data;                                &debug&
               GO TO maintain_exit_false;END;                   &debug&


            present_index := find_index( present_freq + 1 );
            next_index    := find_index( next_stop_freq );
            IF   ( present_index < next_index ) &a vto_bx in between?&
              OR ( present_freq  = next_stop_freq ) THEN
               BEGIN
               tup_flags := vto_bx_pending;
               next_stop_freq := bandcross_table[ present_index ];
               sup_table[table_index] := present_index;
               END
             ELSE
               BEGIN
               sup_flags := source_bc_pending;
               sup_table[table_index] := next_index;
               END;

            next_stp := point_at_frequency(next_stop_freq);
            IF next_stp <= present_pos THEN next_stp := present_pos+1;
            IF next_stp >= 800 THEN sup_flags := end_of_sup_pending;

            sup_table[ next_x_stp ) := next_stp;
            sup_table[ next_flag ]  := sup_flags;

            compute_vto_and_pretune( present_freq );

            IF position_debug THEN  print_debug_data;           &debug&

            END invalid_sup_table;
```

```
SBREAK.UORK.PD8510          THU, DEC 22, 1983, 10:25 AM    PAGE 26

WEJECT;
        next_stp := sup_table[ next_x_stp ];
        sup_flags  := sup_table[ next_flag ];
        xstp     := next_stp - present_pos - 1;

        lock_vto_at_pretune;
        set_if_gain;
        check_overload;

        xcnd1 := clr_stop_sup;
        xcnd1 := normal_sup;

        END emptyfifo and no retrace pending
      ELSE
        BEGIN
        next_stp := present_poe ;
        next_stop_frtq := present_freq ;
        END else;

     IF trigger_source THEN
       trig_priv_ib(source);

  GO TO maintain_loop;

  maintain_exit_false: bool_temp     :=FALSE;
        GO TO maintain_sweep_exit;
  maintain_exit_true:  bool_temp     :=TRUE;

  maintain_sweep_exit:
      xcnd1 := ttop_sup;
      IF (tst_overload>0) OR (ref_overload>0) THEN warn(if_overload);
      IF NOT TBIT(bbstatus,conversion_miss) THEN warn( sup_too_fast );
      maintain_sweep := bool_temp;

  END;  & maintain_sweep &
```

```
SBREAK.UORK.PD8510          THU, DEC 22, 1983, 10:25 AM    PAGE 27

REJECT;
COMMENT                                                    step_source
*************************************************************************
*************************************************************************
end of comment;
BOOLEAN PROCEDURE step_source( frequency_value );
    VALUE   frequency_value;
    INTEGER frequency_value;                                    ENTRY;
BEGIN
BOOLEAN rtr_flg;
RLPHA sup_command;
QURD present_freq;

   sync_flg := 0;       & used by check_sup_brk_fifo &

   UHILE NOT empty_fifo( fifo_sup_brk )
      DO check_fifo_sup_brk;
      & clear out any pending fifo items &

   IF frequency_value <= 0 THEN
      BEGIN
      reset_sup_table;
      sup_command := retrace_type ;
      END
    ELSE     sup_command := "IF";


   IF NOT forced_step THEN
      BEGIN

      present_freq := frequency_at_point( frequency_value );
      sup_table[table_index] := find_index( present_freq );
      compute_vto_and_pretune( present_freq );

      IF frequency_value >= 0 THEN
         BEGIN
         urt_priv_ib_source( no_fun, sup_command );
         DO
            check_fifo_sup_brk
          UNTIL  source_settled  OR abort_flg   ;
         END;
       & ELSE use a true CU request in non-alternate sweep &
      END normal step;

   IF  ( sync_flg OR abort_flg ) THEN
      BEGIN
      rtr_flg := FALSE;
      delay(delay_50nS);
      END
    ELSE rtr_flg := TRUE;

   step_source := rtr_flg;

END step_source;
```

```
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WEJECT;
COMMENT                                                    phase_lock
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR phase_lock
*
* FUNCTION: Pretunes the VTO to the specified frequency value,
*           phase-locks the VTO to the already selected phase-lock
*           signal, and returns to the calling procedure when the
*           phase-locking is complete, including any required settling,
*           or when an error condition results in an irrecoverable
*           situation.  Will attempt to recover from any situation
*           that does not affect the rest of the measurement
*           and control sections.  For example, it may retry VTO pretune
*           and phase-lock, but should not reset the source or phase-
*           lock channel multiplexer.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:   none
*
*    OUTPUT: phase_lock        true  * successful completion.
*                              false * aborted phase_lock or
*                                    irrecoverable situation.
*
* COMMENTS:
*    The calling process may be suspended awaiting settling times.
* Should there be provision for this routine to return more information
* about the reason for an abnormal termination, or is a simple boolean
* sufficient?
*
*************************************************************************
*
* LOGIC INFORMATION FOR phase_lock
*
* INTIAL REFINEMENT:
*
*
*
*************************************************************************
;
BOOLEAN PROCEDURE  phase_lock;                                  ENTRY;
   BEGIN & phase_lock &

      phase_lock := lock_vto_at_pretune;

   END;  & phase_lock &
```

```
SBREAK.UORK.PD8510          THU, DEC 22, 1983, 10:25 AM    PAGE 29

WEJECT;
COMMENT                                                    trigger_yadc
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR trigger_yadc
*
* FUNCTION: Triggers the YADC, and returns to the calling procedure
*           when the YADC conversion is complete (including multiple
*           conversions in the case of point-to-point averaging) or
*           when an irrecoverable situation is detected.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* USAGE:
*    INTEGER CONSTANT start := 0,
*                     stop  := 800.
*    step_size := 4.
*    FOR frequency_value := start UNTIL stop BY step_size DO
*       IF phase_lock(frequency_value) = true THEN
*          trigger_yadc
*       ELSE
*          figure out how to recover gracefully.
*
* COMMENTS:
*    The calling process may be suspended awaiting completion.
* The YADC is assumed to already be in the trigger mode.  There is no
* provision for abnormal abort since such a condition will not be
* detectable at this level.
*
*************************************************************************
*
* LOGIC INFORMATION FOR trigger_yadc
*
* INTIAL REFINEMENT:
*
*
*************************************************************************
;
```

```
SBREAK.WORK.PD8510          THU, DEC 22, 1983, 10:25 AM    PAGE  30


@EJECT;
SUBROUTINE trigger_yadc;                                        ENTRY;
   BEGIN & trigger_yadc &

   actrl       := actrl_aavc;

   force_trig_yadc;

   DO
      check_fifo_sup_brk
   UNTIL sup_status = aadc_brk;

   disable_phase_lock_loop;
   trigger_yade := 0;
   actrl       := zero;      & fear sweep node starting with non-zero&

   END;  & trigger_yadc &
```

```
SBREAK.WORK.PD8510          THU, DEC 22, 1983, 10:25 AM    PAGE  31


@EJECT;
COMMENT                                                          break_idle
*****************************************************************
*
* EXTERNAL SPECIFIERTION FOR break_idle
*
* FUNCTION: Service all legal inputs from the sweep-break fifo and
*           report all illegal inputs as errors.  Return when the input
*           is a exit_break_idle.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* USAGE:
*    break_idle.
*
* COMMENTS: The purpose of this routine is to assure that there is
*           never an extended period when there is not some routine
*           running to check the swoep_break_fifo in order to provide
*           reasonable response time to the user for such items as
*           start frequency entries.  Such entries would otherwise have
*           to wait until the next sweep, which could be indefinite in
*           the case of a "hold" sweep.  This routine provides service
*           for those interrupts that occur when the
*           control routine is not expecting sweep-breaks as a
*           direct result of an active sweep.  The control routine
*           causes this routine to terminate by sending it a
*           exit_break_idle via the sweep-break-fifo prior to beginning
*           any sweep operations.  This routine is called when there
*           will be a lull in such operations, so that interrupts will
*           still be serviced in reasonable time, specifically feedback
*           from the source for user inputs such as start frequency.
*
*****************************************************************
*
* LOGIC INFORMATION FOR break_idle
*
* INITIAL REFINEMENT:
*
*
*
*****************************************************************
;
SUBROUTINE break_idle;                                          ENTRY;
   BEGIN & break_idle &
   DO
      BEGIN
      check_abort;
      check_fifo_sup_brk;
      END
   UNTIL sup_status = exit_break_idle;
   END;  & break_idle &
```

```
SBREAK.WORK.PD8510          THU, DEC 22, 1983, 10:25 AM    PAGE  32


BOOLEAN SUBROUTINE break_paused;                                ENTRY;
   BEGIN & break_paused &

   DO check_fifo_sup_brk
    UNTIL (sup_status = exit_break_idle ) OR ( sup_status = abort_sup);

   break_paused := NOT( sup_status = abort_sup );
   END;  & break_paused &

END$

      SUBROUTINE print_debug_data;                              &debug1
      BEGIN WHex(bandnun,1); WHex(sup_status,3);                &debug2
            WNUM(present_pos); WNUM(next_stp);                  &debug1
            Whex(sup_flags,2);                                  &debug2
            WQURO(present_freq); WQURO(next_stop_freq);         &debug1
            CRLF;                                               &debug2
      END print_debug_data;                                     &debug1


PROCEDURE alt_debug_sub(itr); VALUE str; ALPHA str;             &debug2
BEGIN                                                           &debug2
   IF alt_debug THEN                                            &debug2
      BEGIN WSTR(str);            WNUM(coupled_tables);         &debug2
      WNUM(current_entry_ch); WNUM(current_acquisition_ch);     &debug2
      CRLF; END;                                                &debug1
END alt_debug_sub;                                              &debug2
```

```
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INTEGER CONSTANT
   correct_off       := 0,          & fixed by datap &  & cal_mode &
   correct_on        := 1,

   response          := 1,          & fixed by datap &  & cal_type &
   one_port_on_1     := 2,
   one_port_on_2     := 3,
   two_port          := 4,
   simple_two_port   := 5,
   undefined_cal     := -1,

   std_open          := 0,                              & cal_std_type &
   std_short         := 1,      & also used by arrays in sstds.work &
   std_load          := 2,
   std_thru          := 3,
   std_z             := 4,      & arbitrary z &
   std_undefined     := -1,

   done_1_port_cn_1      := 0,                          & cal_done_type &
   done_1_port_on_2      := 1,
   done_reflection       := 2,
   done_trans            := 3,
   done_isol             := 4,
   done_2_port           := 5,
   done_class            := 6;
```

```
FCAL.UORK.PDS510              TNU, DEC 22, 19&3, 10:26 AM     PAGE  1


EXTERNAL INTEGER cal_type;
EXTERNAL ACCLEAR cal_in_progress,
                 cal_coeffe_allocated,
                 neasuring_std_data;

DOUBLE PROCEDURE  cal_erray_addr( array_number );
   VALUE    array_number;
   INTEGER array_number;                                  EXTERNAL.L;
INTEGER PROCEDURE cal_size;                               EXTERNAL.L;
SUBROUTINE restore_paran;                                 EXTERNAL.L;
SUBROUTINE deallocate_cal_array;                          EXTERNAL.L;
BOOLEAN PROCEDURE  partial_allocate_cal( type );
   VALUE    type;
   INTEGER type;                                          EXTERNAL.L;
SUBROUTINE cal_acquisition_done;                          EXTERNAL.L;
SUBKOUTINE acquire_data;                                  EXTERNAL.L;
```

```
SCAL.UORK.PDS510              TNU, DEC 22, 19&3, 10:26 AM     PAGE  1


N6&XL,P,"cal"
BEGIN

#FILE edebugc2.work;                                      & DEBUG &
#FILE ftern.work;                                         & DEBUG &
#FIIE ftarn3.work;                                        & DEBUG &
#FILE factive.work;                          & for select_active_fcn &
#FILE ftine.work;                               & for tdr_check     &
#FILE ftin*2.work;                              & user3_zero       &
#FILE ftopmisc.work;                        & for beep and done_tone &
#FILE futil.work;                               & for tell and warn &
#FILE Futil2.work;                              & for clear_message &
#FILE fcalO.work;                    & correction_off and recall_cal &
#FILE ccal.work;                                & for connand_token &
#FILE fconnand.work;                & for singls_owecp and n_ewwep &
#FILE cnenu.work;
#FILE fnenu.work;
#FILE fstinuli.work; & entsr_freuuency_at point and point_at_frequency &
#FILE fchdata.work;
#FILE cchtable.work;
#FILE fchtable.work;
#FILE Fcontvar.work;                              & for dp_rau_base &
#FILE fsize.work;
#FILE fnenngr.work;                 & for request_ and release_array &
#FILE cnbngr.work;                                  & for oave_op &
#FILE fdatangr.work;                             & for gen_cal_info &
#FILE fnbncal.work;
#FILE ccalnenu.work;                    & for cnd_... for hilights &
#FILE fstds.work;                   & for annctate_std_classes, etc. &
#FILE caverage.work;                                & for evg_on &
#FILE fparan.work;                          & for neu_paraneter &

PROCEDURE cody_user3( fron_addr, to_addr, size );
   VALUE fron_addr, to_addr, size;
   DOUBLE fron_addr, to_addr;
   INTEGER size;                                          EXTERNAL;
SUBROUTINE CNV1E_save;                                    EXTERNAL;
SUBROUTINE fetch_CNVE1;                                   EXTERNAL;
COMPLEX PROCEDURE exp_cnplx(val); VALUE val; COMPLEX val;  EXTERNAL;

EXTERNAL REAL  TwoPi, systen_z0;
```

```
SCAL.UORK.PD8510              TNU, DEC 22, 19&3, 10:26 AM     PAGE  2


@EJECT;
INTEGER CONSTANT user3_length      := 6,
                 min_nun_of_slides := 4,
                 real_size         := 4,
                 elide_data_blk    := 7 * real_size;

REAL    CONSTANT unscale_c0 := 1.0@-15,
                 unscale_c1 := 1.0@-27,
                 unscale_c2 := 1.0@-36;

COMPLEX CONSTANT conplex_1  := (1.0,0.0);


GLOBAL INTEGER cal_type;
GLOBAL BOOLEAN cal_in_progress,
               cal_coeffs_allocated,
               neasuring_std_data;

INTEGER cal_stds_renaining,
        nun_slides,
        old_paran,
        tenp_number_of_groups,
        pt_count,
        last_class;
BOOLEAN refl_conputed;
DOUBLE  cal_coeff_addr,
        elide_data_ptr,
        data_source,
        data_destination;

BYTE    TABLE    check_done   :=
                 done_reflection, done_reflection, done_reflectioo,
                 done_isol,
                 done_trans,  done_trans,
                 done_reflection, done_reflection, done_reflection,
                 done_isol,
                 done_trans,  done_trans;
INTEGER TABLE    needed_nask  :=          & indexed by cal_done type &
        %7,      &done_1_port_on_1       &          & bit patterns &
        %7,      &done_1_port_on_2       &
      %1C7,      &done_reflection        &
      %C30,      &done_trans             &
      %20&,      &done_iaol              &
      %FFF,      &done_2_port            &
        %1;      &done_response          &
INTEGER TABLE  cal_stds_needed :=              & indexed by cal_type &
         0,    & place holder    &                   & bit patterns &
         1,    & response        &
        %7,    & one-port port 1 &
        %7,    & one-port port 2 &
      %FFF,    & two-port        &
      %03F;    & sinple_two_port &
BYTE TABLE cal_arrays :=                       & indexed by cal_type &
         0,    & place holder    &              & nunber of arrays &
         1,    & response        &
         3,    & one-port port 1 &
```

```
SCAL.WORK.PD&510              TNU, DEC 22, 19&3, 10:26 AM     PAGE  3


         3,    & one-port port 2 &
        12,    & two-port        &
        12;    & sinple_two_port &

INTEGER TABLE  cal_menus :=                    & indexed by cal_type &
       0,          & place holder    &
       SID_CLASS_MENU,  & response    &
       PORT_ONE_REFL,   & one-port port  &
       PORT_TUO_REFL,   & one-port port  &
       CAL_MENU2,       & two-port       &
       CAL_MENU3;       & sinple_two_port &
```

```
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%EJECT; COMMENT                                                cal_size
%*************************************************************************
*
*   array size required for error coefficient arrays and array header
*   for current cal_type.
*
%*************************************************************************
;
INTEGER PROCEDURE cal_size;                                    ENTRY;
   BEGIN & cal_size &
   cal_size := ( ( INTEGER(cal_arrays[cal_type]) * array_size +
                   header_size
                 ) OR %003F
               ) + 1;          & bump up to even 64-byte boundary &
   END;  & cal_size &
```

```
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%EJECT;
COMMENT                                                        cal_array_addr
%*************************************************************************
*
%*************************************************************************
;
DOUBLE PROCEDURE  cal_array_addr( array_number );
   VALUE   array_number;
   INTEGER array_number;                                       ENTRY;
   BEGIN & cal_array_addr  &

   IF ( (cal_coeffs_allocated )          RNO
        (array_number <= cal_arrays[cal_type])
      ) THEN
      cal_array_addr := cal_coeff_addr + DOUBLE(array_number*array_size)
   ELSE
      cal_array_addr := 0;

   END;  & cal_array_addr  &
```

```
SCAL.WORK.PD8510              THU, DEC 22, 1983, 10:26 PM    PAGE  6

%EJECT; COMMENT
%*************************************************************************
%*************************************************************************;
SUBROUTINE tell_comp_cal_coeff;     tell( corp_cal_coeff );


SUBROUTINE tell_connect_std;        tell( connect_std );


SUBROUTINE tell_press_done;         tell( press_done  );
```

```
SCPL.WORK.PD8510              THU, DEC 22, 1983, 10:26 PM    PAGE  7

%EJECT; COMMENT                                                restore_param
%*************************************************************************
*
%*************************************************************************
;
SUBROUTINE restore_param;                                      ENTRY;
   BEGIN & restore_param &
      new_parameter( old_param );
   END;  & restore_param &
```

```
SCAL.WORK.PD&S10          THU, DEC 22, 1983, 10:26 AM    PAGE  8

#EJECT; COMMENT                                    deallocate_cal_array
*****************************************************************
*
*****************************************************************
;
SUBROUTINE deallocate_cal_array;                              ENTRY;
   BEGIN & deallocate_cal_array &
      IF cal_coeffs_allocated THEN
         release_array( cal_coeff_addr );
      cal_coeffs_allocated := FALSE;
   END;  & deallocate_cal_array &


COMMENT                                                    abort_cal
*****************************************************************
*
*****************************************************************
;
SUBROUTINE abort_cal;
   BEGIN & abort_cal &
      restore_param;
      deallocate_cal_array;
      cal_type := undefined_cal;
      cal_in_progress := FALSE;
      pop_menu( CAL_MENU );
   END;  & abort_cal &
```

```
SCAL.WORK.PD&S10          THU, DEC 22, 1983, 10:26 AM    PAGE  9

#EJECT; COMMENT                                    allocate_cal_array
*****************************************************************
*
*****************************************************************
;
BOOLEAN PROCEDURE allocate_cal_array;
   BEGIN & allocate_cal_array &
      BOOLEAN result;

      IF cal_coeffs_allocated THEN
         release_array(cal_coeff_addr );
      cal_coeffs_allocated := TRUE;
      cal_in_progress := TRUE;
      cal_coeff_addr := request_array( cal_size );
      IF cal_coeff_addr <> 0 THEN
         BEGIN
            set_entry_ch_double(cal_coeff_addr, ch_e_coeff_base);
            hilight_off( end_response_type, end_class_done );
            result := TRUE;
         END
      ELSE & allocation error &
         BEGIN
            warn( exceeded_available_memory );
            abort_cal;
            result := FALSE;
         END;

      allocate_cal_array := result;

   END;  & allocate_cal_array &
```

```
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#EJECT; COMMENT                                    partial_allocate_cal
*****************************************************************
*
*****************************************************************
;
BOOLEAN PROCEDURE  partial_allocate_cal( type );
   VALUE   type;
   INTEGER type;                                              ENTRY;
   BEGIN & partial_allocate_cal &
      BOOLEAN result;

      cal_type := type;
      cal_in_progress := FALSE;
      result := allocate_cal_array;
      set_entry_ch_integer( cal_type, ch_correction_type );

      partial_allocate_cal := result;
   END;  & partial_allocate_cal &
```

```
SCAL.WORK.PD&S10          THU, DEC 22, 1983, 10:26 AM    PAGE 11

#EJECT; COMMENT                                    allocate_cal
*****************************************************************
*
*****************************************************************
;
BOOLEAN PROCEDURE allocate_cal( type );
   VALUE   type;
   INTEGER type;
   BEGIN & allocate_cal &
      BOOLEAN  result;
      INTEGER  required,
               avail;

      cal_type := type;
      cal_in_progress := FALSE;

      required := cal_seg_size( cal_size );      & bubble blocks req'd &
      avail := cal_seg_avail;

      IF avail >= required THEN    & there will be enough ram space.   &
         BEGIN & if &
            num_slides := 0;
            ref1_computed := FALSE;
            result := allocate_cal_array;
            set_entry_ch_integer( cal_type, ch_correction_type );
         END   & if &
      ELSE                         & there will not be enough space an &
         BEGIN & else &            & bubble to store the completed cal &
            warn( select_delete_cal_set );
            abort_cal;                    & performs a pop_menu(CAL_MENU) &
            result := FALSE
         END;  & else &

      allocate_cal := result;

   END;  & allocate_cal &
```

```
SCAL.WORK.PD8510          THU, DEC 22, 1983, 10:26 AM    PAGE 12

REJECT; COMMENT                                          init_correction
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE init_correction;                                        ENTRY;
   BEGIN & init_correction &
      measuring_std_data := FALSE;
      cal_coeffs_allocated := FALSE;
      cal_type := undefined_cal;
      cal_in_progress := FALSE;
      init_cal0;
   END;  & init_correction &
```

```
SCAL.WORK.PD8510          THU, DEC 22, 1983, 10:26 AM    PAGE 13

REJECT; COMMENT                                              set_cal_type
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  set_cal_type( type );
   VALUE   type;
   INTEGER type;
   BEGIN & tet_cal_type &

      IF allocate_cal( type ) THEN
         BEGIN & if &
            old_param := entry_ch_integer( ch_param );
            cal_stds_remaining   := cal_etde_needed[ type ];

            IF ( (cal_type <> two_port) AND
               (cal_type <> simple_two_port)
            ) THEN
               tell_connect_std ;

            IF cal_type = response THEN
               set_std_class( freq_retp_std )       & before gen_menu &
            ELSE
               @BEGIN & else &
                  annotate_etd_classes;
                  gen_menu( cal_menus[type], 1 );    & after annot ... &
               END;  & else &
         END;  & if &

   END;  & set_cal_type &
```

```
SCAL.WORK.PD8510          THU, DEC 22, 1983, 10:26 AM    PAGE 14

REJECT; COMMENT                                              resume_cal
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE resume_cal;
   BEGIN & resume_cal &
      IF cal_in_progress THEN
         gen_menu( cal_menus[cal_type], 1 )
      ELSE
         warn( no_cal_in_progress );
   END;  & resume_cal &


SUBROUTINE clear_message_and_in_progress;
   BEGIN
   clear_message( comp_cal_coeff );
   cal_in_progress := FALSE;     & needs to be false after a "compute" &
   END;
```

```
SCAL.WORK.PD8510          THU, DEC 22, 1983, 10:26 AM    PAGE 15

REJECT; COMMENT                                             move_slide_val
*****************************************************************************
* move_slide_val is used to move data to/from local stack to more
*   long term memory
* IT IS VERY DEPENDENTED ON THE ALLOCATION ORDER OF THE LOCAL STACK
*****************************************************************************
;
PROCEDURE move_slide_val( from_adr, to_adr );  VALUE from_adr, to_adr;
                                          DOUBLE from_adr, to_adr;
   BEGIN
      INTEGER POINTER from = from_adr,
                      to   = to_adr;

      MOVE to := from,+(slide_data_blk/2);

   END move_slide_val;
```

```
SCAL.WORK.PDS510          THU, DEC 22, 1983, 10:26 AM    PAGE 16

%EJECT; COMMENT                                          load_slided
*****************************************************************
*
*****************************************************************
;
PROCEDURE load_slided;
BEGIN
REAL ARRAY    values[ 0 : ( slide_data_blk / real_size )  - 1 ];
REAL           x,  y,  x2,  y2,  x2_y2,
              sx = values[ 0 ]     ,sy = values[ 1 ],
              sx2= values[ 2 ]     ,sy2= values[ 3 ], sxy = values[ 4 ],
              sx3_y2x = values[ 5 ],sy3_x2y = values[ 6 ];
DOUBLE add_src, add_dst;

add_src := data_source;
IF memory_stolen( slide_data_ptr, slide_load_arrays_id,
                                  slide_data_blk * pt_count )
    THEN num_slides := 0 ;

IF slide_data_ptr # 0 THEN
   BEGIN
   add_dst := slide_data_ptr ;

   REPEAT pt_count DO
      BEGIN
      IF  num_slides = 0 THEN
            sx := sy := sx2 := sy2 := sxy := sx3_y2x := sy3_x2y := 0.0
       ELSE  move_slide_val( add_dst ,  ADDRS( values )  );

      ASSEMBLE(             MOVE.L add_src,R3;    JSR    fetch_CMVE1;
          MOVE.L   R0, x;   MOVE.L  R1, y;        ADD.L  R6, add_src);

      x2    := x * x;
      y2    := y * y;
      x2_y2 := x2 + y2;
      sx    := sx  +  x;              sy    := sy   + y;
      sxy   := sxy + (x*y);
      sx2   := sx2 + x2;              sy2   := sy2  + y2;
      sx3_y2x:= sx3_y2x + (x * x2_y2);  sy3_x2y:= sy3_x2y + (y * x2_y2);

      move_slide_val( ADDRS( values ),  add_dst );
      add_dst  := add_dst  + slide_data_blk;
      END loop;

   num_slides := num_slides + 1 ;
   release_auxiliary_memory( slide_data_ptr, slide_load_arrays_id );

   END & array space available &
    ELSE warn( exceeded_available_memory );
END load_slided;
```

```
SCAL.WORK.PDS510          THU, DEC 22, 1983, 10:26 AM    PAGE 17

%EJECT; COMMENT                                          compute_load
*****************************************************************
*
* PROBLEMS: Due to the limited numerical resolution a potential problem
*           may occur. The input values are points on a circle, and
*           terms to the third power occur, this means the input
*           resoulution is approx 8 bits. So the circle finding routine
*           will find the center of the circle to -48db of the data.
*           i.e. -- Do NOT expect more than approx -48db accuracy on the
*           circle compaired to the worst case data value.
*           NOTE:Also num of slides have some effect on the resolution.
*****************************************************************
;
PROCEDURE compute_load;
BEGIN
REAL          tx, ty, tx2, ty2, txy, tx3_y2x, ty3_x2y;
REAL          x, y, det, sx_tx, ay_ty;
REAL ARRAY    values[ 0 : ( slide_data_blk / real_size )  - 1 ];
REAL          sx = values[ 0 ]     ,sy = values[ 1 ],
              sx2= values[ 2 ]     ,sy2= values[ 3 ], sxy = values[ 4 ],
              sx3_y2x = values[ 5 ],sy3_x2y = values[ 6 ];
DOUBLE  add_dst, add_src;

IF memory_stolen(  slide_data_ptr, slide_load_arrays_id,
                                   slide_data_blk * pt_count )
    THEN num_slides := 0 ;

add_src  := slide_data_ptr    ;
add_dst  := data_destination  ;
```

```
SCAL.WORK.PDS510          THU, DEC 22, 1983, 10:26 AM    PAGE 18

%EJECT;
IF num_slides <= min_num_of_slides THEN
   warn( more_slides_needed )
 ELSE
   BEGIN
   tell_comp_cal_coeff ;
   REPEAT pt_count DO
      BEGIN
      move_slide_val( add_src ,  ADDRS( values ) );

      tx  :=  sx / num_slides ;          ty  := sy / num_slides  ;
      tx2 :=  sx2 - ( sx_tx := sx * tx );
      ty2 :=  sy2 - ( sy_ty := sy * ty );
      txy :=  sxy -   sx * ty ;

      tx3_y2x := sx3_y2x + ( tx * ( 2.0 * sx_tx - 3.0*sx2 - sy2 ) )
                         - ( 2.0 * ty *  txy  ) ;
      ty3_x2y := sy3_x2y + ( ty * ( 2.0 * sy_ty - 3.0*sy2 - sx2 ) )
                         - ( 2.0 * tx *  txy  ) ;
      det     := .5 / ( ( tx2 * ty2 ) - ( txy * txy ) ) ;

      x       := tx + det * ( ( ty2 * tx3_y2x ) - ( txy * ty3_x2y ) ) ;
      y       := ty + det * ( ( tx2 * ty3_x2y ) - ( txy * tx3_y2x ) ) ;

      ASSEMBLE(   MOVE.L  add_dst, R8;    MOVE.L  x, R0;  MOVE.L y,  R1;
                  JSR     CMV1E_save;     MOVE.L  R8, add_dst );

      add_src  := add_src  + slide_data_blk;
      END;
   num_slides  := 0;
   IF frequency_covered THEN  tell_press_done
      ELSE tell_connect_std;
   previous_menu;
   END else enought slides;

release_auxiliary_memory( slide_data_ptr, slide_load_arrays_id );

END compute_load;
```

```
SCAL.WORK.PDS510          THU, DEC 22, 1983, 10:26 AM    PAGE 19

%EJECT; COMMENT                                          take_data
*****************************************************************
*
*****************************************************************
;
PROCEDURE take_data;
   BEGIN & take_data &
   BOOLEAN is_sliding, std_in_band;
   REAL    fmin,  fmax;
   INTEGER class, pt_start, pt_stop ;

      is_sliding := TBIT( std_measured( fmin, fmax, class ) , 1);

      IF cal_type = one_port_on_2 THEN class := class - port_offset;
      IF cal_type = response      THEN class := 0;

      std_in_band   :=  TRUE;
      pt_start  :=  point_at_frequency( OURD( fmin ) ) / step_size;
      pt_stop   :=  point_at_frequency( BURD( fmax ) ) / step_size;
&WHUM( pt_start ); WHUM(pt_stop); &
                  & the following is to make sure take_data banding
                      agrees  with standard_specs in std_act
                      problems when buckets step < 1 Hz      &

&WRERL( REAL( entry_frequency_at_point( pt_start*step_size) ) ); &
      IF NOT(fmin <= REAL(entry_frequency_at_point(pt_start*step_size)))
         THEN IF pt_start<number_of_points THEN pt_start := pt_start + 1
                                           ELSE std_in_band := FALSE;

&WRENL( REAL( entry_frequency_at_point( pt_stop *step_size) ) );  CRLF;&
      IF NOT(fmax >= REAL(entry_frequency_at_point(pt_stop *step_size)))
         THEN    IF pt_stop  >  0    THEN     pt_stop  := pt_stop  - 1
                                           ELSE std_in_band := FALSE;

      pt_count  := pt_stop - pt_start + 1;

      IF ( pt_count > 0 )  AND  std_in_band  THEN
         BEGIN
         data_source :=dp_rau_base[current_entry_ch,generic_param]
                     + DOUBLE(   pt_start * user3_length );
         data_destination := cal_coeff_addr
                     + DOUBLE( ( class * array_size )
                               + (pt_start * user3_length ) );

         IF is_sliding THEN
            load_slided
          ELSE
            copy_user3( data_source, data_destination, pt_count );
         END pt_count > 0;

      highlight_last_element;
      IF frequency_covered OR is_sliding THEN
         BEGIN
            IF is_sliding AND num_slides <= min_num_of_slides
               THEN tell( slide_load)
             ELSE   tell_press_done;
```

```
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          cal_stds_remaining := RBI1( cal_stds_remaining, class );
          last_class := class;
        END
      ELSE tell_connect_std;

  END;  & take_data &
```

```
SCRL.WORK.PD8510              THU, DEC 22, 1983, 10:26 RM    PAGE 21

%EJECT;
PROCEDURE zero_std( std );
                                          VALUE std;  INTEGER std;
BEGIN

  cal_stds_remaining := KBIT( cal_stds_remaining, std );
  user3_zero( (cal_coeff_addr + DOUBLE( std * array_size ) ),
                                                 number_of_points  );
END zero_std;


SUBROUTINE omit_isolation;
BEGIN
  zero_std( isoln_fwd_std );
  zero_std( isoln_rev_std );
  hilight_command(cmd_omit_isolation);
  beep(done_tone);
  tell_press_done ;
END omit_isolation;
```

```
SCRL.WORK.PD8510              THU, DEC 22, 1983, 10:26 RM    PAGE 22

%EJECT; COMMENT                                              std_act
*****************************************************************
*
*****************************************************************
;
COMPLEX PROCEDURE std_act( freq,  class );
                                  VALUE  freq,  class;
                                    REAL freq; INTEGER class;
BEGIN
INTEGER type, type2;
REAL    freq_radians, loss, delay, z_line;
COMPLEX result, Z0;
REAL POINTER etd_coeff;
BYTE POINTER std_type = std_coeff;
REAL real_result = result, imag_result = result + 4;
DOUBLE d= std_coeff;                                    & DEBUG &

SUBROUTINE rotate;
  result := result * exp_cplx( CGMPLEX( 0.0 , delay * freq_radians ) );

STPNTR( etd_coeff, standard_specs( freq, class ) );

freq_radians := TwoPi * freq;
type  := std_type[ type_index  ];
type2 := std_type[ type2_index ];

&IF cal_debug THEN BEGIN
WSTR("std_act");WREAL(freq);WNUM(class);WHex(d,7);WNUM(type);
                                                WNUM(type2);CRLF;END;&

delay  := std_coeff[ delay_index ];
loss   := etd_coeff[  loss_index ];
z_line := std_coeff[    z0_index ];
Z0     := COMPLEX( system_z0, 0.0 );
result := 0.0;

IF type = std_thru THEN
       &thru& BEGIN
              result := complex_1;
              END
 ELSE
    BEGIN
    IF type = std_open  THEN
       &open&BEGIN
            imag_result := (std_coeff[c0_index] * unscale_c0)
                 + freq * ( (std_coeff[c1_index] * unscale_c1)
                                + freq * ( std_coeff[c2_index]
                                      * unscale_c2 )       );
                                & order important -- overflow prob&
            imag_result := -1.0 / ( imag_result * freq_radians );
           END
    ELSE IF type = std_load  THEN
       &load& result := Z0
    ELSE IF type = std_z     THEN
       & z  & real_result := std_coeff[ z0_index ]
    ; COMMENT unneeded
```

```
SCRL.WORK.PD8510              THU, DEC 22, 1983, 10:26 RM    PAGE 23

    ELSE IF type = std_short THEN
      &short&      &default value are correct &   ;

  result := ( result - Z0 ) / ( result + Z0 );
  delay  := -2.0 * delay;
  rotate;

  END not a thru;

&IF cal_debug THEN BEGIN
WSTR("     ");WCPX(result);WREAL(delay);WREAL(loss);WREAL(z_line);CRLF;
END;&
    std_act := result;
END std_act;
```

```
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#EJECT; COMMENT                                  compute_freq_resp_coeff
*****************************************************************
*
* BE CAREFUL OF ACCESSING THE ARRAYS ( ONLY WORD WRITE ACESSES )
*****************************************************************
;
PROCEDURE compute_freq_resp_coeff;
BEGIN
DOUBLE add;
INTEGER index;
REAL    freq;
COMPLEX coeff, meas ;
   add := cal_coeff_addr;
   FOR index := 0 STEP step_size UNTIL 800 DO
        BEGIN
        freq  :=  REAL( entry_frequency_at_point( index ) );

        ASSEMBLE(MOVE.L add   ,R8; JSR fetch_CMVE1; MOVEM.L R0-R1,meas);

        coeff:=meas/ std_act( freq, freq_resp_std );

        ASSEMBLE(MOVE.L  add,       R8;
                 MOVEM.L coeff,  R0-R1;    JSR CMV1E_save );

        add := add + user3_length;

        END loop;
   clear_message_and_in_progress;
END;
```

```
SCAL.WORK.PD8510          THU, DEC 22, 1983, 10:26 AM    PAGE 25

#EJECT; COMMENT                                  compute_1_port_coeff
*****************************************************************
*
* BE CAREFUL OF ACCESSING THE ARRAYS ( ONLY WORD WRITE ACESSES )
*****************************************************************
;
PROCEDURE compute_1_port_coeff( first_std_class );
                          VALUE first_std_class; INTEGER first_std_class;
BEGIN
DOUBLE add;
INTEGER offset, index;
REAL    freq;
COMPLEX meas1    , meas2    , meas3    ,
        act_1    , act_2    , act_3    ,
        term21_21, term32_32, term13_13,
        term21_3 , term32_1 , term13_2 ,
        coeff1   ,   coeff2 ,   coeff3 ,
        det,
        term21=coeff1,term32=coeff2,term13=coeff3;


   add := cal_coeff_addr;
   offset := array_size;
   IF NOT cal_in_progress  & only occurs on port2 of 2port reflection&
     THEN add := cal_coeff_addr + ( port_offset * offset ) ;
   tell_comp_cal_coeff ;
```

```
SCAL.WORK.PD8510          THU, DEC 22, 1983, 10:26 AM    PAGE 26

#EJECT;
   FOR index := 0 STEP step_size UNTIL 800 DO
        BEGIN
        freq  :=  REAL( entry_frequency_at_point( index ) );

        act_1 := std_act(  freq, first_std_class );
        act_2 := std_act(  freq, first_std_class + 1 );
        act_3 := std_act(  freq, first_std_class + 2 );

        ASSEMBLE(MOVE.L add   ,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,meas1;
                 ADD.W  offset,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,meas2;
                 ADD.W  offset,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,meas3 );

        term21 := meas2 - meas1;
        term32 := meas3 - meas2;
        term13 := meas1 - meas3;

        term21_3  := term21 * act_3;
        term32_1  := term32 * act_1;
        term13_2  := term13 * act_2;

        term21_21 := term21 * act_2 * act_1;
        term32_32 := term32 * act_3 * act_2;
        term13_13 := term13 * act_1 * act_3;

        det   := term21_21       +  term32_32       +  term13_13;

        coeff1:=(term21_21*meas3 +  term32_32*meas1  +  term13_13*meas2)
                / det;                                    &directivity&

        coeff2:=-(term21_3       +  term32_1        +  term13_2)
                / det;                                    &source match&

        coeff3:= coeff1 * coeff2 +
              ( (term21_3* meas3 +  term32_1 *meas1  +  term13_2 *meas2)
                / det  );                                 &tracking&

        ASSEMBLE(MOVE.L  add,   R8;
                 MOVEM.L coeff1,R0-R1; JSR CMV1E_save ;
                 MOVE.L  adc,    R5;    ADD.W offset,R8;
                 MOVEM.L coeff2,R0-R1; JSR CMV1E_save ;
                 MOVE.L  add,    R8;    ADD.W offset,R8; ADD.W offset,R8;
                 MOVEM.L coeff3,R0-R1; JSR CMV1E_save );

        add := add + user3_length;

    END loop;

   clear_message_and_in_progress;
   refl_computed := TRUE;

END compute_1_port_coeff;
```

```
SCAL.WORK.PD8510          THU, DEC 22, 1983, 10:26 AM    PAGE 27

#EJECT; COMMENT                                  compute_2_port_coeff
*****************************************************************
* Order (structure) of error coeffs is VERY important  ( see acorrect )
*  e     e     e     e     e     e     e     e     e     e     e     e
*   DF    SF    RF    XF    LF    TF    OR    SR    RR    XR    LR    TR
*
* BE CAREFUL OF ACCESSING THE ARRAYS ( ONLY WORD WRITE ACESSES )
*****************************************************************
end of comment;
PROCEDURE compute_2_port_coeff;
BEGIN
DOUBLE  add,  add2;
INTEGER offset, coeff_offset, index, port;
REAL    freq;
COMPLEX coeff1   ,   coeff2 ,   coeff3 ,
        coeff4   ,   coeff5 ,   coeff6 ,
        meas4    ,    meas5 ,    meas6 ;

   add := cal_coeff_addr;
   tell_comp_cal_coeff ;
   offset := array_size;

   FOR port := 1 TO 2 DO
     BEGIN
     IF port = 2 THEN add := cal_coeff_addr + (port_offset * offset);

     IF ( (cal_type = simple_two_port) AND (port = 2) ) THEN
      copy_user3( cal_coeff_addr, add, port_size * number_of_points )
     ELSE
      FOR index := 0 STEP step_size UNTIL 800 DO
        BEGIN
        RSSEMBLE(MOVE.L add   ,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,coeff1;
                 ADD.W  offset,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,coeff2;
                 ADD.W  offset,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,coeff3;
                 ADD.W  offset,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,meas4;
                 ADD.W  offset,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,meas5;
                 ADD.W  offset,R8;JSR fetch_CMVE1;MOVEM.L R0-R1,meas6 );

        coeff5 :=  meas5 - coeff1;
        coeff5 :=  coeff5 / ( coeff3  + ( coeff2 * coeff5 ) );
                                          & load match &

        coeff6 :=  ( meas6 - meas4) * ( complex_1 - (coeff2 * coeff5) );
                                          S transmission tracking &
                                          & nothing needed for xtalk &

        add2   := add + ALEFT( DOUBLE( offset ) , 2 );   &4*offset&
        RSSEMBLE(MOVE.L  add2,   R8;
                 MOVEM.L coeff5,R0-R1; JSR CMV1E_save  ;
                 MOVE.L  add2,   R8;    ADD.W offset,R8;
                 MOVEM.L coeff6,R0-R1; JSR CMV1E_save );

        add := add + user3_length;

        END add index loop;
```

```
SCAL.WORK.PDS510              THU, DEC 22, 1983, 10:26 AM     PAGE 28

    END port loop;

   clear_message_and_in_progress;

END cenpute_2_port_coeff;
```

```
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REJECT; COMMENT                                                cal_done
*****************************************************************
*
*****************************************************************
;
PROCEDURE  cal_done( type );
   VALUE  type;
   INTEGER type;
   BEGIN & cal_done &

   IF (type = done_claes ) AND NOT frequency_covered THEN
        warn( aot_finished_caling )
   ELSE
       IF (type * done_class ) AND ( col_type * response ) THEN
          BEGIN
          hilight_loot_class;
          IF last_claeo_element > 1 THEN
             previous_nenu;
          IF ( (cal_stds_renaining AND  cal_stds_needed[ cal_type ) AND
                    needed_mask[ check_wons[ last_class ] ! ) = 0 ) THEN
              BEGIN
              IF cal_type >= tuo_port THEN tell_press_done
                 ELSE tell( press_save ) ;
              END
           ELSE tell_connect_std ;
          END
       ELSE IF ( (cal_stds_renaining AND needed_nask[type]) # 0) THEN
          uarn( not_finished_caling )
       ELSE
          BEGIN & enough standards done and not a done_claas &
          CRSE type  OF
             BEGIN & case &
                BEGIN                                  & done_1_port_on_1 &
                   cenpute_1_port_coeff( port1_1st_std );
                   IF cal_type * sinple_tuo_port THEN
                      BEGIN & if &
                         cal_in_progress :* TRUE;      & not yet FALSE &
                         hilight_connand(cnd_cal_sinple_reflection);
                      END;  & if &
                END;
                BEGIN                                  & done_1_port_on_2 &
                   compute_1_port_coeff( port2_1st_std );
                END;
                BEGIN                                   & done_reflection &
                   compute_1_port_coeff( port1_1st_std );
                                                        & special port2 call &
                   compute_1_port_coeff( port2_1st_std );
                   cal_in_progress := TRUE;             & not yet FALSE &
                   hilight_connand(cnd_cal_reflection);
                END;
                BEGIN                                            & done_trans &
                   IF cal_type = sinple_tuo_port THEN
                      hilight_connand(cnd_cal_sinple_thru)
                   ELSE
                      hilight_connand(cnd_cal_thru);
                END;
```

```
SCAL.WORK.PDS510              THU, DEC 22, 1983, 10:26 AM     PAGE 30

                BEGIN                                  & done_isol &
                   IF cal_type = sinple_two_port THEN
                      hilight_connand(cnd_cal_sinple_isolation)
                   ELSE
                      hilight_connand(cnd_cal_isolation);
                END;
                BEGIN                                & done_2_port &
                   compute_2_port_coeff;
                   cal_type := two_port;  & in case of sinple_two_port &
                END;
                BEGIN                    & done_class ( done_response ) &
                   conoute_freq_resp_coeff;
                END;
             END;  & case &

             IF NOT cal_in_progress THEN
               BEGIN & if &
               tell( select_cal_set );
               gen_cal_info( save_cp );
               END   & if &
             ELSE
               BEGIN
               previous_nenu;
               IF ((cal_stds_renaining AND cal_stds_needed[cal_type])=0)
                THEN tell( press_save );
               END;

          END;  & not a done_class and enough standards done &

   END   & cal_done & ;
```

```
SCAL.UORK.PD&510              THU, DEC 22, 1983, 10:26 AM     PAGE 31

REJECT;
COMMENT                                                cal_acquisiton_done
*****************************************************************
*
*   Called by control, in the control process.
*
*****************************************************************
;
SUBROUTINE cal_acquisition_done;                                  ENTRY;
   BEGIN & cal_acouisition_done &

      take_data;
      IF last_class_elenent <= 1 THEN
         cal_done(done_class);
      beep(done_tone);
      clear_nessage( neasuring_std );
      nunber_of_groups := tenp_nunber_of_groups;
      neasuring_std_data := FALSE;

   END;  & cal_acquisition_done &
```

```
SCAL.WORK.PD8510              THU, DEC 22, 1983, 10:26 AM    PAGE  32


%EJECT;
COMMENT                                                    acquire_data
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
!   Begin data acquisition for obtaining calibration data.  If swept,
!   take one additional sweep to allow for settling.  If averaging is
!   turned on, take enough sweeps for the averaging factor plus 1.
!
!   Called from the command process, as with most other cal operations.
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
;
SUBROUTINE acquire_data;                                   ENTRY;
   BEGIN & acquire_data &
      IF NOT measuring_std_data THEN
         BEGIN & if &
            temp_number_of_groups := number_of_groups;
            measuring_std_data := TRUE;
         END;  & if &
      tell( measuring_std );

      IF sweep_mode = swept THEN
         IF entry_ch_integer(ch_average_mode) = avg_on THEN
            n_sweep( entry_ch_integer(eb_average_factor) + 1 )
         ELSE
            n_sweep(2)
      ELSE
         single_sweep;
   END;  & acquire_data &
```

```
SCBL.WORK.PD8510              THU, DEC 22, 1983, 10:26 AM    PAGE  33


%EJECT;
SUBROUTINE check_refl_status;
BEGIN
   tell_connect_std ;
   IF refl_computed THEN
      BEGIN  & must redo all of reflection&
      cal_stds_remaining := cal_stds_remaining  OR
         ( needed_mask[done_reflection] AND cal_stds_needed[cal_type] );
      hilight_off( cmd_port1_std1, cmd_port2_std3 );
      hilight_off(cmd_cal_reflection,cmd_cal_reflection);
      hilight_off(cmd_cal_simple_reflection,cmd_cal_simple_reflection);
      refl_computed := FALSE;
      END      must redo all of reflection;
END check_refl_status;

PROCEDURE if_correct_off_select_cal_kit( kit ); VALUE kit; INTEGER kit;
BEGIN
   IF entry_ch_integer( ch_correction_mode ) = correct_off THEN
      BEGIN & if &
         select_cal_kit( kit );
         gen_menu(CRL_TYPE_MENU, 1 )
      END  & if &
   ELSE
      warn( turn_correct_off );
END if_correct_off_select_cal_kit;

%FILE fcalmenu.work;

%END$
```

```
FCRLO.WORK.PD8510             THU, DEC 22, 1983, 10:26 AM    PAGE  1


EXTERNAL INTEGER default_cal_set;

PROCEDURE  clear_param_cal( cal_set );
   VALUE   cal_set;
   INTEGER cal_set;                                        EXTERNAL.L;
SUBROUTINE correction_off;                                 EXTERNAL.L;
PROCEDURE  correction_on( new_cal_set );
   VALUE   new_cal_set;
   INTEGER new_cal_set;                                    EXTERNAL.L;
PROCEDURE  param_correction_change( param );
   VALUE   param;
   INTEGER param;                                          EXTERNAL.L;
PROCEDURE  save_cal;                                       EXTERNAL.L;
PROCEDURE  init_cal0;                                      EXTERNAL.L;
```

```
SCAL0.WORK.PD8510             THU, DEC 22, 1983, 10:26 AM    PAGE  1


%68KL,P,"cal0"
BEGIN

%FILE fcal.work;
%FILE fmenu.work;
%FILE futil.work;                                  & for tell and warn &
%FILE ccal.work;                                   & cal_type constants &
%FILE ccalmenu.work;                                 & cmd_ constants &
%FILE crims.work;                                  & control_variables &
%FILE fkernel.work;                                & acquire and release &
%FILE fcontrol.work;                                       & abort sweep &
%FILE fcontv2.work;                                        & for rebuild &
%FILE fchtable.work;                       & set_entry_ch_... entry_ch_... &
%FILE cchtable.work;                         & ch_correction_type ..._mode &
%FILE ctrace0.work;                                & for update_proc_vars &
%FILE ftrace0.work;                                        & for partial &
%FILE fcontvar.work;                & max_parameter, partial_new_step_size &
%FILE fnbngr.work;          & for save_data, recall_data, read_data_header &
%FILE fdispran.work;                               & for crt_disp_quad, etc &
%FILE ctpngr.work;                                         & for cal_file &
%FILE fchdata.work;                                        & for step_size &
%FILE fstimuli.work;          & for init_source and update_start_stop_... &
%FILE fgratic.work;                                & for trace_and_graticule &


GLOBAL INTEGER default_cal_set;

INTEGER current_cal_set;
BYTE ARRAY param_cal_set[1:max_parameter];    & cal set for each param &
```

```
SCRLD.WORK.PD8510              THU, DEC 22, 1983, 10:26 AM     PAGE  2

%EJECT; COMMENT                                          clear_paran_cal
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%   Eliminates any parameter links to the specified cal_set.  Used when
%   the cal_set is being deleted or overwritten by a new cal_set.
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
PROCEDURE  clear_paran_cal( cal_set );
   VALUE   cal_set;
   INTEGER cal_set;                                              ENTRY;
   BEGIN & clear_paran_cal &
      INTEGER paran;

      IF cal_set = current_cal_set THEN
         current_cal_set := 0;

      FOR paran := 1 UNTIL max_parameter DO
         IF paran_cal_set[paran] = cal_set THEN
            paran_cal_set[paran] := 0;            & 0 = correction off &

   END;  & clear_paran_cal &
```

```
SCRLD.WORK.PD8510              THU, DEC 22, 1983, 10:26 AM     PAGE  3

%EJECT; COMMENT                                       partial_correction_off
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
SUBROUTINE partial_correction_off;
   BEGIN & partial_correction_off &

      hilight_key( cnd_correction_off,
                   cnd_correction_on,
                   end_correction_off
                 );
      current_cal_set := 0;
      set_entry_ch_integer( correct_off, eh_correction_mode );
      deallocate_cal_array;

   END;  & partial_correction_off &
```

```
SCRLD.WORK.PD8510              THU, DEC 22, 1983, 10:26 AM     PAGE  4

%EJECT; COMMENT                                          correction_off
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
SUBROUTINE correction_off;                                       ENTRY;
   BEGIN & correction_off &

      abort_sweep;
      acquire( control_variables );

      partial_correction_off;
      clear_paran_cal( paran_cal_set[entry_ch_integer(ch_paran)] );

      IF entry_ch_integer(ch_correction_type) = two_port THEN
         rebuild := TRUE;                 & reduced amount of data needed &
      partial(update_proc_vars);
      release( control_variables );          & and processing variables &
      restart_sweep;

   END;  & correction_off &
```

```
SCRLD.WORK.PD8510              THU, DEC 22, 1983, 10:26 AM     PAGE  5

REJECT; COMMENT                                             recall_cal
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
INTEGER PROCEDURE recall_cal(new_cal_set);
   VALUE   new_cal_set;
   INTEGER new_cal_set;
   BEGIN & recall_cal &
      INTEGER         paran_bitmap,
                      new_step;
      BYTE    RRRRY   header[0:header_size+63];
      INTEGER POINTER iptr;
      REAL    POINTER rptr;
      QUAD    POINTER qptr = rptr;
      LABEL   exit_recall;

      paran_bitmap := 0;

      abort_sweep;
      acquire( control_variables );

      IF ( (new_cal_set > 0) AND (new_cal_set <= 8) ) THEN
         BEGIN & if new_cal_set within range &
            STPNTR( iptr, ADRS(header) );
            IF read_data_header( ADRS(header),
                                 cal_file,
                                 new_cal_set
                               ) THEN
               BEGIN & if header read successful &
                  partial_correction_off;

                  new_step := iptr[hd_step_size];
                  IF new_step <> step_size THEN
                     partial_new_step_size( new_step );
                  STPNTR( qptr, ADRS(iptr[hd_start_frequency]) );
                  set_entry_ch_quad( qptr, ch_start_frequency );
                  STPNTR( qptr, ADRS(iptr[hd_center_frequency]) );
                  set_entry_ch_quad( qptr, ch_center_frequency );
                  STPNTR( rptr, ADRS(iptr[hd_sweep_time]) );
                  set_entry_ch_real( rptr, ch_sweep_time );
                  STPNTR( rptr, ADRS(iptr[hd_source_power]) );
                  set_entry_ch_real( rptr, ch_source_power );
                  set_entry_ch_integer( iptr[hd_power_slope_node],
                                        ch_power_slope_node
                                      );
                  paran_bitmap := iptr[hd_paran_bitmap];
                  IF iptr[hd_power_slope_node] = power_slope_on THEN
                     BEGIN & power slope on &
                        STPNTR( rptr, ADRS(iptr[hd_power_slope]) );
                        set_entry_ch_real( rptr, ch_power_slope );
                     END;  & power slope on &

                  partial_allocate_cal( iptr[hd_array_type] );
                  cal_in_progress := FALSE;          & set TRUE above &
                  IF NOT cal_coeffs_allocated THEN
```

```
SCALO.WORK.PDS510              THU, DEC 22, 1983, 10:26 AM    PAGE   6

                    BEGIN & allocation failure &
                       partial_correction_off;
                       GO TO exit_recall;
                    END;  & allocation_failure &

                 update_start_stop_center_span;
                 init_source;

                 IF NOT TBIT( param_bitmap,
                              entry_ch_integer( ch_param )
                            ) THEN
                    BEGIN & if &
                       warn( cal_not_for_param );
                       partial_correction_off;
                    END   & if &
                 ELSE If recall_data( entry_ch_double(ch_e_coeff_base)
                                      - header_size,
                                      cal_file,
                                      new_cal_set
                                    ) THEN
                    BEGIN & else if array read is successful &
                       hilight_key( cnd_correction_on,
                                    cnd_correction_on,
                                    cnd_correction_off
                                  );
                       current_cal_set := new_cal_set;
                       set_entry_ch_integer( correct_on,
                                             ch_correction_mode
                                           );
                    END   & else if array read successful &
                 ELSE & array read unsuccessful &
                    BEGIN & else unsuccessful &
                       warn( no_e_coeffs );
                       partial_correction_off;
                    END;  & else unsuccessful &
              END   & if header read successful &
           ELSE & header read unsuccessful &
              partial_correction_off;
        END   & if new_cal_set within range &
     ELSE & new_cal_set outside of range (including 0) &
        partial_correction_off;

exit_recall:

     rebuild := TRUE;                                & can be smarter &
     partial( update_proc_vars );
     release( control_variables );
     restart_sweep;

     recall_cal := param_bitmap;

  END;  & recall_cal &
```

```
SCALO.WORK.PDS510              THU, DEC 22, 1983, 10:26 AM    PAGE   7

%EJECT; COMMENT                                                correction_on
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  correction_on( new_cal_set );
  VALUE   new_cal_set;
  INTEGER new_cal_set;                                          ENTRY;
  BEGIN & correction_on &
     INTEGER param;
     INTEGER param_bitmap;

     param_bitmap := recall_cal( new_cal_set );

     FOR param := 1 UNTIL max_parameter DO
        IF TBIT( param_bitmap, param ) THEN
           param_cal_set(param) := new_cal_set;

  END;  & correction_on &
```

```
SCALO.WORK.PDS510              THU, DEC 22, 1983, 10:26 AM    PAGE   8

%EJECT; COMMENT                                       param_correction_change
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  param_correction_change( param );
  VALUE   param;
  INTEGER param;                                                ENTRY;
  BEGIN & param_correction_change &
     INTEGER new_cal_set;

     IF NOT cal_in_progress THEN
        BEGIN & if &
           new_cal_set := param_cal_set( param );
           IF new_cal_set <> current_cal_set THEN
              recall_cal( new_cal_set );
        END;  & if &

  END;  & param_correction_change &
```

```
SCALO.WORK.PDS510              THU, DEC 22, 1983, 10:26 AM    PAGE   9

%EJECT; COMMENT                                                 save_cal
*****************************************************************************
*   This routine is called by gen_cal_info(save_op).
*   It postpones providing the save routines with address and size until
*   until the last moment, simplifying MP-IB operation.
*****************************************************************************
;
PROCEDURE  save_cal;                                            ENTRY;
  BEGIN & save_cal &
     INTEGER param_bitmap;
     INTEGER POINTER iptr;

     clear_param_cal( default_cal_set );

     STPNTR(iptr, entry_ch_double(ch_e_coeff_base) - header_size );

     urt_disp_quad( RDRS(iptr[hd_start_frequency]),
                    entry_ch_quad( ch_start_frequency ) );
     urt_disp_quad( RDRS(iptr[hd_center_frequency]),
                    entry_ch_quad( ch_center_frequency ) );
     urt_disp_real( RDRS(iptr[hd_sweep_time]),
                    entry_ch_real( ch_sweep_time ) );
     urt_disp_real( RDRS(iptr[hd_source_power]),
                    entry_ch_real( ch_source_power ) );
     urt_disp_real( RDRS(iptr[hd_power_slope]),
                    entry_ch_real( ch_power_slope ) );
     urt_disp_int(  RDRS(iptr[hd_power_slope_node]),
                    entry_ch_integer( ch_power_slope_node ) );
     urt_disp_int(  RDRS(iptr[hd_step_size]), step_size );
     iptr[hd_array_type]       := cal_type;

     & bits set correspond to applicable parameters based on the      &
     & constants declared for ch_param in ccontvar.                   &
     IF ( (cal_type = two_port) OR (cal_type = simple_two_port) ) THEN
        param_bitmap := %01FE          & s-parameter derived params &
                                & see parameter constants in ccontvar &
     ELSE
        param_bitmap := SHIFT(%0000, entry_ch_integer(ch_param));
     urt_disp_int(  RDRS(iptr[hd_param_bitmap]), param_bitmap );

     save_data( RDRS(iptr),
                cal_size,
                cal_file,
                default_cal_set
              );

     IF cal_type = two_port THEN
        restore_param;

     correction_on( default_cal_set );

  END;  & save_cal &
```

```
SCALO.WORK.PD$510          THU, DEC 22, 1983, 10:26 AM    PAGE  10

%EJECT; COMMENT                                              init_cal0
%*************************************************************************
*
%*************************************************************************
;
PROCEDURE  init_cal0;                                          ENTRY;
   BEGIN & init_cal0 &
      INTEGER paran;

      default_cal_set := 1;
      current_cal_set := 0;
      FOR paran := 1 UNTIL max_paraneter DO
         paran_cal_set[paran] := 0;              & 0 = correction off &

   END;  & init_cal0 &

END$
```

```
CCRLMENU.WORK.PD$510          THU, DEC 22, 1983, 10:26 AM    PAGE  1

INTEGER CONSTANT

cmd_correction_on := 153,
cmd_correction_off := 154,
cmd_correction_default := 155,
cmd_cal_kit_1 := 156,
cmd_cal_kit_2 := 157,
cmd_ref_plane_menu := 159,
cmd_modify_cal_kit_1 := 162,
cmd_modify_cal_kit_2 := 163,
cmd_delete_cal := 164,
cmd_ref_plane_1 := 165,
cmd_ref_plane_2 := 166,
cmd_freq_setup := 167,
cmd_response_type := 168,
cmd_1_port_1_type := 169,
cmd_1_port_2_type := 170,
cmd_simple_2_port_type := 171,
cmd_2_port_type := 172,
cmd_port1_std1 := 173,
cmd_port1_std2 := 174,
cmd_port1_std3 := 175,
cmd_done_1_port_on_1 := 176,
cmd_port2_std1 := 177,
cmd_port2_std2 := 178,
cmd_port2_std3 := 179,
cmd_done_1_port_on_2 := 180,
cmd_cal_reflection := 181,
cmd_cal_thru := 182,
cmd_cal_isolation := 183,
cmd_done_2_port := 184,
cmd_done_reflection := 185,
cmd_fwd_transmission := 186,
cmd_fwd_match := 187,
cmd_rev_transmission := 188,
cmd_rev_match := 189,
cmd_done_trans := 190,
cmd_omit_isolation := 191,
cmd_fwd_isolation := 192,
cmd_rev_isolation := 193,
cmd_done_isolation := 194,
cmd_cal_simple_reflection := 195,
cmd_cal_simple_thru := 196,
cmd_cal_simple_isolation := 197,
cmd_done_simple_reflection := 198,
cmd_class_std1 := 159,
cmd_class_std2 := 200,
cmd_class_std3 := 201,
cmd_class_std4 := 202,
cmd_class_std5 := 203,
cmd_class_std6 := 204,
cmd_class_std7 := 205,
cmd_class_done := 206,
cmd_group7 := 0;
```

```
FCRLMENU.WORK.PD$510          THU, DEC 22, 1983, 10:26 AM    PAGE  1

COMMENT
  This is a software generated file !!!
  Changes must be made in $KINFO.WORK
  Run GENSK.LAMI to re-generate file;

SUBROUTINE proc7;  ENTRY;
BEGIN

CASE command_token-153 OF
BEGIN
& 153 &
correction_on(default_cal_set);
& 154 &
correction_off;
& 155 &
BEGIN
   tell( select_cal_set );
   gen_cal_info( no_op );
END;
& 156 &
if_correct_off_select_cal_kit( 1 );
& 157 &
if_correct_off_select_cal_kit( 2 );
& 158 &
resume_cal;
& 159 &
BEGIN END;
& 160 &
select_active_function( active_system_z0 );
& 161 &
warn(command_not_inplemented);
& 162 &
select_cal_kit( 1 );
& 163 &
select_cal_kit( 2 );
& 164 &
BEGIN
   tell( select_delete_cal_set );
   gen_cal_info( clear_op );
END;
& 165 &
select_active_function( active_ref_plane_1 );
& 166 &
select_active_function( active_ref_plane_2 );
& 167 &
tdr_check;
& 168 &
let_cal_type( response );
& 169 &
set_cal_type( one_port_on_1 );
& 170 &
set_cal_type( one_port_on_2 );
& 171 &
set_cal_type( simple_two_port );
& 172 &
```

```
FCRLMENU.WORK.PD$510          THU, DEC 22, 1983, 10:26 AM    PAGE  2

set_cal_type( two_port );
& 173 &
set_std_class( port1_1st_std );
& 174 &
set_std_class( port1_2nd_std );
& 175 &
set_std_class( port1_3rd_std );
& 176 &
cal_done( done_1_port_on_1 );
& 177 &
set_std_class( port2_1st_std );
& 178 &
set_std_class( port2_2nd_std );
& 179 &
set_std_class( port2_3rd_std );
& 180 &
cal_done( done_1_port_on_2 );
& 181 &
check_refl_status;
& 182 &
tell( connect_thru );
& 183 &
tell( isolate_ports );
& 184 &
cal_done( done_2_port );
& 185 &
cal_done( done_reflection );
& 186 &
   set_std_class( trans_fwd_std );
& 187 &
   set_std_class( match_fwd_std  );
& 188 &
   set_std_class( trans_rev_std );
& 189 &
   set_std_class( match_rev_std );
& 190 &
cal_done( done_trans );
& 191 &
omit_isolation;
& 192 &
set_std_class( isoln_fwd_std );
& 193 &
set_std_class( isoln_rev_std );
& 194 &
cal_done(done_isol);
& 195 &
check_refl_status;
& 196 &
tell( connect_thru );
& 197 &
tell( isolate_ports );
& 198 &
cal_done( done_1_port_on_1 );
& 199 &
set_element( 1 );
& 200 &
```

FCHLMENU.WORK.PD8S10 THU, DEC 22, 1983, 10:26 AM PAGE 3

```
set_element( 2 );
& 201 &
set_element( 3 );
& 202 &
set_element( 4 );
& 203 &
set_element( 5 );
& 204 &
set_element( 6 );
& 205 &
set_element( 7 );
& 206 &
cal_done(done_class);
& 207 &
acquire_data;
& 208 &
compute_load;
END;
END $proc7;
```

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```
RSMB,L
      MED M58K ERSE STATEMENT
      MAM CASE,7,"FIX 1.S.80: MAKE CALL RELATIVE"
      ENT  CASE
*
RO    REG  0
R8    REG  8
S     REG  15
*
CASE 1ST RO
      BLT  XIT
      MOVE.L (S)+,R8
      CMP  -6(R8),RO
      BGE  CASEI
      ROD  RO,RO
      NEG  RO
      ROD  -8(R8,RO),R8
CASEI JMP  (R8)
XII   RTS
      END
```

ACASEBIG.WORK.PD8S10 THU, DEC 22, 1983, 10:26 AM PAGE 1

```
RSMB,L
      MED M68K CASE STATEMENT
      MAM bigcase,7," MAKE CALL REL and LONG"
      ENT  CASE
*
RO    REG  0
R8    REG  8
S     REG  15
*
CASE 1ST RO
      BLT  XIT
      MOVE.L (S)+,R8
      CMP  -8(R8),RO
      BGE  CASEI
      ROD  RO,RO
      NEG  RO
      ROD  -10(R8,RO),R8
CASEI JMP  (R8)
XIT   RTS
      END
```

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```
INTEGER CONSTANT  ch1       := 1,
                  ch2       := 2,
                  no_ch     := -1;
```

```
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EXTERNAL INTEGER   marker_state.L;
EXTERNAL INTEGER   number_of_groups.L;
EXTERNAL INTEGER   sweep_mode.L;
EXTERNAL INTEGER   trace_mode.L;
EXTERNAL INTEGER   step_size.L;
EXTERNAL INTEGER   if_test_gain.L;
EXTERNAL INTEGER   if_ref_gain.L;
EXTERNAL INTEGER   ch_table.L;
```

```
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M68XL,P,"chdata"
BEGIN

%FILE cdatap.work;
%FILE cstimuli.work;
%FILE ctraces.work;
%FILE cymdc.work;
%FILE ccontvar.work;
%FILE ccal.work;
%FILE cchars.work;          & for er, newline, hp_logo_h, hp_logo_p &

COMMENT
   The following tables are 3-dimensional:
     format    = maximum value of 11
     parameter = maximum value of 12
     channel   = maximum value of 2
   They are later equated to an assembly language entry point
   in order to simulate arrays with indices starting at 1 instead of 0.
;

REAL TABLE scale_tbl :=
  10.0, 10.0,     & format 1 -- log magnitude &
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  1.00, 1.00,     & format 2 -- linear magnitude &
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  100.0, 100.0,   & format 3 -- phase &
  100.0, 100.0,
  100.0, 100.0,
  100.0, 100.0,
  100.0, 100.0,
  100.0, 100.0,
  100.0, 100.0,
  100.0, 100.0,
  100.0, 100.0,
  100.0, 100.0,
```

```
SCNDATA.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  2

  100.0, 100.0,
  100.0, 100.0,
  1.0E-8, 1.0E-8, & format 4 -- group delay &
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  1.0E-8, 1.0E-8,
  10.0, 10.0,     & format 5 -- real &
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,     & format 6 -- imaginary &
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  10.0, 10.0,
  0.20, 0.20,     & format 7 -- bullseye polar w/log marker readout &
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,     & format 8 -- bullseye polar w/linear marker readout &
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
```

```
SCNDATA.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  3

  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,     & format 9 -- imaginary vs real &
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,     & format 10 -- impedance Smith chart &
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,     & format 11 -- admittance Smith chart &
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  0.20, 0.20,
  1.00, 1.00,     & format 12 -- SWR &
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00,
  1.00, 1.00;

REAL TABLE ref_position_tbl :=
```

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```
  5.0, 5.0,       & format 1 -- log magnitude &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  0.0, 0.0,       & format 2 -- linear magnitude &
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  5.0, 5.0,       & format 3 -- phase &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,       & format 4 -- group delay &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,       & format 5 -- real &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
```

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```
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,       & format 6 -- imaginary &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,       & format 7 -- bullseye polar u/log marker readout &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,       & format 8 -- bullseye polar u/linear marker readout &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,       & format 9 -- imaginary vs real &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,       & format 10 -- impedance Smith chart &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
```

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```
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,       & format 11 -- admittance Smith chart &
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  5.0, 5.0,
  1.0, 1.0,       & format 12 -- SWR &
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0;

RERL TRBLE ref_value_tbl :=
  0.0, 0.0,       & format 1 -- log magnitude &
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,       & format 2 -- linear magnitude &
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
```

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```
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,       & format 3 -- phase &
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,       & format 4 -- group delay &
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,       & format 5 -- real &
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,       & format 6 -- imaginary &
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  0.0, 0.0,
  1.0, 1.0,       & format 7 -- bullseye polar u/log marker readout &
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
```

```
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  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,       & format 8 -- bullseye polar w/linear marker readout &
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,       & format 9 -- imaginary vs real &
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,       & format 10 -- impedance Smith chart &
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,       & format 11 -- admittance Smith chart &
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,       & format 12 -- SUR &
  1.0, 1.0,
```

```
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  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0,
  1.0, 1.0;

INTEGER TABLE format_tbl :=
  fmt_log_mag,    fmt_log_mag,     & s11    frequency domain &
  fmt_log_mag,    fmt_log_mag,     & s21  &
  fmt_log_mag,    fmt_log_mag,     & s12  &
  fmt_log_mag,    fmt_log_mag,     & s22  &
  fmt_linear_mag,fmt_linear_mag,   & z1   &
  fmt_linear_mag,fmt_linear_mag,   & z2   &
  fmt_linear_mag,fmt_linear_mag,   & y1   &
  fmt_linear_mag,fmt_linear_mag,   & y2   &
  fmt_log_mag,    fmt_log_mag,     & user1 &
  fmt_log_mag,    fmt_log_mag,     & user2 &
  fmt_log_mag,    fmt_log_mag,     & user3 &
  fmt_log_mag,    fmt_log_mag,     & user4 &
  fmt_linear_mag,fmt_linear_mag,   & s11    band-pass time-domain &
  fmt_linear_mag,fmt_linear_mag,   & s21  &
  fmt_linear_mag,fmt_linear_mag,   & s12  &
  fmt_linear_mag,fmt_linear_mag,   & s22  &
  fmt_linear_mag,fmt_linear_mag,   & z1   &
  fmt_linear_mag,fmt_linear_mag,   & z2   &
  fmt_linear_mag,fmt_linear_mag,   & y1   &
  fmt_linear_mag,fmt_linear_mag,   & y2   &
  fmt_linear_mag,fmt_linear_mag,   & user1 &
  fmt_linear_mag,fmt_linear_mag,   & user2 &
  fmt_linear_mag,fmt_linear_mag,   & user3 &
  fmt_linear_mag,fmt_linear_mag,   & user4 &
  fmt_real,       fmt_real,        & s11    low_pass time-domain &
  fmt_real,       fmt_real,        & s21  &
  fmt_real,       fmt_real,        & s12  &
  fmt_real,       fmt_real,        & s22  &
  fmt_real,       fmt_real,        & z1   &
  fmt_real,       fmt_real,        & z2   &
  fmt_real,       fmt_real,        & y1   &
  fmt_real,       fmt_real,        & y2   &
  fmt_real,       fmt_real,        & user1 &
  fmt_real,       fmt_real,        & user2 &
  fmt_real,       fmt_real,        & user3 &
  fmt_real,       fmt_real,        & user4 &
  fmt_log_mag,    fmt_log_mag,     & s11    aux voltage domain &
  fmt_log_mag,    fmt_log_mag,     & s21  &
  fmt_log_mag,    fmt_log_mag,     & s12  &
  fmt_log_mag,    fmt_log_mag,     & s22  &
  fmt_linear_mag,fmt_linear_mag,   & z1   &
  fmt_linear_mag,fmt_linear_mag,   & z2   &
  fmt_linear_mag,fmt_linear_mag,   & y1   &
  fmt_linear_mag,fmt_linear_mag,   & y2   &
```

```
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  fmt_log_mag,    fmt_log_mag,     & user1 &
  fmt_log_mag,    fmt_log_mag,     & user2 &
  fmt_log_mag,    fmt_log_mag,     & user3 &
  fmt_log_mag,    fmt_log_mag;     & user4 &

REAL TABLE delay_tbl :=                          & electrical delay &
  0.0,   0.0,     & s11   &
  0.0,   0.0,     & s21   &
  0.0,   0.0,     & s12   &
  0.0,   0.0,     & s22   &
  0.0,   0.0,     & z1    &
  0.0,   0.0,     & z2    &
  0.0,   0.0,     & y1    &
  0.0,   0.0,     & y2    &
  0.0,   0.0,     & user1 &
  0.0,   0.0,     & user2 &
  0.0,   0.0,     & user3 &
  0.0,   0.0;     & user4 &

INTEGER TABLE parm_desc_tbl :=
  num_h1,                    & s11, numerator_port          &
  denom_a1,                  & s11, denominator_port        &
  driven_a1,                 & s11, driven_port             &
  lock_to_a1,                & s11, phase_lock_port         &
  conv_pff,                  & s11, parameter_conversion    &

  num_b2,                    & s21, numerator_port          &
  denom_a1,                  & s21, denominator_port        &
  driven_a1,                 & s21, driven_port             &
  lock_to_a1,                & s21, phase_lock_port         &
  conv_off,                  & s21, parameter_conversion    &

  num_b2,                    & s12, numerator_port          &
  denom_a1,                  & s12, denominator_port        &
  driven_a1,                 & s12, driven_port             &
  lock_to_a1,                & s12, phase_lock_port         &
  conv_off,                  & s12, parameter_conversion    &

  num_b1,                    & s22, numerator_port          &
  denom_a1,                  & s22, denominator_port        &
  driven_a1,                 & s22, driven_port             &
  lock_to_a1,                & s22, phase_lock_port         &
  conv_off,                  & s22, parameter_conversion    &

  num_b1,                    & z1, numerator_port           &
  denom_a1,                  & z1, denominator_port         &
  driven_a1,                 & z1, driven_port              &
  lock_to_a1,                & z1, phase_lock_port          &
  conv_s_to_z,               & z1, parameter_conversion     &

  num_b2,                    & z2, numerator_port           &
  denom_a2,                  & z2, denominator_port         &
  driven_a1,                 & z2, driven_port              &
  lock_to_a1,                & z2, phase_lock_port          &
  conv_s_to_z,               & z2, parameter_conversion     &
```

```
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  num_b1,                    & y1, numerator_port           &
  denom_a1,                  & y1, denominator_port         &
  driven_a1,                 & y1, driven_port              &
  lock_to_a1,                & y1, phase_lock_port          &
  conv_s_to_y,               & y1, parameter_conversion     &

  num_b2,                    & y2, numerator_port           &
  denom_a2,                  & y2, denominator_port         &
  driven_a1,                 & y2, driven_port              &
  lock_to_a1,                & y2, phase_lock_port          &
  conv_s_to_y,               & y2, parameter_conversion     &

  num_a1,                    & user1, numerator_port        &
  denom_no_ratio,            & user1, denominator_port      &
  driven_a1,                 & user1, driven_port           &
  lock_tc_a1,                & user1, phase_lock_port       &
  conv_off,                  & user1, parameter_conversion  &

  num_b2,                    & user2, numerator_port        &
  eemen_no_ratio,            & user2, denominator_port      &
  driven_a1,                 & user2, driven_port           &
  lock_to_a1,                & user2, phase_lock_port       &
  conv_off,                  & user2, parameter_conversion  &

  num_a2,                    & user3, numerator_port        &
  denom_no_ratio,            & user3, denominator_port      &
  driven_a1,                 & user3, driven_port           &
  lock_to_a1,                & user3, phase_lock_port       &
  conv_off,                  & user3, parameter_conversion  &

  num_b1,                    & user4, numerator_port        &
  denom_no_ratio,            & user4, denominator_port      &
  driven_a1,                 & user4, driven_port           &
  lock_to_a1,                & user4, phase_lock_port       &
  conv_off;                  & user4, parameter_conversion  &

BYTE TABLE old_id_bytes :=       & EACH TOTAL BYTE COUNT MUST BE EVEN &
  0, 0, 0, 0, 0, 0, 0, 0, 0, 0,    & old_id[1:old_id_size] = [1:20]) &
  0, 0, 0, 0, 0, 0, 0, 0, 0, 0;                    & it - 20 &
                                  & old_id_size from testset &

COMMENT
  Any miscellaneous instrument state variables are grouped into
  integer tables below and global variables of the appropriate
  type are equated to their corresponding table entry.
;

INTEGER TABLE integer_vars :=
  continuous,        & number_of_groups &
  swept,             & sweep_mode &
  single_ch,         & trace_mode &
  4,                 & step_size &
  auto_range,        & if_test_gain &
  auto_range,        & if_ref_gain &
  0,                 & srq_mask_primary &
  0,                 & srq_mask_secondary &
```

```
SCMDR1A.WORK.PD&510          THU, DEC 22, 1983, 10:27 AM    PAGE 12

  0,                & plot_quadrant &
  0;                & marker_state &

BYTE TABLE title_bytes :=       & EACH TOTAL BYTE COUNT MUST BE EVEN &
  50,02,            & title_line[-1:title_size) (17May83 = [-1:50]) &
  hp_logn_h,hp_logo_p,  0,0,0,0,0,0,0,0,0,0,          & 1 - 11 &
                        0,0,0,0,0,0,0,0,0,0,0,0,0,0,  & 12 - 25 &
  0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,  & 26 - 50 &
  0,0; & two additional for buffering during word moves due to dg ran. &
                                    & title_size from cscreen &

BYTE TABLE ch_cnd1_bytes :=     & EACH TOTAL BYTE COUNT MUST BE EVEN &
  50, 0,          & ch_cnd1_line[-1:title_size) (17May83 = [-1:50]) &
  0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,  & 1 - 25 &
  0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,  & 26 - 50 &
  0,0; & two additional for buffering during word moves due to dg ran. &
                                    & title_size from cscreen &

BYTE TABLE ch_cnd2_bytes :=     & EACH TOTAL BYTE COUNT MUST BE EVEN &
  50, 0,          & ch_cnd2_line[-1:title_size) (17May83 = (-1:50]) &
  0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,  & 1 - 25 &
  0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,  & 26 - 50 &
  0,0; & two additional for buffering during word moves due to dg ran. &
                                    & title_size from cscreen &

INTEGER TABLE   plot_pen_tbl := 1,1,2;      & pen colors for ch1, ch2 &

GLOBAL BYTE     old_id          = oid_id_bytes[-1];   & 1 through 20 &

GLOBAL INTEGER  number_of_groups = integer_vars[0];
GLOBAL INTEGER  sweep_mode       = integer_vars[1];
GLOBAL INTEGER  trace_mode       = integer_vars[2];
GLOBAL INTEGER  step_size        = integer_vars[3];
GLOBAL INTEGER  if_test_gain     = integer_vars[4];
GLOBAL INTEGER  if_ref_gain      = integer_vars[5];
GLOBAL INTEGER  srq_mask_primary = integer_vars[6];
GLOBAL INTEGER  srq_mask_secondary=integer_vars[7];
GLOBAL INTEGER  plot_quadrant    = integer_vars[8];
GLOBAL INTEGER  marker_state     = integer_vars[9];

GLOBAL BYTE     title_line       = title_bytes[1];     & 0 through 50 &
GLOBAL BYTE     ch_cnd1_line     = ch_cnd1_bytes[1];   & 0 through 50 &
GLOBAL BYTE     ch_cnd2_line     = ch_cnd2_bytes[1];   & 0 through 50 &

COMMENT
  Softkey hilighting bitmap: 24 entries * 16 bits = 384 command codes
  When adding or deleting entries, subtract or add the number of entries
  * 16 - 1 to the CONSTANT hilite_max in SMENU.WORK and re-compile it
  along with this module.
;
GLOBAL INTEGER TABLE  hilite_bitmap :=
  & may have to fix up by hand (later) &
  0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,  &0..23&
  0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0;  &24..47&

GLOBAL INTEGER TABLE coupled_bitmap :=
```

```
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  -1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  -1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1;   &0..23 set to &FFFF = coupled &

COMMENT
  The following tables contains channel values of different
  data types (quad,integer,double,real) on both channels.
  Table entries are preceded by BOOLEAN values indicating whether or
  not the table elements are coupled.

  Table naming conventions are as follows:
    b<n> for BOOLEAN TABLEs
    t<n> for data TABLEs
  Tables b1 and t1 must occur first,
  The variable max_save must be equated to the first label following the
        save/recall group.
  For any additional data tables, just add to the last n value used.
  Last n value used is found at the end of all the data tables.

NOTE !!!
  The comment, ch_<element>, included with each table correspond to the
  ch_<element> constants declared in CCNTABLE.WORK.  Therefore, any
  additions/deletions to those constants must also be made to this group
  of tables in order for the information to track each other.
;

BOOLEAN CONSTANT
  coupled   := TRUE,
  uncoupled := FALSE;

  & ch_start_frequency &
BOOLEAN TABLE b01 := coupled;
QUAD    TABLE t01 :=  2000000000, 2000000000;

  & ch_center_frequency &
BOOLEAN TABLE b02 := coupled;
QUAD    TABLE t02 := 10000000000,10000000000;

  & ch_start_aux_out &
BOOLEAN TABLE b03 := coupled;
QUAD    TABLE t03 := 0,0;

  & ch_center_aux_out &
BOOLEAN TABLE b04 := coupled;
QUAD    TABLE t04 := 0,0;

  & ch_start_time &
BOOLEAN TABLE b05 := coupled;
QUAD    TABLE t05 := -1000000,-1000000; & scaled to femtpseconds &

  & ch_center_time &
BOOLEAN TABLE b06 := coupled;
QUAD    TABLE t06 :=  1500000, 1500000; & scaled to femtoseconds &

  & ch_start_gate &
BOOLEAN TABLE b07 := coupled;
QUAD    TABLE t07 :=  -500000, -500000; & scaled to femtoseconds &
```

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  & ch_center_gate &
BOOLEAN TABLE b08 := coupled;
QUAD    TABLE t08 :=        0,       0; & scaled to femtoseconds &

  & ch_sweep_time &
BOOLEAN TABLE b09 := coupled;
REAL    TABLE t09 := .1, .1;

  & ch_source_power &
BOOLEAN TABLE b10 := coupled;
REAL    TABLE t10 := 10.0, 10.0;

  & ch_power_slope &
BOOLEAN TABLE b11 := coupled;
REAL    TABLE t11 := 0.0, 0.0;

  & ch_power_slope_mode &
BOOLEAN TABLE b12 := coupled;
INTEGER TABLE t12 := power_slope_off, power_slope_off;

  & ch_domain &
BOOLEAN TABLE b13 := uncoupled;
INTEGER TABLE t13 := freq_domain, freq_domain;

  & ch_gating &
BOOLEAN TABLE b14 := coupled;
INTEGER TABLE t14 := gate_off, gate_off;

  & ch_gate_window &
BOOLEAN TABLE b15 := coupled;
INTEGER TABLE t15 := normal_window, normal_window;

  & ch_time_window &
BOOLEAN TABLE b17 := coupled;
INTEGER TABLE t17 := normal_window, normal_window;

  & ch_tdr_stimulus_type &
BOOLEAN TABLE b18 := coupled;
INTEGER TABLE t18 := step_tdr, step_tdr;

  & ch_param &
BOOLEAN TABLE b20 := uncoupled;
INTEGER TABLE t20 := 1,2;

  & ch_marker1 &
BOOLEAN TABLE b21 := coupled;
QUAD    TABLE t21 := 4000000000,4000000000;

  & ch_marker2 &
BOOLEAN TABLE b22 := coupled;
QUAD    TABLE t22 := 4000000000,4000000000;

  & ch_marker3 &
BOOLEAN TABLE b23 := coupled;
QUAD    TABLE t23 := &000000000,4000000000;
```

```
SCMDATA.WORK.PD&510          THU, DEC 22, 1983, 10:27 AM    PAGE 15

  & ch_marker4 &
BOOLEAN TABLE b24 := coupled;
QUAD    TABLE t24 := 4000000000,4000000000;

  & ch_marker5 &
BOOLEAN TABLE b25 := coupled;
QUAD    TABLE t25 := 4000000000,4000000000;

  & ch_average_factor &
BOOLEAN TABLE b26 := uncoupled;
INTEGER TABLE t26 := 1,1;

  & ch_average_mode &
BOOLEAN TABLE b27 := uncoupled;
INTEGER TABLE t27 := avg_off, avg_off;

  & ch_correction_type &
BOOLEAN TABLE b28 := coupled;
INTEGER TABLE t28 := undefined_cal, undefined_cal;

  & ch_correction_mode &
BOOLEAN TABLE b29 := coupled;
INTEGER TABLE t29 := correct_off, correct_off;

  & ch_math_op &
BOOLEAN TABLE b30 := uncoupled;
INTEGER TABLE t30 := trace_data_div_mem, trace_data_div_mem;

  & ch_mem_nmbr &
BOOLEAN TABLE b63 := uncoupled;
INTEGER TABLE t63 := mem1, mem2;

  & ch_smoothing_aperture &
BOOLEAN TABLE b31 := uncoupled;
REAL    TABLE t31 := 0.0,0.0;

  & ch_smoothing_mode &
BOOLEAN TABLE b32 := uncoupled;
INTEGER TABLE t32 := smoothing_off, smoothing_off;

  & ch_n_state &
BOOLEAN TABLE b33 := uncoupled;
INTEGER TABLE t33 := n_off, n_off;

  & ch_d_state &
BOOLEAN TABLE b34 := uncoupled;
INTEGER TABLE t34 := d_on, d_on;

  & ch_trace_math &
BOOLEAN TABLE b64 := uncoupled;
INTEGER TABLE t64 := math_off, math_off;

  & ch_stimulus_mode &
BOOLEAN TABLE b35 := uncoupled;
INTEGER TABLE t35 := start_stop, start_stop;
```

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SCNDATA.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  16


  & ch_atten_port1 &
BOOLEAN TABLE b36 := coupled;
REAL    TABLE t36 := 0.0, 0.0;

  & ch_atten_port2 &
BOOLEAN TABLE b37 := coupled;
REAL    TABLE t37 := 0.0, 0.0;

  & ch_wade_gain &
BOOLEAN TABLE b3& := coupled;
INTEGER TABLE t3& := 0, 0;

  & ch_phase_offset &
BOOLEAN TABLE b39 := uncoupled;
REAL    TABLE t39 := 0.0, 0.0;

  & ch_magnitude_slope &
BOOLEAN TABLE b71 := uncoupled;
REAL    TABLE t71 := 0.0, 0.0;

  & ch_magnitude_effect &
BOOLEAN TABLE b72 := uncoupled;
REAL    TABLE t72 := 0.0, 0.0;

  & ch_stimulus_elepc &
BOOLEAN TABLE b73 := uncoupled;
REAL    TABLE t73 := 0.0, 0.0;

  & ch_stimulus_offset &
BOOLEAN TABLE b74 := uncoupled;
QUAD    TABLE t74 := 0, 0;

  & ch_ref_plane_1 &
BOOLEAN TABLE b75 := coupled;
REAL    TABLE t75 := 0.0, 0.0;

  & ch_ref_plane_2 &
BOOLEAN TABLE b76 := coupled;
REAL    TABLE t76 := 0.0, 0.0;

  & ch_systen_z0 &
BOOLEAN TABLE b77 := coupled;
REAL    TABLE t77 := 50.0, 50.0;

COMMENT ---------- end of save/recall state ----------;

  & ch_basis_s_paren &
BOOLEAN TABLE b40 := uncoupled;
INTEGER TABLE t40 := %AAA, %AAA;

  & ch_refl_trans &
BOOLEAN TABLE b41 := uncoupled;
INTEGER TABLE t41 := %AAA, %AAA;

  & ch_paran_conversicn &
```

```
SCNDATA.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  17

BOOLEAN TABLE b42 := uncoupled;
INTEGER TABLE t42 := &AAA, %AAA;

  & ch_fermat &
BOOLEAN TABLE b43 := uncoupled;
INTEGER TABLE t43 := &AAA, %AAA;

  & ch_scale &
BOOLEAN TABLE b44 := uncoupled;
REAL    TABLE t44 := %AAAAAAAA, %AAAAAAAA;

  & ch_ref_value &
BOOLEAN TABLE b45 := uncoupled;
REAL    TABLE t45 := %AAAAAAAA, %AAAAAAAA;

  & ch_ref_position &
BOOLEAN TABLE b46 := uncoupled;
REAL    TABLE t46 := &AAAAAAAA, %AAAAAAAA;

  & ch_elec_delay &
BOOLEAN TABLE b47 := uncoupled;
REAL    TABLE t47 := %AAAAAAAA, %AAAAAAAA;

  & ch_start_stimulus &
BOOLEAN TABLE b48 := coupled;
QUAD    TABLE t48 := %AAAAAAAAAAAAAAAA, %AAAAAAAAAAAAAAAA;

  & ch_stop_stimulus &
BOOLEAN TABLE b49 := coupled;
QUAD    TABLE t49 := &AAAAAAAAAAAAAAAA, %AAAAAAAAAAAAAAAA;

  & ch_center_stimulus &
BOOLEAN TABLE b50 := coupled;
&UAD    TABLE t50 := %AAAAAAAAAAAAAAAA, %AAAAAAAAAAAAAAAA;

  & ch_span_stimulus &
BOOLEAN TABLE b51 := coupled;
QUAD    TABLE t51 := %AAAAAAAAAAAAAAAA, %AAAAAAAAAAAAAAAA;

  & ch_rau11_base &
BOOLEAN TABLE b52 := uncoupled;
DOUBLE  TABLE t52 := %AAAAAAAA, %AAAAAAAA;

  & ch_rau21_base &
BOOLEAN TABLE b53 := uncoupled;
DOUBLE  TABLE t53 := %AAAAAAAA, %AAAAAAAA;

  & ch_rau12_base &
BOOLEAN TABLE b54 := uncoupled;
DOUBLE  TABLE t54 := %AAAAAAAA, %AABBAAAA;

  & ch_rau22_base &
BOOLEAN TABLE b55 := uncoupled;
DOUBLE  TABLE t55 := %AAAAAAAA, %AAAAAAAA;

  & ch_d_base &
```

```
SCNDATA.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  18

BOOLEAN TABLE b56 := uncoupled;
DOUBLE  TABLE t56 := %AAAAAAAA, %AAAAAAAA;

  & ch_f_base &
BOOLEAN TABLE b57 := uncoupled;
DOUBLE  TABLE t57 := %AAAAAAAA, %AAAAAAAA;

  & ch_n_base &
BOOLEAN TABLE b58 := uncoupled;
DOUBLE  TABLE t5& := %AAAAAAAA, %AAAAAAAA;

  & ch_trace_base &
BOOLEAN TABLE b59 := uncoupled;
DOUBLE  TABLE t59 := %AAAAAAAA, %AAAAAAAA;

  & ch_n_trace_base &
BOOLEAN TABLE b60 := uncoupled;
DOUBLE  TABLE t60 := %AAAAAAAA, %AAAAAAAA;

  & ch_e_coeff_base &
BOOLEAN TABLE b61 := coupled;
DOUBLE  TABLE t61 := %AAAAAAAA, %AAAAAAAA;

  & ch_finished_signal &
BOOLEAN TABLE b62 := uncoupled;
INTEGER TABLE t62 := %AAA, %AAA;

  & ch_stop_gate &
BOOLEAN TABLE b65 := coupled;
DOAD    TABLE t65 := %AAAAAAAAAAAAAAAA, %AAAAAAAAAAAAAAAA;

  & ch_channel_no &
BOOLEAN TABLE b66 := uncoupled;
INTEGER TABLE t56 := 1, 2;

& last used =  77 (11 Aug 83, UCC) -- 16,19,67,68,69,70 are also free &

INTEGER TABLE filler := 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0;

COMMENT ---------- end of instrument state set up ----------;

GLOBAL INTEGER ch_table = b01;              & start of channel table  &
GLOBAL INTEGER min_save = scale_tbl;        & start of save/recall    &
GLOBAL INTEGER nax_save = b40;              & start of non-save/recall&
GLOBAL INTEGER last_state = integer_vars;   & start of last state     &
GLOBAL INTEGER nas_dump = filler;           & end of entire nach state&


COMMENT ---------- equating PFR tables ----------;

ASSEMBLE(
        "               ENT scale               ";
        "               ENT ref_position        ";
        "               ENT ref_value           ";
        "               ENT format              ";
        "               ENT elec_delay          ";
```

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SCNDATA.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  19

        "               ENT parameter_descriptor  ";
  "scale                EQU $scale_tbl-108        ";
  "ref_position         EQU $ref_position_tbl-108 ";
  "ref_value            EQU $ref_value_tbl-108    ";
  "format               EQU $format_tbl-6         ";
  "elec_delay           EQU $delay_tbl-12         ";
  "parameter_descriptor EQU &parm_desc_tbl-12     "
        );                          & these arrays are declared in FCMPFR &

COMMENT --------- equating plotter pen setup tables ------------------
        --------- and softkey hilite bitmap info.   ------------------;

ASSEMBLE(
        "               ENT plotter_pen         ";
        "               ENT hilite_info         ";
  "plotter_pen          EQU &plot_pen_tbl       ";
  "hilite_info          EQU &hilite_bitmap      "
        );      & these arrays are declared in FCMDATA2 &

END&
```

```
FCHDATR2.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM     PAGE  1


EXTERNAL INTEGER TABLE  coupled_bitmap.L;
EXTERNAL BYTE ARRAY old_id.L[1:20];
EXTERNAL INTEGER
   min_save.L,
   max_save.L,
   max_dump.L,
   plot_quadrant.L,
   arq_mask_primary.L,
   arq_mask_secondary.L,
   last_state.L;
EXTERNAL BYTE ARRAY title_line.L[-1:50];
EXTERNAL INTEGER ARRAY plotter_pen.L [0:2];
EXTERNAL INTEGER ARRAY halite_info.L [0:1,0:24];
   COMMENT
   upper limit of 24 should change as number of entries in 1st row of
   halite_bitmap table (found in schdata) increases or decreases;
```

```
FCHPFR.WORK.PD8510            THU, DEC 22, 1983, 10:27 AM     PAGE  1

COMMENT requires max_... constants from cdatap, ccontvar, and cchtable;
& These arrays are defined in file fchdata &
EXTERNAL INTEGER ARRAY format.L[ 0:max_domain,
                                 1:max_parameter,
                                 1:max_ch
                               ];
EXTERNAL REAL ARRAY elec_delay.L[ 1:max_parameter,
                                  1:max_ch
                                ];
EXTERNAL REAL ARRAY scale.L[ 1:max_format,
                             1:max_parameter,
                             1:max_ch
                           ];
EXTERNAL REAL ARRAY ref_position.L[ 1:max_format,
                                    1:max_parameter,
                                    1:max_ch
                                  ];
EXTERNAL REAL ARRAY ref_value.L[ 1:max_format,
                                 1:max_parameter,
                                 1:max_ch
                               ];
EXTERNAL INTEGER ARRAY parameter_descriptor.L[ 1:max_parameter,
                                               1:max_parameter_entry
                                             ];
```

```
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1280
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20352
9216
1024
20480
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20544
16384
9216
1280
20496
16440
16392
20472
20480
16392
20472
20472
20528
20432
9216
1280
20480
16432
16424
16448
20440
20416
20544
20432
9216
1280
20488
16440
16408
16432
20488
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20448
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20464
20456
16384
20472
16400
16384
16416
16392
16400
16408
```

```
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```
SCHQUICK.WORK.PDS510          THU, DEC 22, 1983, 10:27 AM    PAGE  1


{$L-}
PROGRAM chquick(input,output);

( the 'quick' format is a compact and abbreviated character set for
  use in the monitor. )

{
DOCUMENTATION FOR THE 'quick' CHARACTER FORMAT


Display Generator Data:

a3 a2 a1 a0    b3 b2 b1 b0    c3 c2 c1 c0    d3 d2 d1 d0

    for characters, a3 = 0
                    d2 = d1 = d0 = 0
    IF a2=1 (LDXY -- char's only)
                    b3 = b2 = b1 = b0 = sign of least-significant byte
    IF a2=0 (LDR or RTS)
                    c3 = c2 = c1 = c0 = d3 = d2 = d1 = d0 = 0

'quick' Format:

IF a2=1 THEN
     (LDXY)                   c3 c2 c1 c0    d3 a2 a1 a0
IF a2=0 THEN
     (LDB or RTS)             b3 b2 b1 b0    d3 d2 d1 d0

TO UNPACK FROM 'quick' FORMAT TO DISPLAY GENERATOR DATA,

      temp := packed[i];                              & sign extend &
      unpacked[i] := LEFT( (temp AND 7), 12) +
                     ( IF IBIT(temp,2) THEN (temp AND XOFFS )
                       ELSE  LEFT( (temp AND ZFO), 4) );

   NOTE:  The initial assignment to 'temp' performs a sign extension
          of the byte data in addition to setting up an intermediate
          variable.

   packed[ ]    is a byte array containing the packed 'quick' data.
   unpacked[ ]  is an integer destination array for the unpacked data.
)

VAR
   i,command,data,j,cnt : integer;
   input : FILE OF integer;

BEGIN (chargen)
   cnt := 2;
   writeln;
   write(' ');
   read(j);
   WHILE NOT eof(input) DO
      BEGIN (while)
```

```
SCHQUICK.WORK.PDS510          THU, DEC 22, 1983, 10:27 AM    PAGE  2


      i := j;
      IF i < 0 THEN
         writeln('*** Illegal character set value ***');
      IF (i MOD 8) <> 0 THEN
         writeln('*** (i MOD 16) <> 0 ***');
      command := i DIV 4096;
      i := i MOD 4096;
      IF command < 4 THEN
         i := i DIV 16;
      IF command > 7 THEN
         writeln('ERROR');
      data := i + command;
      data := data MOD 256;
      IF data > 127 THEN
         data := data - 256;
      write(data:3,',');
      cnt := cnt+4;
      IF ((j=9216) OR (cnt > 68)) THEN
         BEGIN (if)
         writeln;
         cnt := 0;
         END; (if)
      IF j = 9216 THEN
         BEGIN (if)
         write(' ');
         cnt := 2;
         END; (if)
      read(j);
   END; (while)
END. (chargen)
```

```
FCHTAB2.WORK.PDS510           THU, DEC 22, 1983, 10:27 AM    PAGE  1


INTEGER PROCEDURE  ch_integer(element, ch);
   VALUE   element, ch;
   INTEGER element, ch;                                          EXTERNAL;
REAL PROCEDURE  ch_real(element, ch);
   VALUE   element, ch;
   INTEGER element, ch;                                          EXTERNAL;
QUAD PROCEDURE  ch_quad(element, ch);
   VALUE   element, ch;
   INTEGER element, ch;                                          EXTERNAL;
DOUBLE PROCEDURE  ch_double(element, ch);
   VALUE   element, ch;
   INTEGER element, ch;                                          EXTERNAL;
```

```
FCHTAB3.WORK.PDS510           THU, DEC 22, 1983, 10:27 AM    PAGE  1


EXTERNAL INTEGER current_acquisition_ch;

INTEGER PROCEDURE  acquisition_ch_integer(element);
   VALUE   element;
   INTEGER element;                                              EXTERNAL;
REAL PROCEDURE  acquisition_ch_real(element);
   VALUE   element;
   INTEGER element;                                              EXTERNAL;
QUAD PROCEDURE  acquisition_ch_quad(element);
   VALUE   element;
   INTEGER element;                                              EXTERNAL;
DOUBLE PROCEDURE  acquisition_ch_double(element);
   VALUE   element;
   INTEGER element;                                              EXTERNAL;
PROCEDURE partial_select_entry_ch(neu_channel);
   VALUE   neu_channel;
   INTEGER neu_channel;                                          EXTERNAL;
PROCEDURE select_entry_ch(neu_channel);
   VALUE   neu_channel;
   INTEGER neu_channel;                                          EXTERNAL;
PROCEDURE select_acquisition_ch(neu_channel);
   VALUE   neu_channel;
   INTEGER neu_channel;                                          EXTERNAL;
PROCEDURE  select_coupled(coupled, element, element_size);
   VALUE   coupled, element, element_size;
   INTEGER element, element_size;
   BOOLEAN coupled;                                              EXTERNAL;
BOOLEAN PROCEDURE coupled_ch (element);
  VALUE element; INTEGER element;                                EXTERNAL;
SUBROUTINE init_ch_table;                                        EXTERNAL;
```

```
CCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  1

COMMENT
**************************************************************************
*
* CHANNEL DESCRIPTOR
*
**************************************************************************
;
$FILE cchconst.work;       & constant values for Ch 1, Ch 2, and no Ch &

COMMENT
These integer constants are the byte offsets for each channel parameter
into the ch_table.

When adding a new element to the channel table, insert the element where
appropriate (i.e. calibration saves, save/recall) as indicated by the
comments seperating groups of constants.  Assign the value of the
element with the preceding element constant plus the preceding element's
byte size (use constants qsz,dsz,rsz,etc.), then change the value of the
following element to that of the new element plus the new element's byte
size:
                :
                :
          element_n  := element_n0 + qsz,   { elemcnt_n0 = qsz bytes }
          element_new:= element_n + isz,    { element_n = isz bytes }
          element_nn := element_new + bsz,  { element_new= bsz bytes }
             etc.
The byte size of each element will be commented to the left of it.
The insertion of a new element constant must correspond to the byte
offset of its new entry into the ch_table.

The byte size constants, qsz..bsz, represent 2 sets of each element
data type (1 for each channel) and an boolean to indicate whether the
element is coupled or uncoupled.
This boolean occurs before each set of elements in the ch_table.

Constant declarations used to specify data acquisition control are
contained in the file FYADC.  Those for data processing control are
contained in the file fDATRP.
;
INTEGER CONSTANT  qsz := 18,                 & 2 quads + 1 boolean    &
                  dsz := 10,                 & 2 doubles + 1 boolean  &
                  rsz := 10,                 & 2 reals + 1 boolean    &
                  u3ez:= 14,                 & 2 user3s + 1 boolean   &
                  isz := 6,                  & 2 integers + 1 boolean &
& taboo &     &   bsz := 4,  &              & 2 bytes + 1 boolean    &
                  quadsz := 8,                                 & 8 bytes &
                  realsz := 4,                                 & 4 bytes &
                  intsz  := 2;                                 & 2 bytes &
```

```
CCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  2

$EJECT;
INTEGER CONSTANT  ch_table_base          := 0,

                  & array header integer indices &

  & quad    &     hd_start_frequency     := 0,
  & quad    &     hd_center_frequency    := 4,
  & real    &     hd_sweep_time          := 8,
  & real    &     hd_source_power        := 10,
  & integer &     hd_param_bitmap        := 12,
  & integer &     hd_step_size           := 13,
  & integer &     hd_array_type          := 14,
  & real    &     hd_power_slope         := 15,
  & integer &     hd_power_slope_mode    := 17,
                  hd_header_size         := 32,  & words rounded up to &
                                                 & a 32-word multiple. &

                  & save/recall chtable indices &

  & beginning of coupled stimulus group &
  &  changes affect select_coupled, couple_stimulus, uncouple_stimulus &
  & quad    &     ch_start_frequency     := ch_table_base,
  & quad    &     ch_center_frequency    := ch_start_frequency + qsz,
  & quad    &     ch_start_aux_out       := ch_center_frequency + qsz,
  & quad    &     ch_center_aux_out      := ch_start_aux_out + qsz,
  & quad    &     ch_start_time          := ch_center_aux_out + qsz,
  & quad    &     ch_center_time         := ch_start_time + qsz,
  & quad    &     ch_gate_start          := ch_center_time + qsz,
  & quad    &     ch_gate_center         := ch_gate_start + qsz,
  & real    &     ch_sweep_time          := ch_gate_center + qsz,
  & real    &     ch_source_power        := ch_sweep_time + rsz,
  & real    &     ch_power_slope         := ch_source_power + rsz,
  & integer &     ch_power_slope_mode    := ch_power_slope + rsz,
  & end of coupled stimulus group &

  & integer &     ch_domain              := ch_power_slope_mode + isz,
  & integer &     ch_gating              := ch_domain + isz,
  & integer &     ch_gate_window         := ch_gating + isz,
  & integer &     ch_time_window         := ch_gate_window + isz,
  & integer &     ch_tdr_stimulus_type   := ch_time_window + isz,
  & integer &     ch_param               := ch_tdr_stimulus_type + isz,
  & quad    &     ch_marker1             := ch_param + isz,
  & quad    &     ch_marker2             := ch_marker1 + qsz,
  & quad    &     ch_marker3             := ch_marker2 + qsz,
  & quad    &     ch_marker4             := ch_marker3 + qsz,
  & quad    &     ch_marker5             := ch_marker4 + qsz,
  & integer &     ch_average_factor      := ch_marker5 + qsz,
  & integer &     ch_average_mode        := ch_average_factor + isz,
  & integer &     ch_correction_type     := ch_average_mode + isz,
  & integer &     ch_correction_mode     := ch_correction_type + isz,
  & integer &     ch_math_op             := ch_correction_mode + isz,
  & integer &     ch_men_mmbr            := ch_math_op + isz,
  & real    &     ch_onoothing_aperture  := ch_men_mmbr + isz,
  & integer &     ch_enoothing_mode      := ch_smoothing_aperture + rsz,
  & integer &     ch_m_state             := ch_smoothing_mode + isz,
  & integer &     ch_d_etate             := ch_m_state + isz,
```

```
CCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  3

  & integer &     ch_trace_math          := ch_d_state + isz,
  & integer &     ch_stimulus_mode       := ch_trace_math + isz,
  & real    &     ch_atten_port1         := ch_stimulus_mode + isz,
  & real    &     ch_atten_port2         := ch_atten_port1 + rsz,
  & integer &     ch_xadc_gain           := ch_atten_port2 + rsz,
  & real    &     ch_phase_offset        := ch_xadc_gain + isz,
  & real    &     ch_magnitude_slope     := ch_phase_offset + rsz,
  & real    &     ch_magnitude_offset    := ch_magnitude_slope + rsz,
  & real    &     ch_stimulus_slope      := ch_magnitude_offset + rsz,
  & quad    &     ch_stimulus_offset     := ch_stimulus_slope + rsz,
  & real    &     ch_ref_clane_1         := ch_stimulus_offset + qsz,
  & real    &     ch_ref_plane_2         := ch_ref_plane_1 + rsz,
  & real    &     ch_system_z0           := ch_ref_plane_2 + rsz,

                  & non-save/recall indices &

  & integer &     ch_basis_s_param       := ch_system_z0 + rsz,
  & integer &     ch_refl_trans          := ch_basis_s_param + isz,
  & integer &     ch_param_conversion    := ch_refl_trans + isz,
  & integer &     ch_format              := ch_param_conversion + isz,
  & real    &     ch_scale               := ch_format + isz,
  & real    &     ch_ref_value           := ch_scale + rsz,
  & real    &     ch_ref_position        := ch_ref_value + rsz,
  & real    &     ch_elec_delay          := ch_ref_position + rsz,
  & quad    &     ch_start_stimulus      := ch_elec_delay + rsz,
  & quad    &     ch_stop_stimulus       := ch_start_stimolus + qsz,
  & quad    &     ch_center_stimulus     := ch_stop_stimulus + qsz,
  & quad    &     ch_span_stimulus       := ch_center_stimulus + qsz,
  & double  &     ch_raw11_base          := ch_span_stimulus + qsz,
  & double  &     ch_raw21_base          := ch_rau11_base + dsz,
  & double  &     ch_raw12_base          := ch_rau21_base + dsz,
  & double  &     ch_raw22_base          := ch_rau12_base + dsz,
  & double  &     ch_d_base              := ch_rau22_base + dsz,
  & double  &     ch_f_base              := ch_d_base + dsz,
  & double  &     ch_n_base              := ch_f_base + dsz,
  & double  &     ch_trace_base          := ch_n_base + dsz,
  & double  &     ch_m_trace_base        := ch_trace_base + dsz,
  & double  &     ch_e_coeff_base        := ch_n_trace_base + dsz,
  & integer &     ch_finished_signal     := ch_e_coeff_base + dsz,
  & quad    &     ch_gate_stop           := ch_finished_signal + isz,
  &,integer &     ch_channel_no          := ch_gate_stop + qsz,

                  & table size &

                  max_ch                 := 2,   & CHANGE ALSO IN fpfr &
                                                 & AND sends           &
                  ch_save_size           := ch_system_z0 + rsz,
                  ch_table_size          := ch_channel_no + isz;
```

```
DCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:27 AM    PAGE  1

   n   nH   description

   0 0000 = hd_start_frequency
   4 0004 = hd_center_frequency
   8 0008 = hd_sweep_time
  10 000A = hd_source_power
  12 000C = hd_param_bitmap
  13 000D = hd_step_size
  14 000E = hd_array_type
  15 000F = hd_power_slope
  17 0011 = hd_power_slope_mode
  32 0020 = hd_header_size
   0 0000 = ch_start_frequency
  18 0012 = ch_center_frequency
  36 0024 = ch_start_aux_out
  54 0036 = ch_center_aux_out
  72 0048 = ch_start_time
  90 005A = ch_center_time
 108 006C = ch_gate_start
 126 007E = ch_gate_center
 144 0090 = ch_sweep_time
 154 009A = ch_source_power
 164 00A4 = ch_power_slope
 174 00AE = ch_power_slope_mode
 180 00B4 = ch_domain
 186 00BA = ch_gating
 192 00C0 = ch_gate_window
 198 00C6 = ch_time_window
 204 00CC = ch_tdr_stimulus_type
 210 00D2 = ch_param
 216 00D8 = ch_marker1
 234 00EA = ch_marker2
 252 00FC = ch_marker3
 270 010E = ch_marker4
 288 0120 = ch_marker5
 306 0132 = ch_average_factor
 312 0138 = ch_average_mode
 318 013E = ch_correction_type
 324 0144 = ch_correction_mode
 330 014A = ch_math_op
 336 0150 = ch_men_mmbr
 342 0156 = ch_smoothing_aperture
 352 0160 = ch_smoothing_mode
 358 0166 = ch_m_state
 364 016C = ch_d_state
 370 0172 = ch_trace_math
 376 0178 = ch_stimulus_mode
 382 017E = ch_atten_port1
 392 0188 = ch_atten_port2
 402 0192 = ch_xadc_gain
 408 0198 = ch_phase_offset
 418 01A2 = ch_magnitude_slope
 428 01AC = ch_magnitude_offset
 438 01B6 = ch_stimulus_slope
 448 01C0 = ch_stimulus_offset
```

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```
  466 01D2 = ch_ref_plane_1
  476 01DC = ch_ref_plane_2
  486 01E6 = ch_system_z0
  496 01F0 = ch_daeis_s_param
  502 01F6 = ch_refl_trans
  508 01FC = ch_psram_conversion
  514 0202 = ch_format
  520 0208 = ch_scale
  530 0212 = ch_ref_value
  540 021C = ch_ref_position
  550 0226 = ch_elec_delay
  560 0230 = ch_start_stimulus
  578 0242 = ch_stop_stimulus
  596 0254 = ch_center_stimulus
  614 0266 = ch_span_stimulus
  632 0278 = ch_raw11_base
  642 0282 = ch_raw21_base
  652 028C = ch_raw12_base
  662 0296 = ch_raw22_base
  672 02A0 = ch_d_base
  682 02AA = ch_f_base
  692 02B4 = ch_n_base
  702 02BE = ch_trace_base
  712 02C8 = ch_n_trace_base
  722 02D2 = ch_e_coeff_base
  732 02DC = ch_finished_signal
  738 02E2 = ch_gate_stop
  756 02F4 = ch_channel_no
    2 0002 = max_ch
  496 01F0 = ch_save_size
  762 02FA = ch_table_size
```

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```
EXTERNAL INTEGER current_entry_ch;
EXTERNAL INTEGER save_size;
EXTERNAL INTEGER last_state_size;
EXTERNAL INTEGER dump_size;

INTEGER PROCEDURE  entry_ch_integer(element);
   VALUE   element;
   INTEGER element;                                              EXTERNAL;
PROCEDURE  set_entry_ch_integer(element_value, element);
   VALUE   element_value, element;
   INTEGER element_value;
   INTEGER element;                                              EXTERNAL;
PROCEDURE  set_ch_integer(element_value, element, channel_no);
   VALUE   element_value, element, channel_no;
   INTEGER element_value;
   INTEGER element, channel_no;                                  EXTERNAL;
PROCEDURE  set_ch_double(element_value, element, channel_no);
   VALUE   element_value, element, channel_no;
   DOUBLE  element_value;
   INTEGER element, channel_no;                                  EXTERNAL;
PROCEDURE  set_ch_real(element_value, element, channel_no);
   VALUE   element_value, element, channel_no;
   REAL    element_value;
   INTEGER element, channel_no;                                  EXTERNAL;
PROCEDURE  set_ch_quad(element_value, element, channel_no);
   VALUE   element_value, element, channel_no;
   QUAD    element_value;
   INTEGER element, channel_no;                                  EXTERNAL;
REAL PROCEDURE  entry_ch_real(element);
   VALUE   element;
   INTEGER element;                                              EXTERNAL;
PROCEDURE  set_entry_ch_real(element_value, element);
   VALUE   element_value, element;
   REAL    element_value;
   INTEGER element;                                              EXTERNAL;
QUAD PROCEDURE  entry_ch_quad(element);
   VALUE   element;
   INTEGER element;                                              EXTERNAL;
PROCEDURE  set_entry_ch_quad(element_value, element);
   VALUE   element_value, element;
   QUAD    element_value;
   INTEGER element;                                              EXTERNAL;
DOUBLE PROCEDURE  entry_ch_double(element);
   VALUE   element;
   INTEGER element;                                              EXTERNAL;
PROCEDURE  set_entry_ch_double(element_value, element);
   VALUE   element_value, element;
   DOUBLE  element_value;
   INTEGER element;                                              EXTERNAL;
```

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```
!job chtable,libm.pd8510,work:outclass=,1
!continue
!purge ychtable
!build ychtable;rec=-1276,,v,ascii
!ed
e cchtable.work
f xchtable
1,/ch_table_base/d
w/:=/d
1,$s/\&[^\&]*\& *//
1,$s/^ *//
g/^ *$/d
1,$s/[^A-Z^a-z^0-9^_].*$//
1,$s/$/,/
$s/,/;/
0a
M63KL,P BEGIN
&FILE cchtable.work;
%LIST;
INTEGER TABLE ychtable :=
.
$a
END$
.
wq xchtable
!ccn63k xchtable,,ychtable
!ed
e ychtable
)w uchtable.work
wq xchtable
!purge dchtable
!build dchtable;rec=-1276,,v,ascii;noccti
!file input=xchtable
!file output=dchtable,old
!run pchtablp.work
!purge xchtable
!purge ychtable
!ed
e dchtable
wq
!tell libm.pd8510; ============== jchtable done ====================
!tell ucc.pd8510; ================ jchtable done ====================
!eoj
```

SCHTABLE.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 1

```
M63KL,P,"chtable"
BEGIN

%FILE ftrace.work;                                        & for partial &
%FILE ftrace2.work;          & for repaint_traces and annotate_math_cp &
%FILE cdebug.work;                                              & DEBUG &
%FILE fterm.work;                                               & DEBUG &
%FILE fterm2.work;                                              & DEBUG &
%FILE ccontvar.work;                                & for max_parameter &
%FILE fcontv2.work;                                       & for rebuild &
%FILE fioconfig.work;
%FILE cchtable.work;
%FILE fbreak.work;
%FILE factive.work;
%FILE fchdata.work;   & must come after cchtable, fdatap, and fcontvar &
%FILE fchdata2.work;
%FILE fstimul1.work;                                & for annotate_stimulus &
%FILE fstimul3.work;                      & for abort_sweep, restart_sweep &
%FILE fcontrol.work;                            & for trace_and_graticule &
%FILE fgratic.work;
%FILE fkernel.work;
%FILE crins.work;                                       & for write_fifo &
%FILE ffifo.work;                                & for array_update_fifo &
%FILE ffifos.work;           & for array_ch_mask and array_update_mask &
%FILE carray.work;                                      & for single_ch &
%FILE cdatap.work;
%FILE fdispram.work;
%FILE fmenu.work;



INTEGER CONSTANT  leds_for_ch1_active := %FFFE,
                  leds_for_ch2_active := %FFFD;
@BYTE leds = bottom + %6C;

BOOLEAN POINTER coupled;
DOUBLE element_addr;          & offset into specific ch_table record    &

DOUBLE ch_address,            & base address of channel table, ch_table &
       coupled_address,       & base address of channel coupling info.  &
       dump_size_dbl,         & length of instrument state information  &
       save_size_dbl,         & length of save/recall state (bytes)     &
       last_state_dbl;        & length of last save/recall state        &

GLOBAL INTEGER save_size = save_size_dbl*2;
GLOBAL INTEGER last_state_size = last_state_dbl*2;
GLOBAL INTEGER dump_size = dump_size_dbl*2;
GLOBAL INTEGER current_acquisition_ch;
GLOBAL INTEGER current_entry_ch;
```

```
SCNTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM     PAGE  2

#EJECT;
COMMENT                                    channel descriptor operators
*****************************************************************
*
*****************************************************************
;
INTEGER PROCEDURE  ch_integer(element, ch);
   VALUE   element, ch;
   INTEGER element, ch;                                          ENTRY;
   BEGIN & ch_integer &
      INTEGER POINTER element_ptr;

      STPNTR( element_ptr, ch_address+element);
      ch_integer := element_ptr [ch-1];

   IF ch_debug THEN
   BEGIN
      WSTR("rI");WHEX(element); WHEX(ch); WHEX(element_ptr[ch-1]);
      CRLF;
   END;

   END;  & ch_integer &


REAL PROCEDURE  ch_real(element, ch);
   VALUE   element, ch;
   INTEGER element, ch;                                          ENTRY;
   BEGIN & ch_real &
      REAL POINTER element_ptr;

      STPNTR( element_ptr, ch_address+element);
      ch_real := element_ptr [ch-1];

   IF ch_debug THEN
   BEGIN
      DOUBLE POINTER d;
      STPNTR(d,ch_address+element);
      WSTR("rR"); WHEX(element); WHEX(ch); WHex(d[ch-1],8);
      CRLF;
   END;

   END;  & ch_real &


QUAD PROCEDURE  ch_quad(element, ch);
   VALUE   element, ch;
   INTEGER element, ch;                                          ENTRY;
   BEGIN & ch_quad &
      QUAD POINTER element_ptr;

      STPNTR( element_ptr, ch_address+element);
      ch_quad := element_ptr [ch-1];

   IF ch_debug THEN
```

```
SCNTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM     PAGE  3

   BEGIN
      QUAD q;
      q := element_ptr(ch-1);
      WSTR("rQ"); WHEX(element); WHEX(ch); WQUAD(q);
      CRLF;
   END;

   END;  & ch_quad &


DOUBLE PROCEDURE  ch_double(element, ch);
   VALUE   element, ch;
   INTEGER element, ch;                                          ENTRY;
   BEGIN & ch_double &
      DOUBLE POINTER element_ptr;

      STPNTR( element_ptr, ch_address+element);
      ch_double := element_ptr [ch-1];

   IF ch_debug THEN
   BEGIN
      WSTR("rD"); WHEX(element); WHEX(ch); WHex(element_ptr[ch-1],8);
      CRLF;
   END;

   END;  & ch_double &
```

```
SCNTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM     PAGE  4

#EJECT;
COMMENT
*****************************************************************
*
*****************************************************************
;
INTEGER PROCEDURE  acquisition_ch_integer(element);
   VALUE   element;
   INTEGER element;                                              ENTRY;
   BEGIN & acquisition_ch_integer &

      acquisition_ch_integer :=
        ch_integer (element, current_acquisition_ch);

   END;  & acquisition_ch_integer &


REAL PROCEDURE  acquisition_ch_real(element);
   VALUE   element;
   INTEGER element;                                              ENTRY;
   BEGIN & acquisition_ch_real &

      acquisition_ch_real :=
        ch_real (element, current_acquisition_ch);

   END;  & acquisition_ch_real &


QUAD PROCEDURE  acquisition_ch_quad(element);
   VALUE   element;
   INTEGER element;                                              ENTRY;
   BEGIN & acquisition_ch_quad &

      acquisition_ch_quad :=
        ch_quad (element, current_acquisition_ch);

   END;  & acquisition_ch_quad &


DOUBLE PROCEDURE  acquisition_ch_double(element);
   VALUE   element;
   INTEGER element;                                              ENTRY;
   BEGIN & acquisition_ch_double &

      acquisition_ch_double :=
        ch_double (element, current_acquisition_ch);

   END;  & acquisition_ch_double &
```

```
SCNTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM     PAGE  5

#EJECT;
COMMENT
*****************************************************************
*
*****************************************************************
;
INTEGER PROCEDURE  entry_ch_integer(element);
   VALUE   element;
   INTEGER element;                                              ENTRY;
   BEGIN & entry_ch_integer &

      entry_ch_integer :=
        ch_integer (element, current_entry_ch);

   END;  & entry_ch_integer &


REAL PROCEDURE  entry_ch_real(element);
   VALUE   element;
   INTEGER element;                                              ENTRY;
   BEGIN & entry_ch_real &

      entry_ch_real :=
        ch_real (element, current_entry_ch);

   END;  & entry_ch_real &


QUAD PROCEDURE  entry_ch_quad(element);
   VALUE   element;
   INTEGER element;                                              ENTRY;
   BEGIN & entry_ch_quad &

      entry_ch_quad :=
        ch_quad (element, current_entry_ch);

   END;  & entry_ch_quad &


DOUBLE PROCEDURE  entry_ch_double(element);
   VALUE   element;
   INTEGER element;                                              ENTRY;
   BEGIN & entry_ch_double &

      entry_ch_double :=
        ch_double (element, current_entry_ch);

   END;  & entry_ch_double &
```

```
SCNTRBLE.WORK.PDB510          THU, DEC 22, 1983, 10:28 AM    PAGE  6


%EJECT;
COMMENT
*********************************************************************
%
*********************************************************************
;
PROCEDURE set_ch_ptrs (element);
  VALUE element;  INTEGER element;
BEGIN
  element_addr := ch_address+element;
  STPNTR (coupled, coupled_address+element);
  IF ch_debug THEN
    BEGIN
      UHEX(element); Uhex(element_addr,3);
      IF coupled THEN USTR(" c") ELSE USTR(" u"); CRLF;
    END;
END set_ch_ptrs;
```

```
SCNTRBLE.WORK.PDB510          THU, DEC 22, 1983, 10:28 AM    PAGE  7


%EJECT;
PROCEDURE  set_ch_integer (elencnt_value, elenent, channel_ne);
  VRLUE   elenent_value, elenent, cluannel_no;
  INTEGER elenent_value, elenent, channel_no;                    ENTRY;
  BEGIN % oet_entry_ch_integer &

    SUBROUTINE oct_value;
      elenent_addr := urt_disp_int (elenent_addr,elenent_value);

    IF ch_debug THEN
    BEGIN
      USTR("I"); UHEX(channel_no); WHEX(elenent_value);
    END;

    set_ch_ptrs (elenent);

    IF coupled THEN
      BEGIN
        set_value;
        set_value;
      END
    ELSE
    IF channel_no = ch1 THEN
      set_value
    ELSE
      urt_disp_int (elenent_addr+2, elenent_value);
  END;  % oet_ch_integer &


P&OCEDORE  oet_eh_double (elenent_valoe, elenent, channel_no);
  VRLUE   elenent_value, elenent, channel_no;
  DOUBLE  elenent_value;
  INTEGER elenent, channel_no;                                   ENTRY;
  BEGIN

    SUBROUTINE eet_value;
      elenent_addr :# Hrt_disp_dh1 (elenent_addr, elenent_value);

    IF ch_debug THEN
    BEGIN
      USTR("D/R"); WHEX(channel_no); UNex(elenent_value,8);
    END;

    set_ch_ptrs (eltnent);

    IF coupled THEN
      BEGIN
        set_value;
        set_value;
      END
    ELSE
      IF channel_no = ch1 THEN
        set_value
      ELSE
        urt_disp_dbl (elenent_eddr+4, elenent_value);
  END; & oet_ch_double &
```

```
SCNTRBLE.UORK.PDB510          THU, DEC 22, 1983, 10:28 AM    PAGE  8


PROCEDURE set_ch_real (elenent_value, elenent, channel_no);
   VALUE elenent_value, elenent, channel_no;
   REAL elenent_value;
   INTEGER elenent, channel_no;                                  ENTRY;
BEGIN
   DOUBLE double_ch_value = elenent_value;
   set_ch_double (double_ch_value, elenent, channel_no);
END set_ch_real;


PROCEDURE  set_entry_ch_integer (elenent_value, elenent);
   VALUE   elenent_value, elenent;
   INTEGER elenent_value, elenent;                               ENTRY;
BEGIN
  set_ch_integer (elenent_value, elenent, current_entry_ch);
END set_entry_ch_integer;


PROCEDURE  set_entry_ch_double(elenent_value, elenent);
   VALUE   elenent_value, elenent;
   DOUBLE  elenent_value;
   INTEGER elenent;                                              ENTRY;
BEGIN & set_entry_ch_double &
   set_ch_double (elenent_value, elenent, current_entry_ch);
END;  & set_entry_ch_double &


PROCEDURE  set_eh_quad(elenent_value, elenent, channel_no);
   VALUE   elenent_value, elenent, channel_no;
   BUAD    elenent_value;
   INTEGER elenent, channel_no;                                  ENTRY;
   BEGIN & set_entry_ch_quad &

      SUBROUTINE set_value;
        elenent_addr := urt_disp_quad (elenent_addr, elenent_value);

      IF ch_debug THEN
      BEGIN
        WSTR("Q"); UHEX(channel_no); UQUAD(elenent_value);
      END;

      set_ch_ptrs (elenent);

      IF coupled THEN
        BEGIN
          set_value;
          set_value;
        END
      ELSE
        IF channel_no = ch1 THEN
          set_value
        ELSE
```

```
SCNTRBLE.UORK.PDS510          THU, DEC 22, 1983, 10:28 AM    PAGE  9


          urt_disp_quad (elenent_addr+8, elenent_value);
   END;  & set_ch_quad &


PROCEDURE  set_entry_ch_quad(elenent_value, elenent);
   VRLUE   elenent_value, elenent;
   OUAD    elenent_value;
   INTEGER elenent;                                              ENTRY;
   BEGIN & set_entry_ch_quad &
     set_ch_quad (elenent_value, elenent, current_entry_ch);
   END;  & set_entry_ch_quad &


PROCEDURE  set_entry_ch_real(elenent_value, elenent);
   VRLUE   elenent_value, elenent;
   RERL    elenent_value;
   INTEGER elenent;                                              ENTRY;
   BEGIN & set_entry_ch_real &
      DOUBLE double_ch_value = elenent_value;
      set_ch_double (double_ch_value, elenent, current_entry_ch);
   END;  & set_entry_ch_real &
```

```
SCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE 10

#EJECT;
COMMENT                                                    select_coupled
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR select_coupled
*
* FUNCTION
*    To perform all of the operations involved in selecting
* functions to be coupled or uncoupled between channels.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
*****************************************************************************
*
* LOGIC INFORMATION FOR select_coupled
*
* INTIAL REFINEMENT:
*
*****************************************************************************
;
PROCEDURE  select_coupled(coupled, element, element_size);
   VALUE   coupled, element, element_size;
   BOOLEAN coupled;
   INTEGER element, element_size;                                  ENTRY;
   BEGIN & select_coupled &
      BOOLEAN POINTER coupled_info;
      INTEGER current_ch;

      current_ch := current_entry_ch;
      STPNTR (coupled_info, coupled_address+element);
      IF (coupled_info := coupled) THEN
        IF element_size = qsz THEN
          set_entry_ch_quad
          (ch_quad(element,current_ch), element)
        ELSE
        IF element_size = dsz THEN
          set_entry_ch_double
          (ch_double(element,current_ch), element)
        ELSE
        IF element_size = isz THEN
          set_entry_ch_integer
          (ch_integer(element,current_ch), element);

   IF ch_debug THEN
   BEGIN
      USTR("select_coupled:");
      IF coupled THEN UHEX(current_ch) ELSE USTR(" uncoupled ");
      UHEX(element); CRLF;
```

```
SCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE 11

   END;

   END;  & select_coupled &
```

```
SCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE 12

#EJECT;
BOOLEAN PROCEDURE coupled_ch (element);
  VALUE element; INTEGER element;                                  ENTRY;
BEGIN
  BOOLEAN POINTER coupled;
  STPNTR (coupled, coupled_address+element);
  coupled_ch := coupled;
END coupled_ch;
```

```
SCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE 13

#EJECT;
COMMENT                                                    select_entry_ch
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE partial_select_entry_ch(new_channel);
   VALUE   new_channel;
   INTEGER new_channel;                                            ENTRY;
   BEGIN & partial_select_entry_ch &

            current_entry_ch := new_channel;

            update_start_stop_center_span;

   END;  & partial_select_entry_ch &


PROCEDURE select_entry_ch(new_channel);
   VALUE   new_channel;
   INTEGER new_channel;                                            ENTRY;
   BEGIN & select_entry_ch &

      IF new_channel <> current_entry_ch THEN
         BEGIN & if &

            IF NOT coupled_ch(rh_start_frequency) THEN
               get_frequency(FALSE);        & before changing entry ch &

            partial_select_entry_ch( new_channel );
            highlight_menu;

            IF new_channel = 1 THEN
               leds := leds_for_ch1_active
            ELSE
               leds := leds_for_ch2_active;

            annotate_stimulus;
            annotate_math_cp;

            select_active_function(active_previous);
                 & update active function entry display and clear any &
                 & partial entry.                                      &
            IF trace_mode = single_ch THEN
               BEGIN & if &
                  abort_sweep;
                  acquire( control_variables );
                  rebuild := TRUE;
                  trace_and_graticule;
                  release( control_variables );
                  repaint_traces;               & also restarts sweep &
               END;  & if &

            break_entry_control( current_entry_ch );
                        & tell break which is the current_entry_ch &
```

```
SCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE 14


        END;  & if &

    IF ch_debug THEN
    BEGIN
       WSTR("entry ch"); WHEX(new_channel); CRLF;
    END;

    END select_entry_ch;
```

```
SCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE 15

#EJECT;
COMMENT                                                  select_acquisition_ch
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE select_acquisition_ch(new_channel);
    VALUE  new_channel;
    INTEGER new_channel;                                              ENTRY;
    BEGIN & select_acquisition_ch &

       If new_channel <> current_acquisition_ch THEN
          BEGIN & if &

             current_acquisition_ch := new_channel;
             break_acq_control;    & used current_acquisition_ch global &

             COMMENT also change all other channel-related functions;

          END if;

    IF ch_debug THEN
    BEGIN
       WSTR("acquis ch"); WHEX(new_channel); CRLF;
    END;

    END select_acquisition_ch;
```

```
SCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE 16

#EJECT;
COMMENT                                                  init_ch_table
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE init_ch_table;                                         ENTRY;
    BEGIN & init_ch_table &

       coupled_address := RDRS(ch_table);
       ch_address := coupled_address+2;
       dump_size_dbl := RDRS(max_dump)-RDRS(min_save);
       save_size_dbl := RDRS(max_save)-RDRS(min_save);
       last_state_dbl := RDRS(max_save)-RDRS(last_state);

       current_acquisition_ch := no_ch; & precede select_acquisition_ch &
       current_entry_ch := no_ch;       & precede select_entry_ch       &

    IF ch_debug THEN
    BEGIN
       WSTR("INIT_CH_TABLE: size ="); WHEX(ch_table_size); CRLF;
       WSTR("coupled"); WHex(coupled_address,8); CRLF;
       WSTR("channel"); WHex(ch_address,8); CRLF;
    END;

    END;  & init_ch_table &


EOF
```

```
UCHTABLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE  1

1
1,/ DEC /-2d
$
? DEC ?
+
.,$d
1,$s/^ *[0-9]* *//
1,$s/^.* DEC /DEC /
1,$s/^ *//
1,$s/[,;]//
g/DEC /.-1,..j
1,$s/ *DEC */ =    /
1,$s/ *$//
1,$s/^\([^ ]*\).*\([ 0-9](5,5)\)$/\2 = \1/
```

```
SCNTRBLP.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE  1


$LIST OFF$
$USLINIT$
PROGRAM chtable_constants( input, output );

{ converts a number (including leading blanks) in the first 5 characters
  of a line to four numbers -- n, 2*n, hex(n), hex(2*n) -- and outputs
  the expanded line.
}

CONST
   hex_chars  = '0123456789ABCDEF';
   line_max   = 80;  {maximum length of an input line}
   hex_max    = 4;   {maximum length of a hex string}

TYPE
   line_index = 0..line_max;
   line_type  = STRING[line_max];
   hex_index  = 0..hex_max;
   hex_type   = STRING[hex_max];

VAR
   line_in,
   line_out   : line_type;
   number     : integer;
   dummy      : line_index;

FUNCTION  hex( number:integer ):hex_type;
   VAR
      position : hex_index;
      temp_string : hex_type;
   BEGIN (hex)
      position := hex_max;
      temp_string := strrpt( '0', hex_max );
      WHILE ( (number > 0) AND (position > 0) ) DO
         BEGIN (while)
            temp_string[position] := hex_chars[ 1 + (number MOD 16) ];
            number := number DIV 16;
            position := position - 1;
         END;  (while)
      hex := temp_string;
   END;  {hex}

BEGIN (chtable_constants)

writeln( output, 'n':6, 'nN':5, 'description':14 );
writeln( output );

WHILE NOT eof( input ) DO
   BEGIN (while)

      readln( input, line_in );
      line_in := strrtrim( line_in );

      strread( line_in, 1, dummy, number );
      strdelete( line_in, 1, dummy-1 );
```

```
SCNTABLP.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE  2


      write(output, number:6) ;
      write(output, hex(number):5 );
      writeln( output, line_in );

   END;  {while}

END.  {chtable_constants}
```

```
FCIRCLE.WORK.PD8510           THU, DEC 22, 1983, 10:28 AM    PAGE  1


COMPLEX PROCEDURE packed_sin_cos(angle);
   VALUE   angle;
   REAL    angle;                                          EXTERNAL.L;
REAL PROCEDURE intersect_angle( d, r1, r2 );
   VALUE d, r1, r2;
   REAL  d, r1, r2;                                        EXTERNAL.L;
INTEGER PROCEDURE arc(dg_addr,x0,y0,radius,start,angle,max_r,enhanced);
   VALUE   dg_addr, x0, y0, radius, start, angle, max_r, enhanced;
   BOOLEAN enhanced;
   INTEGER dg_addr;
   DOUBLE  x0, y0;
   REAL    radius, start, angle, max_r;                    EXTERNAL.L;
INTEGER PROCEDURE r_circle( addr, x0, y0, r, max_r, scale );
   VALUE   addr, x0, y0, r, max_r, scale;
   INTEGER addr, x0, y0;
   REAL    r, max_r, scale;                                EXTERNAL.L;
INTEGER PROCEDURE x_circle( addr, x0, y0, x, max_r, scale );
   VALUE   addr, x0, y0, x, max_r, scale;
   INTEGER addr, x0, y0;
   REAL    x, max_r, scale;                                EXTERNAL.L;
```

```
SCIRCLE.WORK.PD8510           THU, DEC 22, 1983, 10:28 AM    PAGE  1


M68KL,P,"circle"
BEGIN

MFILE cdisplay.work;
MFILE fdisplay.work;

REAL PROCEDURE ATAN( x );
   VALUE x;
   REAL  x;                                                EXTERNAL;
REAL PROCEDURE SIN( x );
   VALUE x;
   REAL  x;                                                EXTERNAL;
REAL PROCEDURE SQRT( x );
   VALUE x;
   REAL  x;                                                EXTERNAL;
COMPLEX PROCEDURE fst_trig( angle );
   VALUE   angle;
   DOUBLE  angle;                                          EXTERNAL.L;

EXTERNAL REAL TwoPi,
              Pi,
              Pi2;


REAL CONSTANT aspect_ratio    := 0.8,
              segment_density := 0.013; & 64 segments/800 pixel radius &
```

```
SCIRCLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE  2


$EJECT;
COMMENT                                                    packed_sin_cos
*****************************************************************
*
* converts angle into a table index, calls table look up and
* interpolation routine, and converts scaled integer result into
* a real cosine in register 0 and sine in register 1.
*
*****************************************************************
;
COMPLEX PROCEDURE packed_sin_cos(angle);
   VALUE  angle;
   REAL   angle;                                           ENTRY;
   BEGIN & packed_sin_cos &
      fst_trig( DOUBLE( angle*4.1721513484 ) );
      ASSEMBLE(
               MOVE.L   R0,  R1;
               SWAP     R0;
               CLR      R0;
               CLR      R1
              );
   END;  & packed_sin_cos &

REAL PROCEDURE acos( x );
   VALUE x;
   REAL  x;
   BEGIN & acos &
      acos := Pi2 - ATAN( x / SQRT(1 - x*x) );
   END;  & acos &
```

```
SCIRCLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE  3


REJECT;
COMMENT                                                    intersect_angle
*****************************************************************
*
*  Returns the angle between the line connecting the centers of two
*  circles of radii r1 and r2 and the intersection point of the two
*  circles measured at the center of the circle with radius r1.
*
*  "d" is the distance between the centers of the two circles, and
*  must be positive.
*
*****************************************************************
;
REAL PROCEDURE intersect_angle( d, r1, r2 );
   VALUE d, r1, r2;
   REAL  d, r1, r2;                                        ENTRY;
   BEGIN & intersect_angle &
      d := ABS(d);
      IF (r1 + d) <= r2 THEN
         intersect_angle := Pi  & r1 circles is on or inside r2 circle &
      ELSE
         intersect_angle := acos( (r1*r1 + d*d - r2*r2) / (2.0*r1*d) );
   END;  & intersect_angle &


COMMENT                                                    circles_intersect
*****************************************************************
*
*  Returns TRUE if two circles with radii r1 and r2 with centers
*  spaced d apart intersect, or if the circle with radius r1 is fully
*  contained within the circle with radius r2.
*  Returns FALSE if the circle with radius r1 lies on or totally
*  outside the circle with radius r2.
*
*  "d" is the distance between the centers of the two circles, and
*  must be positive.
*
*****************************************************************
;
BOOLEAN PROCEDURE circles_intersect( d, r1, r2 );
   VALUE d, r1, r2;
   REAL  d, r1, r2;
   BEGIN & circles_intersect &
      d := ABS(d);
      circles_intersect := ( (r2+r1) > d ) AND
                           ( (r2+d) > r1 );
   END;  & circles_intersect &
```

```
SCIRCLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE  4


REJECT;
COMMENT                                                          arc
*****************************************************************
*
*  Enhanced arcs are drawn solid, others are dashed.
*
*****************************************************************
;
INTEGER PROCEDURE arc(addr,x0,y0,radius,start,angle,max_r,enhanced);
   VALUE  addr, x0, y0, radius, start, angle, max_r, enhanced;
   BOOLEAN enhanced;
   INTEGER addr;    & display address &
   DOUBLE  x0,      & x-coordinate of center &
           y0;      & y-coordinate of center &
   REAL    radius,  & radius 0.0 to 1.0 &
           start,   & angle to start the arc (radians) &
           angle,   & angle of arc (radians) &
           max_r;   & display units for 1.0 radius &        ENTRY;
   BEGIN & arc &
      BOOLEAN blank_segment,
              odd;
      INTEGER number_of_segments;
      REAL x, temp_x, y, a, b;

      radius := radius * max_r;

      COMMENT
      & constant error (between arc and chord) algorithm &
      number_of_segments := INTEGER( angle / SQRT( 8.0 / radius ) );

      & constant length (and intensity) segment algorithm &
      number_of_segments := INTEGER( angle * radius * segment_density );

      & adjust number_of_segments to odd/even number &
      IF angle < (0.98*TwoPi) THEN
         odd := TRUE                        & arc:    odd  # segments &
      ELSE
         odd := FALSE;                      & circle: even # segments &
      number_of_segments := ALEFT( ARIGHT(number_of_segments,1), 1 )
                          + (IF odd THEN 1
                                    ELSE 2);

      & packed_sin_cos loads R0 and R1 &
      packed_sin_cos( start );
      ASSEMBLE(
               MOVE.L  R0, a;                           & a = cos()  &
               MOVE.L  R1, b                            & b = sin()  &
              );
      x := radius*a;
      y := radius*b;

      & packed_sin_cos loads R0 and R1 &
      packed_sin_cos( angle/REAL(number_of_segments) );  & chord angle &
      ASSEMBLE(
               MOVE.L  R0, a;                           & a = cos()  &
               MOVE.L  R1, b                            & b = sin()  &
```

```
SCIRCLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM    PAGE  5


              );

      addr := move2( addr, x0+DOUBLE(x*aspect_ratio), y0+DOUBLE(y) );
      blank_segment := FALSE;          & first segment is not blanked &
      REPEAT number_of_segments DO
         BEGIN & repeat &
            temp_x := a*x - b*y;          & old x has to be used still &
            y := a*y + b*x;
            x := temp_x;
            IF (blank_segment AND (NOT enhanced)) THEN
               addr := move( addr,
                             x0+DOUBLE(x*aspect_ratio),
                             y0+DOUBLE(y)
                           )
            ELSE & not blank_segment or enhanced &
               addr := draw( addr,
                             x0+DOUBLE(x*aspect_ratio),
                             y0+DOUBLE(y)
                           );
            blank_segment := NOT blank_segment;
         END;  & repeat &

      arc := addr;

   END;  & arc &
```

```
SCIRCLE.WORK.POS510          THU, DEC 22, 1983, 10:28 AM     PAGE  6


%EJECT;
COMMENT                                                          r_circle
**************************************************************************
*
**************************************************************************
;
INTEGER PROCEDURE r_circle( addr, x0, y0, r, max_r, scale );
   VALUE   addr, x0, y0, r, max_r, scale;
   INTEGER addr, x0, y0;
   REAL    r, max_r, scale;                                      ENTRY;
   BEGIN & r_circle &
      BOOLEAN enhance;
      INTEGER i,
              j;
      REAL    a,
              d,
              start,
              angle,
              radius;

      radius := 1.0/(1.0 + r);
      d      := 1.0 - radius;

      IF scale > 1.01 THEN
         j := 2
      ELSE
         j := 1;

      FOR i := 1 UNTIL j DO
         BEGIN & for &

            IF circles_intersect( d, radius, scale ) THEN
               BEGIN & if &
                  a := intersect_angle( d, radius, scale );
                  start := Pi - a;
                  angle := 2 * a;
                  IF ( (r = 0.0) AND (i = 1) ) THEN
                     enhance := TRUE
                  ELSE
                     enhance := FALSE;
                  addr := arc( addr,
                               ( DOUBLE(x0) +
                                 DOUBLE( d *
                                         aspect_ratio *
                                         max_r /
                                         scale
                                       )
                               ),
                               DOUBLE(y0),
                               radius / scale,
                               start,
                               angle,
                               max_r,
                               enhance
                             );
               END;  & if &
```

```
SCIRCLE.UORK.PD8510          THU, DEC 22, 1983, 10:22 AM     PAGE  7


            d := 1.0 + radius;          & for right-half plane circles &
         END;  & for &

      r_circle := addr;

   END;  & r_circle &
```

```
SCIRCLE.WORK.PD8510          THU, DEC 22, 1983, 10:28 RM     PAGE  8


%EJECT;
COMMENT                                                          x_circle
**************************************************************************
*
**************************************************************************
;
INTEGER PROCEDURE x_circle( addr, x0, y0, x, max_r, scale );
   VALUE   addr, x0, y0, x, max_r, scale;
   INTEGER addr, x0, y0;
   REAL    x, max_r, scale;                                      ENTRY;
   BEGIN & x_circle &
      INTEGER temp_integer;
      DOUBLE  x_center,
              y_center;
      REAL    a,
              d,
              start,
              angle,
              phi,
              theta,
              radius,
              scaled_radius,
              y_offset;

      x := ABS(x);
      IF x = 0.0 THEN
         BEGIN & if &
            & horizontal line &
            temp_integer := INTEGER( max_r * aspect_ratio );
            addr := move2( addr, x0-temp_integer, y0 );
            addr := plot( addr, x0+temp_integer, y0, normal, alow );
         END   & if &
      ELSE
         BEGIN & else &
            radius := 1.0 / x;
            scaled_radius := radius / scale;
            phi := Pi2 - RTAN( radius );
            d := 1.0 / SIN(phi);
            x_center := DOUBLE(x0);
            y_center := DOUBLE(y0);

            IF circles_intersect( d, radius, scale ) THEN
               BEGIN & if &
                  a := intersect_angle( d, radius, scale );
                  start := 3.0*Pi2 - phi - a;
                  angle := 2.0 * a;
                  x_center := x_center +
                              DOUBLE( aspect_ratio * max_r / scale );
                  y_offset := DOUBLE( max_r * scaled_radius );
                  addr := arc( addr,
                               x_center,
                               y_center + y_offset,
                               scaled_radius,
                               start,
                               angle,
                               max_r,
```

```
SCIRCLE.UORK.PD8510          THU, DEC 22, 1983, 10:28 RM     PAGE  9


                               FALSE
                             );
                  start := Pi2 + phi - a;
                  addr := arc( addr,
                               x_center,
                               y_center - y_offset,
                               scaled_radius,
                               start,
                               angle,
                               max_r,
                               FALSE
                             );
               END;  & if &
         END;  & else &

      x_circle := addr;

   END;  & x_circle &

END$
```

```
CCMDCRSE.WORK.PDS510          THU, DEC 22, 1983, 10:28 AM     PAGE   1

INTEGER CONSTANT

cmd_illegal := 335,
cmd_enter := 336,
cmd_u1 := 337,
cmd_u2 := 338,
cmd_u3 := 339,
cmd_u4 := 340,
cmd_mkrval := 341,
cmd_up := 342,
cmd_down := 343,
cmd_entry_off := 344,
cmd_save := 345,
cmd_savc_1 := 346,
cmd_seve_2 := 347,
cmd_oave_3 := 348,
cmd_eevc_4 := 349,
cmd_save_5 := 350,
cmd_recall := 351,
cmd_recall_1 := 352,
cmd_recall_2 := 353,
cmd_recall_3 := 354,
cmd_recall_4 := 355,
cmd_rscail_5 := 356,
cmd_racall_last := 357,
cmd_tape_senu := 358,
cmd_copy := 359,
cmd_doc := 360,
cmd_quote := 361,
cmd_label := 362,
cmd_key_1 := 363,
cmd_key_2 := 364,
cmd_key_3 := 365,
cmd_key_4 := 366,
cmd_key_5 := 367,
cmd_key_6 := 368,
cmd_key_7 := 369,
cmd_key_8 := 370,
cmd_ch1 := 371,
cmd_s11 := 372,
cmd_s12 := 373,
cmd_s21 := 374,
cmd_s22 := 375,
cmd_mag := 376,
cmd_phase := 377,
cmd_ch2 := 378,
cmd_delay := 379,
cmd_polar := 380,
cmd_paran_nenu := 381,
cmd_fornat_nenu := 382,
cmd_preset := 383,
cmd_local := 384,
cmd_ocale := 385,
cmd_ref_value := 386,
cmd_start := 387,
```

```
CCMDCRSE.WORK.PDS510          THU, DEC 22, 1983, 10:28 AM     PAGE   2

cmd_stop := 388,
cmd_ref_position := 389,
cmd_auto_qcale := 390,
cmd_center := 391,
cmd_span := 392,
cmd_respenee_menu := 393,
cmd_stinulue_menu := 394,
cmd_cal_nenu := 395,
cmd_dispiay_nenu := 396,
cmd_narker_nenu := 397,
cmd_systen_menu := 398,
cmd_prior_menU := 399,
cmd_neasurement_restart := 400,
emd_domain_menu := 401,
cmd_alwert_command := 402,
emd_input_data := 403,
cmd_input_formatted := 404,
cmd_input_rau1 := 405,
cmd_input_rau2 := 406,
emd_input_rau3 := 407,
cmd_input_rau4 := 408,
emd_input_cal_coeff1 := 409,
cmd_input_eal_eoeff2 := 410,
cmd_input_cel_coeff3 := 411,
emd_input_cal_coeff4 := 412,
cmd_input_cal_ceeff5 := 413,
cmd_input_cal_eoeff6 := 414,
cmd_input_cal_coeff7 := 415,
emd_input_cal_coeff8 := 416,
cmd_input_cel_coeff9 := 417,
cmd_input_cal_coeff10 := 418,
cmd_input_cat_coeff11 := 419,
cmd_input_cal_eoeff12 := 420,
cmd_block_a := 421,
cmd_output_formatted := 422,
cmd_output_active := 423,
cmd_output_narker := 424,
cmd_output_statu= := 425,
cmd_output_id := 426,
cmd_output_data := 427,
cmd_output_rau1 := 428,
cmd_output_rau2 := 429,
cmd_output_rau3 := 430,
cmd_output_rau4 := 431,
cmd_output_cal_coeff1 := 432,
cmd_output_cal_coeff2 := 433,
cmd_output_cal_coeff3 := 434,
cmd_output_cal_coeff4 := 435,
cmd_output_cal_coeff5 := 436,
cmd_output_cal_coeff6 := 437,
cmd_output_cal_coeff7 := 438,
cmd_output_cal_coeff8 := 439,
cmd_output_cal_coeff9 := 440,
cmd_output_cal_coeff10 := 441,
cmd_output_cal_coeff11 := 442,
emd_eutput_cal_coeff12 := 443,
```

```
CCMDCRSE.WORK.PDS510          THU, DEC 22, 1983, 10:28 AM     PAGE   3

cmd_output_nenory := 444,
cmd_output_error := 445,
cmd_hpib_talk := 446,
cmd_srq_nask := 447,
cmd_clear_status := 448,
cmd_xfer_binary := 449,
cmd_xfer_ascii := 450,
cmd_xfer_ieee2 := 451,
cmd_xfer_ieee1 := 452,
cmd_keycode := 453,
cmd_output_plot := 454,
cmd_monitor := 455,
cmd_n_groups_hpib := 456,
cmd_output_key := 457,
cmd_cal_set_1 := 458,
cmd_cal_set_2 := 459,
cmn_cal_aet_3 := 460,
cmd_cal_set_4 := 461,
cmd_cal_set_5 := 462,
cmd_cal_eet_6 := 463,
cmd_cal_set_7 := 464,
cmd_cal_set_8 := 465,
cmd_group0 := 0;
```

```
FCMDCRSE.UORK.PDS510          INU, DEC 22, 1983, 10:28 AM     PAGE   1

COnhENT
  This is a softuare generated file !!!
  Changes nust be nade in SKINFO.WORK
  Run GCNSK.LANI to re-generate file;

SUBROUTIKE proc0;  ENTRY;
BEGIN

CASE connand_token-335 Of
BEGIN
& 335 &
uarn(invalid_connand);
& 336 &
keypad_entry(e0);
& 337 &
keypad_entry(e0);
& 338 &
keypad_entry(e3);
& 339 &
keypad_entry(e6);
& 340 &
keypad_entry(e9);
& 341 &
narker_value_entry;
& 342 &
step_entry(step_up);
& 343 &
step_entry(step_doun);
& 344 &
select_active_function(active_off);
& 345 &
gen_save_nenu(5);
& 346 &
save( 1 );
& 347 &
save( 2 );
& 348 &
save( 3 );
& 349 &
save( 4 );
& 350 &
save( 5 );
& 351 &
gen_save_nenu(6);
& 352 &
recall( 1 );
& 353 &
recall( 2 );
& 354 &
recall( 3 );
& 355 &
recall( 4 );
& 356 &
recall( 5 );
& 357 &
```

```
FCMDCASE.UORK.PD8510          THU, DEC 22, 1983, 10:28 AM     PAGE  2

recall( 8 );
& 358 &
gen_nenu(TAPE_DENU, 0);
& 359 &
gen_nenu(COPY_nENU, 0);
& 360 &
uern(connand_not_inplenented);
& 361 &
select_active_function(active_off);
& 362 &
select_active_function(active_off);
& 363 &
process_sofekey(1);
& 364 &
process_coftkey(2);
& 365 &
process_eoftkay(3);
& 366 &
process_eoftkey(4);
& 367 &
process_eoftkey(5);
& 368 &
process_eaftkey(6);
& 369 &
peycass_ppftkey(7);
& 370 &
process_softkey(8);
& 371 &
select_entry_ch(1);
& 372 &
BEGIN & s11 &
   hilight_off( cnd_user1, cnd_user4);
   neu_paraneter(s11);
END;  & s11 &
& 373 &
BEGIN & s12 &
   hilight_off( cnd_user1, cnd_ueer4);
   neu_paraneter(s12);
END;  & s12 &
& 374 &
BEGIN & s21 &
   hilight_off( cnd_user1, cnd_user4);
   neu_paraneter(s21);
END;  & s21 &
& 375 &
BEGIN & s22 &
   hilight_off( cnd_user1, cnd_user4);
   neu_paraneter(s22);
END;  & s22 &
& 376 &
neu_format( fnt_log_nag );
& 377 &
neu_format( fnt_phase );
& 378 &
select_entry_ch(2);
& 379 &
```

```
FCMDERSE.UORK.POSS10          THU, DEC 22, 1S83, 10:2& AM     PAGE  3

neu_fornat( fnt_delay );
& 380 &
neu_format( fnt_z_anith );
& 381 &
gen_nenu(PARAM_DENU, 0);
& 382 &
gen_nenu(FORMAT_DENU, 0);
& 383 &
recall_preset_state;
& 384 &
gen_nenu(MPIB_DENU, 1);
& 385 &
select_aceive_funceien(active_scale);
& 386 &
select_active_function(active_ref_value);
& 387 &
eclect_active_stinulum(active_start);
& 388 &
select_active_stinulus(active_stop);
& 389 &
eaiect_active_function(active_ref_pos);
& 390 &
autp_scale;
& 391 &
select_active_stiaulvs(active_center);
& 392 &
select_active_stinulue(active_epan);
& 393 &
gen_nenu(RESPUNSE_MENU, 0);
& 394 &
gen_nenu(STIMULUS_MENU, 0);
& 396 &
gen_nenu(CAL_MENU, 0);
& 396 &
gen_nenu(DISPLAY_MENU, 0);
& 397 &
BEGIN
   select_narker( active_narker );
   gen_nenu(MARKER_MENU, 0);
END;
& 398 &
gen_nenu(SYSTEN_MENU, 0);
& 399 &
previous_nenu;
& 400 &
neasurenent_restart;
& 401 &
gen_nenufDDMAIN_MENU, 0);
& 402 &
abort_connand := TRUE;
& 403 &
pub_ib_input_select( data_input );
& 404 &
pub_ib_input_select( formatted_input );
& 405 &
pub_ib_input_oelect( rau1_input );
```

```
FCMDCASE.WORK.PD8510          THU, DEC 22, 1983, 10:28 AM     PAGE  4

& 406 &
pub_ib_input_select( reu2_input );
& 407 &
pub_ib_input_select( rau3_input );
& 408 &
pub_ib_input_select( rau4_input );
& 409 &
pub_ib_input_select( cal_coeff1_input );
& 410 &
pub_ib_input_select( cal_coeff2_input );
& 411 &
pub_ib_input_select( cal_coeff3_input );
& 412 &
pub_ib_input_select( cal_coeff4_input );
& 413 &
pub_ib_input_select( cal_coeff5_input );
& 414 &
pub_ib_input_select( cal_coeff6_input );
& 415 &
pub_ib_input_select( cal_coeff7_input );
& 416 &
pub_ib_input_select( cal_coeff8_input );
& 417 &
pub_ib_input_select( cal_cueff9_input );
& 418 &
pub_ib_input_select( cal_coeff10_Input );
& 419 &
pub_ib_input_select( cal_coeff11_input );
& 420 &
pub_ib_input_select( cal_coeff12_input );
& 421 &
pub_ib_input;
& 422 &
pub_ib_output_select( formatted_output );
& 423 &
pub_ib_output_select( active_output );
& 424 &
pub_ib_output_select( narker_output );
& 425 &
pub_ib_output_select( status_output );
& 426 &
pub_ib_output_select( id_output );
& 427 &
pub_ib_output_select( data_output );
& 428 &
pub_ib_output_select( rau1_output );
& 429 &
pub_ib_output_select( rau2_output );
& 430 &
pub_ib_output_select( rau3_output );
& 431 &
pub_ib_output_select( rau4_output );
& 432 &
pub_ib_output_select( cal_coeff1_output );
& 433 &
pub_ib_output_seiect( cal_coeff2_output );
```

```
FCMDCASE.UDRK.PD8510          THU, DEC 22, 1983, 10:28 AM     PAGE  5

& 434 &
pub_ib_output_select( cal_coeff3_output );
& 435 &
pub_ib_output_select( cal_coeff4_output );
& 436 &
pub_ib_output_select( cal_coeff5_output );
& 437 &
pub_ib_output_select( cal_coeff6_output );
& 438 &
pub_ib_output_select( cal_coeff7_output );
& 439 &
pub_ib_output_select( cal_coeff8_output );
& 440 &
pub_ib_output_select( cal_coeff9_output );
& 441 &
pub_ib_output_select( cal_coeff10_output );
& 442 &
pub_ib_output_select( cal_coeff11_output );
& 443 &
pub_ib_output_select( cal_coeff12_output );
& 444 &
pub_ib_output_select( menory_output );
& 445 &
pub_ib_output_sslect( error_output );
& 446 &
pub_ib_output;
& 447 &
select_active_function( active_erq_nask_prinary );
& 448 &
clear_serial_poll;
& 449 &
pub_ib_format_select( output_binary);
& 450 &
pub_ib_format_select( output_ascii);
& 451 &
pub_ib_format_select( output_ieee_double);
& 452 &
pub_ib_format_select( output_ieee_single);
& 453 &
eelect_active_function( active_keycode );
& 454 &
pub_ib_output_seiect(plot_output);
& 455 &
BEGIN
   trap_15_type := normal_trap_15;
   TRAP(15);
END;
& 456 &
select_active_function(active_n_groups_hpib);
& 457 &
pub_ib_output_select( key_output );
& 458 &
select_default_set( 1 );
& 459 &
select_default_set( 2 );
& 460 &
```

FEMDCRSE.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 6

```
select_default_set( 3 );
& 461 &
select_default_set( 4 );
& 462 &
select_default_set( 5 );
& 463 &
select_default_set( 6 );
& 464 &
select_default_set( 7 );
& 465 &
select_default_set( 8 );
END;
END proc0;
```

CCMDDECL.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 1

```
%FILE cdtmgr.work;
%FILE cresp.work;
%FILE cstin.work;
%FILE cparams.work;
%FILE cformat.work;
%FILE edonmenu.work;
%FILE ccalmenu.work;
%FILE cstdnmenu.work;
%FILE cdisp.work;
%FILE cplot.work;
%FILE cmkr.work;
%FILE csysten.work;
%FILE ccndcase.work;
```

DCMDDECL.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 1

```
  1 = cmd_directory
  9 = cmd_directory_off
 10 = cmd_next_page
 11 = cmd_prev_page
 12 = cmd_first_page
 13 = cmd_last_page
 18 = cmd_machine_dump
 26 = end_more
 28 = cmd_file_1
 29 = end_file_2
 35 = cmd_file8
 36 = cmd_reg_1
 37 = cmd_reg_2
 38 = cmd_reg_3
 39 = cmd_reg_4
 40 = cmd_reg_5
 41 = cmd_reg_6
 42 = cmd_reg_7
 43 = cmd_reg_8
 44 = cmd_elect_delay
 45 = cmd_auto_delay
 46 = cmd_phase_offset
 48 = cmd_if_avg_on
 49 = cmd_if_avg_off
 50 = cmd_smoothing_on
 51 = cmd_smoothing_off
 52 = cmd_if_test_port
 53 = cmd_if_ref_port
 54 = cmd_if_no_gain
 55 = cmd_if_12db_gain
 56 = cmd_if_24db_gain
 57 = cmd_if_36db_gain
 58 = cmd_if_48db_gain
 59 = cmd_if_gain_auto
 60 = cmd_power_menu
 61 = cmd_sweep_time
 62 = cmd_n_points_menu
 63 = cmd_cw
 64 = cmd_swept
 65 = cmd_stepped
 66 = cmd_51_points
 67 = cmd_101_points
 68 = cmd_201_points
 69 = cmd_401_points
 70 = cmd_source_power
 71 = cmd_power_slope
 72 = cmd_power_slope_off
 73 = cmd_atten_port1
 74 = cmd_attan_port2
 75 = cmd_hold
 76 = cmd_single
 77 = cmd_n_groups_kbd
 78 = cmd_continuous
 80 = cmd_ccuple_stimulus
 81 = cmd_uncouple_stimulus
```

DCMDDECL.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 2

```
 83 = end_user1
 84 = cmd_user2
 85 = cmd_user3
 86 = cmd_user4
 87 = cmd_redefine_paran
 93 = cmd_label_paraneter
 94 = cmd_redefine_done
118 = cmd_convert_off
119 = cmd_convert_recip
120 = cmd_convert_to_z
121 = cmd_convert_to_y
122 = cmd_sur
123 = cmd_linear_mag
124 = cmd_linear_polar
125 = cmd_log_polar
126 = cmd_imag_vs_real
127 = cmd_y_smith
128 = cmd_imaginary
129 = cmd_real
130 = cmd_freq_domain
131 = cmd_low_pass_request
132 = cmd_time_domain
133 = cmd_aux_domain
134 = cmd_setup_time_domain
135 = cmd_setup_gate_domain
136 = cmd_tdr_domain
137 = cmd_tdr_step
138 = cmd_tdr_impulse
139 = cmd_max_time_windou
140 = cmd_normal_time_windou
141 = cmd_min_time_windou
142 = cmd_gate_on
143 = cmd_gate_off
144 = cmd_gate_start
145 = cmd_gate_stop
146 = cmd_gate_center
147 = cmd_gate_span
149 = cmd_max_gate_windou
150 = cmd_wide_gate_windou
151 = cmd_normal_gate_windou
152 = cmd_min_gate_windou
153 = cmd_correction_on
154 = cmd_correction_off
155 = end_correction_default
156 = cmd_cal_kit_1
157 = cmd_cal_kit_2
159 = cmd_ref_plane_menu
162 = cmd_modify_cal_kit_1
163 = cmd_modify_cal_kit_2
164 = cmd_delete_cal
165 = cmd_ref_plane_1
166 = cmd_ref_plane_2
167 = cmd_freq_setup
168 = cmd_response_type
169 = cmd_1_port_1_type
170 = cmd_1_port_2_type
```

DEMODECL.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 3

```
171 = end_simple_2_port_type
172 = cnd_2_port_type
173 = cnd_port1_std1
174 = cnd_port1_std2
175 = end_port1_std3
176 = end_done_1_port_on_1
177 = cnd_port2_std1
178 = cnd_port2_std2
179 = cnd_port2_otd3
180 = cnd_dons_1_port_on_2
181 = cnd_cal_reflection
182 = end_cal_thru
183 = cnd_cal_isolation
184 = cnd_done_2_port
185 = end_done_reflection
186 = end_fud_transmission
187 = cnd_fwd_match
188 = end_rev_transmiseion
189 = cnd_rev_match
190 = cnd_done_trane
191 = cnd_onit_isolation
192 = cnd_fwd_isolation
193 = cnd_rev_ieolation
194 = cnd_done_isolation
195 = cnd_cal_simple_reflection
196 = cnd_cal_simple_thru
197 = cnd_cal_sincle_isolation
198 = cnd_done_simple_reflection
199 = end_claae_stdf
200 = end_elaas_etd2
201 = cnd_class_std3
202 = cnd_clasi_etd4
203 = end_class_std5
204 = cnd_class_std6
205 = cnd_claes_std7
206 = end_class_done
209 = cnd_select_std
210 = cnd_specify_claaee
211 = cnd_label_classes
212 = cnd_label_cal_kit
213 = cnd_eal_kit_defined
214 = cnd_define_open
215 = end_define_short
216 = end_define_load
217 = cnd_define_air_lins
218 = cnd_define_z
219 = cnd_xpen_c0
220 = cnd_open_cf
221 = cnd_open_c2
222 = cnd_specify_offset
223 = cnd_label_cal_std
224 = cnd_cal_std_defined
225 = cnd_fixed_load
226 = cnd_sliding_load
227 = cnd_offset_delay
228 = cnd_offset_loss
```

DEMODECL.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 4

```
229 = end_offset_z0
230 = cnd_offset_min_f
231 = cnd_offset_nax_f
232 = end_coax
233 = end_waveguide
235 = cnd_port1_1st_std
236 = end_port1_2nd_std
237 = end_port1_3rd_std
238 = end_port2_1st_std
239 = cnd_port2_2nd_st0
240 = cnd_port2_3rd_std
242 = cnd_std_class_specified
243 = cnd_trans_fud_std
244 = cnd_trans_rev_std
245 = end_freq_rasp_std
246 = cnd_single_ch
247 = cnd_dual_ch
248 = cnd_data
249 = cnd_nen
250 = end_d_and_n
251 = cnd_nath
253 = cnd_d_into_n
254 = cnd_overlay
255 = cnd_eplit
256 = cnd_nenory1
257 = cnd_nenory2
258 = cnd_nenory3
259 = cnd_nenory4
262 = cnd_nenory_ch1
263 = cnd_nenory_ch2
264 = cnd_d_plus_n
265 = cnd_d_ninus_n
266 = cnd_d_npy_n
267 = end_d_div_n
268 = cnd_plot_all
269 = cnd_plot_trace
270 = cnd_plot_graticule
271 = cnd_plot_narker
272 = end_plot_text
274 = cnd_ch1_pan
276 = cnd_list_trace
277 = cnd_eyston_paran1
278 = cnd_op_parans
279 = cnd_quadrant_11
280 = cnd_quadrant_21
281 = cnd_quadrant_12
282 = end_quadrant_22
283 = end_qwadrant_full
284 = cnd_pen1
285 = cnd_jen2
286 = cnd_pen3
287 = cnd_pen4
288 = cnd_pen5
289 = end_pen6
290 = cnd_pen7
291 = cnd_pen8
```

DEMODECL.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 5

```
292 = cnd_print_paranc
293 = cnd_plot_params
294 = cnd_next_op_paran
295 = cnd_narker_1
296 = cnd_narker_2
297 = end_narker_3
298 = cnd_narker_4
299 = cnd_narker_5
300 = end_narker_off
301 = cnd_delta_narker
302 = cnd_ref_nkr1
303 = cnd_ref_nkr2
304 = cnd_ref_nkr3
305 = cnd_ref_nkr4
306 = cnd_ref_nkr5
307 = cnd_no_ref_nkr
308 = cnd_nkr_to_nin
309 = cnd_nkr_to_nax
310 = cnd_title
311 = cnd_hpib_info
312 = cnd_crt_off
313 = cnd_eervice_menu
317 = cnd_erase_title
318 = end_title_done
319 = cnd_8510_addr
320 = cnd_nyston_bus_addr
321 = cnd_source_addr
322 = cnd_test_eet_addr
323 = cnd_plotter_addr
324 = cnd_printer_addr
325 = cnd_auto_cnd_addr
326 = end_paes_thru_addr
327 = cnd_revilion
328 = cnd_privib_local
329 = cnd_privib_renote
330 = end_if_gain_nenu
331 = cnd_peek_poke_addr
332 = cnd_peek
333 = cnd_poke
334 = cnd_test_nenu
335 = cnd_illegal
336 = cnd_enter
337 = cnd_u1
338 = cnd_u2
339 = cnd_u3
340 = cnd_u4
341 = cnd_nkrval
342 = cnd_up
343 = cnd_doun
344 = cnd_entry_off
345 = cnd_save
346 = cnd_eave_1
347 = cnd_eave_2
348 = cnd_save_3
349 = cnd_save_4
350 = cnd_save_5
```

DEMODECL.WORK.PD8510 THU, DEC 22, 1983, 10:28 AM PAGE 6

```
351 = end_recall
352 = cnd_recall_1
353 = cnd_recall_2
354 = cnd_recall_3
355 = cnd_recall_4
356 = end_recall_5
357 = cnd_recall_last
358 = cnd_tape_menu
359 = cnd_copy
360 = end_doc
361 = cnd_quote
362 = cnd_label
363 = cnd_key_1
364 = cnd_key_2
365 = cnd_key_3
366 = cnd_key_4
367 = end_key_5
368 = cnd_key_6
369 = end_key_7
370 = end_key_8
371 = end_ch1
372 = cnd_s11
373 = cnd_s12
374 = end_s21
375 = cnd_s22
376 = cnd_nag
377 = end_phase
378 = end_ch2
379 = cnd_delay
380 = cnd_polar
381 = cnd_paran_nenu
382 = cnd_format_menu
383 = cnd_preset
384 = cnd_local
385 = cnd_scale
386 = cnd_ref_value
387 = cnd_start
388 = end_stop
389 = cnd_ref_position
390 = cnd_auto_scale
391 = cnd_center
392 = end_span
393 = cnd_response_menu
394 = cnd_stinulus_menu
395 = cnd_cal_menu
396 = cnd_display_menu
397 = cnd_narker_menu
398 = cnd_systen_menu
399 = cnd_prior_menu
400 = cnd_neasurenent_restart
401 = cnd_donain_menu
402 = cnd_abort_connand
403 = cnd_input_data
404 = cnd_input_formatted
405 = cnd_input_rau1
406 = cnd_input_rau2
```

DCMDDECL.WORK.PD8510 THU, DEC 22, 1983, 10:29 AM PAGE 7

```
  407 = cmd_input_rau3
  408 = cmd_input_rau4
  409 = cmd_input_cal_coeff1
  410 = cmd_input_cal_coeff2
  411 = cmd_input_cal_coeff3
  412 = cmd_input_cal_coeff4
  413 = cmd_input_cal_coeff5
  414 = cmd_input_cal_coeff6
  415 = cmd_input_cal_coeff7
  416 = cmd_input_cal_coeff8
  417 = cmd_input_cal_coeff9
  418 = cmd_input_cal_coeff10
  419 = cmd_input_cal_coeff11
  420 = cmd_input_cal_coeff12
  421 = cmd_block_a
  422 = cmd_output_formatted
  423 = cmd_output_active
  424 = cmd_output_marker
  425 = cmd_output_status
  426 = cmd_output_id
  427 = cmd_output_data
  428 = cmd_output_rau1
  429 = cmd_output_rau2
  430 = cmd_output_rau3
  431 = cmd_output_rau4
  432 = cmd_output_cal_coeff1
  433 = cmd_output_cal_coeff2
  434 = cmd_output_cal_coeff3
  435 = cmd_output_cal_coeff4
  436 = cmd_output_cal_coeff5
  437 = cmd_output_cal_coeff6
  438 = cmd_output_cal_coeff7
  439 = cmd_output_cal_coeff8
  440 = cmd_output_cal_coeff9
  441 = cmd_outcut_cal_coeff10
  442 = cmd_output_cal_coeff11
  443 = cmd_output_cal_coeff12
  444 = cmd_output_memory
  445 = cmd_output_error
  446 = cmd_hpib_talk
  447 = cmd_srq_mask
  448 = cmd_clear_status
  449 = cmd_xfer_binary
  450 = cmd_xfer_ascii
  451 = cmd_xfer_ieee2
  452 = cmd_xfer_ieee1
  453 = cmd_keycode
  454 = cmd_output_plot
  455 = cmd_monitor
  456 = cmd_n_groups_hpib
  457 = cmd_output_key
  458 = cmd_cal_set_1
  459 = cmd_cal_set_2
  460 = cmd_cal_set_3
  461 = end_cal_eet_4
  462 = cmd_cal_set_5
```

DCMDDECL.WORK.PD8510 THU, DEC 22, 1983, 10:29 AM PAGE 8

```
  463 = end_cal_set_6
  464 = cmd_cal_eet_7
  465 = cmd_cal_set_8
```

JCMDDECL.WORK.PD8510 THU, DEC 22, 1983, 10:29 AM PAGE 1

```
!job cmddecl,librm.cd8510,work;outclass=,1
!continue
!ed
e ekinfo.work
f xcmddecl
v/^ *\[/d
1,$s/^ *\[//
1,$s/\&[^\&]*\& *//
1,$s/^  *//
g/^ *$/d
1,$s/[^A-Z^a-z^0-9^_].*$//
1,$s/$/,/
$s/,/;/
0a
M68KL,P BEGIN
#FILE ccmddecl.work;- #
%LIST;
INTEGER TRBLE ycmddecl :=
.
$a
END$
.
uq xcmddecl
!purge ycmddecl
!build ycmddecl;rec=-1276,,v,ascii;disc=500
!con68k xcmddecl,,ycmddecl
!ed
e ycmddecl
)u ucmddecl.work
uq dcmddecl.work
!purge xcmddecl
!purge ycmddecl
#tell librm.pd8510; ============== jcmddecl done ====================
!tell ucc.pd8510; ================ jcmddecl done ====================
!eoj
```

UCMDDECL.WORK.PD8510 THU, DEC 22, 1983, 10:29 AM PAGE 1

```
1
1,/ DEC /-2d
$
? DEC ?
+
.,$d
1,$s/^ *[0-9]* *//
1,$s/^.* DEC /DEC /
1,$s/^ *//
1,$s/[,;]//
g/DEC /.-1,.j
1,$s/ *DEC */ =    /
1,$s/ *$//
1,$s/^\([^ ]*\).*\([ 0-9]{5,5}\)$/\2 = \1/
```

```
SCMDS.WORK.PD8510              THU, DEC 22, 1983, 10:29 AM     PAGE  1


M68KL,P,"cmds"
SECTN

#FILE ccmdcase.work;
#FILE cparams.work;
#FILE cformat.work;
#FILE cprivib.work;
#FILE cdguser.work;
#FILE fparam.work;
#FILE cehtable.work;   & use before fcontvar & & for max_ch, ch_domain &
#FILE fcontvar.work;
#FILE fchtable.work;                          & for entry_ch_integer &
#FILE fchtab3.work;
#FILE fchdata.work;                                 & for sweep_mode &
#FILE fcentrol.work;
#FILE fiocnfig.work;
#FILE fbreak.work;
#FILE cmessag2.work;    & for command_not_implemented and out_of_range &
#FILE futil3.work;                                          & for warm &
#FILE factive.work;
#FILE factive2.work;
#FILE cmenu.work;
#FILE faverage.work;
#FILE cdatap.work;
#FILE foutpot.work;
#FILE fpubib.work;                                  & for local_key &
#FILE ffifo.work;
#FILE ffifos.work;
#FILE edebugxx.work;                        & for trap_15_type, etc. &
#FILE fdatangr.work;
#FILE fcommand.work;            & for abort_command and command_token &
#FILE fmenu.work;
#FILE fstimuli.work;
#FILE fmarker2.work;
#FILE fplotter.work;            & for plotting display areas via HPIB &

PROCEDURE  new_format( format_type );
   VALUE   format_type;
   INTEGER format_type;                                      EXTERNAL;


PROCEDURE  select_active_stimulus( which_function );
   VALUE   which_function;
   INTEGER which_function;
   BEGIN & select_active_stimulus &
      INTEGER domain;

      domain := entry_ch_integer( ch_domain );

      IF ( (sweep_mode = single_pt) AND
           (domain <> time_domain) AND
           (domain <> tdr_domain)
         ) THEN
         select_active_function( active_cu )
```

```
SCMDS.WORK.PD8510              THU, DEC 22, 1983, 10:29 AM     PAGE  2

      ELSE
         select_active_function( which_function );

   END;  & select_active_stimulus &


NFILE fcmdcase.work;

END$
```

```
FCMV9X.WORK.PD8510             THU, DEC 22, 1983, 10:29 AM     PAGE  1


REAL PROCEDURE CMV92(string, index);
   VALUE   string;
   ALPHA   string;
   INTEGER index;                                            EXTERNAL;
QUAD PROCEDURE CMV9A(string, index);
   VALUE   string;
   ALPHA   string;
   INTEGER index;                                            EXTERNAL;
```

```
SCMV9X.WORK.PD8510             THU, DEC 22, 1983, 10:29 AM     PAGE  1


M68KL,P,"CMV9X"
BEGIN

EXTERNAL DOUBLE MYMRM;      & multiplier normalize address = %FFFFF922 &
EXTERNAL DOUBLE LLDRO;      & multiplier mantissa  address = %FFFFF9?? &
EXTERNAL BYTE   RDEXP;      & multiplier exponent  address = %FFFFF912 &
REAL PROCEDURE CMV32(d);
   VALUE d;
   DOUBLE d;                                                 EXTERNAL;

INTEGER CONSTANT length := 0,               & string indices        &
                 size   := -1;

BYTE CONSTANT    end_of_line := %0A;                    & line-feed &
BYTE CONSTANT    max_chars   := 18;          & 999999999999999999 or  &
                                             & +9.999999999999E+11    &
INTEGER CONSTANT max_digits  := 18;                      & 1E18 - 1& 
QUAD CONSTANT    max_integer := 100000000000000000;
                                             & 1E+18 = max_digits + 1 &

DOUBLE  CONSTANT max_mantissa:= %7FFFFFFF;   & 2147483647             &
DOUBLE  CONSTANT max_mantissa_div_10
                             := %CCCCCCCC;   & 214748364              &
```

```
SCNV9X.UORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  2


@EJECT;
COMMENT                                                        CNV92
*****************************************************************
*
*  EXTERNAL SPECIFICATION FOR: CNV92
*
*  FUNCTION:
*     Id convert an ASCII character string number representation into
*  a REAL number representation.  Acceptable strings are a super-
*  set of the NR1, NR2, and NR3 representations of ANSI X3.42-1975,
*  "American National Standard for the Representation of Numeric Values
*  in Character Strings for Information Interchange".  These are the
*  number representations recommended by the IEEE P722/draft 11,
*  "Draft Code and Format Conventions for Use with IEEE Standard
*  488-1978 Digital Interface for Programmable Instrumentation".
*
*  The strings accepted are defined by:
*
*  string ::= ' '* {'+'|'-'} digit* {'.' digit)
*                                 { {'E'|'e'} {'+'|'-'|' '} digit* }
*
*  Where:  digit ::= '0'|'1'|'2'|'3'|'4'|'5'|'6'|'7'|'8'|'9'
*          {   } ==> 0 or 1 occurrence
*            + ==> 1 or more occurrence
*            * ==> 0 or more occurrence
*            | ==> alternation (one choice from the alternates)
*
*  CAUTION:
*     All calling routines must assure that the string passed to CNV92
*  is syntactically correct and does not exceed the specified limits.
*  Since such numbers should never occur within the machine (they
*  originate from the source via private HP-IB, or are checked by the
*  input parser when they originate from the front panel or public
*  HP-IB), there is no checking for some error conditions and others
*  are less than general.  CNV92 will not accept an input string longer
*  than 15 characters, including signs, decimal point, and exponent.
*  The total number of digits (not including signs, decimal point, or
*  exponent part) cannot exceed 12.  These limitations are primarily for
*  implementation convenience to make limit checking easier since there
*  is no real need for very large numbers and since some of the math
*  library does not support larger numbers.  The only allowable blanks are
*  leading blanks and a blank in place of the exponent sign character.
*  The string may be empty, in which case CNV92 returns a value of zero.
*  The only allowable characters are the digits 0-9, +, -, E, space,
*  comma, carriage return, and line feed (note: semicolon is not
*  allowed).  Runs of digits are delimited by any of the above
*  non-digits.
*
*  CNV92 requires a string array that has room for one
*  additional character (CNV92 appends a marker character to the end of
*  the string for internal use).  It will return a zero value if there
*  is not sufficient space for appending one character.  This is o.k. for
*  the applications where this is used most often, but should be changed
*  eventually for more general applications.
*
*****************************************************************
```

```
SCNV9X.UORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  3


;
REAL PROCEDURE CNV92(string, index);
   VALUE  string;
   ALPHA  string;
   INTEGER index;                                          ENTRY;
   BEGIN & CNV92 &

      BYTE POINTER str = string;
      BYTE         result_exponent;
      BOOLEAN      negative;
      BOOLEAN      negative_exponent;
      INTEGER      exponent;
      INTEGER      exponent_adjust;
      INTEGER      strsng_length;
      DOUBLE       mantissa;
      REAL         real_result;

      mantissa := 0;
      negative := FALSE;
      string_length := str[length] - index + 1;
      IF string_length = 0 THEN
         GO TO abort;
      IF string_length >= str[size] THEN
         BEGIN & if &
            mantissa := max_mantissa;
            GO TO abort;
         END; & if &
      exponent := 0;
      exponent_adjust := 0;
      negative_exponent := FALSE;
      str[ string_length+index ] := end_of_line;

& skip leading blanks &
      WHILE str[index] = ' ' DO
         index := index + 1;

& sign &
      IF str[index] = '- THEN
         BEGIN & if &
            negative := TRUE;
            index := index + 1;
         END & if &
      ELSE IF str(index) = '+ THEN
         index := index + 1;

& integer part &
      WHILE ( ('0 <= str[index]) AND (str[index] <= '9) ) DO
         BEGIN & while &
            IF mantissa <= max_mantissa_div_10 THEN
               mantissa := 10*mantissa + (str[index] AND %0F)
            ELSE
               exponent_adjust := exponent_adjust + 1;
            index := index + 1;
         END while;

& fractional part &
```

```
SCNV9X.UORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  4


      IF str[index] = '. THEN
         BEGIN & if &
            index := index + 1;
            WHILE ( ('0 <= str[index]) AND (str[index] <= '9) ) DO
               BEGIN & while &
                  IF mantissa <= max_mantissa_div_10 THEN
                     BEGIN & if &
                        mantissa := 10*mantissa + (str[index] AND %0F);
                        exponent_adjust := exponent_adjust - 1;
                     END;  & if &
                  index := index + 1;
               END while;
         END if;

      IF negative THEN
         mantissa := - mantissa;

& exponent &
      IF mantissa <> 0 THEN
         IF (str[index] AND %5F) = 'E THEN
            BEGIN & if &
               index := index + 1;
         & sign &
               IF str[index] = '- THEN
                  BEGIN & if &
                     negative_exponent := TRUE;
                     index := index + 1;
                  END & if &
               ELSE IF ( (str(index) = '+) OR (str[index] = ' ) ) THEN
                  index := index + 1;

               WHILE ( ('0 <= str[index]) AND (str[index] <= '9) ) DO
                  BEGIN & while &
                     exponent := 10*exponent + (str[index] AND %0F);
                           & no test for |exponent| > 32767 &
                     index := index + 1;
                  END while;
               IF negative_exponent THEN
                  exponent := -exponent;
            END if;

& combine exponent and fractional digits, then shift to make integer &

abort:
      exponent := exponent + exponent_adjust;

      real_result := CNV32( mantissa );

      IF exponent > 0 THEN
         REPEAT exponent DO
            real_result := real_result * 10.0
      ELSE IF exponent < 0 THEN
         REPEAT (-exponent) DO
            real_result := real_result * 0.1;
&     ELSE exponent = 0 and real_result need not be modified          &
```

```
SCNV9X.UORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  5


COMMENT  no test for overflow or underflow ;

      index := index + 1;
      CNV92 := real_result;

   END;  & CNV92 &
```

```
SCMV9X.WORK.PO8510          THU, DEC 22, 1983, 10:29 AM    PAGE  6


REJECT;
CONNENT                                                        CMV9R
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
!  EXTERNAL SPECIFICATION FOR: CMV9R
!
!  FUNCTION:
!     To convert an ASCII character string number representation into
!  a type QUAD INTEGER representation.  Acceptable strings are a super-
!  set of the NR1, NR2, and NR3 representations of ANSI X3.42-1975,
!  "American National Standard for the Representation of Numeric Values
!  in Character Strings for Information Interchange".  These are the
!  number representations recommended by the IEEE P728/draft 11,
!  "Draft Code and Format Conventions for Use with IEEE Standard
!  488-1978 Digital Interface for Programmable Instrumentation".
!
!  The strings accepted are defined by:
!
!  string ::= ' '* {'+'|'-'} digit* ('.' digit)
!                                 ( {'E'|'e'} {'+'|'-'|' '} digit* )
!
!  Where:  digit ::= '0'|'1'|'2'|'3'|'4'('5'|'6'|'7'|'8'|'9'
!          {   } ==> 0 or 1 occurrence
!           +  ==> 1 or more occurrence
!           *  ==> 0 or more occurrence
!           |  ==> alternation (one choice from the alternates)
!
!  CAUTION:
!     All calling routines must assure that the string passed to CMV9R
!  is syntactically correct and does not exceed the specified limits.
!  Since such numbers should never occur within the machine (they
!  originate from the source via private HP-IB, or are checked by the
!  input parser when they originate from the front panel or public
!  HP-IB), there is no checking for some error conditions and others
!  are less than general.  CMV9R will not accept an input string longer
!  than 18 characters, including signs, decimal point, and exponent.
!  The total number of digits (not including signs, decimal point, or
!  exponent part) cannot exceed 12.  These limitations are primarily for
!  implementation convenience to make limit checking easier since
!  there is no real need for very large numbers and since some of the
!  math library does not support larger numbers.  The maximum number
!  representable as a quad integer is about +/- 9.22337204 E+18.
!  The absolute value of the number (including exponent) must
!  be >= 0 and < 1.0E+12.  This is the same restriction as the number
!  of digits mentioned above.  The only allowable blanks are
!  leading blanks and a blank in place of the exponent sign character.
!  The string may be empty, in which case CMV9R returns a value of zero.
!  The only allowable characters are the digits 0-9, +, -, E, space,
!  comma, carriage return, and line feed (note: semicolon is not
!  allowed).  Runs of digits are delimited by any of the above
!  non-digits.
!
!  CMV9R requires a string array that has room for one
!  additional character (CMV9R appends a marker character to the end of
!  the string for internal use).  It will return a zero value if there
!  is not sufficient space for appending one character.
```

```
SCMV9X.WORK.PO8510          THU, DEC 22, 1983, 10:29 AM    PAGE  7

!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
;
QUAD PROCEDURE CMV9R(string, index);
  VALUE   string;
  ALPHA   string;
  INTEGER index;                                              ENTRY;
  BEGIN & CMV9R &
    BYTE POINTER str = string;
    BOOLEAN      negative;
    BOOLEAN      negative_exponent;
    INTEGER      integer_digits;
    INTEGER      fractional_digits;
    INTEGER      string_length;
    INTEGER      partial_exponent;
    INTEGER      exponent;
    QUAD         integer_part;
    LABEL        exit;

    integer_part := 0;
    negative := FALSE;
    integer_digits := 0;
    string_length := str[length] - index + 1;
    IF string_length <= 0 THEN
      GO TO exit;
    IF string_length >= str[size] THEN
      BEGIN & if &
        integer_part := max_integer;
        GO TO exit;
      END; & if &
    exponent := 0;
    fractional_digits := 0;
    negative_exponent := FALSE;
    str[ string_length+index ] := end_of_line;

& skip leading blanks &
    WHILE str[index] = ' ' DO
      index := index + 1;

& sign &
    IF str[index] = '- THEN
      BEGIN & if &
        negative := TRUE;
        index := index + 1;
      END & if &
    ELSE IF str[index] = '+ THEN
      index := index + 1;

& integer part &
    WHILE ( ('0 <= str[index]) AND (str[index) <= '9) ) DO
      BEGIN & while &
        integer_part := 10*integer_part + (str[index) AND %DF);
        integer_digits := integer_digits + 1;
        index := index + 1;
      END while;
```

```
SCMV9X.WORK.PO8510          THU, DEC 22, 1983, 10:29 AM    PAGE  8

& fractional part &
    IF str(index) = '. THEN
      BEGIN & if &
        index := index + 1;
        WHILE ( ('0 <= str[index]) AND (str[index] <= '9) ) DO
          BEGIN & while &
            integer_part := 10*integer_part
                + (str[index] AND %DF);
            fractional_digits := fractional_digits + 1;
            index := index + 1;
          END while;
      END if;

& exponent(s) -- handles multiple exponents &
    IF integer_part<> 0 THEN
      WHILE (str[index] AND %5F) = 'E DO
        BEGIN & while &
          partial_exponent := 0;
          index := index + 1;
      & sign &
          IF str[index] = '- THEN
            BEGIN & if &
              negative_exponent := TRUE;
              index := index + 1;
            END & if &
          ELSE IF ( (str[index] = '+) OR (str[index] = ' ) ) THEN
            BEGIN & else if &
              negative_exponent := FALSE;
              index := index + 1;
            END   & else if &
          ELSE
            negative_exponent := FALSE;
          WHILE ( ('0 <= str[index]) AND (str[index] <= '9) ) DO
            BEGIN & while &
              partial_exponent := 10*partial_exponent +
                                          (str[index] AND %DF);
              index := index + 1;
            END while;
          IF negative_exponent THEN
            exponent := exponent - partial_exponent
          ELSE
            exponent := exponent + partial_exponent;
        END;  & while &


& combine exponent and fractional digits, then shift to make integer &

    IF (integer_digits + exponent) > max_digits THEN
      BEGIN & if &
        integer_part := max_integer;
        GO TO exit;
      END; & if &

    exponent := exponent - fractional_digits;

    IF exponent <> 0 THEN
```

```
SCMV9X.WORK.PO8510          THU, DEC 22, 1983, 10:29 AM    PAGE  9

      IF exponent < 0 THEN
        DO
          BEGIN & do &
            integer_part := integer_part / 10;
            exponent := exponent + 1;
          END & do &
        UNTIL exponent = 0
      ELSE & exponent > 0 &
        DO
          BEGIN & do &
            integer_part := integer_part * 10;
            exponent := exponent - 1;
          END & do &
        UNTIL exponent = 0;


exit:
    index := index + 1;
    CMV9R := IF negative THEN -integer_part ELSE integer_part;

  END; & CMV9R &

END$
```

```
FCOMMAND.WORK.POS510          THU, DEC 22, 1983, 10:29 AM    PAGE  1


EXTERNAL INTEGER command_token;
EXTERNAL BOOLEAN command_pending;
EXTERNAL BOOLEAN abort_command;

PROCEDURE command;                                    EXTERNAL.L;
```

```
SCOMMAND.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  1


%&$KL,P,"command"
BEGIN

%FILE ffifo.work;
%FILE ffifos.work;
%FILE fkernel.work;
%FILE fkernel4.work;
%FILE factive.work;
%FILE factive2.work;
%FILE fstimuli.work;
%FILE fcontrol.work;
%FILE cchtable.work;                                  & for max_ch &
%FILE fcentvar.work;
%FILE fpweib.work;
%FILE cparser.work;
%FILE crins.work;
%FILE cids.work;
%FILE fintrpt.work;
%FILE coebugc0.work;                                  & DEBUG &
%FILE fterm.work;                                     & DEBUG &
%FILE ccndcase.work;                        & solely for cnd_initialize &
%FILE ftpmgr2.work;                         & turning off tape directory&
%FILE fdatamgr.work;
%FILE fmenu.work;
%FILE futil.work;
%FILE fprivib.work;                               & For urt_priv_ib & & DEBUG &
%FILE fprivib2.work;              & for set_ren_priv_ib and intrpt_priv_ib &

GLOBAL INTEGER command_token;          & the current command.              &
GLOBAL BOOLEAN command_pending;        & flag indicating that there is     &
                                       & a command token to be processed&
                                       & allowing current function to      &
                                       & return a second function to be &
                                       & processed before fetching a new&
                                       & command token from the fifo.      &
GLOBAL BOOLEAN abort_command;          & flag to abort command function &
                                       & at earliest convenient time.      &
```

```
SCOMMAND.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  2


%EJECT;
COMMENT:                                                          command
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR command                                        *
*                                                                           *
* FUNCTION: to execute user commands from the command fifo buffer.          *
*                                                                           *
* PARAMETER INFORMATION:                                                    *
*    INPUT:   none                                                          *
*                                                                           *
*    OUTPUT:  none                                                          *
*                                                                           *
* EXTERNAL EFFECTS: none                                                    *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR command                                             *
*                                                                           *
* MODULES CALLED: none                                                      *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
* get_command:                                                              *
*    command := next token from command fifo buffer                         *
*                                                                           *
*    WHILE command <> done DO                                               *
*                                                                           *
*       IF command = rpg_count THEN                                         *
*          process_rpg_count                                                *
*       ELSE                                                                *
*          CASE command OF                                                  *
*             execute individual commands here.                             *
*                                                                           *
*    go to get_command.                                                     *
*                                                                           *
*****************************************************************************
;
```

```
SCOMMAND.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  3


%EJECT;
SUBROUTINE init_token_fifo;                                       ENTRY;
   BEGIN
      init_fifo( token_fifo,
                 token_fifo_size,
                 token_buffer,
                 token_buffer_not_full,
                 token_buffer_not_empty );
   END;


SUBROUTINE init_command;
   BEGIN & init_command &

      iradr(RDRS(intrpt_priv_ib),private_ib_vctr);
      set_ren_priv_ib;

      COMMENT These are in case an SRQ has been asserted since power-up,
      not allowing the edge required to detect an interrupt. ;
      urt_priv_ib( source,   clr_fun, "CS");                      & DEBUG &
      urt_priv_ib( test_set, clr_fun, "CS");                      & DEBUG &

      recall_power_on_state;

   END;  & init_command &
```

```
SCOMMRHO.UORK.PD8510          THU, DEC 22, 1983, 10:29 RM     PAGE  4


%EJECT;
PROCEDURE command;                                          ENTRY;
   BEGIN

      init_command;
      restart_sweep;                                & starts sweep &

loop: preempt;                                    & don't hold off inputs &
      command_token := read_fifo( token_fifo );
      abort_command := FALSE;
      command_pending := TRUE;

      UHILE command_pending DO
         BEGIN & while &
            COMMENT loops if a function returns command_pending = TRUE
                    to allow one function to invoke another function
                    -- e.g. a soft key maps a to another function by
                    setting the value of t for the new function and
                    setting command_pending to TRUE.;

            command_pending := FALSE;
                                                              & DEBUG &
            IF command_debug THEN                             & DEBUG &
               BEGIN & if &                                   & DEBUG &
                  UHEX(command_token); CRLF;                  & DEBUG &
               END;  & if &                                   & DEBUG &

            IF directory_on THEN          & display over tape directory &
              IF ((command_token > cmd_key_8) OR
                 (command_token < end_key_1))     AND
                 (command_token <> cmd_hpib_talk) AND
                 (command_token <> cmd_output_plot)
              THEN
                directory_off;

            IF (command_token OR %00FF) = %FFFF THEN
               rpg_entry(command_token)                       & RPG &
            ELSE
            IF (command_token AND %FF00) = hpib_pass_thru THEN
               pass_thru_command (command_token)      & pass-thru byte &
            ELSE
               BEGIN                                      & not RPG &
                  %FILE fprocs.work;
               END;

         END;  & while &

      GO TO loop;

   END command;


END$
```

```
RCOMPUTE.UORK.PD8510          THU, DEC 22, 1983, 10:29 RM     PAGE  1


 RSMB,R,L
   HED data processing compute routines
   WRM compute,7,"JTB      PD8510"
   UNL
*
*
*   ITEMS TO UORK ON !!
*     1) Need a log nag that returns a fit pt result scaled correctly
*     2) Speed up offset       a) better code ?
*                              b) do scale first to a double and
*                                   offset as a double
*                                  nirco routines exists ??
*              allow for 20 bit scaling vs 16 bit
*     4)ONLY fetch and store pointers on acquire/Release
*     5) add quick URIT
*     &) computed goto's
*        ALSO fix first point
*
 CHI compute_datap
 ENT logE,magE,angE
 ENT dac_smoothing
 ENT fnt_table,correct_table,conv_table,math_table,update_table
 ENT update_d_loop
 ENT array_correct,array_elec_length
 ENT conv_to_z,conv_to_y,conv_to_recip
*    external software
 EXT MPYE_ptr,MIVE_ptr,DVRE_ptr,SUBE_ptr,ADDE_ptr
 EXT DVRE,ADDE,SUBE,MPYE,DIVE
 EXT MPY2,DVR2
 EXT exp_overflow,fat_trig,fat_sqrt
 EXT one_port_correct,tuo_port_correct
*    external hardware
 EXT MPLOG,MRLOG,MIHTP
 EXT MYWRM,LLDRO,RDEXP
 EXT MPYLF,MCPHP
 EXT IFCAM,MSHFT
*    external data
 EXT myeten_10,cpx_1
 EXT step_size,log_table,atn_table          in long address space
*
*
R0  REG 0
R1  REG 1
R2  REG 2
R3  REG 3
R4  REG 4
R5  REG 5
R6  REG 6
R7  REG 7
R8  REG 8
R9  REG 9
R10 REG 10
R11 REG 11
R12 REG 12
R13 REG 13
```

```
RCOMPUTE.UORK.PD8510          THU, DEC 22, 1983, 10:29 RM     PAGE  2


G   REG 13
M   REG 14
S   REG 15
*
```

```
RCOMPUTE.UORK.PD8510          THU, DEC 22, 1983, 10:29 RM     PAGE  3


*EJECT
********** chtable_start *********
dp_n_ptr           EQU  0
dp_d_ptr           EQU  4
dp_f_ptr           EQU  8
dp_trace_ptr       EQU  12
dp_rau_get         EQU  16
dp_rau11_get       EQU  16
dp_rau21_get       EQU  20
dp_rau12_get       EQU  24
dp_rau22_get       EQU  28
dp_correct_ptr     EQU  32
dp_format_switch   EQU  0
dp_correct_switch  EQU  4
dp_trace_math_switch    EQU 8
dp_param_conv_switch    EQU 12
dp_length_inc      EQU  20
dp_length_shift    EQU  24
dp_scr_base        EQU  28
dp_scr_head        EQU  32
dp_scr_tail        EQU  36
dp_scr_end         EQU  40
dp_grp_delay_mem   EQU  44
dp_correct_select  EQU  48
dp_x_offset        EQU  52
dp_polar_gain      EQU  56
dp_y_gain          EQU  56
dp_y_offset        EQU  60
dp_smoothing_scale EQU  64
dp_smoothing_sum   EQU  68
dp_grp_dly_scale   EQU  72
dp_x_min           EQU  76
dp_x_max           EQU  78
dp_y_min           EQU  80
dp_y_max           EQU  82
dp_polar_exp       EQU  84
dp_pos             EQU  88
dp_flg             EQU  90
dp_smoothing_aper  EQU  92
dp_smoothing_delay EQU  94
dp_smoothing_correct    EQU 96
dp_correct_offset  EQU  98
********** chtable_end ***************
```

```
RCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 RM    PAGE  4

*EJECT;
correct_table DEF.L null_rtr correction off
          DEF.L freq_resp response
          DEF.L one_port  one_port
          DEF.L one_port  one_port  on port 2
          DEF.L two_port  two_port  12_term
conv_table DEF.L null_rtr  no conversion
          DEF.L conv_to_z
          DEF.L conv_to_y
          DEF.L conv_to_recip
math_table DEF.L math_off
          DEF.L MPYE_ptr  math_times
          DEF.L DIVE_ptr  math_div
          DEF.L RDDE_ptr  math_plus
          DEF.L SUBE_ptr  math_minus
fnt_table  DEF.L log_mag
          DEF.L lin_mag
          DEF.L phase
          DEF.L delay
          DEF.L real
          DEF.L imag
          DEF.L polar     log_polar
          DEF.L polar     lin_polar
          DEF.L polar     imag_real
          DEF.L polar     z_smith
          DEF.L polar     y_smith
          DEF.L mur
update_table DEF.L update_raw_loop       array processing
          DEF.L update_raw_loop
          DEF.L update_d_loop
          DEF.L update_n_loop
          DEF.L update_F_rect_loop
          DEF.L update_F_polar_loop
```

```
RCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 RM    PAGE  5

*EJECT
freq_resp EQU *
 MOVE.L    dp_correct_ptr(R11),R13
 MOVE.L    R13,  R8
 ROD.W     R6,   R13
 MOVE.L    R13,dp_correct_ptr(R11)
 JMP       DIVE_ptr
*
*
one_port EQU *
 MOVE.L    dp_correct_ptr(R11),R13
 MOVE.L    R13,  R8
 ROD.W     R6,   R13
 MOVE.L    R13,dp_correct_ptr(R11)
 MOVE      dp_correct_offset(R12),R10
 JMP       one_port_correct.L
*
```

```
RCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 RM    PAGE  6

*EJECT
*
*
two_port EQU *
 MOVE.L    dp_correct_ptr(R11),R13
 MOVE.L    R13,  R8
 RDD.W     #6,   B13
 MOVE.L    B13,dp_correct_ptr(R11)
 MOVE.L    dp_raw21_get(R11),R10
 MOVE.L    (R10)+,R2
 MOVE.W    (R10)+,R3
 MOVE.L    B10,dp_raw21_get(R11)          restore ptr
 MOVE.L    dp_raw12_get(R11),R10
 MOVE.L    (R10)+,R4
 MOVE.W    (R10)+,R5
 MOVE.L    B10,dp_raw12_get(R11)          restore ptr
 MOVE.L    dp_raw22_get(R11),R10
 MOVE.L    (R10)+,R6
 MOVE.W    (R10)+,R7
 MOVE.L    R10,dp_raw22_get(R11)          restore ptr
*
 MOVE.L    dp_correct_select(R12),R13
 MOVE.W    dp_correct_offset(R12),R10
 JMP       two_port_correct.L
*
```

```
RCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 RM    PAGE  7

*EJECT
*
conv_to_z EQU *
*  z = z0 * ( 1 - Sii )/( 1 + Sii )
 MOVEM.L  R0/R1, -(S)      save Sii
 MOVEM.L  cpx_1,R2/R3
 JSR      RDDE             1 + Sii
 MOVEM.L  (S)+,R2/R3
 MOVEM.L  R0/R1,-(S)       save 1 + Sii
 MOVEM.L  cpx_1,R0/R1
 JSR      SUBE             1 - Sii
 MOVEM.L  (S)+,R2/R3
 JSR      DVRE                        **** screwed up order fixed here
 CLR.L    R2                 Fast real to user3 conversion
 MOVE.W   system_z0,R2
 MOVE.W   system_z0+2,R3
 JMP      MPYE
*RTS     implied in above
*
*
conv_to_y EQU *
*  y =  ( 1 + Sii )/( z0 * ( 1 - Sii ) ) = 1/z
 BSR conv_to_z
*RTS   drop into conv_to_recip
*
*
conv_to_recip EQU *
* 1/s   =  1 / Sii
 MOVEM.L cpx_1,R2/R3                    see ucode for CPIXV
 JMP     DVRE
*RTS   implied in above
*
```

```
RCOMPWIE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  8


*EJECT
* Log base 10 of Magnitude of a complex in R0,R1
*
*  Rppears to be only 14 bit precision !!!!
leg_mag     EQU  *
 BSR        logE
 BRR        smoothing
*
logE        EQU *
 LER        MPLOC,        R9
 MOVE.L     R0,           (R9)+       load real/imag to find mag
 EXTS.W     R1
 RDD.W      R1,           R1          "square" exp
 MOVE.W     (R9)+,        R0          get mantissa of mag
 MOVE.W     (R9)+,        R2          get exp of mag
 ROR.W      #8,           R0          swap mob and lsb of mantissa
 MOVE.W     R0,           R3
 RMD.W      =H3E,         R3          mask 5 msb ( segment number )
 ROR.W      #2,           R0          more scaling of lsb of mantissa
 RMD.W      =H7FE0,       R0          mask to get segment delta
 LER        log_table.L,  R10         address of segment value
 RDD.W      #3,           R10         save for index
 MOVE.L     (R10),        (R9)+       segment, next seg value to multi
 MOVE.W     R0,           (R9)+       segment delta to multi
 REG.W      R0
 RDD.W      =H8000,       R0
 MOVE.W     R0,           (R9)+       inverted ? segment delta to multi
 EXTS.W     R2                        exp of mag
 RDD.W      R2,           R1          add exp of mag and exp of input
 SWAP       R1
 CLR.W      R1                        sceie up exp
 RSR.L      #1,           R1          ?
 TST.W      R0                        ???
 BPL        log_mag_1
 MOVE.W     (R10),        R0          ?????? use table value
 MOVE.W     (R9)+,        R2          read result of multi, ignore
 BRR        log_mag_2
)cg_mag_1: MOVE (R9),     R0          get interpolated result
log_mag_2: EXTS.L   R0
 RDD.L      R1,           R0          add log parts
*    JSR        CMV32
 MOVE.L     R0,           MYMRM
*MOVE.L     LLDR0,        R0          leave there
 MOVEQ.L    =D31,         R2
 RDD.B      IFCRM+5,      R2          RDEXP w/o TERM
 MOVE.L     =M60548S00,   MPYLF       1/10885.224 -- scaling of LOG
 RDD.B      =HF3,         R2          exp of scaling
 MOVE.L     LLDR0,        R0
 RDD.B      RDEXP+1,      R2
 MOVE.B     R2,           R0
 RTS
```

```
RCOMPWTE.WORK.PD8510          THW, DEC 22, 1983, 10:29 RM    PRGE  9


*EJECT;
* straight use of DAVE'S  code for atn (RTNCP)
*  need to improve to give REAL result and better scaling
*
phase       EQW  *
 BSR        angE
 BRR        smoothing
*
angE        EQW *
 BSR        RTNCP
 ROD.L      *M20000,      R0
 RhD.L      *M3FFFF,      R0
 SWB.L      *M20000,      R0
*    JSR        CMV32
 MOVE.L     R0,           MYMRM
*MOVE.L     LLDR0,        R0          leave there
 MOVEQ.L    *D31,         R2
 RDD.B      IFCRM+5,      R2          RDEXP W/o TERM
 MOVE.L     *M5R000000,   MPYLF       1/728.17777 -- scaling of PHASE
 ROD.B      *HF7,         R2          exp of scaling
 MOVE.L     LLDR0,        R0
 ROD.B      RDEXP+1,      R2
 MOVE.B     R2,           R0
 RTS
*
* group delay
*
delay EQW *
*
 JSR        RTNCP
 MOVE.L     dp_grp_delay_men(R12),R1
 MOVE.L     R0,dp_grp_delay_men(R12)
 SWB.L      R0,           R1
 RWD.L      *M3FFFF,      R1
 BIST       #17,          R1          sign extend
 BEO        del1
 OR.L       *HFFFE0000,   R1
del1 EQW *
*    JSR        CMV32
 MOVE.L     R1,           MYRRM
 MOVE.L     dp_grp_dly_scale(R12),R1
 MOVE.L     LLDB0,        R0
 MOVE.B     RDEXP+1,      R0
 RDD.W      #31,          R0
* scale for number of points
 JSR        MPY2
 BRR        smoothing
```

```
RCOMPWTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 RM    PAGE  10


*EJECT;
*
RTNCP       EQU  *
 CLR.L      R2
 MOVE.W     R0,           R1
 SWAP       R0
 TST.W      R0
*                              imag in R0 and real in R1, donot need exp
 BMI        YNEG
 NEG.W      R0
 TST.W      R1
 BPL        YPXP
 MOVEQ.W    #1,           R2
 EXG        R0,           R1
XYCMP CMP.W R0,           R1
 BLT        RTR1
 EXG        R0,           R1
 NEG        R0                        OVERFLOW CASE OK
 BNE        RTN1
 RODQ.W     #1,           R2
XYRXIS SWRP R2
 MOVE.L     R2,           R0
 BRR        RTN5                      EXIT FOR 0,90,180,270
YPXP NEG.W  R1
 TST.W      R0
 BNE        XYCMP
 BRR        XYRXIS
YREG TST.W  R1
 BMI        YNXN
 MOVEQ.W    #3,           R2
 NEG.W      R1
 EXG        R0,           R1
 BNE        XYCMP
 BRR        XYRXIS
YNXN MOVE   #2,           R2
 BRR        XYCMP
*
RTN1 CLR.L  R3
 SWRP       R2
 SWRP       R0
 CLR        R0
 RSR.L      #1,           R0
 OIVS       R1,           R0
 BMI        RTN2
 REG        R0
 SUBO.W     R1,           R2
 MOVEQ.W    #1,           R3
R1N2 ROL    #7,           R0
 MOVE.W     R0,           R1
 RWD.W      =H3E,         R1
 LER        atn_table.L,  R10
 ROD.W      R1,           R10
 RGR.W      R2,           R0
 BND.W      *M7FE0,       R0
 LER        MINTP,        R9
 MOVE.L     (R10),        (R9)+
```

```
RCOMPWTE.WORK.PD8510          THU, DEC 22, 1583, 10:29 RM    PAGE  11


 MOVE.W     R0,           (R9)+
 REG        R0
 RDD.W      =H8000,       R0
 MOVE.W     R0,           (R9)+
 BPL        RTN3
 MOVE.W     (R10),        R1
 MOVE.W     (R9),         R0    DUMMY READ OF MULTIPLIER
 BRR        RTN4
RTN3 MOVE.W (R9),         R1
RTN4 EOR.W  R1,           R2
 ROO.W      R3,           R2
 MOVE.L     R2,           R0
BTX5        RTS
*
nath_off    RDD.W   W6,  RS
null_rtr    RTS          for computted JSBs
```

```
RCOMPUTE.WORK.PDB510          THU, DEC 22, 1983, 10:29 AM    PAGE  12

*EJECT;
*
*
lin_mag     EQU *
 BSR        magE
 BRR        smoothing
*
magE        EQU *
 LER        APLOG,      R9
 MOVE.L     R0,         (R9)+       load real/imag to find mag
 RDD.B      R1,         R1
 BVS        mag1                    check underflow
 MOVE.L     (R9),       R0          get result
 ADD.B      R1,         R0          add in double orginal exp
 BVS        mag2
 JMP        fet_sqrt.L               wee faster sqrt !!!!
*R1S implied
mag1 MOVE.L (R9),       R0          finish multipler
mag2 MOVE.L #M7FFFFF3F, R0          MRX value
 RTS
*
*
imag        EQU *
 MOVE.W     R1,R0
 BRA        smoothing
*
*
real EQU *
 SWAP       R0
 MOVE.W     R1,R0
 BRA        smoothing
*
```

```
RCOMPUTE.WORK.POS510          THU, DEC 22, 1983, 10:29 AM    PAGE  13

*EJECT
sur         EQU *
 BSR        magE
 MOVE.L     R0,     R1
 REG.B      R0
 BM1        inf_sur
 CMP.B      #022,   R0
 BGT        min_sur
*CLR.W      R1
 RSR.L      R0,     R1          denormalize mag
 CLR.B      R1                  get exp to zero
*
 MOVE.L     R1,     R0          copy denormalized mag
 NEG.L      R0
 #CLR       #31,    R0          R0 = 1 - mag
 RSR.L      #1,     R1
 BOVE.B     #1,     R1
 BSET       #30,    R1          R1 = 1 + mag
 JSR        DVR2                R0 = R1 / R0
 BRR        smoothing
min_sur  EQU *
 MOVE.L     #1#00000001, R0
 BRR        smoothing
inf_sur  EBU *
 MOVE.L     #R7B120014, R0      1,000,000    #E200000  5000  10*MRX_SCALE
 BRR        smoothing
```

```
RCOMPUTE.WORK.PDB510          THU, DEC 22, 1983, 10:29 AM    PAGE  14

*EJECT;
* entrys for array driven data processing
*
*  R11 must be preloaded with a ch ptr base
*  R12 must be preloaded with a ch var base
*  R13 must be preloaded with the adr to store the result
*  R7  is   number of points to process
*
*
array_correct EQU *
 BRA        array_test
array_loop EQU *
 MOVEM.L    R7/R13,  -(S)
 MOVE.L     dp_raw_get(R11),R10
 MOVE.L     (R10)+,R0
 MOVE.W     (R10)+,R1
 RND.W      #hff,   R1
 MOVE.L     R10,dp_raw_get(R11)          restore ptr
*
 MOVE.L     dp_correct_switch(R12),R10
 JSR        (R10)
 MOVEM.L    (S)+,  R7/R13
 SWAP       R0
 MOVE.W     R0,    (R13)+
 SWAP       R0
 MOVE.W     R0,    (R13)+
 NOP
 MOVE.W     R1,    (R13)+
array_test EQU *
 DBRA        R7, array_loop
 RTS
*
```

```
RCOMPUTE.WORK.PDB510          THU, DEC 22, 1983, 10:29 AM    PAGE  15

*EJECT;
* entrys for array driven data processing
*
*  R11 must be preloaded with a ch ptr base
*  R12 must be preloaded with a ch var base
*  R13 must be preloaded with the adr to store the result
*  R7  is   number of points to process
*
*
array_elec_length EQU *
 BRA        array_test_el
array_loop_el EQU *
 MOVEM.L    R7/R13,  -(S)
 MOVE.L     (R13)+,R2
 MOVE.W     (R13)+,R3
*
 MOVE.L     dp_length_shift(R12), R0      keep in a register ???
 JSR        fst_trig.L                    uses R0,R1,R9,R10
 CLR.W      R1
 JSR        MPYE
 MOVE.L     dp_length_inc(R12), R2        update for next bucket
 RDD.L      #2, dp_length_shift(R12)
*
*
 MOVE.L     dp_param_conv_switch(R12),R10
 JSR        (R10)
*
 MOVEM.L    (S)+,  R7/R13
 SWAP       R0
 MOVE.W     R0,    (R13)+
 SWAP       R0
 MOVE.W     R0,    (R13)+
 NOP
 MOVE.W     R1,    (R13)+
array_test_el EQU *
 DBRA        R7, array_loop_el
 RTS
*
```

```
RCOMPUTE.WORK.PD8910          THU, DEC 22, 1983, 10:29 AM    PAGE  16


*EJECT
*
*
```

```
BCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  17


*EJECT;
*
* compute_datap
*
*  R11 must be preloaded with a ch ptr base
*  R12 must be preloaded with a ch var base
*
*       Data in memory  | Imag  |  16 bits
*                       |  Real |  16 bits
*                       |xxx|Exp |   8  bits -- first 8 bits donot care
*                       ----------
update_rau_loop EQU *
compute_datap EQU *
 MOVE.L     dp_rau_get(R11),R10
 MOVE.L     (R10)+,R0
 MOVE.W     (R10)+,R1
 AND.W      #HFF,  R1
 MOVE.L     R10,dp_rau_get(R11)              restore ptr
*
correct_math EQU *
 MOVE.L     dp_correct_switch(R12),R10
 JSR        (R10)
*
 MOVE.L     R0,  R2
 MOVE.L     dp_length_shift(R12), R0
 BKE        do_rotate
 MOVE.L     dp_length_inc(R12), R0        update for next bucket
 ADD.L      R0, dp_length_shift(R12)
 MOVE.L     R2,  R0
 BRA        paran_conv
*
do_rotate EQU *
 MOVE.W     R1,  R3
 JSR        fst_trig.L
 LER        MCPMP,    R9                  complex math multiply
 MOVE.L     R2,   (R9)+
 MOVE.L     R0,   (R9)+
 MOVE.L     dp_length_inc(R12), R0        update for next bucket
 RDD.L      R0, dp_length_shift(R12)
 MOVE.W     (R9)+,    R1
 RDD.B      R3,     R1                    total exp
 BVC        exit_rotate                   exp overflow ?
 JSR        exp_overflow
exit_rotate EQU *
 MOVE.L     (R9),   R0
*
*
paran_conv EQU *
 MOVE.L     dp_paran_conv_switch(R12),R10
 JSR        (R10)
*
```

```
RCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  18


*EJECT
store_in_d EQU *
 MOVE.L     dp_d_ptr(R11),R10              stash into d (by words only)
 SWAP       R0
 MOVE.W     R0,(R10)+
 SWAP       R0
 MOVE.W     R0,(R10)+
 NOP                                       don't write to display too fast
 MOVE.W     R1,(R10)+
 MOVE.L     R10,dp_d_ptr(R11)
*
*
trace_math EQU *
 MOVE.L     dp_n_ptr(R11),R8
 MOVE.L     dp_trace_math_switch(R12),R10
 JSR        (R10)
 MOVE.L     R8,dp_n_ptr(R11)
*
*
format_sel EQU *
 MOVE.L     dp_format_switch(R12),R10
 JMP        (R10)
*
*
```

```
RCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE  19


*EJECT
*
* update entry points
*  fetch date fron store intermediate storage arrays and pick up
*   processing at the proper point
*
*
update_d_loop EQU *
 MOVE.L     dp_d_ptr(R11),R10
 MOVE.L     (R10)+,  R0
 MOVE.W     (R10)+,  R1
 MOVE.L     R10,dp_d_ptr(R11)
 BRA        trace_math
*
*
update_n_loop EQU *
 MOVE.L     dp_n_ptr(R11),R10
 MOVE.L     (R10)+,  R0
 MOVE.W     (R10)+,  R1
 MOVE.L     R10,dp_n_ptr(R11)
 BRA        format_sel
*
*
update_f_polar_loop EQU *
 MOVE.L     dp_f_ptr(R11),R10
 MOVE.L     (R10)+,  R0                   pick up complex value from F
 MOVE.W     (R10)+,  R1
 MOVE.L     R10,dp_f_ptr(R11)
 BRA        polar_scaling
update_f_rect_loop EQU *
 MOVE.L     dp_f_ptr(R11),R10
 MOVE.W     (R10)+,  R1                   skip over imag part should be zero
 MOVE.L     (R10)+,  R0                   pick up scalar from F
 MOVE.L     R10,dp_f_ptr(R11)
 ERA        rect_scaling
*
```

```
ACOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE 20

*EJECT;
inc_smoothing EQU *
* head points to that list item place ( old top of scr )in the ocr array
 MOVE.L    dp_scr_head(R12),  R10
 ADD.W     #06,  R10
 CMP.L     dp_scr_end(R12), R10
 BLT       is1
 MOVE.L    dp_scr_base(R12), R10
is1 EQU *
 MOVE.L    R0, (R10)
 MOVE.L    dp_smoothing_sum(R12), R1
 MOVE.L    R10,     dp_scr_head(R12)
 JSRX      ADD2
 MOVE.L    R0, dp_smoothing_sum(R12)
 R1S
*
dec_smoothing EQU *
* tail points to the last item in the scr array
 MOVE.L    dp_scr_tail(R12),   R10
 MOVE.L    (R10),     R0
 ADD.W     #06,  R10
 CMP.L     dp_scr_end(R12), R10
 BLT       ds1
 MOVE.L    dp_scr_base(R12), R10
ds1 EQU *
 MOVE.L    R10, dp_scr_tail(R12)
 MOVE.L    dp_smoothing_sum(R12), R1
 JSRX      SBR2
 MOVE.L    R0, dp_smoothing_sum(R12)
 RTS
*  print EQU  *
*   EXG R0,R5
*   JSRX      HSTR
*   JSRX   CRLF
*   EXG R5,R0
*   RTS
*  print_r0 EQU *
*   MOVE.L    R0,-(S)
*   MOVE.W    #08,-(S)
*   MOVE.L    R10, R0
*   JSRX      WHex
*   MOVE.L    (S), R0
*   JSRX      UREAL
*   MOVE.L    dp_smoothing_sum(R12), R0
*   JSRX      UREAL
*   JSRX      CRLF
*   MOVE.L    (S)+,R0
*   RTS
```

```
ACOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE 21

*EJECT;
smoothing  EQU *
*  CMPI.W    #0801,   dp_pos(R12)      R debug&
*   bLT       sn                       & debug&
*   LFR       too_many_points,R5 &screwy  debug R
*   MOVE .    R8,R0                    & debug &
*   JSRX      warn                     & debug &
*   RTS                                R debug &
sn EQU *
 MOVE.W    step_size.L,  R2
 ADD.W     R2,     dp_pos(R12)
 TST.W     dp_smoothing_oper(R12)
 BED       no_smoothing
 TST.W     dp_flg(R12)
 BMI       sn1
*s initial setUp
 MOVE.L    R0,-(S)
 MOVE.W    dp_smoothing_correct(R12),R7
 TST.W     dp_flg(R12)
 BNE       sn02
 MOVE.W    dp_smoothing_oper(R12), R7
 MOVE.W    R7, dp_smoothing_delay(R12)
 CLR.L     dp_smoothing_sum(R12)
 MOVE.L    dp_scr_end(R12),  dp_scr_head(R12)
 MOVE.L    dp_scr_base(R12), dp_scr_tail(R12)
*
sn01 EQU *
 MOVE.L    (S),  R0
 BSR       inc_smoothing
sn02 EQU *
 DBRA      R7, sn01
 MOVE.L    (S)+,  R0
 MOVE.W    #0-1,dp_flg(R12)
*R
sn1  EQU *
 TST.W     dp_smoothing_delay(R12)
 BLE       sn2
 SUB.W     #01,dp_smoothing_delay(R12)
*s  delay path
 BSR       inc_smoothing
 RTS
sn2 EQU *
 MOVE.L    R0,-(S)
 CLR.W     R7
 CMPI.W    #0801,   dp_pos(R12)
 BLT       sn31
 MOVE.W    dp_smoothing_oper(R12),R7
sn3 EQU *
 MOVE.L    (S),R0
sn31 EQU *
*a
*R    block average
 BSR       inc_smoothing
 BSR       dec_smoothing
 MOVE.L    dp_smoothing_scale(R12),R1
 JSRX      DIV2
```

```
ACOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE 22

 BSR       store_real_in_f
 DBRA      R7, sn3
 MOVE.L    (S)+, R0
 RTS
no_smoothing EQU *
 BSR       store_real_in_f
 RTS
*
```

```
ACOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE 23

*EJECT
store_real_in_f EQU *
 MOVE.L    dp_f_ptr(R11),R10       stash into f  (WORDS ONLY)
 CLR.W     (R10)+                 imag part of storage is zero
 SWAP      R0
 MOVE.W    R0,(R10)+
 SWAP      R0
 MOVE.W    R0,(R10)+
 MOVE.L    R10,dp_f_ptr(R11)
*
*
*
*    RECTANGULAR SCALING EQUATION          offset first,scale 2nd
*           input is real in R0, and result is in display units
*           with limiting on Y axis values
*
rect_scaling: MOVE.L  dp_y_offset(R12),R2    expect real y in R0
*    JSR       RD02
*    see ADD2 documentation
 SUB.B     R2,          R0          get exp difference for normalize
 BVC       rs2
 BPL       rs1
 RDD.B     R0,          R2
 MOVE.B    #7F,         R0
 SUB.B     R0,          R2
 BRA       rs2
rs1: MOVE.B #80,         R0
rs2: LER   #RLDG,        R9          set ADD address
 MOVE.L    R0,          (R9)+
 SWAP      R2
 MOVE.W    R2,          (R9)+       start ADD with offset's 16 MSBs
 SWAP      R2
 TST.B     R0
 BMI       rs3
 RDD.B     R0,          R2
rs3: MOVE.L    dp_y_gain(R12),R1
*   JSR       MPY2    modified so result is a double
*
 EXG       R1,          R2          cover up of screw up
 RDD.B     R2,          R1
 BVC       rs4
 JSR       exp_overflow
rs4: MOVE.W (R9)+,       R2          offseted value in LSH of R2
 RDD.L     #1,          R9
 RDD.B     (R9)+,       R1           add in exp
 BVC       rs5
 JSR       exp_overflow
rs5: MOVE.L R2,          (R9)+       move scale and value
 MOVE.W    R1,          (R9)+       move exp for unnormalize
 NOP                                 do WAIT test here ??
 MOVE      (R9)+,       R0          result
*
 CMP.W     dp_y_min(R12),R0         limit testing
 BGT       rs8
 MOVE.W    dp_y_min(R12),R0
rs8: CMP.W  dp_y_max(R12),R0
```

```
RCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE 24

 BLT       ro9
 BOVE.U    dp_y_max(R12),R0
*
re9: MOVE.L dp_trace_ptr(R11),R10
 ADD.L     #2,R10                    inc past x-point
 MOVE.U    R0,(R10)+                 place on screen
 MOVE.L    R10,dp_trace_ptr(R11)
rect_scaling_exit EQU *
 RTS
```

```
RCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:29 AM    PAGE 25

*EJECT
*
*     POLAR SCALING COURTION          scales first, then offsets
*                                      ( uhy different ?? available ocode )
*           input is complex in R0/R1, result is in display units
*           with limiting on X and Y axis values
*
polar    EQU  *
atore_polar_in_f EQU *
 MOVE.L  dp_f_ptr(R11),R10       stash into f (by uords only)
 SWAP    R0
 MOVE.U  R0,(R10)+
 SWAP    R0
 MOVE.U  R0,(R10)+
 NOP                             don't write to display too fast
 MOVE.U  R1,(R10)+
 MOVE.L  R10,dp_f_ptr(R11)
*
polar_scaling EQU *
 MOVE.L  R0,IFCAM                          1DA0; LDR2;
 LSR     NSHFT-4, R9
 MOVE.L  dp_polar_gain(R12),(R9)+          LDM0,SHIFT; LDM2,MPYFRC
 MOVE.L  dp_trace_ptr(R11) , R10
 MOD.B   dp_polar_exp+1(R12) , R1
 BVC     ps01
 JSR     exp_overflow
ps01 BLE ps02
 CLR.U   R1                                limit exp to <= 0
ps02 MOVE.U R1, (R9)+                      IDEXP,USHIFT
 MOVE.L  dp_x_offset(R12), R0
 MOVE.L  dp_y_offset(R12), R1
 MOD.U   (R9)+, R1
 ADD.U   (R9)+, R0
* limit test
 CMP.W   dp_x_min(R12),  R0
 BGT     ps03
 MOVE.W  dp_x_min(R12),  R0
 BRR     ps04
ps03 CMP.W  dp_x_max(R12),  R0
 BLT     ps04
 MOVE.U  dp_x_max(R12),  R0
ps04 CMP.W  dp_y_min(R12),  R1
 BGT     ps05
 MOVE.U  dp_y_min(R12),  R1
 BRR     ps06
ps05 CMP.W  dp_y_max(R12),  R1
 BLT     ps06
 MOVE.U  dp_y_max(R12),  R1
*
ps06 MOVE.U R0,(R10)+
 NOP
 MOVE.U  R1,(R10)+
 MOVE.L  R10,dp_trace_ptr(R11)
 RTS
 END
```

```
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COMMENT
*************************************************************************
*************************************************************************
end of comment;

INTEGER CONSTANT  dp_double_base        := 0 ,
                  dp_format_switch      := dp_double_base + 0,
                  dp_correct_switch     := dp_double_base + 1,
                  dp_trace_math_switch  := dp_double_base + 2,
                  dp_param_conv_switch  := dp_double_base + 3,
                  dp_length_initial     := dp_double_base + 4,
                  dp_length_inc         := dp_double_base + 5,
                  dp_length_shift       := dp_double_base + 6,
                    & composite of elec. length, etc. &
                  dp_scr_base           := dp_double_base + 7,
                  dp_scr_head           := dp_double_base + 8,
                  dp_scr_tail           := dp_double_base + 9,
                  dp_scr_end            := dp_double_base +10,
                  dp_grp_delay_men      := dp_double_base +11,
                  dp_correct_select     := dp_double_base +12,
                  dp_last_double        :=(dp_double_base +13) *dsize;
INTEGER CONSTANT  dp_real_base          := dp_last_double / rsize,
                  dp_x_offset           := dp_real_base + 0,
                  dp_y_gain             := dp_real_base + 1,
                  dp_polar_gain         := dp_y_gain,
                  dp_y_offset           := dp_real_base + 2,
                  dp_smoothing_scale    := dp_real_base + 3,
                  dp_smoothing_sum      := dp_real_base + 4,
                  dp_grp_dly_scale      := dp_real_base + 5,
                  dp_last_real          :=(dp_real_base + 6)  * rsize;
INTEGER CONSTANT  dp_integer_base       := dp_last_real / isize,
                  dp_x_min              := dp_integer_base + 0,
                  dp_x_max              := dp_integer_base + 1,
                  dp_y_min              := dp_integer_base + 2,
                  dp_y_max              := dp_integer_base + 3,
                  dp_polar_exp          := dp_integer_base + 4,
                  dp_finished_signal    := dp_integer_base + 5,
                  dp_pos                := dp_integer_base + 6,
                  dp_flg                := dp_integer_base + 7,
                  dp_smoothing_aper     := dp_integer_base + 8,
                  dp_smoothing_delay    := dp_integer_base + 9,
                  dp_smoothing_correct  := dp_integer_base +10,
                  dp_correct_offset     := dp_integer_base +11,
                  dp_list_integer       :=(dp_integer_base +12) *isize;
INTEGER CONSTANT  last_dp_vars          := dp_last_integer;
```

```
FCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  1

USER3 PROCEDURE conv_to_z( real_inag );
   VALUE real_inag;
   USER3 real_inag;                                        EXTERNAL.L;
USER3 PROCEDURE conv_to_y( real_inag );
   VALUE real_inag;
   USER3 real_inag;                                        EXTERNAL.L;
```

```
JCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE  1


!JOB jcompute,library.pd8510.work;pri=cs;outclass=,1
!CONTINUE
!PURGE aequxxx
!CONTINUE
!BUILD aequxxx;REC=-1276,,v,RSCII
!comment ,,aequxxx
M68KL,P BEGIN
#FILE cdatap.work;
#FILE cmessage.work;
#FILE ccompute.work;

INTEGER i;
#LIST;

i:= dsize ^ dp_n_ptr ;
i:= dsize ^ dp_d_ptr ;
i:= dsize ^ dp_f_ptr ;
i:= dsize ^ dp_trace_ptr ;
i:= dsize ^ dp_rau_get ;
i:= dsize ^ dp_rau11_get ;
i:= dsize ^ dp_rau21_get ;
i:= dsize ^ dp_rau12_get ;
i:= dsize ^ dp_rau22_get ;
i:= dsize ^ dp_correct_ptr ;
i:= dsize ^ dp_format_switch ;
i:= dsize ^ dp_correct_switch ;
i:= dsize ^ dp_trace_math_switch ;
i:= dsize ^ dp_param_conv_switch ;
i:= dsize ^ dp_length_inc ;
i:= dsize ^ dp_length_shift ;
i:= dsize ^ dp_scr_base ;
i:= dsize ^ dp_scr_head ;
i:= dsize ^ dp_scr_tail ;
i:= dsize ^ dp_scr_end ;
i:= dsize ^ dp_grp_delay_num ;
i:= dsize ^ dp_correct_select ;

i:= rsize ^ dp_x_offset ;
i:= rsize ^ dp_polar_gain ;
i:= rsize ^ dp_y_gain ;
i:= rsize ^ dp_y_offset ;
i:= rsize ^ dp_smoothing_scale ;
i:= rsize ^ dp_smoothing_sum ;
i:= rsize ^ dp_grp_dly_scale ;

i:= isize ^ dp_x_min ;
i:= isize ^ dp_x_max ;
i:= isize ^ dp_y_min ;
i:= isize ^ dp_y_max ;
i:= isize ^ dp_polar_exp ;
i:= isize ^ dp_pos   ;
i:= isize ^ dp_flg   ;
i:= isize ^ dp_smoothing_aper ;
i:= isize ^ dp_smoothing_delay ;
i:= isize ^ dp_smoothing_correct ;
```

```
JCOMPUTE.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE  2


i:= icize ^ dp_correct_offset ;

END$
!ed
e aequxxx
v/{{ i:= } MOVE }}/d
g/:=/.,.+1j
1,$s/^[^ ]*\* //
1,$s/;.*MOVE =0/EQU /
1,$s/,\$1//
)ts 20,25
1,$s/  */ /g
w
e acomputc.work
/chtable_start/+1,/chtable_end/-1d
.-1r aequxxx
w
q
!CONTINUE
!PURGE aequxxx
!TELL jtb.pd8510  ******   jcompute done    *******
!EOJ
```

```
FCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE  1


EXTERNAL INTEGER group_number.L;

SUBROUTINE abort_sweep;                                  EXTERNAL.L;
SUBROUTINE restart_sweep;                                EXTERNAL.L;
SUBROUTINE measurement_restart;                          EXTERNAL.L;
SUBROUTINE hold_sweep;                                   EXTERNAL.L;
SUBROUTINE single_sweep;                                 EXTERNAL.L;
SUBROUTINE continuous_sweep;                             EXTERNAL.L;
PROCEDURE  n_sweep(n);
   VALUE   n;
   INTEGER n;                                            EXTERNAL.L;
PROCEDURE  control;                                      EXTERNAL.L;
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE  1


M68KL.P,"control"
BEGIN

#FILE finit.work;
#FILE fkernel.work;
#FILE fkernel4.work;
#FILE crins.work;
#FILE cdebug.work;                                              & DEBUG &
#FILE fterm.work;                                               & DEBUG &
#FILE fbreak.work;
#FILE ffifo.work;
#FILE ffifos.work;
#FILE cchtable.work;                                  & for max_ch &
#FILE fchdata.work;
#FILE fcontvar.work;
#FILE fcontv2.work;              & for rebuild and array_processed &
#FILE fstimuli.work;
#FILE fyadc.work;
#FILE fintrpt.work;
#FILE cstin.work;
#FILE fpubib.work;
#FILE cpubib.work;
#FILE ftrace.work;
#FILE fmenu.work;
#FILE cdatap.work;                                & for update_rau_array &
#FILE fcal.work;     & for cal_acquisition_done and measuring_std_data &
#FILE futil.work;                & for warm and measuring_sto_aborted &


INTEGER CONSTANT normal_sweep := 0;                             & DEBUG &
INTEGER CONSTANT cw := -1;
BOOLEAN abort;          & abort current sweep (incl. stepped) if true &
                        & set TRUE by abort_sweep and sweep,          &
                        & set FALSE by control                        &
DOUBLE  CONSTANT complex_size := 6,                  & # bytes/complex &
                 word_size    := 2;                  & # bytes/word    &
INTEGER CONSTANT max_group_number := 27FFF;
GLOBAL  INTEGER  group_number;    & used for starting averaging factor &
```

```
SCONTROL.WORK.PDS510          THU, DEC 22, 1983, 10:30 AM     PAGE  2


REJECT;
COMMENT                                                              sync
*************************************************************************
*
*  wait for data processing to finish any unprocessed data points.
*
*************************************************************************
;
SUBROUTINE sync;
   BEGIN & sync &
      acquire(group_ready_rin);      & since two processes can't wait  &
                                     &    on the same signal.          &
      send(enable_group_ready);      & wait for any pending processing &
      wait(group_ready);             &    to be completed.             &
      release(group_ready_rin);
   END;  & sync &
```

```
SCONTR01.WORK.PDS510          THU, DEC 22, 1983, 10:30 AM     PAGE  3


REJECT;
COMMENT                                                        abort_sweep
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR abort_sweep
*
* FUNCTION: Aborts any active sweep, including stepped.
*           Sets a boolean flag, abort, used to terminate repititive
*           operations.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*************************************************************************
*
* LOGIC INFORMATION FOR abort_sweep
*
* INTIAL REFINEMENT:
*
*    abort source's sweep.
*    abort := TRUE.
*    allow pending processing to complete.
*
*************************************************************************
;
SUBROUTINE abort_sweep;                                          ENTRY;
   BEGIN & abort_sweep &
      IF sweep_debug THEN                                    & DEBUG &
         BEGIN & if &                                        & DEBUG &
            USTR("abort_sup+"); CRLF;                        & DEBUG &
         END;  & if &                                        & DEBUG &
      abort := TRUE;
      write_fifo(fifo_sup_brk, abort_sup);
      wait(aborted);          & until pending conversion stuff is done &
      abort := FALSE;                    & now that abort is verified &
                                                             & DEBUG &
      IF sweep_debug THEN                                    & DEBUG &
         BEGIN & if &                                        & DEBUG &
            USTR("abort_sup("); CRLF;                        & DEBUG &
         END;  & if &                                        & DEBUG &

      sync;

      disable_phase_lock_lost;

      IF sweep_debug THEN                                    & DEBUG &
         BEGIN & if &                                        & DEBUG &
            USTR("abort_sup-"); CRLF;                        & DEBUG &
         END;  & if &                                        & DEBUG &
   END;  & abort_sweep &
```

```
SCONTROL.WORK.PDS510          THU, DEC 22, 1983, 10:30 AM     PAGE  4


REJECT;
COMMENT                                                      restart_sweep
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR restart_sweep
*
* FUNCTION: Restarts sweep, beginning a new group.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*************************************************************************
*
* LOGIC INFORMATION FOR restart_sweep
*
* INTIAL REFINEMENT:
*
*    restart sweep by exiting break_idle and resuming the control loop
*
*************************************************************************
;
SUBROUTINE restart_sweep;                                        ENTRY;
   BEGIN & restart_sweep &
      write_fifo(fifo_sup_brk, exit_break_idle);
   END;  & restart_sweep &
```

```
SCONTROL.WORK.PDS510          THU, DEC 22, 1983, 10:30 AM     PAGE  5


REJECT;
COMMENT                                                  measurement_restart
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR measurement_restart
*
* FUNCTION: Aborts any active sweep, then restarts sweep.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*************************************************************************
*
* LOGIC INFORMATION FOR measurement_restart
*
* INTIAL REFINEMENT:
*
*    abort_sweep.
*    restart_sweep.
*
*************************************************************************
;
SUBROUTINE measurement_restart;                                  ENTRY;
   BEGIN & measurement_restart &
      abort_sweep;
      restart_sweep;
   END;  & measurement_restart &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  6

#EJECT;
COMMENT                                                    hold_sweep
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR hold_sweep
*
* FUNCTION: Aborts any active sweep, and sets sweep mode to hold.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*****************************************************************
*
* LOGIC INFORMATION FOR hold_sweep
*
* INTIAL REFINEMENT:
*
*    abort_sweep
*    number_of_groups := hold
*
*****************************************************************
;
SUBROUTINE hold_sweep;                                      INTRY;
   BEGIN & hold_sweep &
      abort_sweep;
      number_of_groups := hold;    & needn't acquire control variables &
                                   &    since value is a single word.  &
   END;  & hold_sweep &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  7

REJECT;
COMMENT                                                   single_sweep
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR single_sweep
*
* FUNCTION: Aborts any active sweep, sets sweep mode to single, and
*           resumes sweep activity.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*****************************************************************
*
* LOGIC INFORMATION FOR single_sweep
*
* INTIAL REFINEMENT:
*
*    abort_sweep
*    number_of_groups := single
*    resume sweep
*
*****************************************************************
;
SUBROUTINE single_sweep;                                    ENTRY;
   BEGIN & single_sweep &
      abort_sweep;
      number_of_groups := single;  & needn't acquire control variables &
                                   &    since value is a single word.  &
      signal_init( take_sweep_done, 0 );
      restart_sweep;
   END;  & single_sweep &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  8

#EJECT;
COMMENT                                                 continuous_sweep
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR continuous_sweep
*
* FUNCTION: Aborts any active sweep, sets sweep mode to continuous, and
*           resumes sweep activity.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*****************************************************************
*
* LOGIC INFORMATION FOR continuous_sweep
*
* INTIAL REFINEMENT:
*
*    abort_sweep
*    number_of_groups := continuous
*    resume_sweep
*
*****************************************************************
;
SUBROUTINE continuous_sweep;                                ENTRY;
   BEGIN & continuous_surep &
      abort_sweep;
      number_of_groups := continuous;
                                & needn't acquire control variables &
                                &    since value is a single word.  &
      restart_sweep;
   END;  & continuous_sweep &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  9

#EJECT;
COMMENT                                                        n_sweep
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR n_sweep
*
* FUNCTION: Aborts any active sweep, sets sweep mode to n-sweeps, and.
*           resumes sweep activity.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*****************************************************************
*
* LOGIC INFORMATION FOR n_sweep
*
* INTIRL REFINEMENT:
*
*    abort_sweep
*    number_of_groups := n
*    restart_sweep
*
*****************************************************************
;
PROCEDURE  n_sweep(n);
   VALUE   n;
   INTEGER n;                                               ENTRY;
   BEGIN & n_sweep &
      IF n > 1 THEN
         BEGIN & if &
            abort_sweep;
            number_of_groups := n; & needn't acquire control variables &
                                   &    since value is a single word.  &
            signal_init( take_sweep_done, 0 );
            restart_sweep;
         END   & if &
      ELSE IF n = 1 THEN
         single_sweep;
&     ELSE
         no action      &
   END;  & n_sweep &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  10


$EJECT;
COMMENT                                                          sweep
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR sweep
*
* FUNCTION: Sets up parameters (source, test-set, receiver, phase-lock).
*           Initiates as many sweeps as required to acquire all of the
*           acquisition parameters.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* COMMENTS:
*    The concept of multiple channels is implemented at this level.
* Above this level, everything pertains to the instrument as a whole
* (both channels).
*
*****************************************************************************
*
* LOGIC INFORMATION FOR sweep
*
* INTIAL REFINEMENT:
*
*   FOR acquisition_param := first TO last DO
*      BEGIN
*         acquire( control_variables )
*         set up parameter
*         release( control_variables )
*         sweep source
*      END
*
*****************************************************************************
;
PROCEDURE  sweep;
   BEGIN & sweep &
      INTEGER acquisition_param;
      BOOLEAN success;

      success := TRUE;
      FOR acquisition_param := first_aequisition_param WHILE
         ((acquisition_param <= last_acquisition_param) AND success) DO
         BEGIN & for &
            acquire(control_variables);
            success := set_up_param( acquisition_param, inhibit_lock );
            release(control_variables);
            IF success AND (NOT abort) THEN
               BEGIN & if &
                  success := maintain_sweep;
                  success := success AND (NOT abort);
               END   & if &
            ELSE
               preempt;
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  11


         END;  & for &
   END;  & sweep &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  12


$EJECT;
COMMENT                                                          step
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR step
*
* FUNCTION: Sets up parameters (source, test-set, receiver, phase-lock).
*           Controls the stimulus to measure the required number of
*           points.  Makes as many stepped sweeps as required to
*           acquire all of the acquisition parameters.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* COMMENTS:
*    The concept of multiple channels is implemented at this level.
* Above this level, everything pertains to the instrument as a whole
* (both channels).
*
*****************************************************************************
*
* LOGIC INFORMATION FOR step
*
* INTIAL REFINEMENT:
*
*       prev_set := 0.
*       FOR param_set := first_param_set UNTIL last_param_set DO
*          BEGIN   for param_set
*
*             FOR stimulus_value := start STEP step_size UNTIL stop DO
*                BEGIN   for stimulus_value
*
*                   acquire(control_variables).
*                                 don't allow updates except between steps
*                   step_stimulus(stimulus_value).
*
*                   FOR acquisition_param := 1 +
*                                 last_param_of_set[prev_set]
*                         UNTIL last_param_of_set[param_set] DO
*                      BEGIN   for acquisition_param
*                         set up parameter.
*                         trigger_adc.
*                      END.    for acquisition_param
*                   release(control_variables).      allow updates now
*                   preempt.
*
*                END.    for stimulus_value
*             prev_set := param_set.
*
*          END.    for param_set
*
*****************************************************************************
;
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  13


PROCEDURE  step;
   BEGIN & step &
      BOOLEAN success;
      INTEGER param_set,
              prev_set,
              acquisition_param,
              stimulus_value,
              lock_type;

      prev_set := 0;
      success := TRUE;
      FOR param_set := first_param_set WHILE
                  ( (param_set <= last_param_set) AND success ) DO
         BEGIN & for param_set &
            LABEL level1_exit;

            & round-about way to tell "break" before "step" &  & DEBUG &
            acquire(control_variables);                        & DEBUG &
            success := set_up_param( 1+last_param_of_set[prev_set],
                                     inhibit_lock
                                   );                          & DEBUG &
            release(control_variables);                        & DEBUG &
            IF (NOT success) OR abort THEN
               BEGIN & if &
                  preempt;
                  GO TO level1_exit;
               END;  & if &
            init_auto_range;

            FOR stimulus_value := start STEP step_size WHILE
                              ((stimulus_value <= stop) AND success) DO
               BEGIN & for stimulus_value &
                  LABEL level2_exit;

                  lock_type := force_lock;    & due to freq. change &
                  acquire(control_variables);
                           & don't allow updates except between steps &
                  success := step_stimulus(stimulus_value);
                  IF (NOT success) OR abort THEN
                     BEGIN & if &
                        release( control_variables );
                        preempt;
                        GO TO level2_exit;
                     END;  & if &

                  FOR acquisition_param := 1+last_param_of_set[prev_set]
                        UNTIL (
                     (acquisition_param <= last_param_of_set[param_set])
                     AND success
                           ) DO
                     BEGIN & for acquisition_param &
                        success := set_up_param( acquisition_param,
                                                 lock_type
                                               );
                        IF success AND (NOT abort) THEN
                           BEGIN & if &
```

```
SCONTROL.WORK.POS510          THU, DEC 22, 1983, 10:30 AM    PAGE 14

                        lock_type := normal_lock;
                        auto_ranging( acquisition_param );
                        trigger_vadc;
                     END  & if &
                  ELSE
                     preempt;
                  success := success AND (NOT abort);
               END;  & for acquisition_paran &
            release(control_variables);   & allow updates now &
            preempt;
level2_exit:
            success := success AND (NOT abort);
         END;  & for stimulus_value &
      prev_set := paran_set;
level1_exit:
      success := success AND (NOT abort);
   END;  & for paran_set &
END;  & step &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE 15

REJECT;
COMMENT                                                          do_cu
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR do_cu
*
* FUNCTION: Sets up parameters (source, test-set, receiver, phase-lock).
*           Measures the specified point for each acquisition paraneter.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* COMMENTS:
*    The concept of multiple channels is implemented at this level.
* Above this level, everything pertains to the instrument as a whole
* (both channels).
*
*****************************************************************
*
* LOGIC INFORMATION FOR do_cu
*
* INTIAL REFINEMENT:
*
*       set_stimulue(stimulus_value).
*
*       acquire(control_variables).
*       FOR acquisition_paran := first_acquisition_paran UNTIL
*                                last_acquisition_paran DO
*          BEGIN   for
*             set up parameter.
*             trigger_vadc.
*          END.    for
*       release(control_variables).                  allow updates now
*       preempt.
*
*****************************************************************
;
PROCEDURE  do_cu;
   BEGIN & do_cu &
      BOOLEAN success;
      INTEGER acquisition_paran,
              stimulus_value,
              lock_type,
              point,
              word,
              data = REGISTER 5;
      INTEGER POINTER first_point = REGISTER 10,
                      destination = REGISTER 11;
      LABEL   cu_exit;

      SUBROUTINE replicate;
         BEGIN & replicate &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE 16

            STPNTR( first_point, rau_base[acquisition_paran] );
            FOR word := 1 UNTIL 3 DO
               BEGIN & for word &
                  data := first_point;
                  RSSEMBLE( MOVE.L first_point, destination;
                            ADDQ.L =D6,         destination
                          );
                  FOR point := step_size STEP step_size UNTIL stop DO
                     BEGIN & for point &
                        destination := data;
                        ASSEMBLE( ADDQ.L =D6, destination );
                     END;  & for point &
                  RSSEMBLE( ADDQ.L =D2, first_point );
               END;  & for word &
         END;  & replicate &

      & round-about way to tell "break" before frequency change &
      acquire( control_variables );
      IF NOT set_up_paran( first_acquisition_paran, inhibit_lock ) THEN
         GO TO cu_exit;
      release( control_variables );
      init_auto_range;

      lock_type := force_lock;   & due to possible acq'n paran. change &
      acquire( control_variables );    & don't allow update until done &
      IF NOT step_stimulus( cu ) THEN
         GO TO cu_exit;

      success := TRUE;
      FOR acquisition_paran := first_acquisition_paran UNTIL
          ((acquisition_paran <= last_acquisition_paran) AND success) DO
         BEGIN & for acquisition_paran &
            success := set_up_paran( acquisition_paran, lock_type );
            IF success AND (NOT abort) THEN
               BEGIN & if &
                  lock_type := normal_lock;
                  auto_ranging( acquisition_paran );
                  trigger_vadc;
                  replicate;
               END  & if &
            ELSE
               preempt;
            success := success AND (NOT abort);
         END;  & for acquisition_paran &
cu_exit:
      release(control_variables);                  & allow updates now &
      preempt;

   END;  & do_cu &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE 17

REJECT;
COMMENT                                                          group
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR group
*
* FUNCTION:
*    Controls the stimulus and data acquisition for one group of
* measurements.  Inplements swept, stepped, and cw.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* COMMENTS:
*    Everything at this level applies to the instrument as a whole
* (both channels).
*
*****************************************************************
*
* LOGIC INFORMATION FOR group
*
* INTIRL REFINEMENT:
*
*       init_group.                        initialize group paraneters.
*
*       CASE sweep_mode OF
*          BEGIN   case
*    swept    sweep.
*    stepped  step.
*    cw       do_cw.
*          END.    case
*
*****************************************************************
;
SUBROUTINE init_group;
   BEGIN & init_group &

      acquire(group_ready_rin);      & since two processes can't wait  &
                                     &    on the same signal.          &
      send(enable_group_ready);      & wait for any pending processing &
      wait(group_ready);             &    to be completed.             &
      release(group_ready_rin);

      calib_vadc( full_if_cal );     & vadc will decide if necessary   &

      acquire(control_variables);
      init_group_control_vars;       & resets pointers and signals.    &
      release(control_variables);

      IF group_number < max_group_number THEN
         group_number := group_number + 1;

   END;  & init_group &
```

```
SCONTROL.WORK.POS510          THU, DEC 22, 1983, 10:30 AM     PAGE 18



PROCEDURE  group;
   BEGIN & group &
      INTEGER fifo_word;
      BYTE    fifo_word_upper = fifo_word,
              fifo_word_lower = fifo_word+1;

      init_group;

      IF last_acquisition_param < first_acquisition_param THEN
         abort := TRUE
      ELSE IF (NOT abort) THEN
         CASE sweep_mode OF
            BEGIN & case &
& swept &      sweep;
& stepped &    step;
& cw &         do_cw;
            END;  & case &

      & do any required array processing now &

      IF (NOT abort) THEN
         BEGIN & if &
            fifo_word_lower := update_raw_array;
            fifo_word_upper := array_processed AND %01;        & ch1 ? &
            IF fifo_word_upper <> 0 THEN
               write_fifo( array_update_fifo, fifo_word );
            fifo_word_upper := array_processed AND %02;        & ch2 ? &
            IF fifo_word_upper <> 0 THEN
               write_fifo( array_update_fifo, fifo_word );
         END;  & if &

   END;  & group &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE 19


REJECT;
COMMENT                                                              control
*********************************************************************
*
* EXTERNAL SPECIFICATION FOR control
*
* FUNCTION:
*    Controls the stimulus and data acquisition for repeated identical
* groups of measurements.  Implements single sweep, n sweep, and
* continuous sweep.  See ROEF.WCC for definition of "group".
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* COMMENTS:
*    Everything at this level applies to the instrument as a whole
* (both channels).
*
*********************************************************************
*
* LOGIC INFORMATION FOR control
*
* INTIAL REFINEMENT:
*
*    initialize control parameters.
*
*    DO forever
*       BEGIN   do
*
*          break_idle.    wait for Measurements to be resumed
*
*          reset control parameters.
*
*          IF number_of_goups > 0 THEN
*             REPEAT number_of_groups DO
*                group
*          ELSE
*             WHILE number_of_groups = continuous AND (NOT abort) DO
*                group.
*
*       END.    do
*
*********************************************************************
;
SUBROUTINE init_control;
   BEGIN & init_control &

      init_break;
      init_xadc;              & must come after variables are init'd  &
      init_yadc;              &    and all is ready for interrupts.   &
      signal_init( take_sweep_done, 0 );

COMMENT     load ch1 and ch2 data (freq, pwr, speed) into source
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE 20

      set up control variables (switch labels, which get/put
            pointers to use, etc.)
      crank up data processing process(es).
      reset # averages to zero.
      ;
   END;  & init_control &


PROCEDURE  reset_control;
   BEGIN & reset_control &
      INTEGER latest_cmd;

      calib_xadc(force_cal); & it may have been a while since last cal.&
      group_number := 1;        & assures one group without averaging &

      & take care of the highlights &
      IF number_of_groups = continuous THEN
         latest_cmd := cmd_continuous
      ELSE IF number_of_groups = hold THEN
         latest_cmd := cmd_hold
      ELSE IF number_of_groups = single THEN
         latest_cmd := cmd_single
      ELSE
         latest_cmd := cmd_n_groups_kbd;
      hilight_key(latest_cmd, cmd_hold, cmd_continuous);

   END;  & reset_control &


PROCEDURE  control;     & a process &                                ENTRY;
   BEGIN & control &
      LABEL again,
            control_abort;

      init_control;

again:
      DO
         BEGIN & do &
            IF awaited( take_sweep_done ) THEN          & "TS" waiting&
               send( take_sweep_done );
            abort := FALSE;
            break_idle;
                  COMMENT  this idle routine provides for HP-IB and
                  button box interrupts while there is no active
                  measurement taking place.  It will return when
                  measurements are resumed.
                  ;
            IF control_debug THEN                              & DEBUG &
               BEGIN                                           & DEBUG &
                  USTR("control: number_of_groups = ");        & DEBUG &
                  UHEX(number_of_groups);                      & DEBUG &
                  CRLF;                                        & DEBUG &
               END;                                            & DEBUG &
```

```
SCONTROL.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE 21

            END   & do &
         UNTIL rebuild OR
               ( ( number_of_groups <> hold )                          AND
                 ( NOT abort )                                         AND
                 ( last_acquisition_param >= first_acquisition_param )
               );

         IF NOT abort THEN
            reset_control;

         IF number_of_groups > 0 THEN
            REPEAT number_of_groups DO
               IF abort THEN
                  GO TO control_abort
               ELSE
                  group
         ELSE
            WHILE (number_of_groups = continuous) AND (NOT abort) DO
               group;

         IF (NOT abort) THEN
            BEGIN & if not abort &
               IF measuring_std_data THEN
                  BEGIN & if &
                     cal_acquisition_done;
                     restart_sweep;
                  END   & if &
               ELSE
                  number_of_groups := hold;

               set_serial_poll( op_complete_srq );
            END;  & if not abort &

control_abort:
         hilight_key (cmd_hold, cmd_hold, cmd_continuous);

         GO TO again;

      END;  & control &

END$
```

```
FCONTV2.UORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  1

EXTERNAL BOOLEAN rebuild;
EXTERNAL BYTE    array_proceesed;
```

```
CCONTVAR.UORK.POS510         THU, DEC 22, 1983, 10:30 AM    PAGE  1

INTEGER CONSTANT  suept     := 0,                          & sweep modes &
                  stepped   := 1,
                  single_pt := 2;

INTEGER CONSTANT  continuous := -1, & number of groups per sweep mode. &
                  hold       := 0,
                  single     := 1;

INTEGER CONSTANT  start     := 0,                      & stimulus values &
                  stop      := 800,
                  center    := 400,
                  span      := 800;

INTEGER CONSTANT  inhibit_lock := 0,     & eet_up_psran lock paraneter &
                  normal_lock  := 1,
                  force_lock   := 2;

& PARAMETER SET CONSTANTS &

INTEGER CONSTANT  nax_paran_set              := 8,
                  first_paran_set            := 1;

& ACQUISITION PARAMETER CONSTANTS &

INTEGER CONSTANT  nax_acquisition_paran   := 5,
                  first_acquisition_paran := 1;

& PARAMETER DESCRIPTOR CONSTANTS &

INTEGER CONSTANT  s11          := 1,   & values correspond to "annot" &
                  s21          := 2,   &   tables in "pfr", bitnap in &
                  s12          := 3,   &   "scalD", format_nap in     &
                  s22          := 4,   &   "datap", fnt_table in      &
                  z1           := 5,   &   "aconpute", constants in   &
                  z2           := 6,   &   "cdatap" and "cconpute".   &
                  y1           := 7,
                  y2           := 8,
                  user1        := 9,
                  user2        := 10,
                  user3        := 11,
                  user4        := 12,
                  nax_paraneter := 12,          & CHARGE ALSO IN fpfr &
                  null_paran   := -1;
INTEGER CONSTANT  generic_paran := s11; & must have sane relationship  &
                                        &    to s-params as dp_rau_get &
                                        &    of cdatap.                &
INTEGER CONSTANT  nunerator_port      := 1,     & relative order used &
                  denominator_port    := 2,     & by testset file and &
                  driven_port         := 3,     & test-set ID string. &
                  phase_lock_port     := 4,
                  paraneter_conversion := 5,    &\_ not used together &
                  attenuator          := 5,     &/                    &
                  nax_paraneter_entry := 6;     & CHARGE ALSO IN fpfr &
```

```
fCONTVRR.WORK.PD8510         THU, DEC 22, 1983, 10:30 AM    PAGE  1

NFILE ccontvar.work;

EXTERNAL INTEGER       last_paran_set;
EXTERNAL BYTE    ARRAY last_paran_of_set[0:nax_paran_set];
EXTERNAL INTEGER       last_acquisition_paran;
EXTERNAL INTEGER       current_acquisition_paran;
EXTERNAL BYTE    ARRAY paran     [1:nax_acquisition_paran];
EXTERNAL BYTE    ARRAY ch        [1:nax_acquisition_paran];
EXTERNAL DOUBLE  ARRAY rau_base  [1:nax_acquisition_paran];
EXTERNAL DOUBLE  ARRAY rau_fut   [1:nax_acquisition_paran];
EXTERNAL DOUBLE  ARRAY dp_rau_base[ 1:nax_ch, s11:s22 ];

PROCEDURE  reset_acquisition_descriptor;                    EXTERNAL;
PROCEDURE  partial_new_step_size( new_size );
   VALUE   new_size;
   INTEGER new_size;                                        EXTERNAL;
PROCEDURE  new_step_size( new_size );
   VALUE   new_size;
   INTEGER new_size;                                        EXTERNAL;
BOOLEAN PROCEDURE set_up_paran( new_acquisition_paran, lock_type );
   VALUE   new_acquisition_paran, lock_type;
   INTEGER new_acquisition_paran;
   BOOLEAN lock_type;                                       EXTERNAL;
PROCEDURE set_dp_ptrs( chnl, table, ch_trace );
   VALUE   chnl, table, ch_trace;
   INTEGER chnl, table, ch_trace;                           EXTERNAL;
```

```
SCONTVAR.UORK.PDS510         THU, DEC 22, 1983, 10:30 AM    PAGE  1

N68XL,P,"contvar"
BEGIN

NFILE facttbl.work;
NFILE fgratic.work;
NFILE fcontrol.work;
NFILE fstring.work;
NFILE fprivib.work;
NFILE fxadc.work;
NFILE fyadc.work;
NFILE ccontvar.work;
NFILE fsize.work;
NFILE fkernel.work;
NFILE fkernel4.work;
NFILE fstinul.work;
NFILE fstinul2.work;
NFILE ftestset.work;
NFILE fdatap.work;
NFILE cchtable.work;
NFILE fchtabie.work;
NFILE fchtab2.work;
NFILE fchtab3.work;
NFILE fchdata.work;
NFILE fnenngr.work;
NFILE crins.work;
NFILE cids.work;
NFILE fchpfr.work;
NFILE ffnt.work;
NFILE cresp.work;
NFILE fnenu.work;
NFILE cnessag2.work;                    & for exceeded_avilable_nenory &
NFILE futil2.work;                                  & for fatal &
NFILE ccal.work;
XFILE fbreak.work;
NFILE ctrace.work;
NFILE cstin.work;              & for cnd_51_points and cnd_401_points &
NFILE cdebugc2.work;                                & for forced_step &
NFILE ftrace2.work;              & for release_nen and repaint_traces &
NFILE fscreen2.work;                        & for tracei_base, etc. &
NFILE fannot.work;                    & for annotate_enhancenents &
NFILE ftime2.work;                                  & for user3_zero &

EXTERNAL INTEGER ARRAY counter[0:1];      & Senaphore counters Fron    &
                                          &    kernel, only for yadc  &
                                          &    and data processing via &
                                          &    chtable.               &
EXTERNAL BYTE RRRAY link[0:1];            & Links for queues, and     &
                                          & pointers to head of queues &
                                          & fron kernel, only for yadc &
                                          & and data processing via   &
                                          & chtable.                  &
```

```
SCONTVAR.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  2


%EJECT;

INTEGER TABLE cnd :=                          & indexed by step size &
      & 0 &   0,
      & 1 &   0, & cnd_801_points when/if implemented &
      & 2 &   cnd_401_points,
      & 3 &   0,
      & 4 &   cnd_201_points,
      & 5 &   0,
      & 6 &   0,
      & 7 &   0,
      & 8 &   cnd_101_points,
      & 9 &   0,
      & 10 &  0,
      & 11 &  0,
      & 12 &  0,
      & 13 &  0,
      & 14 &  0,
      & 15 &  0,
      & 16 &  cnd_51_points;

BYTE   CONSTANT newline :=  10;                  & ASCII line feed  &
INTEGER CONSTANT none := -1;     & for initialization of current param &
BYTE   CONSTANT all_chs := %03;                & bit set for each channel &
DOUBLE CONSTANT dp_f_bit_bucket := %80000;          & address of ROM &

GLOBAL INTEGER current_acquisition_param;
```

```
SCONTVAR.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  3


%EJECT;
COMMENT
-------------------------------------------------------------------
.
.  ACQUISITION DESCRIPTOR
.
.  Variables for control of the sequencing of acquisition parameters.
.  Indexed by acquisition parameter.
.
-------------------------------------------------------------------
;
GLOBAL INTEGER       last_param_set;
GLOBAL BYTE ARRAY    last_param_of_set[0:max_param_set];
GLOBAL INTEGER       last_acquisition_param;
GLOBAL BYTE ARRAY    param     [1:max_acquisition_param];
                     & index into parameter descriptor table. &
GLOBAL BYTE ARRAY    ch        [1:max_acquisition_param];
                     & bit map of channels that use/need this parmeter &
                     & if more than one ch is set, only the first      &
                     & one's descriptor will be used.                  &
GLOBAL DOUBLE  ARRAY rau_base [1:max_acquisition_param];
                                        & address of rau_data arrays. &
GLOBAL DOUBLE  ARRAY rau_put  [1:max_acquisition_param];
                                        & temp storage during chopped &
INTEGER ARRAY        rau_ready[1:max_acquisition_param];
GLOBAL DOUBLE  ARRAY dp_rau_base[ 1:max_ch, all:a22 ];

GLOBAL BYTE          array_processed;              & bit/ch boolean &

GLOBAL BOOLEAN rebuild;       & rebuild acquisition descriptor if TRUE &
INTEGER param_map;      & bit map of allocated rau arrays, by parameter &
```

```
SCONTVAR.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  4


%EJECT;
COMMENT                                                  chs_are_same
*****************************************************************
*
*****************************************************************
;
BOOLEAN PROCEDURE  chs_are_same;
   BEGIN & chs_are_same &
      INTEGER avg_node_1,
              avg_node_2;

      avg_node_1 := ch_integer(ch_average_node,1);
      avg_node_2 := ch_integer(ch_average_node,2);
      chs_are_same := ( avg_node_1 = avg_node_2 )                PHD
                    ( coupled_ch(ch_start_frequency) )           RWD
                  OR ( ( avg_node_1 = avg_off )                  OR
                       ( ch_integer(ch_average_factor,1) =
                         ch_integer(ch_average_factor,2)
                       )
                     );

   END;  & chs_are_same &
```

```
SCONTVAR.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  5


%EJECT;
COMMENT                                      reset_acquisition_descriptor
*****************************************************************
*
*****************************************************************
;
PROCEDURE  reset_acquisition_descriptor;                          ENTRY;
   BEGIN & reset_acquisition_descriptor &
      INTEGER  parameter,
               chnl;

      acquire(control_variables);

      & initialize acquisition parameter descriptor &

      current_acquisition_param := none;
      current_acquisition_ch := no_ch;

      FOR parameter := 1 UNTIL max_acquisition_param DO
         BEGIN & for &
            ch[parameter] := 0;
            rau_base[parameter] := 0;
         END;  & for &
      last_acquisition_param := 0;
      last_param_set := 0;          & last_param_of_set[0] = 0 always &
      last_param_of_set[0] := 0;
      param_map := 0;
      rebuild := FALSE;

      FOR chnl := 1 TO max_ch DO
         BEGIN & for &
            set_ch_double( 0, ch_d_base, chnl );
            set_ch_double( 0, ch_f_base, chnl );
            set_ch_double( 0, ch_n_base, chnl );
         END;  & for &

      set_ch_double( ADRS(trace1_base),   ch_trace_base,   1 );
      set_ch_double( ADRS(trace1_n_base), ch_n_trace_base, 1 );
      set_ch_double( ADRS(trace2_base),   ch_trace_base,   2 );
      set_ch_double( ADRS(trace2_n_base), ch_n_trace_base, 2 );

      release(control_variables);

   END;  & reset_acquisition_descriptor &
```

```
SCONTVRR.UORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  6


%EJECT;
COMMENT                                          clear_acquisition_descriptor
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
*
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
PROCEDURE  clear_acquisition_descriptor;
   BEGIN & clear_acquisition_descriptor &
      INTEGER  parameter;

      IE last_acquisition_paran > 0 THEN
         FOR parameter := 1 UNTIL last_acquisition_paran DO
            BEGIN & for &
               IF rau_base[parameter] <> 0 THEN
                  release_array( rau_base[parameter] );
               ch[parameter) := 0;
               rau_ready[parameter] := rau_ready_bit_bucket;
            END;  & for &
      last_acquisition_peran := 0;
      last_paran_set := 0;           & last_paran_of_set[0] = 0 always &
      paran_map := 0;
      array_processed := 0;

   END;  & clear_acquisition_descriptor &
```

```
SCONTVRR.UORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  7


%EJECT;
COMMENT                                                    enter_paran
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
*
*   flakes all of the entries in the acquisition parameter descriptor
*   table, except for the rau_reaey signal value, uhich must be the last
*   acquisition parameter for a channel after sorting.
*
*   Returns the address of the rau_base array.
*
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
OOUBLE PROCEDURE enter_paran( parameter, channel );
   VRLUE   parameter, channel;
   INTEGER parameter, channel;
   BEGIN & enter_paran &
      INTEGER eld_paran_map,
              paran_index;

      old_paran_nay := paran_map;
      paran_map := SBIT(paran_map, parameter);

      IF eha_are_sane RND (old_paran_map = paran_map) THEN
         & chs are sane and rau was already allocated that may be used &
         BEGIN & if &
            paran_index := 0;
            DO
               paran_index := paran_index + 1
            UNTIL paran[paran_index] = parameter;
         END   & if &
      ELSE & must allocate a new rau array &
         BEGIN & else &
            paran_index :=
                  last_acquisition_paran := last_acquisition_paran + 1;
            paran[paran_index] := parameter;
            If ( rau_base[paran_index] := request_array(block_size)
               ) = 0 THEN
               fatal( exceeded_available_nenory );
            rau_ready[paran_index] := rau_ready_bit_bucket;
         END;  & else &

      ch[paran_index] := SBIT( ch[paran_index], channel-1 );
      enter_paran := rau_base[paran_index];

   END;  & enter_paran &
```

```
SCONTVRR.UORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  8


%EJECT;
COMMENT                                                          build
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
*
*   Trace must be aborted (abort_sweep) prior to calling this routine
*   since the pointers are modified herein.
*
*   Check -- nay need to acquire(control_variables).
*
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
;
PROCEDURE  build;
   BEGIN & build &
      BYTE     dona_nask,
               old_driven_port,
               neu_driven_port,
               donain;
      INTEGER  channel,
               first_ch,
               last_ch,
               paraneter,
               these_parans;

      rebuild := FALSE;
      clear_acquisition_descriptor;

      IF trace_node = single_ch THEN
         first_ch := last_ch := current_entry_ch
      ELSE
         BEGIN & else &
            first_ch := 1;
            last_ch  := 2;
         END;  & else &

      FOR channel := first_ch UNTIL last_ch DO
         IF ch_integer(ch_d_state, channel) = d_on THEN
            BEGIN & if &
               IF ( (ch_integer(ch_correction_node, channel) =
                                                    correct_on) RND
                  (ch_integer(ch_correction_type, channel) = two_port)
               ) THEN
               BEGIN & if &
                  dp_rau_base[channel,s11] :=
                                    enter_paran(s11, channel);
                  dp_rau_base[channel,s21] :=
                                    enter_paran(s21, channel);
                  dp_rau_base[channel,s12] :=
                                    enter_paran(s12, channel);
                  dp_rau_base[channel,s22] :=
                                    enter_paran(s22, channel);
               END   & if &
               ELSE
                  dp_rau_base[channel,generic_paran] :=
                      enter_paran(ch_integer(ch_paran,channel),channel);

               donain := ch_integer(ch_domain, channel):
```

```
SCONTVRR.UORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE  9


            IF ( (donain = tdr_donain ) OR (donain = time_donain) OR
                 (ch_integer(ch_gating, channel) = gate_on)       OR
                 (sweep_node = single_pt)
               ) THEN
               array_processed := SBIT(array_processed, (channel-1));
         END;  & if &
                                                      & DEBUG &
      & sort either here or below &                   & DEBUG &

      & NOTE: one ch_finished_signal uill always renain as _bit_bucket.&
      set_ch_integer( rau_ready_bit_bucket, ch_finished_signal, 1 );
      set_ch_integer( rau_ready_bit_bucket, ch_finished_signal, 2 );
      IF last_acquisition_paran > 0 THEN
         BEGIN & if &
            paraneter := last_acquisition_paran;
            done_nask := all_chs RND (NOT array_processed );
                                 & all point processed channels &
            UNILE ( (done_nask <> 0) RND
                    (paraneter >= first_acquisition_paran)
                  ) DO
               BEGIN & while &
                  these_parans := ch[paraneter] RND done_nask;
                  IF these_parans <> 0 THEN
                     BEGIN & if &
                        IF these_parans = 1 THEN
                           rau_ready[paraneter] := ch1_rau_ready
                        ELSE IF these_parans = 2 THEN
                           rau_reedy[paraneter] := ch2_rau_ready
                        ELSE & both 1 and 2 &
                           BEGIN & else &
                              rau_ready[paraneter] := ch1_rau_ready;
                              set_ch_integer( ch2_rau_ready,
                                              ch_finished_signal,
                                              1
                                            );
                              & NOTE: ch1's ch_finished_signal uill    &
                              &       always renain ..._bit_bucket.    &
                           END;  & else &
                        done_nask := done_nask - these_parans;
                     END;  & if &
                  paraneter := paraneter - 1;
               END;  & while &
         END;  & if &
                                                      & DEBUG &
      & sort either here or above &                   & DEBUG &

      last_paran_set := first_paran_set;
      old_driven_port := parameter_descriptor[
                                    paran[ first_acquisition_paran ],
                                    driven_port
                                                    ];
      IF ( (last_acquisition_paran > 1) RND
         (slow_test_set)    & until it handles sets better & & DEBUG &
         ) THEN
         FOR paraneter := first_acquisition_paran + 1 UNTIL
               last_acquisition_paran DO
```

```
$CONTVAR.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE 10

          BEGIN & for &
             neu_driven_port := paraneter_descriptor[
                                          paran[ paraneter ),
                                          driven_port
                                          ];
             IF neu_driven_port <> old_driven_port THEN
                BEGIN & if &
                   last_paran_of_set[last_param_set] := paraneter - 1;
                   last_paran_set := last_paran_set + 1;
                   old_driven_port := neu_driven_port;
                END;  & if &
          END;  & for &
       last_paran_of_set[last_paran_set] := last_acquisition_paran;

       build_test_set;

       acquire( processing_variables );
       control_data_proc( 1 );
       control_data_proc( 2 );
       release( processing_variables );

    END;  & build &
```

```
$CONTVAR.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE 11

REJECT;
COMMENT                                                partial_neu_step_size
*************************************************************************
*
*************************************************************************
;
PROCEDURE  partial_neu_step_size( neu_size );
   VALUE   neu_size;
   INTEGER neu_size;                                                ENTRY;
   BEGIN & partial_neu_step_size &
      INTEGER           chnl,
                        points;
      DOUBLE            array;
      REAL              min_sweep_time;
      INTEGER CONSTANT  string_size := 24;
      BYTE ARRAY        temp_array[-1:string_size];
      ALPHA             temp_string;

      & initialize string &
      temp_string := ADR3(temp_array);
      temp_string := init_string( temp_string, string_size );

      step_size := neu_size;
      points := number_of_points;
      rebuild := TRUE;
      hilight_key( cmd[step_size], cmd_91_points, cmd_401_points);

      min_sweep_time := 0.000200 * REAL(points-1);
      urt_priv_ib_source(
                  tl,
                  append_ch[  format_real(   min_sweep_time,
                                             temp_string,
                                             format_table[
                                                   sweep_time_format
                                                   ]
                                             RND %FFFFFF0F
                                          ),
                              newline
                           )
                  );          & mask to set no format scale factor &

      set_xadc_step_size( step_size );

      & RELEASE ALL ARRAYS &
      FOR chnl := 1 TO max_ch DO
         BEGIN & for &
            array := ch_double( ch_d_base, chnl );
            release_array( array );
            set_ch_double( 0, ch_d_base, chnl );

            array := ch_double( ch_f_base, chnl );
            release_array( array );
            set_ch_double( 0, ch_f_base, chnl );

            array := ch_double( ch_n_base, chnl );
            release_array( array );
```

```
$CONTVAR.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE 12

            set_ch_double( 0, ch_n_base, chnl );

            release_mem:
         END;  & for &

      FOR chnl := 1 TO max_ch DO
         BEGIN & for &
            IF ( array := request_array(block_size) ) <> 0 THEN
               BEGIN & if &
                  set_ch_double( array, ch_d_base, chnl );
                  user3_zero( array, points );
               END;  & if &

            IF array <> 0 THEN
               IF ( array := request_array(block_size) ) <> 0 THEN
                  BEGIN & if &
                     set_ch_double( array, ch_f_base, chnl );
                     user3_zero( array, points );
                  END;  & if &

            IF array = 0 THEN
               fatal( exceeded_available_memory );
         END;  & for &

      reqaint_traces;    & reallocates memory array and updates traces &

      IF sweep_mode = stepped THEN
         update_stimulus_step_size;

   END;  & partial_neu_step_size &
```

```
$CONTVAR.WORK.PD8510          THU, DEC 22, 1983, 10:30 AM    PAGE 13

REJECT;
COMMENT                                                    neu_step_size
*************************************************************************
*
*************************************************************************
;
PROCEDURE  neu_step_size( neu_size );
   VALUE   neu_size;
   INTEGER neu_size;                                                ENTRY;
   BEGIN & neu_step_size &

      abort_sweep;
      partial_neu_step_size( neu_size );
      trace_and_graticule;
      restart_sweep;

   END;  & neu_step_size &
```

```
SCONTVAR.UORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE 14


%EJECT;
COMMENT                                                    set_up_paran
*************************************************************************
*
*************************************************************************
;
BOOLEAN PROCEDURE set_up_paran( new_acquisition_paran, lock_type );
   VALUE   new_acquisition_paran, lock_type;
   INTEGER new_acquisition_paran, lock_type;                      ENTRY;
   BEGIN & set_up_paran &
      INTEGER parameter,
              average_factor,
              average_mode;
      BOOLEAN do_lock,
              success;
      LABEL   exit;

      current_acquisition_paran := new_acquisition_paran;
      IF ( ch[current_acquisition_paran] AND %0001 ) = 0 THEN
         select_acquisition_ch( 2 )
      ELSE
         select_acquisition_ch( 1 );

      & change any required parameter-related factors here &

      success := set_test_set( current_acquisition_paran, do_lock );
      IF NOT success THEN
         GO TO exit;

      IF acquisition_ch_integer(ch_average_mode) = avg_off THEN
         average_mode := avg_off
      ELSE & averaging on &
         BEGIN & else &
            average_factor := acquisition_ch_integer(ch_average_factor);
            IF sweep_mode = swept THEN
               BEGIN & else if &
                  average_mode := avg_sweep_to_sweep;
                  IF group_number < average_factor THEN
                     average_factor := group_number;
               END   & else if &
            ELSE & sweep_mode = stepped &
               average_mode := avg_point_to_point;
         END;  & else &

      control_yadc(
                     BORS( raw_put[current_acquisition_paran) ),
                     average_mode,
                     average_factor,
                     RORS( counter(
                              raw_ready[current_acquisition_paran]
                                 ]
                        ),
                     SBIT(0,link[
                              raw_ready[current_acquisition_paran]
                                 ]
                        )
```

```
SCONTVAR.UORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE 15


                  );

      paraneter := paran( current_acquisition_paran );
      control_receiver( paraneter_descriptor[ paraneter AND %003F,
                                              numerator_port
                                             ],
                        paraneter_descriptor[ paraneter AND %003F,
                                              denominator_port
                                             ],
                        paraneter_descriptor[ paraneter AND %003F,
                                              phase_lock_port
                                             ],
                        if_test_gain,
                        if_ref_gain
                       );

      IF ( (NOT forced_step) AND
           ( (lock_type = force_lock) OR
             ( (lock_type = normal_lock) AND do_lock )
           )
         ) THEN
         phase_lock;

exit: set_up_paran := success;

   END; & set_up_paran &
```

```
SCONTVAR.UORK.PD8510          THU, DEC 22, 1983, 10:30 AM     PAGE 16


%EJECT;
COMMENT                                                    set_dp_ptrs
*************************************************************************
*
*  Sets up the pointers for data processing (datap).
*  Parameters:
*     chnl  -- the channel being updated.  Determines the processing
*              variables to be used (e.g. scale/division, etc.).
*              "chnl" is 1, or 2.
*     table -- the dp pointer table to use.  For point-wise data
*              processing, table = chnl. For array processing and
*              updates, table = 0.
*              "table" is 0, 1, or 2.
*     ch_trace -- the channel table index for the trace to be displayed.
*              "ch_trace" is ch_trace_base, or ch_n_trace_base.
*
*************************************************************************
;
PROCEDURE set_dp_ptrs( chnl, table, ch_trace );
   VALUE   chnl, table, ch_trace;
   INTEGER chnl, table, ch_trace;                                 ENTRY;
   BEGIN & set_dp_ptrs &
      DOUBLE POINTER dp_double;

      STPNTR(dp_double, ch_dp_ptrs[table]);

      dp_double[dp_raw11_get]   := dp_raw_base[chnl, t11];
      dp_double[dp_raw21_get]   := dp_raw_base[chnl, s21];
      dp_double[dp_raw12_get]   := dp_raw_base[chnl, t12];
      dp_double[dp_raw22_get]   := dp_raw_base[chnl, s22];

      dp_double[dp_correct_ptr] := ch_double[ch_e_coeff_base, chnl];
      dp_double[dp_d_ptr]       := ch_double[ch_d_base, chnl];
      dp_double[dp_n_ptr]       := ch_double[ch_n_base, chnl];
      dp_double[dp_trace_ptr]   := ch_double[ch_trace,  chnl];

      IF ( (ch_trace = ch_n_trace_base) AND
           (ch_integer[ch_d_state, chnl) = d_on)
         ) THEN
         dp_double[dp_f_ptr] := dp_f_bit_bucket  & n cannot wipe out d &
      ELSE
         dp_double[dp_f_ptr] := ch_double[ch_f_base, chnl];

   END;  & set_dp_ptrs &
```

```
SCONTVAR.UORK.PD8510          THU, DEC 22, 1983, 10:31 AM     PAGE 17


%EJECT;
COMMENT                                            init_group_control_vars
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR init_group_control_vars
*
* FUNCTION
*    To initialize the variables at the beginning of each group.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
*************************************************************************
*
* LOGIC INFORMATION FOR init_group_control_vars
*
* INITIAL REFINEMENT:
*
*************************************************************************
;
PROCEDURE  init_group_control_vars;                               ENTRY;
   BEGIN & init_group_control_vars &
      INTEGER i,
              last;

      annotate_enhancements;

      IF rebuild THEN
         build;

      set_dp_ptrs( 1, 1, ch_trace_base );
      set_dp_ptrs( 2, 2, ch_trace_base );

      IF last_acquisition_paran >= first_acquisition_paran THEN
         FOR i := first_acquisition_paran TO last_acquisition_paran DO
            raw_put[i] := raw_base[i];        & reset raw_put pointers &

COMMENT  These signal_init steps are only required the first time a
         measurement begins after power on, recall, preset, or an
         aborted sweep.  Normally, the data processing is simply waiting
         for the next point and only the data pointers need to be reset.
         ;
      signal_init(ch1_raw_ready,-1);
      link[ ch1_raw_ready ] := ch1_id;
      signal_init(ch2_raw_ready,-1);
      link[ ch2_raw_ready ] := ch2_id;
      signal_init(raw_ready_bit_bucket,-1);
      link[ raw_ready_bit_bucket ] := idle_process;          & a dunny &
```

```
SCONTVRR.UORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 18

COMMENT
      reset signals to go with the d, f, n, trace, and rau arrays.
;
      reset_data_proc;      & tell data proc. that a group is starting &

   END;  & init_group_control_vars &
```

```
SCONTVRR.UORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 19

#EJECT;
COMMENT                                                  init_control_variables
*
*
;
PROCEDURE  init_control_variables;                                    ENTRY;
   BEGIN & init_control_variables &
      INTEGER parameter;

      resource_init(processing_variables);
      resource_init(control_variables);

      reset_acquisition_descriptor;

   END;  & init_control_variables &


END$
                                                                & DEBUG &
                                                                & DEBUG &
                                                                & DEBUG &
```

```
SCONTVRR.UORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 20

#EJECT;                                                         & DEBUG &
PROCEDURE dump_acquisition_descriptor;                          & DEBUG &
   BEGIN & dump_acquisition_descriptor &                        & DEBUG &
      INTEGER i;                                                & DEBUG &
         CRLF; USTR("acquisition descriptor: "); CRLF;          & DEBUG &
         USTR("   last_param_of_set[]"); CRLF;                  & DEBUG &
         USTR("      last_param_set:"); UHex(last_param_set,2);& DEBUG &
         CRLF;                                                  & DEBUG &
         FOR i := 0 UNTIL last_param_set DO                     & DEBUG &
            BEGIN & for &                                       & DEBUG &
               USTR("         ");                              & DEBUG &
               UHex(i,2);                                       & DEBUG &
               USTR("   ");                                    & DEBUG &
               UHex(last_param_of_set[i],2);                    & DEBUG &
               CRLF;                                            & DEBUG &
            END;  & for &                                       & DEBUG &
         USTR("   acquisition_param_descriptor: ");            & DEBUG &
         USTR("(param, ch, rau, signal)"); CRLF;                & DEBUG &
         USTR("      last_acquisition_param:");                 & DEBUG &
         UHex(last_acquisition_param,2); CRLF;                  & DEBUG &
         IF last_acquisition_param <> 0 THEN                    & DEBUG &
            FOR i := 1 UNTIL last_acquisition_param DO          & DEBUG &
               BEGIN & for &                                    & DEBUG &
                  USTR("         ");                           & DEBUG &
                  UHex(i,2);                                    & DEBUG &
                  USTR("   ");                                 & DEBUG &
                  UHex(param[i],2);                             & DEBUG &
                  UHex(ch[i],2);                                & DEBUG &
                  UHex(rau_base[i],8);                          & DEBUG &
                  UHex(rau_ready[i],2);                         & DEBUG &
                  CRLF;                                         & DEBUG &
               END;  & for &                                    & DEBUG &
         USTR("      ch1 finished signal = ");                  & DEBUG &
         UHex(ch_integer(ch_finished_signal,1),2); CRLF;        & DEBUG &
         USTR("      ch2 finished signal = ");                  & DEBUG &
         UHex(ch_integer(ch_finished_signal,2),2); CRLF;        & DEBUG &
   END;  & dump_acquisition_descriptor &                        & DEBUG &
```

```
RCORRECT.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  1

 ASAB,R.1
   MED error correction routines
   NAM correct,7,"JTB      PD8510"
 UNL
*
 ENT one_port_correct,two_port_correct
 ENT s_coeff
*
 EXT RDDE_ptr,SUBE_ptr,MPYE_ptr,DIVE_ptr
 EXT RDDE,SDBE,MPYE,DIVE,DVRE
*
*
R0  REG 0
R1  REG 1
R2  REG 2
R3  REG 3
R4  REG 4
R5  REG 5
R6  REG 6
R7  REG 7
R8  REG 8
R9  REG 9
R10 REG 10
R11 REG 11
R12 REG 12
R13 REG 13
G   REG 13
M   REG 14
S   REG 15
*
 RRM det(S)
 RRM coeff(64)   b11 a11 b21 a21 b22 a22 b12 a12
*                 0   8   10  18  20  28  30  38   HEX byte offset
 ORB
*                take off base page ???
det_coeff HEX 0008,0028,0018,0038          a11*a22 - a21*a12
s11_coeff HEX 0000,0028,0018,0030          b11*a22 - a21*b12
s21_coeff HEX 0010,0028,0018,0020          b21*a22 - a21*b22
s12_coeff HEX 0008,0030,0000,0038          a11*b12 - b11*a12
s22_coeff HEX 0008,0020,0010,0038          a11*b22 - b21*a21
s_coeff EQU det_coeff
*
cpx_1 HEX 0000,4000    imag part = 0  real part = 1/2
      HEX 0000,0001    exp part = 1
 ENT cpx_1
 ORR
```

```
RCORRECT.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  2


*EJECT
*************************************************************************
* one_port correction  assumes R5 constains a ptr to the first error
*          coeff and R10 has the offset needed to get each of the others
*          R0/R1 has the measured value and this will exit with the
*          corrected value in R0/R1
*
*                              ( meas - directivity )
*   e11 actual   =  ----------------------------------------------
*                    tracking  +  source match * ( meas - directivity )
*************************************************************************
one_port_correct EQU *
 JSR     SUBE_ptr         directivity
 MOVE.L  R0,   R5
 MOVE.W  R1,   R6         save a copy of measured-directivity for later
*
 ADD.B   R10,  R8
 JSR     MPYE_ptr         source match
*
 ADD.W   R10,  R8
 JSR     BDDE_ptr         tracking
*
*
 MOVE.L  R5,   R2
 MOVE.L  R6,   R3
*
 JMP     DVRE
*RTS     rte is implied in DVRE
*
```

```
RCORRECT.WORK.RO8510          THU, DEC 22, 1983, 10:31 AM    PAGE  3


*EJECT
*************************************************************************
*two_port_correct                        run time 1 mS/pt
*                              5 cpx div,8 cpx mult,6 cmp sub,2 real add
* R0/R1 = S11,   R2/R3 = S21,   R4/R5 = S12,   R6/R7 = S22
* R8 has ptr to error terms,  R10 has offset between error terms
* R11/R12 have data that must be saved
* R8/R9 is used by math routines  (data in R0/R3)
* R12 will used as ptr to processed error terms
* R13 contains the index describing the S parameter to output
* and R0/R1 on exit has result
* Order (structure) of error coeffs is VERY important  ( see seal )
*  e    e    e    e    e    e    e    e    e    e    e    e    e
*  DF   SF   RF   KF   LF   IF   DR   SR   RR   XR   LR   IR
*************************************************************************
* MOVEM of a's / b's and the cpx_1  would be faster with MOVE.L/MOVE.W
*************************************************************************
two_port_correct EQU *
 MOVEM.L  R2/R3/R11/R12,-(SP)          save for later
 LEA      coeff, R12
*
 BSR      comp_coeff                   b11
 MOVEM.L  cpx_1 ,R2/R3
 JSR      MDDE
 MOVE.L   R0,(R12)+                    a11
 MOVE.L   R1,(R12)+
*
 MOVEM.L  (S)+,R0/R1
 BSR      comp_coeff                   b21
 MOVE.L   R0,(R12)+                    a21
 MOVE.L   R1,(R12)+
*
 MOVE.L   R6,  R0
 MOVE.W   R7,  R1
 BSR      comp_coeff                   b22
 MOVEM.L  cpx_1 ,R2/R3
 JSR      MDDE
 MOVE.L   R0,(R12)+                    a22
 MOVE.L   R1,(R12)+
*
 MOVE.L   R4,  R0
 MOVE.W   R5,  R1
 BSR      comp_coeff                   b12
 MOVE.L   R0,(R12)+                    a12
 MOVE.L   R1,(R12)+
*
 MOVEM.L  det_coeff,R6/R7
 BSR      use_coeff                    det
 MOVEM.L  R0/R1,det
 MOVEM.L  (R13),R8/R7                  R13 has addr of item in s_coeff
 BSR      use_coeff                     selected parameter
 MOVEM.L  det,R2/R3
 MOVEM.L  (S)+,R11/R12
 JMP      DIVE                          result
*RTS  is implied in DIVE
```

```
RCORRECT.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  4


*EJECT
*
*                  compute the interdependent terms ie a's and b's
*
*                              Measured   -  Leakage
*                    b term =  ------------------------
*                                      Tracking
*
*                    a term =  b term   *   Match
*                              NOTE: In a term 11,22 a +1 is added
comp_coeff EQU *
 AND.W   #$FF, R1
 JSR     SUBE_ptr
 ADD.W   R10 , R8
 MOVE.L  R5,   R11
 ADD.W   #6,   R8
 ADD.W   R10 , R8
 JSR     DIVE_ptr
 MOVE.L  R0,(R12)+                     save b term
 MOVE.L  R1,(R12)+
 ADD.W   R10 , R8
 MOVE.L  (R11)+,R2
 MOVE.W  (R11), R3
 JMP     MPYE                          compute a term
*RTS     rts is implied in mpye
*
*
*                  compute a product difference (u*x)-(y*z)
*                  where the terms are the a's and b's terms
*                  R6 and R7 hold indexes to which term to use
*                  R5  upper half is u index, R7 lower half is x index
*                  R7  upper half is y index, R7 lower half is z index
*                  R12 holds the pointer to first coeff
use_coeff EQU *
 LEA     coeff, R12
 MOVEM.L 0(R12,R7.W),R0/R1
 SWAP    R7
 MOVEM.L 0(R12,R7.W),R2/R3
 JSR     MPYE                          y*z term
 MOVE.L  R0,   R4                      save
 MOVE.W  R1,   R5
 MOVEM.L 0(R12,R6.W),R0/R1
 SWAP    R6
 MOVEM.L 0(R12,R6.W),R2/R3
 JSR     MPYE                          u*x term
 MOVE.L  R4,   R2                      restore y*z
 MOVE.W  R5,   R3
 JMP     SUBE                          result
*RTS     rts is implied in sube
*
*
 END
```

```
FCOUPLE.WORK.PD8510           THU, DEC 22, 1983, 10:31 AM    PAGE  1


#FILE ccpltbl.work;

PROCEDURE  set_coupled_status( status, index );
   VALUE   status, index;
   BOOLEAN status;
   INTEGER index;                                    EXTERNAL.L;
SUBROUTINE init_coupled_status;                      EXTERNAL.L;
```

```
SCOUPLE.UORK.PDS510          THU, DEC 22, 1983, 10:31 RM     PAGE  1


%GSKL,P,"couple"
BEGIN

#FILE fcpltbl.work;                                  & for tables &
#FILE fchtab3.work;                                & for eelect_coopled &
#FILE fbreak.work;                                  & for couplrd_break &
#FILE cchtable.work;            & for ch_... and chtable entry sizes &
```

```
SCOUPLE.UORK.PD8510          THU, DEC 22, 1983, 10:31 AM     PAGE  2


REJECT;
COMMENT                                                  set_coupled_status
*************************************************************************
*
*************************************************************************
;
PROCEDURE  set_coupled_status( status, index );
   VALUE   status, index;
   BOOLEAN status;
   INTEGER index;                                                  ENTRY;
   BEGIN & set_coupled_status &

      IF index = couple_source THEN
         coupled_break( status );

      UNILE coupled_chtable_oize[index] <> 0 DO
         BEGIN & while &
            sclcct_coupled( status,
                            coupled_chtable_index[index],
                            coupled_chtable_size[index]
                          );
            index := index + 1;
         END;  & while &

   END;  & set_coupled_status &
```

```
SCOUPLE.UORK.PD8510          THU, DEC 22, 1983, 10:31 RM     PAGE  3


REJECT;
COMMENT                                                  init_coupled_status
*************************************************************************
*
*************************************************************************
;
SUBROUTINE init_coupled_status;                                  ENTRY;
   BEGIN & init_coupled_status &
      set_coupled_status( FALSE, couple_init );
      set_coupled_status( TRUE,  couple_stinulus );
      ielect_coupled( TRUE, ch_gate_stop, qsz );
   END;  & init_coupled_status &

END!
```

```
CCPLTBL.UORK.PD8510          THU, DEC 22, 1983, 10:31 RM     PAGE  1


COMMENT starting indices into scouple's coupled_ch_table_index and
        coupled_chtable_size tables.
        ;
INTEGER CONSTRNT  couple_source   := 0,
                  couple_init     := 15,
                  couple_narkers  := 34,
                  couple_stinulus := 40;
```

```
FCPLTBL.WORK.PD8510          THU, DEC 22, 1983, 10:31 PM    PAGE  1


@FILE ccpltbl.work;

EXTERNAL INTEGER TABLE coupled_chtable_index.L;
EXTERNAL BYTE    TABLE coupled_chtable_size.L;
```

```
SCPLTBL.WORK.PD8510          THU, DEC 22, 1983, 10:31 PM    PAGE  1


M68KL,P,"cpltbl"
BEGIN

@FILE cchtable.work;            & for ch_... and chtable entry sizes &

GLOBAL INTEGER TABLE coupled_chtable_index :=   & 0 size = end of list &
&  0 &     ch_start_frequency,                          & couple_source &
&  1 &     ch_center_frequency,
&  2 &     ch_start_aux_out,
&  3 &     eh_center_aux_out,
&  4 &     ch_start_time,
&  5 &     eh_center_time,
&  6 &     ch_gate_start,
&  7 &     ch_gate_center,
&  8 &     ch_gate_stop,
&  9 &     ch_sweep_time,
& 10 &     sh_source_power,
& 11 &     ch_power_slope,
& 12 &     ch_power_slope_mods,
& 13 &     ch_e_coeff_base,
& 14 &     0,
& 15 &     ch_basis_s_param,                            & couple_init &
& 16 &     ch_refl_trans,
& 17 &     ch_param_conversion,
& 18 &     ch_format,
& 19 &     ch_scale,
& 20 &     ch_ref_value,
& 21 &     eh_ref_position,
& 22 &     ch_rau1_base,
& 23 &     ch_rau21_base,
& 24 &     ch_rau12_base,
& 25 &     ch_rau22_base,
& 25 &     ch_d_base,
& 27 &     ch_f_base,
& 28 &     ch_n_base,
& 29 &     ch_trace_base,
& 30 &     ch_n_trace_base,
& 31 &     ch_finished_signal,
& 32 &     ch_channel_no,
& 33 &     0,
& 34 &     ch_marker1,                                  & couple_markers &
& 35 &     ch_marker2,
& 35 &     ch_marker3,
& 37 &     eh_marker4,
& 38 &     ch_marker5,
& 39 &     0,
& 40 &     ch_e_coeff_base,                             & couple_stimulus &
& 41 &     eh_start_stimulus,
& 42 &     ch_stop_stimulus,
& 43 &     ch_center_stimulus,
& 43 &     ch_span_stimulus,
& 44 &     0;

GLOBAL BYTE TABLE coupled_chtable_size :=      & use 0 for end of list &
&  0 &     qsz,                                         & couple_source &
```

```
SCPLTBL.WORK.PD8510          THU, DEC 22, 1983, 10:31 PM    PAGE  2


&  1 &     qsz,
&  2 &     qsz,
&  3 &     qsz,
&  4 &     qsz,
&  5 &     qsz,
&  6 &     qsz,
&  7 &     qsz,
&  8 &     qsz,
&  9 &     rsz,
& 10 &     rsz,
& 11 &     rsz,
& 12 &     isz,
& 13 &     dsz,
& 14 &       0, & end marker &
& 15 &     isz, & couple_init &
& 16 &     isz,
& 17 &     isz,
& 18 &     isz,
& 19 &     rsz,
& 20 &     rsz,
& 21 &     rsz,
& 22 &     dsz,
& 23 &     dsz,
& 24 &     dsz,
& 25 &     dsz,
& 26 &     dsz,
& 27 &     dsz,
& 28 &     dsz,
& 29 &     dsz,
& 30 &     dsz,
& 31 &     isz,
& 32 &     itz,
& 32 &       0, & end marker &
& 34 &     qsz, & couple_markers &
& 35 &     qsz,
& 36 &     qsz,
& 37 &     qsz,
& 38 &     qsz,
& 39 &       0, & end marker &
& 40 &     dsz, & couple_stimulus &
& 41 &     qsz,
& 42 &     qsz,
& 43 &     qsz,
& 44 &     qsz,
& 45 &     0;   & end marker &

END$
```

```
RCPX.WORK.PP8510             THU, DEC 22, 1983, 10:31 PM    PAGE  1


RSMB,R
      MED COMPLEX FOR M68000
      NAM CPX,7,"MOD JIB 12/22/82"
      ENT RDD1,RDD1A,RDD1M,RDD1T
      ENT SUB1,SUM1A,SUB1M,SUB1T
      ENT SBR1,SBR1A,SBR1M,SBR1T
      ENT MPY1,MPY1R,MPY1M,MPY1T
      ENT DIV1,DIV1R,DIV1M,DIV1T
      ENT DVR1,DVR1R,DVR1M,DVR1T
      ENT MEG1,RMEG1
      ENT RDD1G,SUB1C,SBR1G,MPY1G
      ENT DIV1G,DVR1G
      ENT BPYE,RODE,SUBE,SBRE,DIVE,DVRE
      ENT MPYE_ptr,RODE_ptr,SUBE_ptr,SBRE_ptr,DIVE_ptr,DVRE_ptr
      ENT MPYE_ptrs
      ENT CNV1E,CNVE1,CNVe1,CNVE20_1
      ENT CNV1E_save,fetch_CNVE1
      ENT CKV2E
      ENT copy_user3
      ENT exp_overflow
*
*
      EXT ADDCP,SUBCP,MCPMP,MCPDIV
      EXT LDRRR,LDRRG,LDRRM,LDRRT,XEG2,RMEG2
      EXT ROD2,SUB2,SBR2,MPY2,DVR2
*
R0 REG 0
R1 REG 1
R2 REG 2
R3 REG 3
R4 REG 4
R8 REG 8              R5,R6,R7  are assumed to be unused
R9 REG 9
G  REG 13
R10 REG 10
M REG 14
S REG 15
```

```
RCPX.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  2


*EJECT
*
*  The TYPE 1 routines are 24 bit real and imag mantissas and
*    seperate 8 bit exponents
*
NEG1  JSR    NEG2    NEGATE REAL
      JSR    RNEG2   NEGATE IMAGINARY
      RTS
*
RNEG1 EXG    R0,R2
      JSR    NEG2
      EXG    R0,R2
      EXG    R0,R3
      JSR    NEG2
      EXG    R0,R3
      RTS
```

```
RCPX.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  3


*EJECT
*
R001A JSR    LDRAR
      BRA    ADD1
ADD1G JSR    LDRAG
      BRA    ADD1
RDD1M JSR    LDRRM
      BRA    RDD1
ADD1T JSR    LDRRT
ADD1  EXG    R0,R3
      JSR    ADD2
      EXG    R0,R2
      BOVE.L R3,R1
      JSR    ADD2
      MOVE.L R2,R1
      RTS
*
SUB1R JSR    LDRAR
      BRA    SUB1
SUB1G JSR    LDRAG
      BRA    SUB1
SDB1M JSR    LDRRM
      BRA    SUB1
SUB1T JSR    LDRBT
      BRA    SUB1
SBR1A JSR    LDRAR
      BRA    SBR1
SBR1G JSR    LDRAG
      BRA    SBR1
SBR1M JSR    LDRRM
      BRA    SBR1
SBR1T JSR    LDRRT
      BRA    SBR1
SBR1  EXG    R0,R2
      EXG    R1,R3
SUB1  EXG    R0,R3
      JSR    SBR2
      EXG    R0,R3
      BOVE.L R2,R1
      JSR    SUB2
      MOVE.L R3,R1
      RTS
```

```
RCPX.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  4


*EJECT
*
MPY1A JSR    LDRAR
      BRA    MPY1
MPY1G JSR    LDRAG
      BRA    MPY1
MPY1M JSR    LDRRM
      BRA    BPY1
BPY1T JSR    LDRRT
MPY1  BOVEM.L R0-R1/R4,-(S)  SAVE REGISTERS
      MOVE.L R2,P0
      JSR    MPY2    B*C
      MOVE.L R0,R4
      MOVE.L R3,R0
      MOVE.L (S),R1
      JSR    MPY2    A*D
      MOVE.L R4,R1
      JSR    ADD2    AD+BC
      MOVE.L R0,R4
      MOVE.L R2,RD
      BOVE.L (S)+,R1
      JSR    BPY2    A*C
      EXG    R0,R3
      MOVE.L (S)+,R1
      JSR    MPY2    B*D
      MOVE.L R3,R1
      JSR    SBR2    AC-BD
      MOVE.L R4,R1   RETRIEVE IMAGINARY PART
      MCVE.L (S)+,R4 RESTORE R4
      RTS
*
exp_overflow EQU *
EXPOVF BPL   EXPOVF1
      MOVE.B =H7F, R1
      RTS
EXPOVF1 MOVE.B =H80, R1
      RTS
```

```
RCPX.WORK.PD8510          THU, DEC 22, 1583, 10:31 AM    PAGE  5


*EJECT
*
DIV1A JSR    LDRRA
      BRA    DIV1
DIV1G JSR    LDRRG
      BRA    DIV1
DIV1M JSR    LDRRM
      BRA    DIV1
DIV1T JSR    LDRRT
      BRA    DIV1
DVR1R JSR    LDRRA
      BRA    DVR1
DVR1G JSR    LDRRG
      BRA    DVR1
DVR1M JSR    LDRRM
      BRA    DVR1
DVR1T JSR    LDRRT
DVR1  EXG    R0,R2
      EXG    R1,R3
*
*     A+jB/C+jD = (A+jB)(C-jD)/(C*C+D*D)
*
DIV1  MOVEM.L R0-R4,-(S)
      MOVE.L R2,R0
      MOVE.L R2,R1
      JSR    MPY2
      EXG    R0,R3
      MOVE.L R0,R1
      JSR    MPY2   D*D
      MOVE.L R3,R1
      JSR    ADD2   C*C+D*D
      BOVE.L R0,R4
      MOVEM.L (S)+,R0-R3
      EXG    R0,R3
      JSR    NEG2
      EXG    R0,R3
      BSR    MPY1
      MOVE.L R0,R2
      MOVE.L R4,R0
      JSR    DVR2
      EXG    R0,R4
      BOVE.L R2,R1
      JSR    DVR2
      MOVE.L R4,R1
      MOVE.L (S)+,R4   RESTORE R4
      RTS
```

```
MCPX.WORK.PDB510          THU, DEC 22, 1983, 10:31 AM    PAGE   6

*EJECT
* Convert a real to USER3 with rounding
*PROCEDURE CMV2E1 r ) ;   VALUE r;      REAL r;
*BEGIN
* DOUBLE d_r = s, d = REGISTER 1;;
*   d := d_r * X08000;
*   IF OVERFLOW THEN
*     d:=((d<1) AND X7F) OR (IF  d<0  THEN  R40000000  ELSE XC0000000 );
*   ASSEMBLE( MOVE.L d, R0;   MOVE.W   R0, R1;   CLR.W  R0;  SWAP   R0 )
*END CMV2E;
CMV2E EQU *
  ADD.L   #00008000,R0
  BVC     R3
  MOVE.B  R0, R1
  ROR.B   R1, R1
  TST.L   R0
  BGE     R4
  BOVE.L  #40000000,R0
  BRR     R5
R4 BOVE.L #C0000000,R0
R5 OR.B   R1, R0
R3 MOVE.W R0, R1
  CLR.W   R0
  SWAP    R0
  RTS
```

```
MCPX.WORK.PDB510          THU, DEC 22, 19R3, 10:31 AM    PAGE   7

*EJECT
*
CMV1E_save EQU *
      BSR CMV1E
      SWAP R0
      MOVE.W  R0, (R8)+
      SWAP R0
      MOVE.W  R0, (R8)+
      AND.W  #00FF,R1
      BOVE.W  R1, (R8)+
      RTS
*
* converts 4 word 24 bit complex to 3-word 16 bit complex ( USER3 )
* rounding is done                          ( exp lower half R1 )
* during rounding exp overflows may occur and use not corrected
CMV1E EQU *
FIXUP TST.L R0
      BNE FU1                    zero check real part
      MOVE #NC0, R0
Fin   TST.L R1
      BNE FU2                    zero check imag part
      MOVE #NC0, R1
FU2   CMP.B R0,R1                kroneh if exps are equal
      R4VE R4,-(S)               disk adjust the smaller part
      MOVE.B R1, R4
      SUB.B  R0, R4              exp difference is in R4
      BVC FUP2
      BPL FUP3
      R4VE.B #X7F, R4            positivc exp difference overflow
      BRR FUP2
FUP3  MOVE.B #X80, R4            negative exp difference overflow
FUP2  BPL FUP4
      CMP.B R-16, R4             Imag exp is smaller
      BGE FUP5                   more than 16 bits ??
      CLR.L R1                   yes  -- imag part is zero
      BRR FUP8
FUP5  NEG.B R4                   no   -- shift imag part
      RSR.L R4, R1
      BRR FUP8
FUP4  CBP.B #16, R4              Real exp is smaller
      BLE FUP7                   more than 1E bits ??
      CLR.L R0                   yes  -- real part is zero
      BRR FUP71
FUP7  RSR.L R4, R0               no  -- shift real part
FUP71 MOVE.B R1, R0              more exp into R0
FUP8  BOVE (S)+, R4
FUP1  ADD.L #X08000,R0           Real/Imag normalized -- Round each
      BVC FUV1                   start on real part
      RND #X0FF,R0               rounding caused overflow
      ROD.L #XC0000001,R0        set real part = 1/2
      RSR.L R1, R1               fix exp
FUV1  BDD.1 #X08000,R1           Round imag
      BVC FUV2
      BOVE.L #40000000,R1        rounding caused overflow
      R4D #1, R0                 set imag part = 1/2
```

```
MCPX.WORK.PDB510          THU, OEC 22, 1983, 10:31 RM    PRGE   8

      ROD R0, R0                 fix exp
      RSR.L R1, R0
FUV2  SWAP R0                    Rearrange into proper order
      MOVE R0, R1
      EXG R0, R1
      SWAP R1
      RTS
```

```
MCPX.WORK.PDB510          THU, DEC 22, 1983, 10:31 RM    PRGE   9

*EJECT
*
fetch_CMVE1 EQU *
      MOVEM.L (RS), R0-R1
CMVE1 EQU *                      exp is upper half of R1/conplier format
      SWRP   R1
CMVe1 EQU *                      exp is in lower word of R1
      CLR R2
      OOVE.B R1,R2
      MOVE.L R0, R1
      SWAP   D0
      BOVE.W R2, R0
      MOVE.W R2, R1
      RTS
*
CMVE20_1 EOU *
      SWAP   R1
      BOVE.W R1,R2
      BOVE.L R0,R1
      SWAP   R0
      BOVE.U R2,R1
      RND.U  #NFOFF,R1
      RSL.U  #4,R2
      BOVE.W R2,R0
      BOVE.B R1,R0
      RND.W  #NFOFF,R0
      R1S
***
```

```
RCPX.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 10

*EJECT
*
* copy user3 arrays to new part of memory
*  PROCEDURE copy_user3( from_addr,  to_addr,  size  );
*                        VALUE from_addr, to_addr,  size;
*                        DOUBLE from_addr, to_addr;  INTEGER size;
*
*  note size is the number of point steps to move.
*  note R0,R1,R2,R8,R9 are used and not restored
copy_user3 EQU *
      LINK  B, #-4
      MOVE.L  8(B),   R8
      MOVE.L  8(B), R9
      MOVE.L  12(B),R2
      BRA     cu2
*
cu1   EQU *
      MOVEM.L  (RS), R0-R1    accquire data in a non_interruptable way
      SWAP     R0
      MOVE.W   R0,   (R9)+
      SWAP     R0
      MOVE.W   R0,   (R9)+
      ADD.W    #6,   R8              inc R8 By user 3 size
      SWAP     R1
      MOVE.W   R1,   (R9)+
cu2   DBRA     R2,   cu1
*
      UNLK     A
      MOVE.L  (S)+,   R8
      ADDQ.L  #06,    S
      JMP     (R8)
***
```

```
RCPX.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 11

*EJECT
*
*
* This series of math routines for the three word (16 bit) complex type
*  assume a pointer to the second operator is in R8 if a _ptr entry
*  or in R2 and exp in R3.M and the first operator is
*  in R0 and exp in R1.M. These routines will destory R0/R3 and R9.
*
* entry point pts assume the R8 is ptr to first operataand and
*   R10 is ptr to second
*
MPYE_pts MOVE #LMCPMP,R9
 MOVE.L    (R8)+, (R9)+      LDM1,LDM3; LDM0,LDM2;
 MOVE.L    (R10)+, (R9)+     LDM1; LDM3, OURL, SUMPR, DO UMPYFP;
 MOVE.W    (R8)+, R0
 MOVE.W    (R10)+, R1
 ADD.B     #0, R1
 BVC       M9A01
 BRA       M9A03
*
MPYE MOVE #LMCPMP, R9
 MOVE.L    R2   , (R9)+      LDM1,LDM3; LDM0,LDM2;
 MOVE.L    R0, (R9)+         LDM1; LDM3, OURL, SUMPR, GO UMPYFP;
 ADD.B     R3, R1
 BVC       M9A01
 BRA       B9A03
*
MPYE_ptr MOVE #LMCPMP, R9
 MOVE.L    (R8)+, (R9)+      LDM1,LDM3; LDM0,LDM2;
 MOVE.L    R0, (R9)+         LDM1; LDM3, OURL, SUMPR, GO UMPYFP;
 MOVE.W    (R8)+, R0
 ADD.B     R0, R1
 BVC       M9A01
B9A03 BSR EXPOVF
M9A01 ADDQ #1, R9
 ADD.B     (R9)+, R1          RDEXP
 BVC       B9A02
 BSR       EXPOVF
M9A02 MOVE.L (R9),  R0          RDA0;RDA2
 RTS
```

```
RCPX.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 12

*EJECT
*
ADDE MOVE #LPDDCP, R9
A9A04 MOVE.L R0, (R9)+
 MOVE.L     R2  , (R9)+
 MOVE.W     R3  , R2
A9A05 SUB.B R1, R2
 BVC        A9A1
 BRR        R9A03
*
PDDE_ptr MOVE #LBDDCP, R9
A9A01 MOVE.L R0, (R9)+
 MOVE.L    (R8)+, (R9)+
 MOVE.W    (R8)+, R2
B9A02 SUB.B R1, R2
 BVC       R9A1
R9A03  MPL A9A2
 ADD.B     R2, R1
 MOVE.W    #H7F, R2
 SUB.M     R2, R1
 BRR       A9A1
R9A2 MOVEO #H80, R2
R9A1 MOVE R2, (R9)+
 TSI.B     R2
 BMI       B9A3
 ROD.B     R2, R1
R9A3 MOVE.L (R9)+, R0
 MOVE.W    (R9)+, R2
 ADD.B     R2, R1
 BVS       EXPOVF
 RTS
```

```
RCPX.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 13

*EJECT
*
*    (RS)-R0
SBRE MOVE #LSUBCP, R9
 BRA       A9A04
*
SBRE_ptr MOVE #LSUBCP, R9
 BRA       R9A01
*
*                R0-(R8)
SUBE MOVE  #LSUBCP, R9
 MOVE.L    R2   , (R9)+
 MOVE.L    R0, (R3)+
 MOVE.W    R1, R2
 MOVE.W    R3   , R1
 BRA       R9A05
*
SUBE_ptr MOVE  #LSUBCP, R9
 MOVE.L    (R8)+, (R9)+
 MOVE.L    R0, (R9)+
 MOVE.W    R1, R2
 MOVE.W    (R8)+, R1
 BRA       R9A02
*
*             (R8)/R0
DVRE MOVE #LMCPDIV, R9
 MOVE.L     R0, (R9)+
 EXG        R1, R3
 BRA        D9A01
*
DVRE_ptr MOVE #LMCPDIV, R9
 MOVE.L     R0, (R9)+
 MOVE.L     (R8)+, R2
 MOVE.W     R1, R3
 MOVE.W     (R8)+, R1
D9A01 SUB.B R3, R1
 ADD.B      #1, R1
 MOVE.L     R0, (R9)+
 MOVE.W    (R9)+, R0
 SUB       (R9)+, R1
 MOVE.L    #H20000000, R3
 MOVE.U    R0, R3
 BNE       D9A10
 MOVE.W   #H4000, R0
D9A10 ASR #1, R3
 MOVE.L   R2, (R9)+
 DIVS      R0, R3
 BVC       D9A20
 MOVE.W   #H4000, R3
 ADD.B     #1, R1
D9A20 MOVE R3, (R9)+
 MOVE.L   (R9)+, R0
 ADD      (R9)+, R1
 RTS
*
*             R0/(R8)
```

```
RCPX.UORK.PD8510              THU, DEC 22, 1983, 10:31 AM    PAGE  14


DIVE MOVE =LNCPDIV, R9
 EXG     R0,   R2
 MOVE.L  R0, (R9)+
 BRA     D9A01
DIVE_ptr MOVE =LNCPDIV, R9
 MOVE.L  R0, R2
 MOVE.L  (R8)+, R0
 MOVE.U  (R8)+, R3
 MOVE.L  R0, (R9)+
 BRR     D9A01
*
*
     END


     IF ever needed

R831  MOVE.L R1,-(S)  SAVE IMAGINARY
      MOVE.L R0,R1
      JSRX   MPY2
      MOVE.L (S),R1   GET IMAGINARY
      MOVE.L R0,(S)
      MOVE.L R1,R0
      JSRX   RPY2
      JSRX   RDD2T
      CLR.L  R1
      JAPX   SORT
RRRSI EXG    R0,R2
      EXG    R1,R3
      BSR    RBS1
      EXG    R0,R2
      EXG    R1,R3
      RTS
```

```
FDAIANGR.UORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  1


PROCEDURE gen_save_menu(fn);
   VALUE fn;  INTEGER fn;                                    EXTERNAL.L;
PROCEDURE gen_cal_info (op);
  VALUE op;  INTEGER op;                                     EXTERNAL.L;
PROCEDURE save (reg); VALUE reg;  INTEGER reg;               EXTERNAL.L;
PROCEDURE recall (reg); VALUE reg;  INTEGER reg;             EXTERNAL.L;
PROCEDURE select_default_eet (reg); VALUE reg; INTEGER reg;  EXTERNAL.L;
SUBROUTINE gen_last_reg_menu;                                EXTERNAL.L;
SUBROUTINE save_last_state;                                  EXTERNAL.L;
SUBROUTINE recall_preset_state;                              EXTERNAL.L;
SUBROUTINE recall_power_on_state;                            EXTERNAL.L;
PROCEDURE neu_data(type); VALUE type; INTEGER type;          EXTERNAL.L;

EXTERNAL ALPHA data_type_str.L;
```

```
CDATAP.UORK.PD8510            THU, DEC 22, 1983, 10:31 AM    PAGE  1


MFILE ctrace0.work;                                  & for update_... &
MFILE cdanain.work;                                  & for ..._domain &

COMMENT These are the values for the data processing control variables.
        The name in brackets is the channel table index value.
;
& format - [ch_format] &                    & marker readout/graticule&
& ------ changes in these values should also be made in "ACTIVE" ----- &
& ------ and in "FORMAT"and "DATAP"  --- &
INTEGER CONSTANT  fmt_log_mag          := 1,
                  fmt_linear_mag       := 2,
                  fmt_phase            := 3,
                  fmt_delay            := 4,
                  fmt_real             := 5,
                  fmt_imaginary        := 6,
                  fmt_log_polar        := 7, & log magnitude, phase    &
                  fmt_linear_polar     := 8, & linear magnitude, phase &
                  fmt_imag_vs_real     := 9, & polar graticule         &
                  fmt_z_smith          := 10,& Z:  real, imaginary     &
                  fmt_y_smith          := 11,& Y:  real, imaginary     &
                  fmt_swr              := 12,& SWR:  (1+mag)/(1-mag)   &
                  max_format           := 12;

& trace math - [ch_trace_math and ch_math_op] &
& ------ changes in these values should also be made in "TRACE2" ----- &
INTEGER CONSTANT  math_off             := 0,
                  math_d_times_n       := 1,
                  math_d_divided_by_n  := 2,
                  math_d_plus_n        := 3,
                  math_d_minus_n       := 4,
                  max_math             := 4;& equal to preceeding math &

& parameter conversion - [ch_param_conversion] &
INTEGER CONSTANT  conv_off             := 0,
                  conv_s_to_z          := 1,
                  conv_s_to_y          := 2,
                  conv_reciprocal      := 3;

& reflection/transmission - [ch_refl_trans] &
INTEGER CONSTANT  refl                 := 1,
                  trans                := 2;

& electrical length &
INTEGER CONSTANT  elec_length_off      := 0,
                  elec_length_on       := 1;

& smoothing - [ch_smoothing_mode],  [ch_smoothing_aperture] has M&
INTEGER CONSTANT  smoothing_off        := 0,
                  smoothing_on         := 1;

& trace mode &
INTEGER CONSTANT  overlay              := 0,
                  split                := 1,
                  single_ch            := 2;  & change also in srecall &
```

```
CDRTRP.UORK.PD8510            THU, DEC 22, 1983, 10:31 AM    PAGE  2


& gating - [ch_gating] &
INTEGER CONSTANT  gate_off             := 0,
                  gate_on              := 1;

& windows - [ch_tdr_window, ch_gate_window, ch_time_window] &
INTEGER CONSTANT  min_window           := 0,
                  normal_window        := 1,
                  max_window           := 2,
                  min_gate             := 0,
                  normal_gate          := 1,
                  wide_gate            := 2,
                  max_gate             := 3;

& time domain mode - [ch_time_mode] &
INTEGER CONSTANT  envelope_time        := 0,
                  rf_time              := 1;

& tdr stimulus type - [ch_tdr_stimulus_type] &
INTEGER CONSTANT  step_tdr             := 0,
                  impulse_tdr          := 1;

&*************************************************************&
INTEGER CONSTANT          dsize        := 4,
                          psize        := dsize,
                          rsize        := 4,
                          isize        := 2,
                          bsize        := 1;
INTEGER CONSTANT    dp_ptr_base        := 0,
                    dp_n_ptr           := dp_ptr_base + 0,
                    dp_d_ptr           := dp_ptr_base + 1,
                    dp_f_ptr           := dp_ptr_base + 2,
                    dp_trace_ptr       := dp_ptr_base + 3,
                    dp_rau11_get       := dp_ptr_base + 4,
                    dp_rau_get         := dp_rau11_get,
                    dp_rau21_get       := dp_ptr_base + 5,
                    dp_rau12_get       := dp_ptr_base + 6,
                    dp_rau22_get       := dp_ptr_base + 7,
                    dp_correct_ptr     := dp_ptr_base + 8,
               last_dp_ptr             :=(dp_ptr_base + 9) * psize;

& IMPORTANT: dp_rau_get must have same relationship to s-params as the &
&            "generic_param" constant in ccontvar.                     &
```

```
FORTAP.WORK.PDS510              THU, DEC 22, 1983, 10:31 AM    PAGE  1


@FILE cdatap.work;

EXTERNAL DOUBLE TABLE ch_dp_ptrs;

REAL PROCEDURE frequency_step( ch ); VALUE ch;  INTEGER ch;  EXTERNAL.L;
PROCEDURE data_proc_ch1;                                     EXTERNAL.L;
PROCEDURE data_proc_ch2;                                     EXTERNAL.L;
SUBROUTINE reset_data_proc;                                  EXTERNAL.L;
PROCEDURE set_vars_ptrs_base( ch );  VALUE ch;  INTEGER ch; EXTERNAL.L;
INTEGER PROCEDURE control_data_proc(ch);
   VALUE ch; INTEGER ch;                                     EXTERNAL.L;
PROCEDURE update_data_proc(update_th,update_block);
   VALUE   update_ch, update_block;
   INTEGER update_ch, update_block;                          EXTERNAL.L;
REAL PROCEDURE log_lin_ang( adr, pt, fig, lin, ang);
   VALUE   adr, pt, fig;
   DOUBLE  adr;
   INTEGER pt;
   @BOOLEAN fig;
   REAL    lin, ang;                                         EXTERNAL.L;
PROCEDURE min_max( adr, step, fig, min, min_pt, max, max_pt );
   VALUE adr, step, fig;
   BOOLEAN fig;
   INTEGER step, min_pt, max_pt;
   DOUBLE  adr;
   REAL    min, max;                                         EXTERNAL.L;
```

```
SDATAP.WORK.PDS510              THU, DEC 22, 1983, 10:31 AM    PAGE  1


@$%%L,P,"datap"
BEGIN
COMMENT
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% This the source module for the "datap" (data processing process)
%     Includes
%       1) control_data_proc
%       2) update_data_proc
%       3) reset_data_proc
%          control_data_proc_freq
%       4) data_proc_ch1  -- the actual process
%       5) data_proc_ch2  -- the actual process
%       6) min_max        -- min,max of internal data arrays
%       7) log_lin_ang    -- log_mag, lin_mag, ang of a data point
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
END OF COMMENT;
TYPELENGTH USER3 : 6;

@FILE fterm.work;                                            &DEBUG&
@FILE fterm3.work; & for UREAL &                             &DEBUG&
@FILE cdebug.work;                                           &DEBUG&
@FILE fkernel.work;
@FILE crine.work;
@FILE rehtable.work;
@FILE fchtab2.work;
@FILE fchdata.work;
@FILE fcontvar.work;
@FILE fgratic.work;
@FILE feize.work;
@FILE ftine.work;
@FILE cdatap.work;
@FILE cconputs.work;
@FILE ccal.work;
@FILE fnarker.work;                                & for update_narks &
@FILE fdelay.work;                                  & for total_delay &

DOUBLE ptrs_base = REGISTER 11;
DOUBLE vars_base = REGISTER 12;

SUBROUTINE  compute_datap;                                   EXTERNAL.L;
SUBROUTINE  nagE;                                            EXTERNAL.L;
SUBROUTINE  logE;                                            EXTERNAL.L;
SUBROUTINE  angE;                                            EXTERNAL.L;
EXTERNAL DOUBLE TABLE correct_table.L;
EXTERNAL DOUBLE TABLE conv_table.L;
EXTERNAL DOUBLE TABLE math_table.L;
EXTERNAL DOUBLE TABLE fnt_table.L;
EXTERNAL DOUBLE TABLE update_table.L;
EXTERNAL OUBD   TABLE e_coeff;


INTEGER CONSTANT  dp_scr__array_size      := 6*81 + 1 ,
                  dp_ptrs_array_size      := last_dp_ptr - 1,
                  dp_vars_array_size      := last_dp_vars - 1;
```

```
SDATAP.UORK.PD8510              THU, DEC 22, 1983, 10:31 AM    PAGE  2


GLOBAL BYTE ARRAY ch_dp_scr__0,
                  ch_dp_scr__1,
                  ch_dp_scr__2[0:dp_scr__array_size];
GLOBAL BYTE ARRAY ch_dp_ptrs_0,
                  ch_dp_ptrs_1,
                  ch_dp_ptrs_2[0:dp_ptrs_array_size];
GLOBAL BYTE ARRAY ch_dp_vars_0,
                  ch_dp_vars_1,
                  ch_dp_vars_2[0:dp_vars_array_size];
GLOBAL REAL       system_z0;

DOUBLE TABLE  ch_dp_scr  := @DRS(ch_dp_scr__0),
                            @DRS(ch_dp_scr__1),
                            @DRS(ch_dp_scr__2);
GLOBAL
DOUBLE TABLE  ch_dp_ptrs := @DRS(ch_dp_ptrs_0),
                            @DRS(ch_dp_ptrs_1),
                            @DRS(ch_dp_ptrs_2);
DOUBLE TABLE  ch_dp_vars := @DRS(ch_dp_vars_0),
                            @DRS(ch_dp_vars_1),
                            @DRS(ch_dp_vars_2);

BYTE CONSTANT polar_bit :=0,   polar_code     := 1,    rect_code  :=  0,
              delay_bit :=1,   delay_code     := 2,
              parm_bit  :=2,   parm_conv_code := 4;
BYTE TABLE    format_map  :=
              rect_code,                                     &  log_mag&
              rect_code,                                     &linear_mag&
              rect_code,                                     &  phase  &
              rect_code + delay_code,                        &  delay  &
              rect_code,                                     &   real  &
              rect_code,                                     &   imag  &
              polar_code,                                    & log_polar&
              polar_code,                                    & lin_polar&
              polar_code,                                    & imag_real&
              polar_code + parm_conv_code,                   &  z_smith &
              polar_code + parm_conv_code,                   &  y_smith &
              rect_code;                                     &   sur    &
```

```
SDATAP.UORK.PD8510              THU, DEC 22, 1983, 10:31 AM    PAGE  3


@EJECT;
PROCEDURE init_scr( ch );  VALUE ch;   INTEGER ch;
BEGIN
DOUBLE  scr;
BYTE    POINTER scr_ptr  = scr ;
DOUBLE          vars;
DOUBLE  POINTER double_ptr=vars;
vars := ch_dp_vars[ ch ];
scr  := ch_dp_scr[  ch ];
double_ptr[ dp_scr_base ] :=  @DRS( scr_ptr[ 0 ] ) ;
double_ptr[ dp_scr_end  ] :=  @DRS( scr_ptr[ dp_scr__array_size ] ) ;

END init_scr;


DOUBLE PROCEDURE init_data_proc( ch );  VALUE ch;   INTEGER ch;
BEGIN
DOUBLE          vars;
BYTE    POINTER byte_ptr = vars;
INTEGER index = REGISTER 6;

vars := ch_dp_vars[ ch ];
FOR index := 0 TO dp_vars_array_size DO
      byte_ptr[ index ] := 0;
init_scr( ch );

init_data_proc := vars;
END init_data_proc;


PROCEDURE set_vars_ptrs_base( ch );   VALUE ch;  INTEGER ch;       ENTRY;
BEGIN
    vars_base := ch_dp_vars[ ch ];
    ptrs_base := ch_dp_ptrs[ ch ];
END set_vars_ptrs_base;


REAL PROCEDURE frequency_step( ch ); VALUE ch;  INTEGER ch;       ENTRY;
      frequency_step := REAL(  ch_quad(ch_center_frequency, ch)  -
                               ch_quad(ch_start_frequency, ch) ) * 2.0
                                     / REAL( number_of_points - 1 ) ;
```

```
SDATMP.UORK.PD8510              THU, DEC 22, 1983, 10:31 AM     PAGE  4

REJECT;
COMMENT                                                    data_proc_ch1
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR data_proc_ch1                                  *
*                                                                           *
* FUNCTION:                                                                 *
*                                                                           *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:                                                                 *
*                                                                           *
*    OUTPUT:                                                                *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR data_proc_ch1                                       *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
*                                                                           *
*****************************************************************************
end of comment;
PROCEDURE data_proc_ch1;
                                                                    ENTRY;
BEGIN
DOUBLE  vars ;
INTEGER POINTER int_ptr  = vars;

    vars := init_data_proc( 1 );

    forever_loop:
      BEGIN
         wait(ch1_raw_ready);

         acquire( processing_variables );     & replace with asnb code &

         set_vars_ptrs_base( 1  );

         compute_datap;

         release( processing_variables );     & replace with asnb code &

         send( int_ptr[ dp_finished_signal ] );

      END data_proc_loop;
    GO TO forever_loop;

END data_proc_ch1;
```

```
SDATMP.WORK.PD8510              THU, DEC 22, 1983, 10:31 AM     PAGE  5

REJECT;
COMMENT                                                    data_proc_ch2
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR data_proc_ch2                                  *
*                                                                           *
* FUNCTION:                                                                 *
*                                                                           *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:                                                                 *
*                                                                           *
*    OUTPUT:                                                                *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR data_proc_ch2                                       *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
*                                                                           *
*****************************************************************************
end of comment;
PROCEDURE data_proc_ch2;
                                                                    ENTRY;
BEGIN
DOUBLE  vars ;
INTEGER POINTER int_ptr  = vars;

    vars := init_data_proc( 2 );

    forever_loop:
      BEGIN
         wait(ch2_raw_ready);

         acquire( processing_variables);      & replace with asnb code &

         set_vars_ptrs_base( 2  );

         compute_datap;

         release( processing_variables);      & replace with asnb code &

         send( int_ptr[ dp_finished_signal ] );

      END data_proc_loop;
    GO TO forever_loop;

END data_proc_ch2;
```

```
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REJECT;
COMMENT                                                    reset_data_proc
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR reset_data_proc                                *
*                                                                           *
* FUNCTION:                                                                 *
*                                                                           *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:                                                                 *
*                                                                           *
*    OUTPUT:                                                                *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR reset_data_proc                                     *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
*                                                                           *
*****************************************************************************
```

```
SDATMP.UORK.PD8510              THU, DEC 22, 1983, 10:31 AM     PAGE  7

REJECT end of comment;

PROCEDURE reset_dp_vars(ch);
                                    VALUE ch; INTEGER ch;
BEGIN
DOUBLE data_ptr;
INTEGER POINTER int_ptr  = data_ptr;
REAL    POINTER real_ptr = data_ptr;
DOUBLE  POINTER double_ptr=data_ptr;

 data_ptr := ch_dp_vars[ ch ];
 double_ptr[dp_length_shift] := double_ptr[dp_length_initial];

 int_ptr[dp_pos ] := 0;
 int_ptr[dp_flg ] := 0;

END reset_dp_vars;

SUBROUTINE reset_data_proc;                                         ENTRY;
BEGIN

   reset_dp_vars(  1  );
   reset_dp_vars(  2  );

END reset_data_proc;
```

```
SDATAP.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  8


%EJECT;

PROCEDURE control_data_proc_freq(ch);
                        VALUE ch; INTEGER ch;
                                                          %ENTRY;
BEGIN
DOUBLE          dp_vars_adrs;
DOUBLE POINTER  dp_dbl_ptr  = dp_vars_adrs;
INTEGER POINTER dp_int_ptr = dp_vars_adrs;
REAL POINTER    dp_real_ptr    = dp_vars_adrs;
REAL            elec_delay     , freq_step;

   dp_vars_adrs := ch_dp_vars[ ch ];

   freq_step    := frequency_step( ch );

              & group delay &
   dp_real_ptr[dp_grp_dly_ecale] :=
                        &1.0 / ( freq_step * phase_scaling * 360.0 ) &
            3.8146978-6  / ( freq_step );


   elec_delay   :=  total_delay( ch )  ;

   dp_dbl_ptr[dp_length_initial] :=  DOUBLE (  262144. &2**18&  * (
            ( elec_delay   * REAL(ch_quad(ch_etart_frequency, ch)) )
            - (  ch_real( ch_phase_offset , ch ) / 360.  )     ) ) ;

   dp_tbl_ptr[dp_length_inc ]    :=  DOUBLE ( 262144.  &2**18&   *
                                     elec_delay * frec_step );

   dp_dbi_ptr[dp_length_ehift ]  :=   dp_dbl_ptr[dp_length_initial]
                                 + ( dp_dbl_ptr[dp_length_inc ]
                               * ( dp_int_ptr[ dp_pos] / step_size ) );
END control_data_proc_freq ;
```

```
SDATAP.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE  9


%EJECT;
PROCEDURE control_data_proc_smoothing( ch );
                                        VALUE ch;  INTEGER ch;
BEGIN
DOUBLE   dp_vars_adrs,
         dp_ptrs_adrs;
DOUBLE  POINTER dp_ptr      = dp_ptrs_adrs;
INTEGER POINTER dp_int_ptr  = dp_vars_adrs;
REAL    POINTER dp_real_ptr = dp_vare_adrs;
INTEGER         aper_old, aper_neu, aper_change, pos_adj, sun_adj;

   dp_vars_adrs := ch_dp_vars[ ch ];
   dp_ptrs_adrs := ch_dp_ptrs[ ch ];
   IF ch_integer( ch_smoothing_mode, ch ) = smoothing_on THEN
      BEGIN
      aper_neu := RIGHT(  (
      INTEGER( ( ch_real( ch_smoothing_aperture, ch ) * 8. ) + .5 )
                              /step_size), 1);
      END
    ELSE
      aper_neu := 0;

    aper_old    :=   dp_int_ptr[dp_smoothing_aper] ;
    aper_change := aper_neu  -  aper_old ;
    dp_int_ptr[ dp_smoothing_aper ]  := aper_new;

    IF aper_change # 0  THEN
      BEGIN
      dp_real_ptr[dp_smoothing_scale]:= RERL( aper_neu + aper_neu + 1 );
      IF dp_int_ptr[dp_pos] = 0 OR aper_old = 0 THEN
         dp_int_ptr[ dp_flg ] :=   0   & init smoothing &
       ELSE
         BEGIN   &midscreen resumption &
         pos_adj := aper_change  +  dp_int_ptr[dp_smoothing_delay];

         IF pos_adj >= 0 THEN  & ahead of screen position &
            do_int_ptr[dp_smoothing_delay] :=  pos_adj
          ELSE & pos_adj < 0 &
            BEGIN
            dp_int_ptr[dp_smoothing_delay] :=  0;
            dp_ptr[dp_f_ptr] := dp_ptr[dp_f_ptr] - 6 * pos_adj ;
            dp_ptr[dp_trace_ptr]:=dp_ptr[dp_trace_ptr] - 4* pos_adj;
            END behind of screen position ;

         sun_adj := pos_adj + aper_change
                              - dp_int_ptr[ dp_smoothing_delay );
         IF sun_adj >= 0  THEN  & Increment SUM &
            BEGIN
            dp_int_ptr[ dp_flg ) := 1;       & increments sun &
            dp_int_ptr[dp_smoothing_correct] :=  sun_adj ;
            END
         ELSE & sun_adj < 0 &
            REPEAT -(sun_adj) DO
              ASSEMBLE(
                        MOVE.L dp_vars_adrs, R12 ;
                        JSRX   dec_smoothang.L );
```

```
SDATAP.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 10


       END in midscreen;
     END smoothing change ;
END control_data_proc_smoothing;
```

```
SDATAP.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 11


%EJECT;
COMMENT                                                 control_data_proc
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR control_data_proc                              *
*                                                                           *
* FUNCTION:                                                                 *
*         This routine will convert user variables into internal            *
*         variables needed for data processing.                             *
*         This routine will not distrub any of the data pointers.           *
*                                                                           *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:  ch        Channel (1/2) to be effected                         *
*                                                                           *
*    OUTPUT:                                                                *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR control_data_proc                                   *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
*                                                                           *
*****************************************************************************
```

```
SORTRP.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 12

%EJECT end of comment;
INTEGER PROCEDURE control_data_proc(ch);
                        VALUE ch; INTEGER ch;
                                                        ENTRY;
BEGIN
DOUBLE  dp_vars_adrs;
BYTE    POINTER dp_byte_ptr = dp_vars_adrs;
INTEGER POINTER dp_int_ptr  = dp_vars_adrs;
REAL    POINTER dp_real_ptr = dp_vars_adrs;
DOUBLE  POINTER dp_double_ptr=dp_vars_adrs;
INTEGER POINTER grat_specs;

DOUBLE   gain_l ;
REAL     gain_real = gain_l ;
INTEGER  gain_y = gain_l,     gain_x = gain_l + 2 ;
BYTE     gain_b = gain_l + 3 ;
REAL     x_div_size  ,    x_grad_ref ,
         y_div_size  ,    y_grad_ref ;
INTEGER format_code , format_type;

   dp_vars_adrs := ch_dp_vars[ ch ];
   IF ch = 1 THEN
       STPNTR( grat_specs, ADRS( grat1_specs ) )
   ELSE
       STPNTR( grat_specs, ADRS( grat2_specs ) );


   format_type := ch_integer( ch_format , ch ) - 1;
   format_code := format_map[ format_type ];
```

```
SORTRP.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 13

%EJECT;
   dp_int_ptr[dp_y_min] := grat_specs[ min_y ];
   dp_int_ptr[dp_y_max] := grat_specs[ max_y ];
   y_div_size     := REAL( grat_specs[ div_y ] );
   dp_real_ptr[dp_y_gain] := y_div_size / ch_real(ch_scale,ch);

   IF TBIT( format_code , polar_bit ) THEN
      BEGIN
      dp_int_ptr[dp_x_min] := grat_specs[ min_x ];
      dp_int_ptr[dp_x_max] := grat_specs[ max_x ];
      dp_double_ptr[dp_x_offset] :=DOUBLE( grat_specs[ grat_x ] );
      dp_double_ptr[dp_y_offset] :=DOUBLE( grat_specs[ grat_y ] );
      gain_real                  :=dp_real_ptr[dp_y_gain] / 32768.;

      dp_int_ptr[dp_polar_exp]   := INTEGER( gain_b );
      gain_x                     :=INTEGER(
                                   ALEFT( DOUBLE( gain_y ) , 2) / 5 );
      dp_double_ptr[dp_polar_gain]:= gain_l ;
      END  &polar&
   ELSE
      BEGIN&rect&
      y_grad_ref     := (ch_real(ch_ref_position,ch) * y_div_size]
                         + REAL( grat_specs[ grat_y ]);
      dp_real_ptr[dp_y_offset]:=
                                 ( ( y_grad_ref / dp_real_ptr[ dp_y_gain ] )
                                 - ch_real(ch_ref_value,ch) );
      dp_real_ptr[dp_y_gain] :=
                                 dp_real_ptr[dp_y_gain] /(32765. );
      END  &rect& ;


   control_data_proc_freq( ch );

   control_data_proc_smoothing( ch );

   system_z0 := ch_real( ch_system_z0, ch );
      & assumes that z0 is always coupled -- what if test set different&

   IF ch_integer( ch_correction_mode , ch ) = correct_on THEN
      BEGIN
      dp_double_ptr[dp_correct_switch]    := correct_table[
                                    ch_integer( ch_correction_type , ch)];
      dp_int_ptr[dp_correct_offset]       := array_size - 6;
      dp_double_ptr[dp_correct_select]    := ADRS( s_coeff[
                                    ch_integer( ch_basis_s_param , ch)] );
      END
    ELSE
      dp_double_ptr[dp_correct_switch]    := correct_table[ 0 );
   dp_double_ptr[dp_param_conv_switch] := conv_table[
                                    ch_integer( ch_param_conversion , ch)];
   dp_double_ptr[dp_trace_math_switch] := math_table[
                                    ch_integer( ch_trace_math , ch)];
   dp_double_ptr[dp_format_switch]     := fmt_table[ format_type ];

   dp_int_ptr(dp_finished_signal] := ch_integer(ch_finished_signal,ch);
```

```
SORTRP.WORK.PD8510          THU, DEC 22, 1983, 10:31 AM    PAGE 14

control_data_proc := 0;

END control_data_proc;
```

```
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%EJECT;
COMMENT                                                  update_data_proc
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR update_data_proc                               *
*                                                                           *
* FUNCTION:                                                                 *
*          Starting from a specificed intermediate storage array            *
*          (ie D or M or F), this routine will place on the display         *
*          a complete trace. All pointers to data, and conditions of        *
*          the processing will be setup elsewhere.                          *
*                                                                           *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:  update_ch    The channel ( 1/2 ) to be updated                 *
*            update_block The degree of update ( start at  D, M or F )      *
*                                                                           *
*    OUTPUT: none                                                           *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*        The display and various intermediate arrays are update.            *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR update_data_proc                                    *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*        The address of the start the of the needed update routine is       *
*     found, with the twist that update from F is different if the          *
*     display is in polar or rectangluar. The pointers to memory            *
*     pointers and variables are setup in registers for 'compute'.          *
*     The trace math switch needs to store if updating M in case            *
*     group delay is selected ( normally trace math is skipped ).           *
*     A loop for the correct number of points is than done.                 *
*                                                                           *
*****************************************************************************
```

```
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%EJECT end of comment;
PROCEDURE update_data_proc(update_ch,update_block);
                        VALUE   update_ch, update_block ;
                        INTEGER update_ch, update_block ;       ENTRY;
BEGIN
DOUBLE      ch_byte_dbl,
            update_switch;
INTEGER     point,
           ch_trace;

DOUBLE  POINTER dp_dbl_ptr = vars_base;
INTEGER POINTER dp_int_ptr = vars_base;
BYTE POINTER   dp_byte_ptr = vars_base,
               ch_byte_ptr = ch_byte_dbl;

   IF update_block = update_f   AND
      TBIT(format_map[ch_integer(ch_format ,update_ch) - 1], polar_bit)
     THEN update_block := update_f_polar;

   set_vars_ptrs_base( 0  );
   ch_byte_dbl    :=        ch_dp_vars[ update_ch ] ;


   MOVE dp_byte_ptr :# ch_byte_ptr ,#( last_dp_vars );

   init_ecr( 0 );                   & only needs to done at power up &
   reset_dp_vars( 0 );

   IF update_block = update_a THEN
      BEGIN
         ch_trace := ch_a_trace_base;
         dp_dbl_ptr[dp_trace_math_switch] := math_table; &math off&
      END
    ELSE ch_trace :# ch_trace_base;

   set_dp_ptrs( update_ch, 0, ch_trace);

 IF update_block = update_raw_array THEN
        array_datap( update_ch )
  ELSE
    BEGIN  & normal update &
       update_switch  :=  update_table[ update_block - 1 ];
       set_vars_ptrs_base( 0 );                          &restore&
       FOR point := 0  STEP step_size UNTIL 800  DO
             ASSEMBLE(  MOVE.L  update_switch, R8;
                        JSR     (R5)                );
    END normal update ;

   update_marks;    & move markers, update-mark, set point, ch mark &

END update_data_proc;
```

```
SDRTMP.WORK.PD8510              THU, DEC 22, 1983, 10:32 AM     PAGE 17


REJECT;
COMMENT                                                         log_lin_ang
**************************************************************************
*                                                                        *
* EXTERNAL SPECIFICATION FOR log_lin_ang                                 *
*                                                                        *
* FUNCTION:                                                              *
*                                                                        *
*                                                                        *
* DECLARATION INFORMATION:                                               *
*                                                                        *
*    INPUT:                                                              *
*                                                                        *
*    OUTPUT:                                                             *
*                                                                        *
* EXTERNAL EFFECTS:                                                      *
**************************************************************************
*                                                                        *
* LOGIC INFORMATION FOR log_lin_ang                                      *
*                                                                        *
* MODULES CALLED:                                                        *
*                                                                        *
* INITIAL REFINEMENT:                                                    *
*                                                                        *
**************************************************************************
```

```
SDRTMP.WORK.PD8510              THU, DEC 22, 1983, 10:32 AM     PAGE 18


%EJECT end of comment;
REAL PROCEDURE log_lin_ang( adr, pt, flg, lin, ang);
                    VALUE  adr, pt, flg;      BOOLEAN flg;
                    DOUBLE adr;   INTEGER pt; REAL lin, ang;    ENTRY;
   BEGIN
   LABEL   rect,save;

   ASSEMBLE( MOVE.L adr, R8;   MOVE.W  pt,   R0;       MPY #6,R0;
             DIV    step_size,R0;
             ADD.W  R0,  R8;   MOVEM.L (R5),  R0-R1;    SWAP R1;
             MOVEM.L R0/R1, -(S);                      & save for reuse&
             JSR    angE;     MOVE.L  ang, R9;  MOVE.L R0, (R9);
             MOVEM.L (S),  R0/R1;
             TST.W   flg;      BEQ   rect;
             JSR    magE;      BRA save;
        rect: SWAP R0;          MOVE.W R1,  R0;
        save: MOVE.L  lin, R9;  MOVE.L R0, (R9);
             MOVEM.L (S)+, R0/R1;
             JSR    logE                              );

   END log_lin_ang;
```

```
SDRTMP.WORK.PD8510              THU, DEC 22, 1983, 10:32 AM     PAGE 19


%EJECT;
COMMENT                                                         min_max
**************************************************************************
*                                                                        *
* EXTERNAL SPECIFICATION FOR  min_max                                    *
*                                                                        *
* FUNCTION:                                                              *
*                                                                        *
*                                                                        *
* DECLARATION INFORMATION:                                               *
*                                                                        *
*    INPUT:                                                              *
*                                                                        *
*    OUTPUT:                                                             *
*                                                                        *
* EXTERNAL EFFECTS:                                                      *
**************************************************************************
*                                                                        *
* LOGIC INFORMATION FOR min_max                                          *
*                                                                        *
* MODULES CALLED:                                                        *
*                                                                        *
* INITIAL REFINEMENT:                                                    *
*                                                                        *
**************************************************************************
* HISTORY
*   5/31/73 -- Max was checked only if Min failed, failed on a sloping
*              line, therefore Min and Max checked on all points.
**************************************************************************
```

```
SORTBP.WORK.PDS510          THU, DEC 22, 1983, 10:32 AM    PAGE  20


%EJECT end of comment;
PROCEDURE min_max( adr, step, flg, min, min_pt, max, max_pt );
                        VALUE adr, step, flg;
                DOUBLE adr; INTEGER step, min_pt, max_pt;
                BOOLEAN flg; REAL    min, max;                  ENTRY;
BEGIN
INTEGER pt;
REAL   val;
LABEL   rect, save;
   min := 1@37;
   max := -min;

   FOR pt:= 0 STEP step TO 800  DO
      BEGIN
      ASSEMBLE(
              MOVE.L  adr,   R8;
              TST.W   flg;          BED rect;      & check imag part&
              MOVE.L  (R8)+, R0;    MOVE.W  (R5)+,  R1;
              MOVE.L  R8,    adr;
              JSR     magE;
              BRR     save;
         rect: ADDQ   #2,    R5:    BOVE.L  (R8)+,  R0;
              MOVE.L  R5,    adr;
         save: MOVE.L  R0, val          );

      IF val < min THEN BEGIN   min:=val;   min_pt:= pt; END;
      IF val > max THEN BEGIN   max:=val;   max_pt:= pt; END;

      END loop;
END min_max;
END$
```

```
FDA1AP1.WORK.PDB510         THU, DEC 22, 1983, 10:32 AM    PAGE   1

%FILE cdatap.work;

PROCEDURE control_data_proc_freq(ch);
   VALUE ch; INTEGER ch;                                  EXTERNAL.L;
```

```
CDEBUG.WORK.PDS510          THU, DEC 22, 1983, 10:32 AM    PAGE   1
```

```
CDEBUGCO.WORK.PDB510        THU, DEC 22, 1983, 10:32 AM    PAGE   1

INTEGER BITFIELD debug = X00000000.
```

COEBUGC2.UORK.PD8510 THU, DEC 22, 1983, 10:32 RM PAGE 1

```
INTEGER BITFIELD debug2 = %O000000C2:
```

CDEBUGC4.UORK.PD8510 THU, DEC 22, 1983, 10:32 RM PAGE 1

```
INTEGER BITFIELD debug3 = %O000000C4:
```

CDEBUGXX.WORK.PD8510 THU, DEC 22, 1983, 10:32 RM PAGE 1

FDELRY.UORK.PD8510 THU, DEC 22, 1983, 10:32 RM PAGE 1

```
RERL PROCEDURE total_delay( ch );
  VALUE  ch;
  INTEGER ch;                                          EXTERNAL.L;
```

```
$DELAY.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  1

TAG&KL,P,"delay"
BEGIN

&FILE cdatap.work;                                  & for max_format &
&FILE ccontvar.work;                               & for max_parameter &
&FILE cchteble.work;
&FILE fchtab2.work;                          & for eh_integer and _real &
&FILE fchpfr.work;          & for elec_delay and parameter_descriptor &

INTEGER CONSTANT no_delay := -1;

INTEGER TABLE driven_index :=        & indexed by driven port number  &
      no_delay,       & driven_none    MUST coincide with constants   &
      ch_ref_plane_1, & driven_at      from cyadc.work.               &
      eh_ref_plane_2; & driven_a2   &
INTEGER TABLE numerater_index :=     & indexed by numerater port type &
      eh_ref_plane_1, & num_b1 &     & MUST coincide with constants   &
      eh_ref_plane_2, & num_b2 &     & from cyadc.work.               &
      no_delay,       & num_a2 &
      no_delay,       & num_a1 &
      no_delay,       & num_100khz_cal and non_no_ratio &
      no_delay,       & num_detector_gnd   &
      no_delay,       & num_ref_100khz_cal &
      no_delay,       & num_adc_gnd        &
      no_delay,       & num_vcal           &
      no_delay,       & num_vref           &
      no_delay,       & num_temp1          &
      no_delay,       & num_temp2          &
      no_delay;       & num_analog_in      &
INTEGER TABLE denominator_index :=   & indexed by denom'tor port type &
      ch_ref_plane_1, & denom_b1 &
      no_delay,       & denom_a1 &
      no_delay,       & denom_a2 &
      no_delay,       & not used &
      no_delay,       & denom_100khz_cal &
      no_delay;       & denom_detector_gnd and denom_no_ratio &

RERL PROCEDURE total_delay( ch );
   VALUE  ch;
   INTEGER ch;                                                  ENTRY;
   BEGIN & total_delay &
      INTEGER parameter,
              index;
      RERL accumulated_delay,
           driven_port_delay;

      parameter := ch_integer( ch_param, ch );
      accumulated_delay := elec_delay[ parameter , ch ];
      index := parameter_descriptor[ parameter, driven_port ] AND %003F;
      index := driven_index[ index ];
      IF index <> no_delay THEN
         driven_port_delay := ch_real( index, ch );

      index := parameter_descriptor[ parameter, numerator_part ] AND
                  %003F;
```

```
$DELAY.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  2

      index := numerator_index[ index ];
      IF index <> no_delay THEN
         accumulated_delay := accumulated_delay +
                              driven_port_delay +
                              ch_real( index, ch );

      index := parameter_descriptor[ parameter, denominator_part ] AND
                  %003F;
      index := denominator_index[ index ];
      IF index <> no_delay THEN
         accumulated_delay := accumulated_delay -
                              driven_port_delay -
                              eh_real( index, ch );

      total_delay := accumulated_delay;

   END;  & total_delay &

END$
```

```
$DETOP.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  1

TAG&KL,P,"dgtop"
BEGIN

COMMENT  This is to mark the top of dg ram storage. ;

GLOBAL LABEL mark_dg_top;

mark_dg_top:

END$
```

```
CDGUSER.WORK.PD8510         THU, DEC 22, 1983, 10:32 AM    PAGE  1

INTEGER CONSTANT

  user_display_graphics:= 31,  &index to priv_ib_lun table of addresses&
  user_display_address ;= 31;
```

```
FBAUSER.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  1


SUBROUTINE init_user_graphics;                          EXTERNAL.L;
SUBROUTINE restore_8510_display;                        EXTERNAL.L;
PROCEDURE parse_user_graphics (end);
  VALUE end;  BYTE end;                                 EXTERNAL.L;
EXTERNAL BOOLEAN display_8510_on;
```

```
SDGUSER.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  1


%S8Ki,P,"dguser"

BEGIN

%FILE fterm.work;
%FILE fterm2.work;
%FILE cdebug.work;
%FILE cocreen.uork;
%FILE cdisplay.work;
%FILE fdisplay.work;
%FILE foutput.work;
%FILE fstring.work;
%FILE Foutib.work;

BYTE CONSTANT
  IF  := 10,
  EIX := 3;

INTEGER CONSTANT
  PR := %5041,
  PR := I5052,
  PU := %5055,
  PD := %5044,
  LB := %4C42,
  PC := %5047,          % "clear display" & wear display &
  KP := %4850,          % seve end clear user graphics pg&
  RP := %5250,          & recall user graphics page      &
  CS := %4353,          % "clear screen"  & %510 display &
  RS := I5253,          & "restore screen"= %510 display %
  OP := %4F50,
  OF := %4445,
  max_cnd_cher := 80;

DOUBLE CONSTANT
  fnt_code := %01000000;

INTEGER TABLE MPGL_cnd :=
  PR, PR, PU, PD, LB, PG, KP, RP, CS, RS, OP, DF, 0;

GLOBAL BOOLEAN
  display_%510_on;

BOOLEAN
  pareing_x,            & flag to determine x value for x,y pair &
  label_node,           & LB command has been issued &
  number_mode,          % PR,PR command has been issued &
  pen_up,
  plot_abs;

BYTE ARRAY
  cnd_code [0:1],
  end_char [-1:max_cnd_char];                       % command string &

ALPHA
  cnd_string;
```

```
SDGUSER.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  2


INTEGER
  cnd_code_ptr,
  cnd_value = cnd_code,             & value of 2-letter MPGL command &
  x_vector, y_vector,     & current absolute x,y display vector values &
  x_cnd, y_cnd,                 & x,y plot values for PA/PR commands &
  DG_ptr;                 & pointer to next available word in DG RAM &
```

```
SDGUSER.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  3


%EJECT;
COMMENT
%DOC+

NAME--
  default_mode
*****************************************************************************
*
* SHORT DESCRIPTION--
*   executes a DF command which sets all graphics default modes
*
* EXTENDED DESCRIPTION--
*   This routine resets all flags, pointers, and counters to their
*   default values.  The following attributes are set:
*     - plot absolute
*     - pen up
*   The command input string and command code value are also reset.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set plot absolute, pen up, flags
*   set x,y coordinate values to 0
*   reset command string/code pointers
*   clear flags indicating label mode, plot mode, and parsing
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
%DOC-;
SUBROUTINE default_mode;
BEGIN
  cnd_char[0] := x_vector := y_vector := 0;
  cnd_code_ptr := x_cnd := y_cnd := -1;
  plot_abs := pen_up := pareing_x := TRUE;
  number_mode := label_mode := FALSE;
END default_mode;
```

```
SDGUSER.WORK.PDS510          THU, DEC 22, 1983, 10:32 AM    PAGE  4


REJECT;
COMMENT
$DOC+

NAME--
  new_page
*****************************************************************************
*
* SHORT DESCRIPTION--
*   executes a PC command which clears the user graphics display area
*
* EXTENDED DESCRIPTION--
*   This routine simulates the HP-GL command, PG, which is suppose to
*   perform a page eject or new page function.  It is used in the user
*   graphics display context as a "clear display" command which in
*   effect generates a new or blank page of display memory for the user.
*
*   This will reset the display pointer to the beginning of user display
*   memory, which is where the display starts interpreting th graphics
*   display commands.  This means that any commands currently in the
*   display area will be erased (written over).
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   setattribute
*   jmp
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   clear user graphics display area
*   reset x,y cooredinate display values to 0
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE new_page;
BEGIN
  DG_ptr := setattribute (user_display, nop);
  jmp (DG_ptr, end_position);
  x_vector := y_vector := 0;
```

```
SDGUSER.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  5


  IF plot_debug THEN
    BEGIN LSTR("new pg"); WAIT(DG_ptr); CRLF; END;
END new_page;
```

```
SDGUSER.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  6


REJECT;
COMMENT
$DOC+

NAME--
  init_user_graphics
*****************************************************************************
*
* SHORT DESCRIPTION--
*   initializes use of user accessible graphic display
*
* EXTENDED DESCRIPTION--
*   This routine is invoked upon setting the public HP-IB command
*   pass-thru address to the display (for user graphics purposes).
*   It initializes all user graphic display variables and sets the
*   default modes for plotting.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   default_mode
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set default plotting modes
*   set up plot command string to collect and parse commands
*   set display pointer for plotting to display
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE init_user_graphics;                              ENTRY;
BEGIN
  default_mode;
  new_page;
  display_8510_on := TRUE;
  cmd_char[-1] := max_cmd_char;
  cmd_string := ADDRS(cmd_char);
END init_user_graphics;
```

```
SDGUSER.WORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE  7


REJECT;
COMMENT
$DOC+

NAME--
  clear_8510_display
*****************************************************************************
*
* SHORT DESCRIPTION--
*   clears display generated by 8510
*
* EXTENDED DESCRIPTION--
*   This routine responds to the command, CS, which clears the display
*   generated and used by the 8510 as an instrument.  Anything that
*   shows up on the display after this command is generated by HP-GL
*   type commands sent to the 8510 by command pass-thru on public HP-IB.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   jmp
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   clear flag indicating that 8510 display is on
*   clear 8510 display
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE clear_8510_display;
BEGIN
  display_8510_on := FALSE;
  jmp (start_display+1, user_display);
END clear_8510_display;

SUBROUTINE restore_8510_display;                            ENTRY;
BEGIN
  display_8510_on := TRUE;
  setattribute (start_display+1,nop);
END restore_8510_display;
```

```
SDGUSER.WORK.PD8S10          THU, DEC 22, 1983, 10:32 AM    PAGE  8
```

```
SDGUSER.WORK.PD8S10          THU, DEC 22, 1983, 10:32 AM    PAGE  9


%EJECT;
COMMENT
$DOC+

NAME--
  range_check_vector
*****************************************************************************
*
* SHORT DESCRIPTION--
*   range check and correct x,y coordinate display values
*
* EXTENDED DESCRIPTION--
*   This routine checks the values of incoming x,y display coordinates
*   to see if they fall between 0 and 4095 (display vector resolution).
*   Any value outside this range is set to 0 if it is less than 0 or to
*   4095 if it is greater than 4095.
*
* INPUTS--
*   value - value of the x or y coordinate to range check
*           (passed by reference)
*
* OUTPUTS--
*   0 if value < 0
*   4095 If value > 4095
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   IF value > 4095 THEN set value to 4095
*   IF value < 0    THEN set value to 0
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
PROCEDURE range_check_vector (vector_value);
  INTEGER vector_value;
BEGIN
  IF vector_value > 4095 THEN
    vector_value := 4095
  ELSE
  IF vector_value < 0 THEN
    vector_value := 0;
END range_check_vector;
```

```
SDGUSER.WORK.PD8S10          THU, DEC 22, 1983, 10:32 AM    PAGE 10
```

```
SDGUSER.WORK.PD8S10          THU, DEC 22, 1983, 10:32 AM    PAGE 11


%EJECT;
COMMENT
$DOC+

NAME--
  dg_plot_xy
*****************************************************************************
*
* SHORT DESCRIPTION--
*   plots the vector x,y on the display
*
* EXTENDED DESCRIPTION--
*   This routine plots the x,y vector on the display based on a relative
*   or absolute plot command (PR,PA) which preceded it.  The values are
*   added to current absolute plotting values of x and y on a relative
*   plot or became the current absolute plotting values on an absolute
*   plot command.
*
*   This routine is invoked after both x and y points have been parsed
*   and converted into numerical values.  Range checking is also done
*   after the current absolute plotting values of x and y have been
*   established.
*
* INPUTS--
*   x_cmd = x value of plot command
*   y_cmd = y value of plot command
*   (These are global variables which are not passed as parameters)
*
* OUTPUTS--
*   x_vector = current absolute x plotting value
*   y_vector = current absolute y plotting value
*   (These are global variables which are not passed as parameters)
*
* ROUTINES CALLED--
*   range_check_vector
*   move
*   draw
*   jmp
*
* ERROR CONDITIONS AND RECOVERY--
*   A check is included to prevent x,y values to be written beyond
*   available user display memory.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   IF plot absolute command THEN
*     assign x,y values to current absolute x,y values
*   ELSE
*     add x,y values to current absolute x,y values
*   range check new absolute x,y values
*   IF there is enough room in display memory for x,y values (2 words)
```

```
SOGUSER.WORK.PO8510          THU, DEC 22, 1983, 10:32 AM    PAGE 12

*     THEN
*       IF pen is up THEN
*         plot vector with display been off
*       ELSE
*         plot vector with display been on
*       update pointer to next available word in user display memory
*       reset ready flag for parsing new x,y vectors
*     ELSE
*       set pointer to next available display word to last display word
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
$DOC-;
SUBROUTINE PG_plot_xy;
BEGIN
  IF plot_abs THEN
    BEGIN
      x_vector := x_cmd;
      y_vector := y_cmd;
    END
  ELSE
    BEGIN
      x_vector := x_vector + x_cmd;
      y_vector := y_vector + y_cmd;
    END;
  range_check_vector (x_vector);
  range_check_vector (y_vector);
  IF (DG_ptr < end_position-2) THEN
    BEGIN
      DG_ptr := (IF pen_up THEN
                   move (DG_ptr, x_vector, y_vector)
                 ELSE
                   draw (DG_ptr, x_vector, y_vector));
      jmp (DG_ptr, end_position);
      IF plot_debug THEN
        BEGIN
          WCHAR(' );
          IF pen_up THEN WCHAR('-) ELSE WCHAR('+);
          IF plot_abs THEN WCHAR('a) ELSE WCHAR('r);
          WCHAR('=); WHEX(x_vector); WHEX(y_vector); WSTR(" @");
          WHEX(DG_ptr); CRLF;
        END;
    END
  ELSE
    DG_ptr := end_position;
END DG_plot_xy;
```

```
SOGUSER.WORK.PO8510          THU, DEC 22, 1983, 10:32 AM    PAGE 13

$EJECT;
COMMCK1
$DOC+

NAME--
  get_cmd
*****************************************************************
*
* SHORT DESCRIPTION--
*   returns the command value of command mnemonic
*
* EXTENDED DESCRIPTION--
*   This routine does a linear search for the 2-letter command mnemonic
*   just parsed in a command table (HPGL_command) and returns the
*   corresponding command value.  The end of the command table contains
*   a zero value which is used to end the linear search.  This zero
*   value is returned if a command mnemonic is not found.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   command value of corresponding to index of mnemonic in command table
*   (0 if not found)
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   linearly search for a match between parsed mnemonic and table
*     mnemonic until found or end of table (0) is found
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
$DOC-;
INTEGER PROCEDURE get_cmd;
BEGIN
  INTEGER i=REGISTER 8, end_entry;
  i := -1;
  DO UNTIL
    ((end_entry := HPGL_cmd[i:=i+1]) = end_value) OR
      (end_entry = 0);                  $ last command in HPGL_cmd table &
  get_cmd := i;
END get_cmd;
```

```
SOGUSER.WORK.PO8510          THU, DEC 22, 1983, 10:32 AM    PAGE 14
```

```
SOGUSER.WORK.PO8510          THU, DEC 22, 1983, 10:32 AM    PAGE 15

$EJECT;
COMMENT
$DOC+

NAME--
  call_cmd
*****************************************************************
*
* SHORT DESCRIPTION--
*   execute plot command corresponding to command value
*
* EXTENDED DESCRIPTION--
*   This routine executes the plot command just parsed.  These commands
*   consist of a small subset of HP-GL commands and a few 8510 user
*   display commands.  These commands are sent to the 8510 over the
*   public bus with a controller via pass-thru.  They allow the user
*   to use the user accessible display area as a plotter and provide
*   some limited control over the general display area.
*
*   The following are a subset of HP-GL commands that are implemented:
*
*     PA = plot absolute
*     PR = plot relative
*     PU = pen up
*     PD = pen down
*     LB = label
*     PG = page eject (acts as a clear screen or user display memory)
*     OP = output P1,P2
*     DF = default plot modes
*
*   The following are a set of 8510 user display commands to provide the
*   user some control over the general display:
*
*     KP = keep page
*          clears the user display area, but saves the user display
*          memory (with all the plot commands) until a PG command or
*          it is written over with other plot commands
*     RP = restore page
*          recalls the display area cleared but saved by a KP command
*     CS = clear screen
*          clears the 8510 display area
*     RS = restore screen
*          restores the 8510 display area
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   get_cmd
*   new_page
*   jmp
*   setattribute
*   clear_8510_display
```

```
$DGUSER.UDRK.PDS510            THU, DEC 22, 1983, 10:32 AM    PAGE  16

*   restore_3510_display
*   pub_ib_output_select
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   get command value corresponding to command mnemonic just parsed
*   and execute corresponding commands/routines accordingly:
*     PR = set plot absolute flag and number parsing mode
*     PP = clear plot absolute flag and set number parsing mode
*     PU = set pen up flag
*     PD = clear pen up flage
*     LS = set label (string printing) mode
*     PG = call routine to clear user display area
*     KP = call routine to save and clear user display area
*     RP = call routine to recall user display area save with KP
*     CS = call routine to clear 3510 display
*     RS = call routine to restore 3510 display
*     DP = call routine to output the P1,P2 plot limits
*     DF = call routine to set defualt plotting modes
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
%BROUTINE call_cmd;
BEGIN
  IF plot_debug THEN
    BEGIN
      UCHAR(cmd_code[0]); UCHAR(cmd_code[1]);
      CRLF;
    END;
  cmd_code_ptr :* a_end :* y_cmd :* -1;
  CASE get_cmd OF
    BEGIN
      & PR &
      plot_abs :* parsing_a :* number_mode :* TRUE;
      & PP &
      BEGIN
        parsing_a :* number_mode := TRUE;
        plot_abs :* FALSE;
      END;
      & PU &
      pen_up := TRUE;
      & PD &
      pen_up :* FALSE;
      & LB &
```

```
$DGUSER.UDRK.PDS510            THU, DEC 22, 1983, 10:32 PM    PAGE  17

      BEGIN
        number_mode := FALSE;
        label_mode := TRUE;
      END;
      & PG &
      new_page;
      & KP &
      jmp (user_display, end_position);        & save page and clear &
      & RP &
      octattribute (user_display, nop);        & recall page on disp.&
      & CS &
      clear_3510_display;
      & RS &
      restore_3510_display;
      & DPS
      pub_ib_output_select (DG_plp2_output);
      & DF &
      default_mode;
    END case;
END call_end;
```

```
$DGUSER.UDRK.PDS510            THU, DEC 22, 1983, 10:32 AM    PAGE  14

REJECT;
COMMENT
$DOC+

NAME--
  convert_vector
*****************************************************************************
*
* SHORT DESCRIPTION--
*   converts numerical input string to integer value
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*   cmd_string or cmd_char - contains numerical input string
*                            (declared globally)
*
* OUTPUTS--
*   integer value for cmd_string input
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
INTEGER PROCEDURE convert_vector;
BEGIN
  BYTE char;
  INTEGER i=REGISTER 6, start, vector_value, lgth;
  vector_value := 0;
  IF (lgth:=cmd_char[0]) > 0 THEN
    BEGIN
      start := (IF cmd_char[1] <> '- THEN
                  1 ELSE 2);
      IF lgth >= start THEN
        FOR i := start TO lgth DO
          IF ((char:=cmd_char(i]) >= '0) AND (char <= '9) THEN
            vector_value := vector_value*10 + (char-48);
      IF start = 2 THEN                        & negative number &
        vector_value := -vector_value;
    END;
  IF plot_debug THEN
    BEGIN
```

```
$DGUSER.UDRK.PDS510            THU, DEC 22, 1983, 10:32 AM    PAGE  15

      IF parsing_a THEN UCHAR('a) ELSE UCHAR('y);
      USTR(cmd_string);
    END;
  cmd_char [0] :* 0;                       & reset string length to 0 &
  convert_vector := vector_value;
END convert_vector;
```

```
SDGUSER.UORK.PD8510          THU, PEC 22, 1983, 10:32 AM    PAGE 20

#EJECT;
COMMENT
$UXC+

NAME--
  parse_xy
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE parse_xy;
BEGIN
  IF parsing_x THEN
    BEGIN
      x_cnd := convert_vector;
      parsing_x := FALSE;
    END
  ELSE
    BEGIN
      y_cnd := convert_vector;
      DG_plot_xy;
      parsing_x := TRUE;
    END;
END parse_xy;
```

```
SDGUSER.UORK.PD8510          THU, PEC 22, 1983, 10:32 AM    PAGE 21

#EJECT;
COMMENT
$DOC+

NAME--
  parse_user_graphics
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
COMMENT
  Takes 2 character command mnemonics ONLY !!!
;
PROCEDURE parse_user_graphics (end);
  VALUE end;  BYTE end;                                          ENTRY;
BEGIN
  IF (end <= 'z) AND (end >= 'a) THEN          & upshift character &
    end := end - 32;
  IF label_mode THEN
    BEGIN
      IF DG_ptr < end_position THEN
      IF end <> ETX THEN
        append_ch (end_string,end)             & collect label str &
      ELSE
        BEGIN
          INTEGER DG_avail;
          label_mode := FALSE;                 & end of string     &
          IF (DG_avail:=end_position-DG_ptr-1) < cnd_char[0] THEN
            end_char[0] := DG_avail;           & truncate lb string&
          IF DG_avail > 0 THEN
            BEGIN
              DG_ptr := lb (DG_ptr, cnd_string);  & send to display  &
```

```
SDGUSER.UORK.PD8510          THU, DEC 22, 1983, 10:32 AM    PAGE 22

              jmp (DG_ptr, end_position);
            END
          ELSE
            DG_ptr := end_position;
          IF plot_debug THEN
            BEGIN
              USTR(cnd_string); USTR(" 8");
              UHEX(DG_ptr); CRLF;
            END;
          end_char[0] := 0;                    & reset lb,x,y str  &
        END;
    END
  ELSE

  IF (end >= 'A) AND (end <= 'Z) THEN          & regular commands  &
    BEGIN
      IF number_node THEN                      & plot last x,y pts &
        BEGIN
          number_node := FALSE;                & terminate x,y inp.&
          parse_xy;
        END;
      end_code [end_code_ptr:=end_code_ptr+1] := end;
      IF end_code_ptr = 1 THEN                 & get 2 chars/cmd   &
        call_cmd;
    END
  ELSE

  IF number_node THEN
    BEGIN                                      & parse x,y vectors &
      IF DG_ptr < end_position THEN
        IF (end = ',) OR (end = ';) OR (cnd = LF) THEN
          parse_xy
        ELSE
          append_ch (cnd_string, cnd);
    END
  ELSE
    IF plot_debug THEN BEGIN USTR("? "); UHEX(cnd); CRLF; END;
END parse_user_graphics;

END$
```

```
SDISMON.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE 1

MC68KL,L,I,A,P,"display"
BEGIN
USE REGISTER 0-11;

NFILE edisplay.work;
NFILE fioconfig.work;

COMMENT                                                          display
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR display                                        *
*                                                                           *
* FUNCTION: to encapsulate a set of utility procedures for using the        *
*           display.                                                        *
*                                                                           *
* COMMENTS:  The routine "init_display" must be called once prior           *
*            to using any of the following routines to initialize           *
*            pointers used by the following routines.                       *
*                                                                           *
*            All of the following routines use an "a" parameter to          *
*            specify the location in the display memory where the           *
*            display instruction will be stored.  "A"=000                   *
*            corresponds to the first location in the display memory        *
*            (MC68000 address 2FF0000), and "a"=3FFF corresponds            *
*            to the last location (MC68000 address 2FF7FFE).  "a"           *
*            are "word" or "integer" addresses starting from the base       *
*            of the display memory -- successive locations differ by        *
*            one, as opposed to two for byte addresses used by the          *
*            MC68000.                                                       *
*                                                                           *
*            Caution should be exercised in using display locations         *
*            "a"=3000 through 3FFF to avoid damaging the                    *
*            character set vectors that are stored in those locations.      *
*                                                                           *
*****************************************************************************
;
INTEGER CONSTANT  blanked := 1000,   & blank - x-coordinate attribute &
                  char    := 3000;   & character set block address    &
INTEGER POINTER   loxy,
                  lda,
                  jump,
                  jumpsub,
                  rtnsub;
INTEGER POINTER   dg = lda;

COMMENT
 It is faster to use an integer procedure (function) returning the
incremented display address than to pass the display address by
reference, primarily due to the time required to increment the
display address when passed by reference.
 It is also faster to index using the address and the address+1
and then return the address+2 than it is to increment the address
between the two coordinates.
```

```
SDISMON.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE  2
```

```
SDISMON.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE  3

$EJECT;
COMMENT                                                          drau
*****************************************************************
*                                                               *
* EXTERNAL SPECIFICATION FOR drau                               *
*                                                               *
* FUNCTION: Draw a line from the present "pen" position to the  *
*           coordinate (x,y).  Begin at location "a" in the display *
*           memory and return the next available display memory *
*           location.                                           *
*                                                               *
* DECLARATION INFORMATION:                                      *
*    INTEGER PROCEDURE drau(a,x,y)                              *
*       VALUE   a,x,y                                           *
*       INTEGER a,x,y                                           *
*                                                               *
*    INPUT:   a          integer    display location            *
*                                      (0 to 16383).            *
*             x          integer    x-coordinate (-4095 to +4095). *
*             y          integer    y-coordinate (-4096 to +4095). *
*                                                               *
*    OUTPUT:  drau       integer    Next available display location. *
*                                                               *
* EXTERNAL EFFECTS: none.                                       *
*                                                               *
*****************************************************************
*                                                               *
* LOGIC INFORMATION FOR drau                                    *
*                                                               *
* MODULES CALLED: none                                          *
*                                                               *
* INITIAL REFINEMENT:                                           *
*    display_memory[a]   := x                                   *
*    display_memory[a+1] := y                                   *
*    a := a + 2                                                 *
*                                                               *
*****************************************************************
;
INTEGER PROCEDURE drau(a,x,y);
   VALUE   a,x,y;
   INTEGER a,x,y;                                          ENTRY;
   BEGIN  & drau &
      ldxy[a]   := x AND %FFF;
      ldxy[a+1] := y AND %FFF;
      drau := a + 2;
   END drau;
```

```
SDISMON.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE  4

$EJECT;
COMMENT                                                         xdrau
*****************************************************************
*                                                               *
* EXTERNAL SPECIFICATION FOR xdrau                              *
*                                                               *
* FUNCTION: Draw a line from the present "pen" position to the  *
*           coordinate (x,y).  Begin at location "a" in the display *
*           memory and return the next available display memory *
*           location.  Use the current display memory y-coordinate and *
*           the supplied x-coordinate.                          *
*                                                               *
* DECLARATION INFORMATION:                                      *
*    INTEGER PROCEDURE xdrau(a,x)                               *
*       VALUE   a,x                                             *
*       INTEGER a,x                                             *
*                                                               *
*    INPUT:   a          integer    display location            *
*                                      (0 to 16383).            *
*             y          integer    y-coordinate (-4096 to +4095). *
*                                                               *
*    OUTPUT:  xdrau      integer    next available display location. *
*                                                               *
* EXTERNAL EFFECTS: none.                                       *
*                                                               *
*****************************************************************
*                                                               *
* LOGIC INFORMATION FOR xdrau                                   *
*                                                               *
* MODULES CALLED: none                                          *
*                                                               *
* INITIAL REFINEMENT:                                           *
*    display_memory[a] := x                                     *
*    a := a + 2                                                 *
*                                                               *
*****************************************************************
;
INTEGER PROCEDURE xdrau(a,x);
   VALUE   a,x;
   INTEGER a,x;                                            ENTRY;
   BEGIN  & xdrau &
      ldxy[a]   := x AND %FFF;
      xdrau := a + 2;
   END xdrau;
```

```
SDISMON.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE  5

$EJECT;
COMMENT                                                         ydrau
*****************************************************************
*                                                               *
* EXTERNAL SPECIFICATION FOR ydrau                              *
*                                                               *
* FUNCTION: Draw a line from the present "pen" position to the  *
*           coordinate (x,y).  Begin at location "a" in the display *
*           memory and return the next available display memory *
*           location.  Use the current display memory x-coordinate and *
*           the supplied y-coordinate.                          *
*                                                               *
* DECLARATION INFORMATION:                                      *
*    INTEGER PROCEDURE ydrau(a,y)                               *
*       VALUE   a,y                                             *
*       INTEGER a,y                                             *
*                                                               *
*    INPUT:   a          integer    display location            *
*                                      (0 to 16383).            *
*             y          integer    y-coordinate (-4096 to +4095). *
*                                                               *
*    OUTPUT:  ydrau      integer    next available display location. *
*                                                               *
* EXTERNAL EFFECTS: none.                                       *
*                                                               *
*****************************************************************
*                                                               *
* LOGIC INFORMATION FOR ydrau                                   *
*                                                               *
* MODULES CALLED: none                                          *
*                                                               *
* INITIAL REFINEMENT:                                           *
*    display_memory[a+1] := y                                   *
*    a := a + 2                                                 *
*                                                               *
*****************************************************************
;
INTEGER PROCEDURE ydrau(a,y);
   VALUE   a,y;
   INTEGER a,y;                                            ENTRY;
   BEGIN  & ydrau &
      ldxy[a+1] := y AND %FFF;
      ydrau := a + 2;
   END ydrau;
```

```
SOISMON.WORK.PO8S10          THU, DEC 22, 1983, 10:33 AM    PAGE  6


REJECT;
COMMENT                                                          move
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR move                                           *
*                                                                           *
* FUNCTION: Draw a blank line from the present "pen" position to the        *
*           coordinate (x,y).  Begin at location "a" in the display         *
*           memory and return the next available display memory             *
*           location.                                                       *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*    INTEGER PROCEDURE move(a,x,y)                                          *
*       VALUE   a,x,y                                                       *
*       INTEGER a,x,y                                                       *
*                                                                           *
*    INPUT:   a           integer    display location                     *
*                                       (0 to 16383).                       *
*             x           integer    x-coordinate (-4096 to +4095).       *
*             y           integer    y-coordinate (-4096 to +4095).       *
*                                                                           *
*    OUTPUT:  move        integer    next available display location.      *
*                                                                           *
* EXTERNAL EFFECTS: None.                                                   *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR move                                                *
*                                                                           *
* MODULES CALLED: None                                                      *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*    display_memory[a]   := x  (blanked)                                    *
*    display_memory[a+1] := y                                               *
*    a := a + 2                                                             *
*                                                                           *
*****************************************************************************
;
INTEGER PROCEDURE move(a,x,y);
   VALUE   a,x,y;
   INTEGER a,x,y;                                                ENTRY;
   BEGIN  & move &
      idxy[a]   := blanked + (x AND XFFF);
      idxy[a+1] := y AND XFFF;
      move := a + 2;
   END move;



INTEGER PROCEDURE movcch(a,row,col);
   VALUE   a,row,col;
   INTEGER a,row,col;                                            ENTRY;
   & row 1, col 1 is upper left character position &
   & movech(a,r,c) == move(a, -12S*r, 64*(c-1) )  &
   BEGIN  & move &
      idxy[a]   := blanked + LEFT((col-1 AND X3F), 6);
```

```
SOISMON.WORK.PO8S10          THU, DEC 22, 1983, 10:33 AM    PAGE  7

      idxy[a+1] := LEFT((-row  AND X1F), 7);
      nevech := a + 2;
   END move;



INTEGER PROCEDURE plot(a,x,y,penctl,linectl);
   VALUE   a,x,y,penctl,linectl;
   INTEGER a,x,y,penctl,linectl;                                 ENTRY;
   BEGIN  & plot &
      idxy[a]   := (x AND XFFF) + LEFT((penctl AND X3),12);
      idxy[a+1] := (y AND XFFF) + LEFT((linectl AND X3),12);
      plot := a + 2;
   END plot;



INTEGER PROCEDURE printch(a,ch);
   VALUE a,ch;
   INTEGER a;
   BYTE ch;                                                      ENTRY;
   BEGIN  & printch &
      junpsub[a] := char + (INTEGER(ch) AND XOOFF);
      printch := a + 1;
   END printch;



INTEGER PROCEDURE crlf(a);
   VALUE a;
   INTEGER a;                                                    ENTRY;
   BEGIN & crlf &
      INTEGER CONSTANT  cr          := XOOOD,
                        lf          := XOOOA;
      junpeub[a]   := char + cr;
      junpsub[a+1] := char + lf;
      crlf := a+2;
   END crlf;



INTEGER PROCEDURE lb(a,string);
   VALUE a,string;
   INTEGER a;
   ALPHA string;                                                 ENTRY;
   BEGIN  & lb &
      INTEGER i;
      BYTE POINTER ptr = string;

      FOR i := 1 UNTIL ptr[0] DO
         BEGIN % for &
            junpsub[a] := char + (INTEGER(ptr[i]) AND XOOFF);
            a := a + 1;
         END for;
      lb := a;
   END lb;
```

```
SOISMON.WORK.PO8S10          THU, DEC 22, 1983, 10:33 AM    PAGE  8



INTEGER PROCEDURE setattribute(a, attribute);
   VALUE a,attribute;
   INTEGER a;
   BYTE attribute;                                               ENTRY;
   BEGIN  & setattribute &
      ida(a) := LEFT( INTEGER(attribute AND XOF), &);
      setattribute := a + 1;
   END setattribute;



INTEGER PROCEDURE jnp(a, address);
   VALUE a, address;
   INTEGER a, address;                                           ENTRY;
   BEGIN  & jnp &
      junp[a] := address AND X3FFF;
      jnp := a + 1;
   END jnp;



INTEGER PROCEDURE jsr(a, address);
   VALUE a, address;
   INTEGER a, address;                                           ENTRY;
   BEGIN  & jsr &
      junpsub[a] := address AND X3FFF;
      jsr := a + 1;
   END jsr;



INTEGER PROCEDURE rts(a, attribute);
   VALUE a,attribute;
   INTEGER a;
   BYTE attribute;                                               ENTRY;
   BEGIN  & rts &
      rtnsub[a] := LEFT( INTEGER(attribute AND XOF), 8);
      rts := a + 1;
   END rts;



INTEGER PROCEDURE dg_write(a, data);
   VALUE a,data;
   INTEGER a,data;                                               ENTRY;
   BEGIN & dg_write &
      dg[a] := data;
      dg_write := a + 1;
   END dg_write;
```

```
SOISMON.WORK.PO8S10          THU, DEC 22, 1983, 10:33 AM    PAGE  9

REJECT;
COMMENT                                                       print_hex
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR print_hex                                      *
*                                                                           *
* FUNCTION: Display least significant byte of a number as a                 *
*           hexadecimal digit.                                              *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*    INTEGER PROCEDURE print_hex(a,num)                                     *
*       VALUE   a,num                                                       *
*       INTEGER a,num                                                       *
*                                                                           *
*    INPUT:   a           integer    display location                     *
*                                       (0 to 16383).                       *
*             num         integer    integer number to be displayed.      *
*                                                                           *
*    OUTPUT:  print_hex   integer    next available display location.      *
*                                                                           *
* EXTERNAL EFFECTS: none.                                                   *
*                                                                           *
* COMMENT:                                                                  *
*    ---------- WARNING ----------                                         *
*    This routine is not planned for inclusion in production software.      *
* It is provided at this time for convenience until a complete i/o          *
* formatting and driver package is completed.                               *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR print_hex                                           *
*                                                                           *
* MODULES CALLED: none                                                      *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*    mask off least significant byte.                                       *
*    convert to hexadecimal.                                                *
*    output the resulting character.                                        *
*                                                                           *
*****************************************************************************
;
INTEGER PROCEDURE print_hex(a,num);
   VALUE   a,num;
   INTEGER a,num;                                                ENTRY;
   BEGIN  & print_hex &
      num := num AND XF;
      print_hex := printch(a, num + (If num<10 THEN 48 ELSE 55) );
   END print_hex;
```

```
SDISMON.UORK.PO8510          THU, DEC 22, 1983, 10:33 AM    PAGE 10


%EJECT;
COMMENT                                                          dg_hex
*****************************************************************
*                                                               *
* EXTERNAL SPECIFICATION FOR dg_hex                             *
*                                                               *
* FUNCTION: Display a specified number of least significant digits *
*           of a number.                                        *
*                                                               *
* DECLARATION INFORMATION:                                      *
*    INTEGER PROCEDURE dg_hex(a,num,digits)                     *
*       VALUE   a,num,digits                                    *
*       DOUBLE  digits                                          *
*       INTEGER a,num                                           *
*                                                               *
*    INPUT:   a          integer    display location            *
*                                    (0 to 16383).              *
*             num        double     number to be displayed.     *
*             digits     integer    number of digits to be displayed *
*                                                               *
*    OUTPUT:  dg_hex     integer    next available display location. *
*                                                               *
* EXTERNAL EFFECTS: none.                                       *
*                                                               *
* COMMENT:                                                      *
*    ------------------- WARNING -------------------------     *
*    This routine is not planned for inclusion in production software. *
* It is provided at this time for convenience until a complete i/o *
* formatting and driver package is completed.                   *
*                                                               *
*****************************************************************
*                                                               *
* LOGIC INFORMATION FOR dg_hex                                  *
*                                                               *
* MODULES CALLED: none                                          *
*                                                               *
* INITIAL REFINEMENT:                                           *
*    move most significant byte to the least significant position. *
*    REPEAT digits OO                                           *
*       convert least significant byte to hex.                  *
*       output hex byte.                                        *
*       rotate next significant byte to the least significant position.*
*                                                               *
*****************************************************************
;
INTEGER PROCEDURE dg_hex(a,num,digits);
   VALUE   a,num,digits;
   DOUBLE  num;
   INTEGER a,digits;                                             ENTRY;
   BEGIN  & dg_hex &
      num := RLEFT(num, 4*(9-digits));
      REPEAT digits OO
         BEGIN & repeat &
            a := print_hex(a,num);
            num := RLEFT(num,4);
         END repeat;
      dg_hex := a;
   END dg_hex;


INTEGER PROCEDURE init_display;                                  ENTRY;
   BEGIN & init_display &
      INTEGER addr;
      INTEGER POINTER dg_ptr;


      & initialize pointers &
      STPKTR(lda,    RDRS(dgran) );
      STPNTR(rtnsub, RDRS(dgran) + %10000);
      STPNTR(lday,   RDRS(dg_lday) );    & offset included in fioconfig &
      STPNTR(junpsub,RDRS(dgran) + %40000);
      STPNTR(junp,   RDRS(dgran) + %60000);

      & initialize display &

      addr := 0;
      addr := setattribute(addr, eod);
      init_display := setattribute(addr,clear);

   END init_display;


INTEGER PROCEDURE clear_display;                                 ENTRY;
   BEGIN & clear_display &
      INTEGER addr,
              eod_attribute;
      INTEGER POINTER dg_ptr;

      eod_attribute := LEFT( INTEGER(eod RNO %OF), S );

      STPNTR(dg_ptr, RDRS(dgran));

      REPEAT %2E7F DO      & %2E7F = 15384 - charset - monitor_display &
         BEGIN & repeat &
            dg_ptr := eod_attribute;
            STPKTR(dg_ptr, RDRS(dg_ptr[1]) );
         END;  & repeat &

      clear_display := init_display;

   END;  & clear_display &

END$
```

```
C0ISP.UORK.PDS510            THU, DEC 22, 1983, 10:33 AM    PAGE  1


INTEGER CONSTANT

cmd_single_ch := 246,
cmd_dual_ch := 247,
cmd_data := 248,
cmd_mem := 249,
cmd_d_and_m := 250,
end_math := 251,
cmd_d_into_m := 253,
cmd_overlay := 254,
cmd_split := 255,
cmd_memory1 := 256,
cmd_memory2 := 257,
cmd_memory3 := 258,
cmd_memory4 := 259,
cmd_memory_ch1 := 262,
cmd_memory_ch2 := 263,
cmd_d_plus_m := 264,
cmd_d_minus_m := 265,
end_d_mpy_m := 266,
cmd_d_div_m := 267,
cmd_groups := 0;
```

```
FOISP.WORK.PD8510            THU, DEC 22, 1983, 10:33 AM    PAGE  1


COMMENT
  This is a software generated file !!!
  Changes must be made in SKIMFO.UORK
  Run GENSK.LANI to re-generate file;

SUBROUTINE procS;  ENTRY;
BEGIN

CASE command_token-246 OF
BEGIN
& 246 &
select_trace_mode( single_ch );
& 247 &
BEGIN END;
& 248 &
set_trace_type( trace_data );
& 249 &
set_trace_type( trace_mem );
& 250 &
set_trace_type( trace_data_and_mem );
& 251 &
set_trace_type( entry_ch_integer(ch_math_op) );
& 252 &
BEGIN END;
& 253 &
set_trace_type( trace_data_into_mem );
& 254 &
select_trace_mode( overlay );
& 255 &
select_trace_mode( split );
& 256 &
select_memory( mem1 );
& 257 &
select_memory( mem2 );
& 258 &
select_memory( mem3 );
& 259 &
select_memory( mem4 );
& 260 &
BEGIN END;
& 261 &
BEGIN END;
& 262 &
select_memory( data1 );
& 263 &
select_memory( data2 );
& 264 &
select_math_op( trace_data_plus_mem );
& 265 &
select_math_op( trace_data_minus_mem );
& 266 &
select_math_op( trace_data_times_mem );
& 267 &
select_math_op( trace_data_div_mem );
END;
```

```
FDISP.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE  2

END proc8;
```

```
CDISPLAY.WORK.PDS510       THU, DEC 22, 1983, 10:33 AM    PAGE  1

& attributes &
BYTE CONSTANT  nop          := 0,
               cleer        := 1,
               incroff      := 2,
               incr         := 3,
               charincroff  := 4,
               cherincr     := 5,
               brighteff    := 6,
               bright       := 7,
               dimoff       := 8,
               dim          := 9,
               oodoff       := 10,
               eod          := 11,
               blinkoff     := 12,
               blink        := 13,
               testdgoff    := 14,
               toetdg       := 15;
INTEGER CONSTRNT
               normal       := 0,   & x-coordinate attributes &
               blank        := 1,   & "penctl"                &
               dotted       := 2,
               dotted_blank:= 3,
               alou         := 1,   & y-coordinate attributes &
               dinchr       := 2,   & "linectl"               &
               dinchr_elou := 3;
```

```
FOISPLAY.WORK.PD8510       THU, DEC 22, 1983, 10:33 AM    PAGE  1

INTEGER PROCEDURE drau(a,x,y);
   VNLUE   a,x,y;
   INTEGER a,x,y;                                    EXTERNAL;
INTEGER PROCEOURE nove(a,x,y);
   VRLUE   a,x,y;
   INTEGER a,x,y;                                    EXTERNAL;
INTEGER PROCEDURE nove2(a,x,y);
   VRLUE   a,x,y;
   INTEGER a,x,y;                                    EXTERNAL;
INTEGER PROCEDURE novech(a,rou,col);
   VRLUE   a,rou,col;
   INTEGER a,rou,col;                                EXTERNAL;
INTEGER PROCEDURE novech2(a,rou,col);
   VRLUE   a,rou,col;
   INTEGER a,rou,col;                                EXTERNAL;
INTEGER PROCEDURE plot(a,x,y,penctl,linectl);
   VRLUE   a,x,y,penctl,linectl;
   INTEGER a,x,y,penctl,linectl;                     EXTERNAL;
INTEGER PROCEDURE printch(a,ch);
   VRLUE a,ch;
   INTEGER a;
   BYTE ch;                                          EXTERNAL;
INTEGER PROCEOURE crlf(a);
   VRLUE a;
   INTEGER a;                                        EXTERNRL;
INTEGER PROCEDURE Ib(a,string);
   VRLUE a,string;
   INTEGER a;
   RLPHR string;                                     EXTERNAL;
INTEGER PROCEDURE setattribute(a, attribute);
   VRLUE a,attribute;
   INTEGER a;
   BYTE attribute;                                   EXTERNAL;
INTEGER PROCEDURE jnp(a, address);
   VRLUE a, address;
   INTEGER a, address;                               EXTERNAL;
INTEGER PROCEDURE jsr(a, address);
   VRLUE a, address;
   INTEGER a, address;                               EXTERNAL;
INTEGER PROCEDURE rts(a, attribute);
   VRLUE a,attribute;
   INTEGER a;
   BYTE attribute;                                   EXTERNRL;
```

```
SOISPLRY.U98K.PD&S10       THU, DEC 22, 1983, 10:33 AM    PAGE  1

M68KL,P,"display"
BEGIN

NFILE cdisplay.uork;
NFILE fiocnfig.uork;

COMMENT                                                          display
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR display                                        *
*                                                                           *
* FUNCTION: to encapsulate a set of utility procedures for using the        *
*           display.                                                        *
*                                                                           *
* COMMENTS:  The routine "lnit_display" nust be called once prior           *
*            to using any of the following routines to initialize           *
*            pointers used by the following routines.                       *
*                                                                           *
*            Rll of the following routinee uee an "a" paraneter to          *
*            epecify the location in the display nenory uhere the           *
*            display instruction uill be etored.  "R"=000                   *
*            corresponds to the first location in the dieplay nenory        *
*            (MC6$000 address XFF0000), and "a"=X3FFF corresponds           *
*            to the last location (MC6$000 address XFF7FFE).  "a"           *
*            are "uord" or "integer" addreeses starting fron the baee       *
*            of the display nenory -- successive locations differ by        *
*            one, as opposed to tuo for byte addresses used by the          *
*            MC68000.                                                       *
*                                                                           *
*            Caution should be exercised in ueing display locations         *
*            "a"=X3000 through X3FFF to avoid danaging the                  *
*            character set vectors that are etored in thoee locations.      *
*                                                                           *
*****************************************************************************
;
INTEGER CONSTANT  blanked := X1000,   & blank - x-coordinate attribute &
                  char    := X3000,   & character set block address    &
                  rtnsub  := X2000,   & opcode bits for RTS instruction&
                  coord_nask := X0FFF;
INTEGER POINTER   ldxy,
                  Ida,
                  junp,
                  junpsub;
INTEGER POINTER   dg = Ida;

COMMENT
 It is Faster to use an integer procedure (Function) returning the
increnented display address than to pass the display address by
reference, prinarily due to the tine required to increnent the
display address uhen passed by reference.
 It is also Faster to indee using the address and the address+1
and then return the address+2 than it is to increnent the address
betueen the tuo coordinates.
```

```
$DISPLAY.WORK.POS510          THU, DEC 22, 1983, 10:33 AM    PAGE  2
```

```
$DISPLAY.WORK.POS510          THU, DEC 22, 1983, 10:33 AM    PAGE  3

$EJECT;
COMMENT                                                              draw
*********************************************************************
*                                                                   *
* EXTERNAL SPECIFICATION FOR draw                                   *
*                                                                   *
* FUNCTION: Draw a line from the present "pen" position to the      *
*           coordinate (x,y).  Begin at location "a" in the display *
*           memory and return the next available display memory     *
*           location.                                               *
*                                                                   *
* DECLARATION INFORMATION:                                          *
*    INTEGER PROCEDURE draw(a,x,y)                                  *
*       VALUE   a,x,y                                               *
*       INTEGER a,x,y                                               *
*                                                                   *
*    INPUT:   a          integer    display location               *
*                                     (0 to 16333).                 *
*             x          integer    x-coordinate (-4096 to +4095).  *
*             y          integer    y-coordinate (-4096 to +4095).  *
*                                                                   *
*    OUTPUT:  draw       integer    next available display location. *
*                                                                   *
* EXTERNAL EFFECTS: none.                                           *
*                                                                   *
*********************************************************************
*                                                                   *
* LOGIC INFORMATION FOR draw                                        *
*                                                                   *
* MODULES CALLED: none                                              *
*                                                                   *
* INITIAL REFINEMENT:                                               *
*    display_memory[a]   := x                                       *
*    display_memory[a+1] := y                                       *
*    a := a + 2                                                     *
*                                                                   *
*********************************************************************
;
INTEGER PROCEDURE draw(a,x,y);
   VALUE   a,x,y;
   INTEGER a,x,y;                                              ENTRY;
   BEGIN  & draw &
      idxy[a]   := x AND coord_mask;
      idxy[a+1] := y AND coord_mask;
      draw := a + 2;
   END draw;
```

```
$DISPLAY.WORK.POS510          THU, DEC 22, 1983, 10:33 AM    PAGE  4

$EJECT;
COMMENT                                                             xdraw
*********************************************************************
*                                                                   *
* EXTERNAL SPECIFICATION FOR xdraw                                  *
*                                                                   *
* FUNCTION: Draw a line from the present "pen" position to the      *
*           coordinate (x,y).  Begin at location "a" in the display *
*           memory and return the next available display memory     *
*           location.  Use the current display memory y-coordinate and *
*           the supplied x-coordinate.                              *
*                                                                   *
* DECLARATION INFORMATION:                                          *
*    INTEGER PROCEDURE xdraw(a,x)                                   *
*       VALUE   a,x                                                 *
*       INTEGER a,x                                                 *
*                                                                   *
*    INPUT:   a          integer    display location               *
*                                     (0 to 16383).                 *
*             y          integer    y-coordinate (-4096 to +4095).  *
*                                                                   *
*    OUTPUT:  xdraw      integer    next available display location. *
*                                                                   *
* EXTERNAL EFFECTS: none.                                           *
*                                                                   *
*********************************************************************
*                                                                   *
* LOGIC INFORMATION FOR xdraw                                       *
*                                                                   *
* MODULES CALLED: none                                              *
*                                                                   *
* INITIAL REFINEMENT:                                               *
*    display_memory[a] := x                                         *
*    a := a + 2                                                     *
*                                                                   *
*********************************************************************
;
INTEGER PROCEDURE xdraw(a,x);
   VALUE   a,x;
   INTEGER a,x;                                                ENTRY;
   BEGIN  & xdraw &
      idxy[a]   := x AND coord_mask;
      xdraw := a + 2;
   END xdraw;
```

```
$DISPLAY.WORK.POS510          THU, DEC 22, 1983, 10:33 AM    PAGE  5

$EJECT;
COMMENT                                                             ydraw
*********************************************************************
*                                                                   *
* EXTERNAL SPECIFICATION FOR ydraw                                  *
*                                                                   *
* FUNCTION: Draw a line from the present "pen" position to the      *
*           coordinate (x,y).  Begin at location "a" in the display *
*           memory and return the next available display memory     *
*           location.  Use the current display memory x-coordinate and *
*           the supplied y-coordinate.                              *
*                                                                   *
* DECLARATION INFORMATION:                                          *
*    INTEGER PROCEDURE ydraw(a,y)                                   *
*       VALUE   a,y                                                 *
*       INTEGER a,y                                                 *
*                                                                   *
*    INPUT:   a          integer    display location               *
*                                     (0 to 16383).                 *
*             y          integer    y-coordinate (-4096 to +4095).  *
*                                                                   *
*    OUTPUT:  ydraw      integer    next available display location. *
*                                                                   *
* EXTERNAL EFFECTS: none.                                           *
*                                                                   *
*********************************************************************
*                                                                   *
* LOGIC INFORMATION FOR ydraw                                       *
*                                                                   *
* MODULES CALLED: none                                              *
*                                                                   *
* INITIAL REFINEMENT:                                               *
*    display_memory[a+1] := y                                       *
*    a := a + 2                                                     *
*                                                                   *
*********************************************************************
;
INTEGER PROCEDURE ydraw(a,y);
   VALUE   a,y;
   INTEGER a,y;                                                ENTRY;
   BEGIN  & ydraw &
      idxy[a+1] := y AND coord_mask;
      ydraw := a + 2;
   END ydraw;
```

```
SDISPLAY.WORK.PDBS10          THU, DEC 22, 1983, 10:33 AM    PAGE  6


@EJECT;
COMMENT                                                              move
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR move                                           *
*                                                                           *
* FUNCTION: Draw a blank line from the present "pen" position to the        *
*           coordinate (x,y).  Begin at location "a" in the display         *
*           memory and return the next available display memory             *
*           location.                                                       *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*    INTEGER PROCEDURE move(a,x,y)                                          *
*       VALUE   a,x,y                                                       *
*       INTEGER a,x,y                                                       *
*                                                                           *
*    INPUT:   a          integer    display location                      *
*                                      (0 to 16383).                        *
*             x          integer    x-coordinate (-4096 to +4095).        *
*             y          integer    y-coordinate (-4096 to +4095).        *
*                                                                           *
*    OUTPUT:  move       integer    next available display location.       *
*                                                                           *
* EXTERNAL EFFECTS: none.                                                   *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR move                                                *
*                                                                           *
* BODULES CALLED: none                                                      *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*    display_memory[a]   := a  (blanked)                                    *
*    display_memory[a+1] := y                                               *
*    a := a + 2                                                             *
*                                                                           *
*****************************************************************************
;
INTEGER PROCEDURE move(a,x,y);
   VALUE   a,x,y;
   INTEGER a,x,y;                                                  ENTRY;
   BEGIN & move &
      ldxy[a]   := blanked + (x RND coord_mask);
      ldxy[a+1] := y RND coord_mask;
      move := a + 2;
   END;  & move &

INTEGER PROCEDURE move2(a,x,y);
   VALUE   a,x,y;
   INTEGER a,x,y;                                                  ENTRY;
   BEGIN & move2 &
      a     := move(a,x,y);
      move2 := move(a,x,y);
   END;  & move2 &
```

```
SDISPLAY.WORK.PDBS10          THU, DEC 22, 1983, 10:33 AM    PAGE  7


INTEGER PROCEDURE novech(a,row,col);
   VALUE   a,row,col;
   INTEGER a,row,col;                                              ENTRY;
   & row 1, col 1 is upper left character position &
   & novech(a,r,c) := move(a, -128*r, 64*(c-1) )   &
   BEGIN & novech &
      ldxy[a]   := blanked + LEFT((col-1 RND X003F), 6);
      ldxy[a+1] := LEFT((-row  RND X001F), 7);
      novech := a + 2;
   END;  & novech &

INTEGER PROCEDURE novech2(a,row,col);
   VALUE   a,row,col;
   INTEGER a,row,col;                                              ENTRY;
   BEGIN & novech2 &
      a     := novech(a,row,col);
      novech2 := novech(a,row,col);
   END;  & novech2 &


INTEGER PROCEDURE plot(a,x,y,penctl,linectl);
   VALUE   a,x,y,penctl,linectl;
   INTEGER a,x,y,penctl,linectl;                                   ENTRY;
   BEGIN  & plot &
      ldxy[a]   := (x AND coord_mask) + LEFT((penctl AND X0003),12);
      ldxy[a+1] := (y AND coord_mask) + LEFT((linectl AND X0003),12);
      plot := a + 2;
   END plot;


INTEGER PROCEDURE printch(a,ch);
   VALUE a,ch;
   INTEGER a;
   BYTE ch;                                                        ENTRY;
   BEGIN  & printch &
      jumpsub[a] := char + (INTEGER(ch) RND X00FF);
      printch := a + 1;
   END printch;


INTEGER PROCEDURE crlf(a);
   VALUE a;
   INTEGER a;                                                      ENTRY;
   BEGIN & crlf &
      INTEGER CONSTANT  cr         := X0000,
                        IF         := X000R;
      jumpsub[a]   := char + cr;
      jumpsub[a+1] := char + IF;
      crlf := a+2;
   END crlf;
```

```
SDISPLAY.WORK.PDBS10          THU, DEC 22, 1983, 10:33 AM    PAGE  8


INTEGER PROCEDURE lb(a,string);
   VALUE a,string;
   INTEGER a;
   ALPHA string;                                                   ENTRY;
   BEGIN  & lb &
      INTEGER i;
      BYTE POINTER ptr = string;

      FOR i := 1 UNTIL ptr[0] DO
         BEGIN & for &
            jumpsub[a] := char + (INTEGER(ptr[i]) AND X00FF);
            a := a + 1;
         END for;
      lb := a;
   END lb;


INTEGER PROCEDURE setattribute(a, attribute);
   VALUE a,attribute;
   INTEGER a;
   BYTE attribute;                                                 ENTRY;
   BEGIN  & setattribute &
      lda[a] := LEFT( INTEGER(attribute AND X00OF), 3);
      setattribute := a + 1;
   END setattribute;


INTEGER PROCEDURE jmp(a, address);
   VALUE a, address;
   INTEGER a, address;                                             ENTRY;
   BEGIN  & jmp &
      jump[a] := address AND X3FFF;
      jmp := a + 1;
   END jmp;


INTEGER PROCEDURE jsr(a, address);
   VALUE a, address;
   INTEGER a, address;                                             ENTRY;
   BEGIN  & jsr &
      jumpsub[a] := address AND X3FFF;
      jsr := a + 1;
   END jsr;


INTEGER PROCEDURE rts(a, attribute);
   VALUE a,attribute;
   INTEGER a;
   BYTE attribute;                                                 ENTRY;
   BEGIN  & rts &
      dg[a] := rtnsub OR LEFT( INTEGER(attribute AND X00OF), 8);
```

```
SDISPLAY.WORK.PDBS10          THU, DEC 22, 1983, 10:33 AM    PAGE  9


      rts := a + 1;
   END rts;


INTEGER PROCEDURE dg_write(a, data);
   VALUE a,data;
   INTEGER a,data;                                                 ENTRY;
   BEGIN & dg_write &
      dg[a] := data;
      dg_write := a + 1;
   END dg_write;


INTEGER PROCEDURE dg_read(a, data);
   VALUE a;
   INTEGER a,data;                                                 ENTRY;
   BEGIN & dg_read &
      data := dg[a];
      dg_read := a + 1;
   END;  & dg_read &


INTEGER PROCEDURE dg_read_xy(a, x, y);
   VALUE a;
   INTEGER a,x,y;                                                  ENTRY;
   BEGIN & dg_read_xy &
      x := dg[a];
      y := dg[a+1];
      dg_read_xy := a + 2;
   END;  & dg_read_xy &
```

```
$DISPLAY.WORK.PDS510          THU, DEC 22, 1983, 10:33 AM    PAGE 10


REJECT;
COMMENT                                                        print_hex
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICRIION FOR print_hex                                      *
*                                                                           *
* FUNCTION: Display least significant byte of a number as a                 *
*           hexadecimal digit.                                              *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*    INTEGER PROCEDURE print_hex(a,num)                                     *
*       VALUE  a,num                                                        *
*       INTEGER a,num                                                       *
*                                                                           *
*    INPUT:   a           integer   display location                        *
*                                      (0 to 16383).                        *
*             num         integer   integer number to be displayed.       *
*                                                                           *
*    OUTPUT:  print_hex   integer   next available display location.       *
*                                                                           *
* EXTERNAL EFFECTS: none.                                                   *
*                                                                           *
* COMMENT:                                                                  *
*    ------------------- WARNING -------------------------                 *
*    This routine is not planned for inclusion in production software.      *
* It is provided at this time for convenience until a complete i/o          *
* formatting and driver package is completed.                               *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR print_hex                                           *
*                                                                           *
* MODULES CALLED: none                                                      *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*    mask off least significant byte.                                       *
*    convert to hexadecimal.                                                *
*    output the resulting character.                                        *
*                                                                           *
*****************************************************************************
;
INTEGER PROCEDURE print_hex(a,num);
   VALUE  a,num;
   INTEGER a,num;                                              ENTRY;
   BEGIN  & print_hex &
      num := num AND %000F;
      print_hex := printch(a, num + (IF num<10 THEN 48 ELSE 55) );
   END print_hex;
```

```
$DISPLAY.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE 11


EJECT;
COMMENT                                                          dg_hex
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICRIION FOR dg_hex                                         *
*                                                                           *
* FUNCTION: Display a specified number of least significant digits          *
*           of a number.                                                    *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*    INTEGER PROCEDURE dg_hex(a,num,digits)                                 *
*       VALUE  a,num,digits                                                 *
*       DOUBLE  digits                                                      *
*       INTEGER a,num                                                       *
*                                                                           *
*    INPUT:   a           integer   display location                        *
*                                      (0 to 16383).                        *
*             num         double    number to be displayed.                 *
*             digits      integer   number of digits to be displayed      *
*                                                                           *
*    OUTPUT:  dg_hex      integer   next available display location.       *
*                                                                           *
* EXTERNAL EFFECTS: none.                                                   *
*                                                                           *
* COMMENT:                                                                  *
*    ------------------- UPDATING ------------------------                 *
*    This routine is not planned for inclusion in production software.      *
* It is provided at this time for convenience until a complete i/o          *
* formatting and driver package is completed.                               *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR dg_hex                                              *
*                                                                           *
* MODULES CALLED: none                                                      *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*    move most significant byte to the least significant position.          *
*    REPEAT digits OO                                                       *
*       convert least significant byte to hex.                              *
*       output hex byte.                                                    *
*       rotate next significant byte to the least significant position.     *
*                                                                           *
*****************************************************************************
;
INTEGER PROCEDURE dg_hex(a,num,digits);
   VALUE  a,num,digits;
   DOUBLE  num;
   INTEGER a,digits;                                           ENTRY;
   BEGIN  & dg_hex &
      num := RLEFT(num, 4*(9-digits));
      REPEAT digits DO
         BEGIN & repeat &
            a := print_hex(a,num);
            num := RLEFT(num,8);
         END repeat;
```

```
$DISPLAY.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE 12


      dg_hex := a;
   END dg_hex;


INTEGER PROCEDURE init_display;                                ENTRY;
   BEGIN & init_display &
      INTEGER addr,
              eod_attribute;
      INTEGER POINTER dg_ptr;

      eod_attribute := LEFT( INTEGER(eod AND %000F), 8 );

      STPNTR(dg_ptr, RDRS(dgran));

      REPEAT %2E7F DO                & %2E7F = 16384 - charset - monitor_display &
         BEGIN & repeat &
            dg_ptr := eod_attribute;
            STPNTR(dg_ptr, RDRS(dg_ptr[1]) );
         END;  & repeat &

      & initialize pointers &
      STPNTR(lda,    RDRS(dgran) );
      STPNTR(ldxy,   RDRS(dg_ldxy) );    & offset included in fiocnfig &
      STPNTR(junpaub,RDRS(dgran) + %040000);
      STPNTR(jump,   BDRS(dgran) + %060000);

      & initialize display &

      COMMENT display memory is currently full of eod's.  Location 0
            will retain its eod.  Location 1 will be replaced later by
            an attribute clear.
            ;
      init_display := 2; & 0=eod, 1=eod, return 2 -- see clear_display &

   END init_display;


INTEGER PROCEDURE clear_display;                               ENTRY;
   BEGIN & clear_display &

      init_display;                    & returned variable not used &
      setattribute( 1, clear );        &          ditto             &
      clear_display := 2;        & 0=eod, 1=clear attributes, return 2 &

   END;  & clear_display &

END$
```

```
FDISPLY2.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM    PAGE 1


INTEGER PROCEDURE xdraw(a,x);
   VALUE   a,x;
   INTEGER a,x;                                             EXTERNAL;
INTEGER PROCEDURE ydraw(a,y);
   VALUE   a,y;
   INTEGER a,y;                                             EXTERNAL;
INTEGER PROCEDURE dg_write(a, data);
   VALUE a,data;
   INTEGER a,data;                                          EXTERNAL;
INTEGER PROCEDURE dg_read(a, data);
   VALUE a;
   INTEGER a,data;                                          EXTERNAL;
INTEGER PROCEDURE dg_read_xy(a, x, y);
   VALUE a;
   INTEGER a,x,y;                                           EXTERNAL;
INTEGER PROCEDURE print_hex(a,num);
   VALUE   a,num;
   INTEGER a,num;                                           EXTERNAL;
INTEGER PROCEDURE dg_hex(a,num,digits);
   VALUE   a,num,digits;
   DOUBLE  num;
   INTEGER a,digits;                                        EXTERNAL;
INTEGER PROCEDURE init_display;                             EXTERNAL;
INTEGER PROCEDURE clear_display;                            EXTERNAL;
```

```
RDISPRAM.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM     PAGE   1

8SMB,R
 NAM dispram,7,"JTS.PD8510    7/2/83"
*
R0  REG 0
R1  REG 1
R2  REG 2
R3  REG 3
R8  REG 8
R9  REG 9
S   REG 15
*
 ENT  wrt_disp_quad
 ENT  wrt_disp_dbl
 ENT  wrt_diap_real
 ENT  wrt_diap_int
 ENT  wrt_diap_byte
 ENT  wrt_disp_str
**************************************************************************
* wrt_disp_quad( add, val ); VALUE add, val; DOUBLE add; QUAD val;
* wrt_diap_dbl(  add, val ); VALUE add, val; DOUBLE add; DOUBLE val;
* wrt_diap_real( add, val ); VALUE add, val; DOUBLE add; REAL val;
* wrt_disp_int(  add, val ); VALUE add, val; DOUBLE add; INTEGER val;
* wrt_disp_byte( add, val ); VALUE add, val; DOUBLE add; BYTE val;
* wrt_disp_str(  add, str_add ); VALUE add, str_add; DOUBLE add;
*                                                  ALPHA str_add;
*
* Theae routines handle the transfer ef data from main memory ta display
*  ( expanded ) memory. The destination address is aweys the first
*  param with the item to move ( or its address in the case of strings )
*  is the second. The string item may be in display memory.
*
* The routinee are DOUBLE PROCEDUREa, returning the incremented display
*  ram addraas in R0.
*
* The atack cannot be in diaplay memory.
*
* The present dieplay memory cannot accept byte writes and if multiword
*  write are too cloee to each other ( approx 1.5 uSecS ) probleme occur
* However the hardware will sueport byte and multi word reads.
**************************************************************************
*
```

```
RDISPRAM.WORK.RDS510          THU, DEC 22, 1983, 10:33 AM     PAGE   2

*EJECT
wrt_disp_quad EQU *
   MOVE.L R0,     R8          disp addrese ptr
   MOVE.L (S)+,   R9          save rtr addrees
   MOVE.W (3)+,   (R8)+       start moving first word of item from stack
   MOVE.W (S)+,   (R8)+
wrt_disp_2word EQU *
   MOVE.W (S)+,   (RS)+
wrt_disp_1word EQU *
   MOVE.W (S)+,   (RS)+
   MOVE.L R8,     R0           rtr inerenented disp address
   JMP    (R9)                 RTS
*
wrt_disp_dbl  EQU *
wrt_disp_real EQU *
   MOVE.L R0,     R8          disp addraas ptr
   MOVE.L (3)+,   R9          save rtr addraas
   BRA wrt_disp_2word
*
wrt_disp_int  EQU *
   MOVE.L R0,     RS          disp addraas ptr
   MOVE.L (S)+,   R9          save rtr address
   BRA wrt_disp_1word
```

```
RDISPRAM.WORK.PD8510          THU, DEC 22, 1983, 10:33 AM     PAGE   3

*EJECT
*
* wrt_diap_byte first creates the  memory contents on the stack and then
*  writes a full word . Thie requires to first read the unmodlfied byte
*  portion and ORing with the modified portion
*
* is used by disp_wrt_str
*
wrt_disp_byte EQU *
   MOVE.L R0,     R1          copy disp ptr
   BCLR   #0,     R1          clear and test for even/odd address
   MOVE.L R1,     R8          move word ptr - does not effect status CC
   BEQ    even
*          odd destination address
   MOVE.B (R8),  4(S)
   BRA    wrt
even EQU * even destination address
   MOVE.B 5(S),  4(S)         swap stack bytes
   MOVE.B 1(R8), 5(S)
wrt  EQU *
   MOVE.W 4(S),  (R8)
   ADD.L  #1,     R0
   MOVE.L (S),    R8
   ADD.W  #6,     S           reset etack pointer
   JMP    (R8)
*
*
wrt_disp_str EQU *
   MOVE.L 4(8),  R9           R0 has disp add, now R9 str add
   MOVE.B  (R9), R2           get string length
   EXTS.W  R2
loop EQU *
   MOVE.B  (R9)+,R3           get byte -- etarting with length byte
   MOVE.W  R3,  -(S)          etash on stak -- donot care about MSB half
   BSR     wrt_disp_byte
   DBRA    R2,   loop
*
   MOVE.L  (S),  R8
   ADD.W   #8,   S            clear off stack
   JMP     (R8)
*
   END
```

```
FDISPRAM.WORK.PD8510          THU, DEC 22, 1983, 10:38 AM     PAGE   1

DOUBLE PROCEDURE  wrt_disp_quad( add, val );
        VALUE add, val; DOUBLE add; QUAD val;                  EXTERNAL;
DOUBLE PROCEDURE  wrt_ditp_dbl(  add, val );
       VALUE add, val; DOUBLE add; DOUBLE val;                 EXTERNAL;
DOUBLE PROCEDURE  wrt_disp_real( add, val );
       VALUE add, val; DOUBLE add; REAL   val;                 EXTERNAL;
DOUBLE PROCEDURE  wrt_disp_int(  add, val );
       VALUE add, val; DOUBLE add; INTEGER val;                EXTERNAL;
DOUBLE PROCEDURE  wrt_disp_byte( add, val );
       VALUE add, val; DOUBLE add; BYTE   val;                 EXTERNAL;
DOUBLE PROCEDURE  wrt_disp_str(  add, str_add );
       VALUE add, str_add; DOUBLE add; ALPHA  str_add;  .      EXTERNAL;
```

```
CDISPTBL.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  1

INTEGER CONSTANT                                    & case indesee &
   dg_etop                 :=  0,
   dg_jnp                  :=  1,
   dg_jnp_neu_adr          :=  2,
   dg_move                 :=  3,
   dg_move_neu_adr         :=  4,
   dg_movech               :=  5,
   dg_movech_neu_adr       :=  6,
   dg_printch              :=  7,
   dg_setattribute_neu_adr :=  8,
   dg_move2_neu_adr        :=  9,
   dg_movech2_neu_adr      := 10;
```

```
FDISPTBL.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  1

#FILE cdisptbl.work;

INTEGER PROCEDURE display_fron_tabla( addr, table_addr );
   VALUE  addr, table_addr;
   INTEGER addr;
   DOUBLE  table_addr;                                  EXTERNAL.L;
```

```
SDISPI8L.WORK.PD8510          THU, DEC 22, 1883, 10:34 AM    PAGE  1

%68KL,P,"dieptbl"
BEGIN

NFILE fdisplay.work;
#FILE cdisptbl.work;
```

```
SDISPIBL.UORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  2

@EJECT;
COMMENT                                          dasplay_fron_table
ααααααααααααααααααααααααααααααααααααααααααααααααααααααααααααααααα
α
;
INTEGER PROCEDURE display_fron_table( addr, table_addr );
   VALUE  addr, table_addr;
   INTEGER addr;
   DOUBLE  table_addr;                                          ENTRY;
   BEGIN & display_fron_table &
      INTEGER size;
      INTEGER POINTER line;

      $1PNTR( line, table_addr );

      UNILE line <> dg_etop DO
         BEGIN & uhile &
            CASE line OF
               BEGIN & case $
& dg_atop                  & ;
& dg_jnp                   & BEGIN
                                addr := jnp(addr, line[1]);
                                size := 2;
                             END;
& dg_jnp_neu_adr           & BEGIN
                                addr := jnp(line[1], line[2]);
                                size := 3;
                             END;
& dg_move                  & BEGIN
                                addr := nove(addr, iine[1], line[2]);
                                size := 3;
                             END;
$ dg_nove_neu_adr          & BEGIN
                                addr := nove(line[1], line[2], line[3]);
                                size := 4;
                             END;
& dg_novech                & BEGIN
                                addr := novech(addr, line[1], line[2]);
                                size := 3;
                             END;
& dg_novech_neu_adr        & BEGIN
                                addr := novech(line[1],line[2],line[3]);
                                size := 4;
                             END;
& dg_printch               & BEGIN
                                addr := printch(addr,line[1]);
                                size := 2;
                             END;
& dg_setattrivute_neu_adr & BEGIN
                                addr := setattribute(line[1], line[2]);
                                size := 3;
                             END;
& dg_move2_neu_adr         & BEGIN
                                addr := move2(line[1], line[2], line[3]);
                                size := 4;
                             END;
```

```
SBISPTd1.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  3

$ dq_movech2_new_adr      $ BEGIN
                              addr :# movech2(line[1),line[2),line[3));
                              sies := 4;
                          END;
              END;  R case &
           STPNTR( line, AORS(line[size]) );
       END;  & while &

     display_from_table := addr;

  END;  R display_fren_table R

END#
```

```
##IV3.WORK.PD8510              THU, DEC 22, 1SS3, 10:34 AM    PAGE  1

ASMB,B
      NED TYPE 3 DIVIDE
      NAM DIV3,7,"jtb 3/83"
      ENT DVR3,DVR3R,DVR3N,OVR3T,OIV3,DIV3R,OIV3N,DIV3I
      ENT MOD3,MOO3R,MOO3O
      ENT DIV3C,DVR3C
      ENT DIV3R,DIV3L
      ENT LDR2R,LDR2G,LDR2N,LDR2T
*
R0    REG 0
R1    REG 1
R2    REG 2
R3    REG 3
R8    REG 8
G     REG 13
11    REG 14
S     REG 15
*
*MDR3T BSR    LDR2T
*      BRA    RDR3
*MDR3M BSR    LDR2M
*      BRA    RDR3
*M##3G BSR    LDR2G
*      ##R    MDR3
*MDR3R BSR    LDR2R
*MOR3  BSR    OVR3
*      EXG    R0,R1
*      RTS
*MOD3T BSR    LDR2I
*      BRR    MDO3
*MDD3M BSR    LDR2M
*      BRA    MOD3
MOD3G BSR    LDR2G
      ERR    MOD3
MOD3R BSR    LDR2R
MOD3  BSR    DIV3
      EXG    R0,R1
      TST.L  R0
      RTS
*
LDR2I MOVE.L 8(S),R1
      MOVE.L 4(S),8(S)
      MOVE.L (S),4(S)
      ADDO.L #4,S
      RTS
*
LDR2M EXG    R1,R8
      BOVE.L 4(S),R8
      MOVE   (R8),R8
      MOVE.L O(M,R8),RS
      EXG    R1,R8
      MODQ.L #2,4(S)
      RTS
*
LDR2G EXG    R1,R8
```

```
##IV3.WORK.PD8510              THU, DEC 22, 1983, 10:34 AM    PAGE  2

      MOVE.L 4(S),R8
      MOVE   (R8),R8
      MOVE.L (R8),#S      ** modified to dave's 1-word absolute G mode
      EXG    R1,R8
      ADGO.L #2,4(S)
      RTS
*
LDR2R EXG    R1,RS
      ROVE.L 4(S),R8
      MDD    (R8),R8      COMPUTE RDDRESS RELATIVE TO CRLL
      MOVE.L (R8),F8      FETCH OPERAND
      EXG    R1,R8
      RDDQ.L #2,4(S)
      RTS
*
DIV3T BSR    LDR2T
      BRA    DIV3
DIV3M BSR    LDR2M
      BRA    DIV3
DIV3G BSR    LDR2G
      BRR    DIV3
DIV3R BSR    LDR2R
      BRR    OIV3
DVR3T BSR    LDR2T
      BRR    OVR3
DVR3N BSR    LDR2M
      BRR    DVR3
DVR3G BSR    LDR2G
      BRA    OVR3
DVR3R BSR    LDR2R
DVR3  EXG    R1,R0   EXCHANGE REGISTERS
DIV3  TST.L  R1
      BED    DVZRD   DIVIDE BY ZERO?
      BGE    DV301   PLUS?
      CMP.L  =D-32768,R1   CHECK FOR 16 BIT DIVISOR
      BLT    DV305   NOPE
      BRR    DV302   YES
DV301 CMP.L  =D32767,R1    CHECK FOR POSITIVE 16 BIT DIVISOR
      BGT    DV305   NOPE
DV302 MOVE.L R0,-(S) SRVE R0 IN CRSE OF OVERFLOW
      DIVS   R1,R0   TRY DIVIDING
      BVS    DV304   DO LONG URY IF OVERFLOW
      RDDQ.L #4,S    DIVIDE OK, DUMP SAVED R0
      BOVE.L R0,R1   SEPRRRTE DUOTIENT RND REMRINDER
      SWRP   R1
      EXTS.L R1
      EXTS.L R0      CONVERT RESULTS TO 32 BITS
      RTS            RETURN TO CALLER
*
DV304 MOVE.L (S)+,R0 RESTORE R0 FROM STACK
DV305 MOVEM.L R2/R3,-(S)   SAVE REGISTERS
      MOVEQ  #32,R3  LOOP COUNTER
      CLR.L  R2
      CLR    -(S)    RESULT AND REMRINDER SIGN
      BSR    DIV3R   INITIALIZE REGISTERS
      BRA    DV330
```

```
PDIV3.UORK.PD8510             THU, DEC 22, 1##3, 10:34 AM    PAGE  3

DV320 LSL.L  R1,R0   GET DIVIDEND BIT
      ROXL.L #1,R2   #NSERT IN RE##INDER
DIV3L:DV330 CMP.L  R1,R2   CRN NE SUBTRRCI?
      BMI    DV340   SKIP IF N0
      SUB.L  R1,R2
      RDDO.L #1,R0   SET OUOTIENT BIT
DV340 SUBQ   #1,R3   DECREMENT LOOP COUNTER
      BGE    DV320   GO DO NEXT BIT
      MOVE.L R2,R1   POSITION REMRINDER
DV345 MOVE   (S)+,R2 GET SIGN INFO
      BGE    DV350   OUOTIENT POSITIVE
      NEG.L  R0
DV350 TSI.B  R2
      BGE    DV360   REMRINDER POSITIVE
      NEG.L  R1
DV360 MOVEM.L (S)+,R2/R3
      RTS
*
DVZRD MOVE.L =H7FFFFFFF,R0
      CLR.L  R1
      BRR    DV345
*
DIV3R TST.L  R0    POSITIVE?
      BGE    DV310
      NOT    4(S)
      NEG.L  R0
DV310 TST.L  R1    POSITIVE?
      BGE    DV315
      NOT.B  4(S)
      KEG.L  R1
DV315 RTS
      END
```

```
CDOMAIN.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  1


& time domain - [ch_domain] &
INTEGER CONSTANT  freq_domain          := 0,
                  time_domain          := 1,
                  tdr_domain           := 2,
                  aux_domain           := 3,

                  max_domain           := 3;
```

```
FDOMAIN.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  1

PROCEDURE  update_domain_vars;                              EXTERNAL;
PROCEDURE  partial_set_domain;                              EXTERNAL;
```

```
SDOMAIN.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  1

?68KL,P,"domain"
BEGIN

NFILE futil3.work;                              & for warm & & DEBUG &
NFILE cmessag0.work;          & for command_not_inplemented & & DEBUG &
RFILE cdommenu.work;
NFILE factive.work;
RFILE factive2.work;
RFILE fecttbl.work;
RFILE cchtable.work;
NFILE fchtable.work;
NFILE fchtab2.work;                                & for ch_integer &
NFILE fchtab3.work;                                & for coupled_ch &
RFILE fchdata.work;                              & for marker_state &
NFILE cdatap.work;                    & for update_raw_array, and ... &
NFILE fcommand.work;
RFILE fmenu.work;
NFILE fcontv2.work;                                & for rebuild &
RFILE fcontrol.work;             & for abort_sweep and restart_sweep &
NFILE feereen.work;           & for print_string and ecreen addresses &
NFILE fstimuli.work;             & for update_start_stop_center_span &
NFILE fstimul3.work;                         & for annotate_stimulus &
RFILE ffifo.work;                                & for write_fifo &
NFILE ffifos.work;                           & for array_update_fifo &
NFILE carray.work;          & for time_update_mask and array_ch_mask &
NFILE fcouple.work;                        & for set_coupled_status &
NFILE Ftime.work;                                & for tdr_check &
NFILE fpfr.work;                                 & for recall_pfr &
NFILE ftrace0.work;                                 & for partial &

PROCEDURE  new_format_partial;                              EXTERNAL;


INTEGER CONSTANT gate_markers_on  := Z01C0,
                 gate_markers_off := ZFE3F;
```

```
SDOMAIN.MARK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  2

%EJECT;
COMMENT                                                 update_domain_vars
*************************************************************************
*
*************************************************************************
;
PROCEDURE  update_domain_vars;                                      ENTRY;
  BEGIN & update_domain_vars &
     INTEGER fifo_word;
     BYTE    fifo_word_upper = fifo_word,
             fifo_word_lower = fifo_word+1;

     fifo_word_lower := 0;
     fifo_word_upper := time_update_mask OR (current_entry_ch AND
                                              array_ch_mask
                                            );
     write_fifo( array_update_fifo, fifo_word );
  END;  & update_domain_vars &
```

```
SDOMAIN.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  3


&EJECT;
COMMENT                                                    set_domain
*************************************************************************
*
*************************************************************************
;
PROCEDURE  partial_set_domain;                                    ENTRY;
   BEGIN & partial_set_domain &
      INTEGER start_suffix_display,
              stop_suffix_display;
      ALPHA suffix_str;
      BOOLEAN markers_coupled,
              stimulus_coupled;

      stimulus_coupled := FALSE;
      markers_coupled  := FALSE;
      IF ( ch_integer(ch_domain,1) = ch_integer(ch_domain,2) ) THEN
         BEGIN & if &
            markers_coupled := TRUE;
            IF coupled_ch(ch_start_frequency) THEN
               stimulus_coupled := TRUE;
         END;  & if &
      set_coupled_status( markers_coupled,  couple_markers );
      set_coupled_status( stimulus_coupled, couple_stimulus );

      rebuild := TRUE;                & for array vs point node change &
      suffix_str := active_suffix( active_start );
      recall_pfr;
      new_format_partial;

      IF current_entry_ch = 1 THEN
         BEGIN & if &
            start_suffix_display := start1_suffix_display;
            stop_suffix_display  := stop1_suffix_display;
         END   & if &
      ELSE
         BEGIN & else ch 2 &
            start_suffix_display := start2_suffix_display;
            stop_suffix_display  := stop2_suffix_display;
         END;  & else ch 2 &

      print_string( suffix_str,
                    stim_suffix_size,
                    start_suffix_display
                  );
      print_string( suffix_str,
                    stim_suffix_size,
                    stop_suffix_display
                  );
   END;  & partial_set_domain &

PROCEDURE  set_domain( domain );
   VALUE   domain;
   INTEGER domain;
   BEGIN & set_domain &
```

```
SDOMAIN.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  4


      set_entry_ch_integer( domain, ch_domain );
      abort_sweep;

      IF domain = aux_domain THEN                              & DEBUG &
         select_active_function( active_aux_out )              & DEBUG &
      ELSE                                                     & DEBUG &
         select_active_function( active_previous );

      partial_set_domain;

      update_domain_vars;

      update_start_stop_center_span;    & also calls annotate_stimulus &
      partial( update_raw_array );
      restart_sweep;
   END;  & set_domain &
```

```
SDOMAIN.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  5


&EJECT;
COMMENT                                              select_active_gate
*************************************************************************
*
*************************************************************************
;
PROCEDURE  select_active_gate( active_gate );
   VALUE   active_gate;
   &NTEGER active_gate;
   BEGIN & select_active_gate &
      INTEGER domain;

      IF active_gate > 0 THEN
         select_active_function( active_gate );

      marker_state := marker_state OR gate_markers_on;

   END;  & select_active_gate &
```

```
SDOMAIN.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE  6


#EJECT;
PROCEDURE set_time_window( window);     VALUE window;  INTEGER window;
BEGIN
   hilight_on( cmd_max_time_window, cmd_min_time_window);
   set_entry_ch_integer( window, ch_time_window );
   update_domain_vars;
END set_time_window ;


PROCEDURE set_gate_window( window );   VALUE window;   INTEGER window;
BEGIN
   hilight_on( cmd_max_gate_window, cmd_min_gate_window);
   set_entry_ch_integer( window, ch_gate_window );
   update_domain_vars;
END;

SUBROUTINE set_gate_status;
BEGIN
   hilight_on( cmd_gate_on, cmd_gate_off);
   abort_sweep;
   update_domain_vars;
   rebuild := TRUE;                              & updates  array node &
   restart_sweep;
END;


NFILE fdonmenu.work;

END$
```

```
CDCMMENU.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  1


INTEGER CONSTANT

cmd_freq_domain := 130,
cmd_low_pass_request := 131,
cmd_time_domain := 132,
cmd_aux_domain := 133,
cmd_setup_time_domain := 134,
cmd_setup_gate_domain := 135,
cmd_tdr_domain := 136,
cmd_tdr_step := 137,
cmd_tdr_impulse := 133,
cmd_max_time_window := 139,
cmd_normal_time_window := 140,
cmd_min_time_window := 141,
cmd_gate_on := 142,
cmd_gate_off := 143,
cmd_gate_start := 144,
cmd_gate_stop := 145,
cmd_gate_center := 146,
cmd_gate_span := 147,
cmd_max_gate_window := 149,
cmd_wide_gate_window := 150,
cmd_normal_gate_window := 151,
cmd_min_gate_window := 152,
cmd_group11 := 0;
```

```
FDCMMENU.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  1


COMMENT
  This is a software generated file !!!
  Changes must be made in SKINFD.WORK
  Run GENSK.LAKI to re-generate file;

SUBROUTINE proc11;  ENTRY;
BEGIN

CASE command_token-130 OF
BEGIN
& 130 &
BEGIN
   hilight_on( cmd_freq_domain, cmd_aux_domain);
   set_domain( freq_domain );
END;
& 131 &
BEGIN END;
& 132 &
BEGIN
   hilight_on( cmd_freq_domain, cmd_aux_domain);
   set_domain( time_domain );
END;
& 133 &
BEGIN
   warn( command_not_implemented );                          & DEBUG &
   hilight_on( cmd_freq_domain, cmd_aux_domain);
   set_domain( aux_domain );
END;
& 134 &
BEGIN END;
& 135 &
select_active_gate( 0 );                    & turn on gate markers &
& 136 &
BEGIN
   tdr_check;
   hilight_key( cmd_low_pass_request, cmd_freq_domain, cmd_aux_domain);
   set_domain( tdr_domain );
   previous_menu;
END;
& 137 &
BEGIN
   hilight_on( cmd_tdr_step, cmd_tdr_impulse);
   set_entry_ch_integer( step_tdr, ch_tdr_stimulus_type );
   update_domain_vars;
END;
& 138 &
BEGIN
   hilight_on( cmd_tdr_step, cmd_tdr_impulse);
   set_entry_ch_integer( impulse_tdr, ch_tdr_stimulus_type );
   update_domain_vars;
END;
& 139 &
set_time_window( max_window);
& 140 &
set_time_window( normal_window);
```

```
FDCMMENU.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE  2


& 141 &
set_time_window( min_window);
& 142 &
BEGIN
   set_entry_ch_integer( gate_on, ch_gating );
   set_gate_status;
END;
& 143 &
BEGIN
   set_entry_ch_integer( gate_off, ch_gating );
   marker_state := marker_state AND gate_markers_off;
   set_gate_status;
END;
& 144 &
select_active_gate( active_gate_start );
& 145 &
select_active_gate( active_gate_stop );
& 146 &
select_active_gate( active_gate_center );
& 147 &
select_active_gate( active_gate_span );
& 148 &
BEGIN END;
& 149 &
set_gate_window( max_gate );
& 150 &
set_gate_window( wide_gate );
& 151 &
set_gate_window( normal_gate );
& 152 &
set_gate_window( min_gate );
END;
END proc11;
```

```
CDTMGR.WORK.PD8510            THU, DEC 22, 1983, 10:34 AM    PAGE  1


INTEGER CONSTANT

end_directory := 1,
cmd_directory_off := 9,
cmd_next_page := 10,
cmd_prev_page := 11,
cmd_first_page := 12,
cmd_last_page := 13,
cmd_machine_dump := 18,
end_more := 26,
cmd_file_1 := 28,
end_file_2 := 29,
cmd_file8 := 35,
cmd_reg_1 := 36,
cmd_reg_2 := 37,
end_reg_3 := 38,
cmd_reg_4 := 39,
cmd_reg_5 := 40,
cmd_reg_6 := 41,
cmd_reg_7 := 42,
cmd_reg_8 := 43,
end_group1 := 0;
```

```
FDTMGR.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE  1

COMMENT
  This is a software generated file !!!
  Changes must be made in SKINFO.WORK
  Ram GENSK.LRMI to re-generate file;

SUBROUTINE proc1;  ENTRY;
BEGIN

CASE command_token-1 OF
BEGIN
& 1 &
IF valid_directory THEN
  BEGIN
    gen_menu(DIRECTORY_MENU, 1);
    list_directory;
  END;
& 2 &
setup_tape_op(record_op);
& 3 &
setup_tape_op(restore_op);
& 4 &
setup_tape_op(delete_op);
& 5 &
undelete_file;
& 6 &
BEGIN END;
& 7 &
init;
& 8 &
previous_menu;
& 9 &
BEGIN END;
& 10 &
list_directory;
& 11 &
list_directory;
& 12 &
list_directory;
& 13 &
list_directory;
& 14 &
gen_file_menu(e_param_file);
& 15 &
gen_file_menu(data_file);
& 16 &
gen_file_menu(format_file);
& 17 &
gen_file_menu (display_file);
& 18 &
gen_file_menu(machine_file);
& 19 &
gen_reg_menu(state_file);
& 20 &
gen_file_menu(state_set);
& 21 &
```

```
FDTMGR.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE  2

gen_reg_menu(memory_file);
& 22 &
gen_file_menu(memory_set);
& 23 &
gen_reg_menu(cal_file);
& 24 &
gen_file_menu(cal_set);
& 25 &
gen_reg_menu(cal_std_file);
& 26 &
& dummy statement &;
& 27 &
BEGIN END;
& 28 &
file_chosen;
& 29 &
file_chosen;
& 30 &
file_chosen;
& 31 &
file_chosen;
& 32 &
file_chosen;
& 33 &
file_chosen;
& 34 &
file_chosen;
& 35 &
file_chosen;
& 36 &
reg_chosen;
& 37 &
reg_chosen;
& 38 &
reg_chosen;
& 39 &
reg_chosen;
& 40 &
reg_chosen;
& 41 &
reg_chosen;
& 42 &
reg_chosen;
& 43 &
reg_chosen;
END;
END proc1;
```

```
SDTMGR.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE  1

$$$KL,P,"DTMGR"

BEGIN

COMMENT
$DOC+

NAME--
  DTMGR
*****************************************************************************
*
* SHORT DESCRIPTION--
*   Processes softkey commands corresponding to TAPE, SAVE, RECALL menus
*   and register menus brought up by CRL.
*
* EXTENDED DESCRIPTION--
*   This module processs tape/bubble data functions corresponding to
*   softkeys found in the following sequence of menus (brought up from
*   left to right):
*
*   Tape Menu    Data Type Menu          Register Menu     File Menu
*   ---------    --------------          -------------     ---------
*
*   (RECORD)     [INSTRUMENT STATES]     [ REG 1 )         (FILE 1)
*
*   [RESTORE]    [CRL DATA]              [ REG 2 ]         [FILE 2]
*
*   [DELETE]     [MEMORY TRACE]          [ REG 3 ]         [FILE 3]
*                                            .                 .
*                other data types do         .                 .
*                not bring up register       .                 .
*                menu:                   [ REG 4 ]         [FILE 8]
*
*                [FORMATTED DATA]
*
*                [RAW DATA]
*                    .
*                    .
*                  etc.
*
*  Data type menu provides a selection of a data type to store on or
*  restore from or delete from tape.
*
*  Register menu provides a selection of bubble registers to record data
*  from or restore data to tape.  These registers contain only certain
*  data types (cal data, instrument state, memory trace), thus this menu
*  is generated only upon selection of those data types.
*
*  File menu provides a selection of tape files of the selected data
*  type from which to store, restore, or delete a file.
*
*  NOTES: Other tape function softkeys (INIT, DIRECTORY, UN-DELETE) do
*         not bring up the subsequent menus.
*
*         [DELETE] softkey function does not cause the register menu
```

```
SDTMGR.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE  2

*         to be brought up.
*
*         Register menu contains 1-4 for [MEMORY TRACE] data type only
*
*
*  This module also handles data being saved and recalled to and from
*  bubble memory.  A standard softkey menu containing numbered registers
*  headed by a data type is used to provide a choice from which data can
*  be saved to and recalled from:
*
*  <data type>    <--- CRL DATA, MEMORY TRACE, or INSTRUMENT STATES
*  [ REG 1 ]
*
*  [ REG 2 )
*
*  [ REG 3 ]
*       .
*       .
*       .
*
*  [ REG 2 ]
*
*  An asterisk occuring immediately to the left of a "reg" softkey label
*  indicates that a register currently contains useful data, otherwise
*  that register essentially has no valid data.
*
*  CRL DATA registers are the only ones which can be deleted (and the
*  same register menu is used to provide a selection of cal registers
*  to be deleted).
*
*****************************************************************************
$DOC-;
```

```
SDTMGR.WORK.POS510              THU, DEC 22, 1983, 10:34 AM     PAGE  3


@EJECT;
@FILE fcommand.work;  & command_token &
@FILE cscreen.work;   & user display address &
@FILE fskpos.work;    & softkey display positioning info. and routines &
@FILE cmenu.work;     & softkey menu number constants to index tables  &
@FILE fmenu.work;
PFILE cdtmgr.work;    & command token values for DMTGR &

@FILE futil2.work;    & for CLEAR_MESSAGE &
@FILE futil3.work;    & for TELL, WARN &
@FILE futil4.work;    & for MACRO-TELL,WARN &
@FILE cmsgnbn.work;   & message numbers &
@FILE cmsgtape.work;

@FILE ftpmgr.work;    & tape routines &
@FILE ftpmgr2.work;
@FILE fmbmgr.work;    & bubble routines &
@FILE fcel0.work;     & save_cal routine and default_cal_mat &
@FILE fdisplay.work;  & register/file menu modifications &

@FILE cchtable.work;  & this group of externals are for machine dumps &
@FILE fcontvar.work;
@FILE fsize.work;     & for array_size &
@FILE fchtable.work;
@FILE fcmdata.work;
@FILE fchdata2.work;

@FILE frecall.work;   & for recalling instrument states &
@FILE fcontrol.work;
@FILE ftopmisc.work;  & for beep (done_tone) &

GLOBAL INTEGER tape_mbn_fn;

INTEGER CONSTANT
  record_op  := 1,
  restore_op := 2,
  delete_op  := 3,
  undelete_op := 4;
  & other <xxx>_op's (0,5,6,7) are in cmbmgr.work &

BOOLEAN data_in_bubble,
        prior_reg_menu,
        fix_reg_menu;
GLOBAL  & For debug purposes &
INTEGER file_num, reg_num,
        data_type;
GLOBAL  & for debug purposes &
DOUBLE  data_addr,
        data_byte_cnt;
GLOBAL  ALPHA data_type_str;

& table of messages corresponding to current tape/bubble operation &
INTEGER TABLE tape_prompt :=
  0,
  record_macro,
  restore_macro,
```

```
SDTMGR.WORK.POS510              THU, DEC 22, 1983, 10:34 AM     PAGE  4


  delete_macro;

INTEGER TABLE prompt1 :=
  0,
  select_record,
  select_restore,
  0,
  0,
  save_prompt,
  recall_prompt,
  delete_prompt;

INTEGER TABLE prompt2 :=
  0,
  select_file_record,
  select_file_restore,
  select_file_delete,
  0,
  saving_data,
  recalling_data,
  deleting_data;
```

```
SDTMGR.WORK.POS510              THU, DEC 22, 1983, 10:34 AM     PAGE  5


@EJECT;
COMMENT
$DOC+

NAME--
  file_size
*****************************************************************************
*
* SHORT DESCRIPTION--
*   computes number of bytes to the nearest factor of 256
*
* EXTENDED DESCRIPTION--
*   This routine rounds up to a 256 byte boundary given a number of
*   bytes.  This is used to determine the number of tape records
*   (256 bytes/record) will be required to save/recall data to/from
*   tape.
*
* INPUTS--
*   bytes = a number of bytes
*
* OUTPUTS--
*   number of bytes rounded up to nearest 256 byte boundary (double)
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   add to the given number of bytes the difference between 256 and
*     the remainder of the number bytes into 256
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
DOUBLE PROCEDURE file_size (bytes); VALUE bytes; DOUBLE bytes;
  file_size := bytes + (256 - (bytes AND 2OFF));
```

```
SDTMGR.WORK.POS510              THU, DEC 22, 1983, 10:34 PM     PAGE  6


@EJECT;
COMMENT
$DOC+

NAME--
  rau_data_info
*****************************************************************************
*
* SHORT DESCRIPTION--
*   supplies address and byte length information for rau data arrays
*
* EXTENDED DESCRIPTION--
*   This routine provides tape file information for source and
*   and destination addresses along with their corresponding byte
*   lengths for recording or restoring a tape file of rau data or
*   a machine dump (which includes rau data).
*
*   Multiple tape file information (file containing more than one
*   contiguous block of data) is stored in a table of current appending
*   data addresses (file_address) and corresponding byte lengths
*   (file_byte_cnt).
*
* INPUTS--
*   n = first available index in appending tape file information
*
* OUTPUTS--
*   n = (variable parameter) next available index in appending tape
*       file information.
*
* ROUTINES CALLED--
*   file_size
*
* ERROR CONDITIONS AND RECOVERY--
*   Range checking is done on file append indices which prevents any
*   additional address and byte length information from being processed
*   upon exceeding these bounds.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE rau_data_info (n); VALUE n; INTEGER n;
BEGIN
  INTEGER raus, i=REGISTER 6;
  raus := file_size (block_size);
```

```
SDTBG0.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE  7

  FOR i := first_acquisition_param TO last_acquisition_param DO
  IF n < max_file_appends THEN
    BEGIN                              & append all of raw data arrays &
      file_byte_cnt [n] := block_size;
      file_address [n]  := raw_base[i] - header_size;
      data_byte_cnt := data_byte_cnt + raws;
      n := n + 1;
    END;
END raw_data_info;
```

```
SDTMSD.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE  8

%EJECT;
COMMENT
$DOC+

NAME--
  machine_dump_info
**************************************************************************
*
* SHORT DESCRIPTION--
*   supplies information about the machine dump state
*
* EXTENDED DESCRIPTION--
*    *data bubble (nodule 1)
*    *current instrument state
*     formatted data
*     data (uncorrected, unformatted)
*     raw data
*     user graphics display
*
*   * = must be in this order on recording as well as restoring
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
**************************************************************************
*
* INITIAL REFINEMENT--
*
**************************************************************************
*
* REVISION LOG--
*
**************************************************************************
DECLARATION--
;
%ROUTINE machine_dump_info;                                    ENTRY;
                                        & delete entry point !!! &
BEGIN
  file_address &0& := data_addr := ADRS(min_seve);
  file_byte_cnt&0& := dump_size;
  file_address [1] := entry_ch_double (ch_f_base) - header_size;
  file_byte_cnt[1] := file_byte_cnt[2] := data_byte_ent;
  file_address [2] := entry_ch_double (ch_d_base) -header_size;
  file_address [3] := %100000+(2*user_display);
  file_byte_ent[3] := 2*(character_set-user_display);
  data_byte_ent := 2 * (file_size (data_byte_cnt)) +
                   file_size (dump_size) + file_size (file_byte_cnt[3]);
```

```
SDTMGR.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE  9

  raw_data_info(4);                    & append raw data info &
  data_byte_cnt := data_byte_cnt+131072;   & bubble 1 contents    &
END machine_dump_info;
```

```
SDTMBR.WORK.PD8S10          THU, DEC 22, 1983, 10:34 AM    PAGE 10

%EJECT;
PROCEDURE set_data_type (type);
  VALUE type; INTEGER type;
BEGIN
  data_type_str := file_type[data_type:=type];
  change_softkey (data_type_str, cmd_file_1, 1);
END set_data_type;
```

```
$DIMGR.WORK.PDS510          THU, DEC 22, 1983, 10:34 AM    PAGE 11

%EJECT;
COMMENT
$DOC*

NAME--
  new_data
*****************************************************************
*
* SHORT DESCRIPTION--
*   sets up file information for new data type
*
* EXTENDED DESCRIPTION--
*   This routine sets up information needed for saving and recalling
*   the different data types to and from tape, bubble, and RAM.
*   Such information includes destination or source addresses of data
*   being saved or recalled, number of bytes of data being saved or
*   recalled, and any "appending" data information (their addresses and
*   lengths) located non-contiguously with deleted data type.
*
*   "Appended" data information applies only to data being saved and
*   recalled to or from tape.  It is stored in or read from the first
*   record (256 bytes) of each tape file.  A copy of this information
*   is resident in RAM (whenever a tape file is recorded or restored)
*   in the following data structures:
*     - file_address*  * table of "appending" data addresses
*     - file_byte_cnt * table of "appending" data byte lengths
*                       corresponding to "appending" data addresses
*
*   Softkey labels heading bubble register and tape file menus
*   corresponding to the selected data type are also updated.
*
* INPUTS--
*   type = data type selected for saving, recalling, deleting, etc.
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   set_data_type
*   machine_dump_info
*   raw_data_info
*   entry_ch_double
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************
*
* REVISION LOG--
```

```
$DIMGR.WORK.PDS510          THU, DEC 22, 1983, 10:34 AM    PAGE 12

*
*****************************************************************
DECLARATION--
;
PROCEDURE new_data(type); VALUE type; INTEGER type;              ENTRY;
&
$DOC-&

BEGIN
  INTEGER i=REGISTER &;
  set_data_type (type);
  IF tape_mbn_fn > 0 THEN
  IF tape_mbn_fn <> delete_op THEN
    BEGIN
      FOR i := 0 TO max_file_appends DO
        file_address[i] := file_byte_ent[i] := 0;
      data_addr :* 0;
      data_byte_cnt := file_byte_cnt&DB :*
        (if type=state_file THEN save_size ELSE block_size);
      IF type = state_file THEN
        data_addr := RORS(min_save)
      ELSE
      IF type = format_file THEN
        data_addr :* entry_ch_double (ch_f_base)-header_size
      ELSE
      IF type = data_file THEN
        data_addr := entry_ch_double (ch_d_base)-header_size
      ELSE
      IF type = display_file THEN
        BEGIN
          data_addr := %100000+(2*uter_display);
          data_byte_cnt := 2*(character_set-user_display);
        END
      ELSE
      IF type = s_param_file THEN
        BEGIN
          & should instrument state be saved too ? &
          raw_data_info(0);
          data_addr := raw_base[first_acquisition_param]-header_size;
        END
      ELSE
      IF type = machine_file THEN
        machine_dump_info;
      file_address&DB := data_addr;
    END;
END new_data;
```

```
$DIMGR.WORK.PDS510          THU, DEC 22, 1983, 10:34 AM    PAGE 13

%EJECT;
COMMENT
$DOC*

NAME--
  prompt_for_data
*****************************************************************
*
* SHORT DESCRIPTION--
*   display message prompting for data selection
*
* EXTENDED DESCRIPTION--
*   This routine displays a message which prompts the user to select
*   a data type to be recorded on, restored from, or deleted from tape.
*   The tape operation selected (tape_mbn_fn) indexes into a table of
*   message prompts (tape_prompt) which displays the corresponding
*   acknowledging the operation selected.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   message prompt on display
*
* ROUTINES CALLED--
*   macro_tell
*
* ERROR CONDITIONS AND RECOVERY--
*   No range checking is done on the value of tape_mbn_fn (tape funtion
*   selected) which indexes into a fixed size table, tape_prompt.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   call routine to display message to select data
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
$DOC-;
SUBROUTINE prompt_for_data;
  macro_tell (select_tape_data, tape_prompt[tape_mbn_fn]);
```

```
$DIMGR.WORK.PDS510          THU, DEC 22, 1983, 10:34 AM    PAGE 14

%EJECT;
COMMENT
$DOC*

NAME--
  setup_tape_op
*****************************************************************
*
* SHORT DESCRIPTION--
*   sets current tape function
*
* EXTENDED DESCRIPTION--
*   This routine sets a global variable containing the current tape
*   operation to the selected tape operation.  It is invoked by pressing
*   one the [DELETE], [RECORD], or [RESTORE] softkeys from the tape
*   menu.  A softkey menu of data types is then generated to provide a
*   selection of data types the user wishes to delete, record, or
*   restore.  A message or prompt is also displayed to indicate the
*   tape function selected.
*
*   An error message is displayed if no tape or an uninitialized tape is
*   in the tape drive (and no new menu is brought up).
*
* INPUTS--
*   op = tape operation selected from tape menu
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   valid_directory
*   gen_menu
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   IF a valid tape is in the tape drive THEN
*     set tape operation variable
*     display tape operation prompt
*     generate menu of data types
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE setup_tape_op (op);
VALUE op;  INTEGER op;
```

```
SDTMGR.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE 15

&
$WOC-&

bEGIN
  IF valid_directory THEN
  BEGIN
    tape_nbn_fn := op;
    prompt_for_data;
    gen_nenu (DRTR1_MENU,1);
  END;
END setup_tape_op;
```

```
SDTMGA.WORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE 16

@EJECT;
COMMENT
@DOC=

WOME--
  gen_file_menu
*****a*****a*****************************************************************
*
* SHORT DESCRIPTIOH--
*   generattt a tape file nenu
*
* EXTENDED DESCRIPTION--
*   This routine generates the tape file nenu corresponding to the
*   data type selected fron a previous menu.  The oofthey label heading
*   the file menu is updated to correspend to the selected data type
*   and an asterisk (*) is placed to the right of any file label with
*   a tape file cmntaining that data type found in the tape directory.
*
*   R check is also nade for data types uhich represent all registers
*   of a single data type (ic: CRL DATA 1-8, MERDRY 1-4).  For these
*   cases, a global variable containing the current register number
*   selected fron a register menu is set to 1.  This will ensure that
*   all registers of these data types are recorded and restored starting
*   from register 1 to the maximum allowed register.
*
*   Rn error message it displayed if no tape or an Uninitialized tape is
*   in the tape drive (and the file menu is net brought up).
*
* INPUTS--
*   type = data type selected from previous menu
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   valid_directory
*   scan_directory
*   neu_data
*   gen_menu
*   printch
*
* ERROR CDNDITIONS AND RECOVERY--
*   No range checking done on the value of the data type selected.
*   It is assuned that the calling routine passes a value corresponding
*   to the softkey that it pressed.
*
* NOTES--
*   This routine is also invoked upon selecting a register to record
*   fron or restore to for individual register data types (such as
*   instrument states, cal data, nenory traces).
*
* ROTHOR--
*
*****************************************************************************
*
* INITIAL REFIWEMENT--
```

```
SDTHOR.UORK.PD8510          THU, DEC 22, 1983, 10:34 AM    PAGE 17

*   IF a valid tape is NOT in the tape drive THEM
*     generate outer level tape menu
*   ELSE
*     set up neu data type information for tape files and file nenu
*     generate file nenu
*     scan directory for tape file containing selected data type and
*       place asterisk to left of corresponding file label
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
OECLARRTION--
;
PROCEOURE gen_file_nehu (type);
VRLUE type;  INTEGER type;
&
$DOC-&

BEGIN
  IF NOT valid_directory THEN
    gen_nenu(TAPE_MENU,0)
  ELSE
  BEGIN
    INTEGER i,length;
    ALPHA annot;
    BYTE POINTER string=annot;
    new_data (type);
    compute_tell (data_type_str, prompt2[tape_nbn_fn]);
    IF (data_in_bubble := (data_type <= cal_set)) THEN
      IF data_type >= state_set THEN
        reg_num := 1;
    gen_nenu (FILE_MENU,1);
    FOR i := 0 TO 7 DO
      IF scan_directory (0,LEFT(data_type,4) OR (i+1)) < 0 THEN
        & indicate empty file: "FILE n --> FILE n &
        printch (field[i+8],' ');
  END;
END gen_file_nenu;
```

```
BBIMGR.WORK.PB8510          THU, DEC 22, 1983, 10:34 AM    PAGE 18

@EJECT;
COMMENT
$DOC=

NAME--
  file_chosen
*****************************************************************************
*
* SHORT DESCRIPTION--
*   performs tape operation on selected tape file
*
* EXTENDED DESCRIPTION--
*   This routine does the required tape operation on the tape file
*   number uhich has just been selected.  Appropriate tape operation
*   routines are called corresponding to the current tape operation:
*     - record
*     - restore
*     - delete
*   Upon return fron the performed tape operations, the tape menu is
*   regenerated (outer level menu).
*
*   An error message is displayed if no tape or an uninitialized tape is
*   in the tape drive.
*
* IMPUTS--
*   nun = tape file number selected
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   valid_directory
*   record_data
*   record_file
*   restore_data
*   restore_file
*   delete_file
*   tell
*
* ERROR CONDITIONS RND RECOVERY--
*   No range checking is done on the value of the file number selected.
*   It is assuned that the calling routine passes a value corresponding
*   to the softkey that is pressed.
*
* NOTES--
*
* RUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   IF a valid tape is not loaded THEN
*     re-display tape nenu and error nessage
*   ELSE
*     IF tape operation = record THEN
*       IF current data type resides in bubble THEN
```

```
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!         copy bubble data into tape file
!       ELSE
!         copy data from RAM into tape file
!     IF tape operation = restore THEN
!       IF current data type resides in bubble THEN
!         copy tape file into bubble
!       ELSE
!         copy tape file into RAM
!     IF tape operation = delete THEN
!       delete tape file from tape
!   re-display tape menu
!
!*****************************************************************************
!
! REVISION LOG--
!
!*****************************************************************************
DECLARATION--
;
SUBROUTINE file_chosen;
&
&DOC-&

BEGIN
  file_num := command_token(f-cmd_file_1;
  IF NOT valid_directory THEN
    gen_menu(TAPE_MENU,0)
  ELSE
  CASE tape_mbn_fn OF
  SBEGIN
    & nothing &   BEGIN END;
    $ record &    BEGIN
                    tell (recording_file);
                    IF data_in_bubble THEN
                      record_data (data_type,file_num,reg_num)
                    ELSE
                      record_file (data_addr, data_byte_cnt,
                                   LEFT(data_type,4) OR file_num, -1);
                  END;
    & restore  &  BEGIN
                    tell (restoring_file);
                    IF data_in_bubble THEN
                      restore_data (data_type, file_num, reg_num)
                    ELSE
                      restore_file (data_addr,
                                    LEFT(data_type,4) OR file_num, -1);
                  END;
    & delete   &  delete_file (data_type, file_num);
  END;
  data_in_bubble := FALSE;
  pop_menu (TAPE_MENU);
END file_chosen;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  reg_data
!*****************************************************************************
!
! SHORT DESCRIPTION--
!   processes register chosen to record from or restore to
!
! EXTENDED DESCRIPTION--
!   This processes the register number which has been selected to record
!   data from or restore data to a tape file.  The register number is
!   saved in a global variable which is used to inform the recording or
!   restoring routine of the chosen register once a tape file has been
!   selected.  The tape file is selected from a menu which is brought up
!   from this routine.
!
!   If a data register contains no valid data, the tape menu is re-
!   generated and an error message is displayed indicating this.
!
! INPUTS--
!   num = register number selected
!
! OUTPUTS--
!   none
!
! ROUTINES CALLED--
!   warn
!   gen_file_menu
!
! ERROR CONDITIONS AND RECOVERY--
!   No range checking is done on value of register number selected.
!   It is assumed that the calling routine passes a value corresponding
!   to the softkey that is pressed.
!
! NOTES--
!
! AUTHOR--
!
!*****************************************************************************
!
! INITIAL REFINEMENT--
!   IF the current data type selected = menory trace or cal data THEN
!     get corresponding offset into bubble directory
!     IF directory entry contains no data THEN
!       display error message indicating this
!   IF data type = instrument state OR directory entry contains data
!     THEN
!       assign global variable containing register to record from or
!         recall to with register selected
!       generate tape file menu headed by selected data type
!
!*****************************************************************************
!
```

```
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! REVISION LOG--
!   12-21-83  -- check if tape function selected is LOAD or STORE
!
!*****************************************************************************
DECLARATION--
;
PROCEDURE reg_data;
&
&DOC-&

BEGIN
  INTEGER n=REGISTER 6;
  & find index offset to menory/cal data that contains data lgth &
  IF (data_type = menory_file) THEN
    n := men_dir_offset+reg_num
  ELSE
  IF (data_type = cal_file) THEN
    n := cal_dir_offset+reg_num
  ELSE                          & other bubble data has no directory entry  &
    n := 31;                    & contains Z851D via nbnload initialization &
  IF (tape_nbn_fn = record_op) OR (tape_nbn_fn = restore_op) THEN
  IF (nbn_dir(n) = 0) AND (tape_nbn_fn = record_op) THEN
    compute_warn (data_type_str, no_reg_data)
  ELSE
    gen_file_menu (data_type);
END reg_data;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  reg_chosen
!*****************************************************************************
!
! SHORT DESCRIPTION--
!   performs bubble operation on selected data register
!
! EXTENDED DESCRIPTION--
!   This routine does the required bubble operation on the register
!   number which has just been selected.  Appropriate bubble operation
!   routines are called corresponding to the current bubble operation:
!     - save
!     - recall
!     - delete  (cal data only)
!
!   An error message is displayed when trying to recall or delete data
!   from an empty register.
!
! INPUTS--
!   num = register number selected
!
! OUTPUTS--
!   none
!
! ROUTINES CALLED--
!   tell
!   save_data
!   recall_data
!   save_cal
!   clear_cal
!   gen_menu
!   abort_sweep
!   restart_sweep
!
! ERROR CONDITIONS AND RECOVERY--
!   No range checking is done on the value of the register selected.
!   It is assumed that the calling routine passes a value corresponding
!   to the softkey that is pressed.
!
! NOTES--
!   This routine applies only to instrument states and cal data which
!   have corresponding data register menus to select from.
!
! AUTHOR--
!
!*****************************************************************************
!
! INITIAL REFINEMENT--
!   display message indicating current bubble function being done
!   update current register number to value of register selected
!   abort the sweep
!   IF current data type selected = instrument state THEN
```

```
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*     save or recall instrument state depending on bubble function
*   ELSE
*     save, recall, or delete cal data depending on bubble function
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE reg_chosen;
&
$DOC-&

BEGIN
  reg_num := (IF reg_num < 0 THEN    &MP-ID call&
                -reg_num
              ELSE
                command_token + 1 - end_reg_1);
  IF (tape_nbn_fn = record_op) OR (tape_nbn_fn = restore_op) THEN
    reg_data
  ELSE
    BEGIN
      compute_tell (data_type_str, prompt2[tape_nbn_fn]);
      abort_sweep;
      IF data_type = state_file THEN
        IF tape_nbn_fn = save_op THEN
          save_data(data_addr, data byte_cnt, data_type, reg_num)
        ELSE            & recall_op &
        BEGIN
          recall_type := normal_recall;
          IF (reg_num = &) THEN
            recall_data (RORS(last_state), data_type, prior_state)
          ELSE
            recall_data (data_addr,data_type,reg_num);
        END
      ELSE
      IF data_type = cal_file THEN
        BEGIN
          IF tape_nbn_fn = clear_op THEN
            BEGIN
              IF clear_cal (reg_num) THEN
                beep (done_tone);
              clear_param_cal (reg_num);
            END
          ELSE
            BEGIN
              default_cal_set := reg_num;
              hilight_on (cmd_reg_1, cmd_reg_8);
              IF tape_nbn_fn = save_op THEN
                save_cal;
            END;
          pop_menu (CRL_MENU);
        END;
      restart_sweep;
```

```
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    END;
END reg_chosen;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  reg_prompt
*****************************************************************************
*
* SHORT DESCRIPTION--
*   prompt user to select a save/recall register
*
* EXTENDED DESCRIPTION--
*   This routine displays a message prompting the user to select a
*   data register from which to record or restore data on tape, or
*   from which to delete data from (specifically cal coefficients).
*   The prompt is constructed based on the current tape or bubble
*   operation selected (tape_nbn_fn) and the data type selected
*   (data_type).  These variables index tables containing the message
*   numbers and strings to create the prompt.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   message prompt on display
*
* ROUTINES CALLED--
*   compute_tell
*
* ERROR CONDITIONS AND RECOVERY--
*   No range checking is done on the value of tape_nbn_fn (tape function
*   selected) into fixed size table, tape_prompt.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   display prompt to select data register
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE reg_prompt;
  compute_tell (data_type_str, prompt1[tape_nbn_fn]);
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  menu_incr
*****************************************************************************
*
* SHORT DESCRIPTION--
*   determines whether to increase or decrease a menu level
*
* EXTENDED DESCRIPTION--
*   This routine returns an increment value (1 or -1) which indicates
*   whether to increase or decrease a menu level.  It is invoked by
*   routines which generate the commonly used save/recall register menu
*   depending on whether it is generated as a result of the [PRIOR MENU]
*   key or other keys/softkeys.
*
*   A global variable, prior_menu, determines whether or not the [PRIOR
*   MENU] was pressed, and consequently returns an increment of -1.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   1 = increase to next menu level for generating data register menu
*  -1 = decrease to prior menu level for generating data register menu
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   IF [PRIOR MENU] key was NOT pressed THEN
*     return +1
*   ELSE
*     return -1
*     reset prior menu flag
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
INTEGER SUBROUTINE menu_incr;
BEGIN
  IF NOT prior_reg_menu THEN
```

```
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    menu_incr := 1
  ELSE
    BEGIN
      menu_incr := -1;
      prior_reg_menu := FALSE;
    END;
END menu_incr;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  gen_cal_info
*****************************************************************
*
* SHORT DESCRIPTION--
*   displays softkey menu of cal data save/recall registers
*
* EXTENDED DESCRIPTION--
*   This routine sets up the current cal data storage operation and
*   displays the register menu from which to select a register to save,
*   recall, or delete data.  An asterisk is placed to the left of any
*   register containing data after the menu is displayed.
*
* INPUTS--
*   op = value indicating a save, recall, or delete cal data.
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   set_data_type
*   gen_menu
*   printch
*
* ERROR CONDITIONS AND RECOVERY--
*   No range checking is done on the value of the cal data operation.
*   It is assumed that the calling routine passes a value corresponding
*   to the softkey that is pressed.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   update current data type selected as cal data
*   update data type annotation for register menu
*   update current bubble function selected based on parameter, OP
*   display message prompting user to save or recall data
*   display softkey menu of registers
*   scan bubble directory for cal data and place an asterisk to the left
*     of any register containing data
*
*****************************************************************
*
* REVISION LOG--
*   10/7/83   -- eliminated save/recall function of menu,
*                used to give a choice of which register to save to or
*                recall from by default (via DONE (cal) and CORRECTION
*                ON keys, respectively).
*   10/10/83  -- hilight default cal save/recall registers
```

```
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*
*****************************************************************
DECLARATION--
;
PROCEDURE gen_cal_info (op);
  VALUE op;  INTEGER op;                                    ENTRY;
&
$DOC-&

BEGIN
  INTEGER i;
  set_data_type (cal_file);
  IF (tape_nbn_fn := op) = clear_op THEN
    reg_prompt;
  hilight_command (cmd_reg_1-1+default_cal_set);  & default register &
  IF NOT fix_reg_menu THEN
    BEGIN
      change_softkey (" ", cmd_reg_5, 1);         & delete "power up" &
      change_softkey ("* 8 ", cmd_reg_8, 2);      & delete "last state"&
      fix_reg_menu := TRUE;
    END;
  gen_menu (REG_MENU, menu_incr);
  FOR i := 0 TO 7 DO
    IF nbn_dir[i+1] = 0 THEN
      & indicate empty reg: * n --> n &
      printch (field[i+8],' ');
END gen_cal_info;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  gen_save_menu
*****************************************************************
*
* SHORT DESCRIPTION--
*   displays save/recall menu for instrument states
*
* EXTENDED DESCRIPTION--
*   This routine generates the softkey menu for saving or recalling
*   data.  This menu is a modification of the "register menu" after it
*   has been displayed.  For saving instrument states, only 7 registers
*   are displayed to choose from.  For recalling instrument states,
*   the 8th register softkey is annotated as [LAST STATE] for the
*   purpose of recalling the "last" known state that the instrument was
*   in.
*
* INPUTS--
*   fn = value indicating a save or recall data operation
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   menu_data
*   gen_menu
*   blank_softkey
*   change_softkey
*
* ERROR CONDITIONS AND RECOVERY--
*   No range checking is done on save/recall operation value (fn).
*   It is assumed that the calling routine passes a value corresponding
*   to the (save/recall) key that is pressed.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   update current data type selected as instrument state data
*   update current bubble function selected based on parameter, FN
*   display message prompting user to save or recall data
*   display softkey menu of registers
*   IF bubble function is saving data THEN
*     delete last softkey (reg 8)
*   ELSE
*     modify last softkey's annotation to read "LAST STATE"
*
*****************************************************************
*
* REVISION LOG--
```

```
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*   10/10/83  -- turn off hilights that may have been on due to the
*                CRL use of the menu
*
*****************************************************************
DECLARATION--
;
PROCEDURE gen_save_menu(fn);
VALUE fn;  INTEGER fn;                                      ENTRY;
&
$DOC-&

BEGIN
  INTEGER i;
  mmo_data (state_file);
  hilight_off (cnd_reg_1, end_reg_8);
  tape_nbn_fn := fn;
  reg_prompt;
  IF fix_reg_menu THEN
    BEGIN
      change_softkey ("(POWER UP)", end_reg_5, 1);
      change_softkey ("LAST STATE", cnd_reg_8, 2);
      fix_reg_menu := FALSE;
    END;
  i := (IF fn > delete_op THEN 0 ELSE menu_incr);
  prior_reg_menu := FALSE;
  gen_menu (REG_MENU, i);
  blank_softkey (5);
  blank_softkey (6);
  IF fn <> recall_op THEN          $ delete LAST STATE for non-RECALL &
    blank_softkey (7);
END gen_save_menu;
```

```
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@EJECT;
COMMENT
$DOC+

NAME--
  gen_nbn_menu
*****************************************************************
*
* SHORT DESCRIPTION--
*   generates cal kit or memory register menu
*
* EXTENDED DESCRIPTION--
*   This routine generates and modifies the general purpose data reg
*   menu (REG_MENU) for cal kit or memory depending on the currently
*   selected data type to be recorded or restored via tape.
*
*   For cal kits, only 2 registers are displayed.  For memory traces,
*   the first 4 registers are displayed.  Each softkey in these menus
*   will contain an "*" to the left of the label to indicate whether
*   the corresponding register contains data.
*
*   These menus are displayed as part of the recording or restoring
*   sequence of individual data registers from bubble.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   hilight_off
*   gen_menu
*   blank_softkey
*   printch
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*   Cal kit data menu generates only the first 2 data registers.
*   Memory trace data menu generates only the first 4 data registers.
*   Any cosmetic changes to the position and number of registers must
*   be made at this level.
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   display prompt to select data register
*   turn off any hilights (possibly generated by use of menu by cal)
*   generate data register menu
*   IF currently selected data = memory trace THEN
*     blank out last 4 softkeys
*     check memory trace directory and display "*" by data registers
*       that contain memory
```

```
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*   ELSE
*   IF currently selected data = cal kit THEN
*     blank out all but first 2 softkeys
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
$DOL-;
PROCEDURE gen_nbn_menu;
BEGIN
  INTEGER i;
  reg_prompt;
  hilight_off (cnd_reg_1, end_reg_8);
  gen_menu (REG_MENU, menu_incr);
  IF data_type = memory_file THEN
    FOR i := 1 TO 4 DO                & display only 4 registers for mem &
      BEGIN
        IF nbn_dir[mem_dir_offset+i] = 0 THEN
          & indicate empty reg: " n --> n &
          printch (field[i+7],' );
        blank_softkey (i+3);
      END
  ELSE
  IF data_type = cal_std_file THEN  & display only 2 registers for std &
    FOR i := 2 TO 7 DO
      blank_softkey (i);
END gen_nbn_menu;
```

```
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$EJECT;
COMMENT
$DOC+

NAME--
  select_nbn_menu
*****************************************************************
*
* SHORT DESCRIPTION--
*   determine which data register menu to generate
*
* EXTENDED DESCRIPTION--
*   This routine determines which routine to call that modifies the data
*   register menu based on the data type selected.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   gen_save_menu
*   gen_cal_info
*   gen_nbn_menu
*
* ERROR CONDITIONS AND RECOVERY--
*   The last ELSE statement assumes that the data type is that of
*   MEMORY TRACE or CAL KIT.  Other data types (non- instrument state,
*   cal) are not range checked and will generate a full data register
*   menu even if that data type is not stored in bubble.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   IF data type = instrument state THEN
*     call routine which generates instrument state register menu
*   ELSE
*   IF data type = cal coefficients THEN
*     call routine which generates the cal coeff register menu
*   ELSE
*     call routine which generates cal kit and memory trace menus
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
$DOC-;
SUBROUTINE select_nbn_menu;
BEGIN
  IF data_type=state_file THEN
```

```
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    gen_save_menu(tape_mbn_fn)
  ELSE
  IF data_type=cal_file THEN
    gen_cal_info (tape_mbn_fn)
  ELSE
    gen_mbn_menu;
END $select_mbn_menu;
```

```
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$EJECT;
COMMENT
$DOC+

NAME--
  gen_reg_menu
*****************************************************************************
*
* SHORT DESCRIPTION--
*   generate appropriate menu based on tape/bubble operation selected
*
* EXTENDED DESCRIPTION--
*   This routine is called upon selecting a data type softkey to
*   record, restore, or delete from tape.  It generates the data
*   register menu for data types found in bubble or the data file menu
*   for data types found only in RAM.
*
* INPUTS--
*   type * data type selected
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   select_mbm_menu
*   gen_file_menu
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   On deleting tape files, the data registers menu is not generated
*   for data types found in bubble memory.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set new data type selected
*   IF tape operation <> delete THEN
*     generate data register menu
*   ELSE
*     generate data file menu
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
PROCEDURE gen_reg_menu (type);  VALUE type; INTEGER type;
$BEGIN
  new_data (type);
  IF tape_mbn_fn <> delete_op THEN
    select_mbn_menu
```

```
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  ELSE
    gen_file_menu (type);
END gen_reg_menu;
```

```
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$EJECT;
COMMENT
$DOC+

NAME--
  gen_last_reg_menu
*****************************************************************************
*
* SHORT DESCRIPTION--
*   generates prior data register menu
*
* EXTENDED DESCRIPTION--
*   This routine generates the data register menu which is modified
*   after it is displayed according to the data type represented.
*   This routine is invoked by the procedure previous_menu which is
*   called upon pressing the [PRIOR MENU] key.
*
*   A prior menu flag is set to indicate to the routines which actually
*   generate and modify the menu that the menu level is to decrease.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   modified data register menu
*
* ROUTINES CALLED--
*   select_mbn_menu
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set prior menu flag
*   call routine to determine menu modification
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE gen_last_reg_menu;                                    ENTRY;
$BEGIN
  prior_rtg_menu := TRUE;
  select_mbn_menu;
END gen_last_rtg_menu;
```

```
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$EJECT;
PROCEDURE hpib_call (type, fn, reg);
  VALUE type, fn, reg;  INTEGER type, fn, reg;
BEGIN
  menu_data (type);
  tape_nbm_fn := fn;
  reg_num := -reg;
  reg_chosen;
END hpib_call;
```

```
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$EJECT;
PROCEDURE select_default_set (reg);
  VALUE reg; INTEGER reg;                                          ENTRY;
  hpib_call (cal_file, pwr_op, reg);

PROCEDURE save_cal_set (reg);
  VALUE reg; INTEGER reg;                                          ENTRY;
  hpib_call (cal_file, save_op, reg);

PROCEDURE delete_cal_set (reg);
  VALUE reg; INTEGER reg;                                          ENTRY;
  hpib_call (cal_file, clear_op, reg);
```

```
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$EJECT;
COMMENT
$DOC+

NAME--
  save_last_state
*****************************************************************************
*
* SHORT DESCRIPTION--
*   saves "last instrument state" information
*
* EXTENDED DESCRIPTION--
*   This routine saves a partial instrument state containing enough
*   information to reconstruct entire instrument state.  A "last state"
*   is saved between changes to major instrument state variables, so
*   that a state prior to these changes can easily be recalled without
*   the user explicitly saving it away in a register.
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   save_data
*   clear_message
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   save last instrument state in bubble
*   clear message displaying acknowledgment of data that was saved
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE save_last_state;                                        ENTRY;
&
$DOC-&
  save_data (ADRS(last_state),last_state_size,state_file,prior_state);
```

```
SDTMGR.WORK.PD8510          THU, DEC 22, 1983, 10:35 AM    PAGE 42

$EJECT;
COMMENT
$DOC+

NAME--
  save
*****************************************************************************
*
* SHORT DESCRIPTION--
*   saves an instrument state over public HP-IB
*
* EXTENDED DESCRIPTION--
*   This routine saves an instrument state in response to a public
*   HP-IB mnemonic.  This by-passes bringing up the save/recall menu
*   followed by selecting a register to save the data into.
*
* INPUTS--
*   reg = number to save instrument state in
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   abort_sweep
*   save_data
*   restart_sweep
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   abort any sweep in progress
*   call routine to save an instrument state in register
*   restart any sweep that was aborted
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE save (reg); VALUE reg;  INTEGER reg;                     ENTRY;
&
$DOC-&

  hpib_call (state_file, save_op, reg);
```

```
SDTMGR.WORK.PD8510          THU, DEC 22, 1983, 10:35 AM     PAGE  43


$EJECT;
COMMENT
$DOC+

NAME--
  recall
*****************************************************************************
*
* SHORT DESCRIPTION--
*   recalls an instrument state over public HP-IB
*
* EXTENDED DESCRIPTION--
*   This routine recalls an instrument state in response to a public
*   HP-IB mnemonic.  This by-passes bringing up the save/recall menu
*   followed by selecting a register to recall the data from.
*
* INPUTS--
*   reg * number to save instrument state in
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   abort_sweep
*   recall_data
*   restart_sweep
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   abort any sweep in progress
*   call routine to recall an instrument state from a register
*   restart any sweep that was aborted
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE recall (reg); VALUE reg;  INTEGER reg;                    ENTRY;
&
$DOC-$

  hpib_call (state_file, recall_op, reg);
```

```
SDTMGR.WORK.PD8510          THU, DEC 22, 1983, 10:35 AM     PAGE  44


REJECT;
COMMENT
$DOC+

NAME--
  recall_preset_state
*****************************************************************************
*
* SHORT DESCRIPTION--
*   recalls instrument preset state
*
* EXTENDED DESCRIPTION--
*   This routine recalls the instrument preset state in response to
*   pressing the "preset" key on the front panel.  The sweep is aborted
*   prior to recalling data and restarted after data is recalled from
*   bubble.
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*   tell
*   warn
*   clear_message
*   abort_sweep
*   restart_sweep
*   recall_data
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   display message indicating data being loaded
*   abort sweep
*   recall data (instrument preset state) from bubble
*   IF error in recalling THEN
*     display error message
*   restart sweep
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE recall_preset_state;                                     ENTRY;
&
$DOC-$.
```

```
SDTMGR.WORK.PD8510          THU, DEC 22, 1983, 10:35 AM     PAGE  45


BEGIN
  tell (loading_data);
  abort_sweep;
  recall_type := preset_recall;
  init_softkeys;
  IF NOT recall_data (RDRS(min_save), state_file, preset_state) THEN
    BEGIN
      clear_message (recall_error);
      macro_warn (recall_error, preset_macro);
    END;
  restart_sweep;
END recall_preset_state;
```

```
SDTMGR.WORK.PD8510          THU, DEC 22, 1983, 10:35 AM     PAGE  46


REJECT;
COMMENT
$DOC+

NAME--
  recall_power_on_state
*****************************************************************************
*
* SHORT DESCRIPTION--
*   recalls "power up" instrument state register
*
* EXTENDED DESCRIPTION--
*   This routine is called only on "power up" and recalls the instrument
*   state contained in a designated "power up" register (1).
*   Bubble function variables are initialized at this point as well as
*   tape function variables (done through an externally declared
*   routine.  After the data has been recalled from bubble into RAM,
*   the "last state" information of the current instrument state is
*   saved.
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*   init_tape_mgr
*   bubble_ok
*   recall_data
*   save_last_state
*   tell
*   clear_message
*
* ERROR CONDITIONS AND RECOVERY--
*   A bubble failure (i.e. no 2nd bubble, broken or uninitialized 2nd
*   bubble) prior to recalling data will cause a fatal message to be
*   displayed which consequently hangs the system (via external routine
*   bubble_ok).
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   initialize tape and bubble variables
*   IF data bubble is initialized and working THEN
*     recall data from bubble
*     clear recall acknowledgment message from display
*     save "last state"
*   ELSE
*     hang system
*
*****************************************************************************
*
* REVISION LOG--
```

```
SDTMGR.WORK.PDtS1D          Thu, DEC 22, 1983, 10:35 Am    PAGE 47

*
*********************************************************************
DECLARATION--
;
SUBROUTINE rRcall_power_on_state;                              ENTRY;
*
$DEC-&

BEGIN
  init_tape_mgr;
  init_softkeys;
  icll (ioading_data);
  tape_mbn_fn := 0;
  reg_mun := 1;
  prior_reg_menu := fix_reg_menu :* data_in_bubble :* FALSE;
  set_data_type (otate_file);
  IF bubble_ok THEN
    BEGIN
      racoll_data (ROWS(nin_save), otate_file, pur_on_etate);
      clear_message (data_recalled);
      save_last_atats;
    END;
END recall_power_on_ttate;


$FILE fdtngr.uork;


END$
```

```
RFFT.WORK.PD$S1D            THU, DEC 22, 1983, 10:35 AM    PAGE  1

 RSM8,1
  MED FFt routines jtb ( from Wds ) Feb,1982
  MAR FFt,7
  UNL
*              UARNING uses all registers ( or most )
R0  REG 0          usually  A (first ) data value ( mantissa )
R1  REG 1          usually  b (second) data value ( mantissa )
R2  REG 2          usually  A (first ) data value ( exp )
R3  REG 3          usually  B (second) data value ( exp )
R4  REG 4          used for exp arithentic
R5  REG 5          Angle delta for sin/cos table
R6  REG 6          Inner loop counter    master value in  2(S)
R7  REG 7          Outer loop counter    master value  in 8(S)
R8  REG 8          ptr to mircocode mapper ( hardware math )
R9  REG 9          ptr to   R (first ) data value
R10 REG 10         ptr to   B (second) data value
R11 REG 11         ptr to   sin_cue table fur B data value
R12 REG 12         not used ( used to be )
R13 REG 13         constant 12         not really needed
S   REG 15
*                  STACK
*               0   oeperateen between R,B data in outer loop ( hyteo )
*               2   oeperateen between R,B data in outer loop(data pts)
*              .4   Intial data array address  -- 32 bit
*               8   Inner loop counter
*              10   Intial sin_cue array address -- 32 bit
*
* bees the In-place dccinotion in free with natural erver twiddles.
*    eee BRIGHAM (1974) fig 11-4c or OPPENHEIM/SCHAFFER (1975) fig 6.15
* An outer loop starts at 1 increasing to 1/2 FFT size, with
*    an inner loop starting at 1/2 FFT oize decreeing to 1
* Basic buuterfly is  R,B inputs
*                     R+B, (R-b)*W  outputs     ( W io the twiddle )
*
* Uses a full 360 deg sin_cos table, and attempts to avoid mpye if
* not needed:
* Older version use 90 deg table
*  was siouer 270 vs 220 nS  -- took less space 250 vs 350 bytes
*
*  Major changes from Dave's version were
*         Word writes only to Ram  --- maybe display ram
*         Met fixed to just 1024 pt transforms
*
 ENT FFt
 ENT iFFt
 EXT XFM2P              REGULAR 2 PT XFM
 EXT XFM20              2 PT XFM W/O sin/cos MPY
 EXT sine_cos
 EXT preempt
```

```
RFFT.WORK.PD8S1D            THU, DEC 22, 1983, 10:35 AM    PAGE  2

*EJEGT                                  these set the FFT size
hftaz   EQU 3072        HALF FFT SIZE *6    only used just below
fftsz   EQU 512         HALF FFT SIZE       can be set by a paraneter
fftang  EQU 4
ifftang EQU -4
cpxsz   EQU E
iFFt  MOVE.W  #ifftang,   R5
      LEA     sine_cos.L, A11
      ADD.L   =H1000,     A11
      BRA     FFTS
FFt   MOVE.W  #fftang,    R5     ANGLE ADRDELTA
      LEA     sine_cos.L, R11
FFTS: BOVE.L  R11, -(S)          STORE INIT ANGLE PTR
   MOVE.W  #1,     -(S)          OUTER LOOP INIT VALUE
   MOVE.L  R0,     -(S)          ADR OF DATA ARRAY
   BOVE.W  #fftsz, -(S)          INNER LOOP INIT VALUE
   BOVE.W  #hftsz, -(S)          DATA ADRDELTA
   MOVE.W  #12,    R13           GONSTANT 12
*
```

```
RFFT.WORK.PD8S1D            THU, DEC 22, 1983, 10:35 AM    PAGE  3

*EJEGT       start new inner/outer loop pats
*
FFTO MOVE.L 4(S),  R9           INIT LOWER RDRPTR
   MOVE.L R9,    R10
   ADD.W  (S),   R10            INIT UPPER PORPTR
   MOVE.W  8(S), R7       INIT OUTER LOOP   progress fron 1 to 1/2 size
*
* NOTE: ROUTINE ASSUMES ADDRESS ARRAY DOES NOT GROSS
*       THE 64Kbyte ADDRESS TRANSITION.
*
   BOVE.L (R9)+, R0             get A (first) point
   MOVE.W (R5)+, R2
*
*      outer loop
*
FFTO1: MOVE.L 10(S), R11        INIT ANGLE PTR
   MOVE.W  2(S),  R6        INIT INNER LOOP CTR  progress 1/2 size to 1
   LEA     XFM20, R5
*
   MOVE.L (R10)+, R1            get B (second) data point
   MOVE.W (R10)+, R3
*
   SUB.B  R3,     R2                    * Find exp difference
   MVC    FFT3                          * check for over/underflow
   BSR    ovf_R2R3
*
FF13: MOVE.L R0, (R8)+
   MOVE.L R1, (R5)+
   MOVE.W R2, (R5)+             ADD    A + B    first half of butterfly
*
   TST.B  R2
   BMI    FFT31
   ADD.B  R2,    R3
FFT31: SUB0   #cpxsz, R9        set back A (first) data ptr
*
   MOVE.W (R8)+, R4
   MOVE.W (R5)+, (R9)+      STORE RESULT    over orginal A (firet) data
   MOVE.W (R8)+, (R9)+          word writes for display ran
   MOVE.L R0,    (R8)+
   MOVE.L R1,    (R8)+
   MOVE.W R2,    (R5)+          SUB     A - B  second half of butterfly
*                                           note: no sin/cos
   ADD.B  R3,    R4
   MVC    FFT41
   SSR    ovf_B4
FFT41 MOVE.W R4, (R9)+          STORE EXP     over orginal A (first) data
*
   MOVE.W R3,    R4
   MOVE.L (R10)+, R1                        get next B (second) data
   MOVE.W (R10)+, R3                        reset B (second) data ptr
   SUB.W  R13,    R10           STORE RESULT over orginal B (second) data
   MOVE.W (R5)+, (R10)+                     word writes to display ran
   MOVE.W (R5)+, (R10)+
   ADD.W  R1,     R8
   ADD.B  (R8)+,  R4
   MVC    FFT51                             over/underflow check
```

```
AFFT.WORK.PO8510              THU, DEC 22, 1983, 10:35 AM    PAGE  4

   BSR    ovf_R4
FFI51 SUB.W  #1,  R6      OCCR INNER LOOP    if zero finished with inner
   BGT    FF16                               if postive do more inner
*
*            finished with inner loop
*
   MOVE.W R4,    (R10)+       STORE EXP    over orginal B (second) data
   ADD.W  #13,   R9                        inc A (first) data ptr
   ADD.W  #cpxsz, R10                      inc B (second) data ptr
   MOVE.L R1,    R0                        move what was B to R data
   MOVE.W R3,    R2
   SUB.W  #1.    R7          DECR OUTER LOOP
   BGT    FF101
*
*            finished with outer loop and inner loop=1 therefore done!
*
   ADD.W  #14, 3
   RTS
*
```

```
AFFT.WORK.PO8510              THU, DEC 22, 1983, 10:35 AM    PAGE  5

*EJECT    inner loop  enter
*            note B (second) data is in R1/3
*
FFTS MOVE.L (R9)+,R0             get next A (first) data point
   MOVE.W (R9)+,  R2
   SUB.B  R3,     R2             find exp difference
   BVC    FFT7                   over/under flow check
   BSR    ovf_R2R3
*
* main inner loop loop point
FFT7 LEA  XFM2P,  R8             full butterfly mpy ptr
   MOVE.L R0,    (R5)+
   MOVE.L R1,    (R5)+
   MOVE.W R2,    (R8)+           ADD  R + B   first half of  butterfly
*
   TST.B  R2
   BNE    FFT71
   ROR.B  R2,     R3
FFI71 ADD.W R5,   R11            INCR ANGLE  of sin_cos table
   MOVE.W R4,    (R10)+          STORE OLD EXPONENT  ( bogus first pass
   SUB.W  #cpxsz, R9       reset to point back to present A (first) data
   ADD.W  #cpxsz, R10            point to next B (second) data
*
   MOVE.W (R8)+,  R4
   MOVE.W (R8)+, (R9)+           STORE RESULT   over old A (first) data
   MOVE.W (R5)+, (R9)+           word writes to display  ram
   MOVE.L R0,    (R8)+
   MOVE.L #1,    (R8)+
   MOVE.W R2,    (R5)+           SUBTRACT     A - B
*
   ADD.B  R3,     R4
   BVC    FFI73                  more over/underflow
   BSR    ovf_R4
FFT73 MOVE.W R4, (R9)+           STORE EXPONENT -- A (first) data
*
   MOVE.W R3,     R4
   MOVE.L (R9)+,  R0             load in new A (first) data
   MOVE.W (R9)+,  R2
*
   MOVE.L (R11), (R5)+           LOAD SIN/COS VALUE
*
   MOVE.L (R10)+, R1             load in new B (second) data
   MOVE.W (R10)+, R3             while mpy working
   SUB.W  R13,    R10       reset b (second) data ptr back to old point
   SUB.B  R3,     R2
   BVC    FFTB1                  under/overflow   check
   BSR    ovf_R2R3
*
FFIB1: MOVE.W (R8)+, (R10)+      STORE RESULT over old B (second) data
       MOVE.W (R8)+, (R10)+           word writes to display ram
   ADD.W  #1,    R5
   ADD.B  (R8)+,  R4
   BVC    FFTB5                   under/overflow
   BSR    ovf_R4
*
FFTB5 SUB.W #1,   R6             DECR INNER LOOP
```

```
AFFT.WORK.PO8510              THU, DEC 22, 1983, 10:35 AM    PAGE  6

   BGT    FFT7                   loop back if more
   MOVE.W R4,    (R10)+          STORE EXPONENT   -- inner loop finish
   SUB.W  #1,    R7              DECR OUTER LOOP
   BLE    FFT9                   or both inner and outer loop finished?
   MOVE.L R10,   R9              INIT ADR PTRS  -- more to do on outer
   ADD.W  #cpxsz, R9
   ADD.W  (S),    R10
   MOVE.L R1,    R0              B (second) prefetch will be new A data
   MOVE.W R3,    R2
   BRA    FFT01
*
* inner loop and outer loop finished __ set up new loop conditions
*
FF19 LSL.W S(S)                  OUTER LOOP DOUBLED
   ASR.W  2(S)                   INNER LOOP HALVED
   ASR.W  (S)                    ADR DELTA HALVED
   ADD.W  R5,    R5              ANGLE DELTA DOUBLED
   BRA    FF10
*
*
*
*
*
ovf_R2R3 EQU *
   BPL    ovf_23
   ROO.B  R2,     R3
   MOVE.W #H7F,   R2
   SUB.B  R2,     R3
   RTS
ovf_23 MOVEO #h80, R2
   RTS
*
*
*
*
*
*
ovf_R4   EQU *
   BPL    ovf_4
   MOVE.W #H7F,  R4
   RTS
ovf_4 MOVE.W #H80,R4
   RTS
*
*
*
*
```

```
AFFT.WORK.PO8510              THU, DEC 22, 1983, 10:35 AM    PAGE  7

*EJECT        unpack bit-reversing routine see Rebiner/Gold(1975)  p365
 EXT fftun                                  or Oppenhein/Schafer(1975) p316
untbl DEF un128-un1024
      DEF un256-un1024
      DEF un512-un1024
      DEF un1024-on1024          unused, but needed to simplify indexing
      DEF un1024-un1024
fftun EQU *
 MOVE.L R0,        R5            R5  has start adr  for data array
*MOVE.W #fftsz,    R0            actual 1/2 fft size
*ASR.W  #6,R0                 convert to an index   = (fft size / 256) * 2
*LEA    untbl.L,   R9            maybe .L not needed look at obj code
*LEA    un1024.L,  R13
*ADD.W  0(R9,R0.W),R13        R13 has branch adr dependent on array size
 MOVE.L R8,        R10           R10 has destination adr for data array
 MOVE.L R5,        R9            R9  has source adr for data array
 CLR.W  R0                       R0  will be iten index
*
loop EQU *
 CMP.L R9,      R10
 BGT   swap
no_swap EQU *
 ADD.W  #cpxsz, R9
 BRA    un1024
*JMP    (R13)                      conditional on fft size
swap EQU *                         display ran word writes only
 MOVE.L (R9),   R1              Need faster algorithm
 MOVE.L (R10),  R2
 SWAP   R2
 MOVE.W R2,    (R9)+
 SWAP   R2
 MOVE.W R2,    (R9)+
 SWAP   R1
 MOVE.W R1,    (R10)+
 SWAP   R1
 MOVE.W R1,    (R10)+
 NOP
 MOVE.W (R9),   R1
 MOVE.W (B10), (R9)+
 NOP
 MOVE.W R1  , (R10)+
*JMP    (R13)                      conditional on fft size
*
hit_test EQU *
un1024: BCHG #10, R0             note: R0 is actually 2*index
 BEQ bit_rev
un512:  BCHG #9, R0
 BEQ bit_rev
un256:  BCHG #8, R0
 BEQ bit_rev
un128:  BCHG #7, B0
 BEQ  bit_rev
 BCHG #6, B0
 BEQ  bit_rev
 BCHG #5, R0
 BEQ  bit_rev
```

```
BEFT.WORK.PD8510          THU, DEC 22, 1983, 10:35 AM    PAGE  3

 BCMG #4, D0
 BCA  bit_rev
 BCMG #3, R0
 BEQ  bit_rev
 BCMG #2, R0
 BEQ  bit_rev
 BCMG #1, R0
 BEQ  bit_rev
 JSR  preempt.L          release the preceeeor for higher priotority use
 RTS
bit_rev MOVE.W D0, R1
 ADD.W R1, R1
 RDO.W R0, R1             mpy by 3 the doubled A0  -- to get byte index
 LER   0(R8,R1.W), R10
 ARR   loop
e
 END
```

```
CFIFO.WORK.PD8510         THU, DEC 22, 1983, 10:35 AM    PAGE  1

INTEGER CONSTANT ewp_brk_fifo_size:=5,
                 token_fifo_size := 8,
                 keyboard_fifo_size := 8,
                 public_ib_fifo_size := 8,
                 arrey_update_fifo_size := 8;
```

```
FFIFO.UORK.PD8510         THU, DEC 22, 1983, 10:35 AM    PAGE  1

PROCEDURE init_fifo(fifo, size, resource, not_full, not_empty);
   VALUE size, resource, not_full, not_empty;
   INTEGER ARRAY fifo[*];
   INTEGER size, resource, not_full, not_empty;          EXTERNAL;
PROCEDURE urite_fifo(fifo, number);
   VALUE number;
   INTEGER ARRAY fifo[*];
   INTEGER number;                                       EXTERNAL;
INTEGER PROCEDURE read_fifo(fifo);
   INTEGER ARRAY fifo[*];                                EXTERNAL;
BOOLEAN PROCEDURE empty_fifo(fifo);
   INTEGER ARRAY fifo[*];                                EXTERNAL;
```

```
SFIFO.UORK.PD5510         THU, DEC 22, 1983, 10:35 AM    PAGE  1

BEGIN

RFILE cdebug.work;                                      & debug S
RFILE fterm.work;                                       & debug &
RFILE fkernel.work;
RFILE fkernel4.work;
RFILE crima.work;
RFILE cfifo.work;
```

```
SFIFO.UORK.PD8510              THU, DEC 22, 1983, 10:35 AM     PAGE  2


@EJECT;
COMMENT                                                              fifo
*****************************************************************************
*
* MODULE fifo
*
* ENTRY POINTS:
*
*    init_fifo(fifo, size, resource, not_full, not_empty)
*    write_fifo(fifo, value)
*    read_fifo(fifo)
*
* NOTE:
*    Routines in this module use a fifo which must be defined as
*    follows:
*
*    INTEGER CONSTANT size := your fifo's size
*    INTEGER RRRRY fifo[-6:size]
*
*    Three resource identification numbers (rins) must be allocated in
*    the file FRINS -- one for your fifo's resource number, and two for
*    the "not_empty" and "not_full" signals.
*
*    The fifo must be initialised before use by the call:
*       init_fifo( fifo, size, resource, not_full, not_empty )
*    Once initialized, you need not ever use any of the parameters
*    except "fifo" again.
*
* The purpose of this module is to define a fifo data-type and operators
* for it.  The desire was to hide as much knowledge of the structure
* of the fifo as possible.  The fifo is currently (16 Oct 81)
* implemented as a circular buffer in the array.
*
*****************************************************************************
;
GLOBAL INTEGER ARRAY token_fifo[-6:token_fifo_size);
GLOBAL INTEGER RRRRY keyboard_fifo[-6:keyboard_fifo_size];
GLOBAL INTEGER RRRRY public_ib_fifo[-6:public_ib_fifo_size];
GLOBAL INTEGER RRRRY array_update_fifo[-6:array_update_fifo_size);

INTEGER CONSTANT  head_index      := -6,   & offsets from fifo origin. &
                  tail_index      := -5,
                  not_empty_index := -4,
                  not_full_index  := -3,
                  resource_index  := -2,
                  size_index      := -1;
```

```
SFIFO.UORK.PD8510              THU, DEC 22, 1983, 10:35 AM     PAGE  3


@EJECT;
COMMENT                                                          init_fifo
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR init_fifo
*
* FUNCTION: To initialize a fifo data type -- includes the fifo array
*           and the associated resource number and signal variables.
*
* DECLARATION INFORMATION:
*    PROCEDURE init_fifo( fifo, size, resource, not_full, not_empty )
*       VALUE size, resource, not_full, not_empty
*       INTEGER RRRRY fifo[*]
*       INTEGER size, resource, not_full, not_empty
*
*    INPUT:  fifo       the  array in which the fifo will be built
*            size       the size (maximum index) of the fife array
*            resource   a resource identification number for the fifo
*            not_full   a resource identification number for signalling
*            not_empty  a resource identification number for signalling
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS: none
*
*****************************************************************************
*
* LOGIC INFORMATION FOR init_fifo
*
* PROCEDURES CALLED: none
*
* INTIAL REFINEMENT:
*
*    initialize the fifo resource number.
*    initialize the fifo signal variables.
*    initialize the variables in the fifo prefix (locations -6 to -1).
*
*****************************************************************************
;

PROCEDURE init_fifo(fifo, size, resource, not_full, not_empty);
   VALUE size, resource, not_full, not_empty;
   INTEGER RRRRY fifo[*];
   INTEGER size, resource, not_full, not_empty;                      ENTRY;
   BEGIN & init_fifo &
      resource_init ( resource );
      signal_init   ( not_full,  size );
      signal_init   ( not_empty, 0 );

      fifo[size_index]      := size;
      fifo[resource_index]  := resource;
      fifo[not_full_index]  := not_full;
      fifo[not_empty_Index] := not_empty;
      fifo[head_index]      := 0;
      fifo[tail_index]      := 0;
   END init_fifo;
```

```
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```

```
SFIFO.UORK.PD8510              THU, DEC 22, 1983, 10:35 AM     PAGE  5


@EJECT;
COMMENT                                                         write_fifo
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR write_fifo
*
* FUNCTION: To insert a value into the fifo.
*
* DECLARATION INFORMATION:
*    PROCEDURE write_fifo( fifo, number )
*       VALUE         number
*       INTEGER ARRAY fifo[*)
*       INTEGER       number
*
*    INPUT:  fifo       the fifo array
*            number     the integer value to be inserted into the fifo
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS: If the fifo is full, the calling routine will be
*                   suspended until there is room in the fifo to insert
*                   the value.
*
*****************************************************************************
*
* LOGIC INFORMATION FOR write_fifo
*
* PROCEDURES CALLED: none
*
* INTIAL REFINEMENT:
*
*    acquire the fifo.
*    IF fifo is full then wait until not full.
*    insert the number in the fifo and update the index.
*    send the not empty signal to any process that may be waiting.
*    release the fifo.
*
* COMMENT: Since there can be multiple fifo writers and only one process
*    is alloued to wait for a signal at a time, the "acquire" serves to
*    both protect the "wait" and to keep two processes from interrupting
*    each other during the tail index increment.
*
*****************************************************************************
;
PROCEDURE write_fifo(fifo, number);
   VALUE number;
   INTEGER RRRRY fifo[*];
   INTEGER number;                                                   ENTRY;
   BEGIN & write_fifo &
      acquire( fifo[resource_index] );
      wait( fifo[not_full_index] );

      IF fifo_debug THEN                                    & DEBUG &
         BEGIN & if &                                       & DEBUG &
            USTR("write_fifo: #"); UHex(ADRS(fifo),8);      & DEBUG &
            WHEX(number);                                   & DEBUG &
```

```
SFIFO.WORK.PD8S10            THU, DEC 22, 1983, 10:35 AM     PAGE   6

          CRLF;                                              & DEBUG &
       END;  & if &                                          & DEBUG &
    fifo[ fifo[tail_index] ] := number;
    fifo[tail_index] := If fifo[tail_index] >= Fifo[size_index] THEN 0
                 ELSE fifo[tail_index] + 1;
                                      & increment nodule fifo size &
    send( fifo[not_empty_index] );
    release( fifo[resource_index] );
  END write_fifo;
```

```
SFIFO.WORK.PD8S10            THU, DEC 22, 1983, 10:35 AM     PAGE   8

#EJECT;
COMMENT                                                      empty_fifo
***********************************************************************
*
* EXTERNAL SPECIFICATION FOR empty_fifo
*
* FUNCTION: To return true if the fifo is empty.  This enables a routine
*           the check for an entry in a fifo without being suspended
*           until the fifo is not empty.
*
* DECLARATION INFORMATION:
*    BOOLEAN PROCEDURE empty_fifo( fifo )
*       INTEGER ARRAY fifo[*]
*
*    INPUT:  fifo       the fifo array
*
*    OUTPUT: empty_fifo  true if the fifo is empty
*
* EXTERNAL EFFECTS:
*    none
*
***********************************************************************
*
* LOGIC INFORMATION FOR empty_fifo
*
* PROCEDURES CALLED: none
*
* INTIAL REFINEMENT:
*
*    acquire the fifo.
*    return TRUE if fifo is empty, false otherwise.
*    release the fifo.
*
***********************************************************************
;
BOOLEAN PROCEDURE empty_fifo(fifo);
  INTEGER ARRAY fifo[*];                                       ENTRY;
  BEGIN & empty_fifo &
     empty_fifo := NOT pending( fifo[not_empty_index] );
  END empty_fifo;

END$
```

```
SFIFO.WORK.PD8S10            THU, DEC 22, 1983, 10:35 AM     PAGE   7

#EJECT;
COMMENT                                                       read_fifo
***********************************************************************
*
* EXTERNAL SPECIFICATION FOR read_fifo
*
* FUNCTION: To read a value from the fifo.
*
* DECLARATION INFORMATION:
*    PROCEDURE read_fifo( fifo )
*       INTEGER ARRAY fifo[*]
*
*    INPUT:  fifo       the fifo array
*
*    OUTPUT: read_fifo  the integer value from the fifo
*
* EXTERNAL EFFECTS: If the fifo is empty, the calling routine will be
*                   suspended until the fifo is not empty.
*
* COMMENT: There can be only one fifo reader.
*
***********************************************************************
*
* LOGIC INFORMATION FOR read_fifo
*
* PROCEDURES CALLED: none
*
* INTIAL REFINEMENT:
*
*    If fifo is empty then wait until not empty.
*    remove the number from the fifo and update the index.
*    send the not full signal to any process that may be waiting.
*
***********************************************************************
;
INTEGER PROCEDURE read_fifo(fifo);
  INTEGER ARRAY fifo[*];                                       ENTRY;
  BEGIN & read_fifo &
     wait( fifo[not_empty_index] );

     read_fifo := fifo[ fifo[head_index] ];
     IF Fifo_debug THEN                                      & DEBUG &
        BEGIN & if &                                         & DEBUG &
           WSTR("read_fifo:  &"); WHex(RDRS(fifo),&);        & DEBUG &
           WHEX( fifo[fifo[head_index]] );                   & DEBUG &
           CRLF;                                             & DEBUG &
        END;  & if &                                         & DEBUG &
     fifo[head_index] := If fifo[head_index] >= fifo[size_index] THEN 0
                 ELSE fifo[head_index] + 1;
                                      & increment modulo fifo size &
     send( fifo[not_full_index] );
  END read_fifo;
```

```
FFIFOS.WORK.PD8S10           THU, DEC 22, 1983, 10:35 AM     PAGE   1

#FILE cfifo.work;

EXTERNAL INTEGER ARRAY fifo_sup_brk[-6:sup_brk_fifo_size];
EXTERNAL INTEGER ARRAY token_fifo[-6:token_fifo_size];
EXTERNAL INTEGER ARRAY keyboard_fifo[-6:keyboard_fifo_size];
EXTERNAL INTEGER ARRAY public_ib_fifo[-6:public_ib_fifo_size];
EXTERNAL INTEGER ARRAY array_update_fifo[-6:array_update_fifo_size];
```

```
AFLT.WORK.POSSIO              THU, DEC 22, 1983, 10:35 AM    PAGE  1

MSM8,8
      MED TYPE 2 ARITHMETIC - APR 25 84
      NAM FLTPT.7,"DOS/jtb MPR 83"
      ENT ADD2,ADD2M,ADD2R,ADD2T,MPY2,MPY2M,MPY2R,MPY2T
      ENT SUB2,SUB2R,SUB2M,SUB2T,SBR2,SBR2M,SBR2R,SBR2T
      ENT CMP2,CMP2M,CMP2R,CMP2T,CPR2,CPR2M,CPR2R,CPR2T
      ENT ADD2G,SUB2G,SBR2G,CMP2G,CPR2G
      ENT MPY2G,DIV2G,DVR2G
      ENT OVR2,DVR2R,DVR2M,OVR2T,DIV2,DIV2R,DIV2M,DIV2T
      ENT MOD2,MOD2R,MOD2G
      ENT CMV24,CMV25,CMV31,CMV32,CMV41,CMV42,CMV51,CMV52
      ENT CMV13,CMV23,CMV14,CMV15
      ENT ABS2,ABSX,NEG2,NNEG2
      ENT MPY3,MPY3R,MPY3M,MPY3T,MPY3G
*
      EXT LDR2M,LDR2R,LDR2T,LDR2G
      EXT ABDLF,SUBLF,LLDMY,YDEXP,MPYLF
      EXT LLDRO,LLDX2,DIVFP,MYNRM,MPYDL
*
R0    REG 0
R1    REG 1
R2    REG 2
R3    REG 3
RB    REG 8
G     REG 13
B     REG 14
J     REG 15
*
* AS MUCH AS REASONABLE THESE ROUTINES ATTEMPT TO DUPLICATE
* LYNN'S PRESENT C8000 FLOATING POINT ROUTINES, BUT USING
* THE 85101 MATH HARDWARE WHERE POSSIBLE. THE BASIC KNOWN
* DIFFERENCES ARE
* 1. REPRESENTATION OF 0:  LYNN SOMETIMES USES 0*2^0, I PREFER 0*2^-256
*    THESE ROUTINES PRESENTLY HAVE CHECKS ADDED SO THEY CAN
*    GRACEFULLY ACCEPT LYNN'S "0" BUT THEY WILL OUTPUT 0*2^M
*    WHERE M IS AT LEAST 32 SMALLER THAN INPUT EXPONENT.
* 2. THESE ROUNTINES ASSUME NORMALIZED INPUTS. SOME WILL REACT
*    DIFFERENTLY THAN LYNN'S TO UNNORMALIZED INPUTS. HOWEVER,
*    ALL OUTPUTS SHOULD BE FULLY NORMALIZED EXCEPT 0. DIVIDE
*    MAY NOT OUTPUT NORMALIZED RESULTS FOR UNNORMALIZED DIVIDENDS.
* 3. THESE ROUTINES ATTEMPT TO RIGOROUSLY CHECK FOR ANY POSSIBLE
*    EXPONENT UNDER OR OVERFLOW. NO PRESENT ATTEMPT IS MADE TO
*    IMPLEMENT GRADUAL, OR EVEN ACCURATE, UNDERFLOW. IT JUST
*    FORCES THE EXPONENT TO THE LIMIT (+255 OR -256).
* 4. NO ATTEMPT WAS MADE TO APPROACH LYNN'S LEVEL OF CODE COMPACTION.
* 5. THE BCD ROUTINES WERE NOT ADDRESSED AT ALL SINCE THE BCD
*    MATH TYPES SHOULD BE DROPPED, IN MY OPINION.
*
* NO PRETENSES ARE MADE REGARDING THE APPLICABILITY, LEGITIMACY,
*  CORRECTNESS, OR PERFORMANCE OF THE FOLLOWING ROUTINES.  THEY
*  WERE DONE SOLELY TO GAIN EXPERIENCE WITH THE HARDWARE MULTIPLIER
*  AND TO PROVIDE A TEMPORARY SOLUTION TO THE LACK OF THE PROJECT'S
*  DEFINITION AND IMPLEMENTATION OF ITS OWN SOFTWARE PACK.
*
ABS2  TST.L  R0
```

```
AFLT.WORK.POSSIO              THU, DEC 22, 1983, 10:35 AM    PAGE  2

      BGE    ABSX
NEG2  MOVE.L #2,-(S)    SAVE R2
      MOVE.B R0,R2
      CLR.B  R0
      REG.L  R0
      BVC NEG20
      LSR.L #1, R0
      ROOO.B #1, R2
      BVC NEG20
      MOVEO #H7F, R2
NEG20 MOVE.B R2, R0
      BOVE.L (S)+, R2
      RTS
NNBS2 TST.L  R1
      BGE    ABSX
NNEG2 EXG    R0,#1
      BSR    NEG2
      EXG    R0,R1
ABSX  RTS
*
MPY2T JSRX   LDR2T
      BRR    MPY2
MPY2M JSRX   LDR2M
      BRA    MPY2
MPY2G JSRX   LDR2G
      BRA    MPY2
MPY2B JSRX   LDR2R
MPY2  MOVE.L R1, LLDR0
      ADD.B R0, R1
      BVC MPY20
      BPL MPY21
      MOVEO #H7F, R1
      DEB MPY20
MPY21 MOVEQ #H80, R1
MPY20 CLR.B R0
      BOVE.L R0, MPYLF
      MOVE.L LLDR0, R0
*      CLR.B R0
*      TST.L R0
*      BED MPYRT
      R00.B  R0EXP+1, R1
      BVC MPY22
      BPL MPY23
      MOVEO #H7F, R1
      BRA MPY22
MPY23 MOVEO #H80, R1
BPY22 MOVE.B RL, R0
MPYRT RTS
*
*
*
* POSSIBLE PROBLEM WITH THIS BOD (SUB, GUP) ROUTINE MAY RESULT
* WHEN X*2^R IS ADDED TO 0*2^M WHERE M > R.  IT WILL LOSE (B-M)
* BITS OF X IN THE BLIGNMENT OPERATION.  THIS PRESENTLY DOESN'T SEEM
* SIGNIFICANT ENOUGH TO WORRY ABOUT IN AMAGICAL SITUATIONS.
*
```

```
AFLT.WORK.POSSIO              THU, DEC 22, 1983, 10:35 AM    PAGE  3

ADD2T JSRX   LDR2T
      BRR    ADD2
ADD2M JSRX   LDR2M
      BAR    ADD2
BDD2G JSRX   LDR2G
      BRR    ADD2
ADD2R JSRX   LDR2R
ADD2  MOVE.L R1, LLDMY
ADD2B BNE ADD201
      MOVE.B #80, R1
BDD201 MOVE.L R0, LLDR0
      BNE ADD202
      MOVE.B #80, R0
ADD202 SUB.B R1, R0
      BVC ADD20
      BPL ADD21
      ADD.B R0, R1
      MOVE #H7F, R0
      SUB.B R0, R1
      BAR ADD20
ADD21 MOVEO #80, R0
ADD20 MOVE.B R0, RDDLF+1
      BNI ADD22
      ADD.B R0, R1          R1 HAS EXPONENT
ADD22 MOVE.L LLDR0, R0
*      CLR.B R0
*      TST.L R0
*      BEO ADDRT
      ADD.B RDEXP+1, R1
      BVC ADD23
      BPL ADD24
      MOVEO #H7F, R1
      BRA ADD23
BDD24 MOVEO #80, R1
ADD23 MOVE.B R1, R0
ADDRT RTS
*
SUB2T JSRX   LDR2T
      BRR    SUB2
SUB2M JSRX   LDR2M
      BRA    SUE2
SUB2G JSRX   LOR2G
      BRA    SUB2
SUB2R JSRX   LDR2R
      BRR    SUB2
SBR2T JSRX   LDR2T
      BRR    SBR2
SBR2M JSRX   LDR2M
      BRR    SBR2
SBR2G JSRX   LDR2G
      BRR    SBR2
SBR2R JSRX   LDR2R
SBR2  EXG    R0,R1
SUB2  MOVE.L R1, SUBLP
      BRR ADD2B
*
```

```
RFLT.WORK.POSSIO              THU, DEC 22, 1983, 10:35 AM    PAGE  4

CMP2T JSRX   LDR2T
      BRR    CMP2
CMP2M JSRX   LDR2M
      BRR    CMP2
CMP2G JSRX   LDR2G
      BRR    CMP2
CRP2R JSRX   LDR2R
      BRR    CMP2
CPR2T JSRX   LDR2T
      BRR    CPR2
CPR2M JSRX   LDR2M
      BRR    CPR2
CPR2G JSRX   LDR2G
      BRR    GPR2
CPR2R JSRX   LDR2R
GPR2  EXG    R1,R0
CMP2  BSR SUB2
      CLR.B R0
      TST.L R0
      RTS
*
*MOD2T JSRX   LDR2T
*      BRR    MOD2
*MOD2M JSRX   LDR2M
*      BRR    MOD2
MOD2G JSRX   LDR2G
      BRR    MOD2
MOD2R JSRX   LDR2R
      BRR    MOD2
*MOR2T JSRX   LDR2T
*      BRR    MOR2
*MOR2M JSRX   LDR2M
*      BRR    MOR2
*MOR2G JSRX   LDR2G
*      BRR    MOR2
*MOR2R JSRX   LDR2R
*MOR2  EXG    R0,R1
MOD2  MOVE.L R0,-(S)
      MOVE.L R1,-(S)
      BSR    DIV2          NOT TOO SURE       jtb  A MOD y acts like
      BSR    CMV23         BBOUT THIS ACCURACY     A MOD Y/2
      BSR    CMV32         FOR A MOD FUNCTION
      BSR    MPY2T
      BSR    SBR2T
      RTS
*
OIV2T JSRX   LDR2T
      BRA    DIV2
OIV2M JSRX   LDR2M
      BRR    DIV2
DIV2G JSRX   LDR2G
      BRA    DIV2
OIV2R JSRX   LDR2R
      BRA    DIV2
DVR2T JSRX   LDR2T
      BRR    DVR2
```

```
RFLT.WORK.PD8510              THU, DEC 22, 1983, 10:35 PM    PAGE   5

DVR2M JSRX   LDR2M
      BRR    DVR2
DVR2G JSRX   LD82G
      BRR    DVR2
DVR2R JSRX   LDR2R
DVR2  EXG    R0,R1
DIV2  MOVE.L R2,-(S)        contents of R0 is divide by R1 -- rtred R0
      MOVE.B R0,R2
      SUB.B  R1,R2
      BVS FIX00V
      CLR.B R0
      CLR.B R1
      SWRF R2
      CLR R2
      TST.L R1
      BEQ DV2R0
      BRL DIV21
      NEG.L R1
      BVS DIVMI
      NOT R2
DIV21 TST.L R0
      BPL DIV22
      NOT R2
      NEG.L R0
      BVC DIV22
      SWRP R2
      BJR FIXP1
      BRB DIV23
DIV22 SWRP R2
DIV23 BTSI #30, R1
      BNE DIV24
      RSL.L R1, R1
      BOO.B #1, R2                          jtb fix
      BVC DIV23
      BRR FIX00V
DIV24 CBP.L R1, R0
      BLT DIV25
      RSR.L #1, R0
      RDD.B #1, R2                          jtb fix
      BVC DIV24
      BRR FIX00V
DIV25 MOVE.L R0, LLDP0
      MOVE.L R1, LLDR2
      MOVEO #5, R0
      NEG.L R1
      BRR DIV26
DIV2G1 SUB.L LLDB2, R1
DIV26 LSR.L #1, R1
      BOVE.L R1, DIVFP
      SUBQ #1, R0
      BLE DIV27
      CLR.L R1
      BRR DIV251
DIV27 MOVE.L LLB80, R0
*      CLR.B R0
*      IST.L R0
```

```
RFLT.WORK.PD8510              THU, DEC 22, 1983, 10:35 PM    PAGE   C

*      BED DIV29
       TST.L R2
       BPL DIV28
       NEG.L R0
DIV28  MOVE.B R2, B0
DJV29  CLR.L R1
       MOVE BDEXP,  R2     DUMMY READ
       MOVE.L (S)+, R2
       RTS
DV2R0  MOVE.L #M7FFFFF7F,R0   MAX POS NUM
       BRR DIV29
FIX00V: IST.B R2
       BMI DV2R0
       MOVE.L #H80, R0
       BRB DIV29
DIVMI  SWRP R2
       NEG.L R0
       BVC DJV28
       BSR FIXP1
       BRB DIV28
PIXP1  LSR.L #1, R0
       BOOO #1, R2
       BVC OTV30
       RODO #4, 3     CLOBACK SUBROUTINE CALL
       BRR FIX00V
OIV30  BTS
*
CNV13:CNV23:CNV15:CNV25 IST.B  B0    CONVERT TO OOUBLE
       BGE   FIN01
       CLR.L R0
       RTS
FIN01  CMP.B #032,R0
       BGE   FIX0V
       MOVE.L R2,-(S)
       MOVEO  #31,R2
       SUB.B  R0,R2
       CLR.B  R0
       RSR.L  R2,R0
*  ROUNDING **** extend and carry bit has last bit shifted out
       BCC    FIX03
       RDO.L  #1,R0
FIX03  MOVE.L (S)+,R2    RESTORE REG
       BIS
*
FIXOV  TST.L  R0
       BLT    FXOVN
       MOVE.L #M7FFFFFFF,R0
       RTS
FXOVN  MOVE.L #M80000000,R0
       BTS
*
CNV52 EXTS   B0
CNV42 EXTS.L N0
       BRB    CNV32
CNV51 EXTS   B0
CNV41 EXTS.L R0
```

```
RFLT.WORK.PD8510              THU, DEC 22, 1983, 10:35 PM    PAGE   7

CNV31 CLR.L  R1
CNV32 ROVE.L B0, BYNRM
      BOVE.L LLDR0, R0
      BOVE.B RDEXP+1, R0
      RDD.B #31, R0
      RTS
*
CRV14:CNV24 BSR    CNV23
      CMP.L  #032767,R0
      BGT    C2410
      CMP.L  #D-32768,R0
      BLT    C2420
      RTS
C2410 MOVE   #032767,R0
      RTS
C2420 MOVE   #H8000,R0
      RTS
*
*      MED TYPE 3 MULTIPLY
*      MRR MPY3,7
*
MPY3T JSRX    LDR2T
      BRR     MPY3
MPY3M JSRX    LDR2M
      BRR     MPY3
MPY3G JSRX    LDR2G
      BRR     MPY3
MPY3B JSRX    LDR2R
MPY3  MOVE.L R0, MPY0I
      MOVE.L R1, MPYDI+4
      MOVE.L MPYDI+S, R0
      RTS
*                    67.13-73.13 uS
* RODED TEMP TILL 8510 LIBRRRY RHO LYNN'S LIBRRRY BECOME MORE IN SYCH
* BELIEVE THIS IS A 32*32=64 BIT
      ENT MPY3L
MPY3L SUBO.L #4,S      MAKE ROOM IN STACK
      CLR.L  -(S)      INITIALIZE PRODUCT AREA
      MOVE.L R0,-(S)   SAVE MULTIPLICAND
*
      MULU   R1,R0     LOW ORDER PROD
      ROVE.L R0,8(S)
*
      MOVE   (S),R0    MID PROD
      MULU   R1,R0
      ROO.L  R0,6(S)
      BCC    MY21S
      RODD   B1,4(S)
*
MY21S SUAP   R1        USE MSM OF MULTIPLIER
      MOVE   2(S),R0
      MULU   R1,R0     MID PROD
      ROD.L  R0,6(S)   ADD TO OTHER MID PROD
      bCC    MY220     CARRY INTO HIGH PROD
      RDOO   B1,4(S)
MY220 bOVE   (S),R0
```

```
RFLT.WORK.PD8510              THU, DEC 22, 1983, 10:35 PM    PAGE   8

      MULU   R1,R0     HIGH PROD
      BOD.L  4(S),R0   GET MID PROD
*
*     FIXUP UP SIGN
*
      SWAP   R1
      BGE    MY230
      SUB.L  (S),R0
MY230 TST.L  (S)+
      BGE    MY240
      SUB.L  R1,R0
MY240 AODQ.L #4,S      CLEAN UP STACK
      MOVE.L (S)+,R1
      RTS              RETURN TO CALLER
      END
```

```
RFMT.WORK.PDS510                THU, DEC 22, 1983, 10:36 AM     PAGE   1


RSMB,8
     MED
     MAN FBT,3,"JTB JULY 28,1982"
*
*
*
     ENT format_integer,format_double,format_quad,format_real
     ENT format_3_cmpx,bcd_of_int
*
*
*
      ENT DIV3L,MEG2,TEMI,MPY2,MPY3L,CMP2,CMVE1
*
msh REG 0
lah REG 1
exp REG 2
*
R0 REG 0   REGISTERS: M6SKL - 4 FES 1980
R1 REG 1
R2 REG 2
R3 REG 3
R4 REG 4
R5 REG 5
R6 REG 6
R7 REG 7
R8 REG 8
R9 REG 9
R10 REG 10
R11 REG 11
R12 REG 12
R13 REG 13
R14 REG 14
R15 REG 15
G REG 13
H REG 14
S REG 15
*
*
 ORB
exp_letter: HEX 6570    f,p
            HEX 6EED    n,u
            HEX 6020    m,
            HEX 684D    k,n
            HEX 4754    G,T
 ORR
```

```
RFMT.WORK.PDS510                THU, DEC 22, 1983, 10:36 AM     PAGE   2


*EJECT
*********************************************************************
* format_TYPE
*
* Converte a data value into an ASCII string for output to display,
*        MP-IB or whatever.
*
* R large number of formats are available -- fixed, Floating, powers of
*        see exanplee                          3,fixed or free field,etc
*
* R11 fixed formats are right justified.
*
* Tining  approx 600 - 900 uSec   depending on input values and optiona
*
* calling protocol:
*    RtPHR PROCEDURE format_integer(value,etr,fetcede);
*                       VRLUE value,etr,fntcode;
*                      IMTEGER value; RLPHR str; DOUBLE fntcode;EXTERNRL;
*    RLPHR PROCEDURE format_double(value,etr,fntcode);
*                       VRLUE value,etr,fntcode;
*                      OOUBLE value; RLPHR str; DOOBLE fntcode; EXTERNPL;
*    RLPHR PROCEDURE format_quad(value,etr,fntcade);
*                       VRLUE value,atr,fntcode;
*                       BUAD value; RLPHR str; DOUBLE fntcode; EXTERNRL;
*    RLPHR PROCEDURE format_real(value,str,fntcede);
*                       VRLUE value,etr,fntcode;
*                       REAL value; RLPHR str; DOUBLE fntcode; EXTERNRL;
*    RLPHR PROCEDURE format_3_cmpx(value,str,fntcode);
*                       VRLUE value,str,fntcode;
*                       USERS value; RLPHR str; OOUBLE fntcode;EXTERNRL;
* ........ etr:=fonat(X,etr,X3000R05);
* ........ USTR(format(y,string,fntcode1);
*
* value: R IMTEGER, DOUBLE, OUBO, REAL, or USER3
* str:   An RLPHR (32 adra value) where the string ie be created
*          [-1] location nust be setup
* fntcode:R DOUBLE containing the formatting instructions
*        An alternative calling sequence that ia valid ia fntcode ae
*          tuo integers or four bytes
*
*********************************************************************
*********************************************************************
*
*       Variable allocation
*                          stack
*                        a 2sb lab a
*                  12(M)a neb 3sb a  fntcode
*                        a 2eb Isb a
*                   8(M)a nsb 3sb a  str eddress
*                        a   leu   a
*                   4(M)a   hsu   a   rtr bddrass
*                        a   Isu   a
*                    (M)a   nsu   a   eld M
*                        a -2b -1b a  flags    | ieading_digits
*                  -4(M)a -4b -3b a  exponent | exponent/3
*
```

```
RFMT.WORK.PDS510                THU, DEC 22, 1933, 10:36 AM     PRGE   3


*          flags: 0:No exponent
*                 1:trailing zero delete ( if in decinal part,Not fixed
*                 2:nantieaa value zero
*                 7:Neg input value                                width)
*
*          R0  MSU of value     RS   next char pointer
*          R1  LSU (if needed)
*          R2  exp -- power of ten
*
*          R7  uidth
*
*********************************************************************
* TO BE DONE
*    inprove speed of internal format to RSCII conversions
*********************************************************************
*
*
*                 fntcode COOING
*    12(M)
*  bit 31  M/U
*  bit 30  output code 0=decinal 1=hex
*  bit 29  fixed uidth 0=off     1=on (leading spaces,trailing zeros)
*  bit 28  fixed sign  0=Off     1=on (force "+" always)
*
*  bit 27  M/U
*  bit 26  exponent type1        0 normal 0 n/u  1 sci(3's) 1 letter
*  bit 25  exponent type2        0        1      0         1
*  bit 24  forced exp  0=off     1=on
*
*    13(M)
*  bit 23-20 (7-4 of 13(M)):Forced exp in powers of three
*                                  (range +-7 * 3 = +-21 )
*  bit 19-16 (3-0 of 13(M)): Round digit   0= no rounding
*                                          1= round 2ndMSD
*                                       to 15= round LSD
*    14(M)
*  bit 15-8 uidth: nax string uidth   (range 1-27F -- 1 to 127 decinal)
*                                  if 0 use inputted string's [-1] val
*    15(M)
*  bit  7-4 exp offset: the decinal exp is offseted ( range 0 - ZF )
*                       estenially a power of ten scaling
*  bit  3-0 dec_digits: nax # of digits to right of decinal point
*                         if fixed uidth not set and trailing digits
*                            zero, then do not output zero digits
*                         if 0, no decinal point  (range 0-ZF, 0 to 15)
*                              and if forced exp=0 then integer format
*                       in hex/bin nodes, number of significant digits
*****
```

```
RFMT.WORK.PDS510                THU, DEC 22, 1983, 10:36 AM     PRGE   4


*EJECT
* FORMRT EXAMPLES
*   fntcode
* 30000a03          fix uidth of 10 chars-Floating point out
*                             3 decinal digits
* 30050a03          fix uidth of 10 chars-Floating point out
*                             3 decinal digits -- round 9thMSD
* 30000a00          fix uidth of 10 chars-Floating point out
*                             NO decinal digits
* 00000a00          nax uidth of 10 chars-floating point out
*                             NO decinal digits
* 21100a02          fix uidth of 10 chars- forced exp +3
*                             0000.0DE03
* 01100a02          nax uidth of 10 chars- forced exp +3
*                             D000.0DE03 -- trailing zeros delete
* 01000R00          MAx uidth of 10 chars-integer format- no exp
*                             NO decinal digits
* 26000F08          fix uidth of 15 chars-letter exp (power of 3)
*                             8 decinal digits
* 04000F08          nax uidth of 15 chars- power of 3 exp
*                             8 decinal digits
* 40000908          8 hex digits plus leading space
*********************************************************************
```

```
AFNT.WORK.PD8510          THU, DEC 22, 1983, 10:36 AM    PAGE  5


*EJECT
format_integer EQU *
      EXTS.L R0
fernit_double EQU *
      LINK   R1,#-4
      BTST   #6,12(R)    chock output code bit( 0=dccinei 1=hex)
      BEQ    fd001
      eSR    eheck_str_uidth
      BSR    eutput_leading_spacei
      BSR    output_hex_chars
      BRR    fdex
*
fd001 JSR    CRV3a       convert double to bed  -- deetorye reg R0-R4?
*
fdecimal EQU *
      BSR    rnnnding
      BSR    compute_exp_velue
      BSR    chock_etr_uidth      oeed to do here to init pointere
      BSR    chech_needed_uidth   uill oleo output loading spaces
      BSR    output_escii_data
*
fdex  EQU *
fexit MOVE.1 $(R),R9     compute Retiers outputted(sub etart from finish)
      SUB.1  R9,R8
      MOVE   R8,R0
      SUb.b  #1,R0
      MOVE.B R0,(R9)     nave # chars to etring length
exit  MOVE.1 R9,R0       leave in R0 string address
*
      RRLX   R
      MOVE.1 (S)+,R8
      MODG   #08,S       romove paremeters
      JMP    (RS)
*
*
*
format_quad EQU *
      LINK   R1,R-4
      BTST   #6,12(R)    check output code bit( 0=decimal 1=hex)
      BEQ    fq001
      BSR    check_str_uidth
      BSR    output_leading_spaces
      CMP.$  =D5,R7      if nore than $ digits output RSM digits first
      RLE    fq101
      SUB.$  #5,R7
      RSR    output_hex_chars
      MOVE.B R8,R7
fq101 EXG    R0,R1       nove LSH in R0 to outputted
      BSR    output_hex_chars
      BRR    fqex
*
fq001 JSR    CMVRa       convert quad to bed -- destory reg R0-R4 ?
      BRR    fdecimal
fqex  BRR    fexit
*
*
```

```
BFBT.WORK.PD8510          THU, DEC 22, 1983, 10:36 AM    PAGE  6


format_real EQU *
      LINK   R1,R-4
      BIST   #6,12(R1)   check output code bit( 0=decimal 1=hex)
      BEQ    fr001
      BSR    check_str_uidth
      BSR    output_leading_spaces
      BSR    output_hex_chars
      BRB    frex
*
Er001 JSR    CMV2a       convert real to Bcd -- destory reg R0-R1,R5?
      BRR    fdecimal
frex  BRR    fexit
*
*
```

```
AFNT.WORK.PD8510          THU, DEC 22, 1983, 10:36 AM    PAGE  7


*EJECT;
* format_3_cnpx converts a USER3 number into a string the consists
* of the RERL,IRRG value. Each of the values are fornattid accord to
* the fnt_code inputted. Both results are returned in the single string
* provided and are seperated by a ",".
format_3_cnpx EQU *
      LINK   R1,R-4
      BTST   R6,12(R)    check output code bit( 0=decinal 1=hex)
      BEQ    fc001
      BSR    check_str_uidth
      BSR    output_leading_spaces
      CMP.B  #D4,R7      if nort than 4 digits output RSM digits first
      BLE    fq101
      SUB.B  #4,R7
      BSR    output_hex_chars
      MOVE.9 #4,R7
      BRR    fq101       nove LSH in R0 to outputted
*
fc001 MOVE.L S(R),  R8
      ROVE.B -1(R5), R6    nax string length
      MOVE.U  R6,   -(S)
      SUB.B   #2,    B6    make roon for aeperator ", "
      BSR.B   #1,    R6    divide by 2 -- two equal substrings
      MOVE.B  R6, -1(R8)
      JSR     CRVE1
*     EXG     R0,    B1     it use to do inag then real
      MOVE.L  R1,   -(S)   aave inag part
*
      BOVE.L 12(R), -(S)   fnt code
      MOVE.L  $(R), -(S)   alpha ptr
      BSR    format_real   conv real part
*
      MOVE.L  (S)+,  R0    get inag part
      MOVE.L  $(R),  R8
      MOVE.B -1(R8), R5    get nodified length
-     MOVE.B  (RS), R6     N chars so far
      EXTS.W  R6
      ADD.U   86,   B5     adjust ptr to free space
      MOVE.6  (R8), R6
      MOVE.W  R6,  -(S)    save last char of first substring
      MOVE.B  R5,  (RS)+   set substring nax length
*
      MOVE.L 12(R), -(S)    fnt code
      MOVE.L  R5  , -(S)   alpha ptr
      BSR    format_real   conv inag part
*
      MOVE.L  R0  ,  R8    restore nodified ptr
      MOVE.U  (S)+,  R6
      MOVE.B  R6, -1(R8)   reinsert first substring's last char
      MOVE.S  (R8),  B0    save second substring's length
      MOVE.B  =',,  (R8)   insert ","
      ADD.B   #1,,   R0    add to length for seperator
      BOVE.L  $(R),  B9    retsore orginal alpha ptr
      ADD.B   R0  , (R9)   conpute total string length
      MOVE.U  (S)+,  R6
      MOVE.B  R6, -1(R9)   restore orginal nax length
```

```
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      BRR    exit
```

```
RFMT.WORK.PDP$10          THU, DEC 22, 1983, 10:36 AM    PAGE  9

*EJECT
check_ttr_width EQU *     limit fmt_code values correlated with str value
      MOVE.L $(M),R8
      MOVE.B -1(R8),R6    get max string length
      BGT     cau1
      MOVE.B #01, R6      limit max string length to a min of 1
cau1  MOVE.B 14(M),R7     move width to R7
      BLE     cau2        if actual length 0 or neg use max string value
      CMP.B  R6,R7        compare to requested max
      BLE     cau3
cau2  MOVE.B R6,14(M)     set requested value to max
      MOVE.B R6,R7
cau3  CLR.B  (R5)+        clr string length
      RMD.B  #F,15(M)     mask away exp offset ( already saved if needed )
      MOVE.B 15(R),R8     move digit count into R8 for later use
      RTS
;
;
output_leading_spaces EQU *   output spaces till requested width<=
      BTST   #5,12(M)         R6 which is width of output
      BED    ols02        not fixed width format
ols01 CMP.B  R6,R7
      BLE    ols02
      MOVE.B #' ,(R8)+    output a space
      SUB.B  #1,R7        decrement width value
      BRR    ols01
ols02 MOVE.B R6,R7
      RTS
;
;
output_hex_chars EQU *    output hex ascii chars -- data in R0.L
;                         R7 has digit count
och01 CMP.B  #05,R7
      BLE    och02
      SUB.B  #1,R7        only 8 chars possible therefore padd with '0
      MOVE.B #'0,(R8)+
      BRR    och01
och02 MOVE   #09,R6
      SUB.B  R7,R6        move first used bits to bits 0-3
      BOD.B  R6,R6
      ROO.B  R6,R6        convert digit shift to bit shift
      ROL.L  R6,R0        shift count is MOD 64
ohc03 MOVE.B R0,R2
      BHDI.B #F,R2        get 4 bits to convert to ascii
      CMP.B  #09,R2       0-9 or A-F ?
      BLE    obc04
      BOD.B  #7,R2        A-F
ohc04 BOO.B  #30,R2
      BOVE.B R2,(R8)+
      ROL.L  B4,R0        rotate around next 4 bits
      SUB.B  #1.R7        dec digit count by one
      TST.B   R7          zero? (it finished)
      BGT     ohc03
      RTS
```

```
RFMT.WORK.PDP$10          THU, DEC 22, 1983, 10:36 AM    PAGE  10

*EJECT
;
* rounding will take the 16 bed digits in R0(MSW1/R1(LSW) and round
* at the specified digit LSD=15,2MSB=1 and 0 means no rounding.
* All the less singficant digits are set to zero, and 5 is added to the
* digit to be round, any carry is then propagated. If the MSD has a
* carry then all the digits are shifted down one digits and BSD=1.
rounding EQU *
      MOVE.B  13(M),R3      get digit placement to round
      AND.W   #F,   R3
      BEQ     rnd_exit      EQ (0) no rounding
      CLR.L   #4            NE (>0)   round
      CLR.L   R5
      MOVEM.L R0/R1/R4/R5,-(S) move bed digits and dummy value onto stack
      LEA     $(S), R9      R9  pointer for R0/R1 -- actual value
      LEA     16(S),R10     R10 pointer for R4/R5 -- dummy value
      BOVE.W  #015, R1
      SUB.W   #3,   R1
      RSR.W   #1,   R1      #1 is byte to be rounded
      BOVE.W  #07,  R0
      SUB.W   #1,   R0      R0 is bytes to be rounded
      #tA     rnd02
;
rnd01 CLR.B   -(R9)         clear low bytes ( pre rounding)
rnd02 DBRA    R1,rnd01
;
      BOVE    #R00,CCR      clear extend bit
      B1ST    #0,   R3
      BNE     rn404         NE(1) round lower digit of byte
      MOVE.B  #MS0,-1(R10)  EQ(0) round upper digit of byte
      ABCD    -(R10),-(R9)  add BCD digits to obtain extend bit
      CLR.B   (R9)          clr upper/lower digit
      BRA     rnd06
rnd04 MOVE.B  #M05,-1(R10)  rounding lower digit
      ABCD    -(R10),-(R9)
      BNO.B   #MF0,  (R9)   clear lower digit
      BRA     rnX06
;
rnd05 RSCD    -(R10),-(R9)  add BCD digits to zero to propagate carry
      BCC     rnd07         CC(0) progration finished exit
rnd06 DBRA    R0,rnd05      CS(1) continue till no more digits
;
rnd07 MOVEM.L (S)+,R0/R1/R4/R5
      BCC     rnd_txit      CC(0) no carry then exit
      ROXR.L  #t,R0         CS(1) rotate into MSH
      ROXR.1  R1,R1          now rotated 4 bits from R0 into R1
      LSR.L   B1,B0
      ROXR.L  #1,R1
      LSR.L   R1,R0
      ROXR.L  #1,R1
      LSR.L   #1,R0
      ROXR.L  B1,R1
      ADD.B   #1,#2         correct exp for digit rotate
rnd_exit    RTS
```

```
AFMT.WORK.PDP$10          THU, DEC 22, 1983, 10:36 AM    PAGE  11

*EJECT
;
* compute_exp_value computes the actual exponent and form to be used
*   uses the exponent of the converted value (in R2.S) and the fmt_code
compute_exp_value EQU *
      MOVE.B 15(M),R3
      AND.B  #MF,15(M)    save only dec digit part
      LSR.B  #4,R3        rotate down exp offset part
      SUB.B  R3,R2        adjust exp by offset
      TST.L  R0
      BNE    cev00        NE(1) input value not zero
      TST.L  R1           continue testing
      BNE    cev00        NE(1) input value not zero
      CLR.B  R2           input zero ==> adjusted exp = 0
      BSET   B10, R2-     set mantissa zero flag
;
cev00 MOVE.W R2,-2(B)     save converted value sign/exp
      BTST   #0,12(M)     forced exp ?
      BED    cev01        EQ(0) NO
      MOVE.B 13(M),R2     NE(1) yes, use it
      RSR.B  #4,R2        rotate down the force value
      BOVE.B R2,R3
      BSL.B  #1,R3        R3=2*R2
      ROO.B  R3,R2        R2=R2+2*R2  -- quick times 3
      BTST   R2,-2(M)     was mantissa zero --
      BED    cev0         NO
      MOVE.B R2,-1(M)     YES -- replace computed exp with forced
cev0  TST.B  R2           if it zero
      BNE    cev01
      BSET   #0,-2(M)     yes -- so no exp part in output
;
cev01 BTST   #2,12(M)     power of three exp?
      BEO    cev03
      TST.B  R2           yes comp power of 3*SIGN(exp)*MOO(RBS(exp)/3
      BGE    cev02        actually 3*(exp -  (IF exp<0 THEN 2 ELSE 0) )
      SUB.B  #2,R2
cev02 EXTS   R2
      EXTS.L R2
      DIV    #03,R2
      B1ST   #1,12(M)     letter exp ?
      BED    cev23        0=NO
      CMP.W  #0-5,R2      min limit
      BGE    cev21
      MOVE.W #D-5,R2      NO - limit value
      BRA    cev22
cev21 CMP.W  #D4,R2       max limit
      BLE    cev22
      MOVE.W #04,R2       NO - limit value
eev22 MOVE.B R2,-3(M)     save power of 3 exp for indexing of exp lette
cev23 MOVE.B R2,R3
      BSL.B  #1,R3        R3=2*R2
      BOO.B  R3,R2        R2=R2+2*R2  -- quick times 3
;
cev03 MOVE.B R2,-4(M)     save actual exp
      SUB.B  -1(M),R2     -(leading digits)=new exp - old exp - 1
      SUB.B  #1,R2        NOTE: leading digits>0 digits to left of "."
```

```
RFMT.WORK.PDP$10          THU, DEC 22, 1983, 10:36 AM    PAGE  12

      CMP.B  15(M),R2           leading digits<=0 digits to right of"."
      BLT    cev04        limit neg value to fmt_code limit
      MOVE.B 15(M),R2
cev04 NEG.B  R2
      MOVE.B R2,-1(M)     save leading_digit count
      RTS
```

```
MFNT.WORK.PDS510          THU, DEC 22, 1983, 10:36 AM    PAGE 13

*EJECT
*
* check_needed_width computes needed width for ascii output and checks
*    that versus max available (from fmt_code). If OK outputs leadings
*    spaces and continues -- If NOT OK outputs "????" and exits format
check_needed_width EQU *
      CLR    R6              R6 will hold needed width
      BTST   #4,12(A7)       fixed sign space?
      BNE    cnu01
      BTST   #7,-2(A7)       OR inputted value neg
      BEQ    cnu02
cnu01 BDO.B  #1,R6
*
cnu02 TST.B  -1(A7)          positive leading digits
      OGT    cnu03
      BDO.B  #1,R6           NO
      BOB    cnu04
cnu03 RDO.B  -1(A7),R6       Yes
*
cnu04 TST.B  15(A7)          positive decimal digits?
      BLE    cnu05
      BDO.B  #1,R6           Yes, and donot forget decimal point
      BDO.B  15(A7),R6
*
cnu05 BTST   #0,-2(A7)       test no_exp_flag
      BNE    cnu05
      BTST   #1,12(A7)       letter exp?
      BEQ    cnu06
      BDO.B  #2,R6           yes
      BRR    cnu08
cnu06 BDO.B  #03,R6          no- normal exp
      BTST   #4,12(A7)       fixed sign (for exp)
      BNE    cnu07
      TST.B  -4(A7)          OR neg value exp
      BOE    cnu08
cnu07 BDO.B  #1,R6           yes - inc counter
*
cnu05 MOVE.B 14(A7),R7       get max available space from fmt_code
      CMP.B  R6,R7           R6 too big?
      BGE    output_leading_spaces  NO
*
      SUB.B  #1,R7
      EXTS   R7
cnu09 MOVE.B #'?,(R8)+       fill output with "?"
      DBRR   R7,cnu09
      BDO.L  #04,S           delete subroutine return address
      BRA    fexit
```

```
MFBI.WORK.PDS510          THU, DEC 22, 1983, 10:36 AM    PAGE 14

*EJECT
*
*  output_ascii_data outputs the converted value as specced in fmt_code
output_ascii_data EQU *
      BCLR   #1,-2(A0)     clr trailing zero flag
      BTST   #7,-2(A0)     input value neg?
      BEQ    sad01
      MOVE.B #'-,(R8)+     yes
      BRA    oad02
oad01 BTST   #4,12(A0)     fixed sign format
      BEQ    oid02
      MOVE.B #' ,(R8)+     output space
*
oad02 MOVE.B -1(A0),R6
      EXTS   R8
      BGT    oad06         leading_digits neg?
      MOVE.B #'0,(R8)+     YES
      NEG    R6            negate leading_digit
      BOVE.B 15(R),R7
      EXTS   R7
      BLE    exp_out       decimal_digits count>0
      MOVE.B #'.,(R8)+     yes - output decimal point
      BRA    oad04
oad03 MOVE.B #'0,(R8)+     zero fill loop
      SUB    #1,R7         dec decimal_digits counter
oad04 DBRA   R6,oad03
      BTST   #5,12(A7)
      BNE    oad05          NE(1)  fixed width, leave trail zero clear
      BSET   #1,-2(A7)      EQ(0) not fixed width, set trail zero flag
oad05 BSR    output_number  output R7 numbers
      BRR    exp_out
*
oad06 MOVE   R6,R7
      BSR    output_number  output R7 (leading_digit) numbers
      MOVE.B 15(A7),R7
      EXTS   R7
      BLE    exp_out       decimal_digits count > 0
      MOVE.B #'.,(R8)+     yes  -- decimal point
      BTST   #5,12(A7)
      BNE    oad07          NE(1)  fixed width, leave trail zero clear
      BSET   #1,-2(A7)      EQ(0) not fixed width, set trail zero flag
oad07 BSR    output_number  output R7 (decimal_digits) numbers
*
exp_out EQU *
      BTST   #1,12(A0)     letter exp?
      BEQ    oe001
      MOVE.B #' ,(R8)+     yes output space
      BTST   #0,-2(A7)     no_exp_flag
      BNE    exp_ex
      MOVE.B -3(A7),R2     get exp value  -- range check done earlier
      BEQ    exp_ex        if zero no letter
      EXTS   R2
      LEA    exp_letter,R0
      MOVE.B 5(R5,R2),(R8)+  get letter
      BRA    exp_ex
*
```

```
MFNT.WORK.PDS510          THU, DEC 22, 1983, 10:36 AM    PAGE 15

eo001 BTST   #0,-2(A7)     no_exp_flag
      BNE    exp_ex
      MOVE.B #'E,(R3)+     output "E"
      MOVE.B -4(A7),R0     get exp value
      EXTS   R0
      BGE    eo002
      MOVE.B #'-,(R5)+     output minus
      NEG    R0
      BRR    eo003
eo002 BTST   #4,12(A7)     Fixed output sign for exp?
      BEQ    eo003
      MOVE.B #'+,(R5)+     output plus sign
*
eo003 JSR    bcd_of_int    convert exp to bcd    ???? save R8 ?????
      MOVE.B R0,R1         copy exp digits
      RSR    #4,R0         get 1st digit
      RND    #NF,R0
      BNE    eo004         first exp zero  ?
      BTST   #5,12(A7)     fixed width output?
      BEQ    eo005         no - skip first zero exp
eo004 OR     #H30,R0
      MOVE.B R0,(R8)+      output 1st exp digit
eo005 RND    #NF,R1
      OR     #H30,R1
      MOVE.B R1,(R5)+      output 2nd exp digit
exp_ex EQU *
      RTS
*
*
*
*output_number outputs to string R7 ascii chars from R0/R1 (a BCD number
*     It does a multi reg 4 bits shift, shifting out desire number,
*        shifting in zeros.  Terminates if only zeros to output and
*        trailing zeros flag is set.
output_number BRR on002
on001 ROL.L  #4,R1
      ROL.L  #4,R0         shift r0,r1
      MOVE   R0,R2         get value to output
      AND    #NF,R2        mask four bits needed
      OR     #H30,R2       convert ascii
      MOVE.B R2,(R8)+      output
      MOVE   R1,R2         get value to be carried up to R0
      RND    #NF,R2        again mask four bits needed
      AND.L  #HFFFFFFF0,R0
      RND.L  #HFFFFFFF0,R1
      OR.B   R2,R0         move bit shift out of R1 into R0
      BTST   #1,-2(A7)
      BEQ    on002         EQ(0) trailing zero flag false
      TST.L  R0            NE(1) exit if R0,R1 all zeros
      BNE    on002         NE(1) ROW0, continue outputing
      TST.L  R1            EQ(0) R0=0, test R1
      BEQ    on003         EQ(0) both R0/R1 zero exit
on002 DBRR   R7,on001      NE(1) more sinficant data, loop
on003 RTS
```

```
MFNT.WORK.PDS510          THU, DEC 22, 1983, 10:36 AM    PAGE 16

*EJECT
*
*   PROCEDURE CNV3a(x); VALUE x; DOUBLE x;
*
*  Converts a Double (32 bit)  number (internal representation) to
*        -- a positive bcd (ready for ascii) integer value in R0.L
*        -- a nant sign bit (R2 bit 15)
*        A 2's comp binary code power of ten exp value in R2 (Bits 0-7)
*  The converted value is left justified  in R0 and there are
*     Max 8  significant digits
*        If Double is too large for 8 than Quad routine is used
*
*
*  IF input < 0 THEN set nant flag
* check if greater than 8 digits -- if so use QUAD routine
* convert input to BCD
* shift BCD value TILL MSD(most sign digit) is nonzero
*       and adjust exponent value so that decimal point is after MSD
* Return sign flag and exp in R2
* Return converted value in R0, R1 not used
*
CNV3a CLR    -(S)   allocate space for sign/exp temp
      TST.L  R0
      BGE    CNV3    neg input ?
      NEG.L  R0
      BSET   #7,(S)  set neg nant flag
CNV3  CMP.L DIG8,R0
      BGE cnv3A      too big for 8 digits
      BSR    CNV37
      MOVEQ  #7,exp   initialize exp counter
      MOVE.L #HF0000000,R4   mask for testing nsd
      TST.L  R0       zero input ?
      BNE    C3001      nonzero
      CLR    exp
      BRA    CNV3ex
C3002 SUBQ   #1,exp    decrement loop counter
      ASL.L  #4,R0   shift legt one bcd digit
C3001 MOVE.L R4,R3 reset MSD nask
      AND.L  R0,R3    nask MSD
      BEQ    C3002    Is MSD ZERO?
CXV3ex OR    (S)+,exp   Or in nant neg flag in exp word
      CLR.L  R1       double result does not require R1
      RTS
*
*
*    BINARY TO BCD (LATER ASCII) CONVERTOR
*       CONVERT BINARY TO 8 DIGITS
*    INPUT/OUTPUT R0       positive values only
*
*
*
bcd_of_int:CNV46:CNV47  EXTS.L  R0
CNV37 TST.L  R0   CHECK SIGN                ***TRY TO LIMIT TO POSTIVE?
      BNE    C3710       convert if not zero
      RTS              exit if zero
```

```
RFNT.WORK.PD851D              THU, DEC 22, 1983, 10:36 AM    PAGE 17


*EJECT
*
*   PROCEDURE CNVRa(x); VALUE x;  QUAD x;
*
*  Converts a Quad (64 bit)  number (internal representation) to
*       -- a positive bcd (ready for ascii) integer value in R0/R1.L
*       -- a sign bit (R2 bit 15)
*       A 2's comp binary code power of ten exp value in R2 (Bits 0-7)
*  The converted value is left justified  in R0 and there are
*     Max 16 significant digits
*
*
CNVRa CLR    -(S)      Allocate sign flag
      TST.L  R0H
      BGE    testR     Is input value Negate
      NEG.L  1eh       NEGATE QUAD VALUE
      NEGK.L R0h
      BSET   R7,(S)    set neg flag
testR TST.L  R0h       test if upper half is zero
      BNE    CNVR      No
      TST.L  1eh
      BLT    CNVB      Will not fit in a double
      EXG    1eh,R0h   move lower half to R0h
      BRA    CNV3      use simpler double conversion routine
o
cnv3B CLR.L  R1         entry point for when double to bcd >8 digits
      EXG    R0,R1
*
CNVR  BSR    CNVRS
      MOVE   #15,exp   initialize exp counter
      MOVE.L #F0000000,R4  MASK for testing MSD
      CLR.L  R3        CLR digit mask -- used in multi reg block shifit
      BRR    CR001
CR002 SUB0   #1,exp    decrement exp counter
      ASL.L  #4,R3
      OR     #F,R3     create Digit mask for multi reg rotate later
      ROL.L  #4,R0H    rotate MSH
      ROL.L  #4,1eh    ROTATE LSH
CR001 MOVE.L R4,R5     load ntd test mask
      RND.L  R0h,R5    mask MSD
      BEQ    CR002     Zero continue shift
      BOVE.L R3,R4     Copy digit mask
      RWD.L  1eh,R4    RO=RO+r1*mask
      OR.L   R4,R0
      NOT.L  R3        not mask
      RWD.L  R3,R1     R1=R1* NOT mask
*
      OR     (S)+,exp
      RTS
```

```
RFBI.WORK.PD5510              THU, DEC 22, 19R3, 10:36 AM    PAGE 1S


*EJECT
*
*
*
*    QUAD TO BCDL VERSION
*       16 DIGITS
*      INPUT/OUTPUT R0/R1       positive volume only
*
*
*
CRVRS MOVE.L R0,R2
      MOVE.L R1,R3
      CMP.L  DIG16,#2
      BMI    MY825
      BNE    MVB50     NO DIVIOE NECESSARY
      CMP.L  DIG16+4,R3
      BCS    BY3S0     SKIP ON LOGICAL LESS THAN
MV825 MOVE.L #S9999999,R0
      BOVE.L R0,R1
      BRA    CNVRex
MYS36 MOVEM.L R2-R3,-(S) SAVE REGS
      CLR    -(S)      SIGN FOR OIV3L
      MOVEQ  S32,R3    BIT COUNT FOR DIV3L
      BOVE.L R1,R2
      EXG    R0,R2
      MOVE.L DIG0,R1
      JMP    OIV3L
MYS37 BSR    C3710     CONVERT TO BCD
MVS40 EXG    R0,R1
      BSR    C3710     CONVERT TO BCD
      EXG    R0,R1
RYB50 EXG    R0,R2
      EXG    R1,R3     MOU DO LSH OF PRODUCT
      TST.L  R0        SEE IF DIVIDE NECESSRRY
      BNE    MYS55
      CMP.L  DIGS,R1
      BCS    BY860     SKIP IF NO DIVIDE NECESSARY
MY855 BSR    MY836       GO DIVIDE BY 10^S
MY857 BSR    C3710     CONVERT TO BCD
BYS60 EXG    R0,R1
      BSR    C3710
      EXG    R0,R1
CNVRex RTS
DIG16 HEX    23,86F2,6FC1,0    10^16 IN QUAD BINARY
DIGS  DEF.L  100000000
```

```
RFNT.UORK.PDS510              THU, DEC 22, 19R3, 10:36 RM    PAGE 19


*EJECT
*
*   PROCEDURE CNV2a(R); VALUE R; REAL R;
*
*  Converts a real number (internal representation) to
*       -- a positive bcd (ready for ascii) integer value in R0.L
*       -- a sign bit (R2 bit 15)
*       A 2's comp binary code power of ten exp value in R2 (Bits 0-7)
*  The converted value is left justified  in R0 and there are
*     7 eignificant digits
*
*
* IF input value<0 THEN set sign Flag, and negate input
* Convert exp to nearest power of ten,
*    and normalize mantissa to a value between 1.0 to 10.0
*THEN convert to a double between 1,000,000 to 9,999,999
*Convert double to BCD
*If exp <0 THEN set exp flag and negate exp
*Conbine exp and sign flags
*
CNV2a CLR    -(S)  allocate space for sign info
      TST.L  R0
      BGE    SOM
      BSET   #7,(S) set sign neg
      JSR    KEG2
SGN   BOVE.L R0,-(S)     SAVE R
      EXTS   R0
      SUBQ   #1,R0
      MPY    #D1000,R0      try simpler appoarch
      DIV    #03322,R0      ?(R0+R0+R0)/10  -- exact not needed?
      MOVE   R0,-(S)
      NEG    R0
      JSR    TENI
      MOVE.L 2(S),R1     FETCH R
      JSR    MPY2
      MOVE.L R0,2(S)     SRVE  R
      MOVE.L #01000000,R2
      MOVE.L #F10,R1
      JSR    CMP2
      BLT    DIG
      RDDQ   #1,(S)
      MOVE.L #0100000,R2
      BRA    DIG01
DIG:  BOVE.L 2(S),R0
      MOVE.L #F1,R1
      JSR    CMP2
      BGE    DIG01
      SUBQ   #1,(S)
      MOVE.L #D10000000,R2
DIG01 MOVE.L R2,R1
      MOVE.L 2(S),R0
      MOVE.A R0,R2
      CLR.B  R0
      JSR    MPY3L
      EXTS   R2
      BPL    DIG02
```

```
RFNT.WORK.PD8510              THU, DEC 22, 1983, 10:36 AM    PAGE 20


      NOT    R2
      BEQ    DIG12
      ASR.L  R2,R0
      BCS    DIG03
      BRR    DIG04
DIG02 LSL.L  R1,R1
      ROXL.L #1,R0
      SUBQ   #1,R2
      BGE    DIG02
DIG12 TST.L  R1
      BPL    DIG04
DIG03 RDDQ.L #1,R0
DIG04 BSR    CNV37
      ROL.L  #4,R0
      BOVE   (S),R2 place exp in R2
      TST.L  R0          test if zero
      BNE    dx1
      CLR    R2
      BRA    dx2
dx1   RND    #0FF,R2   env exp to byte iten
dx2   OR     6(S),R2   add binary exp value with sign flag
      CLR.L  R1          clr R1 to zero
DIGX: RDDQ.L #8,S     DELETE EXPONENT/temp copy of real/sign flags
      MOVE.L (S)+,R3 FETCH RETURN ADDRESS
      JMP    (R3)    RETURN TO CALLER
```

```
AFMT.WORK.PD8510              THU, DEC 22, 1983, 10:36 AM    PAGE 21

*EJECT
*
*      BASIC BINARY TO BCD CONVERTER
*         YIELDS A 8 DIGIT RESULT FOR A RESTIVE INTEGER INPUT
*           INPUT RANGE 0-99999999 (0 - Hex5F5E0FF)
*      INPUT/OUTPUT VIA R0  -- NO LIMIT CHECKING
*
*      A TWO PASS OPERATION CONVERING 4 DIGITS AT TIME
*      WILL SKIP THE FIRST PASS IF NOT NEEDED
*
*
*     4 DIGITS = 15.25-45.5 uS
*     8 DIGITS = 45.5-109 uS
*
C3710 CMP.L  #010000,R0    RSH=0?
      BNE    C3750         YES
      DIVU   #010000,R0    SPLIT INTO WORDS
      BSR    C3750
      SWAP   R0           GET LEAST SIGNIFICANT HALF
C3750 CMP    #01000,R0      9000   CONVERT WORD TO BCD
      BLT    WDIG
      CMP    #06000,R0      6000
      BLT    C378D
      CMP    #08000,R0      8000
      BLT    C3760
      CMP    #09000,R0      9000
      BLT    C3770
      ADD    #027864,R0
      BRA    WDIG
C3760 CMP    #07000,R0      7000
      BLT    C3765
      ADD    #021672,R0
      BRA    WDIG
C3765 ADD    #018576,R0
      BRA    WDIG
C3770 ADD    #024768,R0
      BRA    WDIG
C3780 CMP    #03000,R0      3000
      BLT    C3790
      CMP    #04000,R0      4000
      BLT    C3785
      CMP    #05000,R0      5000
      BLT    C3788
      ADD    #015480,R0
      BRA    WDIG
C3785 ADD    #09258,R0
      BRA    WDIG
C3788 ADD    #012354,R0
      BRA    WDIG
C3790 CMP    #02000,R0      2000
      BLT    WOIGP
      ADD    #03096,R0
WOIGP ADD    #03096,R0
WDIG  ROL    #4,R0
      CMP    #01600,R0       100
      BLT    TDIG
```

```
AFMT.WORK.PD8510              THU, DEC 22, 1983, 10:36 AM    PAGE 22

      CMP    #09600,R0      800
      BLT    B3780
      CMP    #012800,R0     800
      BLT    D3760
      CMP    #014400,R0     900
      BLT    B3770
      ADD    #022464,R0
      BRA    TDIG
03780 CMP    #011200,R0     700
      BLT    D3765
      ADD    #017472,R0
      BRA    TDIG
03765 ADD    #014976,R0
      BRA    TDIG
03770 ADD    #019968,R0
      BRA    TDIG
B3750 CMP    #04800,R0      300
      BLT    B3790
      CMP    #06400,R0      400
      BLT    03785
      CMP    #08000,R0      500
      BLT    D378E
      ADD    #012480,R0
      BRA    TDIG
03785 ADD    #07488,R0
      BRA    TDIG
B3788 ADD    #09984,R0
      BRA    TOIG
03790 CMP    #03200,R0      200
      BLT    TOIGP
      ADD    #02496,R0
TOIGP ADD    #02496,R0
TDIG  AOR    #4,R0
TDIGA CMP.B  #010,R0      10
      BLT    LDIG
      CMP.B  #060,R0      60
      BLT    E3750
      CMP.B  #080,R0      80
      BLT    E3760
      CMP.B  #090,R0      90
      BLT    E3770
      ADD    #054,R0
      RTS
E3770 ADD    #048,R0
      RTS
E3760 CMP.B  #070,R0      70
      BLT    E3765
      ADD    #042,R0
      RTS
E3765 ADD    #036,R0
      RTS
E3750 CMP.B  #030,R0      30
      BLT    E3790
      CMP.B  #040,R0      40
      BLT    E3785
      CMP.B  #050,R0      50
```

```
AFMT.WORK.PD8510              THU, DEC 22, 1983, 10:36 AM    PAGE 23

      BLT    E3788
      ADD    #030,R0
      RTS
E3755 ADD    #018,R0
      RTS
E3758 ADD    #024,R0
      RTS
E3790 CMP.B  #020,R0      20
      BLT    LDIGP
      ADD    #06,R0
LDIGP ADD    #06,R0
LDIG  BIS
*
```

```
AFMT.WORK.PD8510              THU, DEC 22, 1983, 10:36 AM    PAGE 24

*EJECT
*****************************************************************************
* int_of_bcd
*
* Converte a postive 4 digit BCD value ( 0-9999 ) to binary integer
*
* NO ERROR or LIMIT CHECKING !!!!!!!
*
* calling protocol:
*      INTEGER PROCEDURE int_of_bcd(I): VALUE I: INTEGER I: EXTERNAL:
*      ..... j:=int_of_bcd(k):
*
*
* method: The passing parameter is a integer type but with BCD coding
*          of 4 digits.  |D3|D2|D1|D0|
*         result is D0+10*(D1+10*(D2+10*D3)) (starting with 03)
*
*****************************************************************************
*int_of_bcd: CLR.L  R1
*      EXG    R0,R1
*      SWAP   R1
*      BSR    X10
*      BSR    X10
*      BSR    X10
*      BSR    X10
*      RTS
*
*X10:  MPY    #D10          MPY *10 the present binary result and add
*      ROL.L  #4,R1         in next BCD digit
*      ADD    R1,R0
*      CLR.B  R1
*      RTS
      END
```

```
FFNT.WORK.PD8510          THU, DEC 22, 1983, 10:36 AM    PAGE  1

     ALPHA PROCEDURE format_integer(value,str,fntcode);
                   VALUE value,str,fntcode;
                 INTEGER value; ALPHA str; DOUBLE fntcode;EXTERNAL;
     ALPHA PROCEDURE format_double(value,str,fntcode);
                   VALUE value,str,fntcode;
                  DOUBLE value; ALPHA str; DOUBLE fntcode; EXTERNAL;
     ALPHA PROCEDURE format_quad(value,str,fntcode);
                   VALUE value,str,fntcode;
                   QUAD value; ALPHA str; DOUBLE fntcode; EXTERNAL;
     ALPHA PROCEDURE format_real(value,str,fntcode);
                   VALUE value,str,fntcode;
                   REAL value; ALPHA str; DOUBLE fntcode; EXTERNAL;
     ALPHA PROCEDURE format_3_cnpv(value,str,fntcode);
                   VALUE value,str,fntcode;
                   USER3 value; ALPHA str; DOUBLE fntcode;EXTERNAL;
```

```
CFORMAT.WORK.PD8510       THU, DEC 22, 1983, 10:36 AM    PAGE  1

INTEGER CONSTANT

cmd_sur := 122,
cmd_linear_mag := 123,
cmd_linear_polar := 124,
cmd_log_polar := 125,
cmd_imag_vs_real := 126,
cmd_y_smith := 127,
cmd_imaginary := 128,
cmd_real := 129,
cmd_group6 := 0;
```

```
FFORMAT.WORK.PD8510       THU, DEC 22, 1983, 10:36 PM    PAGE  1

COMMENT
  This is a software generated file !!!
  Changes must be made in SKIMFO.WORK
  Run GENSK.LAKI to re-generate File;

SUBROUTINE proc6;  ENTRY;
BEGIN

CASE command_token-122 OF
BEGIN
& 122 &
neu_format( fnt_sur );
& 123 &
neu_format( fnt_linear_mag );
& 121 &
neu_format( fnt_linear_polar );
& 125 &
neu_format( fnt_log_polar );
& 126 &
neu_format( fnt_imag_vs_real );
& 127 &
neu_format( fnt_y_smith );
& 128 &
neu_format( fnt_imaginary );
& 129 &
neu_format( fnt_real );
END;
END proc6;
```

```
SFORMAT.WORK.PD8510       THU, DEC 22, 1983, 10:36 AM    PAGE  1

%&XL,P,"format"
BEGIN

RFILE futil3.work;                                  & for warn & & DEBUG &
RFILE cmessag0.work;          & for command_nat_inplemented & & DEBUG &
RFILE cformat.work;
RFILE factive.work;
RFILE fannot.work;
RFILE ccontvar.work;                                & for max_peraneter &
RFILE ftrace.work;
RFILE fgratic.work;
RFILE fdatap.work;
RFILE cchtable.work;
RFILE fchtable.work;
RFILE fpfr.work;
RFILE fchpfr.work;
RFILE fscreen.work;
RFILE fmenu.work;
RFILE fconnand.work;                                      & command_token &
RFILE crina.work;                             & for proceeeing_variables &
RFILE Fkernel.work;                                & for acquire_releaee &

ALPHA TABLE fernat_annotation :=    & nust correspond to cdatap values &
   "",              &  not used            &
   "log MAG",       &  fnt_log_nag         &
   "LINEAR",        &  fnt_linear_nag      &
   angle_char,      &  fnt_phase           &
   "-"+delta_char+phi_char+"/"+delta_char+omega_char,
                    &  fnt_delay           &
   "Re",            &  fnt_real            &
   "In",            &  fnt_inaginary       &
   "",              &  fnt_log_polar       &
   "",              &  fnt_linear_polar    &
   "",              &  fnt_inag_vs_real    &
   "Z",             &  fnt_z_snith         &
   "Y",             &  fnt_y_snith         &
   "SWR";           &  fnt_sur             &

INTEGER TRBLE format_hilight :=
     0,             &  0  not used         &
     0,             &  1  fnt_log_nag - a "hard" key &
     end_linear_nag,&  2  fnt_linear_nag   &
     0,             &  3  fnt_phase   - a "hard" key &
     0,             &  4  fnt_delay   - a "hard" key &
     cnd_real,      &  5  fnt_real        &
     cnd_inaginary, &  6  fnt_inaginary   &
     cnd_log_polar, &  7  fnt_log_polar   &
     cnd_linear_polar, &  &  fnt_linear_polar &
     end_inag_vs_real, &  9  fnt_inag_vs_real &
     0,             & 10  fnt_z_snith  - a "hard" key &
     cnd_y_snith,   & 11  fnt_y_snith     &
     cnd_sur;       & 12  fnt_sur         &
```

```
$FORMAT.WORK.PD8510          THU, DEC 22, 1983, 10:36 AM    PAGE  2


%EJECT;
COMMENT                                                annotate_format
*****************************************************************
*
*****************************************************************
;
PROCEDURE  annotate_format;                                    ENTRY;
   BEGIN & annotate_format &
      INTEGER format_display,
              format;

      IF current_entry_ch = 1 THEN
         format_display := format1_display
      ELSE & current_entry_ch = 2 &
         format_display := format2_display;
      format := entry_ch_integer(ch_format);
      print_string( format_annotation[format],
                    format_size,
                    format_display
                  );
      hilight_key( format_hilight[format], cmd_mar, cmd_real );

   END;  & annotate_format &
```

```
$FORMAT.WORK.PD8510          THU, DEC 22, 1983, 10:36 AM    PAGE  3


%EJECT;
COMMENT                                                new_format_partial
*****************************************************************
*
*****************************************************************
;
PROCEDURE  new_format_partial;                                 ENTRY;
   BEGIN & new_format_partial &

      & update any active function annotation &
      select_active_function( active_previous );
      annotate_format;
      annotate_ref_value;
      annotate_scale;

      & update the display &
      partial_trace_and_graticule;
      partial( update_d );

   END;  & new_format_partial &


PROCEDURE  new_format( format_type );
   VALUE  format_type;
   INTEGER format_type;                                        ENTRY;
   BEGIN & new_format &
      INTEGER d,
              p;

      acquire( processing_variables );   & to assure no datap conflict &
      d := entry_ch_integer(ch_domain);
      p := entry_ch_integer(ch_param);
      format[ d, p, current_entry_ch ] := format_type;
      recall_pfr;              & also stores format_type into ch_table &

      new_format_partial;

      release( processing_variables );

   END;  & new_format &

RFILE fformat.work;

END$
```

```
$FSTMATH.WORK.RD8510         THU, DEC 22, 1983, 10:36 AM    PAGE  1


RSAB,R
 %%% fstmath,7,"JTB,LAMI. PD8510    9/2/82"
;
R0  REG 0
R1  REG 1
R2  REG 2
R3  REG 3
R4  REG 4
R8  REG 8
R9  REG 9
R10 REG 10
S   REG 15
*
 ENT fst_trig,fst_trig_long,fst_sqrt
 EXT sine_cos,sqrt_tbl    & look up tables &
 EXT %OSFR
*
fst_trig_long EQU *          ENTRY FOR 32 BITS/CYCLE
   SWAP R0
   ROL.L #2, R0
fst_trig EQU *
   %OVE =LHOSFR, R9    ENTRY FOR 16 BITS/CYCLE
   %OVE.L R0, R1
   ROR.L R6, R1
   AND =H0FFC, R1          index for 1024pt table
   LER sine_cos.L, R10
   BOO R1, R10
   LSL N7, R0
   RND =h7F80, R0
   %OVE.L (R10)+, (R9)+    start interpolation  -- first table value
   %OVE.L (R10),  (R9)%                           second table value
   MOVE R0, (R9)+                                 delta
   NEG R0
   MDD =H8000, R0
   MOVE R0, (R9)+                                 1-delta
   BMI FSC1                input value exact at first table value
   MOVE.L (R9)+, R0
   RTS
FSC1: MOVE.L -4(R10), R0
   BOVE.L (R9)+, R9    DUMMY READ
   RTS
;
* REAL PROCEDURE fst_sqrt(N) --- 16-bit precision using table look-up
*           occupies 153 words: 56-word program, 97-word table
*           execution time = 52 usec (worst case)
*
fst_sqrt EQU *
      MOVEM.L R1-R4/R8,-(S)  SAVE REGISTERS
      MOVE.B R0,R2           Put exponent in R2
      CLR    R0              Use 16-bit mantissa and
      SWAP   R0              put it in lower word of register
      TST    R0              Do not compute SQRT(n) where N <= 0
      BLE    ERR
      EXTS   R2              Make exp. word size for possible byte overflow
      BTST   N0,R2
```

```
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      BEQ    3QEXP        If exponent is odd then
      PODQ   #1,R0          round up bit about to be shifted, if any
      BVC    SQOK           if it overflows on rounding then
      MOVE   #N7FFF,R0      set value back to highest positive value
SQOK  RSR    K1,R0          mantissa/2
      RODQ   R1,R2          increment exponent to make it even
SQEXP RSR    N1,R2        SQRT(exponent) = exponent/2
*
* Take square root of mantissa
*
      LER      sqrt_tbl.L,RS    Address of lookup table (offset by 64)
*                                  Table from 0.25 to 1, 0.25-= bit 7 = 62
      MOVE     R0,R1        Copy mantissa
      RNDI     #HFF00,R1    Xi in MSByte
      SUB      R1,R0        X-Xi = dX in LSBs, ie: 00XX
      RSR      S7,R1        Get even word addressing
      MOVE     0(R8,R1),R3 Yi
      MOVE     2(R8,R1),R4 Y(i+1)
      CMPI     #HFE,R1      Y(i+1) = 1 ?
      BEQ      NOSUB
      SUB      R3,R4        Y(i+1)-Y(i) <= 10 bits
NOSUB MULU     R4,R0        (Y(i+1)-Y(i))dX <= 18 bits
      RSL.L    R8,R0        SQRT(Y)*128
      SURP     R0           dY
      RDD      R3,R0        Y := Y(i) + dY (fraction part)
      ADDQ     S2,R0        Round bit about to be shifted out, if any
      LSR      R2,R0        Shift in positive sign bit
      BSET     R14,R0       Set assumed significant bit
      SURP     R0           Put 16-bit mantissa in upper word
      CLR      R0
%MS   MOVE.B   R2,R0        Combine mantissa & exponent
      MOVEM.L  (S)+,R1-R4/R8  RESTORE REGISTERS
      RTS
*
ERR   CLR.L    R0           Set result to 0 for N<=0
      MOVE0.B  #H80,R2      Exp for 0 (or very small number) = -128
      BRR      BMS
;
*****************************************************************
* ( external )
* LOOKUP TABLE --- contains 17-bit square root values from .25 to 1    *
* which have been rounded up from a 24-bit value.  There is an assumed *
* positive sign bit (0) and a significant bit (1) which accounts for   *
* the 17th bit per 16-bit entry.                                       *
* Asterisks indicate values which have been rounded up by 1 bit.       *
*****************************************************************
*
   END
```

```
CGRAIIC.UORK.PD8510          TNU, DCC 22, 1983, 10:36 RM    PAGE  1


INTEGER CONSTRNT  min_x          :=  0,          & grat_apeco indices &
                  nax_x          :=  1,
                  nin_y          :=  2,
                  nax_y          :=  3,
                  grat_x         :=  4,
                  grat_y         :=  5,
                  div_x          :=  6,
                  div_y          :=  7,
                  grat_type      :=  8,
                  nax_grat_index :=  8,        & value of last entry &
                  grat_specs_size:=  nax_grat_index + 1;

INTEGER CONSTRNT  rectangular    :=  0, & for graticule_type,grat_specs&
                  polar          :=  1,          & for graticule_type &
                  bullseye       :=  1,              & for grat_specs &
                  anith          :=  2,              & for grat_specs &
                  ns_graticule   := -1;          & for graticule_type &
```

```
fGRATIC.UORK.PD8510          TNU, DEC 22, 1983, 10:36 RM    PAGE  1


RFILE cgratic.work;

EXTERNAL INTEGER POINTER
   grat1_specs,
   grat2_specs;
EXTERNAL BYTE TABLE type_of_grat;

INTEGER PROCEDURE graticule_type( ch );
   VALUE  ch;
   INTEGER ch;                                          EXTERNAL.L;
PROCEDURE  partial_trace_and_graticule;                 EXTERNAL.L;
SUBROUTINE trace_and_graticule;                         E&TERNAL.L;
```

```
SGRATIC.UORK.PD8510          TNU, DEC 22, 1983, 10:36 AM    PAGE  1


%68KL,P,"graticule"
BEGIN

RFILE cchtable.work;
RFILE fchtable.work;
RFILE fchtab2.work;
RFILE fchdata.work;
RFILE facrcen.work;
RFILE edispiay.work;
RFILE fdisplay.work;
RFILE fcircle.work;
RFILE cgratic.work;
RFILE cgratic2.work;                  & constants for grat_specs_table &
RFILE fccntvar.work;
RFILE ftrace.work;
RFILE fnarker.work;
RFILE ffifo.work;
RFILE ffifos.work;
RFILE cdatap.work;
RFILE fkernel.work;                        & for acquire and release &
RFILE crins.work;                          & for processing_variables &

EXTERNAL RERL CONSTANT TwoPi;



GLOBAL BYTE TABLE type_of_grat :=                  & indexed by format &
   &  not used        0 & no_graticule,
   &  fnt_log_nag     1 &  rectangular,
   &  fnt_linear_nag  2 &  rectangular,
   &  fnt_phase       3 &  rectangular,
   &  fnt_delay       4 &  rectangular,
   &  fnt_real        5 &  rectangular,
   &  fnt_inaginary   6 &  rectangular,
   &  fnt_log_polar   7 &     bullseye,
   &  fnt_linear_polar 8 &     bullseye,
   &  fnt_inag_vs_real 9 &     bullseye,
   &  fnt_z_anith    10 &        anith,
   &  fnt_y_enith    11 &        anith,
   &  fnt_vsur       12 &  rectangular;

INTEGER TABLE grat_specs_table :=
   & rect_normal  nin_x  &              x0_nin,  &  0 &
   &              nax_x  &              x0_nax,
   &              nin_y  &              y0_nin,
   &              nax_y  &              y0_nax,
   &              grat_x &               xgrat,
   &              grat_y &               ygrat,
   &              div_x  &                 div,
   &              div_y  &                 div,
   &            grat_type &          rectangular,
   & rect/split_1 nin_x  &              x1_nin,  & 18 &
   &              nax_x  &              x1_nax,
   &              nin_y  &              y1_nin,
   &              nax_y  &              y1_nax,
```

```
3GRATIC.UORK.POSSTO          TNU, DEC 22, 1983, 10:36 RM    PRGE  2


   &              grat_x &              x1_grat,
   &              grat_y &              y1_grat,
   &              div_x  &             half_div,
   &              div_y  &             half_div,
   &            grat_type &          rectangular,
   & rect/split_2 nin_x  &              x2_nin,  & 36 &
   &              nax_x  &              x2_nax,
   &              nin_y  &              y2_nin,
   &              nax_y  &              y2_nax,
   &              grat_x &             x2_grat,
   &              grat_y &             y2_grat,
   &              div_x  &             half_div,
   &              div_y  &             half_div,
   &            grat_type &          rectangular,
   &   polar/     nin_x  & x0_nin + nax_grat/10,  & 54 &
   &   normal     nax_x  & x0_nax - nax_grat/10,
   &              nin_y  &              y0_nin,
   &              nax_y  &              y0_nax,
   &              grat_x &    xgrat + half_grat,
   &              grat_y &    ygrat + half_grat,
   &              div_x  &                 div,
   &              div_y  &                 div,
   &            grat_type &               polar,
   &   polar/     nin_x  &              x1_nin,  & 72 &
   &   split_1    nax_x  &              x1_nax,
   &              nin_y  & y1_nin - half_grat/8,
   &              nax_y  & y1_nax + half_grat/8,
   &              grat_x &   x1_grat + qtr_grat,
   &              grat_y &   y1_grat + qtr_grat,
   &              div_x  &   (5 * half_div) / 4,
   &              div_y  &   (5 * half_div) / 4,
   &            grat_type &               polar,
   &   polar/     nin_x  &              x2_nin,  & 90 &
   &   split_2    nax_x  &              x2_nax,
   &              nin_y  & y2_nin - half_grat/8,
   &              nax_y  & y2_nax + half_grat/8,
   &              grat_x &   x2_grat + qtr_grat,
   &              grat_y &   y2_grat + qtr_grat,
   &              div_x  &   (5 * half_div) / 4,
   &              div_y  &   (5 * half_div) / 4,
   &            grat_type &               polar;

BYTE TABLE grat_specs_grat_offset :=          & indexed by type_of_grat &
   & 0       rectangular &          0,
   & 1         bullseye &         54, & 2 bytes/integer x 9 entries &
   & 2           anith &         54; &     x 3 tables = 54          &

BYTE TABLE grat_specs_node_offaet :=      & indexed by channel if split &
   & 0           normal &          0,
   & 1   split channel 1 &         18,
   & 2   split channel 2 &         36;

DOUBLE                                & addresses into grat_specs_tahle &
   grat1_specs_double,
   grat2_specs_double;
DOUBLE  TABLE grat_specs :=                       & indexed by channel &
```

```
SGRRTIC.WORK.PB0510          THU, DEC 22, 1983, 10:36 AM    PAGE  3


   0,
   &OR3( grat1_specs_double ),
   &NK3( grat2_specs_double );
GLOBAL INTEGER POINTER          & provide pointers for outside world &
   grat1_specs = grat1_specs_double,
   grat2_specs = grat2_specs_double;

INTEGER POINTER specs;                  & pointer into grat_specs_table &

INTEGER TABLE jump_channel :=
   0,
   jump_channel1,
   jump_channel2;
INTEGER TABLE end_ch_position :=
   0,
   end_ch1_position,
   end_ch2_position;
INTEGER TABLE graticule_display :=
   0,
   graticule1_display,
   graticule2_display;
INTEGER TABLE graticule_position :=
   0,
   graticule1_position,
   graticule2_position;
INTEGER TABLE trace_display :=
   0,
   trace1_display,
   trace2_display;
INTEGER TABLE tracem_display :=
   0,
   tracelm_display,
   trace2m_display;
INTEGER TABLE trace_mark_display :=
   0,
   trace_mark1_display,
   trace_mark2_display;

INTEGER addr;                           & display generator ram address  &
```

```
SGRRTIC.WORK.PB0510          THU, DEC 22, 1983, 10:36 AM    PAGE  4


REJECT;
COMMENT                                                    graticule_type
*****************************************************************************
*
*****************************************************************************
;
INTEGER PROCEDURE graticule_type( ch );
   VALUE  ch;
   INTEGER ch;                                                     ENTRY;
   BEGIN & graticule_type &
      graticule_type := type_of_grat[ ch_integer( ch_format, ch ) ];
   END;  & graticule_type &
```

```
SGRRTIC.WORK.PB0510          THU, DEC 22, 1983, 10:37 AM    PAGE  5


REJECT;
COMMENT                                                    rect_graticule
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  rect_graticule;
   BEGIN & rect_graticule &
      INTEGER i,
              grat_size,                & graticule width in pixels &
              div_size;                 & pixels per division       &

      div_size  := specs[div_x];                        & div_x = div_y &
      grat_size := 10 * div_size;

      addr := move2( addr, specs[grat_x], specs[grat_y] );
      addr := setattribute( addr, incr );
      FOR i := 1 UNTIL 10 DO
         BEGIN & for &
            addr := move( addr, 0, 0 );                 & to settle &
            addr := plot( addr, grat_size, 0, normal, slow );
            addr := plot( addr, -grat_size, div_size, blank, slow );
         END for;
      addr := move( addr, 0, 0 );                       & to settle &
      addr := plot( addr, grat_size, 0, normal, slow );
      FOR i := 1 TO 10 DO
         BEGIN & for &
            addr := move( addr, 0, 0 );                 & to settle &
            addr := plot( addr, 0, -grat_size, normal, slow );
            addr := plot( addr, -div_size, grat_size, blank, slow );
         END for;
      addr := move( addr, 0, 0 );                       & to settle &
      addr := plot( addr, 0, -grat_size, normal, slow );
      addr := setattribute( addr, incroff );
   END;  & rect_graticule &
```

```
SGRRTIC.WORK.PB0510          THU, DEC 22, 1983, 10:37 AM    PAGE  6


REJECT;
COMMENT                                                  bullseye_graticule
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  bullseye_graticule;
   BEGIN & bullseye_graticule &
      INTEGER radius,
              half_size,
              x_min,
              x_max,
              y_min,
              y_max,
              x0,
              y0;
      REAL    max_r;

      half_size := 5 * specs[div_x];                    & div_x = div_y &
      max_r     := REAL( half_size  );
      x0        := specs[grat_x];
      y0        := specs[grat_y];
      x_min     := x0 - INTEGER(max_r*0.8);
      x_max     := x0 + INTEGER(max_r*0.8);
      y_min     := y0 - INTEGER(max_r);
      y_max     := y0 + INTEGER(max_r);

      FOR radius := 1 TO 5 DO
         BEGIN & for &
            addr := arc( addr,
                         x0,
                         y0,
                         radius*0.2,
                         0.0,                           & start angle &
                         TwoPi,                         & arc angle   &
                         max_r,                         & max_radius  &
                         IF radius=5 THEN TRUE
                                     ELSE FALSE         & enhanced?   &
                       );
         END;  & for &
      & horizontal line &
      addr := plot( addr, x_min, y0, normal, slow );
      & vertical line &
      addr := move2( addr, x0, y_max );
      addr := plot( addr, x0, y_min, normal, slow );
      & diagonal lines &
      & redefine  min and  max &
      y_min := INTEGER(.28284271 * max_r);              & 0.4 cos(pi/4) &
      y_max := INTEGER(.70710678 * max_r);              & 1.0 cos(pi/4) &
      x_min := INTEGER(.22627417 * max_r);              & 0.8 y_min     &
      x_max := INTEGER(.56568543 * max_r);              & 0.8 y_max     &
      & up and to the right &
      addr := move( addr,
                    x0 - x_max,
                    y0 - y_max
                  );
```

```
SGRATIC.WORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  7

      addr := draw( addr,
                    x0 - x_min,
                    y0 - y_min
                  );
      addr := move( addr,
                    x0 + x_min,
                    y0 + y_min
                  );
      addr := draw( addr,
                    x0 + x_max,
                    y0 + y_max
                  );
      & down and to the right &
      addr := move( addr,
                    x0 - x_max,
                    y0 + y_max
                  );
      addr := draw( addr,
                    x0 - x_min,
                    y0 + y_min
                  );
      addr := move( addr,
                    x0 + x_min,
                    y0 - y_min
                  );
      addr := draw( addr,
                    x0 + x_max,
                    y0 - y_max
                  );
   END;  & bullseye_graticule &
```

```
SGRATIC.WORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  8

   &EJECT;
   COMMENT                                          smith_chart_graticule
   ***************************************************************************
   *
   ***************************************************************************
   ;
   PROCEDURE  smith_chart_graticule( scale );
      VALUE   scale;
      &ERL    scale;              & (outer circle radius) / (r=0 radius) &
      BEGIN & smith_chart_graticule &
         INTEGER i, j,
                 radius,
                 half_size,
                 x0,
                 y0;
          REAL   max_r,
                 one_over_scale,
                 angle,           & intersection of r=1 and outer circle &
                 u, v,                                  & real and imag.  &
                 r,                                     & resistance &
                 x;                                     & reactance  &

         one_over_scalc := 1.0 / scale;

         half_size := 5 * specs[div_x];                 & div_x = div_y &
         max_r := REAL( half_size );
         x0 := specs[grat_x];
         y0 := specs[grat_y];

         & outer circle &
         addr := arc( addr,
                      x0,
                      y0,
                      1.0,
                      0.0,                                  & start angle &
                      TwoPi,                                & arc angle   &
                      max_r,                                & max_radius  &
                      TRUE
                    );
         addr := r_circle( addr, x0, y0,                        & R = 1 &
                           1.00, max_r, scale
                         );
         IF ABS(scale - 1.0) > 0.001 THEN               & scale <> 1.0 &
            addr := r_circle( addr, x0, y0,                     & R = 0 &
                              0.00, max_r, scale
                            );
         addr := x_circle( addr, x0, y0,                        & N = 0 &
                           0.00, max_r, scale           & horiz. line &
                         );

         & scale * max_gamma &
         r := (2-ecale) / (2*ecale);                & for max gamma / 2 &

         addr := r_circle( addr, x0, y0,
                           r, max_r, scale
                         );
```

```
SGRATIC.WORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  9

      IF scale < 1.4 THEN
         addr := r_circle( addr, x0, y0,
                           1.0/r, max_r, scale
                         )
      ELSE
         addr := x_circle( addr, x0, y0,
                           4.0*one_over_scale, max_r, scale
                         );

      IF scale < 0.899 THEN
         BEGIN & if &
            addr := r_circle( addr, x0, y0,
                              1.0/r, max_r, ccale
                            );

            angle := interaect_angle( 0.5, 0.5, scale );
            IF angle >> 1.83 THEN
               angle := 1.83;        & helps meet 1.0 circle at scale=1&

            & quarter point &
            packed_sin_cos(0.25*angle);         & rtns cos/sin in R0/R1 &
            ASSEMBLE( MOVE.L R0, u;                     & u = cos(angle) &
                      MOVE.L R1, v                      & v = sin(angle) &
                    );
            u := 0.5 + 0.5*u;                           & 1 - real part &
            v := 0.5*v;
            x := (2*v) / ( u*u + v*v );
            addr := x_circle( addr, x0, y0,
                              x, max_r, ecale
                            );
            & half point &
            packed_sin_cos(0.50*angle);         & rtns cos/sin in R0/R1 &
            ASSEMBLE( MOVE.L R0, u;                     & u = cos(angle) &
                      MOVE.L R1, v                      & v = sin(angle) &
                    );
            u := 0.5 + 0.5*u;                           & 1 - real part &
            v := 0.5*v;
            x := (2*v) / ( u*u + v*v );
            addr := x_circle( addr, x0, y0,
                              x, max_r, scale
                            );
            & three-quarter point &
            packed_sin_cos(0.75*angle);         & rtns cos/sin in R0/R1 &
            ASSEMBLE( MOVE.L R0, u;                     & u = cos(angle) &
                      MOVE.L R1, v                      & v = sin(angle) &
                    );
            u := 0.5 + 0.5*u;                           & 1 - real part &
            v := 0.5*v;
            x := (2*v) / ( u*u + v*v );
            addr := x_circle( addr, x0, y0,
                              x, max_r, scale
                            );
         END  & if &
      ELSE & scale >= 0.999 &
         BEGIN & else &
```

```
SGRATIC.WORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE 10

            addr := x_circle( addr, x0, y0,
                              one_over_scale, max_r, scale
                            );
            addr := x_circle( addr, x0, y0,
                              2.0*one_over_scale, max_r, scale
                            );
            IF scale <= 1.999 THEN
               addr := x_circle( addr, x0, y0,
                                 0.5*one_over_scale, max_r, scale
                               )
            ELSE & scale > 1.999 &
               BEGIN & else &
                  r := (1-ecale) / (1+ecale);
                  addr := r_circle( addr, x0, y0,
                                    r, max_r, ecale
                                  );
               END;  & else &
         END;  & else &

   END;  & smith_chart_graticule &
```

```
SGRATIC.UWRK.PO8S10              THU, DEC 22, 1983, 10:37 AM       PAGE  11

BEJECT;
COMMENT                                                     initialize_trace
*****************************************************************************
*
aeaaeeaaeaaaaaaaaaaaeaaaaeaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaeaaaaaaaaaaaaaa
;
PURCEOURE  initialize_trace( grat_type );
   VRLUE  grat_type;
   INTEGER grat_type;
   BEGIN & initialize_trace &
      INTEGER pixels_per_point,
              grat_eize,
              half_aize,
              x,
              y,
              i;

      grat_aize := 10 * opecs[div_x];                       & div_x = div_y &
      half_aize := BRIGHT( grat_aize, 1 );                   & grat_aize/2 &
      x         := specs[grat_x];
      y         := epecs[grat_y];

      IF grat_type = rectangular THEN
         BEGIN & rectangular &
            pixels_per_point := grat_aize / (stop-start);
            y := y + half_size;
            & should be done in the reverse direction &          & DEBUG &
            addr := nove(addr,                                 & firet point &
                         x,
                         y
                        );
            FOR i := atep_size STEP atep_size UNTIL atop 00
               addr := drau(addr,                    & renaining points &
                            x + (i*pixels_per_point),
                            y
                           );
         END   & rectangular &
      ELSE & polar &
         FOR i := start STEP step_size UNTIL stop 00
            addr := nove(  addr,
                           x,
                           y
                        );
   END;  & initialize_trace &
```

```
3GRATIC.UWRK.PDS510              THU, DEC 22, 1983, 10:37 AM       PAGE  12

BEJECT;
COMMCNT                                              partial_trace_and_graticule
*****************************************************************************
*
aaaaeaaaaaaaaaeaaeaaaaaaeaaaaaaeaaeaaaaeaaaaaeaaaaaaaaaaaaaaaaaaaaaaaeeaaaaaaa
;
PROCEDURE  partial_trace_and_graticule;                              ENTRY;
   BEGIN & partial_trace_and_graticule &
      INTEGER ch,
              specs_offeet,
              graticule,
              previous_graticule;
      DOUBLE PAINTER grat_epecs_adr;

      previous_graticule := no_graticule; & assure no natch &

      FOR ch := 1 UNTIL nax_ch DO
         BEGIN & far channel &

            IF ( (trace_node = oingle_ch) AND
                 (current_entry_ch <> ch)
               ) THEN & don't draw graticule &
               BECIN & if &
                  addr := jnp(junp_channel[ch], end_ch_position[ch]);
                  graticule := no_graticule;
               END   & if &
            ELSE
               BEGIN & alse drau graticule &
                  & -- graticule(s) -- &

                  graticule := graticule_type( ch );

                  specs_offset := IF trace_node = split THEN
                                     grat_specs_node_offset(ch)
                                  ELSE
                                     0;
                  specs_offset := specs_offset +
                                  grat_specs_grat_offset[ graticule ];
                  STPNTR( grat_specs_adr, grat_specs[ch] );
                  grat_specs_adr := RORS( grat_speca_table ) +
                                    specs_offset;
                  STPNTR( specs, grat_specs_adr );

                  & DRAU GRATICULE &
                  addr := graticule_position[ch];

                  IF graticule <> previous_graticule THEN & guaranteed &
                     BEGIN & if &                         & <> for ch1 &
                        IF graticule = rectangular THEN
                           rect_graticule
                        ELSE IF graticule = bullseye THEN
                           bullseye_graticule
                        ELSE
                           smith_chart_graticule( ch_real( ch_ref_value,
                                                           ch
                                                         )
```

```
SGRATIC.UOKK.PDSS10              THU, DEC 22, 1383, 10:37 AM       PAGE  13

                                                ):
                     END   & if &
                  ELSE IF ( ( graticule = snith ) AND
                            ( ch_real( ch_ref_value, 1 ) <>
                              ch_real( ch_ref_value, 2 )
                            )
                          ) THEN     & Snith chart scales are not sane &
                     snith_chart_graticule( ch_real(ch_ref_value, ch) );

                  previdua_graticule := graticule;
                  addr := jnp( addr,
                               graticule_display[ch] + graticule_size
                             );

                  & -- trace(s) -- &

                  addr := trace_display[ch];
                  initialize_trace( graticule );
                  addr := jnp(addr, trace_diaplay(ch]+tracc_size);

                  & trace nark &
                  addr := trace_nark_display[ch];
                  IF ( (trace_mode <> split) AND
                       (graticule = rectangular)
                     ) THEN
                     BEGIN & if &
                        addr := setattribute( addr, incr );
                        IF ch=1 THEN
                           BEGIN & if ch = 1 &
                              addr := nove(addr, -112, -50);
                              addr := printch(addr, '1);
                              addr := nove(addr, -16, 0); & align nark &
                              addr := printch(addr, ch1_trace_nark);
                           END   & if ch = 1 &
                        ELSE
                           BEGIN & else ch = 2 &
                              addr := nove(addr, 0, -50);
                              addr := printch(addr, ch2_tracc_nark);
                              addr := nove(addr, -16, 0);
                              addr := printch(addr, '2);
                           END;  & else ch = 2 &
                        addr := sctattribute(addr, incroff);
                     END;  & if &
                  addr := jmp( addr,
                               trace_nark_display[ch]+trace_nark_size
                             );

                  & nenory trace &                                    & DEBUG &
                  addr := tracen_display[ch]:                         & DEBUG &
                  initialize_trace( graticule );                      & DEBUG &
                  addr := jnp( addr,                                  & OEBUG &
                               tracen_display[ch]+irace_size          & DEBUG &
                             );
                  addr := setattribute(junp_channel(ch), nop);
               END;  & else drau graticule &
```

```
SGRATIC.WORK.PDS510              THU, DEC 22, 1983, 10:37 AM       PAGE  14

            IF trace_node = split THEN
               previeus_graticule := no_graticule
            ELSE & not split &
               previous_graticule := graticule;

         END;  & for channel &

      annotate_ref_position;

      update_narks;

   END;  & partial_trace_and_graticule &


SUBROUTINE trace_and_graticule;                                      ENTRY;
   BEGIN & trace_and_graticule &
      acquire( proccasing_variables );

      partial_trace_and_graticule;

      release( processing_variables ); COMMENT  nust release before the
                                       write_fifo, else if fifo is full
                                       the fifo reader cannot get the
                                       processing vars in order to enpty
                                       the fifo.;
      & TELL DATA PROCESSING ABOUT THE CHANGE &
      urite_fifo( array_update_fifo, %4100 );      & update ch1 dp vars &
      urite_fifo( array_update_fifo, %4200 );      & update ch1 dp vars &
   END;  & trace_and_graticule &
```

```
SGRATIC.WORK.PD8510            INU, DEC 22, 1983, 10:37 AM     PACE  15

REJECT;
COMMENT                                                      init_gratic
**********************************************************************
*
*   Only initializes the gratx_space pointers.
*
**********************************************************************
;
SUBROUTINE init_gratic;                                          ENTRY;
   BEGIN 8 init_gratic 8
      STPNTR( grat1_specc, WORS(grat_space_table) );
      STPNTR( grat2_space, WORS(grat_speca_table) );
   END;  8 init_gratic 8

END8
```

```
CGRATIC2.WORK.PD8510           THU, DEC 22, 1983, 10:37 AM     PACE  1

COMMENT                                 Conatanta far grat_space_table
   xgrat, ygrat, and nax_grat are defined in cscreen.work;
INTEGER CONSTRNT
   half_grat := nax_grat/2,
   qtr_grat  := nax_grat/4,
   div       := nax_grat/10,
   half_div  := half_grat/10,
   x1_grat   := xgrat,
   y1_grat   := ygrat + qtr_grat,
   x2_grat   := xgrat + half_grat + 32,
   y2_grat   := ygrat + qtr_grat,
   x0_min    := xgrat - 8,
   y0_min    := ygrat - 8,
   x1_min    := x1_grat - 8,
   y1_min    := y1_grat - 8,
   x2_nin    := x2_grat - 8,
   y2_Min    := y2_grat - 8,
   x0_nax    := xgrat + nax_grat + 16,
   y0_nax    := ygrat + nax_grat + 16,
   x1_max    := x1_grat + half_grat + 16,
   y1_nax    := y1_grat + half_grat + 16,
   x2_nax    := x2_grat + half_grat + 16,
   y2_nax    := y2_grat + half_grat + 16;
```

```
CH2OUICK.UORK.PD8510           INU, DEC 22, 1983, 10:37 AM     PBCE  1

BYTE TRBLE johnsfun :=
   80,  5,-124, 66,
   64,  5, 80,  4, CE,
   80, 69,  4, 66,
   80, 13, 60, 28, 52, 13, -4,  4,-28, -4,-12,-20,  4, -4, 20,  4, 36,
 12, 20, 28,  4, 12,-12, 29,-92, 66,
   80, 13,108, 20, 12,  4,-60,  4, 68,-11,-60, 36,  4, 29,-44, 66,
   80,  5, 62, 44,  4,-36,  4, 12, 28, 28, 12, 12, 20, -4, 20,-12,  4,
-12, -4, 69,-100, 66,
   80,  5, 60, 20, -4, 20,  4, 12, 20, -4, 20,-12,  4, 21,  4, 12, 20,
 -4, 20,-12,  4,-12, -4, 69,-100, 66,
   80, 37, 52,  4, 68,-28,-44, 52,  4,-44,  4, 36, 52,  4,-60, 37,-44,
 66,
   80,  5,116, 44,  4,-36,  4,  4,-20, 28,  4, 20, -4,  4,-12, -4,-12,
-12,  4,-12, 12, 69,-52, 66,
   80,  5, 84, 36,  4, 12,-12, -4,-12,-20,  4, -4, 20,  4, 36, 12, 20,
 20,  4, 20, -4, 29,-100, 66,
   80, 13, 52, 36, 68,-36,  4, 44,  4,-28,-60, 61,-44, 66,
   80, 13, 84, 28,  4, 12,-12, -4,-12,-20,  4, -4, 20, 12, 20, -4, 20,
 12, 20, 28,  4, 12,-12, -4,-12, 37,-76, 66,
   80, 45, 84,-28,  4, -4, 20, 12, 20, 28,  4, 12,-12,  4,-28, -4,-12,
-12,  4,-12, 12, 69,-52, 66,
   80,  5, 68, 52,  4,-44,  4,  6, 28, 52,  4,-44,  4, 69,-84, 66,
   80, 29, 52,  4,  4,  5, 20,  4, 20, 28, 12,  4, 20,-20, 12,-20, -4,
 69,-100, 66,
   80, 37, 52,-12,  4,-12, 20,  4, 36, 20, 20, 20,  4, 20,-12,  4,-20,
 -4,-12, -4, 44,-12, -4,  4,-20, 20,  4, 37,-60, 66,
   80, 13, 68, 36,  4,-28,  4, -3,-12, 28, 68, 28,-60,-20, 68,-20,-60,
 69,-44, 66,
   80, 37, 52,-28,  4,  4, 68, 36,  4, 20,-12,-12,-12,-28,  4, 36,  4,
 20,-12,-12,-12,-28,  4,  4, 68, 36,  4, 37,-108, 66,
   80,  5, 60,  4, 52,  4,-44, 28, -4, 28, 12,  5, 62,-20, 12,-20, -4,
 69,-100, 66,
   80,  5,116,  4,-60, 36,  4, 20, 20,  4, 36,-12, 20,-28,  4,  4,-60,
 69,-44, 66,
   80,  5, 84, 44,  4,-36,  4,  5,-28,  4, 68, 52,  4,-44,  4,  4,-60,
 52,  4,-44,  4, 69,-44, 66,
   80,  5, 84, 44,  4,-36,  4,  5,-28,  4, 68, 62,  4,-44,  4,  4,-60,
 69,-44, 66,
   80, 37, 84, 20,  4,  4,-20,-20, -4,-20, 12,  4, 52,  4,-44,  5, 52,
 28, 12, 28, -4, 21,-100, 66,
   80, 53, 52,  4, 68,  4,-60,  5, 36,-44,  4, 52,  4,-43, 36,  4,-60,
  4, 68, 69,-108, 66,
   80, 13, 52, 36,  4,-11,  4,  4, 68,  4,-60,-11, 68, 36,  4, 29,-108,
 66,
   80,  5, 68, 12,-12, 28,  4, 12, 20,  4, 52,  4,-44, 29,-60, 66,
   80, 53, 52,-28, 36, 36,-28, -3, 68,-36,-36, 44, 44,-35,  4,  4,-60,
  4, 68, 69,-108, 66,
   80,  5, 52,  4, 68,  4,-60, 44,  4,-36,  4, 69,-44, 66,
   80,  5,116, 28,-44, 28, 62,  4,-60,  4, 68,-20,-44,-20, 52,  4,-60,
  4, 68, 69,-108, 66,
   80,  6, 52,  4, 68, 52,-60,  4, 68,  4,-60,-44, 68,  4,-60, 69,-44,
 66,
   80, 53, 60,  4, 52,  4,-44,-20, -4,-20, 12,  4, 52,  4,-44,  5, 52,
 28, 12, 28, -4, 21,-100, 66,
```

```
CH2QUICK.WORK.PD8510           THU, DEC 22, 1983, 10:37 AM     PRCE  2

   80,  5,116,  4,-60,  4, 68, 44,  4, 12,-12, -4,-12,-36,  4, 69,-76,
 66,
   80,  5, 60,  4, 52,  4,-44, 28, -4, 28, 12,  4, 52,-20, 12,-20, -4,
 53,-44,  4, 52,-19,-28, 28,-28, 21,-36, 66,
   80, 45,116,-36,  4,  4,-60,  4, 68, 44,  4, 12,-12, -4,-12,-36,  4,
 36,  4, 20,-28, 21,-44, 66,
   80, 53,108,-20, 12,-20, -4,  4,-12, 36, -4, 20, -4,  4,-12,-20, -4,
-20, 12, 69,-52, 66,
   80,  5,116, 52,  4,-44,  4, 29,  4,  4,-60,  4, 68, 45,-108, 66,
   80,  5, 60,  4, 60,  4,-52, 28, -4, 28, 12,  4, 60,  4,-52, 21,-52,
 66,
   80, 29, 52,-20, 68, 28,-60, 28, 68,-20,-60, 45,-44, 66,
   80,  5,116, 12,-60, 20, 52, 20,-44, 12, 68, -4,-60,-12, 52,-12,-44,
 -4, 68, 69,-108, 66,
   80,  5, 52, 52, 68,-44,-60,  6, 68, 52,-60,-44, 68, 69,-108, 66,
   80,  5,116, 28,-28, 28, 36,-20,-28,  4,-28,  4, 36,-20, 36, 69,-108,
 66,
   80,  5,116, 52,  4,-44,-60, 52,  4,-44,  4, 52, 68,-44,  4, 69,-108,
 66;
```

```
CMDOC.WORK.PDB510              THU, DEC 22, 1983, 10:37 AM     PAGE  1


FILE DESCRIPTIONS FOR 'CM' FILES

DCMBRSIS - input data file describing the 8510 character set used by the
           program PCMBRSIS.
DCMQUICK - input data file describing the 8510 monitor character set
           used by the program PCMQUICK.  Creates a compacted set.
           The elements (character strokes) in this file are the same as
           those in DCM84SIS with the character number (first number)
           removed and the commas replaced with newlines.  Double
           stroking has been removed from most of these, and the set is
           a very limited subset of the characters in DCMBRSIS.
FCMQUICK - a RFILE containing the ALGOL source for the compact character
           set for the monitor.  Created by PCMQUICK from DCMQUICK.
LCMRRSET - a linker command file for loading the character set.
PCMBRSIS - the program file that takes DCMBRSIS as input and creates
           the RSM63000 source file SCMRRSET for the 8510 character set.
PCMQUICK - the program file that takes DCMQUICK as input and creates
           the RLGOL include file FCMQUICK for the 8510 monitor's
           compacted character set.
RCMRRMOV - the relocatable code for the character move program.
RCMRRSET - the relocatable code for the character set.
SCMRRMOV - the RLGOL source for the character move program.  Moves the
           character set from main Memory into display memory.
JCMRRSET - the RSMBB000 source file of the 8510 character set.  Created
           from DCMBRJIS by the program PCMBBSII.
SCMBRSIS - the PASCAL source file for the program PCMBRSIS.  Takes
           QCMBRSIS as input and created the RSM6SD00 source file
           JCMRRSET for the 8510 character set.
SCMQUICK - the PASCAL source file for the program PCMQUICK.  See
           PCMQUICK above.
```

```
FMBBR BUO.WORK.PDB510          THU, DEC 22, 1983, 10:37 AM     PAGE  1


COMMENT
hard_flags are hardware flags on the processor board for realtime
signaling -- either input or output.
    R READ of the specific flag will cause a set or clear of a testpoint
      bit on processor board multi-point testpoint near U79.

  PIN      1      2      3      4      5      6      7      8
  FLAG     1      2     n/u     4     n/u     6      7      8

 These flags can be used as output signaling or input signaling.
     However reading the hard_flags will set flag 7.

end of comment;
INTEGER hard_flag = %90000,
    clr_flg_1 = hard_flag +%10, set_flg_1 = hard_flag +%12,
    clr_flg_2 = hard_flag + %C, set_flg_2 = hard_flag + %E,
    clr_flg_4 = Hard_flag + %0, set_flg_4 = hard_flag + %2,
    clr_flg_6 = hard_flag + %4, set_flg_6 = hard_flag + %6,
    clr_flg_8 = hard_flag + %8, set_flg_5 = hard_flag + %A;
BITFIELD test_fig = hard_flag + %16:
         1rfint,   &mistin,   flg_7,  flg_1,
         flg_2,    flg_8,     flg_6,  flg_4;
```

```
DIBDOC.UORK.PDB510             THU, DEC 22, 1983, 10:37 AM     PAGE  1


FILES USED IN CREATING THE HP-IB PARSE TRBLE:

SIBTBL -- source list of HP-IB commands and values.

IBIREE -- source for program that reads SIBTBL and creates M68ALGOL
          parse tables in SIBTREE.
CIBTREE -- a constant declaration for the parse table length.
FIBTREE -- the table name declarations for the parse tables of SIBTREE.
PIBTREE -- the program object file from IBTREE.

SIBTREE -- the M68RLGOL parse table definitions as a separately
           compilable program.
DIBTREE1 -- numeric and string data for merging into SIBTREE (chars)
OIBTREE2 -- numeric and string data for merging into SIBTREE (numbers)

UTBTREE -- an EO (.PUB.CAO) command (")u") file that merges OIBTREE1 and
           DIBIREE2 into SIBTREE.
```

```
JIBGEN.UORK.PDB510             THU, DEC 22, 1983, 10:37 AM     PAGE  1


SUSLIMITS
&LIST OFFS

PROGRAM ibgen(input, list, output, err);

( ibgen:  reads an "input" file of the form
      FA 3;
      F6 4;
      $include FILE2       must begin in column 1.
      OUT 7;
      OP 15 comments here;
      !
                  <mnem> <value> <comments> ;
                      ...
                  !

 [ Blanks are delineters; Everything after the value is shipped until
   the semicolon (comments); Lower case characters are all upshifted. }

   and "output"s a file (SIBTREE) for use by "parser".  "list" is
   for diagnostic listing.  "err" is used for error messages.)

CONST
   endsy        = '!';
   symbol_end   = '$';
   illegal      = 1;
   value_illegal= 'cmd_illegal';
   size_illegal = 11;  { number of chars in value_illegal }
   maxtable     = 2000;
   delim        = '@';
   blank        = '^';  { Blank substitution character }
   linewidth    = 72;   { Source line width. }
   linemax      = 110;  { Max characters per input line. }
   reserved     = 46;   { space reserved for manual tree entries }
   symtab_max   = 10000;

TYPE
   symtab_index = 1..symtab_max;
   line_type    = string [linemax];
   cursor       = 1..maxtable;
   ptrtype      = ^cell;
   cell         = RECORD
                    labl        : char;
                    value       : integer;
                    lnc, rs     : ptrtype;
                    END;
   err_word_type= -32768..32767;

VAR
   symtab       : string [symtab_max];
   root         : ptrtype;
   cellptr, ptr : ptrtype;
   index, symbol: symtab_index;
   labels       : RRRAY [cursor] OF char;
   lncs         : RRRAY [cursor] OF integer;
```

```
SIBGEN.WORK.PDS510          THU, DEC 22, 1983, 10:37 AM     PAGE   2

   i, j          : integer;
   nextlabel     : cursor;
   eol           : boolean;  { End of line flag. }
   altfile       : boolean;  { Using alternate file. }
   err,
   list,
   output2,
   input2        : text;
   instr         : line_type;
   linecount     : integer;  { Input line count. }
   chcnt         : integer;  { Character counter. }
   ch            : char;  { Last character. }
   mnemonic      : PACKED ARRAY [1..linemax] OF char;
   mnem_index    : 0..linemax;
   err_occurred : boolean;



PROCEDURE getjcu(err_word:err_word_type);                    INTRINSIC;

FUNCTION mnem_valid_ident:boolean;
   VAR
      i : 0..linemax;
   BEGIN {mnem_valid_ident}
      mnem_valid_ident := true;
      IF mnem_index <= 0 THEN
         mnem_valid_idant := false
      ELSE
         FOR i := 1 TO mnem_index DO
            BEGIN {for}
               { downshift }
               IF ( (mnemonic[i]>='A') AND (mnemonic[i]<='Z') ) THEN
                  mnemonic[i] := chr(     ord(mnemonic[i]) +
                     ( ord('a') - ord('A') )      );
               { valid character for an identifier? }
               IF ( ( (mnemonic[i]<'a') OR (mnemonic[i]>'z') ) AND
                    ( (mnemonic[i]<'0') OR (mnemonic[i]>'9') ) AND
                    (  mnemonic[i]<>'_')     ) THEN
                  mnem_valid_ident := false;
            END; {for}
         { start with an alpha? }
         IF ( (mnemonic[1]<'a') OR (mnemonic[1]>'z') ) THEN
            mnem_valid_ident := false;
   END; {mnem_valid_ident}

PROCEDURE nextch;

   LABEL 1;

   VAR
      i, j, ninlen  : integer;

   BEGIN  {nextch}
      IF eol THEN
         BEGIN  {if eol}
```

```
SIBGEN.WORK.PDS510          THU, DEC 22, 1983, 10:37 AM     PAGE   3

         1: IF altFile THEN
               BEGIN  {if altfile}
                  readln(input2, instr);
                  IF eof(input2) THEN
                     BEGIN  {if eof}
                        altfile := false;
                        GOTO 1
                     END;  {if eof}
               END  {if altfile}
            ELSE
               BEGIN  {else not altFile}
                  readln(input, instr);
                  IF etrlen(instr) > 10 THEN
                     IF (str(instr,1,9)='$INCLUDE ') OR (etr(instr,1,9)
                           = '$include ') THEN
                        BEGIN  {if $include}
                           reset(input2, etr(instr,10,strlen(instr)),
                                 'NOCCTL,SHARED');
                           altFile := NOT eof(input2);
                           IF NOT altfile THEN
                              GOTO 1;
                           readln(input2, instr);
                        END;  {if $include}
               END;  {else not altfile}
            linecount := linecount + 1;
            IF strlen(instr) > linewidth THEN
               setstrlen(instr, linewidth);
            chcnt := 0;
            eol := false;
            writeln(list, instr);
         END;  {if eol}
      IF eof(input) THEN
         BEGIN  {if eof}
            writeln (err,' **** EOF ENCOUNTERED');
            err_occurred := true;
            ch := chr(0)
         END  {if eof}
      ELSE  IF chcnt >= strlen(instr) THEN
         BEGIN  {if chcnt}
            eol := true;
            ch := ' '
         END  {if chcnt}
      ELSE
         BEGIN  {else}
            chcnt := chcnt + 1;
            ch := instr[chcnt];
         END;  {else}
   END {nextch};

PROCEDURE next_upshifted_ch;
   BEGIN {next_upshifted_ch}
      nextch;
      IF ((ch >= 'a') AND (ch <= 'z')) THEN {shift to upper case }
         ch := chr( ord(ch) - ord('a') + ord('A') );
   END;  {next_upshifted_ch}
```

```
SIBGEN.WORK.PDS510          THU, DEC 22, 1983, 10:37 AM     PAGE   4

FUNCTION unravel(node:ptrtype):integer;

   VAR
      ptr          : ptrtype;

   BEGIN  {unravel}
      ptr := node;
      WHILE ptr <> NIL DO
         BEGIN  {while}
            IF ptr^.lnc <> NIL THEN
               ptr^.value := unravel(ptr^.lnc);
            ptr := ptr^.rs;
         END;  {while}
      ptr := node;
      unravel := nextlabel;
      WHILE ptr <> NIL DO
         BEGIN  {while}
            labels[nextlabel] := ptr^.labl;
            lncs[nextlabel] := ptr^.value;
            nextlabel := nextlabel + 1;
            ptr := ptr^.rs;
         END;  {while}
      nextlabel := nextlabel + 1;
   END;  {unravel}

PROCEDURE preorder(node:ptrtype; level:integer);
   VAR
      i : integer;
   BEGIN {preorder}
      IF node<>nil THEN
         BEGIN {if}
            FOR i := 1 TO level DO
               write(list,'   ');
            write(list,node^.labl:1,' ',node^.value:6);
            IF node^.value < 0 THEN
               BEGIN { if }
                  write(list,' ');
                  index := -node^.value;
                  WHILE syntab[index] <> symbol_end DO
                     BEGIN { while }
                        write(list,syntab[index]);
                        index := index + 1;
                     END;  { while }
               END;  { if }
            writeln(list);
            preorder(node^.lnc, level+1);
            preorder(node^.rs, level);
         END; {if}
   END; {preorder}

BEGIN  {sbgen}
   rewrite(output,'OUTPUT','NOCCTL');
   rewrite(output2,'OUTPUT2','NOCCTL');
   rewrite(list,'LIST','NOCCTL');
   rewrite(err,'$STDLIST','NOCCTL');
   reset(input,'INPUT','NOCCTL,SHARED');
```

```
SIBGEN.WORK.PDS510          THU, DEC 22, 1983, 10:37 AM     PAGE   5

   strinsert(value_illegal, syntab, illegal);
   err_occurred := false;
   symbol := illegal + size_illegal;
   etrappend(syntab, symbol_end);
   eol := true;
   altfile := false;
   new(root);
   root^.labl := ' ';
   root^.value := 0;
   root^.lnc := NIL;
   root^.rs := NIL;
   mnem_index := 0;
   next_upshifted_ch;
   WHILE ch=' ' DO  { Skip leading blanks. }
      next_upshifted_ch;
   WHILE ch<>endsy DO  { Repeat until end marker. }
      BEGIN  {while ch<>endsy}
         cellptr := root;

         WHILE ch<>' ' DO  { Get mnemonic. }
            BEGIN  {while ch<>' '}
               mnem_index := mnem_index + 1;
               mnemonic[mnem_index] := ch;
               IF ch = blank THEN
                  ch := ' ';
               IF cellptr^.lnc = NIL THEN ( ch is first child )
                  BEGIN  {if cellptr}
                     IF cellptr^.value <> 0 THEN
                        BEGIN {if}
                           writeln(err, instr);
writeln(err,'An earlier mnemonic is a prefix of this mnemonic.');
                           err_occurred := true;
                        END;  {if}
                     new(ptr);
                     ptr^.labl := ch;
                     ptr^.value := 0;
                     ptr^.lnc := NIL;
                     ptr^.rs := NIL;
                     cellptr^.lnc := ptr;
                     cellptr := ptr;
                  END  {if cellptr}
               ELSE { ch is not the first child, make it last sibling }
                  BEGIN  {else cellptr}
                     cellptr := cellptr^.lnc;
                     WHILE ((cellptr^.labl<>ch) AND (cellptr^.rs<> NIL))
                        DO
                        cellptr := cellptr^.rs;
                     IF cellptr^.labl <> ch THEN
                        BEGIN  {if}
                           new(ptr);
                           ptr^.labl := ch;
                           ptr^.value := 0;
                           ptr^.lnc := NIL;
                           ptr^.rs := NIL;
                           cellptr^.rs := ptr;
                           cellptr := ptr;
```

```
SIBBEN.WORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  6

                    END;  (if)
                END;  (else cellptr)
              next_upshifted_ch;
           END;  (while ch<>' ')

        { now get value }
        WHILE ch=' ' DO  { Skip delimiting blanks. }
           nextch;
        IF cellptr^.lnc <> NIL THEN
           BEGIN ( if )
              writeln(err, inetr);
writeln(err,'This mnemonic is a prefix of an earlier mnemonic');
              err_occurred := true;
           END;  ( if )
        WHILE ch='-' DO  ( '-' is illegal. )
           BEGIN (while)
              writeln(err, inetr);
              erlteln(err,'Negative values are illegal.');
              err_occurred := true;
              nextch;
           END; (while)
        index := symbol;
        WHILE (
                ( (ord(ch) >= ord('0')) AND (ord(ch) <= ord('9')) ) OR
                ( (ord(ch) >= ord('A')) AND (ord(ch) <= ord('Z')) ) OR
                ( (ord(ch) >= ord('a')) AND (ord(ch) <= ord('z')) ) OR
                ( ch = '_' )
              ) DO
           BEGIN  (while)
              index := index + 1;
              setstrlen(syntab, 1+strlen(syntab) );  (increment length)
              syntab[ strlen(syntab) ] := ch;
              nextch;
           END;  (while)
        cellptr^.value := -(symbol+1);
        symbol := index + 1;
        strappend(syntab, symbol_end);

        mnen_index := 0;

        { now skip comments, if any }
        WHILE ch <> ';' DO  { Find end of line marker. }
           nextch;
        nextch;  { Skip over semicolon. }
        WHILE ch = ' ' DO  ( Skip leading blanks. )
           nextch;
     END;  (while ch<>endey)

   writeln(list,'----');
   sreorder(root,0);

   { transfer tree information to tables }
   FOR i := 1 TO maxtable DO
      BEGIN  (for)
         labels[i] := delim;
         lncs[i] := -illegal;
```

```
SIBGEN.WORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  7

      END;  (for)
   FOR i := 1 TO 128 DO
      labels[i] := chr(i-1);
   nextlabel := 130 + reserved; { skip one to leave a deliniter }
   cellptr := root^.lnc;
   WHILE cellptr <> NIL DO
      BEGIN  (while)
         IF cellptr^.lnc <> NIL THEN
            lncs[1+ord(cellptr^.labl)[ ] := unravel(cellptr^.lnc)
         ELSE
            lnce(1+ord(cellptr^.labl)] := cellptr^.value;
         cellptr := cellptr^.rs;
      END;  (while)


   writeln(list,'----');
   FOR i := 1 TO maxtlabel-1 DO
      BEGIN ( for )
         write(list,i:4,' ',labels[1]:1,' ',lncs[i]:7);
         IF lnce(i) < 0 THEN
            BEGIN ( if )
               write(list,' ');
               index := -lncs[i];
               WHILE syntab[index] <> symbol_end DO
                  BEGIN ( while )
                     write(liet,syntab[index]);
                     index := index + 1;
                  END;  ( while )
            END;  ( if )
         writeln(list);
      END;  ( for )

   writeln(output2,'INTEGER CONSTANT tablecize := ',nextlabel-1:5,';');

   writeln(output,'MASM,KL,P,"ihtree"');
   writeln(output,'BEGIN & ibtree &');
   writeln(output);
   writeln(output,'NFILE ccnddecl.work;');
   writeln(output);


   write[output,'GLOBAL BYTE TABLE mnen :=  ');    { 1 extra blank for }
   j := 27;                                        { nice appearance.  }
   FOR i := 1 TO maxlabel-1 DO
      BEGIN (for)
         IF ((i=130) OR (i=130+reserved)) THEN
            BEGIN (if)
               writeln(output);
               j := 99;
            END; (if)
         j := j + 4;
         IF j > 72 THEN
            BEGIN (if)
               writln(output);
               write[output,'& ',(i-1):4,' &   ');
               j := 11;                                  ( header )
```

```
SIBGEN.WORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  8

               j := j + 4;                               { entry  }
            END; (if)
         IF ((i-1 < 33) OR (i-1 = 127)) THEN
            write(output,ord(labels[i]):3)
         ELSE
            write(output,' ''',labels[i]:1);
         IF i < nextlabel-1 THEN
            write(output,',')
         ELSE
            writeln(output,';');
      END; (for)

   writeln(output);
   write(output,'GLOBAL INTEGER TABLE ib_link := ');
   j := 32;
   FOR i := 1 TO nextlabel-1 DO
      BEGIN (for)
         IF ((i=130) OR (i=130+reserved)) THEN
            BEGIN (if)
               writeln(output);
               j := 99;
            END; (if)
         IF lncs[i] > 0 THEN
            BEGIN ( if )
               j := j + 7;
               IF j > 72 THEN                      { start a new line }
                  BEGIN (if)
                     writeln(output);
                     write(output,'& ',(i-1):4,' &   ');
                     j := 11;                              { header }
                     j := j + 7;                           { entry  }
                  END; (if)
               write(output,(lncs[i]-1):6);{ -1 to convert to origin 0 }
            END  ( if )
         ELSE
            BEGIN ( else )
               { find symbol length }
               index := -lncs[i];
               WHILE syntab[index] <> symbol_end DO
                  index := index + 1;
               index := index + lncs[i];  (symbol length (lncs < 0))
               j := j + index + 2;      { "2" for comma and minus sign }
               IF j > 72 THEN                      { start a new line }
                  BEGIN (if)
                     writeln(output);
                     write(output,'& ',(i-1):4,' &   ');
                     j := 11;                              { header }
                     j := j + index + 2;                   { entry  }
                  END; (if)
               index := -lncs[i];
               write(output,'-');
               WHILE syntab[index] <> symbol_end DO
                  BEGIN ( while )
                     write(output,syntab[index]);
                     index := index + 1;
                  END; ( while )
```

```
SIBGEN.WORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  9

            END;  ( else )
         IF i < nextlabel-1 THEN
            write(output,',')
         ELSE
            writeln(output,';');
      END; (for)
   writeln(output);
   writeln(output,'END$ & ibtree &');
   IF err_occurred THEN
      setjcu( -1 );

END.  (ibgen)
```

```
UIBGEN.UORK.PDBS10          THU, DEC 22, 1983, 10:37 AM    PAGE  1


)p off
1
1,$e/-cnd_0,/ 12417,/g
1,$e/-cnd_[1-9],/ 12417,/g
1,$s/-cnd_decinal_pt,/ 12425,/g
1,$e/-cnd_minus,/ 12417,/g
1,$s/-cnd_plus,/ 12417,/g
1,$e/-cnd_quote,/ 4261,/g
1,$e/-cnd_label,/ 4267,/g
1,$e/-cnd_block_a,/  173,/g
/\$  129 \$.*$/ka
/\$  174 \$.*$/kb
/\$  129 \$.*cnd_illegal/kc
/\$  173 \$.*cnd_illegal/hd
'br dibtree1.work
'a,'bd
'dr dibtree2.uork
'e,'dd
w
q
```

```
SIBTBL.UORK.PDS510          THU, DEC 22, 1983, 10:37 AM    PAGE  1


,       end_enter;
        cnd_enter line-feed;
;       end_enter;
0       cnd_0 these values (0-9, +, -, .) are for auto-replecement;
1       cnd_1;
2       cnd_2;
3       end_3;
4       cnd_4;
5       cnd_5;
6       cnd_6;
7       cnd_7;
8       cnd_8;
9       cnd_9;
.       cnd_decinal_pt;
-       end_minus;
+       cnd_plus;
=       cnd_quote   (the value here is for later replacement);
##      cnd_block_a (the value here is for later replacement);
ADDRAUIC    end_auto_cnd_addr;
ADDRHIKD    cnd_eyeten_bus_addr;
ADDRPASS    cnd_pass_thru_addr;
ADDRPLOT    cnd_plotter_addr;
ADDRPRIN    cnd_printer_addr;
ADD*SOUR    end_source_addr;
ADDRTEST    cnd_eeet_set_addr;
ATTE1       cnd_atten_port1;
ATTE2       end_atten_port2;
BUTO        cnd_auto_scale;
AUXV        cnd_aux_domain;
AVERO       cnd_if_avg_off;
AVER1       cnd_if_avg_on;
AVEROff     end_if_avg_off;
AVERON      crd_if_evg_on;
CENT        cnd_center;
CF          end_center  For backward compatibility;
CHAN1       cnd_ch1;
CHAN2       cnd_ch2;
CHEQ        cnd_couple_stimulus;
CHNE        cnd_uncouple_stimulus;
CLES        cnd_clear_status;
CONT        cnd_continuous;
CONVOFF     cnd_convert_off;
CONVO       cnd_convert_off;
CONVRECI    cnd_convert_recip;
CONVY       cnd_convert_to_y;
CONVI       cnd_convert_to_z;
CORRO       cnd_correction_off;
CORR1       cnd_correction_cn;
CORRDFF     cnd_correction_off;
CORRON      cnd_correction_on;
CRTO        cnd_crt_off;
CRTOFF      cnd_crt_off;
CS          cnd_clear_status  For backward compatibility;
CU          cnd_cu;
DRT@MERO    end_d_and_m;
```

```
SIBTBL.UORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  2


DATPPLUS    cnd_d_plus_m;
DATAIMTO    cnd_d_into_m;
DATA1MU     cnd_d_minus_m;
DRTATIME    cnd_d_mpy_m;
DATROIVI    cnd_d_div_m;
DATA1       cnd_memory_ch1;
DATA2       cnd_memory_ch2;
DPTRONLY    cnd_data;
DELR        cnd_delay;
DEN00       cnd_illegal;
DEMOR1      cnd_illegal;
DEMOR2      cnd_illegal;
DEMOB1      cnd_illegal;
OEHOSER1    cnd_illegal;
OEHOSER2    cnd_illegal;
DF          cnd_span-   For backward compatibility;
DN          cnd_down    For backward compatibility;
DOUN        cnd_down;
ELED        cnd_elect_dclay;
EMTRO       cnd_entry_off;
EMTROFF     cnd_entry_off;
EQUA        cnd_mkrval;
EXCIO       cnd_illegal;
EXCI1       cnd_illegal;
EXCI2       cnd_illegal;
EXCIOFF     cnd_illegal;
EXCIMONE    cnd_illegal;
FA          cnd_start   For backward compatibility;
FB          cnd_stop    For backward compatibility;
FORM1       cnd_xfer_binary;
FORM2       cnd_xfer_ieee1;
FORM3       cnd_xfer_ieee2;
FORM4       cnd_xfer_ascii;
FREO        cnd_freq_domain;
FULL        cnd_quadrant_full;
GRIKO       cnd_if_no_gain;
GR1K1       cnd_if_12db_gain;
GRIN2       cnd_if_24db_gain;
GRIN3       cnd_if_36db_gain;
GR1N4       cnd_if_48db_gain;
GRINRUTO    cnd_if_gain_auto;
GRINOFF     cnd_if_no_gain;
GR1kREFE    cnd_if_ref_port;
GRINTEST    cnd_if_test_port;
GATEO       cnd_gate_off;
GATE1       cnd_gate_on;
GATECENT    cnd_gate_center;
GATEMRXI    cnd_max_gate_uindow;
GATEMINI    cnd_min_gate_uindow;
GATENORM    cnd_normal_gate_uindow;
GATEOFF     cnd_gate_off;
GATEON      cnd_gate_on;
GATESPAN    cnd_gate_span;
GATESTAR    cnd_gate_start;
GATES1DP    cnd_gate_stop;
HOLD        cnd_hold;
```

```
SIBTBL.UORK.PD8510          THU, DEC 22, 1983, 10:37 AM    PAGE  3


IMAG        end_imaginary;
INPUCMLC01  cnd_input_cal_coeff1;
INPUCRLC02  end_input_cal_coeff2;
INPUCRLC03  cnd_input_cal_coeff3;
INPUCALC04  cnd_input_cal_coeff4;
INPUCRLC05  cnd_input_cal_coeff5;
INPUCRLC06  cnd_input_cal_coeff6;
INPUCRLC07  cnd_input_cal_coeff7;
INPUCRLC08  cnd_inpul_cal_coeff8;
INPUCRLC09  cnd_input_cal_coeff9;
INPUCRLC10  cnd_input_cal_coeff10;
INPUCMLC11  cnd_input_cal_coeff11;
INPUCRLC12  cnd_input_cal_coeff12;
INPUDA1A    cnd_input_data;
INPUFORM    cnd_input_formatted;
INPURRU1    cnd_input_rau1;
INPURRU2    cnd_input_rau2;
INPURAU3    cnd_input_rau3;
INPURAU4    cnd_input_rau4;
INVS        cnd_y_anlth;
IP          cnd_preset  For backward compatibility;
KEYC        cnd_keycode;
LB          cnd_label (the value here is for later replacement);
LEFL        end_quadrant_21;
LEFU        cnd_quadrant_11;
LIN1        cnd_linear_mag;
LOCP        cnd_peek_poke_addr;
LOCKO       cnd_illegal;
LOCKA1      cnd_illegal;
LOCKR2      cnd_illegal;
LOCKOFF     cnd_illegal;
LOCKMONE    cnd_illegal;
LOGO        cnd_mag;
MAGO        cnd_illegal;
MARKO       cnd_marker_off;
MARK1       cnd_narker_1;
MARK2       cnd_narkcr_2;
MARK3       cnd_narker_3;
MARK4       cnd_narker_4;
MARK5       cnd_narker_5;
MARKMRKI    cnd_mkr_to_max;
MARKMINI    cnd_mkr_to_min;
MARKOFF     cnd_narker_off;
MARRO       end_no_ref_mkr  This entire set needs uork (incl lcgends);
MARR1       cnd_ref_mkr1;
MARR2       cnd_ref_mkr2;
MARR3       cnd_ref_mkr3;
MARR4       cnd_ref_mkr4;
MARR5       cnd_ref_mkr5;
MARROFF     cnd_no_rcf_mkr;
MATH        cnd_nath;
MEAS        cnd_neasurenent_restart;
MEM0t       cnd_nenory1;
MEMO2       cnd_nenory2;
MEMO3       cnd_nenory3;
MEMO4       cnd_nenory4;
```

```
SIBTBL.WORK.PRRS10          THU, DEC 22, 1983, 10:37 AM    PAGE  4

MEGAONLY    cmd_men;
MENUCOPY    cmd_copy;
MENUCRLI    cmd_cal_menu;
MENUDELM    cmd_delte_marker;
MENUDISP    cmd_display_menu;
MENUDOMN    cmd_domain_menu;
MENUDUAL    cmd_dual_ch;
MENUFORM    cmd_format_menu;
MENUGAIN    cmd_if_gain_menu;
MENUHPIB    cmd_hpib_info;
MENUMARK    cmd_marker_menu;
MENUNUMP    cmd_n_points_menu;
MENUPARA    cmd_param_menu;
MENUPOIN    cmd_n_points_menu;
MENUPOWE    cmd_power_menu;
MENURECL    cmd_recall;
MENUREDE    cmd_redefine_param;
MENUREFP    cmd_ref_plane_menu;
MENURESP    cmd_response_menu;
MENUSAVE    cmd_save;
MENUSERV    cmd_service_menu;
MENUSTIM    cmd_stimulus_menu;
MENUSYST    cmd_system_menu;
MENUTAPE    cmd_tape_menu;
MENUTEST    cmd_test_menu;
MON1        cmd_monitor;
MUMICR1     cmd_illegal;
MUMEM2      cmd_illegal;
MUMEB1      cmd_illegal;
MUMEB2      cmd_illegal;
MUMESERV1   cmd_illegal;
MUMESERV2   cmd_illegal;
MUMESERV3   cmd_illegal;
MUMESERV4   cmd_illegal;
MUMESERV5   cmd_illegal;
MUMESERV6   cmd_illegal;
MUMESERV7   cmd_illegal;
MUMESERV8   cmd_illegal;
MUMG        cmd_n_groups_hpib;
OA          cmd_output_active  For backward compatibility;
OI          cmd_output_id  For backward compatibility;
OPERD       cmd_illegal;
OPERMEXT    cmd_illegal;
OPFROFF     cmd_illegal;
OPERPARA    cmd_ep_parame;
OPERPLOT    cmd_illegal;
OPENPRIN    cmd_illegal;
OS          cmd_output_status  For backward compatibility;
OUTPACTI    cmd_output_active;
OUTPCALC01  cmd_output_cal_coeff1;
OUTPCALC02  cmd_output_cal_coeff2;
OUTPCALC03  cmd_output_cal_coeff3;
OUTPCALC04  cmd_output_cal_coeff4;
OUTPCALC05  cmd_output_cal_coeff5;
OUTPCALC06  cmd_output_cal_coeff6;
OUTPCALC07  cmd_output_cal_coeff7;
```

```
SIBTBL.WORK.PRS10           THU, DEC 22, 1983, 10:37 AM    PAGE  5

OUTPCALC08  cmd_output_cal_coeff8;
OUTPCALC09  cmd_output_cal_coeff9;
OUTPCALC10  cmd_output_cal_coeff10;
OUTPCALC11  cmd_output_cal_coeff11;
OUTPCALC12  cmd_output_cal_coeff12;
OUTPDATA    cmd_output_data;
OUTPERRO    cmd_output_error;
OUTPFORM    cmd_output_formatted;
OUTPIDEN    cmd_output_id;
OUTPKEY     cmd_output_key;
OUTPMARK    cmd_output_marker;
OUTPMEMO    cmd_output_memory;
OUTPPLOT    cmd_output_plot;
OUTPRAW1    cmd_output_raw1;
OUTPRAW2    cmd_output_raw2;
OUTPRAW3    cmd_output_raw3;
OUTPWAIN    cmd_output_raw4;
OUTPSTAT    cmd_output_status;
OVER        cmd_overlay;
PEEK        cmd_peek;
PEN1        cmd_pen1;
PEN2        cmd_pen2;
PEN3        cmd_pen3;
PEN4        cmd_pen4;
PEN5        cmd_pen5;
PEN6        cmd_pen6;
PEN7        cmd_pen7;
PEN8        cmd_pen8;
PIMO        cmd_phase_offset;
PHAS        cmd_phase;
PLAN1       cmd_ref_plane_1;
PLAN2       cmd_ref_plane_2;
PLOTALL     cmd_plot_all;
PLOTGRAT    cmd_plot_graticule;
PLOTMARK    cmd_plot_marker;
PLOTTEXT    cmd_plot_text;
PLOTTRAC    cmd_plot_trace;
POIN101     cmd_101_points;
POIN201     cmd_201_points;
POIN401     cmd_401_points;
POIN51      cmd_51_points;
POKE        cmd_poke;
POLALINA    cmd_linear_polar;
POLALOGA    cmd_log_polar;
POLAREIN    cmd_imag_ve_real;
POWE        cmd_source_power;
PRES        cmd_preset;
PRIO        cmd_prior_menu;
PRMP        cmd_swept;
RCO         cmd_recall_last  For backward compatibility;
RC1         cmd_recall_1  For backward compatibility;
RC2         cmd_recall_2  For backward compatibility;
RC3         cmd_recall_3  For backward compatibility;
RC4         cmd_recall_4  For backward compatibility;
RC5         cmd_recall_5  For backward compatibility;
RERL        cmd_real;
```

```
SIBTBL.WORK.PRS10           THU, DEC 22, 1983, 10:37 AM    PAGE  6

RECA1       cmd_recall_1;
RECA2       cmd_recall_2;
RECA3       cmd_recall_3;
RECA4       cmd_recall_4;
RECA5       cmd_recall_5;
RECALRST    cmd_recall_last;
REDES11     cmd_illegal;
REDES12     cmd_illegal;
REDES21     cmd_illegal;
REDES22     cmd_illegal;
REDEUSER1   cmd_illegal;
REDEUSER2   cmd_illegal;
REDEUSER3   cmd_illegal;
REDEUSER4   cmd_illegal;
REFP        cmd_ref_position;
REFV        cmd_ref_value;
REVI        cmd_revision;
RIGL        cmd_quadrant_22;
RIGU        cmd_quadrant_12;
RM          cmd_sro_mask  For backward compatibility;
S11         cmd_s11;
S12         cmd_s12;
S21         cmd_s21;
S22         cmd_s22;
SAVE1       cmd_save_1;
SAVE2       cmd_save_2;
SAVE3       cmd_save_3;
SAVE4       cmd_save_4;
SAVE5       cmd_save_5;
SCAL        cmd_scale;
SELC1       cmd_cal_set_1;
SELC2       cmd_cal_set_2;
SELC3       cmd_cal_set_3;
SELC4       cmd_cal_set_4;
SELC5       cmd_cal_set_5;
SELC6       cmd_cal_set_6;
SELC7       cmd_cal_set_7;
SELC8       cmd_cal_set_8;
SING        cmd_single_ch;
SLO         cmd_power_slope_off  For backward compatibility;
SL1         cmd_power_slope  For backward compatibility;
SLOPO       cmd_power_slope_off;
SLOP1       cmd_power_slope;
SLOPOFF     cmd_power_slope_off;
SLOPOR      cmd_power_slope;
SMIC        cmd_polar;
SMOO0       cmd_smoothing_off;
SMOO1       cmd_smoothing_on;
SMOOOF      cmd_smoothing_off;
SMOOON      cmd_smoothing_on;
SOFT1       cmd_key_1;
SOFT2       cmd_key_2;
SOFT3       cmd_key_3;
SOFT4       cmd_key_4;
SOFT5       cmd_key_5;
SOFT6       cmd_key_6;
```

```
SIBTBL.WORK.PRS10           THU, DEC 22, 1983, 10:37 AM    PAGE  7

SOFT7       cmd_key_7;
SOFT8       cmd_key_8;
SPAN        cmd_span;
SPLI        cmd_split;
SROM        cmd_sro_mask;
STAR        cmd_start;
STEP        cmd_stepped;
STIO        cmd_illegal;
STOP        cmd_stop;
SV1         cmd_save_1  For backward compatibility;
SV2         cmd_save_2  For backward compatibility;
SV3         cmd_save_3  For backward compatibility;
SV4         cmd_save_4  For backward compatibility;
SV5         cmd_save_5  For backward compatibility;
SWET        cmd_sweep_time;
SYSL        cmd_privib_local;
SYSR        cmd_privib_remote;
SYSTO       cmd_illegal;
SYSTOFF     cmd_illegal;
SYSTPARA    cmd_system_params;
SYSTPLOT    cmd_illegal;
SYSTPRIN    cmd_illegal;
TRPCOCLE    cmd_illegal;
TRPEDIRE    cmd_illegal;
TRPEINIT    cmd_illegal;
TRPERECO    cmd_illegal;
TRPEREST    cmd_illegal;
TRPEUNDE    cmd_illegal;
TIMD        cmd_time_domain;
TIMEIMPU    cmd_tdr_impulse;
TIMEMAXI    cmd_max_time_window;
TIMEMINI    cmd_min_time_window;
TIMENORM    cmd_normal_time_window;
TIMESTEP    cmd_tdr_step;
TIML        cmd_tdr_domain;
TITL        cmd_label (the value here is for later replacement);
UP          cmd_up;
USER1       cmd_user1;
USER2       cmd_user2;
USER3       cmd_user3;
USER4       cmd_user4;
SUR         cmd_sur;
!
NOTE:       labels used here must be from the command case label values.
```

```
CIBTREE.WORK.PDS510              THU, DEC 22, 1983, 10:37 AM     PAGE   1

INTEGER CONSTANT tablesize :=     1540;
```

```
FIOTREE.WORK.PDS510              THU, DEC 22, 1983, 10:37 AM     PAGE   1

%FILE cibtree.work;

EXTERNAL BYTE TABLE mnem.L;
EXTERNAL INTEGER TABLE ib_link.L;
```

```
SIBTREE.WORK.PDS510              THU, DEC 22, 1983, 10:17 AM     PAGE   1

%68KL,P,"ibtree"
BEGIN & ibtree &

%FILE ccnddecl,work;

GLOBAL BYTE TABLE mnem :=    0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10,
&   11 &    11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25,
&   26 &    26, 27, 28, 29, 30, 31, 32, '!', '"', '#', '$', '%', '&', "'", '(',
&   41 &    ')', '*', '+', ',', '-', '.', '/', '0', '1', '2', '3', '4', '5', '6', '7',
&   56 &    '8', '9', ':', ';', '<', '=', '>', '?', '@', 'A', 'B', 'C', 'D', 'E', 'F',
&   71 &    'G', 'H', 'I', 'J', 'K', 'L', 'M', 'N', 'O', 'P', 'Q', 'R', 'S', 'T', 'U',
&   86 &    'V', 'U', 'X', 'Y', 'Z', '[', '\', ']', '^', '_', '`', 'a', 'b', 'c', 'd',
&  101 &    'e', 'F', 'g', 'h', 'i', 'j', 'k', 'l', 'm', 'n', 'o', 'p', 'q', 'r', 's',
&  116 &    't', 'u', 'v', 'w', 'x', 'y', 'z', '{', '|', '}', '~',127, '@',

&  129 & & numeric & ' ', '-', ',', 'E', 'U', 'C', '$', '@', ' ', '-', 'E', 'U',
&  141 &             '.', 'C', 'R', '8', ' ', 's', '-', '-', 'U', 'C', '$', '@', ',',
&  153 &             '.', '-', 'U', 'C', 'S', '8', '1', '2', '3', '4', '@', 'N', '@',
&  165 & & string  & '', '@', '$', '', ' ', '@', 'I', '@',
&  173 & & block_a & '@', 'R',

&  175 &    'R', '@', 'C', '@', 'I', '@', 'U', '@', 'O', '@', 'N', '@', 'I', '@', 'S',
&  190 &    '@', 'S', '@', '1', '@', 'O', '@', 'N', '@', 'I', '@', 'R', 'L', 'R', '@',
&  205 &    'R', '@', 'U', '@', 'O', '@', '1', '@', 'S', '@', 'E', '@', 'R', 'R', 'P',
&  220 &    'S', 'T', '@', 'K', '@', 'D', '@', '1', '2', '@', 'E', '@', 'T', 'T', '@', 'O',
&  235 &    '@', 'V', '@', 'I', 'X', '@', 'F', '@', 'F', 'N', '@', 'O', '1', 'D', '@',
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&  150 &              -cmd_enter,-cmd_illegal,152,16536,158,163,
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&  161 &              -cmd_u4,-cmd_illegal,-cmd_enter,
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&  264 &   -cmd_ch2,-cmd_illegal,   263,-cmd_illegal,
&  268 &   -cmd_couple_stimulus,-cmd_illegal,-emd_uncouple_etimuluc,
&  271 &   -cmd_illegal,   266,   265,   270,-cmd_illegal,
&  276 &   -cmd_clear_statue,-cmd_illegal,   276,-cmd_illegal,
&  280 &   -cmd_convert_off,-cmd_illegal,   280,-cmd_illegal,
&  284 &   -cmd_cmovert_recip,-cmd_illegal,   284,-cmd_illegal,   286,
&  289 &   -cmd_illegal,   282,-cmd_coovert_off,   288,
&  293 &   -cmd_convert_to_y,-cmd_cemvert_to_z,-cmd_illegal,
&  294 &   -cmd_continuous,   290,-cmd_illegal,-cmd_correction_off,
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&  304 &   -cmd_cerrection_eff,-cmd_correction_on,   301,-emd_illegal,
&  308 &     304,-cmd_illegal,   296,   306,-cmd_illegal,-emd_crt_off,
&  314 &   -cmd_illegal,   313,-emd_illegal,-cmd_crt_off,   315,
&  319 &   -emd_illegal,   317,-emd_illegal,   261,-emd_center,   272,
&  325 &     278,  310,  320,-emd_clear_etatue,-cmd_cw,-cmd_illegal,
&  331 &   -emd_d_and_n,-emd_illegal,   331,-emd_illegal,-cmd_d_minus_n,
&  336 &   -cmd_illegal,   335,-emd_illegal,   333,   337,-emd_illegal,
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&  367 &   -emd_illegal,   368,-cmd_illegal,   368,-cmd_illegal,   339,
&  373 &     346,  352,  358,  364,-emd_mmmary_ch1,-cmd_memory_ch2,
&  373 &     370,-cmd_illegal,  372,-cmd_illegal,   381,-cmd_illegal,
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&  393 &   -emd_illegal,-cmd_illegal,   392,-emd_illegal,   395,
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&  479 &   -cad_illegal,-cmd_otart,-cmd_etop,   470,   474,   478,
&  485 &   -cmd_illegal,-emd_if_gain_auto,-cmd_illegal,   486,
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&  525 &   -cmd_illegal,-cmd_nax_gatc_uindow,-cmd_illegal,   526,
&  529 &   -cmd_illcgal,-cmd_nin_gate_uindou,-cmd_illegal,   530,
&  533 &   -cmd_illcgal,   528,   532,-cmd_illegal,
&  537 &   -cmd_normal_gate_uindou,-cmd_illegal,   537,-cmd_illcgal,
&  541 &     539,-cmd_illcgal,-cmd_gate_off,-cmd_illegal,   543,
&  546 &   -cmd_gate_on,-cmd_illegal,-cmd_gate_span,-cmd_illegal,   548,
&  551 &   -emd_illegal,-cmd_gete_etart,-cmd_illegal,-emd_gate_etop,
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&  590 &   -cmd_input_cal_coeff4,-cmd_input_cal_coeff5,
&  592 &   -emd_input_cal_coeff6,-cmd_input_cal_coeff7,
&  594 &   -cmd_input_cal_coeff8,-cmd_input_cal_coeff9,-cmd_illcgal,
&  597 &   -cmd_input_cal_coeff10,-cmd_input_cal_coeff11,
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&  603 &   -cmd_illegal,   601,-cmd_illegal,   604,-cmd_illegal,   606,
&  609 &   -cmd_illegal,-cmd_input_data,-cmd_illegal,   610,
&  613 &   -cmd_illegal,   612,-cmd_illegal,-cmd_input_formatted,
&  617 &   -cmd_illegal,   616,-cmd_illegal,   618,-cmd_illegal,
&  622 &   -cmd_input_rau1,-cmd_input_rau2,-cmd_input_rau3,
&  625 &   -cmd_input_rau4,-cmd_illegal,   622,-cmd_illegal,   627,
&  630 &   -cmd_illegal,   608,   614,   620,   629,-cmd_illcgal,   631,
&  637 &   -cmd_illegal,-cmd_y_smith,-cmd_illegal,   636,   638,
&  642 &   -cmd_illcgai,   585,   640,-cmd_preset,-cmd_illegal,
&  647 &   -cmd_keycode,-cmd_illegal,   647,-cmd_illegal,   649,
&  652 &   -cmd_illcgal,-cmd_quadrant_21,-emd_quadrant_11,-cmd_illegal,
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&  680 &   -cmd_peek_poke_addr,   675,-cmd_illegal,-cmd_nag,
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&  690 &     660,  685,-cmd_illegal,-cmd_illegal,-cmd_illegal,
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&  699 &   -cmd_nkr_to_nin,-cmd_illegal,   699,-cmd_illegal,   697,
&  704 &     701,-cmd_illegal,-cmd_narker_off,-cmd_illegal,   706,
&  709 &   -cmd_illegal,-cmd_narker_off,-cmd_narker_1,-cmd_narker_2,
&  713 &   -cmd_narker_3,-cmd_narker_4,-cmd_narker_5,   703,   708,
&  718 &   -cmd_illcgal,-cmd_no_ref_nkr,-cmd_illegal,   719,
&  722 &   -cmd_illegal,-cmd_no_ref_nkr,-cmd_ref_nkr1,-cmd_ref_nkr2,
&  726 &   -cmd_ref_nkr3,-cmd_ref_nkr4,-cmd_ref_nkr5,   721,
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&  735 &   -cmd_illegal,   693,   731,   734,-cmd_illcgal,
&  740 &   -cmd_neasurement_reitart,-cmd_illegal,-cmd_ncn,-cmd_illegal,
&  744 &     742,-cmd_illegal,   744,-cmd_illegal,-cmd_nemory1,
&  749 &   -cmd_nemory2,-cmd_nemory3,-cmd_nemory4,   746,-cmd_illegal,
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&  764 &     758,  762,-cmd_illegal,-cmd_delta_marker,-cmd_illegal,
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&  774 &   -cmd_illegal,-cmd_donain_nemu,-cmd_illcgal,   775,
&  778 &   -cmd_illcgal,-cmd_dual_ch,-cmd_illegal,   779,-cmd_illegal,
&  783 &     769,  773,  777,  781,-cmd_illcgal,-cmd_format_nenu,
&  789 &   -cmd_illegal,   788,-cmd_illegal,   790,-cmd_illcgal,
&  794 &   -cmd_if_gain_nenu,-cmd_illegal,   794,-cmd_illegal,   796,
&  799 &   -cmd_illegal,-cmd_hpib_info,-cmd_illegal,   800,-cmd_illegal,
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&  809 &   -cmd_illegal,   808,-cmd_illegal,-cmd_n_points_menu,
&  813 &   -cmd_illegal,   812,-cmd_illegal,   814,-cmd_illegal,
&  818 &   -cmd_paran_menu,-cmd_illegal,   818,-cmd_illegal,
&  822 &   -cmd_n_points_mcnu,-cmd_illegal,-cmd_poucr_ncnu,-cmd_illcgal,
&  826 &     822,  824,-cmd_illcgal,   820,   826,-cmd_illegal,
&  832 &   -cmd_recall,-cmd_illegal,-cmd_redefine_paran,-cmd_illegal,
&  836 &   -cmd_rtf_plane_menu,-cmd_illegal,-cmd_response_menu,
&  839 &   -cmd_illegal,   832,   834,   836,   838,-cmd_illegal,   840,
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&  855 &   -cmd_stimulus_menu,-cmd_illegal,   855,-cmd_illegal,
&  859 &   -cmd_system_menu,-cmd_illegal,   859,-cmd_illegal,   849,
&  864 &     853,  857,  861,-cmd_illegal,-cmd_tape_menu,
&  869 &   -cmd_illegal,   868,-cmd_illegal,-cmd_test_menu,-cmd_illegal,
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&  881 &     792,  798,  804,  810,  816,  829,  845,  863,
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&  931 &   -cmd_n_groups_hpib,-cmd_illegal,   930,-emd_illegal,   933,
&  936 &   -cmd_illegal,-cmd_illegal,-cmd_illegal,   937,-cmd_illegal,
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&  982 &   -cmd_output_cal_coeff5,-cmd_output_cal_coeff6,
&  984 &   -cmd_output_cal_coeff7,-cmd_output_cal_coeff8,
&  986 &   -cmd_output_cal_coeff9,-cmd_illcgal,-cmd_output_cal_coeff10,
&  989 &   -cmd_output_cal_coeff11,-cmd_output_cal_coeff12,-cmd_illegal,
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& 1012 &   -cmd_illegal,-cmd_output_formattcd,-cmd_illegal,  1013,
& 1016 &   -cmd_illegal,  1015,-cmd_illegal,-cmd_output_id,-cmd_illegal,
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& 1026 &   -cmd_illegal,  1025,-cmd_illegal,-cmd_output_marker,
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& 1030 &  -end_illegal,  1029,-end_illegal,-end_output_memory,
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& 1045 &  -cnd_illegal,-cnd_output_raw1,-cnd_output_raw2,
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& 1081 &  -cnd_output_active,-end_output_id,   970,-cnd_output_status,
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& 1091 &  -cnd_pen2,-cnd_pen3,-end_pen4,-end_pen5,-cnd_pen6,-cnd_pen7,
& 1097 &  -cnd_pen8,-end_illegal,  1088,  1090,-cnd_illegal,
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& 1115 &  -cnd_illegal,-cnd_plot_graticule,-cnd_illegal,  1116,
& 1119 &  -cnd_illegal,  1118,-end_illegal,-end_plot_marker,
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& 1176 &  -cnd_log_polar,-cnd_illegal,  1176,-cnd_illegal,  1174,
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& 1269 &  -end_illegal,-cnd_revision,-cnd_illegal,  1225,  1240,  1265,
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& 1329 &  -cnd_power_slope,-end_illegal,-end_power_slope_off,
& 1332 &  -cnd_power_slope,  1328,-end_illegal,  1331,-cnd_illegal,
& 1337 &  -end_power_slope_off,-cnd_power_slope,  1335,-cnd_illegal,
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& 1345 &  -end_illegal,-end_smoothing_off,-cnd_smoothing_oo,  1343,
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& 1360 &  -end_key_6,-cnd_key_7,-end_key_8,-end_illegal,  1355,
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& 1395 &  -end_save_4,-end_save_5,-end_illegal,-cnd_sweep_time,
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& 1428 &  -cnd_privib_remote,  1423,-cnd_illegal,  1427,-end_illegal,
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& 1464 &    1462,-end_illegal,-cnd_illegal,-end_illegal,-cnd_illegal,
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& 1514 &  -cnd_illegal,  1513,-cnd_illegal,  1515,-cnd_illegal,  1494,
& 1520 &    1504,  1511,  1517,-cnd_illegal,-cnd_time_domain,  1519,
& 1526 &  -end_tdr_domain,-end_illegal,  4267,-end_illegal,  1524,
& 1531 &    1528,-cnd_illegal,  1488,  1530,-cnd_illegal,-cnd_user1,
& 1537 &  -cnd_user2,-cnd_user3,-cnd_user4,-end_illegal,  1536,
& 1542 &  -cnd_illegal,  1541,-cnd_illegal,-cnd_up,  1543,-cnd_illegal;

EH08 & ibtree &
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&  129 &  & numeric & ' ', '"', '.', 'E', 'U', 'C', '&', '@', '-', '"', 'E', 'U',
&  141 &              'C', '&', '@', ' ', '+', '-', '"', 'U', 'C', '$', '@', ' ',
&  153 &              '"', 'U', 'C', '$', '@', '1', '2', '3', '4', '@', 'H', '@',
&  165 &  & string  & '"', '@', '@', '"', ' ', ' ', '@', '|', '@',
&  173 &  & block_a & '@', '@',
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&  129 &  & numeric & 129,16513,16521,16528,158,163,-cnd_enter,
&  136 &              -cnd_illegal,137,16521,16528,158,163,-cnd_enter,
&  143 &              -cnd_illegal,144,16536,16536,16536,158,163,
&  150 &              -cnd_enter,-cnd_illegal,152,16536,158,163,
&  156 &              -cnd_enter,-cnd_illegal,-cnd_u1,-cnd_u2,-cnd_u3,
&  161 &              -cnd_u4,-cnd_illegal,-cnd_cntr,
&  164 &  & string  & -cnd_illegal,167,&357,-cnd_quote,&357,167,
&  170 &              -cnd_illegal,-cnd_label,&363,
&  173 &  & block_a & 20654,-cnd_block_a-24576,
```

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MICROMPY.WORK.PD8510          THU, DEC 22, 1983, 10:38 AM    PAGE  1

.MEIR MICROMPY (K=200,M=200,S=2000) .LIST OFF
.SPL
  INTEGER CODEUNIT , MPYTBL;
  LOOICRL LOUN;
  INTEGER ARRAY LEDE(0DE(1:16):=
    2,2,2,2,2,2,1,2,1,0,  3,3,1,1,1,1;
  INTEGER ARRRY POSCODE(1:16):=
    14,12,10,8,6,4,3,1,0,0,  8,11,7,6,5,15;
  LOCICRL RRRRY CODE(0:15);
  LOGICRL RRRRY OEFCODE(0:31):=
    0, 1,1, 0, 1,1, 0,0, 1,0, 0,0, 0,0, 0,0,
    0,0,0,0,0,0,0,0,0,0,  1,1,1,1,1,1,1,0,0;
  BYTE RRRRY MPYTBLM(0:7):="MPYTBL ";
  TWTRIMSIC SOIT;
.EMOSPL;
.TABLE OECLIST:="MODC", "MEMOR", "MUXR", "EXP",
    "MCC", "CC", "CTREM", "UBECCODE", "MPYEM", "REPENT",
    "MDECODE", "BOECODE", "BEXT", "SUMPR", "OURL", "UGO";
.TABLE ERRORS:="811 RLREADY DEFINED","EXPECTED IDENTCOLUM",
 "EXPECTED COLON","EXPECTED PARENTHESIS","EXPECTED EQUAL SIGN",
 "ILLEGAL STATEMENT","INVALID PARAMETER","NAME ALREADY DEFINED",
 "RECOVERY ERROR","ILLEGAL BUS SOURCE","ILLEGAL OPERAND",
 "MISSING END","EXPECTED MARKER","EXPECTED ICBMAR";
.PREAMBLE TREEDEFS.META.UPSOFT;
.PREAMBLE TAAL1B.META.UPSOFT;
.PREAMBLE OUTAME.META.UPSOFT(;
.PREAMBLE ABSIO.BETA.UPSOFT;
   R CODE TEST AND SET PROCEDURE   &
   & MDE -2=SE1 CODE, -1=SET BOTH, 0=TESI/SET BOTH, 1=TEST ONLY R
.SPL
 PROCEDURE SC (STRRT,LEN,VRL,MDE);
 VRLUE STRRT,LEX,VRL,MDE;
 INTEGER STRRT,LEN,VRL,MDE;
 BEGIN LOGICAL IBIT;INTEGER TVRL,I;
  MFLRO:=1;
  IF MDE>-1 THEN BEGIN
   TVRL:=IF VRL>=0 THEN VRL ELSE 3276& + VRL;
   FOR I:=START UNTIL STRRT+LEN-1  DO
   BEGIM IBIT:=(TVRL MOD 2)=1;TVRL:=TVRL&RSR(1);
    IF (CODE(I).(15:1) XOR IBIT)LAND CODE(I).(14:1) THEN MFLRG:=0;
    EMO;
   END;
  IF MDE<1 AMO MFLRG=1 THEN BEGIN
   TVRL:=IF VRL>=0 THEN VRL ELSE 3276S < VRL;
   FOR I:=START UNTIL S(RRT+LEX-1 DO
    BEGIN IBIT:=(TVRL BOD 2)=1; TVRL:=TVRLSRSR(1);
    IF LEM=16 AMD I=STRR1 + 15 THEN IBIT:=(VRL<0);
    CODELI).(15:1]:=IBIT;
    IF MDE>-2 THEM CODE(I).(14:1):=1;
    EMO;
   EMO;
  END;
 INTEGER PROCEDURE CVRL(STRRT,LEH);
 VRLUE STRRT,LEX; INTEGER STRRT,LEM;
 BEGIN INTEGER TVRL,I; TVRL:=0;
```

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MICROMPY.WO&K.PD8510          THU, DEC 22, 1983, 10:38 AM    PAGE  2

  FOR I:=START+LEH-1 STEP -1 UNTIL STRRT  DO BEGIN
   TVRL:=TVRL&LSL(1);
   IF CODE(I).(15:1)=1 THEM TVRL:=TVRL+1; EMO; .
 CVRL:=TVRL;EMO;
 PROCEDURE OUTMEX(VRL,LER);
 VRLUE VRL,LEM; INTEGER VRL,LER;
 BEGIN INTEGER I,TVRL,TIMI1; IIMIT:=VPL;IF VRL<0 THEM LER:=4;
  FOR I:=4 STEP -1 UNTIL 1 DO BEGIN
   TVRL:=TIMIT.(0:4); TIMIT:=TIMIT&LSL(4);
   IF I<= LEM THEN BEGIN
    IF TVRL>9 THEN TVRL:=TVRL+55 ELSE TVRL:=TVRL+48;
    CIO(TVRL); EMO; EMO; EMO;
 PROCEDURE OUTLINE; BEGIN
 FOR IMOX:=0 UNTIL IKV-4 DO CIO(MV(IMBB)); EMO;
  LISISRCE:=M;MCLRSS(33):=MCLRSS(34):=MCLRSS(62):=MCLRS3(63):=R100;
  MCLRSS(37):=MRLRBS(3B):=MCLRBS(98):=MCLRSS(46):=MCLRS3(47):=R100;
  MCLRSS(47):=MCLRSS(47):=MCLRSS(60):=MCLRS3(48):=R100;
 << ! " R $ % ' * . / < > ? AMD AMBSRSAMD AME LABEL CHARACTERS >>
.EMOSPL;
  R       &
MICROMPY=SEIUP PRSS;
PRSS=B(DECLARE/MAP/END/EOFILE/PROCEDURE/'\ IL1) -(.EMPTY) ?6E;
EMO="AERO"  .OUTLINE [\] EXIT;
EOFILE="AEOFA" <"MISSIMC BEJMD">LISTUMIT EXIT;
AME="&MAP" IL1 ORCC #"PCMIR:+512: MCMTR:=1&;" PRSSM;
SETUP= tSM ("^R] .AMSAMD(MPCMTR)
  #"IMCMI:=0; MVM(-3):=MVM(-2):=MVM(-1):=B224;"
  <"MPY MICROASSEMBLER.1(4.25.SD)" !"IU:=40;"
   .ORIELINE(MM(IU)) !"IU:=IU+27:" \,\>LISTUMII MXTL;
LIM  =!"LMUMIT:=FOPEN(TREETEXT,M147); PMOMPT;"
      !"CODEUNIT:=FOPEN(TREEOUT,I20,1,60);"
      !"IF < THEM BEGIN MAIN'FILE'INFO(0): OUIT(2); EMO:"
      !"LISTUMIT:=OUTUMIT:=FOPEN(TREELIST,X517,1,-MO);"
      !"IF < THEM BEGIN PRINT'FILE'INFO(0); OUIT(3); EMO;"
      !"MPYTBL:=FOPEN(MPYTBLM,I14,1);"
      !"IF < THEM BEGIN AMIRT'FILE'INFO(0); OUIT(4); EMO;";
DECLARE="DECLARE"  .RESUD(DECLIST) ?7E <': ?3E
    EOU ?7E $(', ('\ 1L1/.EMPTY) EOU ?7E) '; ?2E TL1;
EOU=.LBL '= ?5E .DNM ?13E !"MCMTR:=MVRLUE;" RMVMUM .XPOP() [*T]
  (!"MFLRG:=SFLRG=0 LOR (SVRLUE=MCMTR LAND SFLRG=ICMTR+32);")
   ?5E .SETV(MCMTR) .SETF(TCMT&+32) .XPOP();
RMVMUM=.TEST(0,0) .REMOVE(LISTRRVRL)/.EMPTY;
PROCEDURE="BEGIN" PMAME ?7E TL1 PBODY;
PBODY=IMIT &(STATE TS IMIT) "EMO" ?12E OREC TL1;
PMAME=.LBL (!"MFLRG:=SVRLUE=0;")  TRE
    !"PCM1R:=((PCMTR+15)/16)*16;" .SETF(1) .SETV(PCMTR);
OREC=!"OUTUMIT:=CODEUMIT; PBSX(PCMTR); OUTUMIT:=LISTUMIT;";
IMIT=.EMPIY (^X !"OO CODE(XCMTR):=DEFCODE(XCMTR+RCMTR)
     UMTIL (XCMTR:=XCMTR+1)>15:*];
STATE=SUBSTAR &(', SUBSTRT T6E) '; T2E:
SUBSTAT=(CMRPT/DITEM .SC(POSCODE(SFLRG=32),LEMCODE(SFLBG-32),SVBLUE,0)
      TIE (CMDEC/.EMPIY));
CMDEC=!"BFLBG:=(SFLRG=40 LAND SVRLUE<4);" .SC(&,2,3,0) TIE;
CMRPT=(<- .LBL.TEST(42,0)) .DNM T13E .SC(10,4,16-(WRLUE+1)/2,0) TIE
     RMVMUM;
DITEM= <- .LBL (!"MFLAG:=SFLAG>32 LAMB SFLRG<43;");
```

```
MICROMPY.WORK.PD8510          THU, DEC 22, 1983, 10:38 AM    PAGE  3

MXTL=[.RLIME() !"MV(IKV):=X134;MV(IKV:=IKV+1):=I32;IKV:=IKV+1;"
  !"IBCK:=0;MCCP:=MECP:=OD;");
TL1=.EMPTY ["         ") .OUTLINE [\]  MXTL;
TS=.EMPTY OUTCODE .OUTLINE MXTL
  [\ !"KSP:=MSP:=0;") OUTROMC;
OUTCODE=.OUTMEX(PCKTR,3) [" "]
    .OUTMEX(CVRL(&,8),2) .OUTMEX(CVRL(0,$),2) [" ");
OUTROMC=[!"OUTUMIT:=CODEUMIT; RBSRC(CVRL(0,16)); OUTUMIT:=LISTUMIT;"];
E=.EMPTY [+E] <.OUISRTB(ERRMUM,ERRORS)>LISTUMII
  !"KSP:=KSP:=0;TOS:=TOS:=OINIT;PUSH(Q,S);"
  => '\ MXTL (!"MFLAG:=MCMTR=0;"
   ("END" OREC TL1 PRSS/--(OITEM) PBODY PRSS/.EMPTY PRSS)/.EMPTY PRSSM);
EXIT=.EMPTY OREC <,\:E " ERRORS" \,\>LISTUMIT
      !"FCLOSE(CODEUMIT,X11,0);"
      !"IF < THEM BEGIN PRINT'FILE'INFO(0); RUIT(6); EMO;"
      !"FCLOSE[MPY1BL;X11,0);"
      !"IF < THEM BEGIN PRINT'FILE'INFO(0); QUIT(7); EMO;"
      !"LIMITS;TERMINATE;";
PRSSM=IMIT &(ORG/ '\ TL1/ EMO/ EOFILE/ MSTATE);
ORG="ORG" ('$ .MEM !"PCXTR:=MVRLUE:"/ .DNM !"PCMTR:=MVALUE;")
    ?13E RMVMUM OREC TL1 !"PCMTR:=(PCMTR/2)^2 + 512;";
MSTATE=IMIT ((<-.LBL +':) .TEST(0,0) TSE .SETF(2)
      .SETV(PCMTR-2560) OMTBL/.EMPTY) SOBMSTAT ?4E &(', SUBMSTRT ?11E)
       '; ?2E TMS;
SUBMSTBT=MITEM .SC(POSCODE(SFLRG-32),LEMCODE(SFLMG-32),SVRLUE,0) ?1E
       (EMGO/.EMPIY);
MITEM=<- .LBL (!"MFLAG:=SFLRG>42 LAND SFLRG<50;");
CMGO=.TEST(48,0) .LBL ?7E .TEST(1,0) ?7E
    .SC(0,5.SVBLUE/16,0) ?1E;
OM1BL=.EMPTY !"OUTUMIT:=MPY1BL;"
      ["GLOBAL INTEGER " & "=XFFFF" .OUTMEX(SVALUE,4) ";" \)
      !"OUTUMIT:=LISTUMIT;";
TMS=.EMPTY .OUTMEX(PCXIR-512,3) [" "] .OUTMEX(CVRL(S,$),2)
    .OUTMEX(CVAL(0,$),2) [" "] .OUTLINE MXTL [\ !"XSP:=MSP:=0;"]
    [!"OUTUMIT:=CODEUMIT; ABSRC(CVRL(0,$)); RBSRC(CVRL(8,8));"]
    [!"OUTUMIT:=LISTUMIT;");
.END MICROMPY
```

```
CIDS.WORK.PD8510              THU, DEC 22, 1983, 10:38 AM    PAGE  1

COMMENT                                          process identifiers
   Process identifier assignments determine the relative priority for
 ecHeduling proceeaee that are ready to run, except for preemptive
 echeduling due to interrupts.  The ready process with the highest
 process id will be scheduled before processes with lower identifiers.
 The nain process becones the idle process after initialization is
 completed, therefore process id 0 (lowest priority) is reserved for the
 nain process.  Preemptive scheduling due to interrupts has higher
 priority than normally scheduled processes, regardless of the process
 id of the interrupt eervice process.  The interrupt vector nunber
 determines relative priorities for interrupts -- the process with the
 lowest interrupt vector nunber has the most priority and will preempt
 interrupt service proceeses with higher interrupt vector numbers.
 ;

R interrupt vector numbers &
BYTE CONSTRNT y_edc_vctr          := Z0;   & highest priority &
                                           & coordinate with "irint" in
                                             file SINTRPI for autoclear&

BYTE CONSTANT refresh_vetr        := Z1;
BYTE CONSTANT public_ib_vctr      := Z2;
BYTE CONSTANT private_ib_vctr     := Z3;
BYTE CONSTRNT botton_vctr         := Z4;
BYTE CONSTANT rpg_vctr            := Z5;
BYTE CONSTANT top_key_vctr        := Z6;
BYTE CONSTANT uart_vctr           := Z7;
BYTE CONSTANT tape_vctr           := Z8;
BYTE CONSTANT private_ib_srq_vctr := Z9;
BYTE CONSTANT tick_vctr           := IR;   & coordinate with "irint" in
                                             file SINTRPI for autoclear&
BYTE CONSTRNT delay_tiner_vctr    := IB;   & coordinate with "inint" in
                                             file SINTRPI for autoclear&
BYTE CONSTANT bubble_vctr         := IC;
BYTE CONSTRNT vctr_d              := ID;
BYTE CONSTRNT power_fail_vctr     := IE;
BYTE CONSTRNT teet_point_vctr     := IF;   & louest priority &

& process ids &
INTEGER CONSTRNT parser_id        := ZF;   & highest priority &
INTEGER CONSTRNT priv_ib_srq_id   := ZE;
INTEGER CONSTRNT botton_id        := ZD;
INTEGER CONSTRNT rpg_id           := ZC;
INTEGER CONSTRNT top_hey_id       := ZB;
INTEGER CONSTRNT hcyboard_id      := IA;
INTEGER CONSTRNT uart_id          := Z9;
INTEGER CONSTRNT command_id       := Z8;
INTEGER CONSTRNT control_id       := Z7;
INTEGER CONSTRNT pub_ib_in_id     := Z6;
INTEGER CONSTRNT pub_ib_out_id    := Z5;
INTEGER CONSTRNT array_update_id  := Z4;
INTEGER CONSTRNT ch1_id           := Z3;
INTEGER CONSTRNT ch2_id           := Z2;
INTEGER CONSTRNT retrace_id       := Z1;
INTEGER CONSTRNT idle_process     := Z0;   & louest priority &
```

```
FIFGAIN.WORK.PD8510          INU, DEC 22, 1983, 10:38 AM    PAGE  1


PROCEDURE  new_if_gain( gain );
   VALUE   gain;
   INTEGER gain;                                        ENTERNAL.L;
PROCEDURE  new_if_gain_port( port );
   VALUE   port;
   INTEGER port;                                        EXTERNAL.L;
```

```
8IFGAIN.WORK.PD8510          INU, DEC 22, 1983, 10:38 AM    PAGE  1


MGBXL,P,"ifgain"
BEGIN

NFILE fcontrol.work;
NFILE cyadc.work;
NFILE fchdata.work;
NFILE fnanu.work;
```

```
3IFGAIN.WKWK.PD8510          INU, DEC 22, 1983, 10:38 AM    PAGE  2


REJECT;
COMMENT
**********************************************************************
*
*  IF GAIN DATA
*
**********************************************************************
;
& IF GAIN &
INTEGER  if_gain_port;                  & new if_gain port    &
EXTERNAL BYTE TABLE end_if_gain;        & from RESPONS        &
EXTERNAL BYTE TABLE cnd_if_port;        & from RESPONS        &
```

```
8IFGAIN.WORK.PD8510          INU, DEC 22, 1983, 10:38 AM    PAGE  3


REJECT;
COMMENT                                                      new_if_gain
**********************************************************************
*
**********************************************************************
;
PROCEDURE  new_if_gain( gain );
   VALUE   gain;
   INTEGER gain;                                                ENTRY;
   BEGIN & new_if_gain &

      abort_sweep;

      IF if_gain_port = test_port THEN
         BEGIN & if &
            hiLight_key( cnd_if_gain[ gain ],
                         cnd_if_gain[ if_test_gain ],
                         cnd_if_gain[ if_teet_gain ]
                       );
            if_teat_gain := gain;
         END  & if &
      ELSE & if_gain_port = ref_port &
         BEGIN & else &
            hiiight_key( cnd_if_gain[ gain ],
                         cnd_if_gain[ if_rtf_gain ],
                         end_if_gain[ if_raf_gain ]
                       );
            if_ref_gain := gain;
         END;  & else &

      restart_sweep;

   END;  & new_if_gain &
```

```
$IFGAIN.WORK.PO8510          THU, DEC 22, 1983, 10:38 AM    PAGE  4


@EJECT;
COMMENT                                                    new_if_gain_port
*************************************************************************
*
*************************************************************************
;
PROCEDURE  new_if_gain_port( port );
   VALUE   port;
   INTEGER port;                                                  EM1&Y;
   BEGIN & new_if_gain_port &

      if_gain_port := port;

      & highlight soft-keys &
      IF port = test_port THEN
         BEGIN & if &
            hilight_key( cnd_if_port[ test_port ],
                         cnd_if_port[ ref_port ],
                         cnd_if_port[ ref_port ]
                       );
            hilight_key( cnd_if_gain[ if_test_gain ],
                         cnd_if_gain[ if_ref_gain ],
                         cnd_if_gain[ if_ref_gain ]
                       );
         END   & if &
      ELSE & port = ref_port &
         BEGIN & else &
            hilight_key( cnd_if_port[ ref_port ],
                         cnd_if_port[ test_port ],
                         cnd_if_port[ test_port ]
                       );
            hilight_key( cnd_if_gain[ if_ref_gain ],
                         cnd_if_gain[ if_test_gain ],
                         cnd_if_gain[ if_test_gain ]
                       );
         END;  & else &

   END;  & new_if_gain_port &

END$
```

```
CIMBM.WORK.PO8510            THU, DEC 22, 1983, 10:38 AM    PAGE  1


BYTE CONSTANT ByteZERO:=0;
INTEGER CONSTANT null := 0,          op_comp := %40,
                 op_fail := %20,     tim_err := %10,
                 un_corr := %4,      busy    := %80,
                 FIFOReady:=0,       UncorErr:=2,
                 CorErr:=3,          IimErr:=4,
                 OPComp:=6,          Duey:=7;
BYTE CONSTANT MBMSelfID := %0,
              MBMSelRegB:=%B,       MBMSelRegE:=%E,
              MBMSelRegF:=%F,
              ang_block := %1,      two_fax := %10,
              enable_Wrt_boot :=%18,low_freq_RCD:=%20, &changed from 28&
              MBMInit:=%11,         MBMRead:=%12,
              MBMWrite:=%13,        MBMWrtBootReg := %16,
              MBMWrtBootLoop:=%17, MBMReadFSR := %1S,
              fMMabort  :=%13,      MBMReadBootLoop:=%1B,
              MBMReadRCD:=%1C,      FIFOReset := %1D,
              fMMpurge :=%1E,       MBMReset:=%1F;
BYTE mbm = %FFFFFC01,
     misc_reg   = mbm + 0,   mbm_data = mbm + %C0,
     mbm_statue = mbm + %C2, mbm_cmd  = mbm + %C2;

SUBROUTINE wait_while_MBB_busy; FORWARD;
```

```
SIMBM.UORK.PDS510            THU, DEC 22, 13E3, 10:38 AM    PAGE  1


%6$%L,"IMBM" BEGIN USE REGISTER 0-11;
COMMENT FOOC_OM
NAME--                                                    procedure_name
*************************************************************************
*
* SHORT DESCRIPTION--
* Dummy block for the linking of the MBM code
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUIPUTS--
*
* %OUTINES CALLED--
*          init_mbm,      tect_mbn,     parms_mbn,
*          set_add_mbn,   read_mbn,     urt_mbn
*          status_mbn,    read_boot_mbn,urt_boot_mbn
*
* ERROR CONDITIONS RNO RECOVERY--
*
* NOTES--
*     Each for the external procedurae are stand alone. The MBM code ie
*   located on the MBM board itself and is a block of 256 bytee of code.
*   Each of the proceduree is selected by a block euitch that selects
*   one of 16 256 bytes ROM eections and enables the MBC chipeclect.
*   Each code section must be <= 256 bytes and the entry point on a
*   XXXXXX00 boundary ( note the link command needs te be adjueted ao
*   that thie will happen bccauee the compiliier overhead adde aene
*   unneeded branche at begining and end of a code module ).
*
* AUTHOR MISIORY--
*         JTB
*
*************************************************************************
*
* IMTIAL REFINEMENT--
*
*************************************************************************
*
* REVISION LOG--
*          May 5 1982  moved into Passi work
*
*************************************************************************
```

```
SIMBM.WORK.PO8510            THU, DEC 22, 1983, 10:38 AM    PAGE  2


@EJECT
DECLARATION--  ;

&#DOC_OFFS

EXTERNAL LABEL init_mbn,test_mbn,parms_mbn;
EXTERNAL LABEL set_add_mbn,read_mbn,urt_mbn;
EXTERNAL LABEL status_mbn,read_boot_mbn,Wrt_boot_mbn;
     GO TO init_mbn;
     GO TO test_mbn;
     GO TO parms_mbn;
     GO TO set_add_mbn;
     GO TO read_mbn;
     OO TO urt_mbe;
     GO TO etatus_mbn;
     GO TO read_boot_mbn;
     GO TO urt_boot_mbn;

END$
```

```
SIMBM0.WORK.PDS510              THU, DEC 22, 1983, 10:38 AM     PAGE   1


M6SKL,P,"IMBM0"
BEGIM USE REGISTER 0-11;

$FILE cimbn.work;

COMMENT $DOC_ON
MAME--                                                          test_nbn
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* SHORT DESCRIPTION--
*    Verification of MBM hardware.
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*         test_nbn    Flag on success of test -- TRUE = successful
*                                                FALSE= failed
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR HISTORY--   JTB
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* IMTIAL REFINEMENT--
*
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* REVISION LOG--
*         Documentcd and Rove in to Pace 1  MAY 7 1BS2
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
DECLARRTIOK--
```

```
SIMBM0.WORK.PD8510              THU, DEC 22, 1983, 10:38 AM     PAGE   2


NEJECT;

BOOLEAK SUBROUTIME test_nbn;                                    EMTRY;
$&DOC_OFF&
BEGIM
        misc_reg:=%80;
        test_nbn:=TRUE;
        misc_reg:=ByteZERO;
 EKO teat_nbn;


SUBROUTIME wait_while_MBM_busy;
    UMILE TBIT(nbn_atatus.Busy) OO;

EMOS
```

```
SIMBM2.WORK.PDSE10              THU, DEC 22, 1983, 10:33 AM     PACE   1


M6SKL,P,"IMBM2"
BECIN USE REGISTER 0-11;

$FILE cinbn.work;
SUBROUTINE wait_while_MBM_buay_or_error;                        FORWARD;

COMMENT.SDOC_ON
MAME--                                                          init_nbn
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* SHORT DESCRIPTION--
*   Reeets and inializes the MSC and bootleop for eelected MBM
*
* ENTEMDED DESCRIPTION--
*   Cause any on going operation to be ceaeed, and all MSC registers
*   are reset. The MSC is then eet op for one MBM operation with
*   RCD error correction ( the data will be corrected on the fly, but
*   an uncorrectable error will not be flagged till after the tranafer
*   ie finiehed -- this is the fastest node ).
*
* IMPUTS--
*       nod       nodule number of MBM   range is 0,1
*
* OUTPUTS--
*       init_nbn  BOOLEAN on the euccees of initialization (see below)
*                 TRUE = successful  FALSE = failed
*
* ROUTINES CALLED--  none
*
* ERROR COMDITIONS AND RECOVERY--
*    A bad boot loop or harduare failure will cause test to fail, and
*    this will require a service cell to fix
*    Init will initialize the boot loop nap on all MBMs, however it
*    appears that this routine will return true if MBMM0 ie good, and
*    MBMM1 is bad, Mowever if MBMM0 is bad, Imit(1) will be false(sorry)
*
*
* AUTHOR MISTORY--   JTB
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* IMIIAL REFIMEMEMI--
*   Abort MBC , if still busy repeative hit with abort ( enall delay
*   between ). Once not buey do a hard raaet and then set up MBC regs
*   with the RED node , one MBM with two channels, etc. Issue the
*   initilaize conmand and wait till completed and report if euceesful.
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* REVISION LOG--
*         Documented and Move into Paas 1  MAY 7 1982
*         Delete the wait till op_conp before aborting as req in
*                 early controllers
*    4/83  Added bailout in busy loop if MEMO good but MBMM1 bad
*
```

```
SIMBM2.UORM.PD8510              THU, DEC 22, 1983, 10:38 AM     PAGE   2


!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
SIMBM2.WORK.PO8510          THU, DEC 22, 1983, 10:38 AM     PAGE  3


REJECT
DECLARATION-- ;

BOOTERM PROCEDURE init_mbm(mod); VALUE mod; INTEGER mod;          ENTRY;
&&DOC_OFF&

BEGIN
BYTE Dummy;

  misc_reg:=%I82;

  IF TBIT(mbm_status,Busy) THEN
     BEGIN

        &EXPERT 3  DO BEGIN mbm_cmd:=MBMabore;
                &EXPERT 255 DO Dummy:=mbm_status; Dummy:=mbm_data; END;
                & Time Delay -- do not understand&
      END;
  &Should be not busy and ready for init mod.

  IF NOT TBIT(mbm_status,Busy) THEN
     BEGIN
     mbm_cmd:=(MBMReset);

     wait_while_BMB_busy; mbm_cmd:=(MBMSelReg8);
     MBITE(BOARS(mbm_data),  one_block, two_fsa,
                        low_freq_RCO , Byte%ERO, LEFT( BYTE(mod), 3));
     wait_while_MBM_busy; mbm_cmd:=(MBMInit);
     RB UNTIL TBIT( mbm_status, Busy );
     wait_while_MBM_busy_or_error;
     END no busy error;
     &else ie a busy error which the following will flag&

  init_mbm:=TBIT(mbm_status,OPComp) RND NOT TBIT(mbm_status, TimErr);

  misc_reg:=2;
 END init_mbm;


SUBROUTINE wait_while_MBM_busy;
    UNTIL TBIT( mbm_status,Busy ) DO;

SUBROUTINE wait_while_MBM_busy_or_error;
BEGIN
BYTE sts=REGISTER 1;    R must be a register &
    DO     sts := mbm_status
     UNTIL NOT TSIT( sts, Busy      )     OR
           ( TBIT( sts, FIFOReady )     AND  TBIT( sts, TimErr  )  );
                R this seems to catch MBMBO good but MBM81 bad &
END;

END&
```

```
SIMBM3.WORK.PRBS10          TWO, DEC 22, 1983, 10:38 RM     PAGE  1


MSBKL,P,"IMBM3"
BEGIN USE REGISTER 0-11;

NFILE cimbm.work;

COMMENT &DOC_ON
NAME--                                                          parms_mbm
*****************************************************************************
*
* SHORT DESCRIPTION--
*   Returns description of MBM hardware -- ie memory organization.
*
* EXTENDED DESCRIPTION--
*   Returns a description of the MBM memory organization so that the
*   rest of the software could adapt to Harewarc changes in MBM hardware
*   i.e. -- a different vendor or larger memorys.
*
* INPUTS--
*
* OUTPUTS--
*   parms_mbm      two packed ascii chars with vendor and memory size
*                        "I1" = INTEL 1 MEGABIT
*   mod            The number of the presently selected memory module
*   pos            The next page number to be used if unchanged
*   pageSize       The number of words per memory page
*   pagemax        The largest addressable page
*                    !+pagenax is the number of pages of storage/module
*   modules        The number of memory modules on the MBM board
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*        If MBC is busy on entry the routine will not check MBM number
*           and will instead return with a zero count on modules.
*
* NOTES--
*
* AUTHOR HISTORY--  JTB
*
*****************************************************************************
*
* INTIAL REFINEMENT--
*  Set the known constant for the Intel 1 megBit memory ( other
*  software will be done for other MBMs ). Read from the MBC the
*  present page and module settings. Then force the MBC to read the
*  status of FSA chips , and count the number of FSRs responding.
*
*****************************************************************************
*
* REVISION LOG--
*  -       Documented and Move into Pass 1  MAY 7 1982
*  4/83    Added busy error check
*
*****************************************************************************
```

```
SIMBM3.WORK.POE510          THU, DEC 22, 1983, 10:38 RM     PAGE  2


REJECT
DECLARATION--;

BLPMA  PROCEDURE parms_mbm(mod,pos,pageSize,pagenax,modules);
       INTEGER mod,pos,pageSize,pagenax,modules;          ENTRY;

&&DOC_OFF&

BEGIN
INTEGER mod_ctr,temp;
    misc_reg:=%83;

    pageSize:=32;

    mbm_cmd:=MBMSelReg5;
    pos:=( ( INTEGER(mbm_data) AND %FF) +
                 LEFT( temp:=INTEGER(mbm_data) , 8)
                 AND (pagenax:=%7FF) );
    mod:=RIGHT(temp,3) AND %F;

    mod_ctr:=0;

    IF NOT TBIT( mbm_status, Busy ) THEN
    BEGIN
       mbm_cmd:=FIFOReset;
       DO UNTIL TBIT(mbm_status,OPComp);
       mbm_cmd:=MBMReadFSR;
       DO UNTIL TBIT(mbm_status,OPComp);
       DO BEGIN
          mod_ctr:=mod_ctr+1;
          temp:=mbm_data
          END UNTIL NOT TBIT(mbm_status,FIFOReady);
    END no busy error;

    modules:=RIGHT(mod_ctr,1);
 .  RSSEMBLE(  LEA   A"I1 -- R.0", R8 ;   MOVE.L R8, R0 ); &PC relative&

    misc_reg:=%3;
END parms_mbm;

END&
```

```
SIMBme.WORK.PO8510          THU, DEC 22, 1983, 10:38 RM     PAGE  1


RBSKL,P,"IMBM4"
BEGIN USE REGISTER 0-11;
RFILE cimbm.work;

COMMENT &DOC_ON
NAME--                                                        set_add_mbm
*****************************************************************************
*
* SHORT DESCRIPTION--
*  Sets up the MBC regs and returns the word count and next MBM page.
*
* EXTENDED DESCRIPTION--
*  The read and write MBM data routines need to specific the starting
*  page address and the number of pages. This routine given the RAM
*  memory address and the starting page will compute the needed number
*  of pages, and also the next available page after the operation.
*
*
* INPUTS--
*     Address   The starting page number ( 0 - 2047 )
*     StartDen  The starting byte address of the RAM block
*     EndMen    The ending byte address of RAM block
*
* OUTPUTS--
*     Address   The next page  available
*     set_add_nen The actual number of number of words that will be
*                 transfered -- the block is always rounded up to integer
*                 page sizes.
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*       If the conditions requested would cause the last page > 2047
*       then the block transfer would be limited to the start page
*       to 2047 page, and the word length would reflect this.
*
* NOTES--
*
* AUTHOR HISTORY--  JTB
*
*****************************************************************************
*
* INTIAL REFINEMENT--
*       The lenght in number of MBM pages of RAM block is computed.
*     This is then added to the starting page to finding the ending
*     pages, if this exceedes 2048 then then length is adjusted down.
*     The length in pages is then converted to words for the return
*     value. The length in pages to broken into two bytes and sent to
*     the BBC, as is the the starting address. The selected module, as
*     as set in the init_MBM routine is read back from the MBC, and ORed
*     into the address mbs.
*
*****************************************************************************
*
* REVISION LOG--
```

```
SIMBM4.UORK.PD8510              THU, DEC 22, 1983, 10:38 AM     PAGE   2

*          Documented and Move into Pace 1  MAY 7 1982
* may 7 S2
*  added fifo_reset
*  checked for pagt start + length > 3048
* 4/83  check for buoy on entry -- if so error exit
*
*****************************************************************************
```

```
SIMBM4.UORK.PD8510              THU, DEC 22, 1983, 10:38 AM     PAGE   3

%EJECT
DECLBRATION--;

DOUBLE PROCEDURE set_add_mbn(Address,StartMem,EndMem);
  VALUE StartMem,EndMem; INTEGER Address;DOUBLE StartMem,EndMem;
                                                                  ENTRY;
&&DOC_OFF&


BEGIN
  INTEGER Length,                 & number of MBI pages needed &
          Add;                    & staring page address &
  BYTE    module_sel_bitt;        & selected MBM module code &
        misc_reg:=X54;

      Length:= 1 + RIGHT( (EndMem-StartMem),6);
      Add:=( Address AND X7FF ) ;
      IF (Address:= Add+LangUi) > 2048 THEN
        BEGIN &error too many paget requested &
        Address:=2048;
        Length :=Address - Add;
        END; &page address error&

      IF NOT TBIT( mbn_status, Busy ) THEN
        BEGIN
        mbn_cmd:=MBMSelRegB;
        Length:=( Length   AND X7FF );
        mbn_data:=Length;     mbn_data:= two_fes OR RIGHT(Length,8);

        wait_while_MBM_buey;
        mbn_cmd:=MBMSelRegF;  module_sel_bits:=mbn_data AND XF8 ;
        wait_while_MBM_buey;
        mbn_cmd:=MBRSelRegE;
        mbn_data:=Add;        mbn_data:= module_sel_bits OR RIGHT(Add,8);

        wait_while_MBM_busy;  mbn_cmd:=FIFOReset;
        END no busy error;

      set_add_mbn:=LEFT( DOUBLE(Length),5 );

      misc_reg:=X4;
END set_add_mbn;


SUBROUTINE wait_while_MBM_busy;
  DO UNTIL NOT TEST( mbn_status, busy, busy + tim_err );

END$
```

```
SIMBM5.UORK.PD8510              THU, DEC 22, 1983, 10:38 AM     PAGE   1

MG&XL,P,"IMBM5"
BEGIN USE REGISTER 0-11;

RFILE cimbn.work;

COMMENT &DOC_ON
NAME--                                                        status_mbn
*****************************************************************************
*
* SHORT DESCRIPTION--
*    Accquires the the MBC status.
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
*
* OUTPUTS--
*    status_mbn    The status of the MBC
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR HISTORY--  JIB
*
*****************************************************************************
*
* INTIAL REFINEMENT--
*    Read the AMC status and return it
*
*****************************************************************************
*
*- REVISION LOG--
*          Documented and Move into Pass 1  MAY 7 1982
*
*****************************************************************************
```

```
SIMBM5.WORK.PD8510              THU, DEC 22, 1983, 10:38 AM     PAGE   2

%EJECT
DECLARATION-- ;

INTEGER SUBROUTINE status_mbn;                                    ENTRY;
&&DOC_OFF&
BEGIN
        misc_reg := X8S;
        status_mbn:=mbn_statut;
        misc_reg := XS;
 END status_mbn;


END$
```

```
SIMBM6.WORK.PDKS10              THU, DEC 22, 1983, 10:38 AM     PAGE   1


%&BKL,P,"IMBM6"
BEGIN USE REGISIER 0-11;

&FILE cimbm.work;

COMMENT $DOC_ON
NAME--                                                          read_mbm
*****************************************************************************
*
* SHORT DESCRIPTION--
*    Reads from the selected MBM a block data to ttort in the RAM.
*
* EXTENDED DESCRIPTION--
*    Reads from the MBM into the RAM the numbert of wordt (16 bit)
*    specified (computed by set-MBM_add) from the MBM page (also set
*    by tet_MBM_add). The data it transfetr a word(!) at at time ( not
*    interrupt driven) and will continue till all bwrde are read or
*    an error occurs.
*    NOTE: Set_MBM_add must be clied juet prior to this precedurc.
*
* INPUTS--
*    Add   Address of the starting RAM location
*    WordLength  The number of werds to be transfer ( from wet_MBM_add )
*
* OBTPUTS--
*    read_mbm   Boolean returning success ( TRUE ) or failed ( FALSE )
*
* ROUTINES CALLED--  eone
*
* ERROR CANDITIONS RND RECOVERY--
*      No recover fron an error is done ( the most likely it an data
*   trror found during trror correctien that could not be corrected )
*   It is reported and a complete set_MBR_add / read_mbm cycle must be
*   done.
*
* NOTES--
*       It there a FIFO overflow problen due te external interrupts ??
*     Urite nay have this problen  never seen for READ.
*
* AUTHOR HISTORY--  JTB
*
*****************************************************************************
*
* INTIAL REFINEMENT--
*    The read command is issued and as data occurs in the FIFO it is
*    moved into RAM. This continues till all the data is transfertd or
*    an error occurs. Success or failure is then reported.
*
*****************************************************************************
*
* REVISION LOG--
*         Documented and Hove into Pats t  BAY 7 1982
*   4/S3   Added busy error check
*
*****************************************************************************
```

```
SIMBM8.WORK.PDBS10              THU, DEC 22, 1983, 10:38 AM     PAGE   2


#EJECT
DECLARATIBN-- ;

BDELEAN PROCEDURE read_mbm(Rdd,WordLengUh); VALUE Rdd,WordLength;
                                        DOUBLE Rdd,WordLength;  ENTRY;
&SDOC_OFF$
BEGIN
DOUBLE  Index = REGISTER 2;
DOUBLE  HiByte  = REGISTER 4;
INTEGER DataInteger = REGISTER 3;
BYTE    DateByte = REGISTER 3;
INTEGER POINTER IntPtr = REGISTER 9;

      miac_reg:=%86;

  IF NOT TBIT( mbm_etatue , Bady ) THEN
     BEGIN
     mbm_end:=MBMReed;
     Index:=0;
     HiByte:=0;
     STPNTR(IntPtr,Rdd);

     DO IF TBIT(mbm_statua,FIFOBeady) THEN
        BEGIN
          DataByte:=mbm_data;
          IF NOT TBIT(HiByte.0) THEN
            DataIntageri=LEFT(DataInteger,S)
          ELSE
            BEGIN
            IntPtr[Indax]:=DataInteger;
            Indax:=Index+1;
            END;
          HiByte:=HiByte+1;
        END
      UNTIL Index>=WordLength OR
            NOT TEST(mbm_otatue,nuII, ap_fail + tin_err);

     wait_while_MBM_boey;
     END not budy error;

   reed_mbm:=TEST(mbm_atatue,op_camp,
                        op_comp + ap_fail + tin_err + un_corr );

   niec_rag:=%6;
END read_mbm ;

SOBROUTINE wait_while_MBM_buey;
  DO UNTIL NOT TEST( mbm_etatUe, buey, buey + tin_err );

EHDB
```

```
SIMBM8.WORK.PDSS10              THU, DEC 22, 1983, 10:39 AM     PAGE   1


%&BKL,P,"IMBM8"
BEGIN USE REGISTER 0-11;

&FILE cimbm.work;

CBBMEKT $DOC_ON
NAME--                                                          urt_mbm
*****************************************************************************
*
* SHORT DESCRIPTION--
*   Multipage urite of data fron RAM to selected MBM.
*
* EXTENDED DESCRIPTION--
*   Writes into MBM fron the RAM the nunbers of words (16 bit) specified
*   (computed by set_MBM_edd) fron a MBM page (also set by tet_MBM_add)
*   The data is trantfered a word(!) at a tint ( not interrupt driven )
*   and will continue till all words are transfer or an error (?) occurs
*   NOTE: Set_MBM_add must also be called just prior to this procedure.
*
* INPUTS--
*   Add     Addrtss of the starting RAM address
*   WordLength  The number of words to be tranefir ( fron stt_MBM_add )
*
* OUTPUTS--
*   urt_mbm  Boolean returning sueess (TRUE) or failure (FALSE)
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS RND RECOVERY--
*     No recover fron an error is done other than to report it,
*   a complete new set_MBM_add / urt_mbm cycle nust be done.
*
* NOTES--
*     The actual transfer to bubble starts after the urite command and
*     atleast two bytes are in the FIFO.
*     Potential problen -- due to the poll nature of this procedure and
*     the requirement that the FIFO never underflows (=> tining error),
*     there it a problen if external interrupts could happen. Turning
*     off the interrupts will cause ether tystsn problen ( naybe just
*     till the FIFO is his 20-30 bytts or Prefill FIFO (Best)  ? ).
*     Spec sheet does not allou pre filling FIFO.
*     Calling routines will need to retry urites
*
* AUTHOR HISTORY--  JTB
*
*****************************************************************************
*
* IXTIRL REFINEMENT--
*   The urite connand is issued and as reon is available in the FIFO
*   data is fetched fron RAM and placed into the FIFO. This continues
*   till all the data is transfer or an error occurs. Wait now till the
*   transfer fron FIFO to MBM is finished and report on the sucess.
*
*****************************************************************************
*
```

```
SIMDMS.WORK.PDBS10              THU, DEC 22, 1983, 10:39 AM     PAGE   2


* REVISION LOG--
*         Documented and Hove into Pais 1  NRY 7 1982
*   4/S3   Rdded buey error check
*  11/83   Speed up urite loop
*
*****************************************************************************
```

```
SIMBMS.WORK.PD8510              THU, DEC 22, 1953, 10:39 AM      PAGE   3

@EJECT
DECLAARATION-- ;

BOOLEAN PROCEDURE  wrt_mbn(Add,WordLength); VALUE Add,Wordlength;
                                         DOUBLE Add,Wordlength;  ENTRY;
&$DOC_OFFS

BECIK
DOUBLE Index • REGISTER 2;
DOUBLE ByteLength = REGISTER 3;
BYTE    POINTER BytePtr = REGISTER 9;

      miec_reg:*%BS;

   IF ROT TBIT( mbn_status, Busy ) THEN
      BEGIN
      Index:=0:
      Bytelangth :• 2 * WordLength;
      STPMTR(BytePtr,Add);
      mbn_cmd:=MBMWrite;

      DO
         IF TBIT(mbn_atatus,FIFOReady) THEN
         BEGIN
         mbn_data:=BytePtr[ Index ];
         Index :=Index * 1;
         END
      UNTIL Index>=BytdLength OR
            NOT TEST(mbn_etetue,null, op_fail * tin_err);

      wait_whilc_MBM_busy;
      END not buoy error;

    Wrt_mbn:*TEST(mbn_etatus,op_comp,
                             op_comp • op_fail + tin_err);
    miec_reg:=%S;
END urt_mbn;


SUBROUTINE wait_while_MBM_busy;
  DO UNTIL NOT TEST( mbn_etatus, busy, busy • tin_err );

END$
```

```
SIMBMA.WORK.PD8510              THU, DEC 22, 1953, 10:39 AM      PAGE   2
```

```
SIMBMR.WORK.PD5510              THU, DEC 22, 1953, 10:39 AM      PAGE   1
```

```
SIMBMC.WORK.PD8510              THU, DEC 22, 1953, 10:39 AM      PAGE   1

M6@K1,P,"1mBmC"
BEGIN USE REGISTER 0-11;

NFILE cimbn.work;

CORMENT $DOC_ON
NAME--                                                          urt_boot_mbn
******************************************************************************
*
* SHORT DESCRIPTION--
*  Thie For restoring a damaged bootloop map of one MBM
*
* EXTENDED DESCRIPTION--
*  The boot loop is restored ( modified ) according to the supplied
*  map. The module needs to be initialized before ueing again.
*
* INPUTS--
*    buf      A 40 Byte array containing the bootloop map
*
* OUTPUTS--
*    urt_boot_mbn  Successful always  * only if no busy error
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*       An busy error on entry will skip urt
*
* NOTES--
*      An init_mbn should occur after the urt_boot_mbn
*
* AUTHOR HISTORY--   JIB
*
******************************************************************************
*
* INTIAL REFINEMENT--
*      The MBC controller and all ite registers all cleared. The enable
*      register ie enabled for writing boot loop of a single two channel
*      MBM. The boot loop register ie filled with all onea (FF), nad the
*      the FIFO is filled ( all 40 bytes ) with the new boot map. The
*      write boot loop command is given, and when done the regieters are
*      returned to previous state, However an initialize is not done
*      (But should be).
*
******************************************************************************
*
* REVISION LOG--
*           Documented and Move into Paes 1  MAY 7 1952
*   4/53   Added busy error check
*
******************************************************************************
```

```
SIMBRC.WORK.PD$S10          THU, DEC 22, 1983, 10:39 AM    PAGE  2


@EJECT
@DECLARATION-- ;

@ODLERN PROCEDURE art_boot_mbn(buf); VALUE buf; DOUBLE buf;       EATRY;
&$OOC_OFF&
BEGIN
BYTE POINTER ptr = buf;
INTEGER index;
   miac_reg:=%SC;

IF NOT TBIT( mbn_etatus, Buty ) THEN
   BEGIN
   mbn_cnd := MBMabort;    wait_while_MBM_buey;
   mbn_cnd := MBMpurge;    wait_while_MBM_buey;
   mbn_cnd := FIFOReset;   wait_while_MBM_buey;
   mbn_cnd := MBMSelRegB;
   @RITE( MDRS(mbn_data), one_block, two_fee, emable_art_boat);

   mbn_end := MBMSelFIFO;
   REPEAT 40 OO mbn_data :- 8FF;
   mbn_cnd := MBMWrtBootRtg;   wait_mbile_MBM_buey;

   FOR index := 0 TO 39 DO mbn_data := ptr[ index ];
   mbn_cnd := MBMWrtbeetLoop;  wait_while_MBM_awey;

   mbn_cnd := MBMabort;    wait_wMile_MBM_bwey;

  mbm_cnd:=(MBM3elMegM);
  MRITE(MMRS(mbn_data),  one_block, two_fee,
                         low_frtq_RCD );
  wait_while_MBM_buey;
  mBn_cnd := MBMSelFIFO;

  art_boat_mbn :=   TRUE;
  EMD
  ELSE
  art_boat_mbn := FALSE;

   miac_reg:=%C;
 EMD wrt_boot_mbn;


SUBROUTIME wait_while_MBM_buey;
    UMILE TBIT(mbn_etatus,Busy) DO;

EMDB
```

```
JIMBMLST.WMMK.PD&S10        THU, DEC 22, 1883, 10:39 AM    PAGE  1


!JOB jimbmlst,LIBRM.PD$S10,work;PRI=CS
!LIST SxMBM.work
!LIST SIMBM.werh
!LIST FMBM.work
!LIST CIMBM.work
!LIST SIMBMO.work
!LIST SIMBM2.work
!LIST SIMBM3.work
!LIST SIMMM4.work
!LIST SIMBM5.work
!LIST SIMBM6.werh
!LIST SIMBM8.work
!LIST SIMBMA.work
!LIST SIMBMC.work
!TELL LIBRM.PO@S10 --- MBM liet job deme
!TELL JTB.P@@S10 --- MBM liet job dome
```

```
'LIMBMTST.WORK.POSS10       THU, DEC 22, 1983, 10:39 AM    PAGE  1


RIMBMTSI.work,
rlibrary.work,
rxmbm.work,
&
RIMBMO.work,
RIMBM2.work,
RIMBM3.work,
RIMBM4.work,
@IMBM5.work,
RIMBM6.work,
RIMBM8.work,
RIMBMA.work,
RIMBMC.work,
&
/E
RAM=100H,RAM=7FFEH;
```

```
SIMBMTST.WORK.PD$S10        THU, DEC 22, 1983, 10:39 AM    PAGE  1


M68KL,"imbmttt" BEGIM USE REGISTER 0-11;
COMMENT INTEL MBM TEST ROUTIME;

MFILE fmbm.work;
MFILE fterm.work;                                          & DEBUG &
MFILE fterm2.work;                                         & DEBUG &
MFILE fterm3.work;                                         & DEBUG &
BYTE SUBROUTIME RCMMR;                                     EXTERMRL;

ALPMA TABLE STS:="FIFO RDY",
                 "",
                 ""UMCOR ERR",
                 "ACDR ERR",
                 "ATIME ERR",
                 ""OP FAIL",
                 "OP COMP",
                 "&WSY"   ;
ALPMA TABLE ME3:=
     ""+27+"M"+27+"K"+27+"J"+"0 -- DISABLE MBC",
     "1 -- READ  STATUS      21 -- URT MASK IMC PATTERK",
     "2 -- URITE CMD         22 -- URT MASK  FF PATTERK",
     "3 -- READ  DATA        23 -- READ MASK PATTERM",
     "4 -- URITE OA1R        24 -- READ BOOT PATTERM",
     "5 -- READ  FIFO        29 -- URT FIFO IMC PATTERM",
     "& -- WRITE FIFO        26 -- URT FIFO  FF PATTERM",
     "7 -- URITEREG2",
     "8 -- URITEREG1",
     "A -- MBM IKTIRLIZE     2A -- MBM VOLTAGE TEST",
     "B -- READ MBM BLOCK    2B -- RESTORE SEED",
     "C -- URI  MBM BLOCK    2C -- CMECK SEED",
     "D -- MBM Parne         20 -- RESTORE BOOT LOOP",
     "E -- Module Sel        10-1F  URT BMC CBO",
     ""+27+"1";  @ memory lock &

BYTE ARRAY buf[0:39];
IMTEGER I,J,K,p0,p1,p2,p3,p4,Module;
DOUBLE StartRdd,EmdAdd,Uords;

IKTEGER ERR;

BYTE CONSTANT ByteZERO:=0;
IMTEGER CONSTANT FIFOReady:=0,UncorErr:=2,CorErr:=3,TimErr:=4,
                 DPComp:=6,Muey:=7;
BYTE CONSTANT MBMSelRegB:=28,MBMSelRegE:=2E,LowfrtqRCD:=2S,
              M&Mlnit:=211,MBMRead:=212,M6MWrite:=213,MBMRegdRCO:=21C,
              MBMReadFSR:=218,MBMabort:=219,MBMpurge:=21E,MBMReset:=21F,
              M&MfifoReset:=21D;
BYTE MISCREG=2FFFFFC01,MBMDATA=2FFFFFCC1,
       MBMSTATUS=2FFFFFCC3,M&MCMD=2FFFFCC3;

BYTE CONSTANT wrt_mask:=216,read_mask:=215,read_beot_loop:=21B;


SUBROUTIME delay;
    REPEAT 62 DO UCMRR(0);  &1 mSec per char&
```

```
SIMBMTST.WORK.PDS510          THU, DEC 22, 1983, 10:39 AM    PAGE  2


INTEGER PROCEDURE RHEX; ENTRY;
  BCCIh
  BYTE Char;
  INTEGER Temp;

  Temp:=0;
  WCHAR('?);
  WHILE ( (Char:=RCHAR) < 13 AND Char > %20 AND Char < ', ) DO
    BEGIN
      IF Char=$ THEN Temp:=RIGHT(Temp,4)
      ELSE IF Char>='0 RNO Char<='9 THEh
                Temp:=LEFT(Temp,4)+( Char AND %F)
      ELSE IF Char>='N AND Char<='F THEN
                Temp:=LIFT(Temp,4)+(Cher AND %7)+9
      ELSE IF Char>='a AND Char<='F THEN
                Temp:=LEFT(Temp,4)+(Char AND %7)+5
      ELSE BEGIN Temp:=0; WCHAR(7); END;
    END;
   RHEX:=Temp;  CRLF;
   END;

SUBROUTINE wait_till_not_Buey;
BEGIN
   DO &null& UNTIL  (statue_mbm AND %70) = 0; &ap comp or fail,tining&
      hISCREG:=%30;
END;


SUBROUTINE urt_reg_1;
BEGIN
   MBMCMD:=%8;  MBMDMTA:=1;
   RBMDRTR:=Byte2ERO;MBMDRTR:=%8;                  & YES! &
   RBMDRTR:=Byte2ERO;ABMDRTH:=ByteZERO+RIEFT(Module,4);
END;


SUBROUTINE urt_reg_2;
BEGIN

   RBMCMD:=%8;          MBMDRIR:=1;
   BBMDBIR:=%10;        MBMDAIA:=%8;
   MBMDRTR:=ByteZERO;   MMMDATR:=ByteZERO+RiEFT(Module,3);
END urt_reg_2;


SUBROUTINE command_init;
BEGIN
        MBMCMD:=MBMabort;      delay;
        MBMCMD:=MBMpurge;      delay;
        MSRCRD:=MSMFxfoReaet;
 END;
```

```
SIMBMTST.WORK.PDS510          THU, DEC 22, 1983, 10:39 AM    PAGE  3


PROCEDURE fill_fifo_ff;
BEGIN
   INTEGER J;

   FOR J:=1 TO 40 DO MBMDRTR:=%FF;
END fill_fifo_ff;


PROCEDURE Fill_fifo_inc;
BEGIN
INTEGER J,K;

   K:=0;
   FOR J:=1 TO 40 DO BEGIN MBMDRTR:=K; K:=LEFT(K,1);
                        IF J=1 THEN K:=1;
                        IF J=9 THEN K:=3;
                        IF 3=1E THEN N:=-1;
                        IF J>=25 THEN K:=3;
                    END;
END fill_fifo_inc;

PROCEDURE  dump_fifo;
BEGIN
INTEGER J,K;

   delay;
   WSTR("Data Read"); CRLF;&deley needed till previous operation finish&
   J:=0; WHILE TBIT(MBMSIRIOS,0) DO BEGIN
      WHex(MBMDRTB,2);
      IF (J:=J+1)>=% THEN BEGIN J:=0; CRLF; END; END;
   CRLF;
END dump_fifo;


PROCEDURE  dump_buf;
BEGIN
INTEGER J,K;

   J:=0;
   FOR K:=0 TO 39 DO
      BEGIN
      WHex( Buf[ K ],2);
      IF (J:=J+1)>=% THEN BEGIN J:=0; CRLF; END;
      END;
   CRLF;
END dump_fifo;


SUBROUTINE input_fifo_data;
BEGIN
   J:=0;
   WHILE ( J<40 AND ( (K:=RHEX)>-1) )
        DO BEGIN J:=J+1; MBMDRTA:=K;  END;
```

```
SIMBMTST.WORK.PDS510          THU, DEC 22, 1983, 10:39 AM    PAGE  4


END;


SUBROUTINE enter_buf;
BEGIN
   J:=0;
   WHILE ( J<40 AND ( (K:=RHEX)>-1) )  DO
        BEGIN
        buf[ J ]:=K;
        J:=J+1;
        END;
END;


PROCEDURE prt_etatus;
BEGIN
INTEGER J,K;

    delay;
  WSTR(" MBC etatus=");&time delay ao to let previoue operation finish&
    WHex(K:=etatus_mbm,2); CRLF;  WSTR("   ");
    FOR J:=0 TO 7 DO IF TBIT(K,J) THEN WSTR(SIS[3]);
    CRLF;
END prt_etatus;


INTEGER SUBROUTINE mod_request;
     BEGIN WSTR("Module #");
           mod_request:=RHEX AND %3;
END mod_request;


DOUBLE SUBROUTINE GETRDD;
BEGIN
   WSTR("Memory Rdd (4 Digits max)"); GETADD:=RMCX;
END;

PROCEDURE MBMSETUP;
BEGIN
INTEGER Temp;
   WSTR("MBM Rdd"); Temp:=RHEX ;
   WSTR("Start "); StartAdd:=GETBDD;
   WSTR("  End "); EndRdd:=GEIRDD;
   Words:=set_add_mbm(Temp,StartRdd,EndRdd);
END;


PROCEDURE operator_cHeck(atr); VALUE atr; RLPMA atr;
BEGIN
   WSTR("Are you sure that you want to "); WSTR(atr); CRLF;
   WSTR("  Selected Module is "); WNUM(Module);       CRLF;
   WSTR("      Hit RETURN to CONTINUE "); J:=RHEX;
END;
```

```
SIMBMTSI.WORK.PDS510          THU, DEC 22, 1983, 10:39 AM    PAGE  5


COMMENT @@@@@@@@@@@@@@@@@;
WSTR("INTEL MBM TEST"); CRLF;
FOR I:=0 TO 14 DO BEGIN WSTR(MES[I]); CRLF; delay;°END;
    Module:=0;

LOOP: WSTR("INPUT TEST"); I:=RHEX;

    IF I=0 THEN MISCREG:=ByteZERO ELSE MISCREG:=%80;

    IF I=1 THEN prt_status

    ELSE IF I=2 THEN MBMCMD:=RHEX

    ELSE IF I=3 THEN BEGIN UKaa(MBMDRTA,2); CRLF; END

    ELSE IF I=4 THEN MBMDRTR:=WHEN

    ELSE IF I=5 THEN dump_fifo

    ELSE IF I=6 THEN input_fifo_data

    ELSE IF I=7 THEN urt_reg_2

    ELSE IF I=8 THEN urt_reg_1

    ELSE IF I=%A THEN
            BEGIN IF init_mbm(Module:=mod_request)
                     THEN WSTR("PASSED") ELSE WSTR("FRILED");
                  MISCREG:=%80;
                  prt_etatus; END
    ELSE IF I=%B THEN
            BEGIN WSTR("READ MBM"); CRLF;BBMSETUP;
          IF read_mbm(StartRdd,Words) THEN WSTR("PASSED")
                                      ELSE WSTR("FRILED");
                  prt_etatus; END

    ELSE IF I=%C THEN
            BEGIN WSIR("WRITE MBM"); CRLF;MBMSETUP;
          IF urt_mbm(StartRdd,Words) THEN WSTR("PASSED")
                                     ELSE WSTR("FRILED");
                  prt_sTaTus; END

    ELSE IF I=%D THEN
            BEGIN  WSTR("Manufacture ");
                   WSTR( parms_mbm(p0,p1,p2,p3,p4) );
                   WSTR("  Present Module  "); WNUM(p0);
                   WSTR("  Present Pas  "); WNUM(p1);
                  CRLF;
                   WSTR("  Page Size "); WNUM(p2);
                   WSTR("  # of Pages "); WNUM(p3);
```

```
SIMBMTST.WORK.PDB510          THU, DEC 22, 1983, 10:39 RM    PAGE   6

                USTR("    # of MBM ="); WNUM(p4);
                CRLF;
          END

    ELSE IF I=XE THEN Module:=mod_request

    ELSE IF (I>=X10 AND I<=X1F) THEN BEGIN MBMCBA:=I; prt_status; END

    ELSE IF I=X21 THEN BEGIN  wrt_reg_2; fill_fifo_inc;
                              MBMCMD:=wrt_nask;
                              prt_status;   END
    ELSE IF I=X22 THEN BEGIN  wrt_reg_2; fill_fifo_ff;
                              MBMCMD:=wrt_nask;
                              prt_status;   END
    ELSE IF I=X23 THEN BEGIN  wrt_reg_2; delay; MBMCMD:=read_nask;
                              dump_fifo;    END
    ELSE IF I=X24 THEN BEGIN  wrt_reg_2; delay;
                              IF (J := read_boot_mbm( ADRS( buf ) )) # 0
                                 THEN
                                 BEGIN
                                 WHEX( J ); CRLF;
                                 dump_buf;
                                 END
                               ELSE
                                 USTR( "FAILED" );
                              CRLF;         END
    ELSE IF I=X25 THEN BEGIN  fill_fifo_inc;
                              prt_status; END
    ELSE IF I=X26 THEN BEGIN  fill_fifo_ff;
                              prt_status; END

    ELSE IF I=X2A THEN
         BEGIN
         WSTR(" Dummy module must be in, NOT normal bubble"); CRLF;
         operator_check("Continue");
         command_init;
         fill_fifo_ff;    MBMCBD:=wrt_nask;     delay;
         WHILE TRUE DO
              BEGIN
              MBMCMD:=MBMabort;   wrt_reg_2;  MBMCMD:=MBMRead;
              wait_till_not_busy;       MBMCMD:=MBMFifoReset;
              MBMCMD:=MBMabort;   wrt_reg_2;
              fill_fifo_ff;       MBMCMD:=MBMWrite;
              wait_till_not_busy;
              END infinite loop;
         END

    ELSE IF I=X2B THEN
         BEGIN
         WSTR(" Seed generating module must be in."); CRLF;
         operator_check("Regenerate Seed");
         command_init;
         wrt_reg_1;              delay;
         MBMDRTR:=XFF;  MBMDRTR:=XFF;
         MBMCMD:=MBMWrite;
         END
```

```
SIMBMTST.WORK.PDB510          THU, DEC 22, 1983, 10:39 RM    PAGE   7

    ELSE IF I=X2C THEN
         BEGIN
         WSTR(" Seed check will erase some of bubble's contents");CRLF;
         operator_check("Continue");
         command_init;
         fill_fifo_ff;    MBMCMD:=wrt_nask;  delay;
         wrt_reg_2;
         fill_fifo_ff;
         MBMCMD:=MBMWrite;   delay;
         MBMCMD:=MBMabort;
         wrt_reg_2;          delay;
         MBMCMD:=MBMRead;    delay;
         dump_fifo;
         END

    ELSE IF I=X2D THEN
         BEGIN
         operator_check("Modify Boot Loop");
         command_init;
         WSTR("Input New Boot Loop Map");    CRLF;
         enter_buf;
         operator_check("Continue");
         IF wrt_bmet_mbm( ADRS( buf ) ) THEN WSTR( " OK " )
                              ELSE WSTR( "FRILED");
         CRLF;
         prt_status;
         END

    ELSE BEGIN WSTR( "BAD COMMAND"); CRLF; END

    ;
GO TO LOOP;
END$
```

```
FINIT.WORK.PDB510             THU, DEC 22, 1983, 10:33 RM    PAGE   1

PROCEDURE  init_array_update_Fifo;                    EXTERNAL.L;
SUBROUTINE init_break;                                EXTERNAL.L;
SUBROUTINE init_ch_stimuli;                             EXTERNAL;
SUBROUTINE init_stimuli;                                EXTERNAL;
PROCEDURE  init_correction;                           EXTERNAL.L;
PROCEDURE  init_ates;                                 EXTERNAL.L;
PROCEDURE  init_group_control_vars;                     EXTERNAL;
PROCEDURE  init_control_variables;                      EXTERNAL;
PROCEDURE  init_kernel;                                 EXTERNAL;
SUBROUTINE init_keyboard_fifo;                        EXTERNAL.L;
PROCEDURE  init_retrace;                              EXTERNAL.L;
SUBROUTINE init_trig;                                 EXTERNAL.L;
SUBROUTINE init_markers;                              EXTERNAL.L;
SUBROUTINE init_message;                                EXTERNAL;
SUBROUTINE init_output;                               EXTERNAL.L;
SUBROUTINE init_sup_brk_fifo;                           EXTERNAL;
PROCEDURE  init_priv_ib;                                EXTERNAL;
PROCEDURE  init_screen;                               EXTERNAL.L;
SUBROUTINE init_token_fifo;                           EXTERNAL.L;
SUBROUTINE init_top_misc;                             EXTERNAL.L;
PROCEDURE  init_trace;                                EXTERNAL.L;
PROCEDURE  init_xadc;                                 EXTERNAL.L;
PROCEDURE  init_yadc;                                 EXTERNAL.L;
SUBROUTINE init_gratic;                               EXTERNAL.L;
```

```
FINTRPT.WORK.PDBS10           THU, DEC 22, 1983, 10:39 AM    PAGE   1

PROCEDURE irint;                                        EXTERNAL;
PROCEDURE iren(bit);  VALUE bit; BYTE bit;              EXTERNAL;
PROCEDURE irack(bit); VALUE bit; BYTE bit;              EXTERNAL;
PROCEDURE irdis(bit); VALUE bit; BYTE bit;              EXTERNAL;
PROCEDURE irset(bit); VALUE bit; BYTE bit;              EXTERNAL;
PROCEDURE irclr(bit); VALUE bit; BYTE bit;              EXTERNAL;
INTEGER SUBROUTINE irirr;                               EXTERNAL;
PROCEDURE iradr(Adrs,Bit);
   VALUE Adrs, Bit;
   DOUBLE Adrs;
   BYTE Bit;                                            EXTERNAL;
```

```
SINTRPT.UORK.PD8610          THU, DEC 22, 1983, 10:39 AM    PAGE  1


M68XL,P,"intrpt"
BEGIN

RFILE eide.work;
RFILE fioconfig.uork;
USE REGISTER 0-11;          & called by rmnitor uhich reverses R12 &

COMMENT
******************** FILE: uintrpt.uork.pd8S10 ************************
*
*              INTERRUPT CONTROL MODULE
*                   RC68000 Processor
*
*               For the 8S101 and M68k Hardware
*****************************************************************************
*
*     JULY 10 1980                          version R01.02.01
*     John Barr
*
*     modified 29 Jan 1981
*        initialize autoclear register to mon-autoclear mode
*        Wayne Cannon
*     Oct 17 1983
*     Removrote parte in assemble for space reason  JTB
*
*****************************************************************************
*
*  ENTRY POINTS
*     irint    is the interrupt system intialize routine.
*     iradr    is the interrupt service routine address set.
*     irrdy    is the interrupt nask enable and clear pending bit routin
*     iron     is the interrupt nask bit enable routine.
*     irdis    is the Interrupt mask bit disable routine.
*     irclr    is the interrupt request bit clear.
*     irset    is the interrupt request bit set.
*     irack    is the interrupt acknowledge bit clear (if nonautoclear).
*     iriit    reads the Interrupt Service (nasked) register
*     irinr    reads the Interrupt Rask register
*     irirr    reads the Interrupt Request register
*     iracr    reads the Autoclear reg.
*
*     IS ??? a stack and restore IMR needed
*****************************************************************************
*
*     The interrupt system uill upon an interrupt determining the
*        interrupting device and via a branch table branch  to
*        external service routines. This module also includes the
*        ulitities for nask setting, and saving and initialization.
*
*     Rs presently configured the high priority interrupts always
*        (0-high,15 - iow) has the highest priority but any device can
*        interrupt (if enabled) at any time ( ie no fencing).
*
*****************************************************************************
*
```

```
SINTRPT.UORK.POS510          THU, DEC 22, 1983, 10:39 AM    PAGE  2

*     The interrupt system is bated on a pair of AMD 9519 interrupt
*        controllers. There is naximun of 16 interrupts (Note:
*        the  ADC ir do not presently go here ).
*        The IRQ inputs are edge sensitive and can be either
*        negative or positive edge. There it a unique nask bit for
*        each input plus a autoclear bit for each input. The Auto
*        clear bit uill cause the input to be re-activited
*        autonatically uith the interrupt acknowledge read ( if
*        autoclear is not used the re-activation must be done
*        nanually before that interrupt can be used again ).
*        Autoclear is not used, therefore, the interrupt must be
*        cleared after processing is complete in order to allou
*        additional interrupts of the same or lower priority to be
*        recognized.
*
*****************************************************************************
*                              I\O ADDRESSES
*
*   I/O ADDRESS
*   R23 --> R10 = 1
*   DEC   HEX    BINARY
*
*  -368  FE90  1001 0N0*  R/U: DATA                      ** INTERRUPT
*  -306  FE92  1001 0N1*  R: STATUS          W: COMMAND  ** CONTROL #1
*
*  -360  FE98  1001 1N0*  R/U: DATA                      ** INTERRUPT
*  -36#  FE9A  1001 1X1*  R: STATUS          W: COMMAND  ** CONTROL #2
*
*
*                    * = 0 if Uord acess, 1 if Byte accessc
*
*
*                          REGISTER BIT ASSIGNMENTS
*
*              7     6     5     4     3     2     1     0
*
* STRTUS REG, COMMANDS ETC CAN BE DOCUMENTED HERE
*
*****************************************************************************
;
BYTE   irdata1   = io + %91,
       ircnd1    = io + 293,
       irstatus1 = io + 293,
       irdata2   = io + %99,
       ircnd2    = io + 29B,
       irstatus2 = io + %98;
BYTE CONSTANT firstirvector := 32;

COMMENT
*****************************************************************************
*
* irint is the interrupt system intialiaze routine.
*
*****************************************************************************
*
*      The intialiazation process uill reset the chips to their poucron
```

```
SINTRPT.UORK.POS510          THU, DEC 22, 1983, 10:39 AM    PAGE  3

*          state and nodified that state to the need nodes. It then uill
*          prepare the chips to accept interrupts by setting the nask
*          ,intial to all false , and setup up the
*          interrupt acknowledge response nap to provide the index to
*          interrupt service routine branch table. Any interrupt re-
*          quest (IRR) are cleared.
*
*          The naster arming bit of both chips is true.
*          The interrupt system is disabled.
*          The nodes are:Fixed proirity, individual response vectors,
*                   Non-polled node, Interrupt out (low true),
*                   Interrupt In - neg edge (high chip), pos edge (low
*
*****************************************************************************
*      SET PROCESSOR INTERRUPT MASK TO LEVEL 7
*      FOR CHIP#1: RESET,SET DEFAULT MODES,ENABLE MASTER MASK (ARM),
*                  MASK OFF ALL INPUTS, CLEAR ALL INPUTS,
*                  POSITIVE EDGE ON INPUTS
*      FOR CHIP2: THE SAME BUT LATCH NEGATIVE EDGE OF INPUTS (vs POS)
*      LORD THE RESPOND RERORIES UITH THE CORRESPONDING INTERRUPT
*                  VECTOR 0-15 UITH 0 AS HIGHEST AND 15 AS LOUEST
*****************************************************************************
;
PROCEDURE irint;            ENTRY;
BEGIN
BYTE CONSTANT irreset    := 0,
              irmode2    := %30, & Default mode &
              irmode1    := %90, & Default Mode = Pos Edge &
              irarn      := %81, & Arm ( enable chip)  &
              irinrfalse := %30, & nask (Disable) ill inputs &
              iracr_yadc := %01, & Auto-clear "yadc"  interrupt &
              iracr_tine := %DC, & Auto-clear "tick" and "delay" int's &
                                 & CAUTION: coordinate with assignments
                                   in file FIDS &
              irirrclr   := %40, & Clear all Input requests &
              irselaer   := %C0, & Presselect Autoclear for urite &
              irselnen   := %E0; & Presselect Response Menary for urite,
                                   Byte count = 1 &
BYTE  Vector=REGISTER 5,   &Used as index to set ir response nemory&
      end   =REGISTER 6;

   ASSERBLE(    DRI = MD700,SR );

   NRITE( ADRS( irendt), irreset, imode1, irarn, irinrfalse,
                  irirrclr, irselaer);
   irdata1 := iracr_yadc;

   NRITE( RDRS( ircnd2), irreset, imode2, irarn, irinrfalse,
                  irirrclr, irselaer);
   irdata2 := iracr_tine;

    FOR Vector := 0 UNTIL 15 DO
          BEGIN
          end := (irselntn OR (Vector AND %7) );
          IF Vector <= 7 THEN
                BEGIN
```

```
SINTRPT.UORK.POS510          THU, DEC 22, 1983, 10:39 AM    PAGE  4

                ircnd1  := end;
                irdata1 := Vector + firstirvector;
                END
             ELSE BEGIN
                ircnd2  := end;
                irdata2 := Vector + firstirvector;
                END;
          END;

END irint;
COMMENT
*****************************************************************************
*
*     iradr is the interrupt service routine address setting routine.
*
*****************************************************************************
*     iradr set the service routine address for a particular interrupt.
*       In addition it uill call irrdy for the selected interrupt
*****************************************************************************
end of comment;
PROCEDURE iradr(adrs,bit);  VALUE adrs,bit;  DOUBLE adrs; BYTE bit;
                                                    ENTRY;
BEGIN
 DOUBLE POINTER irvector = REGISTER 11;
     STPNTR(irvector,LEFT(INTEGER(bit*firstirvector),2));
     irvector := adrs;
     RSSEMBLE( MOVE.B  bit, R0;   BSR irrdy );
END iradr;

COMMENT
*****************************************************************************
*
*     irrdy is the interrupt nask enable and clear pending bit routinue.
*     iren  is the interrupt nask bit enable routine.
*     irdis is the Interrupt nask bit disable routine.
*     irclr is the interrupt request bit clear.
*     irset is the interrupt request bit set.
*     irack is the interrupt acknoudge bit clear (if nonautoclear).
*
*      The Interrupt nonber(0-15) is passed as the paraneter.
*      There is no output paraneter
*
*  irbit is called by all the above routines.
*****************************************************************************
*      irbit first decide uhich chip to effect
*      (if N<8 - Chip#1 else Chip #2) and then use the approiate
*      9519 connand to set or clear the IMR bit. Only one bit can
*      be changed at a time. (Total reg connands could exist)
*
*      Note on IRR: The IRR is a nask reg therefore a ONE (set) nasks
*      (prevents) an interrupt. This I have called DISABLED. Likewise
*      a ZERO (clear) ENABLES interrupts.
*****************************************************************************
;
PROCEDURE  irbit(reg,bit); VALUE reg,bit; BYTE reg,bit;
   BEGIN & irbit &
```

```
SIRTRP1.UORK.PD8510          TMU, DEC 22, 1983, 10:39 RM     PAGE  6


     RSSEMBLE( MOVE   SR,-(S) );              & Push Statue uord.     &
     RSSEMBLE( OKT    #N0700,SR);             & Disable interrupts.   &
     IF bit <=7 THEN ircnd1 := ((bit AND 7) OR reg)
                ELSE ircnd2 := ((bit AND 7) OR reg);
     RSSEMBLE( MOVE   (S)+,SR );              & Restore Statue uord.  &
  END;  & irbit &

SUBROUTINE  irrdy;   & a parameter 'bit' is being passed &       ENTRY;
BEGIN
BYTE CONSTANT irinrclrirrclr := X13; &Clear both an INR and IRR bit&
     & irbit(irinrclrirrcir,bit) &
     RSSEMBLE(  MOVE.U RO,-(S);  MOVE.U #N18, RO; BSR  irbit );
END irrdy;

SOBROUTINE  iren;  & a parameter 'bit' is being paooed &         ENTRY;
BEGIN
BYTE     CONSTANT irinrclr := X28; &Clear (enable) aingle bit of INR&
     & ireit(irinrcir,bit) &
     RSSEMBLE(  MOVE.U RO,-(S);  MOVE.U #H28, DO; BSR  irbit );
END iron ;

SUBROUTINE irdis;     & a parameter 'bit' is being passed &      ENTRY;
BEGIN
BYTE     CONSTANT irinraet := &38; &Sat (naak) aingle bit of INR&
     & irbit(irinraet,bit) &
     RSSEMBLE(  MOVE.U RO,-(S);  MOVE.U #N3&, RO; BSR  irbit );
END irdis ;

SUBROUTINE irclr;   & a parametir 'bit' is being paasad &        ENTRY;
BEGIN
BYTE     CONSTANT irirrclr := &4&; &Clear (remeve) a bit in tha IRR&
     & irbit(irirrmir,bit) &
     RSSEMBLE(  MOVE.U RO,-(S);  MOVE.U #N8&, RO; BSR  irbit );
END irclr;

SUBROUTINE iroet;     & a paranater 'bit' is being passed     & ENTRY;
BEGIN
BYTE     CONSTANT irirraet := IBS; & Set a bit in the IRR&
      &  irbit(irirraet,bit)  &
     RSSEMBLE(  MOVE.U RO,-(S);  MOVE.U #H5S, RO; BSR  irbit );
END irset;

SUBROUTINE irack;   &  a paraneter 'bit' is being passed &       ENTRY;
BEGIN
BYTE     CONSTANT iriercir := X78; & Clear (ranove) a bit in the ISR&
      & irbit(iriercir,bit) &
     RSSEMBLE(  MOVE.W RO,-(S);  MOVE.U #N7B, RO; BSR  irbit );
END irack;

COMMENT
**********************************************************************
*   irisr
*   irinr
*   irirr
*   iracr are a series of routines to read Interrupt eysten reg.
*
```

```
SINTRPT.UORK.PD8S10          TMU, DEC 22, 1983, 10:39 RM     PAGE  6

*    They are integer typed subroutines.
*
**********
*    the entry paint select the reg te read and it is preselected
*         and then branches to irread to combined the tuo 8-bit itens.
*
*    irread reads the selected register and returns the
*         full 16 bit reault. It first loads the upper 8 bits from
*         the lou priority chip .
*         It then laads the lauer 8 and ORs in the Upper bits.
**********
;
BYTE     CONSTANT irrdisr := X#0, &Preselect ISR for Read &
                 irrdinr := X#4, &Preselect INR For Read &
                 irrdirr := X#8, &Preselect IRR for Read &
                 irrdacr := X#C; &Preaelect RC& for Read &

INTEGER SUBROUTINE irread;
     RSSEMBLE( MOVE.& $irdata2, RO;  LSL.U B8,  RO;
               MOVE.& $irdata1, &O   );

INTEGER SUBROUTINE irirr;    ENTRY;
        BEGIN ircnd1 := irrdirr; ircnd2 := irrdirr;
              iriir := irraad; END;
END$



INTEGER SUBROUTINE irier;    ENTRY;
        BEGIN ircnd1 := irrdisr; ircad2 := irrdisr;
              irisr := irread; END;
INTEGER SUBROUTINE irinr;    ENTRY;
        BEGIN ircnd1 := irrdinr; ircad2 := irrdinr;
              irinr := irread; END;
INTEGER SUBROUTINE iracr;   ENTRY;
        BEGIN ircnd1 := irrdacr; ircnd2 := irrdacr;
              iracr := irread; END;
```

```
FIOCNFIG.UORK.PD6610         TMU, DEC 22, 1983, 10:39 RM     PAGE  1

BYTE    io       = XFFFFFE00;
INTEGER botton   = XFFFFF000;
INTEGER dgran    = XFFF00000;
INTEGER dg_ldsy  = dgran + X020000;      & ORs in the ldsy opcode bits &
```

```
JIOLIB.UORK.PDSS10           TMU, DEC 22, 1883, 10:39 RM     PAGE  1

!JOB Jiolib,LIBRN.PO8510,UORK;PRI=CS;OUTCLASS=,1
!COMMENT  COMPILE AND ASSEMBLY JOB FOR 8510 MC68000 ie LIBRRRY
!BUILD Atopniac;DISC=31,32,1;RCC=-1276,,V,ASCII;TEMP
!BUILD Auart   ;DISC=31,32,1;REC=-1276,,V,BSCII;TEMP
!BUILD Atopkad ;DISC=31,32,1;RCC=-1276,,V,ASCII;TEMP
!BUILD Anunber ;OISC=31,32,1;REC=-1276,,V,RSCII;TEMP
!BUILD Abotkbd ;DISC=31,32,1;REC=-127G,,V,ASCII;TEMP
!BUILD Arpg    ;DISC=31,32,1;REC=-127&,,V,RSCII;TEMP
!BUILD Abot    ;DISC=31,32,1;REC=-1276,,V,TSCII;TEMP
!FILE M6BDLLR=R6SKDLLR.M6BK.UPSOFT
!COM68K Stopniac          ,Rtopnitc,$NULL,17
!COM68K Suart             ,Auart   ,&NULL,17
!COM68K Stophbd           ,Atopkbd ,&NULL,17
!COB88K Snunber           ,Anumber ,$NULL,17
!COM68K Sbotkbd           ,Rbotkbd ,SNULL,17
!COM6SK Srpg              ,Rrpg    ,&NULL,17
!COM68K Sbot              ,Abot    ,&NULL,17
!COMMENT &&&&&&   io library compile section finished   &&&&&&&&&&
!FILE rtemp=&NEWPASS;OISC=31,32,1
!FILE TREETENT=^rtcmp
!FILE TREELIST=$NULL
!RUK RSM68K.M68K.bPSOFT;PARM=0
Atopniec
Auart
Atopkbd
Anumber
Abotkbd
Rrpg
Rbot
/E
!PURGE riolib.work
!SRVE SOLDPASS,rialib.work
!TELL LIBRN.PO8510;  io library  UPDATE COMPLETE
!TELL LBNI.PO3510;   io library  UPDATE COMPLETE
!TELL JTB.PO&610;    io library  UPDATE COMPLETE
!TELL UCC.POSS10;    io library  UPDATE COMPLETE
!EOJ
```

```
FKERNEL.WORK.PDBS10          THU, OEC 22, 8983, 10:39 AM    PAGE  1


PROCEDURE send(signal);
   VALUE signal; INTEGER signal;                              EXTERNAL;
PROCEDURE wait(signal);
   VALUE signal; INTEGER signal;                              EXTERNAL;
PROCEDURE acquire(resource);
   VALUE resource; INTEGER resource;                          EXTERNAL;
PROCEDURE release(resource);
   VALUE resource; INTEGER resource;                          EXTERNAL;
```

```
SKERNEL.WORK.PD8510          THU, DEC 22, 1983, 10:39 AM    PAGE  1


MAKL,P,"kernel"
BEGIN                                  & update/status log at end of file &

$FILE cmessage.work;          & for deadlock and process_creation_error &
&FILE futil2.work;                                          & for fatal &
$FILE cdebug.work;                              & for stack_fill & & DEBUG &
$FILE ftern.work;                                                & DEBUG &
&FILE fintrpt.work;
&FILE fiocnfig.work;
&FILE crine.uark;
&FILE cios.work;
&FILE fpubib.work;              & For updating hp-ib lede during ticks &
$FILE fmarknen.work;       & contains nenory linits for stack allocation &

BYTE SUBROUTINE RCHAR;   EXTERNAL;                              & DEBUG &

EXTERNAL DOUBLE MYXRM;      & nultiplier nornaiize address = %FFFFF922 &
EXTERNAL BYTE   RDEXP;      & nultiplier exponent  address = %FFFFF912 &
```

```
SKERNEL.WORK.PD8510          THU, DEC 22, 1983, 10:39 AM    PAGE  2


REJECT;
COMMENT
*****************************************************************************
*
* MODULE kernel
*
* ENTRY POINT(S);
*
*    send: Send a signal te an awaiting process.
*    wait: Wait for a signal fron another process.
*    waitio: Uait for a device interrupt.
*    awaited: Is a process waiting for a signal.
*    acquire: Acquire access to a resource.
*    release: Release access to a resource.
*    delay: Delay the calling process (<= 2 seconds, non-sharable)
*    pause: Delay the calling process (>= .5 second, sharable)
*
*    run: Starts (or reetarts) a process at the beginning.
*    create: Initializes process record for a new process, and starts
*            the process.
*    init_kernel: Initialization routine.
*    signal_init: Initialize a signal variable.
*    resource_init: Initialize a resource variable.
*    terminate: Terminates the calling process.
*    abort: Terninatte the designated process.
*    snapshot: Dunps key variables and stacks.
*
* NOTE:
*    The "nain" process nust not terninate.  After initializing the
*    nodules and creating the processes, the "nain" process should
*    end in a continuous loop uhich is the "idle" process.  The nain
*    process has the louest urgency (priority) of all processes.
*    The "nain" or "idle" process nust always remain ready, that is,
*    it nay never call "acquire", "uait", or any procedure that nay
*    eventually cause suspension (such as i/o) or termination (such as
*    "terminate".  The existence of the "idle" process as an always
*    ready process allows the scheduling algorithn to avoid tine-
*    consuning teating.
*
* The design objective of this nodule is to hide all knowledge of
* processes and their synchronization (i.e. this is an informational
* strength nodule).  Although signal and resource identification
* runbers are inputs of this nodule, no other nodules have any
* knoulrdge of their structure or operations upon then.  Hence this
* is at uorst data coupled to any other nodule.
*
* STRUCTURE NOTES: Each of the functions are separate procedures
*                  Nodule-uide data definitions are
*                  global to the functions, as are supporting
*                  routines used by the functions.
*
* TIMING:  (as of 1 April 1982, for an 5 MHz MC68000.)
*    A single process suap requires about 69 nicroseconds (a call to
* "uait", suspension, scheduling of the next process, restoration of
* the process, and return fron it's call to "uait") plus 125 nano-
* seconds for each level of process priority of the neuly scheduled
```

```
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* process belou the highest priority.
*    A process swap due to an interrupt requires about 46
* nicroseconds (interrupt service, suspension, restoration of the
* interrupt service routint, and return fron it's call to
* uaitio).  There is no tine requirement based on process priority
* level since there is no search for the highest priority process
* -- scheduling is determined by interrupt hardware.
*    A routine that uas running uhen an interrupt occurs has ail of
* its registers pushed onto the stack.  Uhen that process finally is
* scheduled for resunption, that process suap uill require 78 nicro-
* seconds (instead of the 69 for a nornal suap).  Basically an
*
*    For purposes of evaluating whether or not to "uait" versus
* "spin", one should count tuo process suaps in order to suap to do
* useful uork and to suap back.
*    Basically an interrupt caused process suap uill cost a
* process swap on entry and exit totalling 150 nicroseconds.  The
* actual exit suap nay be 69 nicroseconds, but a process suap
* sonetine uill be extended fron 69 to 78 nicroseconds, so
* count then both for the interrupt.
* -- 124 nicroseconds for tuo process snaps as a result of an
*    interrupt.  (46 + 78 = 119)
* -- 138 nicroseconds for tuo process suaps as a result of a "uait"
*    request.
*
* See Uayne Cannon's notes of 23 Sept 1981 for the assenbly listing
* with it's associated tining breakdown for an 8 MHz MC68000.  1 April
* 1982 added code to use the multiplier's nornaiize to find the highest
* priority ready process, rather than a bit test and loop.
*
*****************************************************************************
;
```

```
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REJECT;
COMMENT                                                        DATA
-----------------------------------------------------------------------
. MODULE-WIDE DATA DEFINITIONS
.
.    Note:  Queues are used to link processes awaiting access to a
.           resource instead of dequeues
.           (double-ended queues) since they are always faster for
.           removing items and faster for inserting items if
.           no items are already in the queue.  They are slower if
.           more than one item is in the queue, but this occasion
.           of multiple processes awaiting a resource occurs much less
.           often than a single process being added to an empty queue.
.
-----------------------------------------------------------------------
;
   BYTE CONSTANT false := 0;
   BYTE CONSTANT true := 1;
   INTEGER CONSTANT nil := 0;
   INTEGER CONSTANT min_registers := 0;   & These values are fixed due &
   INTEGER CONSTANT all_registers := -1;  &   to assembly bit tests.   &
   INTEGER CONSTANT max_process := 15;     & Max_process+1 incl. idle &
                                          COMMENT
                                            (If larger than 15, than
                                            'ready' must be a double.)
                                            If max_process is changed,
                                            then "min_rin" in "frine"
                                            must be changed to be equal
                                            to max_process + 1.
                                            Update preempt_mask also.  ;
   GLOBAL                                 & global "only" for yadc!!!  &
                                          &    and kernel macros.      &
   INTEGER running;                       & "ID" of running process.   &
                                          & IO of most urgent process  &
                                          & is "max_process", least    &
                                          & urgent is 1, and the idle  &
                                          & process is 0.              &
   INTEGER delay_timer_id;                & ID of process awaiting a    &
                                          &    delay timer interrupt.  &
   GLOBAL                                 & global "only" for yadc!!!  &
                                          &    and kernel macros.      &
   INTEGER ready;                         & 16 boolean "Ready" flags.  &
                                          & (If max_process>15 then     &
                                          & ready must be double and    &
                                          & EXTS in 'schedule' must     &
                                          & be removed!                 &
   INTEGER TABLE preempt_mask := %FFFE, %FFFC, %FFF8, %FFF0,
                                 %FFE0, %FFC0, %FF80, %FF00,
                                 %FE00, %FC00, %F800, %F000,
                                 %E000, %C000, %8000, %0000;
                                          & Mask for higher priorities.&
   GLOBAL                                 & global "only" for "contvar"&
                                          &    passed to yadc/data-    &
                                          &    processing via chtable. &
                                          &    and for kernel macros.  &
   BYTE ARRAY link[0:max_rin];            & Links for queues, and      &
```

```
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                                          & Pointers to head of queues.&
   BYTE ARRAY owner[min_rin:max_rin];     & Owners of busy resources.  &
   BYTE ARRAY urgency[0:max_process];     & Urgency for scheduling.    &
                                          &    Used to initially enter &
                                          &    process information     &
                                          &    into the tables.        &
   GLOBAL                                 & global "only" for "contvar"&
                                          &    passed to yadc/data-    &
                                          &    processing via chtable. &
                                          &    and for kernel macros.  &
   INTEGER ARRAY counter[0:max_rin];      & Semaphore counters and     &
                                          &    delay_list delay times. &
   INTEGER ARRAY datasize[0:max_process]; & Stack space required.     &
   DOUBLE  ARRAY initialsp[0:max_process];&    S before any execution. &
   DOUBLE  ARRAY initialpc[0:max_process];&    P before any execution. &
   DOUBLE  ARRAY spsave[0:max_process];   & S while not running. &
   @DOUBLE ARRAY max_sp[0:max_process];                    & DEBUG &
   DOUBLE  ARRAY stack_limit[0:max_process];               & DEBUG &

   GLOBAL DOUBLE stack_tsp;               & Next avail. stack location.&
```

```
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@EJECT;
COMMENT                                                     schedule
-----------------------------------------------------------------------
.
. EXTERNAL SPECIFICATION FOR schedule
.
. FUNCTION: To save the state of the running process, determine the
.           next process from the list of ready processes according
.           to priority, restore the state of the selected process,
.           and resume execution of the new process.
.
. DECLARATION INFORMATION:
.    SUBROUTINE schedule
.
.    INPUT: none
.
.    OUTPUT: none
.
. EXTERNAL EFFECTS: none
.
. COMMENTS:  The call to the scheduler is the
.            singular point at which processes are suspended and
.            from which they are resumed.
.
-----------------------------------------------------------------------
.
. LOGIC INFORMATION FOR schedule
.
. MODULES CALLED: none
.
. INITIAL REFINEMENT:
.
.   Enter mutual exclusion state (done by the calling procedure).
.   Save state of current process.
.   Save stack pointer of current process.
.   Select new process (highest priority ready process).
.   Restore stack pointer of new process.
.   Restore state (registers) of new process.
.   Release mutual exclusion state (done by the procedure returned to)
.
-----------------------------------------------------------------------
;
SUBROUTINE schedule;
   BEGIN & schedule &
      LABEL pop_min,
            pop_done;
      INTEGER cursor = REGISTER 6;
      INTEGER temp = REGISTER 9;
      ASSEMBLE( MOVE    SR,-(S) );          & Save status.          &
                                            & Status required only &
                                            & to match interrupts. &
      ASSEMBLE(
              MOVEM.L R13-R14,-(S);         & Push registers.       &
            & MOVE    min_registers,-(S) &  & Mark size of push.    &
              MOVE    #D0,          -(S)
              );
```

```
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                                            & opsave[running] := S &
                                            & assemble required to &
                                            & get access to stack  &
                                            & pointer              &
      ASSEMBLE(
              MOVE   running,temp;
              ADD.L  temp,temp;
              ADD.L  temp,temp;
              MOVE.L S,spsave(temp)
              );
      IF spsave[running] < max_sp[running] THEN              & DEBUG &
         max_sp[running] := spsave[running];                 & DEBUG &
      IF spsave[running] <= stack_limit[running] THEN        & DEBUG &
         @BEGIN & if &                                       & DEBUG &
            USTR("STACK SIZE ERROR for process ");           & DEBUG &
            UMax(running,2); CRLF;                           & DEBUG &
            TRAP(15);                                        & DEBUG &
         END if;                                             & DEBUG &

      ASSEMBLE(                             & Find highest priority &
              CLR.L  cursor;                & ready process by using&
              MOVE.U ready,   cursor;       & normalize function to &
              MOVE.L cursor,  ITYNRM;       & find most significant &
              MOVE.B ROEXP+1, cursor;       & bit.  Read back the   &
              EXTS.U cursor;                & normalized exponent.  &
              ADD.U  #30,     cursor
              );
      running := cursor;
                                            & Restore Stack Pointer&
                                            & S := spsave[running] &
                                            & temp holds (running).&
      ASSEMBLE(
              MOVE.L cursor,temp;
              ADD.L  temp,temp;
              ADD.L  temp,temp;
              MOVE.L spsave(temp),S
              );
      ASSEMBLE( TST     (S)+;               & Test type of block.  &
                BGE     pop_min;
                MOVEM.L (S)+,R0-R14;        & Pop full set.        &
                BRA     pop_done );
pop_min: ASSEMBLE( MOVEM.L (S)+,R13-R14 );  & Pop minimum set.     &
pop_done:ASSEMBLE( RTE );                   & Restore status and PC&
                                            & Status required only &
                                            & to match interrupts. &

   END;  & schedule &
```

```
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$EJECT;
COMMENT                                                          preempt
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR preempt
*
* FUNCTION: To save the state of the running process, determine the
*           next process from the list of ready processes according
*           to priority, restore the state of the selected process,
*           and resume execution of the new process.
*
* DECLARATION INFORMATION:
*    SUBROUTINE preempt
*
*    INPUT: none
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS: preempt leaves the calling process in the ready
*                   state.  Only a higher priority ready process will
*                   cause the calling process to be suspended.
*
*****************************************************************************
*
* LOGIC INFORMATION FOR preempt
*
* MODULES CALLED: none
*
* INITIAL REFINEMENT:
*
*   Save status word.
*   Enter mutual exclusion state.
*   IF a higher urgency process is ready THEN
*      schedule the highest priority process.
*   Release mutual exclusion state and restore status word.
*
*****************************************************************************
;
SUBROUTINE preempt;                                              ENTRY;
  BEGIN & preempt &
     ASSEMBLE( MOVE   SR,-(S) );          % Push Status word.     &
     ASSEMBLE( ORI    #H0700,SR);         & Disable interrupts.   &

     IF (ready AND preempt_mask[running]) <> 0 THEN
        schedule;

     ASSEMBLE( MOVE   (S)+,SR );          & Restore Status word.  &
  END;  & preempt &
```

```
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$EJECT;
COMMENT                                                          send
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR send
*
* FUNCTION: Send "signal" to a process awaiting the "signal".
*
* DECLARATION INFORMATION:
*    PROCEDURE  send(signal)
*       VALUE   signal
*       INTEGER signal
*
*    INPUT:  signal      integer      resource identification number
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS: If a process is awaiting the signal, it is made
*           ready.
*           The calling process remains running.
*
* CAUTION:  This algorithm has better run-time efficiency, but
*           requires that 1) the calling process releases the resource
*           as its next step, 2) the calling process "wait" for a
*           signal as its next step, or 3) that the condition that
*           is being signalled to the waiting process is in no way
*           invalidated before the calling process releases the
*           resource of code or waits for a signal.
*           It is also important that no other process (despite a
*           possible higher urgency) invalidate the signalled
*           condition before the waiting process resumes execution.
*           If the above conditions cannot be guaranteed, then
*           another algorithm (replacement or in addition) must
*           be implemented to guarantee that the process sending
*           the signal yields the processor to the signalee
*           and that the signalee be given priority over other
*           processes.  Obviously, this would mean more run-time
*           overhead, and would be unsatisfactory for interrupts.
*           Additionally, the above algorithm can result in a
*           significant delay before the signalled process is
*           scheduled if the signalling process, or higher priority
*           process does not wait for some condition soon after
*           calling this "send" procedure.  This is not likely to
*           cause a problem, but should be considered.  The
*           references below treat this subject succinctly.
*
* COMMENTS: For now, only one process may be waiting for a single
*           signal.  Set comment for "wait" function.
*
*           The sending of the raw_ready signals is implemented in-line
*           in the yadc data acquisition process for execution-time
*           efficiency.  In this instance, there is no schedule
*           operation.  Rather, it only sets the ready bit of the
*           waiting process and depends upon the preempt in the idle
*           loop to do the scheduling.  This is workable only because
*           the waiting processes are the data processing processes and
```

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*           are among the lowest priority processes (near idle).
*
*           References:  Hoare, "Monitors: An Operating System
*           structuring Concept", Comm of the ACM, Vol 17, No. 10,
*           Oct 1974. Howard, "Signalling in Monitors", Proc. of
*           2nd Int'l Conf on Software Engineering, San Francisco,
*           1974, p47-52. [The term "resource" used here is synonamous
*           with Hoare's "monitor".
*
*****************************************************************************
*
* LOGIC INFORMATION FOR send
*
* MODULES CALLED: none
*
* INITIAL REFINEMENT:
*
*    IF a process is awaiting the signal THEN
*       Enter mutual exclusion state.
*       Ready the signalled process.
*       Unlink the signalled process.
*       Exit mutual exclusion state.
*    ELSE nop.
*
*         NOTE:  The calling process does not relinquish the processor.
*                The signalled process will not obtain the processor
*                   until some process "waits" for a signal or
*                   interrupt.
*
*****************************************************************************
;
PROCEDURE  send(signal);                        & See CAUTION above!    &
  VALUE   signal;
  INTEGER signal;                                                ENTRY;
  BEGIN & send &

     IF (counter[signal] := counter[signal] + 1) <= 0 THEN
                                        & If a process is          &
        BEGIN & if &                    & awaiting the signal...  &
           ASSEMBLE( MOVE   SR,-(S) );  & Save Status word.        &
           ASSEMBLE( ORI    #H0700,SR); & Disable interrupts.      &
           ready := SBIT(ready,link[signal]);   & Make it ready and &
           ASSEMBLE( MOVE   (S)+,SR );  & Restore Status word.    &
        END if;

  END;  & send &
```

```
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$EJECT;
COMMENT                                                          wait
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR wait
*
* FUNCTION: suspend the calling process awaiting "signal", and
*           schedule another process.
*
* DECLARATION INFORMATION:
*    PROCEDURE  wait(signal)
*       VALUE   signal
*       INTEGER signal
*
*    INPUT:  signal      integer    resource identification number.
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS: The calling process is suspended, and another
*                   process is scheduled.
*
* COMMENTS: Initially, only one process will be allowed to wait on
*           a single signal variable, although there is no programmed
*           enforcement of this.  If it later proves to be
*           desirable to allow multiple processes to be queued
*           awaiting signal to be sent, it may be implemented by
*           a separate procedure using a single process signal
*           variable or by establishing a queue for the primitive
*           signal variable.
*
*           The wait on the raw_ready signal by the data processing
*           processes in implemented in-line in the data processing
*           processes for execution-time efficiency.  Since there is
*           only one process waiting for these signals, the link is
*           entered only during initialization.  This is no problem
*           since the link is only consulted after the signal count is
*           tested to assure that there is a process waiting.
*
*****************************************************************************
*
* LOGIC INFORMATION FOR wait
*
* MODULES CALLED: kernel (schedule)
*
* INITIAL REFINEMENT:
*
*    IF signal has not already been sent
*       THEN
*          Enter mutual exclusion state.
*          IF an interrupt didn't send the signal after the test
*             THEN
*                Add the running process to the queue of process(es)
*                     awaiting the signal.
*                Block the running process and schedule a new process.
*          ELSE an interrupt did send the signal and suspension is not
*             necessary.
```

```
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*         Exit mutual exclusion state.
*       ELSE
*         continue
*
* COMMENT:  It is possible for an interrupt to occur after the signal
*           counter is decremented but before interrupts are disabled.
*           If the interrupt sends the signal (increments the counter)
*           the test after the interrupts are disabled will catch the
*           fact.  An alternative would be to disable interrupts prior
*           to decrementing the counter, but this would require two
*           time-consuming status register modifications on every call.
*           The approach implemented only penalizes when a suspension
*           is imminent.
*
*************************************************************************
;
PROCEDURE  wait(signal);
   VALUE   signal;
   INTEGER signal;                                              ENTRY;
   BEGIN & wait &

      IF (counter[signal] := counter[signal] - 1) < 0 THEN
                & interrupt can occur here --^; so test later.     &
         BEGIN & if &                          & If signal not already &
                                               & sent, wait for one.   &
            ASSEMBLE( MOVE   SR,-(S) );        & Push Status word.     &
            ASSEMBLE( ORI   #HO700,SR);        & Disable interrupts.   &
            IF counter[signal] < 0 THEN
               BEGIN & if &                & There was no interim send. &
                  ready := RBIT(ready,running);     & Make not ready  &
                  link[signal] := running;          & Link caller.    &
                  schedule;
               END;  & if &
            ASSEMBLE( MOVE   (S)+,SR );        & Restore Status word.  &
                                               & (restores interrupts).&
         END if;

   END;  & wait &
```

```
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REJECT;
COMMENT                                                        awaited
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR awaited
*
* FUNCTION: test whether any process is waiting for the signal.
*
* DECLARATION INFORMATION:
*    BOOLEAN PROCEDURE awaited(signal)
*       VALUE   signal
*       INTEGER signal
*
*    INPUT:  signal       integer    resource identification number.
*
*    OUTPUT: awaited      boolean    true if a process is awaiting the
*                                    signal, false otherwise.
*
* EXTERNAL EFFECTS: None.
*
*************************************************************************
*
* LOGIC INFORMATION FOR awaited
*
* MODULES CALLED: none
*
* INITIAL REFINEMENT:
*
*    IF a process is waiting for the signal
*       THEN
*          Return true.
*       ELSE
*          Return false.
*
*************************************************************************
;
BOOLEAN PROCEDURE awaited(signal);
   VALUE   signal;
   INTEGER signal;                                              ENTRY;
   BEGIN & awaited &
      awaited := counter[signal] < 0;
   END;  & awaited &
```

```
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REJECT;
COMMENT                                                        pending
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR pending
*
* FUNCTION: test whether a signal is pending.
*
* DECLARATION INFORMATION:
*    BOOLEAN PROCEDURE pending(signal)
*       VALUE   signal
*       INTEGER signal
*
*    INPUT:  signal       integer    resource identification number.
*
*    OUTPUT: pending      boolean    true if a signal is pending.
*                                    false otherwise.
*
* EXTERNAL EFFECTS: None.
*
*************************************************************************
*
* LOGIC INFORMATION FOR pending
*
* MODULES CALLED: none
*
* INITIAL REFINEMENT:
*
*    IF a signal is pending
*       THEN
*          Return true.
*       ELSE
*          Return false.
*
*************************************************************************
;
BOOLEAN PROCEDURE pending(signal);
   VALUE   signal;
   INTEGER signal;                                              ENTRY;
   BEGIN & pending &
      pending := counter[signal] > 0;
   END;  & pending &
```

```
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REJECT;
COMMENT                                                        waitio
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR waitio
*
* FUNCTION: suspend the calling process awaiting an interrupt from the
*           "device", and schedule another process.
*
* DECLARATION INFORMATION:
*    PROCEDURE  waitio(device)
*
*    INPUT:  device     byte    device number for the device awaited.
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS: The calling process is suspended, and another
*                   process is scheduled.
*                   The interrupt request register in the interrupt
*                   controller is cleared for the designated device
*                   to allow another interrupt or a lower priority
*                   pending interrupt to be recognized.
*
* COMMENTS: Only one process may wait for an interrupt from a device
*           at any given time.  In order to simplify and speed the
*           processing of interrupts, the device-process relationship
*           is fixed at compile time.
*
*************************************************************************
*
* LOGIC INFORMATION FOR waitio
*
* MODULES CALLED: kernel (schedule)
*
* INITIAL REFINEMENT:
*
*    Enter mutual exclusion state.
*    Clear the interrupt request bit in the interrupt controller.
*    Block the running process and schedule a new process.
*    Exit mutual exclusion state.
*
*************************************************************************
;
PROCEDURE waitio(device);
   VALUE device;
   BYTE  device;                                                ENTRY;
   BEGIN & waitio &

      ASSEMBLE( MOVE   SR,-(S) );          & Push Status word.     &
      ASSEMBLE( ORI   #HO700,SR);          & Disable interrupts.   &
      irack(device);                       & Clears priority mask. &
      iron(device);                        & Enable interrupt.     &
      ready := RBIT(ready,running);
      schedule;
      ASSEMBLE( MOVE   (S)+,SR );          & Restore Status word.  &
                                           & (restores interrupts).&
```

```
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   END;  & waitio &
```

```
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REJECT;
COMMENT                                                              acquire
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR acquire
*
* FUNCTION: to obtain exclusive access to a resource,
*           and to suspend the calling process if the section is
*           already busy, waiting until it is released.
*
* DECLARATION INFORMATION:
*    PROCEDURE  acquire(resource)
*       VALUE   resource
*       INTEGER resource
*
*    INPUT:  resource  integer  resource identification number (rin).
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS:  If the calling process is suspended due to the
*                    resource being busy, a new process is scheduled.
*
*************************************************************************
*
* LOGIC INFORMATION FOR acquire
*
* MODULES CALLED: kernel (schedule)
*
* INTIAL REFINEMENT:
*
*    IF the resource is busy,
*       THEN enter mutual exclusion state,
*          IF an interrupt didn't release the resource after the test
*             THEN
*                Add the calling process to the queue of processes
*                      awaiting access to the resource,
*                Block the running process and schedule a new process.
*             ELSE an interrupt did release the resource and suspension
*                      is not necessary.
*          Exit mutual exclusion state.
*
* COMMENT:  It is possible for an interrupt to occur after the resource
*           counter is decremented but before interrupts are disabled.
*           If the interrupt releases the resource (increments the
*           counter the test after the interrupts are disabled will
*           catch the fact.  This is only pertinent when there
*           were no processes previously awaiting the resource.
*           If this occurs, the acquiring process will not have
*           been linked yet and release will simply ready the
*           An alternative would be to disable interrupts
*           prior to decrementing the counter, but this would
*           require too time-consuming status register manifications on
*           every call.  The approach implemented only penalizes when a
*           suspension is imminent.
*
*************************************************************************
```

```
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;
PROCEDURE  acquire(resource);
   VALUE   resource;
   INTEGER resource;                                          ENTRY;
   BEGIN & acquire &
      INTEGER cursor = REGISTER 9;

      ASSEMBLE( MOVE SR,-(S) );                  & Save Status word.  &
      ASSEMBLE( ORI  #H0700,SR);                 & Disable interrupts.&
      IF (counter[resource] := counter[resource] - 1) < 0 THEN
         BEGIN & if &                            & Resource is busy.  &
            iink(running] := nil;
            ready := RBIT(ready,running);        & Make not ready.    &
            cursor := resource;
            UNILE link[cursor]<>nil DO           & Find tail of list. &
               cursor := link[cursor];
            link[cursor] := running;          & Link calling process  &
                                              & to the tail of queue  &
                                              & of processes awaiting &
                                              & access to the resource&
            If running = owner[resource] THEN                & DEBUG &
               fatal(deadlock);                              & DEBUG &
            schedule;
            & "owner" updated upon unlink during "release" &
         END  & if &
      ELSE                                                   & DEBUG &
         owner[resource] := running;                         & DEBUG &
      ASSEMBLE( MOVE (S)+,SR );                & Restore Status word. &

   END; & acquire &
```

```
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REJECT;
COMMENT                                                  conditional_acquire
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR conditional_acquire
*
* FUNCTION: to obtain exclusive access to a resource only if not already
*           busy.  Returns TRUE if the resource was successfully
*           acquired, FALSE if not.
*
* DECLARATION INFORMATION:
*    PROCEDURE  conditional_acquire(resource)
*       VALUE   resource
*       INTEGER resource
*
*    INPUT:  resource  integer  resource identification number (rin).
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS:  none.
*
*************************************************************************
*
* LOGIC INFORMATION FOR conditional_acquire
*
* MODULES CALLED: none
*
* INTIAL REFINEMENT:
*
*    IF the resource is busy THEN
*       return FALSE,
*    ELSE
*       make the resource busy and return TRUE.
*
*************************************************************************
;
BOOLEAN PROCEDURE conditional_acquire(resource);
   VALUE   resource;
   INTEGER resource;                                          ENTRY;
   BEGIN & conditional_acquire &

      ASSEMBLE( MOVE  SR,-(S) );             & Save Status word.    &
      ASSEMBLE( ORI   #H0700,SR);            & Disable interrupts.  &
      IF (counter[resource] := counter[resource] - 1) < 0 THEN
         BEGIN & if &
            counter[resource ;= counter[resource] + 1;   & restore it &
            ASSEMBLE( MOVE  (S)+,SR );       & restore status word &
            conditional_acquire := FALSE;
         END  & if &
      ELSE
         BEGIN & else &
            owner[resource] := running;                        & DEBUG &
            ASSEMBLE( MOVE  (S)+,SR );       & restore status word &
            conditional_acquire := TRUE;
         END;  & else &
```

```
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   END; & conditional_acquire &
```

```
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REJECT;
COMMENT                                                          release
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR release
*
* FUNCTION: to release exclusive access to a resource,
*           and to make ready any processes awaiting access.
*
* DECLARATION INFORMATION:
*    PROCEDURE release(resource)
*       VALUE resource
*       INTEGER resource
*
*    INPUT:   resource    integer    resource identification number.
*
*    OUTPUT:  none
*
* EXTERNAL EFFECTS: makes ready the first process awaiting access, if
*                   any.
*
*****************************************************************************
*
* LOGIC INFORMATION FOR release
*
* MODULES CALLED: none
*
* INITIAL REFINEMENT:
*
*    IF no process is awaiting resource access,
*       THEN resource becomes non-busy,
*    ELSE
*       enter mutual exclusion state
*       make the waiting process ready
*       unlink the first waiting process and make it the resource's
*          owner.
*       exit mutual exclusion state
*
*    NOTE:  release does not relinquish the processor to the waiting
*           process.  The waiting process will not have an opportunity
*           to be scheduled until a running process waits, or is
*           blocked attempting to acquire a busy resource.
*
* COMMENT:  There is no test to prevent releasing a non-acquired
*           resource.  If that were to occur, release would be a non-
*           operation, simply making the idle process ready which is
*           always ready anyway.
*
* COMMENT:  It is possible for an interrupt to occur after the resource
*           counter is decremented but before interrupts are disabled
*           during an acquire.  If the interrupt releases the resource
*           (increments the counter) the test in acquire after
*           interrupts are disabled will catch the fact.  This is only
*           pertinent when there were no processes previously awaiting
*           the resource.  If this occurs, the acquiring process will
*           not have been linked yet and release will simply ready the
```

```
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*           idle (0) process as above for releasing a non-acquired
*           resource.  See comments under acquire for alternatives and
*           reasons for the current approach.
*
*****************************************************************************
;
PROCEDURE  release(resource);
   VALUE   resource;
   INTEGER resource;                                          ENTRY;
   BEGIN & release &
      INTEGER cursor = REGISTER 9;

      ASSEMBLE( MOVE   SR,-(S) );              & Save Status word.  &
      ASSEMBLE( ORI    #0700,SR);              & Disable interrupts.&
      IF (counter[resource] := counter[resource]+1) <= 0 THEN
         BEGIN
            cursor := link[resource];
            owner[resource] := cursor;                     & DEBUG &
            link[resource] := link[cursor];      & Unlink process.   &
            ready := SBIT(ready,cursor);         & Make process ready &
         END;  & if &
      ASSEMBLE( MOVE   (S)+,SR );             & Restore Status word &

   END;  & release &
```

```
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REJECT;
COMMENT                                                          delay
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR delay
*
* FUNCTION: to suspend a process for the duration of the specified
*           delay_time.
*
* DECLARATION INFORMATION:
*    PROCEDURE  delay(delay_time)
*       VALUE   delay_time
*       INTEGER delay_time
*
*    INPUT:  delay_time   integer   time in multiples of 32 usec.
*                         [ full 65535 -- not 2's complement ]
*                         minimum = 32 usec = 1      = %0001
*                                   50 usec = 2      = %0002
*                                  100 usec= 3       = %0003
*                                  200 usec= 6       = %0006
*                                  500 usec= 16      = %0010
*                                    1 msec  = 31    = %001F
*                                    2 msec  = 62    = %003E
*                                    5 msec  = 156   = %009C
*                                   10 msec = 313    = %0139
*                                   20 msec = 625    = %0271
*                                   50 msec = 1563   = %061B
*                                  100 msec= 3125    = %0C35
*                                  200 msec= 6250    = %186A
*                                  500 msec= 15625   = %3D09
*                                    1 sec   = 31250 = %7A12
*                                    2 sec   = 62500 = %F424
*                         maximum = 2.1 sec = 65535 = %FFFF
*    OUTPUT: none
*
* EXTERNAL EFFECTS:
*    Upon completion of the delay time interval, the process will be
* made ready, but will only be scheduled if it is the highest priority
* process ready at that time (applies to delay_time >= 16 (500 usec)).
*
* COMMENTS:
*    "delay" is intended to be used by only a single caller at one
* time.  Any subsequent caller will be suspended attempting to
* acquire the time (resource) and its requested delay will then be
* performed upon resumption.  For this reason, unbridled use of
* "delay" will only guarantee a delay of at least the specified time
* and possibly more.
*    The intended use of "delay" is for providing delays for VCO
* settling, settling time after an external analog out step before
* making measurements, etc, which are mutually exclusive.
*    Consider using the general purpose "pause" routine whenever
* possible.
*
* BUGS:
*    The interrupt routine that reschedules the suspended process
* should implement the "preempt" to eliminate an unnecessary pair of
```

```
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* process swaps should the interrupted process have higher priority than
* the "delayed" process.
*
*****************************************************************
*
* LOGIC INFORMATION FOR delay
*
* MODULES CALLED: kernel (preempt)
*
* INITIAL REFINEMENT:
*   acquire delay timer.
*   IF delay > 500 microseconds THEN
*      save running process's id in delay_timer_id.
*      start timer.
*      wait(o(delay_timer).
*      preempt upon return in case interrupted process has priority.
*      release delay timer.
*   ELSE
*      wait in a programmed loop.
*
*****************************************************************
;
   PROCEDURE  delay(delay_time);
      VALUE   delay_time;
      INTEGER delay_time;                                    ENTRY;
      BEGIN & delay &
         BYTE CONSTANT latch_time := 0;
         BYTE    delay_timer    = io + %61;
         BYTE    timer_command  = io + %67;
         BYTE    delay_time_lsb = delay_time + 1;
         BYTE    delay_time_msb = delay_time;

         IF (delay_time AND %FFR0) <> 0 THEN
            BEGIN & if &                  & delay > 500 microseconds &

               acquire(delay_timer_resource);

               delay_timer_id := running;          & save process id &
                                                   &    for return.  &

         & %253 does not allow timer loading to be interrupted per    &
         & Intel Information Sheet 1-2-79 "How the 8253 Really Works". &
               ASSEMBLE( MOVE SR,     -(S) );    & Push status word   &
               ASSEMBLE( ORI  =H0700, SR   );    & Disable interrupts &
               delay_timer := delay_time_lsb;          & start timer &
               delay_timer := delay_time_msb;
               ASSEMBLE( MOVE (S)+,   SR   );    & Restore status word&

               wait(o(delay_timer_vctr);           & suspend thyself &
               irdis(delay_timer_vctr);

               delay_timer_id := idle_process;
               release(delay_timer_resource);

               preempt;                            & any higher pri- &
                                                   & ority processes &
```

```
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                                                   & (like the one we&
                                                   & just interrptd)? &
                                                   & See BUG above.  &

            END   & if &
         ELSE                          & delay < 500 microseconds &
            BEGIN & else &
               TRAP(refresh_vctr);&refr mem for even straight thru time&
               delay_time := delay_time - 1;       & for set-up time &
               WHILE delay_time > 0 DO
                  BEGIN & while &
                     TRAP(refresh_vctr);           & refresh memory &
                     TRAP(refresh_vctr);           & [ 15 usec/TRAP &
                     delay_time := delay_time - 1; &   at 8 MHz]    &
                  END;  & while &
            END;  & else &

      END;  & delay &
```

```
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REJECT;
COMMENT                                                          pause
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR pause
*
* FUNCTION: to suspend a process for the duration of the specified
*           interval.
*
* DECLARATION INFORMATION:
*    PROCEDURE  pause(interval)
*       VALUE   interval
*       INTEGER interval
*
*    INPUT:  interval - integer   time in multiples of 125 msec.
*                                 maximum value = 32767 (68.3 minutes)
*
*    OUTPUT; none
*
* EXTERNAL EFFECTS:
*    Upon completion of the pause interval, the process will be
* made ready, but will only be scheduled if it is the highest priority
* process ready at that time.
*
* COMMENTS:
*    The pause interval is counted on the basis of 125 millisecond
* "ticks" from the hardware clock. The actual pause will be
* the requested interval plus zero/minus one tick.  For example,
* pause(9) could result in a delay of from 1 to 1.125 seconds.
* Similarly, pause(1) could result in a delay of 125 milliseconds,
* or no delay at all.
*    There is a companion routine called "delay" for shorter delays, but
* it is restricted to use by mutually exclusive routines -- it is not
* reentrant.
*
*****************************************************************
*
* LOGIC INFORMATION FOR pause
*
* MODULES CALLED: schedule
*
* INITIAL REFINEMENT:
*    disable interrupts.
*    check validity of requested interval.
*    save running process's id in linked-list of waiting processes.
*    schedule
*    enable interrupts.
*
*****************************************************************
;
   PROCEDURE  pause(interval);
      VALUE   interval;
      INTEGER interval;                                    ENTRY;
      BEGIN & pause &
         INTEGER ptr;
         INTEGER prev_ptr;
```

```
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         IF interval >= 0 THEN
            BEGIN & if &

               ASSEMBLE( MOVE   SR,-(S) );    & Push Status word.    &
               ASSEMBLE( ORI   =H0700,SR);    & Disable interrupts.  &

               prev_ptr := queue_list;
               ptr := link[ pause_list ];

               UNTIL ( (ptr <> nil) AND (counter[ptr] < interval) ) DO
                  BEGIN & while &             & Find place in list.  &
                     interval := interval - counter[ptr];
                     prev_ptr := ptr;
                     ptr := link[ptr];
                  END;  & while &

               link[running] := ptr;          & Add caller to list.  &
               counter[running] := interval;
               link[prev_ptr] := running;

               IF ptr <> nil THEN             & Update next counter. &
                  counter[ptr] := counter[ptr] - interval;

               ready := RSET(rtady,running);  & Make not ready.      &
               schedule;

               ASSEMBLE( MOVE  (S)+,SR  );    & Restore Status word. &
                                              & (restores interrupts).&

            END;  & if &

      END;  & pause &
```

```
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$EJECT;
COMMENT                                                          terminate
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR terminate
*
* FUNCTION: To terminate the running process.
*
* DECLARATION INFORMATION:
*    SUBROUTINE terminate
*
*    INPUT:  none
*
*    OUTPUT: none
*
*****************************************************************************
*
* LOGIC INFORMATION FOR terminate
*
* MODULES CALLED:  none
*
* INITIAL REFINEMENT:
*
*    Make the process not ready.
*    Schedule the highest priority ready process.
*
*****************************************************************************
;
   SUBROUTINE terminate;                                          ENTRY;
      BEGIN
         ready := RSET(ready,running);
         ASSEMBLE( MOVE   SR,-(S)  );              & Push status word.&
         ASSEMBLE( ORI   #H0700,SR );              & Disable interrupt&
         schedule;
         ASSEMBLE( MOVE   (S)+,SR  );              & Restore status.  &
      END terminate;
```

```
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$EJECT;
COMMENT                                                            abort
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR abort
*
* FUNCTION: To terminate the designated process.
*
* DECLARATION INFORMATION:
*    PROCEDURE abort(id)
*
*    INPUT:  id    integer     process id.
*
*    OUTPUT: none
*
* COMMENT:  In order to abort a process, one must be careful not to
*    leave the process on any wait list where it might be rescheduled
*    at a later time.  Similarly, the process may own some resources
*    as a result of being interrupted, or -- heaven forbid -- as the
*    result of the code not releasing a resource prior to suspending
*    itself while waiting for a signal or interrupt.
*
*****************************************************************************
*
* LOGIC INFORMATION FOR abort
*
* MODULES CALLED:  none
*
* INITIAL REFINEMENT:
*
*    Make the process not ready.
*    Schedule the highest priority ready process.
*
*****************************************************************************
;
   PROCEDURE  abort(id);
      VALUE   id;
      INTEGER id;                                                  ENTRY;
      BEGIN & abort &
         ready := RSET(ready,id);
         ASSEMBLE( MOVE   SR,-(S)  );              & Save status.     &
         ASSEMBLE( ORI   #H0700,SR );              & Disable interrupt&
         schedule;
         ASSEMBLE( MOVE   (S)+,SR  );              & Restore status.  &
      END abort;
```

```
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$EJECT;
COMMENT                                                              run
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR run
*
* FUNCTION: To begin execution of a new (or dormant) process.
*
* DECLARATION INFORMATION:
*    PROCEDURE run(processid)
*       VALUE processid
*       INTEGER processid
*
*    INPUT:  processid   integer  process id of the process to run.
*
*    OUTPUT: none
*
* COMMENTS:  can be used in conjunction with create as follows:
*            run( create(process,ptacktize,urgency) )
*
*****************************************************************************
*
* LOGIC INFORMATION FOR run
*
* MODULES CALLED:  none
*
* INITIAL REFINEMENT:
*
*    Initialize stack and saved process state information.
*    Make the process ready.
*    Schedule the highest priority ready process, including the new
*       process.
*
*****************************************************************************
;
   PROCEDURE  run(processid);
      VALUE   processid;
      INTEGER processid;                                           ENTRY;
      BEGIN
         INTEGER CONSTANT activation_size := 18;
         DOUBLE process;
         DOUBLE term;
         DOUBLE marker;
         DOUBLE stack = REGISTER 9;
         term := ADRS(terminate);
         stack := initialsp[processid];
         marker := stack + 2;
         spsave[processid] := stack - activation_size;
         max_sp[processid] := spsave[processid];                   & DEBUG &
         process := initialpc[processid];

         ASSEMBLE(
                  MOVE.L term,-2(stack);       & Terminate routine.   &
                  MOVE.L process,-6(stack);    & Initial p.c.         &
                  MOVE   #H2000,-8(stack);     & Processor status wd. &
                  MOVE.L marker,-12(stack);    & Stack Marker (M=R14) &
```

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                  MOVE.L #H12345678,-16(stack); & R13                  &
               &  MOVE   min_regisfert,-activation_size(stack)  &
                  DOVE   #DO,          -activation_size(stack)
                  );                           & Mark size of push.   &
         ready := SBIT(ready,processid);
         ASSEMBLE( MOVE.L SR,-(S)  );          & Save status.         &
         ASSEMBLE( ORI   #H0700,SR );          & Disable interrupts.  &
         schedule;
         ASSEMBLE( MOVE.L (S)+,SR  );          & Restore status.      &
      END run;
```

```
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$EJECT;
COMMENT                                                           create
************************************************************************
*
* EXTERNAL SPECIFICATION FOR create
*
* FUNCTION: Initialize the process record for a new process.
*
* DECLARATION INFORMATION:
*    INTEGER PROCEDURE create(process,stacksize,urgent)
*       VALUE process, stack, urgent
*       DOUBLE process
*       INTEGER stacksize, urgent
*
*    INPUT:  process    double       address of the outer procedure
*                                    that defines the process,
*                                    e.g. ADRS(procname).
*            stacksize  integer      stack space to allocate for
*                                    the process (in words).
*            urgent     integer      the urgency (priority) to be
*                                    assigned to the process.
*
*    OUTPUT: create     integer      returns process id of created
*                                    process.
*
* COMMENTS: Create currently assumes unique values of urgency (which
*           also should be contiguous to avoid wasting space and time).
*
************************************************************************
*
* LOGIC INFORMATION FOR create
*
* MODULES CALLED: none
*
* INITIAL REFINEMENT:
*
*    Set process's urgency.
*    Decrement available stack marker by process's stack size.
*    Set process's initial stack address.
*    Set process's initial program counter value (begin execution
*       address).
*    Assign and return a process id number.
*
************************************************************************
;
   INTEGER PROCEDURE create(process, stacksize, urgent);
      VALUE process, stacksize, urgent;
      DOUBLE process;
      INTEGER stacksize, urgent;                            ENTRY;
      BEGIN
         INTEGER POINTER ptr;                            & DEBUG &
         INTEGER id = urgent;                   & May later compute a  &
                                                & different id.        &
         urgency[id] := urgent;
         datasize[id] := stacksize;
         stack_top := stack_top - stacksize;    & Order of execution   &
```

```
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         initialsp[id] := stack_top + stacksize;& is important for     &
                                                & reentrancy.          &
         initialpc[id] := process;
         IF ( (stack_top   AND %0001FFFF) <                   & DEBUG &
              (ADRS(nerkl) AND %0001FFFF)                     & DEBUG &
            ) THEN                                            & DEBUG &
            fatal(process_creation_error);                    & DEBUG &
         create := id;

         max_sp[id] := initialsp[id];                         & DEBUG &
         stack_init(id) := stack_top;                         & DEBUG &
         IF id <> 0 THEN                  & init stack space & & DEBUG &
            STPNTR(ptr,initialsp[id])                         & DEBUG &
         ELSE                                                 & DEBUG &
            STPNTR(ptr,initialsp(0)-256);                     & DEBUG &
         REPEAT ARICNT(stacksize,1) DO                        & DEBUG &
            BEGIN                                             & DEBUG &
               ptr := stack_fill;                             & DEBUG &
               STPNTR(ptr,ADRS(ptr[-1]) );                    & DEBUG &
            END;                                              & DEBUG &
      END create;
```

```
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$EJECT;
COMMENT                                                      signal_init
************************************************************************
*
************************************************************************
;
   PROCEDURE signal_init(signal,count);
      VALUE signal,count;
      INTEGER signal,count;                                 ENTRY;
                                        & Count normally = 0.      &
      BEGIN & signal_init &
         counter[signal] := count;      & +n = |n| signals pending.&
                                        &  0 = no signals pending  &
                                        & -n = |n| proc's waiting. &

         link[signal] := nil;
      END signal_init;


   PROCEDURE resource_init(resource);
      VALUE resource;
      INTEGER resource;                                     ENTRY;
      BEGIN & resource_init &
         counter[resource] := 1;        & 1 = notbusy,             &
                                        & 0 = busy, no one waiting.&
                                        & -n = |n| proc's waiting. &

         link[resource] := nil;
      END resource_init;
```

```
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$EJECT;
COMMENT                                                IO DRIVER MODULES
************************************************************************
*
* IO DRIVER modules merged here.
*
************************************************************************
;
```

```
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#EJECT;
COMMENT                          botton kex interrupt service routine;

   SUBROUTINE intrpt_botton;                                    &NTRY;
         & Must be SUBROUTINE.      INTE&&UPT's LIBE/UNLK hills it. &
      BEGIN
         LABEL pop_nin,
               pop_done;
      &  INTEGER CONSTANT nin_registert := 0;      declared in skernel &
      &  INTEGER CONSTANT all_registers := -1;     declared in skernel &
         INTEGER id = REGISTER 9;
         DOUBLE spsave_botton_id = epsave + 4^botton_id;

         RSSEMBLE(
                 MOVEM.L M8-R14,-(S);         & Push registert.      &
               & MOVE    all_registers,-(S) & & Mark size of push.   &
                 MOVE    =D-1,-(S)
                 );

         id := running;
         RSSEMBLE(
                 ROD.L  id,id;
                 ROD.L  id,id;
                 MOVE.L S,spsess(id);
                 MOVE.L epeave_botton_id, S
                 );
         running := botton_id;
         ready := SBIT(ready,botton_id);
         RSSEMBLE(
                 TST.U   (S)+;                & Teet type of block.  &
                 BGE     pop_nin;
                 MOVEM.L (S)+,R0-R14;         & Pop fall aet.        &
                 BRA     pop_done
                 );
pop_nin: ASSEMBLE(MOVEM.L (S)+,R13-R14 );      & Pop nininun oet.     &
pop_donr:ASSEMBLE(&1E);
      END intrpt_botton;
```

```
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#EJECT;
COMMENT                                  rpg interrupt aervace routine;

   SUBUOUTINE intrpt_rpg;                                       ENTRY;
         & Must be SUBROUTINE.      INTERRUPT'a LINK/UNLK kills it. &
      BEGIN
         LABEL pop_nin,
               pop_done;
      &  INTEGER CONSTANT nin_regitters := 0;      declared in skernel &
      &  INTEGER CONSTANT all_registers := -1;     declared in skernel &
         INTEGER id = REGISTER 9;
         DOUBLE spsave_rpg_id = opsave + 4^rpg_id;

         RSSEMBLE(
                 MOVEM.L RO-R14,-(S);         & Puoh regiaters.      &
               & MOVE    all_registers,-(S) & S Mark size of push.   &
                 MOVE    =O-1,-(S)
                 );

         id := running;
         RSSEMBLE(
                 ROD.L  id,id;
                 ROD.L  id,id;
                 MOVE.L S,apsave(id);
                 MOVE.L spsave_rpg_id, S
                 );
         running := rpg_id;
         ready := SBIT(ready,rpg_id);
         RSSEMBLE(
                 TST.U   (S)+;                & Test type of block.  &
                 BGE     pop_nin;
                 MOVEM.L (S)+,RO-R14;         & Pop full sot.        &
                 BRA     pop_done
                 );
pop_nin: RSSEMBLE(MOVEM.1 (S)+,R13-R14 );      & Pop nininun set.     &
pop_done:ASSEMBLE(RTE);
      END intrpt_rpg;
```

```
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#EJECT;
COMMENT                          top keyboard interrupt service routine;

   SUBROUTINE intrpt_top_key;                                   ENTRY;
         & Must be SUBROUTINE.      INTERRUPT'a LINK/UNLK kills it. S
      BEGIN
         LABEL pop_nin,
               pop_done;
      &  INTEGER CONSTANT nin_registers := 0;      declared in skernel &
      &  INTEGER CONSTANT all_registers := -1;     declared in skernel &
         INTEGER id = REGISTER 9;
         DOUBLE spsave_top_key_id = tpsave + 4^top_key_id;

         RSSEMBLE(
                 MOVEM.L RO-R14,-(S);         & Push registert.      &
               & MOVE    all_registers,-(S) & & Mark size of push.   &
                 MOVE    =D-1,-(S)
                 );

         id := running;
         RSSEMBLE(
                 ROD.L  id,id;
                 ROD.L  id,id;
                 MOVE.L S,spsave(id);
                 MOVE.L spsave_top_key_id, S
                 );
         running := top_key_id;
         ready := SBIT(ready,top_key_id);
         RSSEMBLE(
                 TST.U   (S)+;                & Test type of block.  &
                 BGE     pap_nin;
                 MOVEM.L (S)+,RO-R14;         & Pop full set.        &
                 BRA     pop_donc
                 );
pop_nin: ASSEMSLE(MOVEM.L (S)+,R13-R14 );      & Pop nininun set.     &
pop_done:ASSEMSLE(RTE);
      END intrpt_top_key;
```

```
SKERNEL.WORK.PD&S10          THU, DEC 22, 1983, 10:40 AM    PAGE 39

#EJECT;
COMMENT                                  uart interrupt service routine;

   SUBROUTINE intrpt_uart;                                      ENTRY;
         & Must be SUBROUTINE.      INTERRUPT's LINK/UNLK kills it. &
      BEGIN
         LABEL pop_nin,
               pop_done;
      &  INTEGER CONSTANT nin_registtrs := 0;      declared in skernel &
      &  INTEGER CONSTANT all_registers := -1;     declared in skernel &
         INTEGER id = REGISTER 9;
         DOUBLE spaave_uart_id = spsave + 4^uart_id;

         RSSEMBLE(
                 MOVEM.L RO-R14,-(S);         & Push registers.      &
               & MOVE    all_regissers,-(S) & & Mark size of push.   S
                 MOVE    =D-1,-(S)
                 );

         id := running;
         ASSEMSLE(
                 ROD.L  id,id;
                 ROD.L  id,id;
                 MOVE.L S,spsave(id);
                 MOVE.L opsave_uart_id, S
                 );
         running := uart_id;
         ready := SBIT(ready,uart_id);
         RSSEMBLE(
                 TST.U   (S)+;                & Test type of block.  &
                 BGE     pop_nin;
                 MOVEM.L (S)+,RO-R14;         & Pop full set.        &
                 BRA     pop_donc
                 );
pop_nin: ASSEMBLE(MOVEM.L (S)+,R13-R14 );      & Pop nininun set.     &
pop_done:RSSEMBLE(RTE);
      END intrpt_uart;
```

```
SKERNEL.UORK.PDB510          THU, DEC 22, 1983, 10:40 RR    PAGE 40

@EJECT;
COMMENT                    priv_ib_erq     interrupt service routine;

   SUBROUTINE intrpt_priv_ib_erq;                              ENTRY;
         & Must be SUBROUTINE.      INTERRUPT's LINK/UNLK kills it. &
      BEGIN
         LABEL pop_nin,
               pop_done;
      &  INTEGER CONSTANT nin_registers := 0;      declared in skernel &
      &  INTEGER CONSTANT all_registers := -1;     declared in skernel &
         INTEGER id = REGISTER 9;
         DOUBLE spsave_priv_ib_erq_id = spsave + 4*priv_ib_erq_id;

         RSSEMBLE(
                  MOVEM.L R0-R14,-(S);         & Push registers.      &
                & MOVE    all_registers,-(S) & & Mark size of push.   &
                  MOVE    #0-1,-(S)
                  );

         id := running;
         RSSEMBLE(
                  ADD.L  id,id;
                  ADD.L  id,id;
                  MOVE.L #,spsave(id);
                  MOVE.L spsave_priv_ib_erq_id, S
                  );
         running := priv_ib_erq_id;
         ready := SBIT(ready,priv_ib_erq_id);
         RSSEMBLE(
                  TST.U  (S)+;                 & Test type of block.  &
                  BGE    pop_nin;
                  MOVEM.L (S)+,R0-R14;         & Pop full set.        &
                  BRA    pop_done
                  );
pop_nin: RSSEMBLE(MOVEM.L (S)+,R13-R14 );      & Pop nininun set.     &
pop_done:RSSEMBLE(RTE);
      END intrpt_priv_ib_erq ;
```

```
SKERNEL.UORK.PDB510          THU, DEC 22, 1983, 10:40 RR    PAGE 41

@EJECT;
COMMENT                    delay_tiner     interrupt service routine;

   SUBROUTINE intrpt_delay_tiner;                              ENTRY;
         & Must be SUBROUTINE.      INTERRUPT's LINK/UNLK kills it. &
      BEGIN
         LABEL pop_nin,
               pop_done;
      &  INTEGER CONSTANT nin_registers := 0;      declared in skernel &
      &  INTEGER CONSTANT all_registers := -1;     declared in skernel &
         INTEGER id = REGISTER 9;
         INTEGER id2 = REGISTER 6;

         RSSEMBLE(
                  MOVEM.L R0-R14,-(S);         & Push registers.      &
                & MOVE    all_registers,-(S) & & Mark size of push.   &
                  MOVE    #0-1,-(S)
                  );

         RSSEMBLE(
                  MOVE    running,id;

                  ADD.L  id,id;                & stash away interrupted &
                  ADD.L  id,id;                &    process's SP.       &
                  MOVE.L S,spsave(id);

                  MOVE   delay_tiner_id,id2;  & 'cause will need both  &
                  MOVE   id2,id;               &    addr and data reg's &
                  MOVE   id2,running;
                  ADD.L  id,id;                & get delayed process's &
                  ADD.L  id,id;                &    SP.                &
                  MOVE.L opsave(id), S
                  );

         ready := SBIT(ready,id2);
         RSSEMBLE(
                  TST.U   (S)+;                & Test type of block.  &
                  BGE     pop_nin;
                  MOVEM.L (S)+,R0-R14;         & Pop full set.        &
                  BRA     pop_done
                  );
pop_nin: ASSEMBLE(MOVEM.L (S)+,R13-R14 );      & Pop nininun set.     &
pop_done:RSSEMBLE(RIE);
      END intrpt_delay_tiner ;
```

```
SKERNEL.UORK.PDB51D          THU, DEC 22, 1983, 10:40 RM    PAGE 42

@EJECT;
COMMENT                                  tick interrupt service routine
*****************************************************************************
*
* LOGIC INFORMATION FOR tick
*
* MODULES CALLED kernel (schedule)
*
* INITIAL REFINEMENT:
*    save working register set
*    restore working regitter set
*    RTE (to restore status word)
*
*****************************************************************************
;
SUBROUTINE intrpt_tick;                                        ENTRY;
   BEGIN & intrpt_tick &
      INTEGER CONSTANT delta := 1;       & count increments per tick  &
      INTEGER          ptr   = REGISTER 6;

      RSSEMBLE( MOVEM.L R0-R14,-(S) );

      ptr := link[pause_list];

      IF (ptr <> nil) AND ((counter[ptr] := counter[ptr] - 1) <= 0)
            THEN
         BEGIN & if &

            DO                                    & Unlink and start &
               BEGIN & do &                       &   processes that &
                  ready := SBIT(ready,ptr);       &   are timed-out. &
                  link[pause_list] := link[ptr];
                  ptr := link[pause_list];
               END   & do &
            UNTIL ( (ptr = nil) OR (counter[ptr] > 0) );

            IF (ready AND preempt_mask[runnang]) <> 0 THEN
               schedule;                          & Same as preempt  &
                                                  &   without JSR.   &
         END;  & if &

      update_hpib_leds;

      RSSEMBLE( MOVEM.L (S)+,R0-R14 );
      RSSEMBLE( RTE );

   END;  & intrpt_tick &
```

```
SKERNEL.UORK.PDS51D          THU, DEC 22, 1983, 10:40 RM    PAGE 43

@EJECT;
COMMENT                                                      init_kernel
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR init_kernel
*
* FUNCTION: To initialize the kernel data structures for no processes
*           except the idle process.
*
* DECLARATION INFORMATION:
*    PROCEDURE init_kernel
*
*    INPUT:  none
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS: none
*
*****************************************************************************
*
* LOGIC INFORMATION FOR init_kernel
*
* MODULES CALLED: none
*
* INITIAL REFINEMENT:
*
*    Initialize kernel data (link,ready,counter,stack_top).
*    Initialize data for this main/idle process (id=0).
*          (running,ready,stack_top,initialsp,initialpc,urgency).
*    Initialize delay timer.
*    Initialize tick.
*
*****************************************************************************
;
   PROCEDURE init_kernel;                                      ENTRY;
      BEGIN
         BYTE    CONSTANT delay_timer_node := %35; & node 4, binary,  &
                                                   & lsb first, timer0 &
         BYTE    CONSTANT idleurgency      := 0;
         INTEGER CONSTANT idlesize         := %200;
         BYTE    timer_command = io + %67;
         INTEGER index;
         INTEGER idleid;

         DOUBLE  SUBROUTINE stackbase;
            BEGIN
               RSSEMBLE( EXT $RAM# );
               RSSEMBLE( MOVE.L $RAM#,R0 );
               RSSEMBLE( SUB    #D2,R0 );
            END;

         DOUBLE  SUBROUTINE beginexecutionaddress;
            BEGIN
               RSSEMBLE( EXT $RAMt );
               RSSEMBLE( MOVE.L $RAM#+4,R0 );
            END;
```

```
SKERNEL.WORK.PO8510          THU, DEC 22, 1983, 10:40 PM    PAGE 44


      ASSEMBLE( DOVE   SR,-(S)  );      & Save status word.       &
      ASSEMBLE( ORI    #0700,SR );      & Disable Interrupts.     &

      stack_top := ADRS(mark0); & dummys for loadmap marks && DEBUG &
      stack_top := ADRS(mark1);                                  & DEBUG &
      stack_top := ADRS(mark3);                                  & DEBUG &
      stack_top := ADRS(mark_dg_base);                           & DEBUG &
      stack_top := ADRS(mark_dg_top);                            & DEBUG &

      stack_top := ADRS(mark_stack); & this dummy is req'd to force &
           & the linker to load a module for resetting the initial &
           & stack pointer &RAA& value (returned by stackbase)     &

      stack_top := stackbase;
      FOR index := 0 UNTIL max_process DO                        & DEBUG &
         BEGIN & for &                                           & DEBUG &
            spsave[index] := 0;                                  & DEBUG &
            initialsp[index] := 0;                               & DEBUG &
            initialpc[index] := 0;                               & DEBUG &
            datasize[index) := 0;                                & DEBUG &
            urgency[index] := -1;                                & DEBUG &
            max_sp[index) := 0;                                  & DEBUG &
            stack_limit[index] := 0;                             & DEBUG &
         END for;                                                & DEBUG &
      FOR index := 0 UNTIL max_rin DO
         BEGIN & for &
            link[index]    := nil;
            counter[index] := 0;           & necessary for "pause" &
         END for;
      FOR index := min_rin UNTIL max_rin DO                      & DEBUG &
         owner[index] := -1;                                     & DEBUG &
      ready := 0;                       & All bits = false.          &
      idleid := creatc(beginexecutionaddress,idlesize,idleurgency);
      ready := SBIT(ready,idleid);
      running := idleid;

      delay_timer_id := idle_process;
      resource_init(delay_timer_resource);
      timer_command := delay_timer_node; & Initialize delay timer.  &
      iradr( RORS(intrpt_delay_timer), delay_timer_vctr );
      irdie( delay_timer_vctr );        & disable until "delay" is &
                                        & called.  IF interrupted  &
                                        & between iradr and irdis, &
                                        & it will only enable idle.&
      link[pauss_list] := nil;
      iredr( ADRS(intrpt_tick), tick_vctr );

      ASSEMBLE( MOVE   (S)+,SR  );      & Restore status word.    &
   END init_kernel;
                                                          & DEBUG &
                                                          & DEBUG &
                                                          & DEBUG &
```

```
SKERNEL.WORK.PO8510          THU, DEC 22, 1&&3, 10:40 PM    PAGE 45

REJECT;                                                   & DEBUG &
COMMENT                                              snapshot & DEBUG &
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&& & DEBUG &
&                                                         & DEBUG &
& FUNCTION: To dump the kernel data in a meaningful manner.  & DEBUG &
&                                                         & DEBUG &
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&& & DEBUG &
;                                                         & DEBUG &
PROCEDURE  snapshot;                                 ENTRY; & DEBUG &
BEGIN & snapshot &                                        & DEBUG &
   INTEGER i;                                             & DEBUG &
   INTEGER POINTER &tack_data;                            & DEBUG &
                                                          & DEBUG &
   CRLF;                                                  & DEBUG &
   USTR("run="); WHEX(running);                           & DEBUG &
   USTR(" rdy="); UHEX(ready);                            & DEBUG &
   USTR(" stktop="); lelex(stack_tap,S); CRLF;            & DEBUG &
   USTR("  &   link  ctr  opsave"); CRLF;                 & DEBUG &
   FOR i := 0 TO max_process DO                           & DEBUG &
      BEGIN & for &                                       & DEBUG &
         UHEX(i);                                         & DEBUG &
         WHEX(link1i]);                                   & DEBUG &
         WHEN(counter[i]);                                & DEBUG &
         WHhn(epsave[i],8);                               & DEBUG &
         CRLF;                                            & OEBUG &
      END for;                                            & DEBUG &
   WSTR("  &   link  ctr  owner "); CRLF;                 & DEBUG &
   FOR i := min_rin TO max_rin DO                         & DEBUG &
      BEGIN & for &                                       & DEBUG &
         UHEX(i);                                         & DEBUG &
         UHEN[link(i]);                                   & DEBUG &
         WHEX(caunter[i]);                                & DEBUG &
         WHEX(owner[i]);                                  & DEBUG &
         CRLF;                                            & DEBUG &
      END for;                                            & DEBUG &
   TRRP(15);                                              & DEBUG &
END snapshot;                                             & DEBUG &

END& module "kernel"


                                                          & DEBUG &
                                                          & DEBUG &
                                                          & DEBUG &
```

```
SKERNEL.WORK.PO8510          THU, DEC 22, 1583, 10:40 PM    PAGE 46

REJECT;                                                   & DEBUG &
COMMENT                                        MINIMUM  snapshot & DEBUG &
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&& & DEBUG &
&                                                         & DEBUG &
& FUNCTION: To dump the kernel data in a meaningful manner.  & DEBUG &
&                                                         & DEBUG &
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&& & DEBUG &
;                                                         & DEBUG &
PROCEDURE  snapshot;                                 ENTRY; & DEBUG &
BEGIN & snapshot &                                        & DEBUG &
   INTEGER i;                                             & DEBUG &
   INTEGER POINTER stack_data;                            & DEBUG &
                                                          & DEBUG &
   CRLF;                                                  & DEBUG &
   USTR("run   = "); WHEX(running); CRLF;                 & DEBUG &
   USTR("rdy   = "); WHEX(ready);   CRLF;                 & DEBUG &
   USTR("stktop= "); UHex(stack_top,8); CRLF;             & DEBUG &
   WSTR("  #   link .ctr  spsave"); CRLF;                 & DEBUG &
   FOR i := 0 TO max_process DO                           & DEBUG &
      BEGIN & for &                                       & DEBUG &
         WHEX(i);                                         & DEBUG &
         WHEX[link(i]);                                   & DEBUG &
         WHEX(counter(i]);                                & DEBUG &
         WHex(spsave[i],8);                               & DEBUG &
         CRLF;                                            & DEBUG &
      END for;                                            & DEBUG &
   USTR("  #   link  ctr  owner "); CRLF;                 & DEBUG &
   FOR i := min_rin TO max_rin DO                         & DEBUG &
      BEGIN & for &                                       & DEBUG &
         UHEX(i);                                         & DEBUG &
         UHEX(link[i]);                                   & DEBUG &
         UHEX(counter[i]);                                & DEBUG &
         UHex(owner[i]);                                  & DEBUG &
         CRLF;                                            & DEBUG &
      END for;                                            & DEBUG &
   TRRP(15);                                              & DEBUG &
END snapshot;                                             & DEBUG &

                                                          & DEBUG &
                                                          & DEBUG &
                                                          & DEBUG &
```

```
SKERNEL.UDRK.PDS510          THU, DEC 22, 1983, 10:40 PM    PAGE 47

#EJECT;                                                   & DEBUG &
COMMENT                                              snapshot & DEBUG &
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&& & DEBUG &
&                                                         & DEBUG &
& FUNCTION: To dump the kernel data in a meaningful manner.  & DEBUG &
&                                                         & DEBUG &
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&& & DEBUG &
;                                                         & DEBUG &
PROCEDURE  snapshot;                                 ENTRY; & DEBUG &
BEGIN & snapshot &                                        & DEBUG &
   INTEGER i;                                             & DEBUG &
   INTEGER POINTER stack_data;                            & DEBUG &
                                                          & DEBUG &
   CRLF;                                                  & DEBUG &
   USTR("running   = "); UHEX(running); CRLF;             & DEBUG &
   WSTR("ready     = "); UHEX(ready);   CRLF;             & DEBUG &
   USTR("stack_top = "); UHex(stack_top,&); CRLF;         & DEBUG &
   CRLF;                                                  & DEBUG &
USTR(" # link ctr  opsave");
   CRLF;                                                  & DEBUG &
   FOR i := 0 TO max_procets DO                           & DEBUG &
      BEGIN & for &                                       & DEBUG &
         UHex(i,2);                                       & DEBUG &
         UHex(link[i],2);                                 & DEBUG &
         UHex(counter[i],&);                              & DEBUG &
         Uhex(spsavs[i],8);                               & DEBUG &
         CRLF;                                            & DEBUG &
      END for;                                            & DEBUG &
   CRLF;                                                  & DEBUG &
   USTR(" # link ctr owner");                             & DEBUG &
   CRLF;                                                  & DEBUG &
   FOR i := min_rin TO max_rin 00                         & DEBUG &
      BEGIN & for &                                       & DEBUG &
         UHex(i,2);                                       & DEBUG &
         UHex(link(i],2);                                 & DEBUG &
         UHex(counter[i),&);                              & DEBUG &
         UHex(owner[i],2);                                & DEBUG &
         CRLF;                                            & DEBUG &
      END for;                                            & DEBUG &
   CRLF;                                                  & DEBUG &
   USTR("Stack for running process "); CRLF;              & DEBUG &
   STPNTR(stack_data, (linitialsp[running]-datasize[running])  & DEBUG &
          AND XFFFFFFF0) );                               & DEBUG &
   REPERT ( 1 + HRIGHT(datasize[running),&) ) DO          & DEBUG &
      BEGIN & repeat &                                    & DEBUG &
         UHex(ADRS(stack_data),S);                        & DEBUG &
         REPERT 8 00                                      & DEBUG &
            BEGIN & repeat &                              & DEBUG &
               Uhex(stack_data,4);                        & DEBUG &
               STPNTR(stack_data,                         & DEBUG &
                      RDRS(stack_data[1]) );              & DEBUG &
            END repeat;                                   & DEBUG &
         CRLF;                                            & DEBUG &
      END repeat;                                         & DEBUG &
   CRLF;                                                  & DEBUG &
   USTR("<return> for more");                             & DEBUG &
```

```
SKERNEL.UORK.PDB510          THU, DEC 22, 1983, 10:40 AM    PAGE 48

   CRLF;                                                    & DEBUG &
   UNILE RCHRR <> %DO DO ; & wait For carriage return &     & DEBUG &
   FOR i := 0 10 nax_process DO                             & DEBUG &
      BECIN & for &                                         & DEBUG &
         IF urgency[i] <> %FF THEN                          & DEBUG &
            BEGIN & if &                                    & DEBUG &
               CRLF;                                        & DEBUG &
               USTR("Process "); UHex(i,2); CRLF;           & DEBUG &
               STPNIR(stack_data, ((initialsp[i]-datasize[i])  & DEBUG &
                     AND %FFFFFFF0) );                      & DEBUG &
               REPERT ( 1 + ARIGHT(datasize[i],4) ) DO      & DEBUG &
                  BEGIN & repeat &                          & DEBUG &
                     UHex(RDRS(stack_data[i],$);            & DEBUG &
                     REPERT 8 00                            & DEBUG &
                        BEGIN & repeat &                    & DEBUG &
                           UHex(stack_data,4);              & DEBUG &
                           STPWTR(etack_data,               & DEBUG &
                                 RDRS(etack_deta[1]) );     & DEBUG &
                        END repeat;                         & DEBUG &
                     CRLF;                                  & DEBUG &
                  END repeat;                               & DEBUG &
            END if;                                         & DEBUG &
      END for;                                              & DEBUG &
   TRRP(1$);                                                & DEBUG &
END snapshot;                                               & DEBUG &
```

```
SKERNEL.UORK.PDB510          THU, DEC 22, 1983, 10:40 AM    PAGE 49

%EJECT;
COMMENT                                                 updtlc/status log
##############################################################################
* CHANGES:
*   15 Mar  83: Corrected "send" to set the link to nil (assumes that
*               there is never more than one process awaiting a signal
*               -- linked).  Also removed the linking that was present
*               in "wait".
*   12 Nov  82: Corrected "intrpt_tick" to save all registers before
*               suspending the process.
*   09 Nov  82: Corrected interrupt initialization for "delay", and
*               initialization/reset of delay_timer_id variable to
*               point to the idle process when not in use.
*   14 Apr  82: Deleted the interrupt routine for the public hp-ib.
*   01 Apr  82: Changed "schedule" to utilize the multiplier's normalize
*               function rather than the previous bit test and loop to
*               determine the highest priority ready process.
*   26 Mar  82: Added programmed delay for times under 500 microseconds
*               in "delay".
*   08 Jan  82: Added "pending" procedure.
*   06 Jan  82: Added "pause" and "tick" procedures.
*   11 Nov  81: Added timing information to the header.
*   28 Sept 81: Added "delay" procedure, including interrupt service
*               and initialization.  Modified init_kernel to
*               initialize the delay timer counter.
*   25 Sept 81: Corrected the ready vs running tompare in preempt.
*   23 Sept 81: Changed schedule, run, and driver routines to minimize
*               the number of registers pushed during each process
*               swap
*   04 Oct  82: Added test for memory overflow not caught at link time,
*               including room for stack allocation.
*
##############################################################################
;
```

```
FKERNEL2.UORK.PDB510         THU, DEC 22, 1983, 10:40 AM    PAGE  1

EXTERNAL DOUBLE stack_top;

PROCEDURE  snapshot;                                        EXTERNAL;
INTEGER PROCEDURE create(process,stacksize,urgency);
   VALUE process, stacksize, urgency;
   DOUBLE process; INTEGER stacksize, urgency;              EXTERNAL;
PROCEDURE run(processid); VALUE processid; INTEGER processid;  EXTERNAL;
SUBROUTINE terminate;                                       EXTERNAL;
SUBROUTINE intrpt_tick;                                     EXTERNAL;
SUBROUTINE intrpt_delay_timer;                              EXTERNAL;
SUBROUTINE intrpt_rpg;                                      EXTERNAL;
SUBROUTINE intrpt_top_key;                                  EXTERNAL;
SUBROUTINE intrpt_botton;                                   EXTERNAL;
SUBROUTINE intrpt_uart;                                     EXTERNAL;
SUBROUTINE intrpt_priv_ib_arc;                              EXTERNAL;
```

```
FKERNEL3.UORK.POS510         THU, DEC 22, 1983, 10:40 AM    PAGE  1

PROCEDURE uaitio(device); VALUE device; BYTE device;        EXTERNAL;
PROCEDURE delay(delay_time);
   VALUE delay_time; INTEGER delay_time;                    EXTERNAL;
PROCEDURE pause(interval);
   VALUE interval; INTEGER interval;                        EXTERNAL;
```

```
FKERNEL4.WORK.PD8510          THU, DEC 22, 1983, 10:40 AM    PAGE  1


SUBROUTINE preempt;                                          EXTERNAL;
PROCEDURE signal_init(signal,count);
   VALUE signal,count; INTEGER signal,count;                 EXTERNAL;
PROCEDURE resource_init(resource);
   VALUE resource;
   INTEGER resource;                                         EXTERNAL;
&OOLEAN PROCEDURE awaited(signal);
   VALUE signal; INTEGER signal;                             EXTERNAL;
BOOLEAN PROCEDURE pending(signal);
   VALUE signal; INTEGER signal;                             EXTERNAL;
BOOLEAN PROCEDURE conditional_acquire(resource);
   VALUE resource; INTEGER resource;                         EXTERNAL;
```

```
CKEYS.WORK.PD&S10             THU, DEC 22, 1983, 10:40 AM    PAGE  1

INTEGER CONSTANT offset         := -64,      & negative values &
                 zero_token     := offset + 0,  & keep these     &
                 one_token      := offset + 1,  & separate from  &
                 two_token      := offset + 2,  & command token  &
                 three_token    := offset + 3,  & values.        &
                 four_token     := offset + 4,
                 five_token     := offset + 5,
                 six_token      := offset + 6,
                 seven_token    := offset + 7,
                 eight_token    := offset + S,
                 nine_token     := offset + 9,
                 decimal_token  := offset + 10,
                 minus_token    := offset + 11,
                 backspace_token := offset + 13;
```

```
FKEYS.WORK.PD8510             THU, DEC 22, 1983, 10:40 AM    PAGE  1


NFILE ckeys.work;
NFILE commdcase.work;       & For cmd_illegal, _local, _entr, and _u4 &

EXTERNAL INTEGER TABLE top_key_table.L;
EXTERNAL INTEGER TABLE bot_key_table.L;
```

```
SKEYS.WORK.PDSS10             THU, DEC 22, 1883, 10:40 AM    PAGE  1


MGSKL,P,"keys"
BEGIN

NFILE ckeys.work;
NFILE commdecl.work;

GLOBAL INTEGER TABLE top_key_table:=
        cmd_u4,                 &  0 &
        nine_token,             &  1 &
        eight_token,            &  2 &
        seven_token,            &  3 &
        cmd_illegal,            &  4 &
        cmd_illegal,            &  5 &
        end_key_1,              &  6 &
        end_key_5,              &  7 &
        cmd_u3,                 &  8 &
        six_token,              &  9 &
        five_token,             & 10 &
        four_token,             & 11 &
        cmd_entry_OFF,          & 12 &
        cmd_illegal,            & 13 &
        cmd_key_2,              & 14 &
        cmd_key_6,              & 15 &
        cmd_u2,                 & 1E &
        three_token,            & 17 &
        two_token,              & 18 &
        one_token,              & 19 &
        end_down,               & 20 &
        cmd_illegal,            & 21 &
        cmd_key_3,              & 22 &
        end_key_7,              & 23 &
        end_enter,              & 24 &
        minus_token,            & 29 &
        decimal_token,          & 26 &
        zero_token,             & 27 &
        cmd_up,                 & 28 &
        cmd_prior_menu,         & 29 &
        cmd_key_4,              & 30 &
        cmd_key_8,              & 31 &
        cmd_illegal,            & 32 &
        cmd_nkrval,             & 33 &
        backspace_token,        & 34 &
        cmd_illegal;            & 35 &

GLOBAL INTEGER TABLE bot_key_tablt:=
        cmd_ch1,                  & 00 &
        cmd_illegal,              & 01 &
        cmd_illegal,              & 02 &
        end_illegal,              & 03 &
        cmd_s11,                  & 04 &
        cmd_s12,                  & 05 &
        cmd_nag,                  & 0C &
        cmd_phase,                & 07 &
        cmd_ch2,                  & 08 &
        cmd_illegal,              & 09 &
```

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```
        cnd_illegal,            & 10 &
        end_illegal,            & 11 &
        end_e21,                & 12 &
        cnd_p22,                & 13 &
        end_delay,              & 14 &
        cnd_polar,              & 15 &
        cnd_cal_menu,           & 16 &
        cnd_domain_menu,        & 17 &
        cnd_display_menu,       & 18 &
        cnd_marker_menu,        & 19 &
        end_param_menu,         & 20 &
        cnd_illegal,            & 21 &
        cnd_format_menu,        & 22 &
        cnd_illegal,            & 23 &
        cnd_illegal,            & 24 &
        cnd_illegal,            & 25 &
        end_preset, & lab pilot 1  26 &
        cnd_local,              & 27 &
        end_save,               & 28 &
        cnd_recall,             & 29 &
        cnd_preset, & proto M      30 &
        cnd_illegal,            & 31 &
        cnd_scale,              & 32 &
        cnd_auto_scale,         & 33 &
        cnd_illegal,            & 34 &
        end_start,              & 35 &
        cnd_center,             & 36 &
        cnd_illegal,            & 37 &
        cnd_illegal,            & 38 &
        cnd_illegal,            & 39 &
        cnd_ref_value,          & 40 &
        cmd_ref_position,       & 41 &
        cnd_illegal,            & 42 &
        cnd_stop,               & 43 &
        cnd_span,               & 44 &
        cnd_illegal,            & 45 &
        cnd_illegal,            & 46 &
        cnd_illegal,            & 47 &
        cnd_response_menu,      & 48 &
        cnd_illegal,            & 49 &
        cnd_illegal,            & 50 &
        cnd_stimulus_menu,      & 51 &
        cnd_illegal,            & 52 &
        cnd_illegal,            & 53 &
        cnd_illegal,            & 54 &
        cnd_illegal,            & 55 &
        cnd_illegal,            & 56 &
        cnd_illegal,            & 57 &
        end_copy,               & 58 &
        cnd_tape_menu,          & 59 &
        cnd_system_menu,        & 60 &
        cnd_illegal,            & 61 &
        cnd_measurement_restart, & 62 &
        cnd_illegal;            & 63 &

END$
```

SKIMFO.WORK.PD8S10 THU, DEC 22, 1983, 10:40 AM PAGE 1

```
CONNCNT
  Configures bit pairs to correspond to softkeys that are used.
  SKnm = softkey position n contains m lines.
  BSKn = softkey position n that brings up another menu
  n    = 1..8
  n    = 0..2
;

INTEGER CONSTANT

  Sk11 := 1,
  Sk12 := 2,
  Sk13 := 3,
  SK21 := 4,
  SK22 := 5,
  SK23 := %C,
  SK31 := %10,
  SK32 := %20,
  SK33 := %30,
  SK41 := %40,
  SK42 := %80,
  SK43 := %C0,
  SK51 := %100,
  SK32 := %200,
  SK53 := %300,
  SK61 := %400,
  SK62 := %BDO,
  SK63 := %C00,
  SK71 := %1000,
  SK72 := %2000,
  SK73 := %3000,
  SK81 := %4000,
  SK82 := %8000,
  SKS3 := %C000,

  BSK1 := %100
  BSK2 := %200,
  BSK3 := %400,
  BSK4 := %800,
  bSkS := %1000,
  BSK6 := %2000,
  BSN7 := %4000,
  bSK8 := %8000;

CONNEKT
      The rtat of this filt is softuare generated by GENSK.LAHl,
      Any changes must be nade to the input file, SKINFO.WORK.
      ************************************************************
      The following are softkey nenu tablet configured as follows:
        uord 1 = HSByte: corraaponding keys that bring up neu nenus
                 LSByte: nenu's highlight bitnap
        uord 2 = nenu configuration using constants SKnn
        uord 3 = keycode nunber corresponding to softkeys used
         etc.
        uord H = up to 10 keycode values
```

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```
;

$ END OF DIRECT COPY OF FILE

;          DOCUMENTRTION FOR FRONT PRNEL/CBMMAHD INPUT FILE
;
; "$"  Everything before is espied as is into the output file.
;      Anything desired in the output file without being processed
;      by the "BIG TRBLE GENERERBTOR" (GENSK) nust occur before the "$"
;      provided that it does not reference anything generated after
;      the "&".
;
; ";"  Just for conments.  Will be ignored on input and not copied to
;      any of the output files.
;
; "*"  Starts/sseperates softkey nenus.  Must occur after "&" and before
;      "#" in the input file.  An arror nessage will be displayed
;      otherwise. Formatted softkey/command information tables are out-
;      put to NFILE FSKEY.
;
; "."  Indicates and prefixes a softkey nenu constant none that uill be
;      put in NFILE FMENU.UORK which contains these constants and their
;      values.  The values are ordered sequentially as softkey nenus are
;      read in and processed.  Rust occur inmediately after nenu
;      nenu indicator (.) otherwise an error/warning nessage will be
;      displayed and the constant identifier BENUn will be used.
;      (n = computed constant value)
;
; "-"  Starts/seperates individual softkeys and/or softkey positions.
;      Rust occur between nenu indicators (*).  Only up to 8 softkey
;      entries will be recognized (everything else afterwards until the
;      next nenu indicator (*) will be ignored).  Empty or unused
;      softkey positions uhich occur between occupied softkeys or keys
;      uhich create unused positions at the top of the nenu nust have a
;      blank entry between softkey sperators (-).  Houever, it is not
;      necessary to do this for unused softkeys uhich create contiguous
;      gaps at the botton of the nenu.
;
;      SOFTKEY AHNO1BTION FORMRI:
;        <l1> :: "alpha" | byte | "alpha"+<l1> | byte+<l1>
;        <l2> :: sane as above
;      uhere <l1> = 1st line of softkey
;            <l2> = 2nd line of softkey
;      Input lines are direct copies to output file.
;      There is no error checking for the following restrictions:
;        - RLPHR types nust be enclosed in algol deliniters (")
;        - Start in column 1, no blanks between RLPHR/BYTE conbinations
;          (i.e.  "line 1" + 122  should be  "line 1"+122).
;        - Each line should not exceed 10 characters/bytes.
;
;      BRRCKET CHRRRCTERS:
;      sk_braeket_n (n=2..7) is a byte constant that uill generate a
;      character bracketing off n softkey annotations fron the first
;      line of a softkey entry position.  It should be the last
;      character of the first line of a softkey position heading off
;      a bracketed group of softkeys.  If the softkey annotation
```

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```
;      heading off the bracketed group consists of a single lint, then
;      a tuo line entry should be created.  See the followuing examples:
;      e.g.  two-line annotation:              one-line annotation:
;        "LINE ONE"+sk_bracket_4         sk_bracket_4
;        "LINE TWO"                      half_vt+"LINE OKE"
;
;      NOTE:  Softkey annotations should be the FIRST piece of info.
;      within softkey entries !!!
;
; "["  Prefixes and indicates a connand token constant for a softkey
;      entry or front panel/HP-IB connand code.  An error nessage
;      uill be displayed if nore than one connand value indicator occurs
;      in a single softkey entry.  Constant values are determined
;      sequentially and correspond to the occurrence of each softkey
;      entry (uhether or not it has a connand value indicator).
;      These constants and their and values can be found in
;      NFILEs corresponding to the nost recent filename read via
;      "0"..."9","R"..0" prefixes.
;
; "]"  Indicates and prefixes duplicate connand token constants uhich
;      have been previously declared to correspond to an identical
;      function AND refer to the sant annotation (for softkeys).
;      This alininates nore than one connand code per identical
;      function.  In this case, case statenent entries (',') should be
;      onitted since they are taken care of by the previously declared
;      connand code.
;      NOTE:  Rust occur within softkey entries ('-') or after '#'.
;      Any case statenent entries (',') following it uill be ignored.
;      Any case statenent entries before it uill cause this entry to
;      be unrecognized (only within softkey entry information).
;
; ","  Indicate and prefix Algol statements to be executed corresponding
;      to the current connand token (softkey entry/HP-IB printive) being
;      processed.  They nay occur only uithin softkey entries or after
;      connand token constants.  They should not proceed ']' prefixes.
;      NOTE:  Syntax errors uill not be checked.
;
; "^"  Indicates that a softkey brings up another nenu.  "^" is followed
;      by the nenu nunber (inmediate or constant) of the nenu that
;      softkey is to generate.  Only one "^" per softkey entry allowed.
;
; "R"..."O" and
; "0"..."9"
;      Rarks the start of a group of case statements enclosed in a
;      PROCn procedure (n = 0..25, {R=10,B=11..0=25}) and its
;      corresponding connand token constants.  R filename RUST proceed
;      each character entry (uhich can only be used ONCE):
;            <char><filename>
;      There uill be tuo seperate files produced using the given file
;      nane: 1) C<filename>  for connand token constants
;            2) F<filename>  for corresponding case statements
;      All connand token constants (indicated by '(') and corresponding
;      tegnents of code (indicated by ',') will be read into these
;      files.
;      These character prefixes nay occur after the '$', before or after
;      nenu entries, at the beginning or end of softkey entries, or
```

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```
;      before command token entries '[' occuring after '#'.
;
;      NOTE:  The module which includes F<filename> must also include
;      #FILE FCOMMAND.UPDK or an external declaration of the integer
;      variable command_token.
;
; "%"  Indicates the end of menu entries and ignores any entries found
;      after the occurrence of "#".  Only command value indicators, ([)
;      or (]), immediately followed by statement indicators (,) are
;      processed.  This segment of the input file is for HPIB primitives
;      which do not have corresponding softkeys, and for front panel
;      keys which need command values in order to be processed.
;      Error messages are displayed for any input other than that just
;      described.
;
; "@"  Indicates that a command token entry is a software option.
;      It should be followed by a number 0..9  which identifies the
;      which software option that particular command is under (i.e.
;      time domain commands = 1, error correction commands = 2, etc.).
;      The INFO parameter (string) passed upon running CENSK contains
;      a string of software option numbers (0..5).  Each digit will
;      correspond to a software option family that will generate the
;      Algol statements (via ",") for a command token entry.  These
;      program statements are emitted, otherwise.
;      Command token entries without the "@" directive are not options
;      and will not omit program statements in their entries.

1@tmgr.work.L
```

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```
#EJECT**********
.TAPE_MENU
--------
"DIRECTORY"
[end_directory
.IF valid_directory THEN
,  BEGIN
,     gen_menu(DIRECTORY_MENU, 1);
,     list_directory;
,  END;
---------
"STORE"
,setup_tape_op(record_pp);
--------
"LOAD"
,setup_tape_op(restore_op);
--------
"DELETE"
,setup_tape_op(delete_op);
--------
"UN-DELETE"
,undelete_file;
--------

--------

--------
"INITIALIZE"
"TAPE"
^INIT_TAPE_MENU
--------
```

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```
#EJECT**********
.INIT_TAPE_MENU
--------
"INIT TAPE?"
"YES"
,init;
--------
"NO"
,previous_menu;
--------
```

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```
#EJECT**********
.DIRECTORY_MENU
--------
"RESTORE"
"DISPLAY"
[cmd_directory_off
--------

--------

--------
"NEXT"
"PAGE"
[cmd_next_page
,list_directory;
--------
"PREVIOUS"
"PAGE"
[cmd_prev_page
,list_directory;
--------

--------
"FIRST"
"PAGE"
(cmd_first_page
,list_directory;
--------
"LAST"
"PAGE"
(cmd_last_page
,list_directory;
--------
```

```
SKINFO.WORK.PD8STO              THU, DEC 22, 1983, 10:41 AM     PAGE  8


$EJECT**********
.DATA2_MENU
--------
"RAW"
"DATA"
,gen_file_menu(a_param_file);
--------
"DATA"
,gen_file_menu(data_file);
--------
"FORMATTED"
"DATA"
,gen_file_menu(format_file);
--------

--------
"USER"
"DISPLAY"
,gen_file_menu (display_file);
--------

--------

--------
"MACHINE"
"DUMP"
[cmd_machine_dump
,gen_file_menu(machine_file);
--------
```

```
SKINFO.WORK.PD8STO              THU, DEC 22, 1983, 10:41 AM     PAGE  9


$EJECT**********
.DATA1_MENU
--------
"INSTRUMENT"
"STATE"
,gen_reg_menu(state_file);
--------
"INSTRUMENT"
"STATES 1-5"
,gen_file_menu(state_set);
--------
"MEMORY"
"TRACE"
,gen_reg_menu(memory_file);
--------
"MEMORY"
"TRACES 1-4"
,gen_file_menu(memory_set);
--------
"CHL SET"
,gen_reg_menu(cal_file);
--------
"CAL SETS"
"1-5"
,gen_file_menu(cal_set);
--------
"CHL KIT"
,gen_reg_menu(cal_std_file);
--------
"MORE"
[cmd_more
,& dummy statement &;
^DATA2_MENU
--------
```

```
SKINFO.WORK.PD8510              THU, DEC 22, 1983, 10:41 AM     PAGE  10


$EJECT**********
.ABORT_MENU
--------
"ABORT"
--------
```

```
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$EJECT**********
.FILE_MENU
--------
"DATA TYPE "
"# FILE 1"
[cmd_file_1
,file_chosen;
--------
" "
"# FILE 2"
[cmd_file_2
,file_chosen;
--------
" "
"# FILE 3"
,file_chosen;
--------
" "
"# FILE 4"
,file_chosen;
--------
" "
"# FILE 5"
,file_chosen;
--------
" "
"# FILE 6"
,file_chosen;
--------
" "
"# FILE 7"
,file_chosen;
--------
" "
"# FILE 8"
[cmd_file8
,file_chosen;
--------
```

```
3KINFO.UORK.PDS510          THU, DEC 22, 1983, 10:41 RM    PRGE 12

*EJECT**********
.REG_MENU
--------
"DATA TYPE "
"# 1 "
[cmd_reg_1
,reg_chosen;
--------
" "
"# 2 "
[cmd_reg_2
,reg_chosen;
--------
" "
"# 3 "
[cmd_reg_3
,reg_chosen;
--------
" "
"# 4 "
[cmd_reg_4
,reg_chosen;
--------
"(POWER UP)"
"# 5 "
[cmd_reg_5
,reg_chosen;
--------
" "
"# 6 "
[cmd_reg_6
,reg_chosen;
--------
" "
"# 7 "
[cmd_reg_7
,reg_chosen;
--------
" "
"LAST STATE"
[cmd_reg_8
,reg_chosen;
--------

3resp.work.L
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 RM    PRGE 13

*EJECT******
.RESPONSE_MENU
--------
"ELECTRICHL"+sk_bracket_2
"DELRY"
[cmd_elect_delay
,select_active_function( active_electrical_length );
--------
"RUTO DELRY"
[cmd_auto_delay
,uarn( command_not_implemented );
--------
"PHRSE"
"OFFSET"
[cmd_phase_offset
,select_active_function( active_phase_offset );
--------
"MRGNITURE"
"OFFSET"
,warn( command_not_implemented );
,& select_active_function( active_magnituda_offeet ); &
--------
"RVERRGING"+sk_bracket_2
"ON/RESTART"
[cmd_if_avg_on
,if_average_on;
--------
"OFF"
[cmd_if_avg_off
,if_average_off;
--------
"SMOOTHING"+sk_bracket_2
"ON "
[cmd_smoothing_on
,display_smoothing_on;
--------
"OFF"
[cmd_smoothing_off
,display_smoothing_off;
--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 RM    PRGE 14

*EJECT********
.IF_GRIN_MENU
--------
"TEST"+sk_bracket_2
"RMP. GRIN"
[cmd_if_test_port
^IF_GRIN_MENU2
,new_if_gain_port( test_port );
--------
"REFERENCE"
"RMP. GRIN"
[cmd_if_ref_port
^IF_GRIN_MENU2
,new_if_gain_port( ref_port );
--------

--------

--------

--------

--------

--------
```

```
SKINFO.UORK.PDS510          THU, DEC 22, 1983, 10:41 RM    PRGE 15

*EJECT********
.IF_GRIN_MENU2
--------
"GRIN"+sk_bracket_6
"0 (MIN.)"
[cmd_if_no_gain
,new_if_gain( if_no_gain );
--------
" 1 "
[cmd_if_12db_gain
,new_if_gain( if_12db_gain );
--------
" 2 "
[cmd_if_24db_gain
,new_if_gain( if_24db_gain );
--------
" 3 "
[cmd_if_36db_gain
,new_if_gain( if_36db_gain );
--------
"4 (MRX.)"
[cmd_if_48db_gain
,new_if_gain( if_48db_gain );
--------
"RUTO"
[cmd_if_gain_auto
,new_if_gain( auto_range );
--------

--------

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4stin.work.L
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 PM    PAGE 16

^EJECT^^^^^^^
.STIMULUS_MENU
--------
"POWER"
"MENU"
[cmd_power_menu
^POWER_MENU
--------
"SWEEP"
"TIME"
[cmd_sweep_time
,select_active_function(active_sweep_time);
--------
"NUMBER of"
"POINTS"
^N_POINTS_MENU
[cmd_n_points_menu
--------

--------
"SINGLE"+sk_bracket_3
"POINT"
[end_cw
,BEGIN
,  hilight_on( cmd_cw, cmd_stepped);
,  cw_mode;
,END;
--------
"RAMP"
[end_swept
,BEGIN
,  hilight_on( cmd_cw, cmd_stepped);
,  swept_mode;
,END;
--------
"STEP"
[end_stepped
,BEGIN
,  hilight_on( cmd_cw, cmd_stepped);
,  stepped_mode;
,END;
--------
"MORE"
^STIMULUS2_MENU
]cmd_more
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 PM    PAGE 17

^EJECT^^^^^^^
.N_POINTS_MENU
--------
"POINTS:"+sk_bracket_4
"51 "
[cmd_51_points
,new_step_size( 16 );
--------
"101"
[cmd_101_points
,new_step_size( 8 );
--------
"201"
[cmd_201_points
,new_step_size( 4 );
--------
"401"
[cmd_401_points
,new_step_size( 2 );
--------

--------

--------

--------

--------
```

```
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^EJECT^^^^^^^
.POWER_MENU
--------
"POWER"
[cmd_source_power
,select_active_function(active_source_power);
--------

--------
"SLOPE"+sk_bracket_2
"ON "
(cmd_power_slope
,BEGIN
,   hilight_cn( cmd_power_slope, cmd_power_slope_off );
,   set_entry_ch_integer( power_slope_on, eh_power_slope_mode );
,   wrt_priv_ib_source( 811, newline);
,   select_active_function( active_power_slope );
,END;
--------
"OFF"
[cmd_power_slope_off
,BEGIN
,   hilight_on( cmd_power_slope, cmd_power_slope_off );
,   set_entry_ch_integer( power_slope_off, eh_power_slope_mode );
,   select_active_off( active_power_slope );
,   wrt_priv_ib_source( 810, "");
,END;
--------

--------
"ATTENUATOR"sk_bracket_2
"PORT 1"
[cmd_atten_port1
,select_active_function(active_atten_port1);
--------
"PORT 2"
[cmd_atten_port2
,select_active_function(active_atten_port2);
--------

--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 PM    PAGE 19

^EJECT^^^^^^^
.STIMULUS2_MENU
--------
sk_bracket_4
half_vt+"HOLD"
[cmd_hold
,hold_sweep;
--------
"SINGLE"
[cmd_single
,single_sweep;
--------
"NUMBER of"
"GROUPS"
[cmd_n_groups_kbd
,select_active_function(active_n_groups_kbd);
--------
"CONTINUOUS"
[end_continuous
,continuous_sweep;
--------
"STIMULUS"
"OFFSET"
,BEGIN                                                    & DEBUG &
,warn(command_not_implemented );                          & DEBUG &
,& select_active_function( active_stimulus_offset ); &
,END;                                                     & DEBUG &
--------

--------
sk_bracket_2
half_vt+"Ch1 = Ch2"
[end_couple_stimulus
,BEGIN
,  hilight_cn( cmd_couple_stimulus, cmd_uncouple_stimulus );
,  set_coupled_stimulus_status( TRUE );
,END;
--------
"Ch1 "+0163+" Ch2"
[cmd_uncouple_stimulus
,BEGIN
,  hilight_on( cmd_couple_stimulus, end_uncouple_stimulus );
,  set_coupled_stimulus_status( FALSE );
,END;
--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE 20

*EJECT*******
.DEVICE_READY_MENU
--------

--------
"PRESS TO"
"CONTINUE"
,BEGIN
,   previous_menu;
,   device_reversed;
,END;
--------

--------

--------

--------

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Sparams.work.L
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE 21

*EJECT*******
.PARAM_MENU
--------
"a"+177+ak_bracket_4
[cmd_user1
,new_parameter( user1 );
--------
"b"+178
[cmd_user2
,new_parameter( user2 );
--------
"a"+175
[cmd_user3
,new_parameter( user3 );
--------
"b"+177
[cmd_user4
,new_parameter( user4 );
--------

--------

--------
"REDEFINE"
"PARAMETER"
^REDEF_MENU
[cmd_redefine_param
--------

--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE 22

*EJECT*******
.REDEF_MENU
--------
"REDEFINE"+ak_bracket_E
"DRIVE"
^REDEF_DRIVE_MENU
--------
"PHASE LOCK"
^REDEF_LOCK_MENU
--------
"NUMERATOR"
^REDEF_NUM_MENU
--------
"DENOMI-"
"NATOR"
^REDEF_DENOM_MENU
--------
"CONVERSION"
^REDEF_CONV_MENU
--------
"PARAMETER"
"LABEL"
[cmd_label_parameter
,warn( command_not_implemented );
--------

--------
"REDEFINE"
"DONE"
[end_redefine_done
,pop_menu( PARAM_MENU );
--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE 23

*EJECT*******
.REDEF_DRIVE_MENU
--------
"DRIVE"+ak_bracket_3
"PORT 1"
,redefine_param( driven_port, driven_s1 );
--------
"PORT 2"
,redefine_param( driven_port, driven_a2 );
--------
"NONE"
,redefine_param( driven_port, driven_none );
--------

--------

--------

--------

--------

--------
```

```
SKINFO.WORK.PD851D              THU, DEC 22, 1983, 10:41 PM     PAGE  24

*EJECT*******
.REDEF_LOCK_MENU
--------
"LOCK to"+sk_bracket_3
"a1 "
,redefine_param( phase_lock_port, lock_to_a1 );
--------
"a2 "
,redefine_param( phase_lock_port, lock_to_a2 );
--------
"MOKE"
,redefine_param( phase_lock_port, lock_donot_care );
--------

--------

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```

```
SKINFO.WORK.PD851D              THU, DEC 22, 1983, 10:41 PM     PAGE  25

*EJECT*******
.REDEF_NUM_MENU
--------
"NUMERATOR"+sk_bracket_5
"b1 "
,redefine_param( nunerator_port, num_b1 );
--------
"b2 "
,redefine_param( nunerator_port, num_b2 );
--------
"a1 "
,redefine_param( numerator_port, num_a1 );
--------
"a2 "
,redefine_param( nunerator_port, num_a2 );
--------
"SERVICE"
"SELECTIONS"
^REDEF_NUM2_MENU
--------

--------

--------

--------
```

```
3KINFO.UORK.PD851D              THU, DEC 22, 1983, 10:41 AM     PAGE  26

*EJECT*******
.RECEF_NUM2_MENU
--------
"100 kHz"+sk_bracket_8
"TEST CAL"
,redefine_param( numerator_port, num_100khz_cal );
--------
"100 kHz"
"REF CAL"
,redefine_param( numerator_port, num_ref_100khz_cal );
--------
"DETECTOR"
"GROUND"
,redefine_param( numerator_port, num_detector_gnd );
--------
"RDC GROUND"
,redefine_param( nunerator_port, nun_edc_gnd );
--------
"VCAL"
,redefine_param( nunerator_port, nun_vcal );
--------
"VREF"
,redefine_param( numerator_port, num_vref );
--------
"TEMP. 1"
,redefine_param( numerator_port, num_temp1 );
--------
"TEMP. 2"
,redefine_param( nunerator_port, num_temp2 );
--------
```

```
SKINFO.UORK.PD851D              THU, DEC 22, 1983, 10:41 PM     PAGE  27

*EJECT*******
.REDEF_DENOM_MENU
--------
"DENOM."+sk_bracket_4
"a1 "
,redefine_param( denominator_port, denon_a1 );
--------
"a2 "
,redefine_param( denominator_port, denon_a2 );
--------
"b1 "
,redefine_param( denominator_port, denon_b1 );
--------
"NO RATIO"
,redefine_param( denominator_port, denon_no_ratio );
--------

--------

--------

--------
```

```
SKINFO.WORK.FDS510              INU, DEC 22, 1983, 10:41 AM     PAGE  25

*EJECT*******
.REDEF_CONV_MENU
--------
"CONVERT"+sk_bracket_4
"to   S"
[cnd_convert_off
,redefine_paran( parameter_conversion, conv_eff );
--------
"to 1/S"
[cnd_convert_rtcip
,redefine_paran( parameter_conversion, conv_reciprocal );
--------
"to   Z"
[cnd_convert_to_z
,redefine_paran( parameter_conversion, conv_s_to_z );
--------
"to   Y"
[cnd_convert_to_y
,redefine_paran( parameter_conversion, conv_t_to_y );
--------

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6format.work.L
```

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SKINFO.WORK.PDS510              INU, DEC 22, 1983, 10:41 AM     PAGE  29

EJECT*******
.FORMAT_MENU
--------
sk_bracket_5
half_vt+"SUR"
[end_eur
,neu_format( fnt_eur );
--------
"LINEAR"
"MAGNITUDE"
[cnd_linear_mag
,neu_format( fnt_linear_mag );
--------
"POLAR o/"
"LIN MKR"
[cnd_linear_polar
,neu_format( fnt_linear_polar );
--------
"POLAR m/"
"LOG MKR"
[cnd_log_polar
,neu_format( fnt_log_polar );
--------
"POLAR u/"
"Re/Im MKR"
[cnd_ineg_va_raal
,neu_format( fnt_ineg_vt_real );
--------
"INVERTED"
"SMITH"
[cnd_y_smith
,neu_format( fnt_y_smith );
--------
"IMAGINARY"
[cnd_imaginary
,new_format( fnt_imaginary );
--------
"RERL"
[cnd_real
,new_format( fnt_real );
--------

Bdonnenu.work.L
```

```
SKINFO.WORK.PD8510              TNU, DEC 22, 1983, 10:41 AM     PAGE  30

*EJECT********
.DOMAIN_MENU
--------
sk_bracket_4
half_vt+"FREQUENCY"
[cnd_freq_domain
,BEGIN
,   hilight_on( cnd_freq_domain, end_aux_domain);
,   set_domain( freq_domain );
,END;
--------
"TIME"
"LOW PASS"
^LOW_PASS_FREQ
[cnd_low_pass_request
--------
"TIME"
"BAND PASS"
[end_time_domain
,BEGIN
,   hilight_on( cnd_frtq_domain, cnd_aux_domain);
,   set_domain( time_domain );
,END;
--------
"AUX. VOLT"
"OUTPUT"
[end_aux_domain
,BEGIN
,   warn( command_not_implemented );                    & DEBUG &
,   hilight_on( cnd_freq_domain, cnd_aux_domain);
,   act_domain( aux_domain );
,END;
--------

--------
"SPECIFY"+sk_bracket_2
"TIME"
[cnd_setup_time_domain
^TIME_SETUP_MENU
--------
"GATE"
[cnd_setup_gate_domain
^GATE_SETUP_MENU
,select_active_gate( 0 );                  & turn on gate markers &
--------

--------
```

```
SKINFO.WORK.PDS510              TNU, DEC 22, 1983, 10:41 AM     PAGE  31

*EJECT*******
.LOW_PASS_FREQ
--------

--------
"SET FREQ."
"(LOW PASS)"
[end_tdr_domain
,BEGIN
,   tdr_check;
,   hilight_key( cnd_low_pass_request, cnd_freq_domain, cnd_aux_domain);
,   set_domain( tdr_domain );
,   previous_menu;
,END;
--------

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--------
```

```
SKINFO.WORK.POS510          TNU, DEC 22, 1983, 10:41 AM    PAGE  32

*EJECT*******
.TIME_SETUP_MENU
--------
"LOW PASS:"+ek_bracket_2
"STEP"
[cmd_tdr_step
,BEGIN
,   hilight_on( cmd_tdr_step, cmd_tdr_impulse);
,   set_entry_ch_integer( step_tdr, ch_tdr_stimulus_type );
,   update_domain_vars;
,END;
--------
"IMPULSE"
[cmd_tdr_impulse
,BEGIN
,   hilight_on( cmd_tdr_step, cmd_tdr_impulse);
,   set_entry_ch_integer( impulse_tdr, ch_tdr_stimulus_type );
,   update_domain_vars;
,END;
--------

--------

--------
"WINDOW:"+ek_bracket_3
"MAXIMUM"
[cmd_max_time_window
,set_time_window( max_window);
--------
"NORMAL"
[cmd_normal_time_window
,set_time_window( normal_window);
--------
"MINIMUM"
[cmd_min_time_window
,set_time_window( min_window);
--------

--------
```

```
SKINFO.WORK.POS510          TNU, DEC 22, 1983, 10:41 AM    PAGE  33

*EJECT*******
.GATE_SETUP_MENU
--------
"GATE"+ek_bracket_2
"ON"
[cmd_gate_on
,BEGIN
,   set_entry_ch_integer( gate_on, ch_gating );
,   set_gate_status;
,END;
--------
"OFF"
[cmd_gate_off
,BEGIN
,   set_entry_ch_integer( gate_off, ch_gating );
,   marker_state := marker_state AND gate_markers_off;
,   set_gate_status;
,END;
--------
"GATE"+ek_bracket_4
"START"
[cmd_gate_start
,select_active_gate( active_gate_start );
--------
"STOP"
[cmd_gate_stop
,select_active_gate( active_gate_stop );
--------
"CENTER"
[cmd_gate_center
,select_active_gate( active_gate_center );
--------
"SPAN"
[cmd_gate_span
,select_active_gate( active_gate_span );
--------
"GATE SHAPE"
^GATE_SHAPE_MENU
--------

--------
```

```
SKINFO.WORK.POS510          TNU, DEC 22, 1983, 10:41 AM    PAGE  34

*EJECT*******
.GATE_SHAPE_MENU
--------

--------

--------

--------

--------
"GATE SHAPE"+ek_bracket_4
"MAXIMUM"
[cmd_max_gate_window
,set_gate_window( max_gate );
--------
"WIDE"
[cmd_wide_gate_window
,set_gate_window( wide_gate );
--------
"NORMAL"
[cmd_normal_gate_window
,set_gate_window( normal_gate );
--------
"MINIMUM"
[cmd_min_gate_window
,set_gate_window( min_gate );
--------

?calmenu.work.L
```

```
SKINFO.WORK.POS510          THU, DEC 22, 1983, 10:41 AM    PAGE  35

*EJECT*******
.CAL_MENU
--------
"CORRECTION"+ek_bracket_3
"ON"
[cmd_correction_on
,correction_on(default_cal_set);
--------
"OFF"
[cmd_correction_off
,correction_off;
--------
"SELECT"
"CAL SET"
[end_correction_default
,BEGIN
,   tell( select_cal_set );
,   gen_cal_info( no_op );
,END;
--------

--------
"CALIBRATE"+ek_bracket_3
"( KIT #1 )"
[cmd_cal_kit_1
,if_correct_off_select_cal_kit( 1 );
--------
"CALIBRATE"
"( KIT #2 )"
[cmd_cal_kit_2
,if_correct_off_select_cal_kit( 2 );
--------
"RESUME CAL"
"SEQUENCE"
,resume_cal;
--------
"MORE"
]cmd_more
^MORE_CAL
--------
```

```
SKINFO.WORK.PD5510          THU, DEC 22, 1983, 10:41 AM    PAGE  36

*EJECT******
.MORE_CRL
--------
"REFERENCE"
"PLANES"
^REF_PLANE_MENU
[cmd_ref_plane_menu
--------
"SET Z"+176
,select_active_function( active_eyeten_z0 );
--------
"CHL SWEEP"
"VOLTAGE"
,warn(command_not_implemented);
--------

--------
"MODIFY KIT"+sk_bracket_2
"( KIT 41 )"
[cmd_modify_cal_kit_1
^MODIFY_CAL_KIT_MENU
,select_cal_kit( 1 );
--------
"MODIFY KIT"
"( KIT 02 )"
[cod_modify_cal_kit_2
^MODIFY_CAL_KIT_MENU
,select_cal_kit( 2 );
--------

--------
"DELETE A"
"CHL SET"
[cmd_delete_cal
,BEGIN
,   tell( select_delete_cal_set );
,   gen_cal_info( clear_op );
,END;
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  37

*EJECT******
.REF_PLANE_MENU
--------

--------

--------
sk_bracket_2
Half_vt+"PLANE 1"
[cmd_ref_plane_1
,select_active_function( active_ref_plane_1 );
--------
"PLANE 2"
[cmd_ref_plane_2
,select_active_function( active_ref_plane_2 );
--------

--------

--------

--------

--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  38

*EJECT******
.CHL_TYPE_MENU
--------

--------
"SET FREQ."
"(LOW PASS)"
[cod_freq_setup
,tdr_check;
--------

--------
"FREQUENCY"+sk_bracket_5
"RESPONSE"
[cmd_response_type
,set_cal_type( response );
--------
"S"+177+177+"  "
"1-PORT"
[end_1_port_1_type
,set_cal_type( one_port_on_1 );
--------
"S"+178+178+"  "
"1-PORT"
[cmd_1_port_2_type
,set_cal_type( one_port_on_2 );
--------
"ONE-PATH"
"2-PORT"
[cmd_simple_2_port_type
,set_cal_type( simple_two_port );
--------
"FULL"
"2-PORT"
[cmd_2_port_type
,set_cal_type( two_port );
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  39

*EJECT******
.PORT_ONE_REFL
--------
"S"+177+177+"  "+sk_bracket_3
"PORT1 STD1"
[cmd_port1_etd1
,set_etd_class( port1_1st_std );
--------
"PORT1 STD2"
[cmd_port1_std2
,set_etd_class( port1_2nd_etd );
--------
"PORT1 STD3"
[end_port1_std3
,set_etd_class( port1_3rd_std );
--------

--------

--------

--------

--------
"SAVE"
"S"+177+177+" CAL"
[cmd_done_1_port_on_1
,cal_done( done_1_port_on_1 );
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  40

*EJECT*******
.PORT_TWO_REFL
--------
"S"+178+178+"  "+sk_bracket_3
"PORT2 STD1"
[cnd_port2_std1
,set_std_class( port2_1st_std );
--------
"PORT2 STD2"
[cnd_port2_std2
,set_std_class( port2_2nd_std );
--------
"PORT2 STD3"
]cnd_port2_std3
,tet_std_clasa( port2_3rd_std );
--------

--------

--------

--------

--------
"SAVE"
"S"+178+175+" CRL"
[cnd_done_1_port_on_2
,cal_done( done_1_port_on_2 );
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  41

*EJECT*******
.CRL_MENU2
--------
sk_bracket_3
half_vt+"REFLECT'N"
[end_cal_reflection
^REFLECTION_MENU
,check_refl_status;
--------
"TRANS-"
"MISSION"
[end_cal_thru
^TRANSMISSION_MENU
,tell( connect_thru );
--------
"ISOLATION"
[end_cal_isolation
^ISOLATION_MENU
,tell( isolate_ports );
--------

--------

--------

--------

--------
"SAVE"
"2-PORT CAL"
[cnd_done_2_port
,cal_done( done_2_port );
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  42

*EJECT*******
.REFLECTION_MENU
--------
"S"+177+177+"  "+sk_bracket_3
"PORT1 STD1"
]cnd_port1_std1
--------
"PORT1 STD2"
)cnd_port1_std2
--------
"PORT1 STD3"
)cnd_port1_std3
--------
"S"+178+178+"  "sk_bracket_3
"PORT2 STD1"
)cnd_port2_std1
--------
"PORT2 STD2"
)cnd_port2_std2
--------
"PORT2 STD3"
]cnd_port2_std3
--------

--------
"REFLECT'N"
"DONE"
[cnd_done_reflection
,cal_done( done_reflection );
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  43

*EJECT*******
.TRANSMISSION_MENU
--------

--------
"FWD.TRANS."
"FWD_TRANS_"
[cnd_fwd_transmission
,   set_std_class( trans_fwd_std );
--------
"FWD.MATCH"
"FWD_MATCH_"
[cnd_fwd_match
,   set_std_class( match_fwd_std  );
--------
"REV.TRANS."
"REV_TRANS_"
[cnd_rev_transmission
,   set_std_class( trans_rev_std );
--------
"REV.MATCH"
"REV_MATCH_"
[cnd_rev_match
,   set_std_class( match_rev_std );
--------

--------

--------
"TRANS."
"DONE"
[cnd_done_trans
,cal_done( done_trans );
--------
```

```
SKINFO.WORK.POS510          THU, DEC 22, 1983, 10:41 AM    PAGE 44

#EJECT*******
.ISOLATION_MENU
--------

--------

--------
"OMIT"
"ISOLATION"
[cmd_omit_isolation
,omit_isolation;
--------

--------
"FWD ISOL'N"
"FWD_ISOLN_"
[cmd_fwd_isolation
,set_etd_class( isoln_fwd_etd );
--------
"REV ISOL'N"
"REV_ISOLN_"
[cmd_rev_isolation
,set_etd_class( isoln_rev_etd );
--------

--------
"ISOLATION"
"DONE"
[cmd_donc_isolation
,coi_dens(done_isol);
--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE 45

#EJECT*******
.CAL_MENU3
--------
sk_bracket_3
half_vts*"REFLECT'N"
[end_cal_simple_reflection
^SIMPLE_REFLECTION_MENU
,check_refl_status;
--------
"TRANS-"
"MISSION"
[end_cal_simple_thru
^SIMPLE_TRANSMISSION_MENU
,tell( connect_thru );
--------
"ISOLATION"
[end_cal_simple_isolation
^SIMPLE_ISOLATION_MENU
,tell( isolate_ports );
--------

--------

--------

--------

--------
"SAVE"
"2-PORT CAL"
]cmd_done_2_port
--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE 46

#EJECT*******
.SIMPLE_REFLECTION_MENU
--------
"S"+177+177+sk_bracket_3
"PORT1 STD1"
]cmd_port1_std1
--------
"PORT1 S102"
]cmd_port1_std2
--------
"PORT1 S103"
]cmd_port1_std3
--------

--------

--------

--------

--------
"REFLECT'N"
"DONE"
[end_done_simple_reflection
,cal_done( done_1_port_on_1 );
--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE 47

#EJECT*******
.SIMPLE_TRANSMISSION_MENU
--------

--------
"FWD.TRANS."
"FWD_TRANS_"
]cmd_fwd_transmission
--------
"FWD.MATCH"
"FWD_MATCH_"
]cmd_fwd_match
--------

--------

--------

--------

--------
"TRANS."
"DONE"
]cmd_done_trans
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  48

*EJECT*******
.SIMPLE_ISOLATION_MENU
--------

--------

--------
"OMIT"
"ISOLATION"
]cmd_omit_isolation
--------

--------
"FWD ISOL'N"
"FWD_ISOLN_"
]cmd_fwd_isolation
--------

--------

--------
"ISOLATION"
"DONE"
]cmd_done_isolation
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  49

*EJECT*******
.STD_CLASS_MENU
--------
"STANDARD 1"
[cmd_class_std1
,set_element( 1 );
--------
"STANDARD 2"
[cmd_class_std2
,set_element( 2 );
--------
"STANDARD 3"
[cmd_class_std3
,set_element( 3 );
--------
"STANDARD 4"
[cmd_class_std4
,set_element( 4 );
--------
"STANDARD 5"
[cmd_class_std5
,set_element( 5 );
--------
"STANDARD 6"
[cmd_class_std6
,set_element( 6 );
--------
"STANDARD 7"
[cmd_class_std7
,set_element( 7 );
--------
"STANDARDS "
"DONE"
[cmd_class_done
,cal_done(done_class);
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  50

*EJECT*******
.SLIDING_LOAD_MENU
--------
"SLIDE IS"
"SET"
,acquire_data;
--------

--------

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--------

--------
"SLIDING"
"LOAD DONE"
,compute_load;
--------

Cstdmenu.work.L
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  51

*EJECT*******
.MODIFY_CAL_KIT_MENU
--------
"SELECT"
"STANDARD"
[cmd_select_std
,select_active_function( active_std_id );
--------

--------
"SPECIFY"
"SIO CLASS"
[cmd_specify_classes
^SPECIFY_CLASS_MENU
,tell( select_std_class );
--------
"LABEL"
"STD CLASS"
[cmd_label_classes
,warn( command_not_implemented );
--------

--------
"LABEL"
"CAL KIT"
[cmd_label_cal_kit
,warn( command_not_implemented );
--------

--------
"DONE"
^(DEFINED)"
[cmd_cal_kit_defined
,cal_kit_defined;
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  52

#EJECT*******
.MODIFY_STOS_MENU
--------
"SID TYPE"+sk_bracket_5
"OPEN"
[cmd_define_open
^DEFINE_OPEN_MENU
,define_std( std_open );
--------
"SHORT"
[cmd_define_short
^DEFINE_SHORT_MENU
,define_std( std_short );
--------
"LOAD"
[cmd_define_load
^DEFINE_LOAD_MENU
,BEGIN
,   hilight_load_type;
,   define_std( std_load );
,END;
--------
"DELAY/"
"THRU"
[cmd_define_air_line
^SPECIFY_OFFSET_MENU
,BEGIN
,   hilight_offset_type;
,   define_std( std_thru );
,END;
--------
"ARBITRARY"
"IMPEDANCE"
[cmd_define_z
^SPECIFY_Z_MENU
,BEGIN
,   hilight_load_type;
,   define_std( std_z );
,END;
--------

--------

--------

--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  53

#EJECT*******
.DEFINE_OPEN_MENU
--------
" C"+t75+" "
[cmd_open_c0
,select_active_function( active_open_c0 );
--------
" C"+t77+" "
[cmd_open_c1
,select_active_function( active_open_c1 );
--------
" C"+t78+" "
[cmd_open_c2
,select_active_function( active_open_c2 );
--------

--------

--------
"SPECIFY"
"OFFSET"
[end_specify_offset
^SPECIFY_OFFSET_MENU
,hilight_offset_type;
--------
"LABEL STD"
[cmd_label_cal_std
,warn( command_not_implemented );
--------
"DONE"
"(DEFINED)"
[end_cal_std_defined
,pop_menu( MODIFY_CNL_KIT_MENU );
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  54

#EJECT*******
.DEFINE_SHORT_MENU
--------

--------

--------

--------

--------

--------
"SPECIFY"
"OFFSET"
]cmd_specify_offset
^SPECIFY_OFFSET_MENU
--------
"LABEL STD"
]cmd_label_cal_std
--------
"DONE"
"(DEFINED)"
]cmd_cal_std_defined
--------
```

```
SKIKFO.WORK.PD8510          THU, DEC 22, 1883, 10:41 AM    PAGE  55

#EJECT*******
.DEFINE_LOAD_MENU
--------

--------

--------

--------
sk_bracket_2
half_vt+"FIXED"
[cmd_fixed_load
,define_type2( fixed );
--------
"SLIDING"
[cmd_sliding_load
,define_type2( sliding );
--------
"SPECIFY"
"OFFSET"
]end_specify_offset
^SPECIFY_OFFSET_MENU
--------
"LABEL STD"
]cmd_label_cal_std
--------
"DONE"
"(DEFINED)"
]cmd_cal_std_defined
--------
```

```
SKINFO.UORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE  56

#EJECT*******
.SPECIFY_Z_MENU
--------
" C"+176+" "
]cnd_open_c0
--------
" C"+177+" "
]cnd_open_c1
--------
" C"+178+" "
]cnd_open_c2
--------
ok_bracket_2
half_vt+"FIXED"
]cnd_fixed_load
--------
"SLIDING"
]cnc_sliding_load
--------
"SPECIFY"
"OFFSET"
]cnd_specify_offset
^SPECIFY_OFFSET_MENU
--------
"LABEL STD"
]cnd_label_cal_std
--------
"DONE"
"(DEFINED)"
]cnd_cal_etd_defined
--------
```

```
SKINFO.UORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  57

#EJECT*******
.SPECIFY_OFFSET_MENU
--------
"OFFSET"
"DELAY"
[cnd_offset_delay
,select_active_function( active_offset_delay );
--------
"OFFSET"
"LOSS"
[cnd_offset_loss
,select_active_function( active_offset_loss );
--------
"OFFSET"
" Z"+176+" "
[cnd_offset_z0
,select_active_function( active_offset_z0 );
--------
"LOWER"
"FREQUENCY"
[cnd_offset_min_f
,select_active_function( active_offset_min_freq );
--------
"UPPER"
"FREQUENCY"
[cnd_offset_max_f
,select_active_function( active_offset_max_freq );
--------
ok_bracket_2
half_vt+"COAX"
[cnd_coax
,define_type2( coax );
--------
"WAVEGUIDE"
[cnd_waveguide
,define_type2( waveguide );
--------
"DONE"
"(DEFINED)"
,previous_menu;
--------
```

```
SKINFO.UORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE  58

#EJECT*******
.SPECIFY_CLASS_MENU
--------
"S"+177+177+":  "
"1st STD"
[cnd_port1_1st_std
,std_class( port1_1st_std );
--------
"2nd STD"
[cnd_port1_2nd_std
,std_class( port1_2nd_std );
--------
"3rd STD"
[cnd_port1_3rd_std
,std_class( port1_3rd_std );
--------
"S"+178+178+":  "
"1st STD"
[cnd_port2_1st_std
,std_class( port2_1st_std );
--------
"2nd STD"
[cnd_port2_2nd_std
,std_class( port2_2nd_std );
--------
"3rd STD"
[cnd_port2_3rd_std
,std_class( port2_3rd_std );
--------
"MORE"
^SPECIFY_CLASS_MENU2
--------
"DONE"
"(SPEC'D)"
[cnd_std_class_specified
,pop_menu(MODIFY_CAL_KIT_MENU);
--------
```

```
SKINFO.UORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  59

#EJECT*******
.SPECIFY_CLASS_MENU2
--------
"TRANS.:"
"FWD STD"
[cnd_trans_fwd_std
,std_class( trans_fwd_std );
--------
"REV STD"
[cnd_trans_rev_std
,std_class( trans_rev_std );
--------

--------
"FREQUENCY"
"RESP. STD"
[cnd_freq_resp_std
,std_class( freq_resp_std );
--------

--------

--------

--------
"DONE"
"(SPEC'D)"
]cnd_std_class_specified
--------

Sdisp.work.L
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE 60

#EJECT*******
.DISPLAY_MENU
--------
"SINGLE "+ek_bracket_2
"CHANNEL"
[cmd_single_ch
,select_trace_mode( single_ch );
--------
"DUAL   "
"CHANNEL"
[cmd_dual_ch
^DUAL_CH_MENU
--------
ek_bracket_4
half_vt+"DATA"
[cmd_data
,set_trace_type( trace_data );
--------
"MEMORY"
[cmd_mem
,set_trace_type( trace_mem );
--------
#DATA "a3&
"MEMORY"
[cmd_d_and_m
,set_trace_type( trace_data_and_mem );
--------
"MATH"
"(...)"
[cmd_math
,set_trace_type( entry_ch_integer[eh_math_op] );
--------
#SELECT"
"DEFAULTS"
^DISPLAY_DEFAULT_MENU
--------
"DATA "+1S9
"MEMORY"
[cmd_d_into_m
,set_trace_type( trace_data_into_mem );
--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE 61

#EJECT*******
.DUAL_CH_MENU
--------
"2 CHANNEL"+ek_bracket_2
"OVERLAY"
[cmd_overlay
,select_trace_mode( overlay );
--------
"2 CHANNEL"
"SPLIT"
[cmd_split
,select_trace_mode( split );
--------

--------

--------

--------

--------

--------

--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE 62

#EJECT*******
.DISPLAY_DEFAULT_MENU
--------
"MEMORY"+ek_bracket_5
" 1 "
[cmd_memory1
,select_memory( mem1 );
--------
" 2 "
[cmd_memory2
,select_memory( mem2 );
--------
" 3 "
[cmd_memory3
,select_memory( mem3 );
--------
" 4 "
[cmd_memory4
,select_memory( mem4 );
--------
"MORE"
^MEMORY_MENU
--------

--------
"MATH"
"OPERATIONS"
^MATH_MENU
--------

--------
```

```
SKINFO.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE 63

#EJECT*******
.MEMORY_MENU
--------

--------

--------

--------

--------
"DATA from"+ek_bracket_2
"CHANNEL 1"
[cmd_memory_ch1
,select_memory( data1 );
--------
"DATA from"
"CHANNEL 2"
[cmd_memory_ch2
,select_memory( data2 );
--------

--------

--------
```

```
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#EJECT*******
.MATH_MENU
--------

--------

--------

--------
"DATA"+sk_bracket_2
"+ MEMORY"
[cmd_d_plus_m
,select_math_op( trace_data_plus_mem );
--------
"DATA"
"- MEMORY"
[cmd_d_minus_m
,select_math_op( trace_data_minus_mem );
--------
"DATA"
mpy_char+" MEMORY"
[cmd_d_mpy_m
,select_meth_op( trace_data_times_mem );
--------
"DATA"
"/ MEMORY"
[cmd_d_div_m
,select_math_op( trace_data_div_mem );
--------

--------

2plot.work.L
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE  65

#EJECT*******
.COPY_MENU
--------
"PLOT"+sk_bracket_5
"ALL"
[cmd_plot_all
,select_plot_buffer (all);
--------
"TRACE"
[cmd_plot_trace
,select_plot_buffer (trace);
--------
"GRATICULE"
[cmd_plot_graticule
,select_plot_buffer (grid);
--------
"MARKER(S)"
[cmd_plot_marker
,select_plot_buffer (markers);
--------
"TEXT"
[cmd_plot_text
,select_plot_buffer (annotations);
--------
"SELECT"
"QUADRANT"
^PLOT_SETUP_MENU
--------
"SELECT"
"PEN COLOR"
[cmd_ch1_pen
^PEN_MENU
--------
"MORE"
^PLOTPARM_MENU
--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE  66

#EJECT*******
.PLOTPARM_MENU
--------
"LIST TRACE"
"VALUES"
[cmd_list_trace
,IF printer_connected THEN
,  BEGIN
,    abort_sweep;
,    list_trace_values;
,    restart_sweep;
,  END;
--------

--------

--------

--------

--------
"SYSTEM"+sk_bracket_2
"PARAMETERS"
^COPY2_MENU
[cmd_system_params
,select_plot_param (sys_params);
--------
"OPERATING"
"PARAMETERS"
^COPY2_MENU
[cmd_op_parant
,select_plot_param (op_params);
--------
```

```
SKINFO.WORK.PDS510          THU, DEC 22, 1983, 10:41 AM    PAGE  67

#EJECT*******
.PLOT_SETUP_MENU
--------

--------
"K -   LEFT"+sk_bracket_5
"- -  UPPER"
[cmd_quadrant_11
,select_plot_quadrant (upper_left);
--------
"- -   LEFT"
"K -  LOWER"
[cmd_quadrant_21
,select_plot_quadrant (lower_left);
--------
"- K  RIGHT"
"- -  UPPER"
[cmd_quadrant_12
,select_plot_quadrant (upper_right);
--------
"- -  RIGHT"
"- K  LOWER"
[cmd_quadrant_22
,select_plot_quadrant (lower_right);
--------
"K K   FULL"
"K K   PAGE"
[cmd_quadrant_full
,select_plot_quadrant (full_page);
--------

--------

--------
```

```
SKINFB.WORK.PD8510          1HO, DEC 22, 1983, 10:41 AM    PAGE  68

*EJECT*******
.PEN_MENU
--------
"PEN"+sk_bracket_8
" 1 "
(end_pen1
,select_pen(1);
--------
" 2 "
[cmd_pen2
,select_pen (2);
--------
" 3 "
[cnd_pen3
,select_pen (3);
--------
" 4 "
[cnd_pen4
,select_pen (4);
--------
" 5 "
[cnd_pen5
,select_pen (5);
--------
" 6 "
[cn4_pen6
,select_pen (6);
--------
" 7 "
[cnd_pen7
,select_pen (7);
--------
" 8 "
[cnd_pen8
,select_pen (8);
--------
```

```
SKINFO.UORK.PD8510          TMU, DEC 22, 1983, 10:41 AM    PADE  70

*EJECT*******
.MARKER_MENU
--------
"MARKER"+mk_bracket_6
"       1 "
[cnd_marker_1
,select_marker(1);
--------
"       2 "
[cnd_marker_2
,select_marker(2);
--------
"       3 "
[cnd_marker_3
,select_marker(3);
--------
"       4 "
[cnd_marker_4
,select_marker(4);
--------
"       5 "
[cnd_marker_5
,select_marker(5);
--------
"ALL"
"OFF"
(cnd_marker_oFF
,select_marker(0);
--------
delta_char+" MODE"
"MENU"
^DELTA_MARKER_MENU
(cnd_delta_marker
--------
"MORE"
^MARKER2_MENU
]cnd_nere
--------
```

```
SKINFO.UOBK.PD8510          IMU, DEC 22, 1983, 10:41 AM    PAGE  63

*EJECT*******
.COPY2_MENU
--------
"BESTORE"
"DISPLAY"
]cnd_directery_off
--------
ak_bracket_2
half_vt+"PRIht"
[cnd_print_parane
,IF printer_connecte4 THEM
,  output_parameters;
--------
"PLOT"
[end_plet_parane
,dunp_te_plotter;
--------

--------

--------

--------

--------
"NGXT PAGE"
[cnd_next_op_naran
,nast_op_paran;
--------

9mkr.work.L
```

```
SKINFD.UORK.PD8S10          TMU, DEC 22, 1983, 10:41 AM    PAGE  71

*EJECT*******
.DELTR_MARKER_MENU
--------
sk_bracket_6
half_vt+delta_char+" REF = 1"
[cnd_ref_mkr1
,select_ref_marker( 1 );
--------
delta_char+" REF = 2"
[cnd_ref_mkr2
,select_ref_marker( 2 );
--------
delta_char+" REF = 3"
[end_ref_mkr3
,select_ref_marker( 3 );
--------
delta_char+" REF = 4"
[end_ref_mkr4
,select_ref_marker( 4 );
--------
delta_char+" REF = 5"
[cnd_ref_mkr5
,select_ref_marker( 5 );
--------
delta_char+" MODE"
"OFF"
[cnd_no_ref_mkr
,select_ref_marker( 0 );
--------

--------

--------
```

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*EJECT*******
.MARKER2_MENU
--------

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--------

--------

--------

--------
"MARKER to"+sk_bracket_2
"MINIMUM"
[cnd_mkr_to_min
,marker_to( mkr_to_min );
--------
"MAXIMUM"
[cnd_mkr_to_max
,marker_to( mkr_to_max );
--------

Asystem.work.U
```

```
SKINFO.WORK.PDB510          THU, DEC 22, 1983, 10:41 AM    PAGE  73

*EJECT*******
.SYSTEM_MENU
--------
"TITLE"
[end_title
^TITLE_MENU
,select_active_function( activc_title );
--------
"HP-IB"
"ADDRESSES"
[end_hpib_info
^HPIB_MENU
--------
"CRT"
"OFF"
[cnd_crt_off
,warn(command_not_implemented);
--------

--------

--------

--------
"SERVICE"
"FUNCTIONS"
[end_service_menu
^SERVICE_MENU
--------
```

```
SKINFO.WORK.PDB510          THU, DEC 22, 1983, 10:41 AM    PAGE  74

*EJECT*******
.TITLE_MENU
--------
"SELECT"
"LETTER"
,enter_title_char( char_index );
--------

--------
"SPACE"
,enter_title_char( space_index );
--------
"BACKSPACE"
,enter_title_char( bachspace_index );
--------

--------
"ERASE"
"TITLE"
[cnd_erase_title
,erase_title;
--------

--------
"DONE"
[cnd_title_done
,BEGIN
,   select_active_off( active_title );
,   previous_menu;
,END;
--------
```

```
SKINFO.WORK.PDB510          THU, DEC 22, 1983, 10:41 AM    PAGE  75

*EJECT*******
.HPIB_MENU
--------
"8510 HP-IB"+sk_bracket_8
"ADDRESS"
[cnd_8510_addr
,select_active_function( active_R510_hpib_addr );
--------
"SYSTEM BUS"
[cnd_system_bus_addr
,select_active_function( active_system_bus_hpib_addr );
--------
"SOURCE"
[end_source_addr
,select_active_function[ active_source_hpib_addr );
--------
"TEST SET"
[cnd_test_set_addr
,select_active_function( active_testset_hpib_addr );
--------
"PLOTTER"
[cnd_plotter_addr
,select_active_function( active_plotter_hpib_addr );
--------
"PRINTER"
[cnd_printer_addr
,select_active_function( active_printer_hpib_addr );
--------
"AUTO CMD"
[end_auto_cmd_addr
,select_active_function( active_ch_cmd_hpib_addr );
--------
"PASS THRU"
[cnd_pass_thru_addr
,select_active_function( active_pass_thru_hpib_addr );
--------
```

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```
^EJECT^^^^^^^
_SERVICE_MENU
--------
"SOFTWARE"
"REVISION"
(cmd_revision
,select_active_function( active_revision );
--------
"SYSTEM BUS"+sk_bracket_2
"'LOCAL'"
[cmd_privib_local
,BEGIN
,   hilight_en( cmd_privib_local, cmd_privib_remote );
,   abort_sweep;
,   clr_ren_priv_ib;
,   wrt_priv_ib_source(  display_on, " " );
,END;
--------
"^REMOTE^"
[cmd_privib_remote
,BEGIN
,   hilight_on( cmd_privib_local, cmd_privib_remote );
,   abort_sweep;
,COMMENT
,   set_ren_priv_ib;
,COMMENT
,   wrt_priv_ib_source(  display_off, " " );
,   reset_priv_ib_act_func;
,   restart_sweep;
,END;
--------
"IF GAIN"
^IF_GAIN_MENU
[cmd_if_gain_menu
--------
sk_bracket_3
half_vt+"LOCATION"
[cmd_peek_poke_addr
,select_active_function( active_address );
--------
"PEEK"
[cmd_peek
,select_active_function( active_peek );
--------
"POKE"
[cmd_poke
,select_active_function( active_poke );
--------
"TEST MENU"
[cmd_test_menu
,BEGIN
,   trap_15_type := service_trap;
,   TRAP(15);
,END;
--------
```

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```
^

Ocmdcase.work.L

[cmd_illegal
,warn(invalid_command);
;
; The following commands MUST be contiguous!
; Do NOT insert commands in between (for the parser's sake)
;
[cmd_enter
,keypad_entry(e0);
[cmd_u1
,keypad_entry(e0);
[cmd_u2
,keypad_entry(e3);
[cmd_u3
,keypad_entry(e6);
[cmd_u4
,keypad_entry(e9);
;
; END of contiguous command entries
;
[cmd_mkrval
,marker_value_entry;
[cmd_up
,step_entry(step_up);
[cmd_down
,step_entry(step_down);
[cmd_entry_off
,select_actise_function(active_off);
[cmd_save
,gen_save_menu(5);
[cmd_save_1
,save( 1 );
[end_save_2
,save( 2 );
[end_save_3
,save( 3 );
[end_save_4
,save( 4 );
[cmd_save_5
,save( 5 );
[cmd_recall
,gen_save_menu(6);
[cmd_recall_1
,recall( 1 );
[cmd_recall_2
,recall( 2 );
[cmd_recall_3
,recall( 3 );
[end_recall_4
,recall( 4 );
[cmd_recall_5
,recall( 5 );
[cmd_recall_last
```

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```
,recall( 8 );
[cmd_tape_menu
,gen_menu(TAPE_MENU, 0);
[cmd_copy
,gen_menu(COPY_MENU, 0);
[cmd_doc
,warn(command_not_implemented);
[cmd_quote
,select_active_function(active_off);
[cmd_label
,select_active_function(active_off);
[cmd_key_1
,process_softkey(1);
[cmd_key_2
,process_softkey(2);
[cmd_key_3
,process_softkey(3);
[cmd_key_4
,process_softkey(4);
[cmd_key_5
,process_softkey(5);
[cmd_key_6
,process_softkey(6);
[cmd_key_7
,process_softkey(7);
[cmd_key_8
,process_softkey(8);
[cmd_ch1
,select_entry_ch(1);
[cmd_s11
,BEGIN & s11 &
,   hilight_off( cmd_user1, cmd_user4);
,   neu_parameter(s11);
,END;  & s11 &
[cmd_s12
,BEGIN & s12 &
,   hilight_off( cmd_user1, cmd_user4);
,   neu_parameter(s12);
,END;  & s12 &
[end_s21
,BEGIN & s21 &
,   hilight_off( cmd_user1, cmd_user4);
,   neu_parameter(s21);
,END;  & s21 &
[cmd_s22
,BEGIN & s22 &
,   hilight_off( cmd_user1, cmd_user4);
,   neu_parameter1s22);
,END;  & s22 &
[cmd_msg
,new_format[ fnt_log_mag );
[cmd_phase
,new_format( fnt_phase );
[cmd_ch2
,select_entry_ch(2);
[cmd_delay
```

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```
,new_format( fnt_delay );
[cmd_polar
,neu_format( fnt_z_smith );
[end_param_menu
,gen_menu(PRRRM_MENU, 0);
[end_format_menu
,gen_menu(FORMAT_MENU, 0);
[cmd_preset
,recall_preset_state;
[cmd_local
,gen_menu(MPIB_MENU, 1);
[cmd_scale
,select_active_function(active_scale);
[cmd_ref_value
,select_active_function(active_ref_value);
[cmd_start
,select_active_stimulus(active_start);
[cmd_stop
,select_active_stimulus(active_stop);
[cmd_ref_position
,select_active_function(active_ref_pos);
[cmd_auto_scale
,auto_scale;
[end_center
,select_active_stimulus(active_center);
[cmd_span
,select_active_stimulus(active_span);
[cmd_response_menu
,gen_menu(RESPONSE_MENU, 0);
[cmd_stimulus_menu
,gen_menu(STIMULUS_MENU, 0);
[end_cal_menu
,gen_menu(CRL_MENU, 0);
[cmd_display_menu
,gen_menu(DISPLAY_MENU, 0);
[cmd_marker_menu
,BEGIN
,   select_marker( active_marker );
,   gen_menu(MARKER_MENU, 0);
,END;
[cmd_system_menu
,gen_menu(SYSTEM_MENU, 0);
[cmd_prior_menu
,previous_menu;
[cmd_measurement_restart
,measurement_restart;
[cmd_domain_menu
,gen_menu[DOMAIN_MENU, 0);
[cmd_abort_command
,abort_command := TRUE;
[cmd_input_data
,pub_ib_input_select( data_input );
[cmd_input_formatted
,pub_ib_input_select( formatted_input );
[cmd_input_raw1
,pub_ib_input_select( raw1_input );
```

```
SKINFO.WORK.PD8S10          THU, DEC 22, 1983, 10:41 AM    PAGE  30

[cmd_input_raw2
,pub_ib_input_select( raw2_input );
[cmd_input_raw3
,pub_ib_input_select( raw3_input );
[cmd_input_raw4
,pub_ib_input_select( raw4_input );
[cmd_input_cal_coeff1
,pub_ib_input_select( cal_coeff1_input );
[cmd_input_cal_coeff2
,pub_ib_input_select( cal_coeff2_input );
[cmd_input_cal_coeff3
,pub_ib_input_select( cal_coeff3_input );
[cmd_input_cal_coeff4
,pub_ib_input_select( cal_coeff4_input );
[cmd_input_cal_coeff5
,pub_ib_input_select( cal_coeff5_input );
[cmd_input_cal_coeff6
,pub_ib_input_select( cal_coeff6_input );
[cmd_input_cal_coeff7
,pub_ib_input_select( cal_coeff7_input );
[cmd_input_cal_coeff8
,pub_ib_input_select( cal_coeff8_input );
[cmd_input_cal_coeff9
,pub_ib_input_select( cal_coeff9_input );
[cmd_input_cal_coeff10
,pub_ib_input_select( cal_coeff10_input );
[cmd_input_cal_coeff11
,pub_ib_input_select( cal_coeff11_input );
[cmd_input_cal_coeff12
,pub_ib_input_select( cal_coeff12_input );
[cmd_block_a
,pub_ib_input;
[cmd_output_formatted
,pub_ib_output_select( formatted_output );
[cmd_output_active
,pub_ib_output_select( active_output );
[cmd_output_marker
,pub_ib_output_select( marker_output );
[cmd_output_status
,pub_ib_output_select( status_output );
[cmd_output_id
,pub_ib_output_select( id_output );
[cmd_output_data
,pub_ib_output_select( data_output );
[cmd_output_raw1
,pub_ib_output_select( raw1_output );
[cmd_output_raw2
,pub_ib_output_select( raw2_output );
[cmd_output_raw3
,pub_ib_output_select( raw3_output );
[cmd_output_raw4
,pub_ib_output_select( raw4_output );
[cmd_output_cal_coeff1
,pub_ib_output_select( cal_coeff1_output );
[cmd_output_cal_coeff2
,pub_ib_output_select( cal_coeff2_output );
```

```
SKINFO.WORK.PD8S10          THU, DEC 22, 1983, 10:41 AM    PAGE  81

[cmd_output_cal_coeff3
,pub_ib_output_select( cal_coeff3_output );
[cmd_output_cal_coeff4
,pub_ib_output_select( cal_coeff4_output );
[cmd_output_cal_coeff5
,pub_ib_output_select( cal_coeff5_output );
[cmd_output_cal_coeff6
,pub_ib_output_select( cal_coeff6_output );
[cmd_output_cal_coeff7
,pub_ib_output_select( cal_coeff7_output );
[cmd_output_cal_coeff8
,pub_ib_output_select( cal_coeff8_output );
[cmd_output_cal_coeff9
,pub_ib_output_select( cal_coeff9_output );
[cmd_output_cal_coeff10
,pub_ib_output_select( cal_coeff10_output );
[cmd_output_cal_coeff11
,pub_ib_output_select( cal_coeff11_output );
[cmd_output_cal_coeff12
,pub_ib_output_select( cal_coeff12_output );
[cmd_output_memory
,pub_ib_output_select( memory_output );
[cmd_output_error
,pub_ib_output_select( error_output );
[cmd_hplb_talk
,pub_ib_output;
[cmd_srq_mask
,select_active_function( active_srq_mask_primary );
[cmd_clear_status
,clear_serial_poll;
[end_xfer_binary
,pub_ib_format_select( output_binary);
[cmd_xfer_ascii
,pub_ib_format_select( output_ascii);
[cmd_xfer_ieee2
,pub_ib_format_select( output_ieee_double);
[cmd_xfer_ieee1
,pub_ib_format_select( output_ieee_single);
[cmd_keycode
,select_active_function( active_keycode );
[cmd_output_plot
,pub_ib_output_select(plot_output);
[cmd_monitor
,BEGIN
,   trap_15_type := normal_trap_15;
,   TRAP(15);
,END;
[cmd_n_groups_hpib
,select_active_function(active_n_groups_hpib);
[cmd_output_key
,pub_ib_output_select( key_output );
[cmd_cal_set_1
,select_default_set( 1 );
[cmd_cal_set_2
,select_default_set( 2 );
[cmd_cal_set_3
```

```
SKINFO.WORK.PD3S10          THU, DEC 22, 1983, 10:41 AM    PAGE  82

,select_default_set( 3 );
[cmd_cal_set_4
,select_default_set( 4 );
[cmd_cal_set_5
,select_default_set( 5 );
[cmd_cal_set_6
,select_default_set( 6 );
[cmd_cal_set_7
,select_default_set( 7 );
[cmd_cal_set_8
,select_default_set( 8 );
```

```
SKINFO2.WORK.PD8S10         THU, DEC 22, 1983, 10:41 AM    PAGE   1

COMMENT
  Configures bit pairs to correspond to softkeys that are used.
  $Knn = softkey position n contains n lines.
  $$Kn = softkey position n that brings up another menu
  n    = 1..8
  n    = 0..2
;

INTEGER CONSTANT

  $K11 := 1,
  $K12 := 2,
  $K13 := 3,
  $K21 := 4,
  $K22 := 8,
  $K23 := $C,
  $K31 := $10,
  $K32 := $20,
  $K33 := $30,
  $K41 := $40,
  $K42 := $80,
  $K43 := $C0,
  $K51 := $100,
  $K52 := $200,
  $K53 := $300,
  $K61 := $400,
  $K62 := $800,
  $KE3 := $C00,
  $K71 := $1000,
  $K72 := $2000,
  $K73 := $3000,
  $K81 := $4000,
  $K82 := $8000,
  $KC3 := $C000,

  @SK1 := $100,
  @SK2 := $200,
  @SK3 := $400,
  @SK4 := $800,
  @SK5 := $1000,
  @SK6 := $2000,
  @SK7 := $4000,
  @SK8 := $8000;

COMMENT
      The rest of this file is software generated by GENSK.LAMI,
      Any changes must be made to the input file, SKINFO.WORK.
      ********************************************************
      The following are softkey menu tables configured as follows:
        word 1 = MSByte: corresponding keys that bring up new menus
                 LSByte: menu's highlight bitmap
        word 2 = menu configuration using constants $Knn
        word 3 = keycode number corresponding to softkeys used
          etc.
        word N = up to 10 keycode values
```

```
SKINFO2.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM     PAGE  2


;
$ EKO OF DIRECT COPY OF FILE

;          DOCUMENTATION FOR FRONT PANEL/COMMAND INPUT FILE
;
; "$"  Everything before is copied as is into the output file.
;      Anything desired in the output file without being processed
;      by the "bIG TABLE DEMERERRTOR" (GENSK) must occur before the "$"
;      provided that it does not reference anything generated after
;      the "$".
;
; ";"  Just for comments.  Will be ignored on input and not copied to
;      any of the output files.
;
; "#"  Starts/separates softkey menus.  Must occur after "$" and before
;      "%" in the input file.  An error message will be displayed
;      otherwise. Formatted softkey/command information tables are out-
;      put to RFILE FSKEY.
;
; "."  Indicates and prefixes a softkey menu constant name that will be
;      put in RFILE FMENU.WORK which contains these constants and their
;      values.  The values are ordered sequentially as softkey menus are
;      read in and processed.  Must occur immediately after menu
;      menu indicator (.) otherwise an error/warning message will be
;      displayed and the constant identifier AEkUn will be used.
;      (n = computed constant value)
;
; "-"  Starts/seperates individual softkeys and/or softkey positions.
;      Must occur between menu indicators (#).  Only up to 8 softkey
;      entries will be recognized (everything else afterwards until the
;      next menu indicator (#) will be ignored).  Empty or unused
;      softkey positions which occur between occupied softkeys or keys
;      which create unused positions at the top of the menu must have a
;      blank entry between softkey separators (-).  However, it is not
;      necessary to do this for unused softkeys which create contiguous
;      gaps at the bottom of the menu.
;
;      SOFTKEY ANNOTATION FORMAT:
;        <I1> :: "alpha" [ byte | "alpha"+<I1> ] byte+<I1>
;        <I2> :: same as above
;      where <I1> = 1st line of softkey
;            <I2> = 2nd line of softkey
;      Input lines are direct copies to output file.
;      There is no error checking for the following restrictions:
;        - ALPHA types must be enclosed in algol delimiters (")
;        - Start in column 1, no blanks between ALPHA/BYTE combinations
;          (i.e.  "line 1" + 122  should be  "line 1"+122).
;        - Each line should not exceed 10 characters/bytes.
;
;      BRACKET CHARACTERS:
;      sk_bracket_n (n=2..7) is a byte constant that will generate a
;      character bracketing off n softkey annotations from the first
;      line of a softkey entry position.  It should be the last
;      character of the first line of a softkey position heading off
;      a bracketed group of softkeys.  If the softkey annotation
```

```
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;      heading off the bracketed group consists of a single line, then
;      a two line entry should be created.  See the following examples:
;      e.g.  two-line annotation:          one-line annotation:
;         "LINE ONE"+sk_bracket_4          sk_bracket_4
;         "LINE TWO"                       half_vt+"LINE ONE"
;
;      NOTE:  Softkey annotations should be the FIRST piece of info.
;      within softkey entries !!!
;
; "["  Prefixes and indicates a command token constant for a softkey
;      entry or front panel/HP-IB command code.  An error message
;      will be displayed if more than one command value indicator occurs
;      in a single softkey entry.  Constant values are determined
;      sequentially and correspond to the occurrence of each softkey
;      entry (whether or not it has a command value indicator).
;      These constants and their and values can be found in
;      RFILEs corresponding to the most recent filename read via
;      "0".."9","A"..Z" prefixes.
;
; "]"  Indicates and prefixes duplicate command token constants which
;      have been previously declared to correspond to an identical
;      function AND refer to the same annotation (for softkeys).
;      This eliminates more than one command code per identical
;      function.  In this case, case statement entries (',') should be
;      omitted since they are taken care of by the previously declared
;      command code.
;      NOTE:  Must occur within softkey entries ('-') or after '#'.
;      Any case statement entries (',') following it will be ignored.
;      Any case statement entries before it will cause this entry to
;      be unrecognized (only within softkey entry information).
;
; ","  Indicate and prefix Algol statements to be executed corresponding
;      to the current command token (softkey entry/HP-IB printive) being
;      processed.  They may occur only within softkey entries or after
;      command token constants.  They should not proceed ']' prefixes.
;      NOTE:  Syntax errors will not be checked.
;
; "^"  Indicates that a softkey brings up another menu.  "^" is followed
;      by the menu number (immediate or constant) of the menu that
;      softkey is to generate.  Only one "^" per softkey entry allowed.
;
; "F"..."O" and
; "O"..."9"
;      Marks the start of a group of case statements enclosed in a
;      PROCn procedure (n = 0..25, (R=10,B=11..O=25)) and its
;      corresponding command token constants.  A filename MUST proceed
;      each character entry (which can only be used ONCE):
;              <char><filename>
;      There will be two seperate files produced using the given file
;      name: 1) C<filename>  for command token constants
;            2) F<filtname>  for corresponding case statements
;      All command token constants (indicated by '[') and corresponding
;      segments of code (indicated by ',') will be read into these
;      files.
;      These character prefixes may occur after the '#', before or after
;      menu entries, at the beginning or end of softkey entries, or
```

```
SKINFO2.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM     PAGE  4


;      before command token entries '[' securing after '#'.
;
;      NOTE:  The module which includes F<Filename> must also include
;      RFILE FCOMMAND.WORK or an external declaration of the integer
;      variable command_token.
;
; "@"  Indicates the end of menu entries and ignores any entries found
;      after the occurrence of "@".  Only command value indicators, ([)
;      or (]), immediately followed by statement indicators (,) are
;      processed.  This segment of the input file is for HPIB primitives
;      which do not have corresponding softkeys, and for front panel
;      keys which need command values in order to be processed.
;      Error messages are displayed for any input other than that just
;      described.
;
; "@"  Indicates that a command token entry is a software option.
;      It should be followed by a number 0..9  which identifies the
;      which software option that particular command is under (i.e.
;      time domain commands = 1, error correction commands = 2, etc.).
;      The INFO parameter (string) passed upon running GENSK contains
;      a string of software option numbers (0..9).  Each digit will
;      correspond to a software option family that will generate the
;      Algol statements (via ",") for a command token entry.  These
;      program statements are omitted, otherwise.
;      Command token entries without the "@" directive are not options
;      and will not omit program statements in their entries.

Idtngr.work.l
```

```
SKINFO2.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM     PAGE  5


*EJECT**********
.TAPE_MENU
--------
"DIRECTORY"
[cmd_directory
,IF valid_directory THEN
,  BEGIN
,    gen_menu(DIRECTORY_MENU, 1);
,    list_directory;
,  END;
--------
"RECORD"
,setup_tape_op(record_op);
--------
"RESTORE"
,setup_tape_op(restort_op);
--------
"DELETE"
,setup_tape_op(delete_op);
--------
"UN-DELETE"
,undelete_file;
--------

--------

--------
"INITIALIZE"
"TAPE"
^INIT_TAPE_MENU
--------
```

```
SKIMF02.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  6

*EJECT**********
.INIT_TAPE_MENU
--------
"INIT TAPE?"
"YES"
,init;
--------
"NO"
,previous_menu;
--------
```

```
SKIKF02.UORK.PD8S10          IHU, DEC 22, 1983, 10:41 AM    PROE  7

*EJECT**********
.DIRECTORY_MENU
--------
"RESTORE"
"DISPLRY"
[cmd_directory_off
--------

--------
.
--------
"NEXT"
"PROC"
[cmd_next_page
,list_directory;
--------
"PREVIOUS"
"PRGE"
[cmd_prev_page
,list_directory;
--------

--------
"FIRST"
"PRGE"
[cmd_first_page
,list_directory;
--------
"LRST"
"PRGE"
[cmd_last_page
,liat_directory;
--------
```

```
SKIMF02.UORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  8

*EJECT**********
.DRTR2_MENU
--------
"DRTR"
,gen_file_menu(data_file);
--------
"FORMRTTED"
"DRTR"
,gen_file_menu(format_file);
--------
"RRW"
"DRTR"
,gtn_file_menu(s_paran_file);
--------

--------
"USER"
"DISPLRY"
,gen_file_menu (diaplay_filc);
--------

--------

--------
"MRCKINE"
"DUMP"
[cmd_nachine_donp
,gen_file_menu(nachine_file);
--------
```

```
SKIMF02.UORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE  9

*EJECT**********
.DRTR1_MENU
--------
"IKSIRUMENT"
"STRTE"
,gen_reg_menu(state_file);
--------
"IMSTRUMENT"
"STRTES 1-5"
,gen_file_manu(stata_set);
--------
"MEMORY"
"TRRCE"
,gen_reg_menu(nenory_file);
--------
"MEMORY"
"TRRCES 1-4"
,gen_file_menu(menory_aet);
--------
"CRL SET"
,gen_reg_menu(cal_file);
--------
"CRL SETS"
"1-8"
,ger_file_menu(cal_aet);
--------
"CRL KIT"
,gen_rag_menu(cal_std_file);
--------
"MORE"
[cmd_more
,& dunny atatement &;
^ORTR2_MENU
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE 10

*EJECT**********
.FILE_MENU
--------
"DATA TYPE "
"* FILE 1"
[cmd_file_1
,file_choeen;
--------
" "
"* FILE 2"
[cmd_file_2
,file_choeen;
--------
" "
"* FILE 3"
,file_choeen;
--------
" "
"* FILE 4"
,file_choeen;
--------
" "
"* FILE 5"
,file_choeen;
--------
" "
"* FILE 6"
,file_choeen;
--------
" "
"* FILE 7"
,file_choeen;
--------
" "
"* FILE 8"
[cmd_file8
,file_choaen;
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE 11

*EJECT**********
.REC_MENU
--------
"DATA TYPE "
"* 1 "
[cmd_reg_1
,reg_choeen;
--------
" "
"* 2 "
[cmd_reg_2
,reg_choeen;
--------
" "
"* 3 "
[cmd_reg_3
,reg_choeen;
--------
" "
"* 4 "
[cmd_reg_4
,reg_choaen;
--------
"(POWER UP)"
"* 5 "
[cmd_reg_5
,reg_choeen;
--------
" "
"* 6 "
[cmd_reg_8
,reg_choeen;
--------
" "
"* 7 "
[cmd_reg_7
,reg_choeen;
--------
" "
"LAST STATE"
[cmd_reg_8
,reg_choaen;
--------

Sreep.work.L
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:41 AM    PAGE 12

*EJECT******
.RESPONSE_MENU
--------
"ELECTRICRL"+ek_bracket_2
"DELAY"
[end_elect_delay
,select_activc_function( active_electrical_length );
--------
"AUTO DELAY"
[cmd_auto_delay
,warn( command_not_inplenented );
--------
"PHASE"
"OFFSET"
[cmd_phaee_offaat
,select_active_functaon( active_phase_offaet );
--------
"MAGNITUDE"
"OFFSET"
,select_active_function( active_naghitude_offaet );
--------
"AVERAGING"+ak_bracket_2
"ON/RESTRRT"
[cmd_if_avg_on
,if_averese_on;
--------
"OFF"
[cmd_if_avg_off
,if_average_off;
--------
"SMOOTHING"+sk_bracket_2
"ON "
[cmd_anoothing_on
,dieplay_anoothing_on;
--------
"OFF"
[cmd_enoething_off
,dieplay_enoothing_off;
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1953, 10:41 AM    PAGE 13

*EJECT********
.IF_GAIN_MERU
--------

--------
"TEST"+ek_bracket_2
"AMP. GAIN"
[end_if_teat_port
^IF_GAIN_NENU2
,neu_if_gain_port( teat_port );
--------
"REFERENCE"
"AMP. GAIN"
[cmd_if_ref_port
^if_GAIN_NENU2
,neu_if_gain_port( raf_port );
--------

--------

--------

--------

--------

--------
```

```
SKINFO2.WORK.POS510          INW, DEC 22, 1983, 10:41 AM    PAGE 14

#EJECT*******
.IF_GAIN_MENU2
--------

--------
"GAIN"+ek_bracket_6
"0 (MIN.)"
(cmd_if_no_gain
,new_if_gain( if_no_gain );
--------
" 1 "
[cmd_if_12db_gain
,new_if_gain( if_12db_gain );
--------
" 2 "
(cmd_if_24db_gain
,new_if_gain( if_24db_gain );
--------
" 3 "
[cmd_if_36db_gain
,new_if_gain( if_36db_gain );
--------
"4 (MAX.)"
[cmd_if_48db_gain
,new_if_gain( if_48db_gain );
--------
"AUTO"
[cmd_if_gain_auto
,new_if_gain( auto_range );
--------

--------

4stim.work.L
```

```
SKINFO2.WORK.PD8510          INW, DEC 22, 1983, 10:41 AM    PAGE 15

#EJECT*******
.STIMULUS_MENU
--------
"NUMBER of"
"POINTS"
^N_POINTS_MENU
[cmd_n_points_menu
--------
"POWER"
"MENU"
(cmd_power_menu
^POWER_MENU
--------
"SWEEP"
"TIME"
(cmd_sweep_time
,select_active_function(active_sweep_time);
--------

--------
"SINGLE"+ek_bracket_3
"POINT"
(end_cu
,BEGIN
,  hilight_oo( cmd_cu, cmd_stepped);
,  cu_node;
,END;
--------
"RAMP"
[end_swept
,BEGIN
,  hilight_on( cmd_cu, cmd_stepped);
,  swept_node;
,END;
--------
"STEP"
[end_stepped
,BEGIN
,  hilight_on( end_cu, cmd_stepped);
,  stepped_node;
,END;
--------
"MORE"
^STIMULUS2_MENU
]cmd_more
--------
```

```
SKINFO2.WORK.PD8510          INW, DEC 22, 1983, 10:42 AM    PAGE 16

#EJECT********
.N_POINTS_MENU
--------

--------
"POINTS:"+ek_bracket_4
"51 "
(cmd_51_pointe
,new_step_size( 16 );
--------
"101"
(cmd_101_points
,new_step_size( 8 );
--------
"201"
[cmd_201_pointe
,new_step_size( 4 );
--------
"401"
(cmd_401_pointe
,new_step_size( 2 );
--------

--------

--------

--------
```

```
SKINFO2.WORK.PD8510          INW, DEC 22, 1983, 10:42 AM    PAGE 17

#EJECT*******
.POWER_MENU
--------

--------
"POWER"
(cmd_source_power
,select_active_function(active_source_power);
--------
"SLOPE"+ek_bracket_2
"ON "
[cmd_power_slope
,BEGIN
,   hilight_on( cmd_power_slope, end_power_slope_off );
,   set_entry_ch_integer( power_slope_on, ch_power_slope_node );
,   wrt_priv_ib_source( all, newline);
,   select_active_function( active_power_slope );
,END;
--------
"OFF"
[cmd_power_slope_off
,BEGIN
,   hilight_on( cmd_power_slope, cmd_power_slope_off );
,   set_entry_ch_integer( power_slope_off, ch_power_slope_node );
,   select_active_off( active_power_slope );
,   wrt_priv_ib_source( ai0, "");
,END;
--------
"ATTENUATOR"+ek_bracket_2
"PORT 1"
(cmd_atten_port1
,select_active_function(active_atten_port1);
--------
"PORT 2"
[cmd_atten_port2
,select_active_function(active_atten_port2);
--------

--------

--------
```

```
SKINF02.WORK.P08510          THU, DEC 22, 1983, 10:42 AM    PAGE  18

*EJECT*******
.STIMULUS2_MENU
--------
ak_bracket_4
half_vt+"HOLD"
[cmd_hold
,hold_sweep;
--------
"SINGLE"
[cmd_single
,single_sweep;
--------
"NUMBER of"
"GROUPS"
[cmd_n_sweeps
,select_active_function(active_n_sweeps);
--------
"CONTINUAL"
[cmd_continuous
,continuous_sweep;
--------
"STIMULUS"
"OFFSET"
,select_active_function( active_stimulus_offset );
--------

--------
ah_bracket_2
half_vt+"Ch1 + Ch2"
[cmd_couple_stimulus
,BEGIN
,  hilight_on( cmd_couple_stimulus, cmd_uncouple_stimulus );
,  set_coupled_stimulus_status( TRUE );
,END;
--------
"Ch1 "+163+" Ch2"
[cmd_uncouple_stimulus
,BEGIN
,  hilight_on( cmd_couple_stimulus, cmd_uncouple_stimulus );
,  set_coupled_stimulus_status( FALSE );
,END;
--------

Sparams.work.L
```

```
SKINF02.WORK.P08510          THU, DEC 22, 1983, 10:42 AM    PAGE  19

*EJECT*******
.PARAM_MENU
--------

--------
ak_bracket_4
half_vt+" Z"+177+" "
[cmd_z1
,new_parameter( z1 );
--------
" Z"+178+" "
[cmd_z2
,new_parameter( z2 );
--------
" Y"+177+" "
[cmd_y1
,new_parameter( y1 );
--------
" Y"+178+" "
[cmd_y2
,new_parameter( y2 );
--------

--------

--------
"MORE"
^PARAM2_MENU
[cmd_more
--------
```

```
SKINF02.WORK.P08510          THU, DEC 22, 1983, 10:42 AM    PAGE  20

*EJECT*******
.PARAM2_MENU
--------

--------
"User 1"+ak_bracket_4
"(a"+177+")"
[cmd_user1
,new_parameter( User1 );
--------
"User 2"
"(b"+178+")"
[cmd_user2
,new_parameter( user2 );
--------
"User 3"
"(a"+178+")"
[cmd_user3
,new_parameter( user3 );
--------
"User 4"
"(b"+177+")"
[cmd_user4
,new_parameter( user4 );
--------

--------
"REDEFINE"
"PARAMETERS"
^REDEF_MENU
[cmd_redefine_param
--------

--------
```

```
SKINF02.WORK.P08510          THU, DEC 22, 1983, 10:42 AM    PAGE  21

*EJECT*******
.REDEF_MENU
--------
"REDEFINE"+ak_bracket_5
"User 1"
^REDEF2_MENU
,redef_parameter := User1;
--------
"User 2"
^REDEF2_MENU
,redef_parameter := user2;
--------
"User 3"
^REDEF2_MENU
,redef_parameter := user3;
--------
"User 4"
^REDEF2_MENU
,redef_parameter := user4;
--------
"S"+177+177+" "
^REDEF2_MENU
,redef_parameter := a11;
--------
"S"+178+177+" "
^REDEF2_MENU
,redef_parameter := a21;
--------
"S"+177+178+" "
^REDEF2_MENU
,redef_parameter := a12;
--------
"S"+178+178+" "
^REDEF2_MENU
,redef_parameter := a22;
--------
```

```
SKINFO2.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  22

*EJECT*******
.REDEF2_MENU
~~~~~~~~

--------
"EXCITE"+ek_bracket_3
"port 1"
^REDEF3_MENU
,redef_excite := driven_a1;
--------
"port 2"
^REDEF3_MENU
,rvdef_excite := driven_a2;
--------
"NONE"
^REDEF3_MENU
,redef_excite := driven_none;
--------

--------

--------

--------

--------
```

```
SKINFO2.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  23

*EJECT*******
.REDEF3_MENU
~~~~~~~~

--------
"LOCK to"+ek_bracket_3
"a1 "
^REDEF4_MENU
,redef_lock := lock_to_a1;
--------
"a2 "
^REDEF4_MENU
,redef_lock := lock_to_a2;
--------
"NONE"
^REDEF4_MENU
,redef_lock := lock_donot_care;
--------

--------

--------

--------

--------
```

```
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*EJECT*******
.REDEF4_MENU
~~~~~~~~

--------
"NUMERATOR"+ek_bracket_5
"b1 "
^REDEF5_MENU
,redef_numerator := num_b1;
--------
"b2 "
^REDEF6_MENU
,redef_numerator := num_b2;
--------
"a1 "
^REDEF7_MENU
,redef_numerator := num_a1;
--------
"a2 "
^REDEF5_MENU
,redef_numerator := non_a2;
--------
"SERVICE"
"SELECTIONS"
^REDEF5_MENU
--------

--------

--------
```

```
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*EJECT*******
.REDEF5_MENU
~~~~~~~~
"100 kHz"+ek_bracket_5
"TEST CRL"
^REDEF7_MENU
,redef_numerator := num_100khz_cal;
--------
"100 kHz"
"REF CRL"
^REDEF7_MENU
,redef_numerator := num_ref_100khz_cal;
--------
"DETECTOR"
"GROUND"
^REDEF7_MENU
,redef_numerator := num_detector_gnd;
--------
"ADC GROUND"
^REDEF7_MENU
,redef_numerator := num_adc_gnd;
--------
"VCRL"
^REDEF7_MENU
,redef_numerator := num_vcal;
--------
"VREF"
^REDEF7_MENU
,redef_numerator := num_vref;
--------
"TEMP. 1"
^REDEF7_MENU
,redef_numerator := num_temp1;
--------
"TEMP. 2"
^REDEF7_MENU
,redef_numerator := num_temp2;
--------
```

```
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#EJECT*******
.REDEF6_MENU
--------

--------
"DENOM."+ak_bracket_4
"a1 "
^REDEF7_MENU
,redtf_denominator := denon_a1;
--------
"a2 "
^REDEF7_MENU
,redef_denominator := denon_a2;
--------
"b1 "
^REDEF7_MENU
,redef_denominator := denon_b1;
--------
"NO RATIO"
^REDEF7_MENU
,redef_denominator := denon_no_ratio;
--------

--------

--------
```

```
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#EJECT*******
.REDEF7_MENU
--------

--------
"CONVERSION"+ak_bracket_4
"NONE"
,redef_convtrt := conv_off;
--------
"to Z"
,redef_convert := conv_a_to_z;
--------
"to Y"
,redef_convert := conv_a_to_y;
--------
"to  "
"RECIPROCAL"
,redef_convert := conv_reciprocal;
--------

--------
"LABEL"
"PRRRMETER"
[cmd_label_parameter
,warn( command_not_implemented );
--------
"REDEFINE"
"DONE"
[end_redefine_done
,BEGIN
,   redefine_paran;
,   pop_menu( PARAM2_MENU );
,END;
--------

&format.work.L
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 28

#EJECT*******
.FORMAT_MENU
--------
ak_bracket_&
half_vt+"SWR"
[cmd_swr
,new_format( fmt_swr );
--------
"LINERR"
"MAGNITUDE"
[cmd_linear_mag
,new_format( fmt_linear_mag );
--------
"POLAR w/"
"LIN MKR"
[cmd_linear_polar
,new_format( fmt_linear_polar );
--------
"POLAR w/"
"LOG MKR"
[cmd_log_polar
,new_format( fmt_log_polar );
--------
"POLAR w/"
"Re/Im MKR"
[cmd_imag_vs_real
,new_format( fmt_imag_vs_real );
--------
"INVERTED"
"SMITH"
[cmd_y_smith
,new_format( fmt_y_smith );
--------
"IMAGINARY"
[cmd_imaginary
,new_format( fmt_imaginary );
--------
"REAL"
[cmd_real
,new_format( fmt_real );
--------

&donemenu.work.L
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 29

#EJECT*******
.DOMAIN_MENU
--------
ak_bracket_4
half_vt+"FREQUENCY"
[cmd_freq_domain
,BEGIN
,   hilight_on( cmd_freq_domain, cmd_aux_domain);
,   act_domain( freq_domain );
,END;
--------
"TIME"
"LOW PASS"
^LOW_PASS_FREQ
[cmd_low_pass_request
--------
"TIME"
"BAND PASS"
[cmd_time_domain
,BEGIN
,   hilight_on( cmd_freq_domain, cmd_aux_domain);
,   act_domain( time_domain );
,END;
--------
"AUX. VOLT"
"OUTPUT"
[cmd_aux_domain
,BEGIN
,   hilight_on( cmd_freq_domain, cmd_aux_domain);
,   act_domain( aux_domain );
,END;
--------

--------
"SPECIFY"+ak_bracket_2
"TIME"
[cmd_setup_time_domain
^TIME_SETUP_MENU
--------
"GATE"
[cmd_setup_gate_domain
^GATE_SETUP_MENU
,select_active_gate( 0 );                    & turn on gate markers &
--------

--------
```

```
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*EJECT*******
.LOW_PASS_FREQ
--------

--------
"SET FREQ."
"(LOW PASS)"
[end_tdr_domain
,BEGIN
,   tdr_check;
,   hilight_key( cmd_low_pass_request, cmd_freq_domain, cmd_aux_domain);
,   set_domain( tdr_domain );
,   previous_menu;
,END;
--------

--------

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--------

--------
```

```
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*EJECT*******
.TIME_SETUP_MENU
--------

--------
"LOW PASS:"*sk_bracket_2
"STEP"
[end_tdr_step
,bEGIN
,   hilight_on( cmd_tdr_step, cmd_tdr_impulse);
,   set_entry_ch_integer( step_tdr, ch_tdr_stimulus_type );
,   update_domain_vars;
,END;
--------
"IMPULSE"
[end_tdr_impulse
,BEGIN
,   hilight_on( cmd_tdr_step, cmd_tdr_impulse);
,   set_entry_ch_integer( impulse_tdr, ch_tdr_stimulus_type );
,   update_domain_vars;
,END;
--------

--------
"WINDOW:"*sk_bracket_3
"MINIMUM"
[end_min_time_window
,BEGIN
,   hilight_on( cmd_min_time_window, cmd_max_time_window);
,   set_entry_ch_integer( min_window, ch_time_window );
,   update_domain_vars;
,END;
--------
"NORMAL"
[end_normal_time_window
,BEGIN
,   hilight_on( cmd_min_time_window, cmd_max_time_window);
,   set_entry_ch_integer( normal_window, ch_time_window );
,   update_domain_vars;
,END;
--------
"MAXIMUM"
[end_max_time_window
,BEGIN
,   hilight_on( cmd_min_time_window, cmd_max_time_window);
,   set_entry_ch_integer( max_window, ch_time_window );
,   update_domain_vars;
,END;
--------

--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 32

*EJECT*******
.GATE_SETUP_MENU
--------
"GATE"*sk_bracket_2
"ON"
[cmd_gate_on
,BEGIN
,   hilight_on( cmd_gate_on, cmd_gate_off);
,   set_entry_ch_integer( gate_on, ch_gating );
,   abort_sweep;
,   update_domain_vars;
,   rebuild := TRUE;                          & turns on array node &
,   restart_sweep;
,END;
--------
"OFF"
[cmd_gate_off
,BEGIN
,   hilight_on( cmd_gate_on, cmd_gate_off);
,   set_entry_ch_integer( gate_off, ch_gating );
,   marker_state := marker_state AND gate_markern_off;
,   abort_sweep;
,   update_domain_vars;
,   rebuild := TRUE;                          & turns off array node &
,   restart_sweep;
,END;
--------
"GATE"*sk_bracket_4
"START"
[cmd_gate_start
,select_active_gate( active_gate_start );
--------
"STOP"
[cmd_gate_stop
,select_active_gate( active_gate_stop );
--------
"CENTER"
[cmd_gate_center
,select_active_gate( active_gate_center );
--------
"SPAN"
[cmd_gate_span
,select_active_gate( active_gate_span );
--------

--------
"GATE SHAPE"
^GATE_SHAPE_MENU
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 33

*EJECT*******
.GATE_SHAPE_MENU
--------

--------

--------

--------

--------
"GATE SHAPE"*sk_bracket_3
"MINIMUM"
[cmd_min_gate_window
,BEGIN
,   hilight_on( cmd_min_gate_window, cmd_max_gate_window);
,   set_entry_ch_integer( min_window, ch_gate_window );
,   update_domain_vars;
,END;
--------
"NORMAL"
[cmd_normal_gate_window
,BEGIN
,   hilight_on( cmd_min_gate_window, cmd_max_gate_window);
,   set_entry_ch_integer( normal_window, ch_gate_window );
,   update_domain_vars;
,END;
--------
"MAXIMUM"
[cmd_max_gate_window
,BEGIN
,   hilight_on( cmd_min_gate_window, cmd_max_gate_window);
,   set_entry_ch_integer( max_window, ch_gate_window );
,   update_domain_vars;
,END;
--------

--------

?calmenu.work.L
```

```
SKINFD2.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM     PAGE  34

@EJECT@@@@@@@
.CAL_MENU
--------
"CORRECTION"=ok_bracket_3
"ON"
[cmd_correction_on
,recall_cal(default_cal_set);
--------
"OFF"
[cmd_correction_off
,correction_off;
--------
"SELECT"
"CAL SET"
[cmd_correction_default
,gen_cal_info( no_op );
--------
"CAL1SRRTE"=ok_bracket_2
"( NO KIT )"
[end_cal_type_menu
,BEGIN
,   IF entry_ch_integer( ch_correction_mode ) = correct_off THEN
,      gen_menu(CAL_TYPE_MENU, 1 )
,   ELSE
,      warn( turn_correct_off );
,END;
--------
"RESUME CAL"
"SEQUENCE"
,resume_cal;
--------
"SPECIFY"
"CAL KIT"
^STDS_KIT_MENU
--------

--------
"MORE"
]cmd_more
^MORE_CAL
--------
```

```
SKINFD2.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM     PAGE  35

@EJECT@@@@@@
.MORE_CAL
--------

--------
"SET Z"=174
,select_active_function( active_eyeten_a0 );
--------
"REFERENCE"
"PLANES"
^REF_PLANE_MENU
[cmd_ref_plane_menu
--------

--------
"CAL SWEEP"
"VOLTAGE"
,warn(command_not_implemented);
--------

--------
"DELETE A"
"CAL SET"
[end_delete_cal
,gen_cal_info( clear_op );
--------

--------
```

```
SKINFD2.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM     PAGE  35

@EJECT@@@@@@@
.REF_PLANE_MENU
--------

--------
ok_bracket_2
half_vt+"PLANE 1"
[cmd_ref_plane_1
,select_active_function( active_ref_plane_1 );
--------
"PLANE 2"
[end_ref_plane_2
,select_active_function( active_ref_plane_2 );
--------

--------

--------

--------

--------

--------
```

```
SKINFD2.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM     PAGE  37

@EJECT@@@@@@
.CAL_TYPE_MENU
--------

--------
"FREQUENCY"=ok_bracket_4
"RESPONSE"
[cmd_response_type
,set_cal_type( response );
--------
"1-PORT on"
"PORT 1"
[end_1_port_1_type
,set_cal_type( one_port_on_1 );
--------
"1-PORT on"
"PORT 2"
[end_1_port_2_type
,set_cal_type( one_port_on_2 );
--------
"2-PORT"
[end_2_port_type
,set_cal_type( two_port );
--------

--------
"SET FREQ."
"(LOW PASS)"
[end_freq_setup
,tdr_check;
--------

--------
```

```
SKINF02.UORK.POS510          THU, DEC 22, 1983, 10:42 PM    PAGE  38

*EJECT*******
.PORT_ONE_REEL
--------

--------
"PORT 1"+ek_bracket_3
"PORT1 STD1"
[cmd_port1_etd1
,eet_etd_clase( port1_1st_etd );
--------
"PORT1 STD2"
[cmd_port1_ttd2
,set_etd_clase( port1_2nd_etd );
--------
"PORT1 STD3"
[cmd_port1_etd3
,eet_etd_clase( port1_3rd_etd );
--------

--------

--------
"SELECT"
"CRL SET"
]cmd_correction_default
--------
"1-PORT"
"DONE"
[cmd_done_1_port_on_1
,cal_done( done_1_port_on_1 );
--------
```

```
SKINF02.UORK.POS510          THU, DEC 22, 1983, 10:42 PM    PROE  39

*EJECT*******
.PORT_TWO_REFL
--------

--------
"PORT 2"+ak_bracket_3
"PORT2 STD1"
[cmd_port2_etd1
,eet_etd_clase( port2_1st_etd );
--------
"PORT2 STD2"
[cmd_port2_etd2
,eet_ttd_clase( port2_2nd_etd );
--------
"PORT2 STD3"
[cmd_port2_etd3
,eet_etd_clase( port2_3rd_etd );
--------

--------

--------
"SELECT"
"CRL SET"
]cmd_cortection_default
--------
"1-PORT"
"DONE"
[cmd_done_1_port_on_2
,cal_done( done_1_port_on_2 );
--------
```

```
SKINF02.UORK.POS510          THU, DEC 22, 1983, 10:42 PM    PAGE  40

*EJECT*******
.CAL_MENU2
--------

--------
"REFLECTION"+ek_bracket_3
[cmd_cal_reflection
^REFLECTION_MENU
--------
"TRANS-"
"MISSION"
[end_cal_thru
^TRANSMISSION_MENU
,BEGIN
,   tell( connect_thru );
,END;
--------
"ISOLATION"
[end_cal_isolation
^ISOLATION_MENU
,BEGIN
,   tell( isolate_ports );
,END;
--------

--------

--------
"SELECT"
"CAL SET"
]cmd_correction_default
--------
"2-PORT"
"DONE"
[cmd_done_2_port
,cal_done( done_2_port );
--------
```

```
SKINF02.UORK.POS510          THU, DEC 22, 1983, 10:42 PM    PAGE  41

*EJECT*******
.REFLECTION_MENU
--------

--------
"PORT 1"+ak_bracket_3
"PORT1 STD1"
]cmd_port1_etd1
--------
"PORT1 STD2"
]cmd_port1_ttd2
--------
"PORT1 STD3"
]cmd_port1_etd3
--------
"PORT 2"+ak_bracket_3
"PORT2 STD1"
]cmd_port2_etd1
--------
"PORT2 STD2"
]cmd_port2_etd2
--------
"PORT2 STD3"
]cmd_port2_etd3
--------
"REFLECTION"
"DONE"
[cmd_done_reflection
,cal_done( done_reflection );
--------
```

```
SKINF02.WORK.PORSTO          THU, DEC 22, 1983, 10:42 RM    PAGE 42

*EJECT*******
.TRANSMISSION_MENU
--------
"SIMPLE"
"TRANS."
[cmd_simple_trans
,warn( command_not_implemented );
--------

--------
"FWD.TRANS."
"FWD_TRANS_"
[cmd_fwd_Transmission
,   set_std_class( trans_fwd_std );
--------
"FWD.MATCH"
"FWD_MATCH_"
[cmd_fwd_Match
,   set_std_class( match_fwd_std  );
--------
"REV.TRANS."
"REV_TRANS_"
[cmd_rev_transmission
,   set_std_class( trans_rev_std );
--------
"REV.MATCH"
"REV_MATCH_"
[cmd_rev_match
,   set_std_class( match_rev_std );
--------
--------
"TRANS."
"DONE"
[cmd_done_trans
,cal_done( done_trans );
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 RM    PAGE 43

*EJECT*******
.ISOLATION_MENU
--------

--------
"ADD ISOL'N"
"FWD_ISOLN_"
[cmd_fwd_isolation
,   set_std_class( isoln_fwd_std );
--------
"REV ISOL'N"
"REV_ISOLN_"
[cmd_rev_isolation
,   set_std_class( isoln_rev_std );
--------

--------
"OMIT"
"ISOLATION"
[cmd_omit_isolation
,omit_isolation;
--------

--------

--------
"ISOLATION"
"DONE"
[cmd_done_isolation
,cal_done(done_isol);
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 RM    PAGE 44

*EJECT*******
.STD_CLASS_MENU
--------
"STANDARD 1"
[cmd_class_std1
^TAKE_DATA_MENU
,set_element( 1 );
--------
"STANDARD 2"
[cmd_class_std2
^TAKE_DATA_MENU
,set_element( 2 );
--------
"STANDARD 3"
[cmd_class_std3
^TAKE_DATA_MENU
,set_element( 3 );
--------
"STANDARD 4"
[cmd_class_std4
^TAKE_DATA_MENU
,set_element( 4 );
--------
"STANDARD 5"
[cmd_class_std5
^TAKE_DATA_MENU
,set_element( 5 );
--------
"STANDARD 6"
[cmd_class_std6
^TAKE_DATA_MENU
,set_element( 6 );
--------
"STANDARD 7"
[cmd_class_std7
^TAKE_DATA_MENU
,set_element( 7 );
--------
"STANDARDS "
"DONE"
[cmd_class_done
,cal_done(done_class);
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 RM    PAGE 45

*EJECT*******
.SLIDING_LORD_MENU
--------

--------
"SLIDE IS"
"SET"
^TAKE_DATA_MENU
,measurement_restart;
--------

--------

--------

--------

--------

--------
"SLIDING"
"LORD DONE"
,BEGIN
,   previous_menu;
,   previous_menu;
,   compute_load;
,END;
--------
```

```
SkInf02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 46

#EJECT*******
.TAKE_DATA_MENU
--------

--------

--------

--------

--------

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--------

--------
"TAKE DATA"
(cmd_take_data
,take_data;
--------

Cmdmenu.work.L
```

```
SKINF02.WORK.PDS51D          THU, DEC 22, 1983, 10:42 AM    PAGE 47

#EJECT******
.STDS_KIT_MENU
--------

--------
"SELECT"*ak_bracket_2
"( KIT N1 )"
[end_cal_kit_1
,select_cal_kit( 1 );
--------
"SELECT"
"( KIT N2 )"
[end_cal_kit_2
,select_cal_kit( 2 );
--------

--------
"MODIFY"
"CAL KIT"
[end_modify_cal_kit
^MODIFY_CAL_KIT_MENU
--------

--------

--------

--------
```

```
SKINF02.WORK.PDSS1D          THU, DEC 22, 1983, 10:42 AM    PAGE 48

#EJECT*******
.MODIFY_CAL_KIT_MENU
--------

--------
"SELECT"
"STANDARD"
[cmd_select_etd
,select_active_function( active_otd_id );
--------
"SPECIFY"
"STD CLASS"
[end_specify_classes
^SPECIFY_CLASS_MENU
--------
"LABEL"
"STD CLASS"
[cmd_label_classes
,warn( command_not_inplemented );
--------
"LABEL"
"CAL KIT"
[cmd_label_cal_kit
,warn( command_not_inplemented );
--------

--------

--------
"DONE"
"(DEFINED)"
[cmd_cal_kit_defined
,cal_kit_defined;
--------
```

```
SKINF02.WORK.PD851D          THU, DEC 22, 1983, 10:42 AM    PAGE 49

#EJECT*******
.MODIFY_STDS_MENU
--------
"STD TYPE"*ak_bracket_5
"OPEN"
[cmd_define_open
^DEFINE_OPEN_MENU
,define_etd( atd_open );
--------
"SHORT"
[end_define_short
^DEFINE_SHORT_MENU
,dfine_etd( etd_short );
--------
"LOAD"
[cmd_define_load
^DEFINE_LOAD_MENU
,define_etd( etd_load );
--------
"DELAY/"
"THRU"
[end_define_air_line
^SPECIFY_OFFSET_MENU
,define_atd( otd_thru );
--------
"ARBITRARY"
"IMPEDANCE"
[end_define_z
^SPECIFY_Z_MENU
,define_etd( etd_z );
--------

--------

--------

--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  50

*EJECT*******
.DEFINE_OPEN_MENU
--------
" C"+176+" "
[cmd_open_c0
,select_active_function( active_open_c0 );
--------
" C"+177+" "
[cmd_open_c1
,select_active_function( active_open_c1 );
--------
" C"+178+" "
[cmd_open_c2
,select_active_function( active_open_c2 );
--------

--------

--------
"SPECIFY"
"OFFSET"
[cmd_specify_offset
^SPECIFY_OFFSET_MENU
--------
"LABEL STD"
[cmd_label_cal_etd
,warn( command_not_implemented );
--------
"DONE"
"(DEFINED)"
[cmd_cal_std_defined
,pop_menu( MODIFY_DRL_KIT_MENU );
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  51

*EJECT*******
.DEFINE_SHORT_MENU
--------

--------

--------

--------

--------
*SPECIFY"
"OFFSET"
]end_specify_offset
^SPECIFY_OFFSET_MENU
--------
"LABEL STD"
]cmd_label_cal_etd
--------
"DONE"
"(DEFINED)"
]cmd_cal_std_defined
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  52

*EJECT*******
.DEFINE_LOAD_MENU
--------

--------

--------

--------
sk_bracket_2
half_vt+"FIXED"
[cmd_fixed_load
,define_type2( fixed );
--------
"SLIDING"
[cmd_sliding_load
,define_type2( sliding );
--------
"SPECIFY"
"OFFSET"
]cmd_specify_offset
^SPECIFY_OFFSET_MENU
--------
"LABEL STD"
]cmd_label_cal_etd
--------
"DONE"
"(DEFINED)"
]cmd_cal_std_defined
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  53

*EJECT*******
.SPECIFY_2_MENU
--------
" C"+176+" "
]cmd_open_c0
--------
" C"+177+" "
]cmd_open_c1
--------
" C"+178+" "
]cmd_open_c2
--------
sk_bracket_2
half_vt+"FIXED"
]cmd_fixed_load
--------
"SLIDING"
]cmd_sliding_load
--------
"SPECIFY"
"OFFSET"
]end_specify_offset
^SPECIFY_OFFSET_MENU
--------
"LABEL STD"
]cmd_label_cal_etd
--------
"DONE"
"(DEFINED)"
]cmd_cal_std_defined
--------
```

```
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*EJECT*******
.SPECIFY_OFFSET_MENU
--------
"OFFSET"
"DELAY"
[cmd_offset_delay
,select_active_function( active_offset_delay );
--------
"OFFSET"
"LOSS"
[cmd_offset_loss
,select_active_function( active_offset_loss );
--------
"OFFSET"
" Z"+176+" "
[cmd_offset_z0
,select_active_function( active_offset_z0 );
--------
"LOWER"
"FREQUENCY"
[cmd_offset_min_f
,select_active_function( active_offset_min_freq );
--------
"UPPER"
"FREQUENCY"
[cmd_offset_max_f
,select_active_function( active_offset_max_freq );
--------
ak_bracket_2
half_vt+"CORX"
[cmd_ccax
,define_type2( ccax );
--------
"WAVEGUIDE"
[cmd_waveguide
,define_type2( waveguide );
--------

--------
```

```
SKINF02.WORK.PDS510          THU, DEC 22, 1983, 10:42 AM    PAGE  55

*EJECT*******
.SPECIFY_CLASS_MENU
--------
"PORT 1:  "
"1st STD"
[cmd_port1_1st_std
,std_class( port1_1st_std );
--------
"2nd STD"
(cmd_port1_2nd_std
,std_class( port1_2nd_std );
--------
"3rd STD"
[cmd_port1_3rd_std
,std_class( port1_3rd_std );
--------
"PORT 2:  "
"1st SIO"
[cmd_port2_1st_std
,std_class( port2_1st_std );
--------
"2nd STD"
[cmd_port2_2nd_std
,std_class( port2_2nd_std );
--------
"3rd STD"
[cmd_port2_3rd_std
,std_class( port2_3rd_std );
--------

--------
"MORE"
^SPECIFY_CLASS_MENU2
--------
```

```
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*EJECT*******
.SPECIFY_CLASS_MENU2
--------
"TRANS.:"
"FWD STD"
[cmd_trans_fwd_std
,std_class( trans_fwd_std );
--------
"REV STD"
[cmd_trans_rev_std
,std_class( trans_rev_std );
--------

--------
"FREQUENCY"
"RESP. STD"
[cmd_freq_resp_std
,std_class( freq_resp_std );
--------

--------

--------

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```

```
SKINF02.WORK.PDS510          THU, DEC 22, 1983, 10:42 AM    PAGE  57

*EJECT*******
.DISPLAY_MENU
--------
"SINGLE "+ak_bracket_2
"CHANNEL"
[cmd_single_ch
,select_trace_mode( single_ch );
--------
"DUAL   "
"CHANNEL"
[cmd_dual_ch
^DUAL_CH_MENU
--------
ak_bracket_4
half_st+"DATA"
[cmd_data
,set_trace_type( trace_data );
--------
"MEMORY"
[cmd_mem
,set_trace_type( trace_mem );
--------
"DATA "+38
"MEMORY"
[cmd_d_and_m
,set_trace_type( trace_data_and_mem );
--------
"MATH"
"(...)"
[cmd_math
,set_trace_type( entry_ch_integer(ch_math_op) );
--------
"SELECT"
"DEFAULTS"
^DISPLAY_DEFAULT_MENU
--------
"DATA "+169
"MEMORY"
[cmd_d_into_m
,set_trace_type( trace_data_into_mem );
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  58

#EJECT*******
.DUAL_CH_MENU
--------

--------
"2 CHANNEL"+sk_bracket_2
"OVERLAY"
[cmd_overlay
,select_trace_mode( overlay );
--------
"2 CHANNEL"
"SPLIT"
[cmd_split
,select_trace_mode( split );
--------

--------

--------

--------

--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  59

#EJECT*******
.DISPLAY_DEFAULT_MENU
--------
"MEMORY"+sk_bracket_5
" 1 "
[cmd_memory1
,select_memory( mem1 );
--------
" 2 "
[cmd_memory2
,select_memory( mem2 );
--------
" 3 "
[cmd_memory3
,select_memory( mem3 );
--------
" 4 "
[cmd_memory4
,select_memory( mem4 );
--------
"MORE"
^MEMORY_MEMO
--------

--------
"MATH"
"OPERATIONS"
^MATH_MENU
--------

--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  60

#EJECT*******
.MEMORY_MENU
--------

--------
"DATA From"sk_bracket_3
"CHANNEL 1"
[cmd_memory_ch1
,select_memory( data1 );
--------
"DATA from"
"CHANNEL 2"
[cmd_memory_ch2
,select_memory( data2 );
--------
"JOHN'S"
"PLAYGROUND"
^MEMORY2_MENU
--------

--------

--------

--------

--------
```

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SKINF02.WORK.PD8510          THU, DEC 22, 1383, 10:42 AM    PAGE  61

#EJECT*******
.MEMORY2_MENU
--------
"CAL DATA"+sk_bracket_7
" 0 "
[cmd_cal0
,select_memory( cal1 );
--------
"CAL DATA"
" 1 "
[cmd_cal1
,select_memory( cal2 );
--------
"CAL DATA"
" 2 "
[cmd_cal2
,select_memory[ cal3 );
--------
"CAL DATA"
" 3 "
[cmd_cal3
,select_memory( cal4 );
--------
"CAL DATA"
" 4 "
[cmd_cal4
,select_memory( cal5 );
--------
"CAL DATA"
" 5 "
[cmd_cal5
,select_memory( cal6 );
--------
"CAL DATA"
" 5 "
[cmd_cal6
,select_memory( cal7 );
--------
"CAL DATA"
" 7 "
[cmd_cal7
,select_memory( cal8 );
--------
```

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*EJECT*******
.MATH_MENU
--------

--------

--------

--------
"DATA"+sk_bracket_4
"+ MEMORY"
[cmd_d_plus_m
,select_math_op( trace_data_plus_mem );
--------
"DATA"
"- MEMORY"
[cmd_d_minus_m
,select_math_op( trace_data_minus_mem );
--------
"DATA"
mpy_char+" MEMORY"
[cmd_d_mpy_m
,select_math_op( trace_data_times_mem );
--------
"DATA"
"/ MEMORY"
[cmd_d_div_m
,select_math_op( trace_data_div_mem );
--------

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2plot.work.L
```

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SKINFO2.UORK.PO8510          THU, DEC 22, 1983, 10:42 RM    PAGE  63

*EJECT********
.COPY_MENU
--------
"PLOT"+sk_bracket_5
"ALL"
[cmd_plot_all
,select_plot_buffer (all);
--------
"TRACE"
[cmd_plot_trace
,select_plot_buffer (trace);
--------
"GRATICULE"
[cmd_plot_graticule
,select_plot_buffer (grid);
--------
"MARKER(S)"
(cmd_plot_marker
,select_plot_buffer (markers);
--------
"TEXT"
(cmd_plot_text
,select_plot_buffer (annotations);
--------
"SELECT"
"QUADRANT"
^PLOT_SETUP_MENU
--------
"SELECT"
"PEN COLOR"
[cmd_ehi_pen
^PEN_MENU
--------
"PARAMETERS"
"AND DATA"
^PLOTPARM_MENU
--------
```

```
SKINFO2.UORK.PO5510          THU, DEC 22, 1983, 10:42 RM    PAGE  64

*EJECT*******
.PLOTPARM_MENU
--------
"OPERATING"+sk_bracket_2
"PARAMETERS"
^COPY2_MENU
[cmd_op_params
,select_plot_param (op_params);
--------
"SYSTEM"
"PARAMETERS"
^COPY2_MENU
[cmd_eyetem_parems
,select_plot_param (eye_params);
--------

--------
"LIST TRACE"
"VALUES"
(cmd_list_trace
,IF printer_connected THEN
,   BEGIN
,     abort_sweep;
,     list_trace_values;
,     restart_sweep;
,   END;
--------
```

```
SKINFO2.UORK.PO8510          THU, DEC 22, 1983, 10:42 RM    PAGE  65

*EJECT*******
.PLOT_SETUP_MENU
--------
"X X   FULL"+sk_bracket_5
"X X   PAGE"
[cmd_quadrant_full
,select_plot_quadrant (full_page);
--------
"X -   LEFT"
"- -   UPPER"
[cmd_quadrant_11
,select_plot_quadrant (upper_left);
--------
"- -   LEFT"
"X -   LOWER"
[cmd_quadrant_21
,select_plot_quadrant (lower_left);
--------
"- X  RIGHT"
"- -   UPPER"
[cmd_quadrant_12
,select_plot_quadrant (upper_right);
--------
"- -   RIGHT"
"- X  LOWER"
[cmd_quadrant_22
,select_plot_quadrant (lower_right);
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  66

#EJECT*******
.PEN_MENU
--------
"PEN"+sk_bracket_8
" 1 "
[cmd_pen1
,select_pen(1);
--------
" 2 "
[cmd_pen2
,select_pen (2);
--------
" 3 "
[cmd_pen3
,select_pen (3);
--------
" 4 "
[cmd_pen4
,select_pen (4);
--------
" 5 "
[cmd_pen5
,select_pen (5);
--------
" 6 "
[cmd_pen6
,select_pen (6);
--------
" 7 "
[cmd_pen7
,select_pen (7);
--------
" 8 "
[cmd_pen8
,select_pen (8);
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  67

#EJECT*******
.COPY2_MENU
--------
"RESTORE"
"DISPLAY"
)cmd_directory_off
--------
sk_bracket_2
half_vt+"PRINT"
[cmd_print_params
,IF printer_connected THEN
,  output_parameters;
--------
"PLOT"
[cmd_plot_params
,dump_to_plotter;
--------

--------

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--------
"NEXT PAGE"
[cmd_next_op_param
,next_op_param;
--------

$mkr.work.l
```

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SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  68

#EJECT*******
.MARKER_MENU
--------
"MARKER"+sk_bracket_6
"       1 "
[cmd_marker_1
,select_marker(1);
--------
"       2 "
[cmd_marker_2
,select_marker(2);
--------
"       3 "
[cmd_marker_3
,select_marker(3);
--------
"       4 "
[cmd_marker_4
,select_marker(4);
--------
"       5 "
[cmd_marker_5
,select_marker(5);
--------
"ALL"
"OFF"
[cmd_marker_off
,select_marker(0);
--------
delta_char+" MODE"
"MENU"
^DELTA_MARKER_MENU
[cmd_delta_marker
--------
"MORE"
^MARKER2_MENU
)cmd_more
--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  69

#EJECT*******
.DELTA_MARKER_MENU
--------
sk_bracket_6
half_vt+delta_char+" REF = 1"
[cmd_ref_mkr1
,select_ref_marker( 1 );
--------
delta_char+" REF = 2"
(cmd_ref_mkr2
,select_ref_marker( 2 );
--------
delta_char+" REF = 3"
[cmd_ref_mkr3
,select_ref_marker( 3 );
--------
delta_char+" REF = 4"
[cmd_ref_mkr4
,select_ref_marker( 4 );
--------
delta_char+" REF = 5"
(cmd_ref_mkr5
,select_ref_marker( 5 );
--------
delta_char+" MODE"
"OFF"
[cmd_no_ref_mkr
,select_ref_marker( 0 );
--------

--------

--------
```

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SKINFO2.WORK.PD8S10          THU, DEC 22, 1983, 10:42 AM    PAGE  70

*EJECT*******
.MARKER2_MENU
--------

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--------

--------

--------
"MARKER to"+ek_bracket_2
"MINIMUM"
[cmd_mkr_to_min
,marker_to( mkr_to_min );
--------
"MAXIMUM"
[cmd_mkr_to_max
,marker_to( mkr_to_max );
--------

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```

```
SKINFO2.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  71

*EJECT*******
.SYSTEM_MENU
--------

--------
"TITLE"
[cmd_title
^TITLE_MENU
,select_active_function( active_title );
--------
"HP-IB"
"FUNCTIONS"
[cmd_hpib_info
^HPIB_MENU
--------
"CRT"
"OFF"
[cmd_crt_off
,warn(command_not_implemented);
--------

--------

--------

--------
"SERVICE"
"FUNCTIONS"
[cmd_service_menu
^SERVICE_MENU
--------
```

```
SKINFO2.WORK.PD8S10          THU, DEC 22, 1983, 10:42 AM    PAGE  72

*EJECT*******
.TITLE_MENU
--------

--------
"SELECT"
"LETTER"
,enter_title_char( char_index );
--------

--------
"SPACE"
,enter_title_char( space_index );
--------
"BACKSPACE"
,enter_title_char( backspace_index );
--------

--------

--------
"DONE"
[end_title_done
,BEGIN
,   select_active_off( active_title );
,   previous_menu;
,END;
--------
```

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SKINFO2.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE  73

*EJECT*******
.HPIB_MENU
--------

--------
"S510 HP-IB"+ak_bracket_2
"ADDRESS"
[cmd_8510_addr
,select_active_function( active_major_hpib_addr );
--------
"ADDITIONAL"
"ADDRESSES"
^HPIB_ADDRESS_MENU
--------

--------

--------
"SYSTEM"+ek_bracket_2
"*LOCAL*"
[cmd_privib_local
,BEGIN
,   hilight_on( cmd_privib_local, cmd_privib_remote );
,   abort_sweep;
,   clr_ren_priv_ib;
,   urt_priv_ib_source(  display_on, " " );
,END;
--------
"*REMOTE*"
[cmd_privib_remote
,BEGIN
,   hilight_on( cmd_privib_local, cmd_privib_remote );
,   abort_sweep;
,COMMENT
,   set_ren_priv_ib;
,COMMENT
,   urt_priv_ib_source(  display_off, " " );
,   reset_priv_ib_act_func;
,   restart_sweep;
,END;
--------

--------
```

```
SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 74

*EJECT*******
.HPIB_ADDRESS_MENU
--------

--------
"8510 MINOR"=sk_bracket_7
"ADDRESS"
[cmd_minor_addr
,select_active_function( active_minor_hpib_addr );
--------
"SOURCE"
[cmd_source_addr
,select_active_function( active_source_hpib_addr );
--------
"TEST SET"
[cmd_test_set_addr
,select_active_function( active_testset_hpib_addr );
--------
"PLOTTER"
[cmd_plotter_addr
,select_active_function( active_plotter_hpib_addr );
--------
"PRINTER"
[cmd_printer_addr
,select_active_function( active_printer_hpib_addr );
--------
"AUTO CMD"
[cmd_auto_cmd_addr
,select_active_function( active_ch_cmd_hpib_addr );
--------
"PASS-THRU"
[cmd_pass_thru_addr
,select_active_function( active_pass_thru_hpib_addr );
--------
```

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SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 75

*EJECT*******
.SERVICE_MENU
--------

--------
sk_bracket_3
help_vt="PEEK"
[cmd_peek
,select_active_function( active_peek );
--------
"POKE"
[cmd_poke
,select_active_function( active_poke );
--------
"LOCATION"
[cmd_peek_poke_addr
,select_active_function( active_address );
--------
"IF GAIN"
^IF_GAIN_MENU
[cmd_if_gain_menu
--------
"SOFTWARE"
"REVISION"
[cmd_revision
,select_active_function( active_revision );
--------

--------
"TEST MENU"
[end_test_menu
,BEGIN
,   trap_15_type :* service_trap;
,   TRAP(15);
,END;
--------

#

Ocmdcase.work.L

[cmd_illegal
,warn(invalid_command);
;
; The Following commands MUST be contiguous!
; Do NOT insert commands in between (for the parser's sake)
;
[cmd_enter
,keypad_entry(e0);
[end_u1
,keypad_entry(e0);
[cmd_u2
,keypad_entry(e3);
[cmd_u3
,keypad_entry(e6);
[cmd_u4
```

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SKINF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 76

,keypad_entry(e9);
;
; END of contiguous command entries
;
[cmd_mkrval
,marker_value_entry;
[cmd_up
,step_entry(step_up);
[end_down
,step_entry(step_down);
[cmd_entry_off
,select_active_function(active_off);
[cmd_save
,gen_save_menu(5);
[cmd_save_1
,save( 1 );
[end_save_2
,save( 2 );
[end_save_3
,save( 3 );
[end_save_4
,save( 4 );
[end_save_5
,save( 5 );
[cmd_recall
,gen_save_menu(6);
[cmd_recall_1
,recall( 1 );
[end_recall_2
,recall( 2 );
[end_recall_3
,recall( 3 );
[end_recall_4
,recall( 4 );
[end_recall_5
,recall( 5 );
[cmd_recall_last
,recall( 8 );
[cmd_tape_menu
,gen_menu(TAPE_MENU, 0);
[cmd_copy
,gen_menu(COPY_MENU, 0);
[cmd_doc
,warn(command_not_implemented);
[cmd_quote
,select_active_function(active_off);
[cmd_label
,select_active_function(active_off);
[cmd_key_1
,process_softkey(1);
[cmd_key_2
,process_softkey(2);
[cmd_key_3
,process_softkey(3);
[cmd_key_4
,process_softkey(4);
```

```
SKIKF02.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 77

[cmd_key_5
,process_softkey(5);
[cmd_key_6
,process_softkey(6);
[cmd_key_7
,process_softkey(7);
[cmd_key_8
,process_softkey(8);
[cmd_ch1
,select_entry_ch(1);
[cmd_s11
,BEGIN & s11 &
,   hilight_off( cmd_z1, cmd_user4);
,   new_parameter(s11);
,END;  & s11 &
[cmd_s12
,BEGIN & s12 &
,   hilight_off( cmd_z1, cmd_user4);
,   new_parameter(s12);
,END;  & s12 &
[cmd_s21
,BEGIN & s21 &
,   hilight_off( cmd_z1, cmd_user4);
,   new_parameter(s21);
,END;  & s21 &
[cmd_s22
,BEGIN & s22 &
,   hilight_off( cmd_z1, cmd_user4);
,   new_parameter(s22);
,END;  & s22 &
[cmd_mag
,new_format( fmt_log_mag );
[cmd_phase
,new_format( fmt_phase );
[cmd_ch2
,select_entry_ch(2);
[cmd_delay
,new_format( fmt_delay );
[cmd_polar
,new_format( fmt_z_smith );
[cmd_param_menu
,gen_menu(PARAM_MENU, 0);
[cmd_format_menu
,gen_menu(FORMAT_MENU, 0);
[cmd_preset
,recall_preset_state;
[cmd_local
,gen_menu(HPIB_MENU, 1);
[cmd_scale
,select_active_function(active_scale);
[cmd_ref_value
,select_active_function(active_ref_value);
[cmd_start
,select_active_stimulus(active_start);
[cmd_stop
,select_active_stimulus(active_stop);
```

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SKINF02.UORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 78

[end_ref_position
,select_active_function(active_ref_pos);
[cmd_auto_scale
,auto_scale;
[end_center
,select_active_stimulus(active_center);
[cmd_span
,select_active_stimulus(active_span);
[end_response_menu
,gen_menu(RESPONSE_MENU, 0);
(cmd_stimulus_menu
,gen_menu(STIMULUS_MENU, 0);
[end_cal_menu
,gen_menu(CAL_MENU, 0);
[end_display_menu
,gen_menu(DISPLAY_MENU, 0);
[cmd_marker_menu
,BEGIN
,   select_marker( active_marker );
,   gen_menoffMARKER_MENU, 0);
,END;
[end_system_menu
,gen_menu(SYSTEM_MENU, 0);
(cmd_prior_menu
,previous_menu;
[cmd_measurement_restart
,measurement_restart;
[cmd_domain_menu
,gen_menu(DOMAIN_MENU, 0);
[cmd_abort_command
,abort_command := TRUE;
[cmd_input_data
,pub_ib_input_select( data_input );
[cmd_input_formatted
,pub_ib_input_select( formatted_input );
[cmd_input_raw1
,pub_ib_input_select( raw1_input );
[cmd_inout_raw2
,pub_ib_input_select( raw2_input );
[cmd_input_raw3
,pub_ib_input_select( raw3_input );
[cmd_input_raw4
,pub_ib_input_select( raw4_input );
[cmd_input_cal_coeff1
,pub_ib_input_select( cal_coeff1_input );
[cmd_input_cal_coeff2
,pub_ib_input_select( cal_coeff2_input );
(cmd_input_cal_coeff3
,pub_ib_input_select( cal_coeff3_input );
[cmd_input_cal_coeff4
,pub_ib_input_select( cal_coeff4_input );
[cmd_input_cal_coeff5
,pub_ib_input_select( cal_coeff5_input );
[cmd_input_cal_coeff6
,pub_ib_input_select( cal_coeff6_input );
[cmd_input_cal_coeff7
```

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SKINF02.UORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 79

,pub_ib_input_select( cal_coeff7_input );
[cmd_input_cal_coeff8
,pub_ib_input_select( cal_coeff8_input );
[cmd_inpot_cal_coeff9
,pub_ib_input_select[ cal_coeff9_input );
[cmd_input_cal_coeff10
,pub_ib_input_select( cal_coeff10_input );
[cmd_input_cal_coeff11
,pub_ib_input_select( cal_coeff11_input );
[cmd_input_cal_coeff12
,pub_ib_input_select( cal_coeff12_input );
(cmd_block_a
,pub_ib_input;
[cmd_output_formatted
,pub_ib_output_select( formatted_output );
[end_output_active
,pub_ib_output_select( active_output );
[cmd_output_marker
,pub_ib_output_select( marker_output );
[cmd_output_status
,pub_ib_output_select( status_output );
[cmd_output_id
,pub_ib_output_select( id_output );
(cmd_output_data
,pub_ib_output_select( data_output );
[cmd_output_raw1
,pub_ib_output_select( raw1_output );
[cmd_output_raw2
,pub_ib_output_select( raw2_output );
[cmd_output_raw3
,pub_ib_output_select( raw3_output );
[cmd_output_raw4
,pub_ib_output_select( raw4_output );
[cmd_output_cal_coeff1
,pub_ib_output_select( cal_coeff1_output );
[cmd_output_cal_coeff2
,pub_ib_output_select( cal_coeff2_output );
(cmd_output_cal_coeff3
,pub_ib_output_select( cal_coeff3_output );
[cmd_output_cal_coeff4
,pub_ib_output_select( cal_coeff4_output );
[cmd_output_cal_coeff5
,pub_ib_output_select( cal_coeff5_output );
[cmd_output_cal_coeff6
,pub_ib_output_select( cal_coeff6_output );
[cmd_output_cal_coeff7
,pub_ib_output_select( cal_coeff7_output );
[cmd_output_cal_coeff8
,pub_ib_output_select( cal_coeff8_output );
[cmd_output_cal_coeff5
,pub_ib_output_select( cal_coeff9_output );
[cmd_output_cal_coeff10
,pub_ib_output_select( cal_coeff10_output );
[cmd_output_cal_coeff11
,pub_ib_output_select( cal_coeff11_output );
[cmd_output_cal_coeff12
```

```
SKINF02.UORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 80

,pub_ib_output_select( cal_coeff12_output );
(cmd_output_menory
,pub_ib_output_select( menory_output );
[cmd_output_error
,pub_ib_output_select( error_output );
[cmd_hpib_talk
,pub_ib_output;
[cmd_srq_mask
,select_active_function( active_srq_mask_primary );
[cmd_clear_status
,clear_serial_poll;
[cmd_xfer_binary
,pub_ib_format_select( output_binary);
[cmd_xfer_ascii
,pub_ib_format_select( output_ascii);
[cmd_xfer_ieee2
,pub_ib_format_select( output_ieee_double);
[end_xfer_ieee1
,pub_ib_format_select( output_ieee_single);
[cmd_keycode
,select_active_function( active_keycode );
[cmd_pass_source
,pass_thru_option (source);
[cmd_pass_testset
,pass_thru_option (test_set);
[cmd_pass_plotter
,pass_thru_option (plotter);
[cmd_pass_display
,pass_thru_option (user_display_graphics);
[cmd_output_plot
,pub_ib_output_select (plot_output);
[end_monitor
,BEGIN
,   trap_15_type := normal_trap_15;
,   TRAP(15);
,END;
```

```
JLIBRARY.WORK.PD8510          THU, DEC 22, 1983, 10:42 AM    PAGE 1

!JOB JLIBRARY,LIBRN.PD8510,UORK;PRI=CS;OUTCLASS=,1
!COMMENT  COMPILE AND ASSEMBLY JOB FOR 8510 MCGSOOO LIBRARY.
!COMMENT     IT DIFFERS FROM LYNN UHEELWRIGHT'S LIBRARRY
!COMMENT     BECAUSE OF HARDWARE BULTIPLER AND REDUCE BCD TYPES (NO 6,7)
!COMMENT     ALSO THE G MODE ADDRESS IS CHANGED
!COONENT
!COMMENT
!COMMENT ************ CHANGES **********************
!COMMENT
!COMMENT
!COMMENT ALL OF TYPE 6,7 AND  8 REMOVED --ALL BCDS,ECD, BCDL
!COMMENT  REMOVED MBCD6,MBCD7,MBCDXN,MCMV46,MCMV78,MCMV82,MDIGIT7,MDSFT8
!COMMENT          MBCOS
!COMMENT
!COMMENT REPLACED LYNN'S BCMPLX -- BECAUSE OF HARDWARE MULT
!COMMENT
!COMMENT OUAD INTEGER DATA TYPE INCLUDE
!COMMENT
!COMMENT ALSO CHANGED RRE MFLPT ,MPY3  -- BOTH IN MFLPT
!COMMENT             AGAIN FOR THE CHANGED BECAUSE OF HARDWARE MULT
!COMMENT
!COMMENT  ENTRY POINT IOR2G (IN DIV3)
!COMMENT     CHANGED BECAUSE 8510 G MODE IS DIFFERENT FROM LYNN'S
!COMMENT     THIS SHOULD BE THE ONLY G MODE ENTRY POINTS LEFT
!COMMENT
!COMMENT
!COMMENT   USED WITH NO CHANGE MCASE,MSQRT
!COMMENT
!COMMENT
!BUILD AMATHFUN;DISC=31,32,1;REC=-1276,,V,ASCII;TEMP
!BUILD ATERMtmp;DISC=31,32,1;REC=-1278,,V,RSCII;TEMP
!BUILD ASTRtemp;DISC=31,32,1;REC=-1275,,V,ASCII;TEMP
!BUILD RCMV9Xtp;DISC=31,32,1;REC=-1276,,V,RSCLI;TEMP
!BUILD AKERNELt;DISC=31,32,1;REC=-1278,,V,ASCII;TEMP
!BUILD AFIFOtmp;DISC=31,32,1;REC=-1276,,V,RSCII;TEMP
!BUILD ADISPLAY;DISC=31,32,1;REC=-1276,,V,ASCII;TEMP
!BUILD AINTRPTt;DISC=31,32,1;REC=-1274,,V,RSCII;TEMP
!FILE M68DLLR=M68KDLLR.M6SK.UPSOFT
!COM6SK smathfun.uork      ,AMATHFUN,$NULL,17
!COM6SK sterm.uork         ,ATERMtmp,$NULL,17
!COM68K scmv9x.uork        ,RCMV9Xtp,$NULL,17
!COM5SK skernel.uork       ,AKERNELt,$NULL,17
!COM68K sfifo.uark         ,AFIFOtmp,$NULL,17
!COM68K sdisplay.uork      ,RDISPLAY,$NULL,17
!COM6SK sintrpt.uork       ,AINTRPTt,$NULL,17
!COMMENT ********** compile sectson finished **********************
!TELL LIBRN ,PD8510; 1/2 AGSLIB UPDATE COMPLETE
!TELL JTB.PDSS10;    1/2 M6SLIB UPDATE COMPLETE
!FILE rtemp=$NEWPRSS;DISC=31,32,1
!FILE TREE'EXT=*rtemp
!FILE TREELIST=$NULL
!RUN RSMG8K.ME8K.UPSOFT;PARM=0
@MATHFUN
RCPX.uork
AFLT.uork
```

JLIBRARY.WORK.PD5510 THU, DEC 22, 1983, 10:42 AM PAGE 2

```
ACURO.work
ACIV3.work
RSQRT.work
ACASE.work
RDISPRRR.work
RKEkwELt
AFIFDtmp
RDISPLAY
RIRIRPTt
RSTRING.work
ACAV9Xtp
AFMT.work
ATERMtmp
/E
!PURGE rlibrary.work
!SAVE $OLDPASS,rlibrary.work
!TELL LISRM .PD8510; M68LIb UPDATE COMPLETE
!TELL LNMI.PD8510;   M6SLI8 UPDATE COMPLETE
!TELL JTB.PD8510;    M68LIB UPOBTE COMPLETE
!TELL WCC.PD8510;    M6SLIB UPDATE COMPLETE
!EOJ
```

JLINK.WORK.PD8510 THU, DEC 22, 1983, 10:42 RM PAGE 1

```
!job link,librn.pd8510,work;pri=CS;outclass=,1
!shoutime
!setjcw j6Serror,0
!
!purge j68temp.work
!continue
!purge ombnold
!continue
!copy ombnload,onbnoid,neu
!ietjcw jcw,0
!message "RRKLORD"
!continue
!link68k onbnload,imbnload.work,mmbnlaad,45
!if jcw<>0 then
!  oetjcu j68error,1
!  endif
!continue
!protect onbnload.work
!continue
!protect mmbnload.work
!
!continue
!purge objold
!continue
!copy obj,objold,neu
!continue
!setjcw jcw,0
!message "MAIN "
!continue
!link63k obj,lnain.work,loadnop,45
!if jcw<>0 then
!  aetjcu j68error,1
!  endif
!continue
!protect obj
!continue
!protect loadnap
!
!if j68error=0 then
!  message "========================== link done ======================="
!  tell librn.pd5510; ================== link dene ====================
!  tell wcc.pd8510; ==================== link done ====================
!  tell jtb.pd8510; ==-=-=-============== link done ====================
!  tell lani.pd8510; ================== link done ====================
!else
!  message "=========================8=== link failed ================="
!  tell librn.pd5510; ================== link failed ==================
!  tell wcc.pd5510; ==================== link failed ====================
!  tell jtb.pd8510; ==================== link failed ====================
!  tell lani.pd8510; ==================== link failed ====================
!  run hpnail.hpnail.sys;lib=g;stdin=hpnail2.work.pd8510
!  shoujcu
!  endif
!
!purge j68sort2
```

JLINK.WORK.PD8510 THU, DEC 22, 1983, 10:42 RM PAGE 2

```
!file cdeufile=loadnap
!file cdprfile=uloadsrt.work.pd8510
!continue
!ed
!continue
!iort
input loadsort
output j63sort2
key 13,6
end
!eod
!purge loadsort
!rename j68sort2,loadsort
!
!message "========================== done ======================="
!tell librn.pd8510; ============ link sort done ====================
!tell wcc.pd8510; ============== link sort done ====================
!tell jtb.pd8510; ============== link sort done ====================
!tell lani.pd8510; ============ link sort done ====================
!shoutine
!continue
!eoj
```

ULOPDSRT.WORK.PD8510 THU, DEC 22, 1983, 10:42 RM PAGE 1

```
1,/\$DRTE\8/-1,d
/^ ^$/,$d
1,$s/^ ^//
1,$s/.............[0-9A-F]{6,6}../&\n/g
g/^ ^$/d
1,$s/^ ^//
w loadsort
"SORT
"
"INPUT loadsort
"OUTPUT loadsort
"KEY 13,6
"END
"
q
```

```
SLOADSUM.WORK.PDB51D          THU, DEC 22, 1983, 10:42 AM    PAGE  1


$LIST OFF$
$USLINIT$
$STANDARD_LEVEL 'HP3000'$

PROGRAM loadmap_summary(input,output);

CONST
   ff = ' ';                                          {ASCII form-feed}

VAR
   line : STRING[132];
   hex_line : STRING[10];
   done,break1,break2 : boolean;
   mark,number1,number2,number3,number4,number5,number6 : integer;
   number0 : integer;

BEGIN {loadmap_summary}
   reset(input, 'INPUT', 'SHARED');
   rewrite(output, 'OUTPUT', 'NOCCTL');

   number0 := 0;
   number1 := 0;
   number2 := 0;
   number3 := 0;
   number4 := 0;
   number5 := 0;
   number6 := 0;

   WHILE NOT eof(input) DO
      BEGIN {while}
         break1 := false;
         break2 := false;

         readln(input,line);
         WHILE ( eoln(input) AND NOT eof(input) ) DO
                                    { readln gobbles up empty lines }
            BEGIN {while}           { so handle them here.          }
               writeln(output);
               readln(input);
            END;  {while}
         line := strrtrim(line);
         IF ( (strlen(line) > 8) AND
            (str(line,1,1)=' ') AND
            (str(line,2,1)<>' ') AND
            (str(line,7,1)=' ') AND
            ( (str(line,8,1)='0') OR
              (str(line,8,1)='1') OR
              (str(line,8,1)='F')
            )
         ) THEN
         BEGIN {if}
            writeln(output,line);                          {file name}
            write(output, '      ' );
            strdelete(line,1,7);
```

```
SLOADSUM.WORK.PDB51D          THU, DEC 22, 1983, 10:42 AM    PAGE  2

            line := strltrim(line);                        {1st number}
            mark := strpos(line,' ');
            hex_line := strltrim(strrtrim( str(line,1,mark-1) ));
            number1 := hex(hex_line);
            strdelete(line,1,mark);

            IF (number1 <> number2) THEN
               break1 := true;

            line := strltrim(line);                        {2nd number}
            mark := strpos(line,' ');
            hex_line := strltrim(strrtrim( str(line,1,mark-1) ));
            number2 := hex(hex_line);
            write(output, (number2-number1):10 );
            IF break1 THEN
               write(output, '***new*** ')
            ELSE
               write(output, '          ');
            strdelete(line,1,mark);

            line := strltrim(line);                        {3rd number}
            mark := strpos(line,' ');
            hex_line := strltrim(strrtrim( str(line,1,mark-1) ));
            number3 := hex(hex_line);
            strdelete(line,1,mark);

            IF (number3 <> number4) THEN
               break2 := true;

            line := strltrim(line);                        {4th number}
            mark := strpos(line,' ');
            hex_line := strltrim(strrtrim( str(line,1,mark-1) ));
            number4 := hex(hex_line);
            write(output, (number4-number3):10 );
            IF break2 THEN
               write(output, '***neu*** ')
            ELSE
               write(output, '          ');
            strdelete(line,1,mark);

            number0 := number5;
            line := strltrim(line);                        {5th number}
            mark := strpos(line,' ');
            hex_line := strltrim(strrtrim( str(line,1,mark-1) ));
            number5 := hex(hex_line);
            strdelete(line,1,mark);

            hex_line := strltrim(strrtrim( line ));        {6th number}
            number6 := hex(hex_line);
            write(output, (number6-number5):10 );
            IF (number0 <> number6) THEN
               write(output, '***neu***');

            writeln(output);
         END   {if}
      ELSE IF ( (strlen(line) > 7) AND
```

```
SLOADSUM.WORK.PDSS1D          THU, DEC 22, 1983, 10:42 AM    PAGE  3

               (str(line,2,6) = '$DATE$')
            ) THEN
         BEGIN {else if}
            REPEAT
               readln(input,line)
            UNTIL ( (strlen(line) > 7) AND
                  (str(line,2,6) = 'KSPMAX')
                );
            writeln(output,line);
         END   {else if}
      ELSE
         writeln(output,line);
   END;  {while}

END.  {loadmap_summary}
```

```
FLURPLUS.WORK.PDB51D          THU, DEC 22, 1983, 10:42 AM    PAGE  1

EXTERNAL IXTEGER TRBLE priv_ib_lun_table.L;
```

```
&LUNPLUS.WORK.PDB510            THU, DEC 22, 1983, 10:42 AM     PAGE   1


%G&HL.P,"lunplus"
BEGIN

$PILE sdqueer.work;                & for user display address constant &

COMMENT  This table contains the private hpib addresses by logical
         unit, and several additional items that pertain to the entire
         instrument, not to any save/recall or instrument preset state.
         :
GLOBAL INTEGER TABLE priv_ib_lun_table :=     & indexed by priv_ib lun &
   &  0 not used      &  31,                   & declared in CPRIVIB,   &
   &  1 source        &  19,
   &  2 test_set      &  20,
   &  3 plotter       &   5,
   &  4 printer       &   1,
   &  5 priv_ib_pass  &  31,
   &  6 source_2      &  19,
   &  7 test_set_2    &  20,
   &  8 lo_source     &  31,
   &  9 lo_source_2   &  31,
   & 10 user_device_1 &  31,
   & 11 user_device_2 &  31,

   & 12 - 15 fill     &  31, 31, 31, 31,

   & all actual private hp-ib addresses must have lun's <= 15 &

   & 16 major address &  16,
   & 17 minor address &  24,

   & 18 - 31 fill     &  31,31,31,31,31,31,31,31,31,31,31,31,31,31,

   & 31 user display  &  user_display_address;

   & MUST be 32 words (64 bytes) long -- one bubble block &

END$
```

```
LMAIN.WORK.PDB510               THU, DEC 22, 1983, 10:43 AM     PAGE   1

&   page 0 code begins here -- 000000/FE0000 to 007FFF/FE7FFF  &
&   ( 16-bit addressable )                                     &
rmain.work,
rlibrary.work,
ractive.work,
ractv0.work,
ractv2.work,      & has long declarations -- EXTERNAL.L &
rehtable.work,
rstimul1.work,
rcontvar.work,
rxnbn.work,
rxtaco.work,
rsize.work,
rformat.work,
rdomain.work,     & has long declarations -- EXTERNAL.L &
rmtrace.work,     & has long declarations -- EXTERNAL.L &
rmark0.work, & MUST BE LAST ITEM IN PAGE 0 &
&   page 1 code begins here -- 008000/FE8000 to 00FFFF/FEFFFF  &
&   ( requires long address )            ( runs up to stack )  &
rdatap.work,
riolib.work,      &       topnisc, uart, topkbd, botkbd, rpg, boi      &
routpui.work,
rends.work,
rtentrol.work,
rparser.work,
rscreen.work,
rscreen2.work,
rpubib.work,
rparmtbl.work,
routib.work,
rtrace2.work,
rgratic.rmrk,
rbreak.work,
ryadc.work,
rcompute.work,
rcorrect.work,
rdtngr.work,
rcal.work,
rcal0.work,
rpfr.work,
rtestset.work,
rtine.work,
rcouple.work,
rdgueer.work,
rannot.work,
rwadc.work,
rarray.work,
rcircle.work,
rrecall.work,
rstds.work,
rrespons.work,
rconnand.work,
rifgain.work,
rparam.work,
rdelay.work,
```

```
LMAIN.WORK.PDSS10               THU, DEC 22, 1983, 10:43 AM     PAGE   2

rmark1.work,       & DUST BE LAST ITEM IN PAGE 1 &
&   page 3 code begins here -- 018000/FF8000 to 01FFFF/FFFFFF  &
&   ( 16-bit addressable )    ( runs into RAM -- global data ) &
rtpmgr.work,
rmenngr.work,
rmbngr.work,
rmenu.work,
rprivib.work,
rstinul2.work,
rstinul3.work,
rutil.work,
rfft.work,
racttbl.work,
rtrigtbl.work,
raverage.work,    & has long declarations -- EXTERNAL.L &
rfstnath.work,    & has long declarations -- EXTERNAL.L &
rmarker.work,     & has long declarations -- EXTERNAL.L &
rmark3.work, & MUST BE LAST ITEM IN PAGE 3 &
&   d.g. page begins here ----- 108000/F08000 to 120000/F20000  &
&   BEWARE of modules here using fchdata, fchdata2, or fchpFr. &
&         Reading is o.k., but writing is prohibited from d.g.&
rtitle.work,
rsysten.work,
rmarks.work,
rplet.work,
rdieptbl.work,
rtrace.work,
rmarkdg.work,   &---\  Nothing before this should exceed %109800    &
ralphas.work,   &   |                                               &
ralabel.work,   &   |                                               &
ratablea.work,  &   |                                               &
rmathtbl.work,  &   |                                               &
rskey.work,     &   \  These must all be grouped identically with  &
rskpos.work,    &   /  lnbnload.                                    &
rkeys.work,     &   |                                               &
ribtree.work,   &   |                                               &
rcpltbl.work,   &   |                                               &
rdgtop.work,    &*  |                                               &
rchdata.work,   &   |    must be HOLORD below                       &
rlunpius.work,  &   |    must be NOLORD below                       &
rmarknen.work,  &   |                                               &
rsteck.work,    & --/                                               &
/E
ROR=100H RAM=FFFFF800H;   & system 0 to 100, I/D FFF800 to FFFFFF  &
datap:  RAIM=00005000H;   & bottom of page 1 (needs long address)  &
TPMGR:  RAIN=FFFF8000H;   & page 3 &
title:  RAIN=FFF02000H;   & dg (long addr) &
narkd:  RAIN=FFF09800H;
alpha:  NOLORD;
alabe:  NOLORD;
atabl:  NOLORD;
natht:  NOLORD;
skey:   NOLORD;
skpos:  NOLORD;
keys:   NOLORD;
ibtre:  NOLORD;
```

```
LMAIN.WORK.PDB510               THU, DEC 22, 1983, 10:43 AM     PAGE   3

cpltb:  NOLORD;
chdat:  NOLORD;
lunpl:  NOLORD;
narkn:  RAM=FFF20000H;    & just RAM reservation. display address &
stack:  RAM=FFFF8000H;
```

```
SMAIM.WORK.PDS510              THU, DEC 22, 1983, 10:43 AM     PAGE   1


M68KL,"main"
BEGIN

GLOBAL INTEGER TABLE sup_gn := %300;  &non is %300      JTB       DEBUG&

#FILE finit.work;
#FILE cids.work;
#FILE fintrpt.work;
#FILE fkernel.work;
#FILE fkernel2.work;
#FILE fkernel4.work;
#FILE fparser.work;
#FILE crins.work;
#FILE fFifo.work;
#FILE fdatap.work;
#FILE cchtable.work;                                    & for nax_ch &
#FILE fcontvar.work;
#FILE fcontrol.work;
#FILE fpubib.work;
#FILE foutio.work;
#FILE fnarker.work;
#FILE fnenngr.work;
#FILE fmmgr.work;
#FILE cmeeage.work;
#FILE farray.work;
#FILE fprivib2.work;
#FILE fconnand.work;
#FILE factlve2.work;
#FILE fchtab3.work;
#FILE frecall.work;                                  & for recall_type &

   PROCEDURE  botton_box;                                   EXTERNAL.L;
   PROCEDURE  top_key;                                      EXTERNAL.L;
   PROCEDURE  uart_proeess;                                 EXTERNAL.L;
   PROCEDURE  keyboard;                                     EXTERNAL.L;
   PROCEDURE  rpg;                                          EXTERNAL.L;
   PROCEDURE  retrace;                                      EXTERNAL.L;

   RSSEMBLE( DRI.U #M0700,SR );                  & Disable interrupts. &

   recall_type := power_on_recall;
   init_screen;                          & init_screen calls init_display &
   init_ch_table;
   init_save_recall;                      & loads DG RAM data fron bubble &
   irint;
   iren( refresh_vctr);                & enable nenory refresh interrupts &
                                      & nonitor set refresh vector TRAP 1& 

COMMENT                 *** WARNING ***
        The following initialization routines should not do any
        nore that initialize own and global variables.  They should
        not, repeat, not do anything to cause any i/o or interrupts.
        Such initialization should be postponed and performed during
        tht initialization of a process.
;
```

```
SMARIK.WORK.PDS510             THU, DEC 22, 1983, 10:43 AM     PAGE   2


   init_kernel;

   eignal_init( entry_etring_ready, 0 );
   reeource_init( entry_string );
   reeourec_init( active_function_rin );
   eignal_init( aborted, 0 );
   resource_init( group_ready_rin );
   resource_init( nenory_src);          & nenory allocation reeource   &
   reeource_init( trace_narks );
   init_control_variablss;          & control_ and processing_variables &

   init_neseage;
   init_array_update_fifo;
   init_keyboard_fifo;
   init_token_fifo;
   inst_sup_brk_fifo;
   init_public_ib_fifo;
   inst_top_niac;
   init_swp_brk_fifo;
   init_priv_ib;
   init_retrace;
   init_trig;
   init_active;
   init_gratic;
   reset_nenory;                        & initialize nenory allocation &

   RSSEMBLE( RNDI.W #MF8FF,SR );                & Enable interrupts.   &

   run( create( RORS(parser           ), %100, pareer_id        ) );
   run( create( RORS(botton_box       ), %100, botton_id        ) );
   run( create( RORS(rpg              ),  %80, rpg_id           ) );
   run( create( RORS(keyboard         ), %100, keyboard_id      ) );
   run( create( RORS(top_key          ),  %80, top_key_id       ) );
   run( create( RORS(uart_precess     ),  %80, uart_id          ) );
   run( create( RORS(priv_ib_erq      ), %130, priv_ib_erq_id   ) );
   run( create( RORS(retrace          ),  %80, retrace_id       ) );
   run( create( RORS(array_update     ), %200, array_update_id  ) );
   run( create( RORS(control          ), %300, control_id       ) );
   run( create( RORS(data_proc_ch1    ), %100, ch1_id           ) );
   run( create( RORS(data_prcc_ch2    ), %100, ch2_id           ) );
   run( create( RORS(hpib_listener    ), %100, pub_ib_in_id     ) );
   run( create( RORS(hpib_talker      ), %100, pub_ib_out_id    ) );
   run( create( RORS(connand          ), %200, connand_id       ) );


idle:
      IF conditional_acquire( trace_narks ) THEN
         BEGIN & if &
            partial_update_narkt;
            release( trace_narks );
         END;  & if &
      preenpt;       & this preenpt is necessary to schedule the data  &
                     &  processing in order to speed up and simplify  &
                     &  the sending of the rau_ready signal by the    &
                     &  yadc.                                         &
      GO TO idle;
```

```
SMAIM.WORK.PDS510              THU, DEC 22, 1983, 10:43 AM     PAGE   3


END$
```

```
SMARKO.WORK.PDS510             THU, DEC 22, 1983, 10:43 AM     PAGE   1


M68KL,P,"narkO"
BEGIN

COMMENT  This is to nark the end of page 0 progran code. ;

GLOBAL LABEL narkO;

narkO:

ENDS
```

```
3MARK1.UORK.PD8510          THU, DEC 22, 1983, 10:43 AM    PAGE  1

M68KL,P,"mark1"
BEGIN

COMMENT  This is to mark the end of page 1 program code. ;

GLOBAL LABEL mark1;

mark1:

END$
```

```
SMARK3.UORK.PD8510          THU, DEC 22, 1983, 10:43 AM    PAGE  1

M68KL,P,"mark3"
BEGIN

COMMENT  This is to mark the end of page 3 program code. ;

GLOBAL LABEL mark3;

mark3:

END$
```

```
SMARKDG.UORK.PD8510         THU, DEC 22, 1983, 10:43 AM    PAGE  1

M68KL,P,"markdg"
BEGIN

COMMENT  This is to mark the base of dg ram storage. ;

GLOBAL LABEL mark_dg_base;

mark_dg_base:

END$
```

```
FMARKER.UORK.PD8510         THU, DEC 22, 1983, 10:43 AM    PAGE  1

%FILE fmarker2.work;

PROCEDURE  select_ref_marker( mkr );
   VALUE   mkr;
   INTEGER mkr;                                          EXTERNAL.L;
INTEGER PROCEDURE marker_point( mkr, ch );
   VALUE   mkr, ch;
   INTEGER mkr, ch;                                      EXTERNAL.L;
USER3 PROCEDURE ch_marker_value( mkr, ch );
   VALUE   mkr, ch;
   INTEGER mkr, ch;                                      EXTERNAL.L;
USER3 PROCEDURE marker_value( mkr );
   VALUE   mkr;
   INTEGER mkr;                                          EXTERNAL.L;
USER3 PROCEDURE ch_mkr_value(ch);
   VALUE   ch;
   INTEGER ch;                                           EXTERNAL.L;
USER3 PROCEDURE mkr_value;                               EXTERNAL.L;
QUAD PROCEDURE mkr_stimulus_at_pt( mkr );
   VALUE   mkr;
   INTEGER mkr;                                          EXTERNAL.L;
QUAD PROCEDURE mkr_stimulus_value;                       EXTERNAL.L;
PROCEDURE  put_marker( mkr );
   VALUE   mkr;
   INTEGER mkr;                                          EXTERNAL.L;
PROCEDURE  partial_update_marks;                         EXTERNAL.L;
SUBROUTINE update_marks;                                 EXTERNAL.L;
```

```
SMARKER.WORK.PD8510          THU, DEC 22, 1983, 10:43 AM    PAGE  1


M68KL,P,"marker"
BEGIN

%FILE fannot.work;                          & for annotate_mkr_value &
%FILE cmkr.work;
%FILE factive.work;
%FILE factive2.work;
%FILE facttbl.work;
%FILE cchtable.work;
%FILE fchtable.work;
%FILE fchtab2.work;
%FILE fchdata.work;
%FILE fstimuli.work;
%FILE edisplay.work;
%FILE fdisplay.work;
%FILE cscreen.work;
%FILE ctrace.work;
%FILE fmenu.work;
%FILE crims.work;
%FILE fkernel.work;
%FILE fmarks.work;
%FILE fcommand.work;                              & for command_token &
%FILE cdomain.work;                         & for time_ and tdr_domain &
%FILE fdispran.work;                              & for wrt_disp_byte &


TYPELENGTH USER3 : 6;

INTEGER CONSTANT  max_marker  := 5;
INTEGER CONSTANT  coord_mask  := %O'FFF';

GLOBAL INTEGER active_marker;
INTEGER ref_marker;

INTEGER TABLE cmd_mkr :=
      cmd_marker_off,
      cmd_marker_1,
      cmd_marker_2,
      cmd_marker_3,
      cmd_marker_4,
      cmd_marker_5;

INTEGER TABLE cmd_ref_mkr :=
      cmd_no_ref_mkr,
      cmd_ref_mkr1,
      cmd_ref_mkr2,
      cmd_ref_mkr3,
      cmd_ref_mkr4,
      cmd_ref_mkr5;

ALPHA TABLE mkr_ref_off :=
      "",
      " 1 ",
      " 2 ",
```

```
SMARKER.WORK.POS510          THU, DEC 22, 1983, 10:43 AM    PAGE  2

      " 3 ",
      " 4 ",
      " 5 ";

ALPHA TABLE mkr_ref_on :=
      "",
      delta_char+" REF = 1 ",
      delta_char+" REF = 2 ",
      delta_char+" REF = 3 ",
      delta_char+" REF = 4 ",
      delta_char+" REF = 5 ";

BYTE TABLE mkr_ref_suffix :=
      ' ', ' ', ' ', ' ',                 & 0  no ref marker &
      blink_no, '-', '1, blink_off,       & 4  ref marker 1 &
      blink_nn, '-', '2, blink_off,       & 8  ref marker 2 &
      blink_on, '-', '3, blink_off,       & 12 ref marker 3 &
      blink_nn, '-', '4, blink_off,       & 16 ref marker 4 &
      blink_on, '-', '5, blink_off;       & 20 ref marker 5 &

INTEGER TABLE active_mkr :=
      0, & unused &
      active_marker1,
      active_marker2,
      active_marker3,
      active_marker4,
      active_marker5;
INTEGER TABLE ch_marker :=
      0, & unused &
      ch_marker1,
      ch_marker2,
      ch_marker3,
      ch_marker4,
      ch_marker5,
      ch_gate_start,
      ch_gate_center,
      ch_gate_stop;
INTEGER TABLE mkr_position :=
      mkr11_position,
      mkr21_position,
      mkr12_position,
      mkr22_position,
      mkr13_position,
      mkr23_position,
      mkr14_position,
      mkr24_position,
      mkr15_position,
      mkr25_position,
      mkr16_position,  & gate start &
      mkr26_position,
      mkr17_position,  & gate center &
      mkr27_position,
      mkr18_position,  & gate stop &
      mkr28_position;
INTEGER TABLE mkr_display :=
      mkr11_display,
```

```
SMARKER.WORK.PD8510          THU, DEC 22, 1983, 10:43 AM    PAGE  3

      mkr21_display,
      mkr12_display,
      mkr22_display,
      mkr13_display,
      mkr23_display,
      mkr14_display,
      mkr24_display,
      mkr15_display,
      mkr25_display,
      mkr16_display,  & gate start &
      mkr26_display,
      mkr17_display,  & gate center &
      mkr27_display,
      mkr18_display,  & gate stop &
      mkr28_display;
```

```
SMARKER.WORK.PD8510          THU, DEC 22, 1983, 10:43 AM    PAGE  4


REJECT;
COMMENT                                                marker_on_if_not
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE marker_on_if_not;
   BEGIN & marker_on_if_not &
      IF (marker_state AND %O'03E) = 0 THEN       & no markers were on &
         BEGIN & if &             & keep same as select_marker sequence &
            highlight_key( cmd_mkr[active_marker],
                           cmd_marker_1,
                           cmd_marker_off
                         );
            marker_state := SBIT( marker_state, active_marker );
            IF ref_marker <> 0 THEN     & display reference marker too &
               marker_state := SBIT( marker_state, ref_marker );
         END;  & if &
   END;  & marker_on_if_not &
```

```
SMARKER.UORK.PDS510          THU, DEC 22, 1983, 10:43 AM    PAGE  5

%EJECT;
COMMENT                                                    select_marker
*****************************************************************
*
*****************************************************************
;
PROCEDURE  select_marker( nkr );
   VALUE   nkr;
   INTEGER nkr;                                                 EXTRT;
   BEGIN & select_marker &
      hilight_key( cnd_nkr[nkr], end_marker_1, end_marker_off );
      IF nkr = 0 THEN
         BEGIN & if &
            marker_state := marker_state RND %FFC1; & turn off markers &
            IF (  (active_function >= active_marker1) RND
                  (active_function <= active_marker5)
               ) THEN          & turn off active function annotations &
               select_active_function( active_off );
         END   & if &
      ELSE & marker <> 0 &
         BEGIN & else &                    & also in marker_on_if_not &
            active_marker := nkr;
            marker_state := SBIT( marker_state, nkr );
            IF ref_marker <> 0 THEN     & display reference marker too &
               marker_state := SBIT( marker_state, ref_marker );
            select_active_function( active_nkr[nkr] );
         END;  & else &
   END;  & select_marker &
```

```
SMARKER.UORK.PDS510          THU, DEC 22, 1983, 10:43 AM    PAGE  6

%EJECT;
COMMENT                                                    select_ref_marker
*****************************************************************
*
*****************************************************************
;
PROCEDURE  select_ref_marker( nkr );
   VALUE   nkr;
   INTEGER nkr;                                                 ENTRY;
   BEGIN & select_ref_marker &
      INTEGER i,
              j;
      ALPHA   active_label;
      BYTE POINTER active_array = active_label;
      BYTE POINTER ref_label;

      IF ref_marker <> 0 THEN     & erase delta_char from old ref nkr &
         change_softkey( nkr_ref_off[ref_marker],
                         cnd_nkr[ref_marker],
                         IF ref_marker=1 THEN 2 ELSE 1
                       );
      IF nkr <> 0 THEN                 & add delta_char to new ref nkr &
         change_softkey( nkr_ref_on[nkr],
                         cnd_nkr[nkr],
                         IF nkr=1 THEN 2 ELSE 1
                       );

      & add "-N" suffix to the active function annotation &
      STPNTR( ref_label, RDRS( nkr_ref_suffix[ RLEFT(nkr,2) ) ) );
      FOR i := active_marker1 UNTIL active_marker5 DO
         BEGIN & for &
            active_label := active_function_label[i];
            FOR j := 0 UNTIL 3 DO
               urt_disp_byte( RDRS(active_array[j+9]), ref_label[j] );
         END;  & for &
      ref_marker := nkr;

      hilight_key( cnd_ref_nkr[nkr], cnd_ref_nkr1, end_no_ref_nkr );

      IF nkr = 0 THEN                     & turn off delta marker mode &
         select_active_function( active_previous )        & new status &
      ELSE IF (marker_state RND %003E) = 0 THEN       & no marker is on &
         select_marker( nkr )
      ELSE
         BEGIN & else &
            select_active_function( active_nkr[active_marker] );
            marker_state := SBIT( marker_state, nkr );
         END;  & else &

      previous_menu;

   END;  & select_ref_marker &
```

```
SMARKER.UORK.PDS510          THU, DEC 22, 1983, 10:43 AM    PAGE  7

%EJECT;
COMMENT                                                    marker_point
*****************************************************************
*
* The point number of the marker on the specified channel.
* 0 to number of points (not 0 to 800).
*
*****************************************************************
;
INTEGER PROCEDURE marker_point( nkr, ch );
   VALUE   nkr, ch;
   INTEGER nkr, ch;                                             ENTRY;
   BEGIN & marker_point &
      INTEGER point,
              i;

      & get point -- 0 to 800 &
      point := point_at_ch_stimulus( ch_quad(ch_marker[nkr],ch), ch );

      i := %RIGHT( step_size, 1 );                    & divide by 2 &
      point := point + i;                        & round, not truncate &
      UNTIL i > 0 DO
         BEGIN % while &
            point := %RRIGHT( point, 1 );
            i := %RRIGHT(i,1);                           & divide by 2 &
         END;  & while &
         & faster way to do point := point_at_stimulus/step_size &
         &    since step_size is always a power of two. &

      marker_point := point;

   END;  & marker_point &
```

```
SMARKER.UORK.PDS510          THU, DEC 22, 1983, 10:43 AM    PAGE  8

%EJECT;
COMMENT                                                    ch_marker_value
*****************************************************************
*
* value of the specified marker on the specified channel.
*
*****************************************************************
;
USER3 PROCEDURE ch_marker_value( nkr, ch );
   VALUE   nkr, ch;
   INTEGER nkr, ch;                                             ENTRY;
   BEGIN & ch_marker_value &
      INTEGER  index;              & index into formatted data array &
      USER3 POINTER data_ptr;      & pointer to formatted data array &

      index := marker_point( nkr, ch );
      STPNTR( data_ptr, ch_double(ch_f_base, ch) );
COMMENT the compiler does not properly index USER3 pointers yet
      ch_marker_value := data_ptr[index];                       & DEBUG &
      STPNTR( data_ptr, RDRS(data_ptr) + 8*index );             & DEBUG &
      ch_marker_value := data_ptr;                              & DEBUG &

   END;  & ch_marker_value &
```

```
SMARKER.WORK.PD8S10          THU, DEC 22, 1983, 10:43 AM    PAGE  9


#EJECT;
COMMENT                                                    marker_value
*****************************************************************************
*
* value of the specified marker for the current_entry_channel
*
*****************************************************************************
;
USER3 PROCEDURE marker_value( mkr );
   VALUE   mkr;
   INTEGER mkr;                                                    ENTRY;
   BEGIN & marker_value &
      marker_value := ch_marker_value( mkr, current_entry_ch );
   END;  & marker_value &
```

```
SMARKER.WORK.PD8S10          THU, DEC 22, 1983, 10:43 AM    PAGE  10


#EJECT;
COMMENT                                                    ch_mkr_value
*****************************************************************************
*
* value of the active marker for the specified channel.
*
*****************************************************************************
;
USER3 PROCEDURE ch_mkr_value(ch);
   VALUE   ch;
   INTEGER ch;                                                     ENTRY;
   BEGIN & ch_mkr_value &
      USER3   mkr_value,
              ref_mkr_value;

      marker_on_if_not;
      mkr_value := ch_marker_value( active_marker, ch );

      IF ref_marker <> 0 THEN
         BEGIN & if &
            ref_mkr_value := ch_marker_value( ref_marker, ch );
            ASSEMBLE( MOVEM.L mkr_value,      R0-R1          ;
                      SUBP    R1                           ;
                      MOVEM.L ref_mkr_value,  R2-R3          ;
                      SUBP    R3                           ;
                      JSRX    SUBE                         ;
                      SUBP    R1                           ;
                      MOVEM.L R0-R1,          mkr_value
                    );
         END;  & if &
      ch_mkr_value := mkr_value;

   END;  & ch_mkr_value &
```

```
SMARKER.WORK.PD8S10          THU, DEC 22, 1983, 10:43 AM    PAGE  11


#EJECT;
COMMENT                                                    mkr_value
*****************************************************************************
*
* value of the active marker for the current_entry_ch.
*
*****************************************************************************
;
USER3 PROCEDURE mkr_value;                                         ENTRY;
   BEGIN & mkr_value &
      mkr_value := ch_mkr_value( current_entry_ch );
   END;  & mkr_value &
```

```
SMARKER.WORK.PD8S10          THU, DEC 22, 1983, 10:43 AM    PAGE  12


#EJECT;
COMMENT                                                    mkr_stimulus_at_pt
*****************************************************************************
*
* Returns stimulus value for the point nearest the marker.
*
*****************************************************************************
;
QUAD PROCEDURE mkr_stimulus_at_pt( mkr );
   VALUE   mkr;
   INTEGER mkr;                                                    ENTRY;
   BEGIN & mkr_stimulus_at_pt &
      INTEGER     i,
                  point;

      point := marker_point( mkr, current_entry_ch );
      i := step_size;
      UNTIL ( i := RRIGHT(i,1) ) <> 0 DO
         point := RLEFT(point,1);              & multiply by step_size &
      mkr_stimulus_at_pt := entry_stimulus_at_point( point );

   END;  & mkr_stimulus_at_pt &
```

```
SMARKER.UORK.PD8510          THU, DEC 22, 1983, 10:43 AM     PAGE  13

#EJECT;
COMMENT                                                  mkr_stimulus_value
*****************************************************************************
*
* stimulus value of the active marker.
*
*****************************************************************************
;
QUAD PROCEDURE mkr_stimulus_value;                                   ENTRY;
   BEGIN & mkr_stimulus_value &

      marker_on_if_not;

      IF ref_marker <> 0 THEN
         mkr_stimulus_value := mkr_stimulus_at_pt( active_marker )
                             - mkr_stimulus_at_pt( ref_marker )
      ELSE & ref_marktr = 0 &
         mkr_stimulus_value := mkr_stimulus_at_pt( active_marker );

   END;  & mkr_stimulus_value &
```

```
SMARKER.UORK.PD8510          THU, DEC 22, 1983, 10:43 AM     PAGE  14

#EJECT;
COMMENT                                                        put_marker
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  put_markcr( mkr );
   VALUE   mkr;
   INTEGER mkr;                                                      ENTRY;
   BEGIN & put_marker &
      INTEGER  ch,
               d_state,
               n_state,
               x_point,
               mkr_index,        & a preconputed index of [ ch, mkr ] &
               mkr_end,                                & the jump target &
               dg_x,                & x_coordinate display contents &
               dg_y,                & y_coordinate    "        "     &
               dg_addr,
               temp_domain;
      INTEGER POINTER dg_ptr;

      FOR ch :* 1 TO nax_ch DO                & change to "1 ID 2" &
         BEGIN & for &
            d_state := ch_iNteger( ch_d_etate, ch );
            n_state :* ch_integer( ch_n_otete, ch );
            mkr_index :* (mkr-1)*nax_ch + (ch-1);
            dg_addr := mkr_position(mkr_index);
            mkr_end := mkr_display(mkr_index] + mkr_size;

            If ( tbIt( marker_state, mkr ) AND
                 ( (d_state = d_on) OR (n_state = n_on) )
               ) thEN
               BEGIN & if &
                  x_point :* ALEFt( marker_point(mkr,ch), 1 );
                             & times tuo -- two coordinates / point &

                  & which trace gets the marker &
                  If d_state = d_on thEN
                     STPRTR( dg_ptr, ch_double(ch_trace_hese,ch) )
                  ELSE & nenory trace only &
                     STPNTR( dg_ptr, ch_double(ch_n_trace_baee,ch) );

                  dg_x :* dg_ptr[ x_joint ] AND coord_naek;
                  dg_y := dg_ptr[ x_point + 1 ] AND coord_nask;
                  dg_eddr :* nove2( dg_addr, dg_x, dg_y );

                  IF ( (nkr * active_narker) AND
                       (ch = current_entry_ch)
                     ) thEN
                     dg_addr := printch(dg_addr, prinary_narker)
                  ELSE If nkr <= nax_narker THEN      & nornal narker &
                     dg_ador :* printch( dg_addr, narker )
                  ELSE                                & gate narker &
                     BEGIN & else &
                        temp_donain := ch_integer(ch_donain, ch);
```

```
SMARKER.UORK.PD8510          THU, DEC 22, 1983, 10:43 AM     PAGE  15

                     IF ( (tcnp_donain = tine_donain) OR
                          (tenp_donain * tdr_donain)
                        ) THEN
                        dg_addr := printch( dg_addr, gate_narker );
                  END;  & else &

               If nkr <= nax_narker THEN
                  BEGIN & if %
                     dg_addr ;= printch( dg_addr, (nkr + '0) );
                     If ( (nkr * ref_narktr) AND
                          (ch  = current_entry_ch)
                        ) THEN
                        BEGIN & if &
                          dg_addr := setattribute(dg_addr, blink);
                          dg_addr := printch(dg_addr, delta_char);
                          dg_addr := setattribute(dg_addr,blinkoff);
                        END;  & if &
                     END;  & if &

               END;  & if &
            dg_addr := jnp( dg_addr, nkr_end );
         END;  & for &

      END;  & put_narker &
```

```
SMARKER.UORK.PD8510          THU, DEC 22, 1983, 10:43 AM     PAGE  16

#EJECT;
COMMENT                                                      update_narks
*****************************************************************************
*
* update narkers, sweep update nark, and first point so that they
* follou changes in the data.
*
* "partial_update_narks" has no acquire/release so that it can be called
* by process 0, the idle process.  It nust call the routine only on the
* condition that no one else has acquired the resource.
*
*****************************************************************************
;
PROCEDURE  partial_update_narks;                                     ENTRY;
   BEGIN & partial_update_narks &
      INTEGER nkr;

      FOR nkr :* 1 TO (nax_narker + 3) DO
         put_narker( nkr );
      annotate_nkr_value;
      put_npdete_nark;
      reset_first_point;

   END;  & partial_update_narks &


SUBROUTINE update_narks;                                             ENTRY;
   BEGIN & update_narks &
      acquire( trace_narks );
      partial_update_narks;
      release( trace_narks );
   END;  & Update_narks &
```

```
$MARKEN.WORK.PD8510          THU, DEC 22, 1983, 10:43 AM    PAGE  17


%EJECT;
COMMENT                                                    init_markers
**********************************************************************
*
**********************************************************************
;
PROCEDURE  init_markers;                                        ENTRY;
   BEGIN & init_markers &
      INTEGER mkr;

      ref_marker      := 0;
      hilight_off( cmd_delta_marker, cmd_delta_marker );
      active_marker   := 1;
      FOR mkr := 1 UNTIL 5 DO
         change_softkey( mkr_ref_off[mkr],
                         cmd_mkr[mkr],
                         IF mkr=1 THEN 2 ELSE 1
                       );
      select_marker( 0 );
   END;  & init_markers &


%FILE fmkr.work;

END$
```

```
FMARKER2.WKKK.PD8510         THU, DEC 22, 1983, 10:43 AM    PAGE  1


EXTERNAL INTEGER active_marker;

PROCEDURE  select_marker( mkr );
   VALUE  mkr;
   INTEGER mkr;                                          EXTERNAL;
```

```
FMARKMEM.WORK.PD8510         THU, DEC 22, 1983, 10:43 AM    PAGE  1


EXTERNAL LABEL   mark0;
EXTERNAL LABEL   mark1;
EXTERNAL LABEL   mark3;
EXTERNAL LABEL   mentop;
EXTERNAL LABEL   mark_stack;
EXTERNAL INTEGER menbotton;
EXTERNAL LABEL   mark_dg_base;
EXTERNAL LABEL   mark_dg_top;
```

```
SMARKMEM.WORK.PD8510         THU, DEC 22, 1983, 10:43 AM    PAGE  1


$$$KL,P,"markmem"
BEGIN
                                                          & DEBUG &
%FILE cstds2.work;  & for cal_kit_array_size &            & DEBUG &

COMMENT  This is to mark the space for data array allocation. ;

GLOBAL LABEL   mentop;                  & smallest available address &
GLOBAL INTEGER menbotton;               & largest  available address &
GLOBAL DOUBLE ARRAY   sine_cos[0:1024];   & sine cosine math tables &
GLOBAL BYTE ARRAY cal_kit_array[0:cal_kit_array_size-1];      & DEBUG &

mentop:

END$
```

```
FMARKS.UORK.FD8S10              THU, DEC 22, 1983, 10:43 AM      PAGE   1

PROCEDURE  reset_first_point;                                EXTERNAL.L;
PROCEDURE  put_update_mark;                                  EXTERNAL.L;
```

```
SMARKS.WORK.PD8510              THU, DEC 22, 1983, 10:44 AM      PAGE   1

F&&KL,P,"marks"
BEGIN

#FILE cehtable.work;
#FILE fehtab2.work;                                      & for ch_integer &
#FILE fehtab3.work;                          & for current_acquisition_ch &
#FILE cdisplay.work;                                   & for dotted_blank &
#FILE fdisplay.work;
#FILE fdisply2.work;
#FILE focreen.work;
#FILE fcontvar.work;                & for stepped, rau_paee and rau_put &
#FILE fdatap.work;     & for "ch_dp_ptra", tine_donain, and tdr_donain &
#FILE fchdata.work;                    & for sueep_node and step_pile &
#FILE etrace.work;                                            & for d_on &
#FILE ccal.work;                         & for correct_on and two_port &

BYTE    CONSTANT update_nark    := '^';
INTEGER CONSTANT user3_piae     :=  &;

INTEGER TABLE update_mark_poeition :=
      update_mark1_position,
      update_nark2_poeition;
INTEGER TABLE update_mark_display :=
      update_mark1_pieplay,
      update_nark2_display;
INTEGER CONSTANT  coord_mask    := %OFFF;
```

```
SMARKS.UORK.PO8510              THU, DEC 22, 1983, 10:44 AM      PAGE   2

#EJECT;
COMMENT                                                    reset_first_point
**************************************************************************
*
* moves trace positioning vectors to correspond with the first point
* of the trace.  needs only be done once per trace.
* also moves channel 1 trace id mark.
*
**************************************************************************
;
PROCEDURE  reset_first_point;                                    ENTRY;
   BEGIN & reset_first_point &
      INTEGER ch,
              dg_addr,
              x,
              y,
              trace_display,
              trace_position;

      FOR ch := max_ch STEP -1 UNTIL 1 DO
         BEGIN & fcr &
            IF ch_integer( ch_d_state, ch ) = d_on THEN
               BEGIN & if &
                  IF ch = 1 THEN
                     BEGIN & if &
                        trace_display  := trace1_display;
                        trace_poeition := trace1_position;
                     END   & if &
                  ELSE & ch = 2 &
                     BEGIN & elee &
                        trace_diaplay  := trace2_dieplay;
                        trace_poeition := trace2_poeition;
                     END;  & else &

                  dg_addr := dg_read_xy( trace_display, x, y );
                  dg_addr := nove2( trace_poeition, x, y );
               END;  & if &

            IF ch_integer( ch_n_state, ch ) = n_on THEN
               BEGIN & if &
                  IF ch = 1 THEN
                     BEGIN & if &
                        trace_display  := trace1n_display;
                        trace_poeition := trace1n_position;
                     END   & if &
                  ELSE & ch = 2 &
                     BEGIN & else &
                        trace_display  := trace2n_display;
                        trace_position := trece2n_position;
                     END;  & else &

                  dg_addr := dg_read_xy( trace_display, x, y );
                  dg_addr := nove2( trace_position, x, y );
               END;  & if &
         END;  & for &
```

```
SMARKS.WORK.PO8510              THU, DEC 22, 1983, 10:44 AM      PAGE   3

      IF ch_integer( ch_d_state, 1 ) = d_on THEN
         BEGIN & if &
            & update channel 1 trace id mark &
            & x and y arc still set from channel 1 first point reset &
            dg_addr := nove2( trace_mark1_position, x, y );
         END;  & if &

   END;  & reset_first_point &
```

```
SMARKS.WORK.PDS51D          THU, OCC 22, 1983, 10:44 AM    PAGE  4


NEJECT;
COMMENT                                                    put_update_mark
**********************************************************************
*
* placee trace update marker on the ecreen during slow sweeps.
*
**********************************************************************
;
PROCEDURE  put_update_mark;                                        ENTRY;
   BEGIN & put_update_mark &
      INTEGER ch,
              paran,
              domain,
              point_mmbr,
              dg_x,
              dg_y,
              dg_addr;
      DOUBLE  first_point;
      INTEGER POINTER trace_otr;
      DOUBLE  POINTER double_ptr;

      FOR ch := 1 TO max_ch DO
         BEGIN & for &
            dg_addr := update_mark_eoaition[ch-1];
            IF ( ( ch_integer( ch_d_etate, ch ) = d_on ) AND
                 ( ( ch_real( ch_eweep_time, ch ) >= 0.5 ) OR
                   ( eweep_node = stepped )
                 )
               ) THEN
               BEGIN & if &
                  STPNTR( double_ptr, ch_dp_ptrs[ch] );
                  first_point := ch_edouble( ch_d_base, ch );

                  & trace_otr ia the next point to be entered &
                  STPNTR( trace_ptr,
                          (double_ptr[dp_trace_ptr] AND %FFFO7FFE)
                        );
                  dg_x := (trace_ptr[-2] AND coord_maak) - %0010;
                  dg_y := (trace_ptr[-1] AND coord_mask) - %0070;
                  dg_addr := nove2(dg_addr, dg_x, dg_y);
                  dg_addr := printch(dg_addr, update_mark);
               END;  & if $
            & will turn off the update mark if the eucep is feat &
            dg_addr := jmp( dg_addr,
                            update_marh_dieplay[ch-1] + update_mark_eize
                          );
         END;  & for &

      dg_addr := update_rau_position;
      ch := current_acquisition_ch;
      paran := current_acquisition_paran;
      domain := ch_ioteger(ch_domain, ch);
      IF ( ( (ch_integer(ch_correction_mode, ch) = correct_on) AND
             (ch_integer(ch_correction_type, ch) = two_port)
           )                                                       OR
         (ch_integer(ch_gating, ch) = gate_on)                     OR
```

```
SMRRKS.WORK.POS51D          THU, DEC 22, 1983, 10:44 AM    PAGE  5


           (domain = tdr_domain )                                  OR
           (domain = time_domain)
         )                                                           AND
         ( ( ch_real( ch_eweep_time, ch ) >= 0.5 )                 OR
           ( eueep_node = etepped )
         ) THEN
         BEGIN & if &
            point_mmbr := (rau_put[peran] - rau_oaee[peren])/ueer3_eize;
            dg_x := xgrat + point_mmbr*etep_eize*(nax_grat/800);
            dg_addr := nove2(dg_eodr, dg_x, ygrat);
            dg_eddr := plot(dg_addr, dg_x, ygrat, dotted_blank, normal);
         END  & if &
      ELSE
         dg_addr := jmp( dg_addr,
                         update_rau_display + update_rau_eize
                       );

   END;  & put_update_mark &

ENDt
```

```
FMATKFUN.UORK.PDS51D        THU, DEC 22, 1953, 10:44 AM    PAGE  1


EXTERNAL REAL
    TuoPi,
    Pi,
    Pi2,
    Pi4,
    Pi8,
    Sqrt2,
    epeed_pf_light_air,
    speed_of_light;
```

```
SMRTHFUN.UORK.PD851D        THU, DEC 22, 1933, 10:44 AM    PAGE  1


M6SKL,P,"mathfun" BEGIN

USE REGISTER 0-6,8-11;   & becuaae of uae in td_mindou&

RFILE mpytable.uork;

REAL CONSTRNT
    S02P1:=24D413DD2,S02M1:=XGAD9E6FF;

                        & value ( .5 to 1 ) * 2**23  plue exponent&
GLOBAL REAL CONSTANT TuoPi:=X6457E003,Pi:=X6487EDD2,Pi2:=X6457EDD1,
    Pi4:=X6487EDDD,Pi8:=X6487EDFF,Sort2:=X5R827R01,
    deg_to_radians     := 1.745329250-2,
    speed_of_light_air := 2.9969798 , & barr paper R294&
    speed_of_light     := 2.99792508;


REAL PROCEDURE SBR1(X); VALUE X; REAL X;                        EXTERNAL;

REAL PROCEDURE COS(X); VALUE X; REAL X;                         FORUARD;
```

```
SMATHFUN.WORK.PD8610          THU, DEC 22, 1983, 10:44 AM    PAGE  2


#EJECT;
REAL PROCEDURE TENI(I); VALUE I; INTEGER I; ENTRY;
    BEGIN REAL TABLE PWR10:=1@10,1@5,1@2,10;
    INTEGER TABLE EXPN:=10,5,2,1;
    REAL POINTER PTR=REGISTER 9;
    INTEGER POINTER PTI=REGISTER 10; REAL X=REGISTER 5;
    INTEGER X=REGISTER 6;
    X:=ABS(I);
    STPNTR(PTR,ADRS(PWR10));
    STPNTR(PTI,ADRS(EXPN));
    X:=1;
    REPEAT 4 OO BEGIN
      WHILE X>=PTI OO BEGIN X:=X*PTR; X:=X-PTI; END;
      STPNTR(PTR,ADRS(PTR)+4);
      STPNTR(PTI,ADRS(PTI)+2); END;
    TENI:=IF I<0 THEN 1/X ELSE X;
    END TENI;
```

```
SMATHFUN.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE  3


#EJECT;
REAL PROCEDURE CHEBY(X,R,N,1); VALUE X,N,T;
  REAL R,X; INTEGER N,T;
  BEGIN REAL POINTER PC=REGISTER 9;
    REAL TN=REGISTER 10,TN1=REGISIE@ 5,TN2=REGISIER 6,TVAL=REGISTER 4;
    STPNTR(PC,ADRS(R)); TVAL:=0;
    CASE T OF BEGIN
      BEGIN TN1:=1.0; TN2:=X; X:=2*X; END;
      BEGIN TN1:=TN2:=X; X:=X*X=2*2-2; END ODD;
      BEGIN TN1:=1.0; X:=TN2:=X*X*2; X:=2*X-2; TN2:=TN2-1; END EVEN;
    END CASE;
    REPEAT N-1 OO BEGIN
      TVAL:=PC*TN2+TVAL;
      TN:=TN1; TN1:=TN2; TN2:=X*TN1-TN;
      STPNTR(PC,ADRS(PC)+4); END;
    CHEBY:=PC*TN2+TVAL;
  END CHEBY;
```

```
SMATHFUN.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE  4


#EJECT;
REAL PROCEDURE TWOX(X); VALUE X; REAL X; ENTRY;
    BEGIN BYTE XP=X+3,XPSV; REAL PX=REGISTER 5,QX=REGISTER 6;
    BOOLEAN J;
COMMENT

     x      2      2      2      2
    2  = (Q(x )+xP(x ))/(Q(x )-xP(x ))

    see COMPUTER APPROXIMATIONS by JOHN F. HART (JOHN WILEY)
    pg 102 approx 1060;

    SAVE(X); X:=ABS(X);
    XPSV:=X; X:=X-XPSV; J:=X>.5; IF J THEN X:=X-.5;
    QX:=X*X+25.03911;
    PX:=8.677839*X;
    X:=(QX+PX)/(CX-PX);
    XP:=XP+XPSV; ASSEMBLE(SPC);
    IF J THEN X:=X*Sqrt2; RESTORE(PX);
    TWOX:=IF PX<0 THEN 1/X ELSE X;
    END TWOX;


REAL PROCEDURE EXP(X); VALUE X; REAL X; ENTRY;
    EXP:=TWOX(X*1.442695);
```

```
SMATHFUN.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE  5


#EJECT;
REAL PROCEDURE SIN(X); VALUE X; REAL X; ENTRY;
  BEGIN REAL TABLE
    SINE:=.44005058,-1.9563354@-2,2.4975773@-4,-1.50232S@@-6,6.24925@-9;
COMMENT
                                  k
         SIN(aX) = 2 SUMMATION (-1) J    (a)T    (X)
                                    2k+1    2k+1

   a=1 For this approximation  see HART pg113;

    IF ABS(X)>TwoPi THEN X:=X MOD TwoPi;
    IF X<0 THEN SIN:=-SIN(-X) ELSE
      IF X>Pi THEN SIN:=-SIN(X-Pi) ELSE BEGIN
        IF X>Pi2 THEN X:=Pi-X;
        SIN:=IF X>Pi4 THEN COS(Pi2-X) ELSE 2*CHEBY(X,SINE,4,1);
  END; END OF SIN;

REAL PROCEDURE COS(X); VALUE X; REAL X; ENTRY;
  BEGIN REAL TABLE COSINE:=
    .76519768,-.11450348,2.4766398@-3,-2.0938339@-5,9.422344@-S;
COMMENT
                                  k
         COS(aX) = 2 SUMMATION (-1) J  (a)T  (X)
                                    2k  . 2k

    a=1 For this approximation  see HART pg113;

    X:=ABS(X);
    IF X>TwoPi THEN X:=X MOD TwoPi;
    IF X>Pi THEN COS:=-COS(X-Pi) ELSE
    IF X>Pi2 THEN COS:=-COS(Pi-X) ELSE
      COS:=IF X>Pi4 THEN SIN(Pi2-X) ELSE 2*CHEBY(X,COSINE[1],3,2)+
        COSINE;
  END COSINE;
```

```
SMATHFUN.WORK.PDS510          THU, DEC 22, 1983, 10:44 AM     PAGE   6


#EJECT;
REAL PROCEDURE ATAN(X); VALUE X; REAL X; ENTRY;
  BEGIN REAL TABLE ARCTAN:=
    0.39782473,-5.246795@-3,1.2455722@-4,-3.5201766@-6,
    1.0832870B-7,-3.5068451@-5;

COMMENT

    RTAN(t) = pi/8 + SUM R T     (x)
                      k 2k+1
            2k+1
    A  = 2 r    /(2k+1)
     k

    r = TR@(pi/16)    x = (sqrt(2)+1)t-1 / (sqrt(2)-1)t+1

    see CHEBYSHEV METHODS IN NUMERICAL APPROXIMATION by
      . MARTIN AVERY SNYDER  (PRENTICE HALL) pg 52;

    IF X<0 THEN ATAN:=-ATAN(-X) ELSE
    IF X>1 THEN ATAN:=Pi2-RTAN(1/X) ELSE
        RTAN:=Pi8+CHEBY((SQ2P1*X-1)/(SQ2M1*X+1),ARCTAN,E,1);
    END ARCTANGENT;
```

```
SMATHFUN.WORK.PDS510          THU, DEC 22, 1983, 10:44 AM     PAGE   7


#EJECT;
REAL PROCEDURE BESI(X); VALUE X; REAL X; ENTRY;
    BEGIN
     REAL TABLE BESI1:=127.73343,190.49432,82.48903,22.274819,4.0116738,
          .509493365,.047718749,3.418332@-3,1.924694@-4,8.73832@-6,
          3.26091@-7;
     REAL TABLE BESI2:=.39915585,6.27824@-3,2.2511@-4,1.527878@-5,
          1.57817BB-6,2.27083@-7;
     X:=ABS(X);
     BESI:=IF X<=8. THEN BESI1*CHEBY(.125*X,BESI1[1],9,2) ELSE
           (BESI2*CHEBY(S./X,BESI2[1],5,0))*EXP(X)/SQRT(X);
     END;
```

```
SMATHFUN.WORK.PDS510          THU, DEC 22, 1983, 10:44 AM     PAGE   8


#EJECT;
COMPLEX PROCEDURE exp_cmplx( val ); VALUE val; COMPLEX val; ENTRY;
   BEGIN
   COMPLEX result;
   REAL real_val    = val,     imag_val    = val    + 4;
   REAL real_result = result,  imag_result = result + 4;
   REAL temp;

   result := COMPLEX( COS( imag_val ) , SIN( imag_val ) );

   IF real_val # 0.0 &bad test ??& THEN
        BEGIN  & real part of input zero &
        temp := TUOX( 1.442695 * real_val );
        real_result := temp * real_result;
        imag_result := temp * imag_result;
        END if;
   exp_cmplx := result;
   END exp_cmplx;
```

```
SMATHFUN.WORK.PDS510          THU, DEC 22, 1983, 10:44 AM     PAGE   9


#EJECT;
REAL PROCEDURE LOG2(X); VALUE X; REAL X; ENTRY;
  BEGIN REAL TABLE LOGA:=.49875,1.2418@-3,5.55578@-6,2.9696@-8;
    REAL TABLE SCALE:=2.5,2.0,1.75,1.5;
    REAL TABLE LOGSCL:=1.321928,1.0,0.8073549,0.5849625;
    BYTE XP=X+3,XPSV; INTEGER XM=X,M;
COMMENT

    log2(t) = .5 + SUM B T     (x)
                      k 2k+1

    x = (t-sqrt(2))/(1+sqrt(2)) * (sqrt(2)+1)/(sqrt(2)-1)

    r = (2^.25 -1)/(2^.25 +1)  = 5.642723372B-2

          2k+1
    A  = r    /(2k+1)
     k

    see CHEBYSHEV METHODS IN NUMERICAL APPROXIMATION by
        BARTIN AVERY SNYDER  (PRENTICE HALL)  pg 52;

    N:=RLEFT(XM,4) AND 3;
    XPSV:=XP; XP:=0; ASSEMBLE(SPC);
    X:=X*SCALE[N];
    X:=(X-Sqrt2)/(X+Sqrt2)*5.525427;
    LOG2:=XPSV+.5-LOGSCL[N]+CHEBY(X,LOGA,4,1);
  END LOG2;

END$
```

```
SMATHFUN.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM     PAGE  10


REJECT
          save for reference or later use

REAL PROCEDURE LOG(X); VALUE X; REAL X; ENTRY;
    LOG:=10G2(X)*.3010299;

REAL PROCEDURE LN(X); VALUE X; REAL X; ENTRY;
    LN:=LOG2(X)*.69314718;

REAL PROCEDURE TAN(X); VALUE X; REAL X; ENTRY; TAN:=SIN(X)/COS(X);

REAL PROCEDURE TENX(X); VALUE X; REAL X; ENTRY;
    TENX:=TWOX(X*3.321928);
```

```
AMATHTBL.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM     PAGE   1


RSNB,R
 BRT mathtbl,7,"318,LAMI.PD8510   9/3/82"
*******
* 33 point log_2 table -- mantissa part only
*    0 - 3 88
* Created by a PASCAL program -- smathtbl
*******
 ENT log_table
log_table    DEC  -32768
   DEC  -31311
   DEC  -29900
   DEC  -28529
   DEC  -27198
   DEC  -25903
   DEC  -24642
   DEC  -23414
   DEC  -22217
   DEC  -21050
   DEC  -19911
   DEC  -18799
   DEC  -17712
   DEC  -16650
   DEC  -15611
   DEC  -14594
   DEC  -13599
   DEC  -12624
   DEC  -11669
   DEC  -10733
   DEC   -9815
   DEC   -8914
   DEC   -8031
   DEC   -7163
   DEC   -6312
   DEC   -5475
   DEC   -4653
   DEC   -3845
   DEC   -3050
   DEC   -2269
   DEC   -1500
   DEC    -744
   DEC       1
*******
* 33 point arctan table ( 0 - 45 degs )
* Created by a PASCAL program -- smathtbl
*******
 ENT atn_table
atn_table    DEC  -32768
   DEC  -32107
   DEC  -31424
   DEC  -30719
   DEC  -29992
   DEC  -29242
   DEC  -28469
   DEC  -27671
   DEC  -26849
```

```
AMATHTBL.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM     PAGE   2


   DEC  -26002
   DEC  -25130
   DEC  -24232
   DEC  -23307
   DEC  -22356
   DEC  -21379
   DEC  -20376
   DEC  -19348
   DEC  -18290
   DEC  -17208
   DEC  -16101
   DEC  -14970
   DEC  -13815
   DEC  -12638
   DEC  -11440
   DEC  -10222
   DEC   -89DE
   DEC   -7734
   DEC   -6467
   DEC   -5188
   DEC   -3900
   DEC   -2609
   DEC   -1304
   DEC       0
*
**********************************
* LOOKUP TABLE --- contains 17-bit square root values from .25 to 1
* which have been rounded up from a 24-bit value.There as an assumed
* positive sign bit (0) and a significant bit (1) which accounts for
* the 17th bit per 16-bit entry.
* Asterisks indicate values which have been rounded up by 1 bit.
**********************
      ENT sqrt_tbl
sqrt_tbl EQU $-64
      HEX 0000
      HEX 03F8
      HEX 07C1  *
      HEX 0B88
      HEX 0F87
      HEX 1346
      HEX 16F3
      HEX 1A9E  *
      HEX 1E37
      HEX 21C6  *
      HEX 2549  *
      HEX 28C1
      HEX 2C3D  *
      HEX 2F94
      HEX 32EF  *
      HEX 3640
      HEX 3989  *
      HEX 3CC9  *
      HEX 4000
      HEX 432F
      HEX 4656
      HEX 4976  *
```

```
AMATHTBL.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM     PAGE   3


      HEX 4CBE  *
      HEX 4F9E
      HEX 52A8  *
      HEX 55AB  *
      HEX 58A7  *
      HEX 5B9C  *
      HEX 5E8b  *
      HEX 6174  *
      HEX 6456
      HEX 6733  *
      HEX 6A0A  *
      HEX 6CDb
      HEX 6F87  *
      HEX 7260
      HEX 782C
      HEX 7AEA
      HEX 7DA1
      HEX 7083  *
      HEX 8000
      HEX 8278
      HEX 854C  *
      HEX 87EB
      HEX 3A86  *
      HEX 8D1C
      HEX 8FAC
      HEX 923C  *
      HEX 94C6  *
      HEX 974b
      HEX 99CD  *
      HEX 9C4b  *
      HEX 9CC4
      HEX A13b  *
      HEX A3A0
      HEX A61C  *
      HEX A887
      HEX AAEF  *
      HEX AD53
      HEX AFb4
      HEX b212  *
      HEX b46C  *
      HEX b6C3
      HEX B817  *
      HEX BA6B  *
      HEX BCB5
      HEX C000
      HEX C248  *
      HEX C48C
      HEX C6CE
      HEX C9D0
      HEX CA49
      HEX COb3  *
      HEX CFb9
      HEX D1EB
      HEX D41F  *
      HEX D640
      HEX D879
```

```
SMATHTBL.WORK.PSB81e          THU, DEC 22, 1983, 19:44 PM    PAGE  4


      HEX 0AA3  *
      HEX 0CC8
      HEX 0EEF  *
      HEX E111  *
      HEX E330
      HEX E54E  *
      HEX E769  *
      HEX E982  *
      HEX EBA8  *
      HEX EDA8
      HEX EF8E  *
      HEX F1CE  *
      HEX F3D9
      HEX F5E6
      HEX F7F0  *
      HEX F9F7  *
      HEX FBFE  *
      HEX FOFF
      HEX 0291  difference between SQRT(I) and base table entry
*
* NOTE:  Precision errors are bound to occur using this method of
* computing square roots due to linear interpolation between table
* entries and rounding/truncation errors.
*
* Based on an exhaustive search of all possible normalized 16-bit
* numerics values with odd 8 even exponents, there is at most, a
* 1 LSB precision error which occurs in 29.5% of the results where:
*
*      16% are 1 LSB under the actual value from which
*          9% are computed from the upper 1/3 of the table
*          7% are computed from the lower 2/3 of the table
*
*      13.25% are 1 LSB over the actual value from which
*          12.75% are computed from the upper 1/3 of the table
*          0.50% are computed from the lower 2/3 of the table
*
* The upper part of the table contains smaller values and the lower
* part of the table contains larger values (approaching 1).
*
 END
```

```
SMAINTBL.WORK.PDB510          THU, DEC 22, 1983, 10:44 PM    PAGE  1

$LIST OFFB
$USLINIT$

PROGRAM mathtbl(INPUT,OUTPUT);

CONST
    radians_to_degs     = 5.72957795131E1;     {360/2*pi}
    two_radians_scaling = 6.13592315154E-03;  {2*Pi/1024}
    integer_scaling     = 3.27680000000E4 ;
    ln_tcaling          = 4.7274231E4;         {32768/(log(2)*ln(10))}
    radians_of_45_degs  = 0.785398;
    log_10_e            = 0.4343945;

TYPE INTEGER = -32768..32768;

VAR
    f1:TEXT;
    val,
    atan,
    log_2,
    cosine,
    sine,
    ang:UNOREAL;

{*****************************************************************}
{*                                                               *}
{*   Creates an 1025 point sine/cosine table. The output is a    *}
{* ASCII file. There are 1025 entries. The first entry is        *}
{* sin( 0 ) ( 16 bits integer ) and then cosine( 0 ) ( again 16 bits)*}
{* then angle is increment by 2*Pi/1024 radians. The values are  *}
{* scaled by 32768, but since +32768 is not a valid representation*}
{* it is limited to +32767.                                      *}
{*                                                               *}
{*****************************************************************}
PROCEDURE sine_cosine;
VAR index:INTEGER;

BEGIN

   WRITELN(f1,'*******');
   WRITELN(f1,'* 1025 pt (2 Pi radians) sin/cos table (sine first) ');
   WRITELN(f1,'* Each result 16 bit Integer scaled by 32767 ');
   WRITELN(f1,'* Created by a P45CPL program -- smathtbl');
   WRITELN(f1,'*******');
   WRITELN(f1,' ENT sine_coe');
   WRITE(f1,'sine_coe ');


   FOR index := 0 TO 1024 DO
   BEGIN
     ang    := index * two_radians_scaling;
     sine   := integer_scaling * SIN( ang );
     cosine := integer_scaling * COS( ang );
     ang    := ang * radians_to_degs;
```

```
SMAINTBL.WORK.PDB510          THU, DEC 22, 1983, 10:44 PM    PAGE  2

     { limit max value to 2^15 - 1 }
     IF sine   > 32767.499 THEN sine   := 32767.0;
     IF cosine > 32767.499 THEN cosine := 32767.0;

     WRITELN(f1,'   DEC ', sine:7:0,ang:12:6);
     WRITELN(f1,'   DEC ',cosine:7:0);
   END (index loop);
END (sine_cosine);

{*****************************************************************}
{*****************************************************************}
PROCEDURE log_table;
VAR index:INTEGER;

BEGIN

   WRITELN(f1,'*******');
   WRITELN(f1,'* 33 point log_2 table -- mantissa part only');
   WRITELN(f1,'*    0 - 3 db  ');
   WRITELN(f1,'* Created by a PPSCNL program -- smathtbl');
   WRITELN(f1,'*******');
   WRITELN(f1,' ENT log_table');
   WRITE(f1,'log_table ');

   FOR index := 0 TO 32 DO
   BEGIN
      val   := 0.5 + (index/64.0 );
      log_2 := ln_scaling * ln( val );
      log_2 := log_2 +
           integer_scaling * 0.4 * log_10_e / ( val * val * 8192.0 );

     WRITELN(f1,'   DEC ',log_2:7:0);
   END(index_loop)

END(log_table);

{*****************************************************************}
{*****************************************************************}
PROCEDURE atn_table;
VAR index:INTEGER;

BEGIN

   WRITELN(f1,'*******');
   WRITELN(f1,'* 33 point arctan table ( 0 - 45 degs )');
   WRITELN(f1,'* Created by a PPSCNL program -- smathtbl');
   WRITELN(f1,'*******');
   WRITELN(f1,' ENT atn_table');
   WRITE(f1,'atn_table ');

   FOR index := 0 TO 32 DO
   BEGIN
      val := ( 32.0 - index ) / 32.0;
      atan := -integer_scaling * arctan( val ) / radians_of_45_deg;
      val  := -2*val / (1 + 2*val*val + val*val*val*val );
      atan := atan +
```

```
SMATHTBL.WORK.PDB510          THU, DEC 22, 1983, 10:44 PM    PAGE  3

           0.6 * integer_scaling * val / 8192.0;
     IF atan < -32768.0 THEN atan := -32768.0;

     WRITELN(f1,'   DEC ',atan:7:0);
   END(index_loop)

END(atn_table);
{*****************************************************************}
{*****************************************************************}
PROCEDURE sqrt_table;
BEGIN
      WRITELN(f1, '*');
      WRITELN(f1, '*********************************');
      WRITELN(f1,
'* LOOKUP TABLE --- contains 17-bit square root values from .25 to 1 ');
      WRITELN(f1,
'* which have been rounded up from a 24-bit value.There is an assumed');
      WRITELN(f1,
'* positive sign bit (0) and a significant bit (1) which accounts for');
      WRITELN(f1,
'* the 17th bit per 16-bit entry.                                    ');
      WRITELN(f1,
'* Materials indicate values which have been rounded up by 1 bit.    ');
      WRITELN(f1,'*********************');
      WRITELN(f1,'     ENT sqrt_tbl');
      WRITELN(f1,'sqrt_tbl EQU *-64');
      WRITELN(f1,'       HEX 0000');
      WRITELN(f1,'       DEX 03F8');
      WRITELN(f1,'       DEX 07E1  *');
      WRITELN(f1,'       DEX 0BB9');
      WRITELN(f1,'       DEX 0F87');
      WRITELN(f1,'       HEX 1346');
      WRITELN(f1,'       DEX 16F8');
      WRITELN(f1,'       HEX 1A9E  *');
      WRITELN(f1,'       HEX 1E37');
      WRITELN(f1,'       HEX 21C6  *');
      WRITELN(f1,'       DEX 2549  *');
      WRITELN(f1,'       DEX 28C1');
      WRITELN(f1,'       DEX 2C30  *');
      WRITELN(f1,'       DEX 2F94');
      WRITELN(f1,'       HEX 32EF  *');
      WRITELN(f1,'       HEX 3640');
      WRITELN(f1,'       DEX 3389  *');
      WRITELN(f1,'       HEX 3CC9  *');
      WRITELN(f1,'       HEX 4000');
      WRITELN(f1,'       HEX 432F');
      WRITELN(f1,'       HEX 4656');
      WRITELN(f1,'       HEX 4976  *');
      WRITELN(f1,'       HEX 4C8E  *');
      WRITELN(f1,'       HEX 4F9E');
      WRITELN(f1,'       HEX 52A8  *');
      WRITELN(f1,'       HEX 55A8  *');
      WRITELN(f1,'       HEX 5887  *');
      WRITELN(f1,'       HEX 5B9C  *');
      WRITELN(f1,'       HEX 5C80  *');
      WRITELN(f1,'       HEX 6174  *');
```

```
SMATHTBL.WORK.PDBS10          THU, DEC 22, 1983, 10:44 AM    PAGE  4

      WRITELN(f1,'      HEX 6456 ');
      WRITELN(f1,'      HEX 6733  *');
      WRITELN(f1,'      HEX 6A0A  *');
      WRITELN(f1,'      HEX 6CDB');
      WRITELN(f1,'      HEX 6FA7  *');
      WRITELN(f1,'      HEX 726D');
      WRITELN(f1,'      HEX 752E');
      WRITELN(f1,'      HEX 77EA');
      WRITELN(f1,'      HEX 7AA1');
      WRITELN(f1,'      HEX 7053  *');
      WRITELN(f1,'      HEX 6000');
      WRITELN(f1,'      HEX 82A5');
      WRITELN(f1,'      HEX 854C  *');
      WRITELN(f1,'      HEX 87E9');
      WRITELN(f1,'      HEX 8A8e  *');
      WRITELN(f1,'      HEX 8D1C');
      WRITELN(f1,'      HEX 8FAE');
      WRITELN(f1,'      HEX 923C  *');
      WRITELN(f1,'      HEX 94C6  *');
      WRITELN(f1,'      HEX 9748');
      WRITELN(f1,'      HEX 99CD  *');
      WRITELN(f1,'      HEX 9C4B  *');
      WRITELN(f1,'      HEX 9EC4');
      WRITELN(f1,'      HEX A136  *');
      WRITELN(f1,'      HEX A3A0');
      WRITELN(f1,'      HEX A61C  *');
      WRITELN(f1,'      HEX ABB7');
      WRITELN(f1,'      HEX AREF  *');
      WRITELN(f1,'      HEX A053');
      WRITELN(f1,'      HEX AF94');
      WRITELN(f1,'      HEX B212  *');
      WRITELN(f1,'      HEX B46C  *');
      WRITELN(f1,'      HEX B6C3');
      WRITELN(f1,'      HEX B917  *');
      WRITELN(f1,'      HEX B968  *');
      WRITELN(f1,'      HEX B085');
      WRITELN(f1,'      HEX C000');
      WRITELN(f1,'      HEX C248  *');
      WRITELN(f1,'      HEX C48C');
      WRITELN(f1,'      HEX C6CC');
      WRITELN(f1,'      HEX C90D');
      WRITELN(f1,'      HEX CB49');
      WRITELN(f1,'      HEX CD33  *');
      WRITELN(f1,'      HEX CF89');
      WRITELN(f1,'      HEX D1E0');
      WRITELN(f1,'      HEX D41F  *');
      WRITELN(f1,'      HEX D64D');
      WRITELN(f1,'      HEX D879');
      WRITELN(f1,'      HEX DAA3  *');
      WRITELN(f1,'      HEX DCC8');
      WRITELN(f1,'      HEX DEEF  *');
      WRITELN(f1,'      HEX E111  *');
      WRITELN(f1,'      HEX E330');
      WRITELN(f1,'      HEX E54E  *');
      WRITELN(f1,'      HEX E769  *');
      WRITELN(f1,'      HEX E982  *');
```

```
SMATHTBL.WORK.PDBS10          THU, DEC 22, 1983, 10:44 AM    PAGE  5

      WRITELN(f1,'      HEX EB9B  *');
      WRITELN(f1,'      HEX EDAC');
      WRITELN(f1,'      HEX EFBE  *');
      WRITELN(f1,'      HEX F1CE  *');
      WRITELN(f1,'      HEX F3D8');
      WRITELN(f1,'      HEX F5EG');
      WRITELN(f1,'      HEX F7F0  *');
      WRITELN(f1,'      HEX F9F7  *');
      WRITELN(f1,'      HEX FBFC  *');
      WRITELN(f1,'      HEX FDFF');
      WRITELN(f1,
'      HEX 0201  difference between SQRT(1) and last table entry');
      WRITELN(f1, '*');
      WRITELN(f1,
'* NOTE:  Precision errors are bound to occur using this method of');
      WRITELN(f1,
'* computing square roots due to linear interpolation between table');
      WRITELN(f1,
'* entries and rounding/truncation errors.');
      WRITELN(f1, '*');
      WRITELN(f1,
'* Based on an exhaustive search of all possible normalized 16-bit');
      WRITELN(f1,
'* mantissa values with odd & even exponents, there is at most, a ');
      WRITELN(f1,
'* 1 LSB precision error which occurs in 28.8% of the results where:');
      WRITELN(f1, '*');
      WRITELN(f1,
'*     16% are 1 LSB under the actual value from which');
      WRITELN(f1,
'*          9% are computed from the upper 1/3 of the table');
      WRITELN(f1,
'*          7% are computed from the lower 2/3 of the table');
      WRITELN(f1, '*');
      WRITELN(f1,
'*     13.25% are 1 LSB over the actual value from which');
      WRITELN(f1,
'*          12.75% are computed from the upper 1/3 of the table');
      WRITELN(f1,
'*           0.50% are computed from the lower 2/3 of the table');
      WRITELN(f1, '*');
      WRITELN(f1,
'* The upper part of the table contains smaller values and the lower');
      WRITELN(f1,
'* part of the table contains larger values (approaching 1).');
      WRITELN(f1, '*');
END {sqrt_table};

{*****************************************************************************}
{*****************************************************************************}
BEGIN {main}
   REWRITE(f1,'smathtbl.work','nocctl');

   WRITELN(f1,'RSMB,R');
   WRITELN(f1,' MAM mathtbl,7,"JTB,LAHI.PDB510  9/3/82"');
```

```
SMATHTBL.WORK.PDBS10          THU, DEC 22, 1983, 10:44 AM    PAGE  6

   { sine_cosine;   no longer done here -- run time generated }
   log_table;
   atn_table;
   sqrt_table;

   WRITELN(f1,' END');
   CLOSE(f1,'SAVE');
END. {main}
```

```
FMBM.WORK.PDBS10              THU, DEC 22, 1983, 10:44 AM    PAGE  1

COMMENT
*****************************************************************************
*    The magnetic bubble memory (MBM) is a non-volatile mass memory.
* The minimal memory is 1 megabits( during development) and 2 megabits
* (during production), however the actual amount may be greater. MBM is
* a mate memory with finite time random page access (bit serial).
*    MBM is intended to store internal program, calibration data, save/
* recall states, trace and memory data storage and other internal
* information. It is intended that
* most MBM operations will be transparent it the user ( unlike tape
* which the user specify states - use tape --) (in other words , MBM
* is an extntion of the main memory -- just slower and non-volatile)
*
*    In relative preformance terms, the MBM is slower then main memory
* ( by 100:1 ) but faster than tape (100 or 1000:1). The main memory
* and MBM are full Class B but tape has a limited temp range (10-35 C).
* MBM power while operation is half that of the tape and since it is
* much faster, the total power consuntion is atleast 100:1 less. MBM
* having no mechanical parts is quiet, has no mechanical orientation
* or vibration problems. MBM should also have much better error rate
* (Intel 1 Mega with internal correction 10^-11 vs Tape checkeun only
* 10^-5).
*    MBM problems are supply availablity and price -- end of 81 approx
* 65 millicents/bit -- hopefully 25 millicents/bit end of 83 vs
* 15 mc/bit UVEPROM,5-10 mc/bit ROM, 10 mc/bit RAM, 120(now), 50(83)
* mc/bit for CMOS with battery.
*    The present vendor is INTEL (who should announce a second source
* soon) but the Japanesse and Motorola are other future sources (TI,
* National, and Rockwell have dropped out). By late 82 4 mega devices
* should also be available. Given this vendor problem and changing
* technology, the system design should allow for a change of vendor or
* MBM size.
*
*
* HARDWARE DETAIL-- The hardware is such that a power fail will cause
*    the controller chip to become disabled. This will cause the status
*    bits to be all set ( all ones ) and the code such not hang because
*    of this ( in the Intel IB code -- the delay loops will always
*    have a bail out on a bit ( ie timing Error ) high.
*
*
* DETAIL HARDWARE SPECS
*     Memory Size -- using 1,2,or 3 Intel 1 Mgabit MBM **2 most likely
*     Organization -- Each MBM is logical and physical seperate
*                        512 bits by 2048 pages
*     Transfer Rate -- 10K Bytes/sec
*                        MBM can be operated in parallel to improve
*     Access Rate   --
*                        Pages can be prefetched and therefore access
*                         is 1 ms
*     Error Rate    --  10^-12 with internal error correction
*                         Soft error - Hard errors 10^-14
*     Redundancy    --  Transparent and stored on MBM chip
*                         320 loops, 240 useds, 14 for error correction
*     Enviorment    -- Class B - 0-70 C, 0-95% RH, 20G shock,>10G Mag
```

```
FNBN.UORK.RD8510          THU, DEC 22, 1983, 10:44 RM    PAGE  2

&                    Non-operation ie -40-100C,200G shock,>40G mag
&      Interface     -- 40 byte FIFO
&      Power         -- Operating 6.5 W , Standby 1 U
&                       Fully power fail protected -- power down 20uSec
&
&
&      STATUS SITS
&      Bit 0  Fifo Ready
&      Bit 1  Parity Error  -- Ignore
&      Bit 2  Uncorrectable Error   -- fatal retry
&      Bit 3  Correctable Error -- Ignore
&      Bit 4  Timing Error -- FIFO over/under ran -- fatal
&      Bit 5  Op fail
&      Bit 6  Operation complete successfully
&      Bit 7  Busy  rotating bubbles
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
end of comment;
BOOLEAN SUBROUTINE test_nbn;                                    EXTERNAL;
       &for Hardware/power-on verify&
BOOLEAN PROCEDURE  init_nbn(mod); VALUE mod; INTEGER mod;       EXTERNAL;
       &select which hardware module to be used * mod=0,1,...&
RLPNR  PROCEDURE parms_nbn(mod,pos,pagesize,pagemax,modules);
       INTEGER mod,pos,pagesize,pagemax,modulee;                EXTERNAL;
       &returns basic bubble parmetere -- to allow software flexiable
         to future changes
       mod=present active module, pos=last page read/write
       pagesize=# of words per page,pagemax=# of pages (0=first)
       modules=# of available NBN modules&
&OUBLE PROCEDURE set_add_nbn(address,buf_start,buf_end);
  VALUE buf_otert,Duf_end; INTEGER address;
                           DOUBLE buf_start,buf_end;            EXTERNAL;
       &returns the & of pages need to transfer the buffer to/from
        the NBN page (address)
        MUST BE CALLED BEFORE R READ OR WRITE&
INTEGER SUBROUTINE status_nbn;                                  EXTERNAL;
       &returns the present status of NBC -- useful after errors&
BOOLEAN PROCEDURE  read_nbn(buf,buf_length); VALUE buf,buf_length;
                                   DOUBLE buf,buf_length;       EXTERNAL;
       &reads from the NBN into the address of buf, the number
         of pages in the buf -- found from set-add_nbn&
BOOLEAN PROCEDURE  wrt_nbn(buf,buf_length); VALUE buf,buf_length;
                                   DOUBLE buf,buf_length;       EXTERNAL;
       Writes from the NBN into the address of buf, the number
         of pages in the buf -- found from set-add_nbn&
INTEGER PROCEDURE  read_boot_nbn(buf); VALUE buf; DOUBLE buf;   EXTERNAL;
       &reads the boot loop into the buf -- 40 bytes&
       & and returns coded result of boot loop &
BOOLEAN PROCEDURE  wrt_boot_nbn(buf); VALUE buf; DOUBLE buf;    EXTERNAL;
       Writes the boot loop into the buf -- 40 bytes
        may require a hardware jumper&
```

```
FNBMCAL.WORK.RD8510       THU, DEC 22, 1983, 10:44 RM    PAGE  1

INTEGER PROCEDURE cal_seg_size (lgth);
  VALUE lgth; DOUBLE lgth;                                      EXTERNAL;
INTEGER PROCEDURE cal_seg_avail;                                EXTERNAL;
```

```
CNBMGR.UORK.RD8510        THU, DEC 22, 1983, 10:44 RM    PAGE  1

INTEGER CONSTANT
  no_op      := 0,
  save_op := 5,
  recall_op := 6,
  clear_op := 7,
  page_size := 31,              & no. of words for nbn directory info. &
  men_dir_offset := 20,         & start-1 indices to men. trace lgths  &
  cal_dir_offset := 10,
  seg_size  := 115,             & no. of pages per cal. data segment   &
  seg_start := 565,             & starting page of cal bubble segments &
  header_size := 48,            & bytes of trace header info.          &
  header_buffer_size := (header_size + 63) AND %FFC0;
```

```
FNBMGR.WORK.RD8510        THU, DEC 22, 1983, 10:44 RM    PAGE  1

&FILE cnbmgr.work;

BOOLEAN PROCEDURE read_data_header (addr, type, reg);
  VALUE addr, type, reg;  DOUBLE addr;  INTEGER type, reg;      EXTERNAL;

& Recalls a bubble register to a RAM data block &
BOOLEAN PROCEDURE recall_data (addr, type, reg);
   VALUE   addr, type, reg;
   DOUBLE  addr;
   INTEGER type, reg;                                           EXTERNAL;

& Saves RAM data block in bubble register &
BOOLEAN PROCEDURE save_data (addr, lgth, type, reg);
   VALUE addr,lgth,type,reg;
   DOUBLE addr;
   INTEGER lgth, type, reg;                                     EXTERNAL;

& Saves all bubble registers of a type in tape file &
PROCEDURE record_data (type, id, reg);
  VALUE type, id, reg; INTEGER type, id, reg;                   EXTERNAL;

& Restores data from tape to bubble registers &
PROCEDURE restore_data (type, id, reg);
  VALUE type, id, reg;  INTEGER type, id, reg;                  EXTERNAL;

& Clears a cal data register in bubble &
BOOLEAN PROCEDURE clear_cal (reg_num);
  VALUE reg_num;  INTEGER reg_num;                              EXTERNAL;

BOOLEAN PROCEDURE ok_to_save_seg (reg,lgth);
  VALUE reg,lgth; INTEGER reg,lgth;                             EXTERNAL;

INTEGER PROCEDURE get_start_pg (type, reg);
VALUE type,reg;  INTEGER type,reg;                              EXTERNAL;

& Initializes lgth info tables for save/recall status &
PROCEDURE init_save_recall;                                     EXTERNAL;

& Checks if bubbles are present and valid &
BOOLEAN SUBROUTINE bubble_ok;                                   EXTERNAL;

& Updates bubble directory for cal and memory traces &
BOOLEAN SUBROUTINE update_nbn_dir;                              EXTERNAL;

BOOLEAN PROCEDURE wrt_nbn_ok (ram_addr, nbn_pg, byte_cnt);
  VALUE   ram_addr, byte_cnt;
  DOUBLE  ram_addr;
  INTEGER nbn_pg, byte_cnt;                                     EXTERNAL;

EXTERNAL INTEGER ARRAY
  nbn_dir [0:page_size);                  & bubble directory in page 0 &

BOOLEAN SUBROUTINE recall_lunplus;                              EXTERNAL;
BOOLEAN SUBROUTINE save_lunplus;                                EXTERNAL;
```

```
SNBMGR.WORK.POS510          THU, DEC 22, 1983, 10:44 AM    PAGE  1


%GLXL,P,"nBMGR"
BEGIN

COMMENT ******** BUBBLE MANAGER MODULE ********* ----------------------+
|                                                                       |
|  This module contains the basic I/O routines needed to transfer      |
|  files to and from bubble memory:                                     |
|                                                                       |
|  Transfers data from ram to bubble ---                                |
|    save_data (ram_address, byte_lgth, data_type, data_reg)            |
|                                                                       |
|  Transfers data from bubble to ram ---                                |
|    recall_data (ram_address, data_type, data_reg)                     |
|                                                                       |
|  Transfers data from bubble to tape ---                               |
|    record_data (data_type, tape_file_no)                              |
|                                                                       |
|  Transfers data from tape to bubble --                                |
|    restore_data (data_type, tape_file_no)                             |
|                                                                       |
+-----------------------------------------------------------------------+


%FILE fterm.work;     & debug &
%FILE cdebugc4.work;  & debug &
%FILE frecall.work;
%FILE fnbm.work;
%FILE ftpmgr.work;
%FILE futil2.work;
%FILE futil3.work;
%FILE futil8.work;
%FILE cmegnbm.work;
%FILE cmegtape.work;      & for file_error message when recording data  &
%FILE cmegcal.work;       & for no col space message                    &
%FILE cmessegO.work;      & for exceeded_available_memory message       &
%FILE fmemmgr.work;
%FILE fmarkmen.work;
%FILE fehtable.work;
%FILE flunplue.work;      & for priv_ib_lun_table (HPIB addresses, etc) &
%FILE cnbmgr.work;
%FILE fstde.work;
%FILE fstde2.work;        & for cal_kit_array_size and update_kit_label &
%FILE fdetemgr.work;      & for data_type_str (for message)             &
%FILE fdguser.work;       & for init_user_graphics                      &
%FILE ftopmisc.work;      & for beep (done_tone)                        &
%FILE cpubib.work;        & for setting SRQ bits indicating complete or &
%FILE fpubib.work;        &     failed operation occured                &
```

```
SNBMGR.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE  2


REJECT;

INTEGER CONSTANT
  state_page_start:= 1,

  small_cal := 1,               & no. of segments in SMALL cal. model  &
  med_cal   := 2,               & no. of segments in MEDIUM cal. model &
  big_cal   := 4,               & no. of segments in BIG cal. model    &
  cstd_size := cal_kit_array_size/64,   & R pages per cal std data     &
  men_start := seg_start + 8*seg_size;
                                & starting page of cal std bubble data &

INTEGER ARRAY   & starting pages of 5 regs + last state + preset state &
  state_nbm [1:prior_state];

INTEGER ARRAY               & starting pages of 4 memory data registers &
  memory_nbm [1:4];

INTEGER ARRRY                       & starting pages of 2  cal standards &
  cal_std_nbm [1:2];

INTEGER TABLE                   & start pages of cal segments 0 thru 7 &
  cal_nbm :=   seg_start,
               seg_start + seg_size,
               seg_start + 2*seg_size,
               seg_start + 3*seg_size,
               seg_start + 4*seg_size,
               seg_start + 5*seg_size,
               seg_start + 6*seg_size,
               seg_start + 7*seg_size;


INTEGER RRRRY  & max. byte size for each register type&
  nbm_reg_sz [state_file:cal_file];

DOUBLE RRRRY  & max. number of bytes per data set    &
  men_max_reg [state_set:cal_set];

INTEGER pg_check,
        hpib_addr_pg,
        eg_men_base_pg;       & starting page of display RAM in bubble &

BOOLEAN bubble_alive,
        restoring_from_tape;

GLOBAL INTEGER ARRAY
  nbm_dir (0:page_size);                  & bubble directory in page 0 &
```

```
SNBMGR.WORK.POS510          THU, DEC 22, 1983, 10:44 AM    PAGE  3


REJECT;
BOOLEAN PROCEDURE wrt_nbm_ok (ram_addr, nbm_pg, byte_cnt);
  VALUE   ram_addr, byte_cnt;
  DOUBLE  ram_addr;
  INTEGER nbm_pg, byte_cnt;                                    ENTRY;
BEGIN
  INTEGER CONSTANT
          nek_try := 3;
  INTEGER start_pg, try;
  BOOLEAN passed;
  try := 0;
  start_pg := nbm_pg;
  DO    nbm_pg := start_pg                & reset nbm page to write to &
  UNTIL (passed := wrt_nbm (ram_addr, set_add_nbm (nbm_pg,0,byte_cnt)))
    OR ((try:=try+1) = nax_try);
  wrt_nbm_ok := passed;
END wrt_nbm_ok;
```

```
SNBMGR.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE  4


REJECT;
COMMENT
$DOC+

NAME--
  bubble_ok
*************************************************************************
*
* SHORT DESCRIPTION--
*   initialize bubble module which saves/recalls data
*
* EXTENDED DESCRIPTION--
*   This routine acknowledges and initializes the bubble module to
*   transfer data to/from and returns TRUE if the initialization was
*   successful, FALSE if otherwise and displays an error message to
*   indicate this.  R global variable, bubble_alive, is set initially
*   by this routine and is referred to before re-initializing and
*   re-reading the first page of data information.  "Bubble_alive" is
*   reset after every bubble operation (read/writes) throughout the
*   code to determine a successful (TRUE) or unsuccessful (FALSE)
*   operation.  Therefore, module initialization and reading the first
*   page of bubble data information is done only on "power up" and
*   prior to any bubble operation occuring after a read/write failure.
*
* INPUTS--  implied bubble module (integer constant, module)
*
* OUTPUTS--  TRUE if modvle initializes successfully,
*            FALSE if module does not get initialized
*
* ROUTINES CALLED--
*   init_nbm
*   fatal
*
* ERROR CONDITIONS AND RECOVERY--  none
*
* NOTES--
*   Any problems/failures in initializing the bubble module will prevent
*   any data transferring to/from bubble and tape or RAM to occur.
*
* AUTHOR--
*
*************************************************************************
*
* INITIAL REFINEMENT--
*   if bubble module did not initialize successfully on power-up
*   (bubble_alive) then
*   if bubble module initializes successfully then
*     set return value of subroutine to TRUE
*   else
*     set return value of subroutine to FALSE and display error message
*
*************************************************************************
*
* REVISION LOG--
*   1/10/83  -  added check for global variable "bubble_alive"
*               before re-initializing module and re-reading 1st page
```

```
SMBMGR.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE  5

*            of information (helps speed up saves/recalls to/from
*            bubble when by-passed).
*  10/11/83  -  generate FATAL error message (hang 8510) if data bubble
*            does not check out.
*
!*************************************************************************
DECLARATION--
;
BOOLEAN SUBROUTINE bubble_ok;                                    ENTRY;
$
$DOC-&

BEGIN
  pg_check := 0;
  IF NOT (bubble_ok := bubble_alive) THEN
  IF init_mbm (module) THEN
  BEGIN
    IF dump_debug THEN
      BEGIN
        USTR("after init_mbm    = "); WHEX(status_mbm); CRLF;
      END;
    IF read_mbm (MDRS(mbm_dir),set_add_mbm(pg_check,0,2*page_size-1))
    THEN
      IF (mbm_dir[31]=X5510) THEN
        bubble_ok := bubble_alive := TRUE
      ELSE
        fatal (un_init_mbm)
    ELSE
      fatal (bubble_init_error)
  END
  ELSE
    fatal (bubble_init_error);
  IF dump_debug THEN
    BEGIN USTR("bubble 1 status = "); WHEX(status_mbm); CRLF; END;
END bubble_ok;
```

```
SMBMGR.WORK.PD5510          THU, DEC 22, 1983, 10:44 AM    PAGE  6

!EJECT;
COMMENT
$DOC+

NAME--
  get_start_pg
!*************************************************************************
*
* SHORT DESCRIPTION--
*   returns the starting page of a requested data register type
*
* EXTENDED DESCRIPTION--
*   This function returns the starting page of a data register in
*   bubble.  These starting pages are stored in tables whose indices
*   correspond to register numbers:
*
*     state_mbm  = table of 8 starting pages for 8 save/recall registers
*     cal_mbm    = table of 8 starting pages for 8 possible registers
*
*   In the case of calibration data, since there are 8 possible register
*   slots from which 2 or 4 registers can be occupied with larger data
*   blocks (in effect decreasing register availibility), starting pages
*   corresponding to available segments (8 register boundaries) are
*   returned.
*
*   A return value of 0 indicates a possible invalid data type which can
*   not be transferred to/from bubble memory.
*
* INPUTS--  type = data type of register to get starting page from
*           reg  = register number (also page table index)
*
* OUTPUTS-- starting page of requested data type and register number
*
* MODULES CALLED--
*   warn
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
!*************************************************************************
*
* INITIAL REFINEMENT--
*   set page return value to 0
*   If given data type is valid and bubble module is initialized then
*     According to data type, use given register number to index
*       appropriate data type table for first page of that register
*     If data type is calibration and register cannot be accessed then
*       display error message
*   If final page number = 0  and  data type is not calibration then
*     display error message indicating invalid bubble data
*
!*************************************************************************
!
```

```
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* REVISION LOG--
*
!*************************************************************************
DECLARATION--
;
INTEGER PROCEDURE get_start_pg (type, reg);
VALUE type,reg;  INTEGER type,reg;                               ENTRY;
$
$DOC-&

BEGIN
  INTEGER pg, i;
  pg := 0;
  data_type_str := file_type[type];
  IF bubble_ok THEN
    IF (type = state_file) OR (type = state_ext) THEN
      pg := state_mbm[reg]   ELSE
    IF (type = memory_file) OR (type = memory_ext) THEN
      pg := memory_mbm[reg]  ELSE
    IF (type = cal_std_file) OR (type = cal_ext_ext) THEN
      pg := cal_std_mbm[reg] ELSE
    IF (type = cal_ext) THEN
      pg := cal_mbm[3*8+reg]      ELSE
    IF (type = cal_file) THEN
      IF (i:=mbm_dir[reg])=0 AND NOT restoring_from_tape THEN
        compute_warn (data_type_str, no_reg_data)
      ELSE
        pg := cal_mbm[RIGHT(i,8)];
  get_start_pg := pg;
END get_start_pg;
```

```
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!EJECT;
PROCEDURE cal_dump;     & DEBUG ROUTINE ONLY !!! &
BEGIN
  INTEGER i;
  USTR("Cal seg bitmap:"); WHEX(mbm_dir[8]); CRLF;
  USTR("Cal dir/status:");
  FOR i := 1 TO 8 DO WHEX(mbm_dir[i]); CRLF;
  USTR("Cal reg lgths: ");
  FOR i := cal_dir_offset+1 TO cal_dir_offset+5 DO WHEX(mbm_dir[i]);
  CRLF;
  USTR("Mem directory: ");
  FOR i := mem_dir_offset+1 TO mem_dir_offset+4 DO
    WHEX(mbm_dir[i]);  CRLF;
END cal_dump;
```

```
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%EJECT;
COMMENT
%DOC+

NAME--
  update_nbn_dir
*****************************************************************************
*
* SHORT DESCRIPTION--
*   updates changes made to data bubble information directory
*
* EXTENDED DESCRIPTION--
*   This routine updates the data bubble directory found in page 0.
*   A copy of the directory in RAM is changed as data is saved or
*   changed or deleted.  This copy is then written over the non-volatile
*   copy in the data bubble.  The information in the directory consists
*   of the following:
*
*   - cal data bitmap corresponding to 8 possible cal data registers
*   - cal data allocation map made of 8 words where each word contains:
*     MSByte = segment number (1..5) of memory cal data is stored at
*     LSByte = # segments (1,2,4) needed to store cal data
*   - cal data length information (# bytes) made of 8 words for each
*     register
*   - memory trace data length information (8 bytes) made of 4 words
*     for each memory trace
*
* INPUTS--  none
*
* OUTPUTS--
*   TRUE = if write to data bubble succeeds
*   FALSE= if write to data bubble fails
*
* ROUTINES CALLED--
*   wrt_nbn
*   set_add_nbn
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   copy bubble directory to bubble
*   (using low level bubble I/O routine which return TRUE if the
*    operation succeeds, FALSE otherwise)
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
```

```
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DECLARATION--
;
BOOLEAN SUBROUTINE update_nbn_dir;                              ENTRY;
&
%DOC-&

BEGIN
  pg_check := 0;
  COMMENT
  update_nbn_dir := wrt_nbn (RORS(nbn_dir),set_add_nbn(pg_check,0,63));
  update_nbn_dir := wrt_nbn_ok (RORS(nbn_dir), pg_check, 63);
  IF dump_debug THEN
    BEGIN
      USTR("updating nbn dir"); CRLF;
      cal_dump;
    END;
END update_nbn_dir;
```

```
SMBMGR.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE  11


%EJECT;
COMMENT
%DOC+

NAME--
  move_segment
*****************************************************************************
*
* SHORT DESCRIPTION--
*   "garbage collects" physical cal data blocks in bubble
*
* EXTENDED DESCRIPTION--
*   This routine moves physical blocks of cal data from one designated
*   bubble segment boundary to another.  These segments are pre-defined
*   in a table, cal_nbn.  There are 8 segment boundaries (or 8 possible
*   cal data information which can be stored in 1,2, or 4 segments at a
*   time.  This routine "closes" up any segment gaps so that available
*   segments are contiguous and can be allocated as such.  Segments are
*   moved in even segment boundaries only.  Therefore, there can be only
*   one available segment between consecutively occupied segments at any
*   time.
*   An intermediate buffer in RAM is temporarily allocated to transfer
*   from one area of bubble to another.
*
* INPUTS--
*   src_seg  = segment boundary of bubble information to be moved
*   dest_seg = segment boundary of bubble information to be moved to
*   pg_cnt   = number of pages of bubble information to be moved
*
* OUTPUTS--
*   successful/unsuccessful bubble segment re-allocation
*   (TRUE)/(FALSE)
*
* ROUTINES CALLED--
*   warn
*   wrt_nbn
*   read_nbn
*   request_memory
*   release_memory
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
```

```
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DECLARATION--
;
BOOLEAN PROCEDURE move_segment (src_seg, dest_seg, cal_size);
VALUE src_seg, dest_seg, cal_size;  INTEGER src_seg, dest_seg, cal_size;
&
%DOC-&

BEGIN
  INTEGER src_pg, dest_pg, pg_cnt, register, reg=REGISTER 6;
  INTEGER POINTER bitmap;
  DOUBLE buffer;
  BOOLEAN move_ok;

  & get corresponding register info &
  reg := 0;
  move_ok := FALSE;
  DO UNTIL (RIGHT(nbn_dir[(reg:=reg+1)],8)=src_seg) OR (reg=9);
  IF ((register:=reg) = 9) THEN
    warn (invalid_nbn_data)
  ELSE
  IF (buffer:=request_memory(2560)) = 0 THEN
    warn (exceeded_available_memory)
  ELSE
    BEGIN
      src_pg := cal_nbn[src_seg];
      dest_pg:= cal_nbn[dest_seg];
      pg_cnt := cal_size * seg_size;
      IF dump_debug THEN
        BEGIN
          USTR("CRUNCHING CRL DATA:"); UHEX(pg_cnt); USTR(" pgs from");
          UHEX(src_pg); USTR(" to"); UHEX(dest_pg);
          CRLF;
        END;
      DO IF
        (move_ok:=read_nbn(buffer,set_add_nbn(src_pg,0,2559)))
        THEN
        &
        move_ok :=wrt_nbn(buffer,set_add_nbn(dest_pg,0,
                  (IF pg_cnt>=40 THEN 2559 ELSE pg_cnt*64-1)))
        &
        move_ok :=wrt_nbn_ok (buffer, dest_pg,
                             (IF pg_cnt>=40 THEN 2959 ELSE pg_cnt*64-1))
      UNTIL NOT move_ok OR ((pg_cnt:=pg_cnt-40)<=0);   &40 pgs/tape blk&
      IF dump_debug THEN
        BEGIN
          USTR("From"); UHEX(src_pg); USTR(" to"); UHEX(dest_pg); CRLF;
        END;
      IF (bubble_alive:=move_ok)  THEN              & update rtg info. &
        BEGIN
          nbn_dir[register] := cal_size OR LEFT(dest_seg,8);
          SIPNTR (bitmap, RORS(nbn_dir[0&]));
          FOR reg := 0 TO cal_size-1 DO        & update segment bitmap &
            bitmap := SBIT (RBIT(bitmap,src_seg+rtg),dest_seg+reg);
        END;
      release_memory (buffer);
    END;
```

```
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  move_segment := move_ok;
END move_segment;
```

```
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#EJECT;
COMMENT
#DOC+

NAME--
  scan_seg
*****************************************************************************
*
* SHORT DESCRIPTION--
*   returns starting bubble segment for cal data register, if any
*
* EXTENDED DESCRIPTION--
*   This routine returns the starting segment (0..7) of a saved cal
*   register of a given segment size (1,2,4).  A value of 0 is returned
*   if a register of the given segment size cannot be found.
*   The first page of the data bubble contains cal data and memory trace
*   information.  8 words from this page correspond to the 8 possible
*   cal data registers.  Each word contains a page number for the
*   starting cal data bubble segment (upper byte) and the number of
*   segments occupied by the saved cal data (lower byte).
*   This is a general purpose routine used when "garbage collecting"
*   saved cal data blocks.
*
* INPUTS--
*   i  = register to start scanning from
*   sz = number of segments occupied by that register (i)
*
* OUTPUTS--
*   starting segment of first register found occupying a given number of
*   segments
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
INTEGER PROCEDURE scan_seg (i,sz);  VALUE i,sz;  INTEGER i,sz;
&
$DOC-&
```

```
SMBMGR.WORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE 15

BEGIN
  INTEGER n=REGISTER 6;                          &register counter&
  n := 0;
  DO BEGIN
    UHILE RIGHT(nbm_dir[n:*na1],8)<=i AND (n<8) DO;  &get reg w/ seg>i &
    IF (nbm_dir[n] AND 20F)=sz THEN
      i := 10;                                   & indicates segment found &
  END UNTIL (i=10) OR (n=8);
  scan_seg := (IF i=10 THEN RIGHT(nbm_dir[n],8) ELSE 0);
END scan_seg;
```

```
SMBMGR.UORK.PD8510          THU, DEC 22, 1983, 10:44 AM    PAGE 16

#EJECT;
COMMENT
$DOC+

NAME--
  crunch_segments
*****************************************************************************
*
* SHORT DESCRIPTION--
*   updates bookkeeping for cal data "garbage collection"
*
* EXTENDED DESCRIPTION--
*   This routine checks for non-contiguous occupied cal data segments,
*   calls the "move_segment" routine to re-allocate available segments,
*   and updates the corresponding segment bitmap.
*   Cal data segments are reconfigured to occur as paired "small"
*   segments, and "medium" segments so that they lie on even segment
*   boundaries, XXC0XX00.  Segment sizes are currently defined as
*      "small"  = 1 segment
*      "medium" = 2 segments
*      "large"  = 4 segments
*   This routine is called whenever a saved cal is deleted.
*
* INPUTS--  none
*
* OUTPUTS-- successful/unsuccessful bubble segment re-allocation
*           (TRUE)/(FALSE)
*
* ROUTINES CALLED--
*   move_segment
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
BOOLEAN PROCEDURE crunch_segments;
&
$DOC-&

BEGIN
  INTEGER i, seg, segmap;
  BOOLEAN crunch_ok;
```

```
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  i := 0;
  segmap := mbn_dir&0&;
  crunch_ok := TRUE;
  WHILE (i<8) AND TBIT(segmap,i) DO i:=i+1;  &get 1ot avail segment&
  WHILE NOT TBIT(segmap,1) AND ((seg:=scan_seg(i,small_cal))>i) DO
    IF (crunch_ok:=move_segment(seg,i,small_cal)) THEN
      i := i+small_cal;                      &fill u/ small cal. first &
  IF TBIT(i,0) THEN i:=i+1;                  &get even segment Boundary&
  WHILE NOT TBIT(segmap,1) AND ((seg:=scan_seg(i,med_cal))>i) DO
    IF (crunch_ok:=move_segment (seg,i,med_cal)) THEN
      i := i+med_cal:                        &fill u/ med. cal. next   &
  IF NOT TBIT(segmap,0) AND (scan_seg(i,big_cal)=4) THEN
    crunch_ok := move_segment (4,0,big_cal);
  crunch_segments := crunch_ok;
END crunch_segments;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  clear_cal
*****************************************************************************
!
* SHORT DESCRIPTION--
*   deletes a saved cal data
*
* EXTENDED DESCRIPTION--
*   This routine will delete a cal data that has been stored in the
*   data bubble by clearing directory entries and bits corresponding to
*   the cal data register that is to be deleted.  A message is displayed
*   indicating that a cal data is being deleted once a cal data register
*   has been selected.  Any cal data bubble segments that are freed up
*   as a result of a deleted cal will be subsequently garbage collected
*   so that all available segments are contiguous.
*
* INPUTS--
*   reg = cal data register number (1..8) to be deleted
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   get_start_pg
*   crunch_segments
*   update_mbn_dir
*   tell
*   warn
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   get starting page of cal data corresponding to register to delete
*   IF starting > 0 (register contains data) THEN
*     display message indicating cal data is being deleted
*     clear bitt in bubble segment bitmap corresponding to segments
*       occupied by cal data being deleted
*     clear out information words corresponding to deleted register
*     call routine to compact free bubble segment space
*     call routine to update new bubble information/directory
*     IF compacting and updating succeeds THEN
*       display message indicating cal data hat been deleted
*     ELSE
*       display message indicating an error in deleting cal data
*
*****************************************************************************
```

```
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*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
BOOLEAN PROCEDURE clear_cal (reg); VALUE reg; INTEGER reg;        ENTRY;
&
$DOC-&

BEGIN
  BOOLEAN clear_ok;
  INTEGER POINTER scgmap,regmap;
  INTEGER i, seg;
  clear_ok := FALSE;
  IF get_start_pg (cal_file,reg) > 0 THEN
    BEGIN
      compute_tell (data_type_str, deleting_data);
      STPNTR (segmap, RDRS(mbn_dir&0&));
      STPNTR (regmap, BDRS(mbn_dir[reg]));
      seg := RIGHT(regmap,S);                  & starting segment &
      FOR i := 0 TO (regmap AND XOF)-1 DO
        segmap := RSET(segmap, seg+i);         & clear out segment bits &
      mbn_dir[cal_dir_offset+reg] :=
      regmap := 0;                             & clear out register info&
      IF crunch_segments THEN                  & "garbage collect"      &
        clear_ok := update_mbn_dir;            & update cal. dir. info. &
      IF (bubble_alive:=clear_ok) THEN
        BEGIN
          tell (cal_rtg_cleared);
          set_serial_poll (op_complete_srq);
        END
      ELSE
        BEGIN
          warn (cal_clear_error);
          set_serial_poll (op_failed_srq);
        END;
      IF dump_debug THEN
        BEGIN
          WSTR("Dtleting Cal"); CRLF;
          cal_dump;
        END;
    END;
  clear_cal := clear_ok;
END clear_cal;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  cal_seg_size
*****************************************************************************
*
* SHORT DESCRIPTION--
*   indicates number of bubble segments needed to save a calibration
*
* EXTENDED DESCRIPTION--
*   This routine determines how many bubble segments  (1,2,4) are
*   required to store a cal given the number of bytes of the cal data
*   to be stored.
*
* INPUTS--
*   lgth = number of bytes of cal data to be stored
*
* OUTPUTS--
*   number of bubbles segments needed to save cal data
*   (0 indicates a 0 or >32K bytes was passed in lgth)
*
* ROUTINES CALLED-- none
$
* ERROR CONDITIONS AND RECOVERY--
*   Cal data lengths that are greater that 32K or less than 0 return
*   a value of 0.
$
* NOTES--
*   The integer constant "seg_size" defines the number of bubble pages
*   in each bubble segment (1 bubble page = 64 bytes).
$
* AUTHOR--
$
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set default value to 0
*   IF number of bytes fits in 1 segment THEN assign a value of 1 ELSE
*   IF number of bytts fits in 2 segemnts THEN assign a value of 2 ELSE
*   IF number of bytes fits in 4 segments THEN assign a value of 4
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
INTEGER PROCEDURE cal_seg_size (lgth);
  VALUE lgth; DOUBLE lgth;                                        ENTRY;
&
$DOC-&

BEGIN
```

```
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  cal_seg_size := 0;
  IF lgth > 0 THEN
  IF lgth <= LEFT(seg_size,6) THEN cal_seg_size := small_cal  ELSE
  IF lgth <= LEFT(seg_size,7) THEN cal_seg_size := med_cal    ELSE
  IF lgth <= LEFT(seg_size,8) THEN cal_seg_size := big_cal;
END cal_seg_size;
```

```
SMBMGR.WORK.POS510          THU, DEC 22, 1983, 10:45 AM    PAGE 22

%REJECT;
COMMENT
$DOC+

NAME--
  cal_seg_avail
*****************************************************************************
*
* SHORT DESCRIPTION--
*   indicates the number of bubble segments available for cal data
*
* EXTENDED DESCRIPTION--
*   This routine determines the number of available bubble segments
*   for storing a cal by checking the bubble segment bitmap and counting
*   all bits that are clear.  Each clear bit corresponds to an available
*   bubble segment.
*
* INPUTS--  none
*
* OUTPUTS--
*   available bubble segments for storing cal data (0..8)
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY-- none
*
* NOTES--
*   The integer constant "seg_size" defines the number of bubble pages
*   in each bubble segment (1 bubble page = 64 bytes).
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   count clear (available segments) bits in bubble segment bitmap
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
INTEGER PROCEDURE cal_seg_avail;                                    ENTRY;
%
$DOC-%

BEGIN
  INTEGER segmap, sag=REGISTER 5, i=REGISTER 6;
  seg := 0;
  segmap := nbn_dir[0];
  FOR i := 0 TO 7 DO
    IF NOT TSIT (segmap, i) THEN
      seg := seg+1;
  cal_seg_avail := stg;
```

```
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END cal_seg_avail;
```

```
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%REJECT;
COMMENT
$DOC+

NAME--
  ok_to_save_cal
*****************************************************************************
*
* SHORT DESCRIPTION--
*   checks if cal data can stored
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*   reg  = cal data register that is to be stored
*   lgth = number of bytes of cal data to store
*
* OUTPUTS--
*   TRUE  = enough bubble segments available to store cal data
*   FALSE = no/not enough bubble segments available or too many bytes
*           to store (ie. over 32K).
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
BOOLEAN PROCEDURE ok_to_save_cal (reg,lgth);
  VALUE reg,lgth; INTEGER reg,lgth;                                 ENTRY;
%
$DOC-%

BEGIN
  INTEGER cal_size, seg;
  INTEGER POINTER segmap;
  BOOLEAN no_problem;
  cal_size := seg := 0;
  no_problem := FALSE;
  % check for enough cal segments (include segments to be overwritten) %
  IF ((cal_size:=cal_seg_size(lgth)) > 0) AND
     ((cal_seg_avail+(nbn_dir[reg] NWO 20F)-cal_size) >= 0) THEN
    BEGIN
```

```
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      no_problen := TRUE;
      IF nbn_dir[reg*cil_dir_offset) > 0 THEN   & if sal reg full then &
        no_problen := clear_cal (reg);     & delete cal in reg aelected &
      STPNTR (ssenep, ADRS(nbn_dir&O&));  & segnent batnap to update   &
      WHILE TBIT(eegnap,seg) RNO (scg<8) DO
        eeg := ecg + cal_size;              & find 1st available segnent &
      IF no_problen THEN
      IF ssg >= 2 THEN                      & no segnents left to save to&
        BECIN
          uarn (eelect_delete_cal_set);
          no_problen := FRLSE;
        END
      ELSE
        BEGIN
          nbn_dir[reg+cel_dir_effect] := lgth;        & N bytea of cal  &
          nbn_dir(reg} := LEFT(ecg,8) OR cal_size;   & update reg info &
          seg := eeg-1;
          REPERT cal_size DO  segnap:*SBIT(aegnap,(aeg:*seg+1));
        END;
      IF dunp_debug THEN
        BEGIN
          USIR("Saving Cal"); CRLF;
          cal_dunp;
        END;
    END
  ELSE  & call uayne'e atuff that tells ueer to delete a cal &
    uarn (select_delete_cal_aet);
  ok_to_eave_cal := no_eroblen;
END seve_cal;
```

```
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#EJECT;
COMMENT
$OOC+

NAME--
  eave_data
********************************************************************************
*
* SHORT OESCRIPTION--
*   eaves data fron RAM to bubble
*
* EXTENDED DESCRIPTION--
*   This routine will save cave/recall and calibration data currently
*   in RAM to a register in bubble nenory.  There are 7 save/recall
*   registers and fron 2 to 8 calibration data registers (depending on
*   number of points).
*
*   Theee registers are fixed locations in bubble nenory which are
*   accessed through initialized arrays of starting page numbers in
*   bubble corresponding to regieter numbers (segnents in the case  of
*   calibration data uhich is stored someuhat variably).  The register
*   ie determincd through u softkey selection.
*
* INPUTS--
*   addr = etarting RAM addreas of data to aave
*   lgth = number of bytes fron addr to eave
*   type = instrunent state (state_file) or calibration data (cal_file)
*          or nenory trace (mencry_file)
*   reg  = register number to etore data into
*          1-7 for inetrunent atates
*          1-8 for cal data
*          1-4 for nenory traces
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   urt_nbn
*   tell
*   uarn
*
* ERROR CONDITIONS AND RECOVERY--
*   With the poeeibility of bubble nenory urite failure, an error
*   neeeage (warning) is displayed in the event of this occurence,
*   otheruiee a nessage acknowledging the conpletion of the bubble
*   urite is displayed.
*   Does NOT range check data types or register numbers for data types!
*
* NOTES--
*
* AUTHOR--
*
********************************************************************************
*
* INITIRL REFIKEMENT--
*
********************************************************************************
```

```
SMBMGR.WORK.PD8510              THU, DEC 22, 1983, 10:45 AM     PRGE  27

*
* REVISION LOG--
*   1/28/S3   -- nade procedure return boolean value indicating failure
*                 (urite fail, data averflou) or success.
*
********************************************************************************
DECLARRTION--
;
BOOLEAN PROCEDURE save_data (addr, lgth, type, reg);
VRLUE addr,lgth,type,reg;
DOUBLE addr;
INTEGER lgth, type, reg;                                          ENTRY;
&
$DOC-&

BEGIN
  INTEGER POINTER ptr=addr;
  INTEGER i, pg_ptr, save_lgth;
  BOOLERN onit_nsg, save_ok;

  SUBROUTINE urite_to_bubble;
  BEGIN
    i:=-1024;
    DO
      &
      aave_ok:*urt_nbn(RORS(ptr[i:=i+1024)),set_add_nbn(pg_ptr,0,
                    (IF lgth>204S THEN 2047 ELSE lgth-1)))
      &
      eave_oh := urt_nbn_ok (RORS(ptr[i:*i*1024]), pg_ptr,
                           (IF lgth>204S INCN 2047 ELSE lgth-1))
    UNTIL NOT save_ok OR ((lgth:=lgth-204S) <= 0);
    IF dunp_debug THEN
      BEGIN WHEX(pg_ptr-1); CRLF; END;
  END urite_to_bubbie;

  save_ok := FRLSE;
  IF NOT bubble_ok THEN
    uarn (bubble_init_error)
  ELSE
    BEGIN
      enit_neg :* (type=state_file) AND (reg*prior_state);
      IF type <> state_file THEN      & round doun to nearest 64 bytes &
        lgth := save_lgth := lgth RNO %ffC0;
      save_ok := (IF (type = cal_file) THEN
                   ok_to_save_cal (reg,lgth)
                 ELSE
                   (lgth <= nbn_reg_sz[type]));
      IF NOT save_ok THEN
        uarn (data_overflow)
      ELSE
      IF (pg_ptr := get_start_pg(type,reg)) > 0 THEN
        BEGIN
          IF dunp_debug THEN
            BEGIN
              USIR("Saving data "); WHEX(type); UHEX(reg): CRLF;
              USTR(" addr"); WHex(addr,8);
```

```
SMBMGR.WORK.PD&S10              THU, DEC 22, 1983, 10:45 AM     PAGE  28

              USTR(" lgth"); UHEX(lgth);
              uSIR(" pg"); WHEX(pg_ptr);
            END;
          urite_to_bubble;
          IF save_ok THEN
          IF type = nenory_file THEN  & lgth of nen. trace being saved &
            BEGIN
              nbn_dir [nen_dir_offset+reg] := save_lgth;
              save_ok :* update_nbn_dir;
            END
          ELSE
          IF type = cal_file THEN
            BEGIN
              COMMENT urite partial intetrunent to bubble for cal data
                      eet up partial save/recall addr. and lgthe;
              save_ok :* update_nbn_dir;
            END;
          IF NOT (bubble_alive := aave_ok) THEN
            BEGIN
              conpute_uarn (data_type_etr, aave_error);
              eet_serial_poll (op_failed_srq);
            END
          ELSE
          IF NOT onit_nsg THEN
            BEGIN
              conpute_tell (data_type_str, data_saved);
              set_eerial_poll (op_conplete_erq);
            END;
        END;
    END;
  save_data :* save_ok;
END seve_data;
```

```
SMBMGR.WORK.PDB510              THU, DEC 22, 1983, 10:05 AM     PAGE  29

!EJECT;
COMMENT
$DOC&

NAME--
  record_data
*****************************************************************
*
* SHORT DESCRIPTION--
*   save data from bubble to tape
*
* EXTENDED DESCRIPTION--
*   This routines will record on tape all registers of a single data
*   type (save/recall or calibration) from bubble.  Specifically, either
*   ALL the save/recall registers or ALL the calibration data registers.
*   A buffer equivalent to the size of a single tape block (10 records
*   or 2560 bytes) is used to transfer data from bubble to tape.
*   Registers of the same data type are located contiguously in bubble
*   memory to simplify data transfers.
*
*   The data buffer (big_buf) is loaded with bubble data (to capacity)
*   and exported to an external tape loading routine which continues to
*   buffer any remaining bubble data starting from the last bubble page
*   buffered from this end.
*
* INPUTS--
*   type = data type found in bubble memory
*   id   = file number of data type to record to
*
* OUTPUTS--
*   none
*
* ROUTINES CBILED--
*   get_start_pg
*   read_nbn
*   record_file
*   warn
*
* ERROR CONDITIONS AND RECOVERY--
*   Any problems with reading bubble memory will display an error
*   message indicating this.  However, no further attempts will be
*   made to remedy the read failure and the data does not get saved
*   on tape.
*
* NOTES--
*   Individual or groups of registers cannot be recorded.
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   get the length (number of bytes) of data to go on tape
*   get the first page of the group of data registers
*   buffer up data from bubble
*   IF buffering succeeds THEN
```

```
SMBMGR.WORK.PDB510              THU, DEC 22, 1983, 10:45 AM     PAGE  30

*     call tape routine (record_file) to record data
*   ELSE
*     display error message
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE record_data (type, id, reg);  VALUE type,id,reg;
INTEGER type,id,reg;                                          ENTRY;
&
$OOC-&

BEGIN
  DOUBLE lgth,big_buf;       & buffer 2560 bytes (1 tape block of data &
  INTEGER pg;
  IF (big_buf:=request_memory(2560))=0 THEN
    fatal (e=ceeded_available_memory)
  ELSE
  BEGIN
    IF type >= state_set THEN
      lgth := nbn_max_reg [type]
    ELSE
    CASE type-state_file OF
      BEGIN
        & state_file &   lgth := save_size;
        & memory_file &  lgth := nbn_dir [nen_dir_offset+reg);
        & cal_etd_file & lgth := cal_kit_array_size;
        & cal_file &     lgth := nbn_dir [cal_dir_offset+reg]
      END;
    WHex(lgth,8); CRLF;
    IF (pg := get_start_pg (type,reg)) > 0 THEN
    IF read_nbn (big_buf, set_add_nbn(pg,0,(IF lgth>2304 THEN
    &2560 byte nbn buffer = 1 tape block&    2303 ELSE lgth-1)))
    &2304=2560-256 bytes of file header &
    THEN
      record_file (big_buf,                & nbn buffer address    &
                   lgth,                   & number of bytes       &
                   (LEFT(type,4) OR id),   & file no. and type     &
                   pg)                     & nbn page to read from &
    ELSE
      BEGIN
        bubble_alive := FALSE;
        macro_warn (file_error, record_macro);
      END;
    release_memory (big_buf);
  END;
END record_data;
```

```
SMBMGR.WORK.PDB510              THU, DEC 22, 1983, 10:45 AM     PAGE  31

REJECT;
BOOLEAN PROCEDURE read_from_bubble (addr, lgth, pg);
  VALUE addr, lgth;  DOUBLE addr;  INTEGER lgth, pg;
BEGIN
  INTEGER POINTER ptr=addr;
  INTEGER i;
  BOOLEAN recall_ok;
  IF dump_debug THEN
    BEGIN
      WSTR(" addr "); WHex(addr,8); CRlf;
      WSTR(" lgth"); WHEX(lgth); CRLF;
      WSTR(" pages"); WHEX(pg);
    END;
  recall_ok := FALSE;
  i := -1024;
  DO & transfer 1K words at a time &
    recall_ok:=read_nbn(ADRS(ptr[i:=i+1024]),set_add_nbn(pg,0,
    (IF lgth>2048 THEN 2047 ELSE lgth-1)))
  UNTIL NOT recall_ok OR ((lgth:=lgth-2048) <= 0);
  read_from_bubble := bubble_alive := recall_ok;
  IF dump_debug THEN
    BEGIN
      WHEX(pg-1); CRLF;
    END;
END read_from_bubble;
```

```
SMBMGR.WORK.PDB510              THU, DEC 22, 1983, 10:45 AM     PAGE  32

!EJECT;
BOOLEAN PROCEDURE read_data_header (addr, type, reg);
  VALUE addr, type, reg;  DOUBLE addr;  INTEGER type, reg;        ENTRY;
BEGIN
  INTEGER pg;
  read_data_header := IF (pg := get_start_pg (type,reg)) > 0 THEN
                        read_from_bubble (addr,header_buffer_size,pg)
                      ELSE
                        FALSE;
END read_data_header;
```

```
SMBWGR.WORK.PD8510          THU, DEC 22, 1983, 10:45 AM    PAGE 33

%EJECT;
COMMENT
%DOC+

NAME--
  recall_data
*****************************************************************
*
* SHORT DESCRIPTION--
*   transfer data from bubble to RAM
*
* EXTENDED DESCRIPTION--
*   This routine will transfer data from a bubble register to an area
*   in RAM which uses and corresponds to that data.  Any on-going sweep
*   is abort prior to recalling data.  An external routine is then
*   called to update the data traces and display annotations to reflect
*   the newly recalled data, and the sweep is restarted.
*
* INPUTS--
*   addr = RAM address to start transferring data to
*   type = type of data being transferred from bubble to RAM
*          (cal_file, state_file, memory_file ONLY !!!)
*   reg  = bubble register selected containing data to go to RAM
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   do_recall
*   read_nbn
*   tell
*   warn
*
* ERROR CONDITIONS AND RECOVERY--
*   Any failures in reading bubble will display an error message that
*   indicates this and the data may or may not be partially recalled.
*   There is currently no recovery from partial data transfers due to
*   a bubble read failure.  A recall from tape, instrument preset, or
*   power-up will fix any partial data problem that occurs as a result
*   of this possible failure.
*   Only individual cal data, instrument states, and memory traces are
*   recalled in this routine.  Other data types are not checked and
*   cause the routine to be aborted.
*
* NOTES--
*   This routine is also used to recall power-up or instrument preset
*   states for units with secondary and readable bubbles.
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   If bubble exists and is readable THEN
*     get starting page of data register requested
*     get length (number of bytes) of data to transfer
*     abort the sweep
```

```
SMBWGR.WORK.PD8510          THU, DEC 22, 1983, 10:45 AM    PAGE 34

*     transfer data from register to RAM
*     call routine to update display traces and annotations
*     restart the sweep
*     If data transfers successfully THEN
*       display acknowledging message
*     ELSE
*       display error message
*
*****************************************************************
*
* REVISION LOG--
*   1/28/83   --  made procedure return boolean value indicating failure
*                 (read fail, empty register) or success.
*
*****************************************************************
DECLARATION--
;
BOOLEAN PROCEDURE recall_data (addr, type, reg);
  VALUE addr, type, reg;
  DOUBLE addr;  INTEGER type, reg;                              ENTRY;
&
%DOC-&

BEGIN
  %FILE fmenu.work;
  INTEGER pg, lgth;
  ALPHA type_str;
  BOOLEAN recall_ok;              & flag determining recall success  &

  IF dump_debug THEN
    BEGIN  WSTR("Recalling Data "); UHEX(type); UHEX(reg); CRLF; END;
  type_str := file_type[type];
  IF type <> cal_etd_file THEN
    compute_tell (type_str, recalling_data);
  IF (pg := get_start_pg (type,reg)) > 0 THEN
  BEGIN
    IF (type = state_file) THEN
      lgth := (IF (reg=prior_state) THEN
                 last_state_size
               ELSE
                 save_size)
    ELSE
    IF (type = cal_etd_file) THEN
      lgth := cal_kit_array_size
    ELSE
      BEGIN
        INTEGER n;
        n := (IF type=cal_file THEN cal_dir_offset ELSE men_dir_offset);
        lgth := nbn_dir [n+reg) AND %FFC0;
      END;
    recall_data := FALSE;
    IF lgth <= 0 THEN
      compute_warn (data_type_str, no_reg_data)
    ELSE
    IF read_from_bubble (addr, lgth, pg) THEN
      BEGIN
```

```
SMBWGR.WORK.PD8510          THU, DEC 22, 1983, 10:45 AM    PAGE 35

        IF type = state_file THEN
          BEGIN
            do_recall;
            init_user_graphics;
            restore_8510_display;
            highlight_menu;
          END;
        IF type <> cal_etd_file THEN  &don't acknowledge cal kit recall&
          BEGIN
            compute_tell (type_str, data_recalled);
            IF type = cal_file THEN
              beep (done_tone);
          END;
        recall_data := TRUE;
        set_serial_poll (op_complete_srq);
      END
    ELSE
      BEGIN
        UHEX(status_nbn); CRLF;
        compute_warn (type_str, recall_error);
        set_serial_poll (op_failed_srq);
      END;

  END;
END recall_data;
```

```
SMBWGR.WORK.PD8510          THU, DEC 22, 1983, 10:45 AM    PAGE 35

%EJECT;
COMMENT
%DOC+

NAME--
  restore_data
*****************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE restore_data (type,id,reg);  VALUE type,id,reg;
INTEGER type,id,reg;                                            ENTRY;
&
%DOC-&

BEGIN
  INTEGER pg;
  DOUBLE buffer;
  restoring_from_tape := TRUE;
  IF valid_directory THEN
    IF (pg := get_start_pg (type,reg)) > 0 THEN
      IF (buffer := request_memory (2560)) = 0 THEN
        fatal (exceeded_available_memory)
      ELSE
        BEGIN
          BOOLEAN continue;
          continue := TRUE;
          IF type = memory_file THEN       & export reg to restore to &
            nbn_dir[men_dir_offset) := reg
          ELSE
          IF type = cal_file THEN
```

```
SMBMGR.UORX.POS510              THU, OEC 22, 1383, 10:45 RM     PAGE  37


        mbn_dir[cal_dir_offset] := reg;
      restore_file (buffer, LEFT(type,4) OR id, pg);
      releaae_nenory (buffer);
      IF type = cal_std_file THEN                & neu eoftkey label &
        eelect_eel_kit (reg);
    END;
  restoring_fron_tape := FALSE;
END rettore_data;
```

```
SMBMOR.UORK.FD8510              THU, DEC 22, 1S83, 10:45 RM     PRGE  3S


REJECT;
BOOLEAN PROCEDURE load_dg_data;                                   ENTRY;
BECIN
  DOUBLE lgth;
  INIECER POINTER dg_RAM;
  INIECER i;
  INTEGER pg;
  BOOLEAN load_ok;
  lgth := ADRS(nark_dg_top) - ADRS(nark_dg_baee);
  SIPNIR (dg_RAM, BDAS(nark_dg_baee));
  pg := dg_nen_base_pg;
  If dunp_debug THEN
    BEGIN
      USTR("loading  DG RAM: "); UHex(RDRS(nark_dg_base),S);
      UHex(ADRS(nark_dg_top),8); USTR(" fron pages");
      UHEX(pg);
    END;
  i := -1024;
  DO & transfer 1K uords at a tine &
    load_ok :=raad_nbn(ADRS(dg_RAM(i:=i+1024]),eet_add_nbn(pg,0,
    (IF lgth>2048 THEN 2047 ELSE lgth-1)))
  UNTIL NOI load_ok OR ((lgth:=lgth-2048) <= 0);
  IF dunp_debug THEN
    BEGIN WHEX(pg-1); CRLF; WHEX(etatus_nbn); CRLF; END;
  IF NOT load_ok THEN
    fatal (bubhle_init_error);
  load_dg_data := load_ok;
END load_dg_data;
```

```
SMBMGR.UORK.PDS510              THU, DEC 22, 19S3, 10:45 AM     PRGE  39


REJECT;
BOOLEAN SUBROUTINE recall_lunplus;                                ENTRY;
BEGIN
  pg_check := hpib_addr_pg;
  recall_lunplus := read_mbn (ADRS(priv_ib_lun_table),
                             set_add_mbn (pg_check,0,63));
  If dunp_debug THEN
    BEGIN
      USTR("loading 'lunplua' stuff"); WHtx(RDRS(priv_ib_lun_table),8);
      WHEX(hpib_addr_pg); CRLF;
    END;
END recall_hpib_addrest;

BOOLEAN SUBROUTINE save_lunplus;                                  ENTRY;
BEGIN
  pg_check := hpib_addr_pg;
  COMMENT
  eave_lunplue := urt_mbn (ADRS(priv_ie_lun_table),
                          eet_add_mbn (pg_check,0,63));
  seve_lunplus := urt_mbn_ok (RDRS(priv_ib_lun_table), pg_check, S3);
END save_hpib_addrees;
```

```
SMBMGR.WORK.PD8510              THU, DEC 22, 19S3, 10:45 RM     PRGE  40


NEJECT;
COMMENT
$DDC+

NAME--
  init_save_recall
************************************************************************
*
* SHORT DESCRIPTION--
*   initialize arraya and variablea for saving/recalling data
*
* EXTENDED DESCRIPTION--
*
* INPUTS--   none
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
************************************************************************
*
* INITIAL REFINEMENT--
*
************************************************************************
*
* REVISION LOG--
*
************************************************************************
DECLRRATION--
;
PROCEDURE init_aave_recall;                                       ENTRY;
&
$DOC-&

BEGIN
  INTEGER i=REGISTER 6;
  INTEGER page_start,page_cnt;

  & save/recall information &
  page_cnt := RRIGHT(save_size,6);            & byte cnt DIV 64 byte-page &
  IF (save_size AND %3F) > 0 THEN
    page_cnt := page_cnt + 1;
  FOR i := 0 TO preset_state DO
    stete_mbn[i+1] := state_page_start + page_cnt*i;
  mbn_reg_sz[statt_filt] := save_aize;
  mbn_max_reg(state_set] := page_cnt*64*(prior_state);
  page_start := state_mbn (prior_state] +   & compute start of next pg &
                RRIGHT(last_state_size,6);          & last_state_size/64 &
  If (last_state_size AND %3F) <> 0 THEN
```

```
SYSMGR.WORK.PD8510              THU, DEC 22, 1983, 10:45 AM     PAGE  41


    page_start := page_start + 1;

  & cal stds table information &
  mbn_reg_sz [cal_std_file] := cal_kit_array_size;
  mbn_max_reg [cal_std_set] := 2*cal_kit_array_size;
  cal_std_mbn[1] := page_start;
  cal_std_mbn[2] := page_start + catd_oize;

  hpib_addr_pg := page_start + 2*catd_size;

  % display RAM to be downloaded on "power up" &
  dg_mem_base_pg  := hpib_addr_pg + 1;

  & cal. data information &
  mbn_reg_sz [cal_file] := 128;
  mbn_max_reg [cal_set] := 58368;    & 114 pgs * 8 segments * 64 bytes &

  & memory data information &
  page_ent := ((2406+header_size1/64 + 1);
  FOR i := 1 TO 4 DO
    memory_mbn[i] := mem_start + page_ent*(i-1);
  mbn_reg_sz [memory_file] := page_cnt * 64;
  mbn_max_reg [memory_set] := page_cnt*64*4;

  & initialization calls &
  bubble_alive := restoring_from_tape := FALSE;
  bubble_alive := bubble_ok;
  load_dg_data;
END init_save_recall;

END$
```

```
LMBMLOAD.WORK.PD8510            THU, DEC 22, 1883, 10:45 AM     PAGE  1


rmbmload.work,
rxmbm.work,
rlibrary.work,
rstddata.work,
rtitle.work,
rmarkdg.work,   &---\  Nothing before this should exceed X109800    &
ralphas.work,   &   |                                                &
relabel.work,   &   |                                                &
ratablee.work,  &   |                                                &
rmathTbl.work,  &   |                                                &
rskey.work,     &   \  These must all be grouped identically with   &
rskpos.work,    &   /  lmain.work.                                   &
rkeys.work,     &   |                                                &
ribtree.work,   &   |                                                &
rcpltbl.work,   &   |                                                &
rdgtop.work,    &*  |                                                &
rchdata.work,   &   |                                                &
rlumplua.work,  &   |                                                &
rmarkmem.work,  &   |                                                &
rstack.work,    & --/      MUST BE LAST RELOCATABLE                  &
/E
ROM=100H RAM=FFF800H;
title:  MAIN=FFFO8000H  MOLOAD;   & eg (long addr) &
markd:  MAIN=FFFO9800H;
lunpl:
markm:  RAM=FFF20000H;    & just RAM reservation. display address &
stack:  RAM=FFFF8000H;
```

```
MMBMLOAD.WORK.PD8510            THU, DEC 22, 1983, 10:45 AM     PAGE  1


AG8KLDR(9.6.83)     THU, DEC 22, 1983,  6:01 AM
 NAME   MAIN LIMITS         BASE PAGE           RAM

 mbmlo 000042 00190A        000100 000108        FFF7A6 FFF800
       THU, DEC 22, 1983,  5:37 AM  LIBRM   PD8510

 xmbm  00190A 00154E        000108 000108        FFF7A6 FFF7A6
       THU, DEC 22, 1983,  5:59 AM  LIBRM   PD8510

 mathF 00196E 001EE4        000108 000200        FFF7A6 FFF7A6
       THU, DEC 22, 1983,  5:05 AM  LIBRK   PD8510

 CPX   001EE4 002254        000200 000200        FFF7A6 FFF7A6
       THU, DEC 22, 1983,  5:07 AM  MOD JTB 12/22/82

 FLIPT 002254 00255E        000200 000200        FFF7AG FFF7A6
       THU, DEC 22, 1983,  5:07 AM  DDS/jtb RPA 53

 BURD  00255E 0023EE        000200 000200        FFF7A5 FFF7A6
       THU, DEC 22, 1983,  5:07 AM  JTB 23.10.81

 OIV3  0028EE 0029E4        000200 000200        FFF7A6 FFF7A6
       THU, DEC 22, 1983,  5:07 AM  jtb 3/83

 SORT  0029E4 002A44        000200 000200        FFF7A6 FFF7A6
       THU, DEC 22, 1983,  5:07 AM  FIX 27.8.80

 CASE  002A44 002A5C        000200 000200        FFF7A6 FFF7A6
       THU, DEC 22, 1983,  5:07 AM  FIX 1.5.80: MAKE CALL RELATIVE

 FNT   002A5C 003194        000200 00020A        FFF7A6 FFF7A6
       THU, DEC 22, 1983,  5:08 AM  JTB JULT 28,1982

 TERM  003194 0032F2        00020A 00020A        FFF794 FFF7A6
       THU, DEC 22, 1983,  5:08 AM  LIBRM   PD8510

 stdda 0032F2 0032F2        00020A 000042        FFF794 FFF794
       THU, DEC 22, 1983,  5:49 AM  LIBRM   PD8510

 markd F09800 F09800        000D42 000D42        FFF794 FFF794
       THU, DEC 22, 1983,  5:33 AM  LIBRM   PD8510

 alpha F09800 F0A34E        000D42 000042        FFF794 FFF794
       THU, DEC 22, 1983,  5:12 AM  LIBRM   PD8510

 alabe F0A34E F0A7E0        000042 000042        FFF794 FFF794
       THU, DEC 22, 1983,  5:12 AM  LIBRM   PD8510

 etabl F0A7E0 F0AE68        000042 000D42        FFF794 FFF794
       THU, DEC 22, 1983,  5:14 AM  LIBRM   PD8510

 mathT F0AE68 F0AFAE        000D42 000D42        FPF794 FFF794
       FRI, FEB  4, 1983,  3:26 PM  JTB,LANI.PD8510   9/3/82

 skey  F0AFAE F0CD4C        000D42 000D42        FFF794 FFF794
```

```
MMBMLOAD.WORK.PD8510            THU, DEC 22, 1983, 10:45 AM     PAGE  2


       THU, DEC 22, 1983,  5:48 AM  LIBRM   PD8510

 skpos F0CD4C F0CDR4        000D42 000D42        FFF794 FFF794
       THU, DEC 22, 1983,  5:48 AM  LIBRM   PD8510

 keys  F0CDB4 F0CE70        000042 000D42        FFF794 FFF794
       THU, DEC 22, 1983,  5:32 AM  LIBRM   PD8510

 ibtre F0CE70 F0E098        000042 000D42        FFF794 FFF794
       THU, DEC 22, 1983,  5:30 AM  LIBRM   PD8510

 cpltb F0E098 F0E125        000D42 000D42        FFF794 FFF794
       THU, DEC 22, 1983,  5:23 AM  LIBRM   PD8510

 dgtop F0E126 F0E126        000042 000042        FPF794 FFF794
       THU, DEC 22, 1983,  5:24 AM  LIBRM   PD8510

 chdat F0E125 F0F4CC        000D42 000042        FFF794 FFF794
       THU, DEC 22, 1983,  5:18 AM  LIBRM   PD8510

 lunpl F0F4CC F0F50E        000042 000042        FFF794 FFF794
       THU, DEC 22, 1983,  5:32 AM  LIBRM   PD8510

 stack F0F50E F0F50E        000042 000D42        FF8000 FF8000
       THU, DEC 22, 1983,  5:48 AM  LIBRM   PD8510


       LATEST DATE: THU, DEC 22, 1983,  5:59 AM

       INITIAL STACK POINTER / GLOBAL REG = FF8000


 @RAM@      000100  ABS2       002254  ABSA       00255E  A001       001F16
 AOD1A      001F0D  ADD1G      001F06  AOD1M      001F0C  A001T      001F12
 AOD2       0022B4  ADD2R      002200  AOO2G      0022CA  AOO2M      0022C4
 AOO2T      0022BE  AODCP      FFF8DE  RODE       002192  MODE_str   0021A2
 AODFP      FFF836  ADDLF      FFF918  ATRM       001CCE  BESI       001D50
 CASE       002A44  CMP2       00237C  CMP2R      00235E  CBP2G      002358
 CMP2M      002352  CMP2T      00234C  CMPR       00258R  CMPRR      002568
 CAPAG      00256C  CMPRM      002570  CMPAT      002574  CMV13      002482
 CMV14      0024D4  CMV15      002482  CMV1E      00207R  CMV1E_save 002068
 CMV23      002482  CMV24      002404  CMW25      002482  CMV2R      002570
 CMV2E      002040  CMV31      0024CO  CMV32      0024C2  CMV3R      002864
 CMV41      0024BE  CMV42      002488  CMV4R      002862  CMV51      00248C
 CMV52      0024B6  CMV5R      002860  CMVR2      0028C4  CMVR3      00256C
 CMVR4      00286C  CMVR5      00256C  CMVE1      0020FR  CMVE20_1   00210R
 CMVe1      0020FC  COS        001C32  CPINV      FFF9CC  CPR2       00237R
 CPR2R      002376  CPR2G      002370  CPR2M      00236R  CPR21      002364
 CPRR       002536  CPRRR      002578  CPRRG      00257C  CPRRM      002580
 CPRRT      002584  CPXRR      FFF98R  CRLF       003108  DROLF      FFF9EO
 DIV1       001FFE  DIV1R      001FCC  DIV1O      001FD2  DIV1M      001FDS
 DIV1T      001FDE  DIV2       002308  DIV2R      0023BR  DIV2G      002364
 DIV2M      0023RE  DIV2T      0023RS  DIV3       002966  OIV3R      002952
 DIV3G      00254E  DIV3L      0029AA  DIV3M      00294R  OIV3R      0029CE
 DIV3T      002946  DIV9       00267C  DIVR       00283E  DIVRR      002828
 DIVRG      00282E  DTVRM      002834  DIVRT      00283R  DIVE       00223C
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MMBMLOAD.WORK.PO8510          THU, DEC 22, 1983, 10:45 AM    PAGE  3

 DIVE_ptr    002246  DIVFP       FFF91E  DVR1        001FFR  DVR1A       001FE4
 DVR1G       001FEA  DVR1M       001FF0  DVR1T       001FF6  DVR2        0023D6
 DVR2A       0023D2  DVR2G       0023CC  DVR2M       0023C6  DVR2T       0023C0
 DVR3        002964  DVR3R       002962  DVR3G       00295E  DVR3M       00295A
 DVR3T       002956  DVRA        002958  DVRAA       002842  DVRAG       002848
 DVRAM       00284E  DVRA1       002854  DVRE        0021F8  DVRE_ptr    002202
 EXP         001B76  IFCAM       FFF976  LBL_INDEX   F0B048  LDR2A       002934
 LDR2G       002922  LDR2M       00290E  LDR2T       0028FC  LDRAA       002584
 LDRAG       0025C8  LDRAM       0025DG  LDRAT       0025A0  LLDAD       FFF9D6
 LLDR2       FFF9DA  LLDMY       FFF90E  LOG2        001E30  MCPDIV      FFF992
 MCPMP       FFF96E  MOBDG       FFF926  MODFR       FFF86C  MOFR        FFF84A
 MOSFR       FFF894  MINTP       FFF80D  MOO2        002392  MOO2A       00238A
 MOO2G       002354  MOO3        0023F4  MOO3R       0028F2  MOO3G       0028EE
 MPLDG       FFF942  MPLOG       FFF8C8  MPY1        001F86  MPY1A       001F70
 MPY1G       001F76  MPY1M       001F7C  MPY1T       001F82  MPY2        002292
 MPY2A       0022SE  MPY2G       002288  MPY2M       002282  MPY2I       00227C
 MPY3        00250A  MPY3R       002506  MPY3G       002500  MPY3L       002518
 MPY3M       0024FA  MPY31       0024F4  MPY9        0025F2  MPYR        00281E
 MPYAA       002908  MPYRG       0029DE  MPYAM       002814  MPYAT       00281A
 MPYAV       FFF984  MPYDI       FFF8FA  MPYE        002164  MPYE_ptr    002172
 MPYE_ptrs   002152  MPYFP       FFF82E  MPYLF       FFF914  MRLDG       FFF930
 MSHFT       FFF950  MYMAM       FFF922  Multinit1   FFF816  Multinit2   FFF81C
 NEG1        001EE4  NEG2        002258  NEGA        002562  Pi          000114
 Pi2         000118  Pi4         00011C  Pi8         000120  RRbS2       002270
 RCMAR       00320E  RDEXP       FFF912  RMCG1       001EEE  RMEG2       002274
 S8R1        001F5R  S8R1R       001F40  S8R1G       001F4A  S8R1M       001F4C
 S8R1T       001F52  S8R2        002344  S8R2R       002340  S8R2G       00233R
 S8R2A       002334  S8R2T       00232E  S8RE        002100  S8RE_ptr    0021D6
 SIR         001B8R  SK_LABEL    F0B544  SK_MENU     F0B420  SOAT        0029E4
 SU61        001F5E  SU81M       001F28  SU51G       001F2E  SU81M       001F34
 SUB1T       001F3A  SU92        002346  SUB2R       002328  SUB2G       002322
 SUB2M       00231C  SUB2T       002316  SUBCP       FFF81E  SUBE        0021DC
 SUBE_ptr    0021EA  SUBFP       FFF840  SUBLF       FFF91A  Sqrt2       000124
 TEMI        001972  IUOX        001AAA  TuoPi       000110  UCMAR       00319B
 UCPX        00325E  UMEx        0032C2  UMex        003280  UMUh        0031F0
 UOUAD       003212  UREAL       003238  USTR        0031BE  XFM2P       FFF8A4
 XFA2D       FFF80A  active_funetf0A352b active_tableF0RE1E  active_tableF0A0F2
 atn_table   F0AEAA  bcd_of_int   002EE0  blanks      F0CD6E  bot_key_tabIF0C0F0
 byte_list   F09804  ch_cnd1_lineF0F0A1  ch_end2_lineF0F0D7  ch_table    F0F1A2
 copy_user3  002124  coupled_bitnF0F172  coupled_chtaF0ED9Cd coupled_chtaF0E0F5
 deg_to_radia003012S diepiay_alteF0A068v elec_delay  F0EF5E  exp_cnplx   001DCA
 exp_overflou001FBE  fetch_CMVE1 0020F6  Field       F0CD4E  format      F0EEA4
 format_3_cnp002AFC  Format_doubl002A5E  format_integ002R5C  format_quad 002AAE
 format_real 002A0A  format_tableF0ABA0  Hilite_bitnaF0F112  hilite_info F0F112
 ib_link     F0D4S0  if_ref_gain F0F060  if_test_gainF0F05E  init_nbn    0019DC
 kit_base    00020R  kit_base2   0007A6  last_state  F0F056  linit       F0A944
 log_ecale_diF0BC34  log_table   F0AE68  mark_dg_baseF0980D  mark_dg_top F0E126
 mark_stack  F0F50E  marker_etateF0F068  max_dunp    F0F49C  max_save    F0F392
 mbn_miec_etaFFFC00g mbu_prgn_staf9FC00  mbn_eub_prgnFFFC00  min_save    F0E12A
 mkr_inag_forF0A936  mkr_inag_ouffOA592  mkr_real_forF0A928  mkr_real_suffOA854
 nncn        F0CE74  number_of_grF0F056  old_id      F0F041  parameter_deF0EFBE
 parms_nbn   001932  plot_quadrenF0F066  plotter_pen F0F10C  priv_ib_lun_F0F4CE
 read_boot_nb00195A  read_nbn    00194R  ref_positionF0E53E  ref_value   F0E9BE
 acalc       F0E08E  ecale_factorF0ABF2  set_add_nbn 00193R  sk_line1    F0CD84
 sk_line2    F0C094  speed_of_lig000130  speed_of_lig00012C  aqrt_tbl    F0EEAC
 erq_nask_priF0F062  erq_nask_eecF0F064  etatus_nbn  001942  etep_eize   F0F05C
```

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 suffix      F0A7E4  eweep_node  F0F058  test_nbn    00192A  title_line  F0F06B
 top_key_tabIF0CDA8  trace_node  F0F05R  unscale_factF0AC0A  urt_boot_nbn001962
 urt_nbn     001952

HIERRRCHY LIST

CASE:
    entry pte:      CASE
    referenced by:  nathf
CMV9X:
    entry pte:      CMV92       CMV9A
    externale:      CMPAA       CMV32       DIVMA       BPY2n       MPY3R
          MPYAA     MPYAM
    modulee needed: FLTPT       QUAD
CPX:
    entry pte:      ADD1        AOD1A       AOD1G       AOD1M       AOD1T
          AOOE      AODE_ptr    CMVIE       CMVIE_save              CMV2E
          CRVE1     CMVE20_1    CMVe1       DIV1        DIV1R       DIV1G
          DIVAM     DIV1I       DIVE        DIVE_ptr    DVR1        DVR1A
          DVR1G     DVR1M       DVR1T       DVRE        DVRE_ptr    RPY1
          MPY1A     BPY1G       BPY1M       BPY11       MPYE        MPYE_ptr
          MPYE_ptrs MEG1        RMEG1       S8R1        S8R1A       S8R1G
          S8R1M     S8K1T       S8RE        S8RE_ptr    SUB1        SUB1A
          SUB1G     SUB1M       SUB1T       SUBE        SUBE_ptr    copy_user3
          exp_overflou          fetch_CMVE1
    externals:      ADD2        RDOCP       DVR2        LDRAA       LDRAG
          LBRAM     LDRAT       MCPDIV      BCPMP       BPY2        MEG2
          RMEG2     S8R2        3UB2        SUBCP
    referenced by:  FMT
    modules needed: FLTPT       QUAD        nathf
DIV3:
    entry pte:      DIV3        DIV3A       DIV3G       DIV3L       DIV3M
          DIV3R     DIV3T       DVR3        DVR3R       DVR3G       DVR3M
          OVR3T     LDR2R       LBR2G       LDR2M       LDR2T       MOD3
          MOD3A     MOD3G
    referenced by:  FLTPT       FM1         QUAD        mbnlo
FLTPT:
    entry pte:      ABS2        ROD2        RDD2R       ADO2G       RDO2M
          AOD2T     CMP2        CnP2A       CMP2G       CMP2n       CMP2T
          CMV13     CMV14       CMV15       CMV23       CMV24       CMV25
          CMV31     CMV32       CMV41       CMV42       CMV51       CMV52
          CPR2      CPR2A       CPR2G       CPR2M       CPR2T       DIV2
          OIV2A     DIV2G       DIV2M       OIV2T       OVR2        DVR2A
          OVR2G     OVR2M       DVR2T       MDD2        MDD2A       MDD2G
          MPY2      MPY2A       BPY2G       MPY2A       MPY2T       hPY3
          MPY3A     MPY3G       MPY3L       hPY3h       MPY3T       MEG2
          RR9S2     RMEG2       S8R2        S8R2A       S8R2G       S8R2M
          S8R2T     SU82        SUB2R       SUB2G       SUB2M       SUB2T
    externals:      ADOLF       DIVFP       LDR2A       LDR2G       LDR2M
          LDR2T     LLDAO       LLDA2       LLDMY       MPYDI       hPYLF
          MYMAM     RDEXP       SUBLF
    referenced by:  CMV9X       CPX         FMT         QUAD        SQRT
          nathf
    modules needed: DIV3        nathf
```

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MMBMLORO.WORK.PO8510          THU, DEC 22, 1983, 10:45 AM    PAGE  5

FMT:
    entry pte:      bcd_of_int          format_3_cmpx       format_double
          format_integer    format_quad         format_real
    externals:      CMP2        CMVE1       DIV3L       MPY2        MPY3L
          MEG2      TEMI
    referenced by:  TERM
    modules needed: CPX         DIV3        FLTPT       nathf
QUAD:
    entry pte:      ASSA        CMPR        CMPAA       CnPRG       CMPRM
          CMPAT     CMV2A       CMV3A       CMV4A       CMV5A       CMVA2
          CMVR3     CMVA4       CMVA5       CPRR        CPRAA       CPRAG
          CPRAM     CPRAT       DIV9        DIVA        DIVAA       DIVAG
          OIVRn     OIVAT       OMXA        DVRAA       DVARG       DVRAM
          DVRAT     LDRAA       LDRAG       LDRAn       LDRA1       BPY9
          hPYA      MPYAA       MPYAG       MPYAn       MPYAT       NEGA
    externals:      CMV23       CMV32       DIV3L
    referenced by:  CMV9X       CPX
    modules needed: DIV3        FLiPT
SQRT:
    entry pts:      SQRT
    externals:      MEG2
    referenced by:  nathf
    modules needed: FLTPT
TERM:
    entry pts:      CRLF        RCMRR       UCMAR       UCPX        UMEX
          URex      UMUM        UOURD       UREAL       USTR
    externals:      format_double       format_quad         format_real
    referenced by:  fifo        kerne       mbnlo
    modules needed: FMI
alabe:
    entry pts:      active_function_label
    referenced by:  mbnlo
alpha:
    entry pts:      byte_list
    referenced by:  mbnlo
atabl:
    entry pts:      aetiva_table_type   active_tables       display_alternate_value
          format_table      linit       log_scale_div_3     mkr_inag_format
          mkr_inag_suffix   mNr_real_format     mkr_real_suffix
          scale_factors     suffix      unscale_factors
    referenced by:  mbnlo
chdat:
    entry pts:      ch_cnd1_line        ch_cnd2_iine        ch_table
          coupled_bitnap    elec_delay          format      hilite_bitnap
          hilite_info       if_ref_gain         if_test_gain
          last_state        marker_state        max_dunp    max_save
          min_save  number_of_proups    old_id      parameter_descriptor
          plot_quadrant     plotter_pen         ref_position
          ref_value scale   srq_nask_prinary    srq_nask_secondary
          step_size sweep_node          title_line          trace_node
    referenced by:  mbnlo       title
cpltb:
    entry pts:      coupled_chtable_index       coupled_chtable_size
    referenced by:  mbnlo
dgtop:
    entry pts:      mark_dg_top
```

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MMBMLOAD.WORK.PO8510          THU, DEC 22, 1983, 10:45 AM    PAGE  6

    referenced by:  kerne       mbnlo
displ:
    entry pts:      elear_display       crlf        dg_hex      dg_read
          dg_read_ay        dg_urite    drau        init_display
          jnp       jsr       lb          nove        nove2       noveeh
          novech2   plot      print_hex   printch     rts         setattribute
          xdrau     ydrau
    referenced by:  title
displr:
    entry pta:      urt_disp_byte       urt_disp_dbl        urt_disp_int
          urt_disp_quad     urt_disp_real       urt_disp_str
    referenced by:  title
fifo:
    entry pts:      array_update_fifo   enpty_fifo          init_fifo
          keyboard_fifo     public_ib_fifo      read_fifo   tohen_fifo
          urite_fifo
    externals:      CRLF        UMEX        UMex        USTR        acquire
          pending   release     resource_init       send        signsl_init
          uait
    modules needed: TERM        kerne
ibtre:
    entry pta:      ib_link     mnem
    referenced by:  mbnlo
intrp:
    entry pts:      irack       iradr       irclr       irdis       iren
          irint     irirr       irrdy       irset
    referenced by:  kerne
kerne:
    entry pts:      abort       acquire     awaited     conditional_acquire
          counter   create      delay       init_kernel             intrpt_botton
          intrpt_delay_tiner    intrpt_priv_ib_srq  intrpt_rpg              intrpt_tick
          intrpt_top_key        intrpt_uart         link        pause
          pending   preenpt     ready       release     resource_init
          run       running     send        signal_init             smapshot
          stack_top terminate   uait        uaitio
    externals:      $RAM$       CRLF        BYMRM       RDEXP       UMEX
          UMex      USTR        fatal       irack       iradr       irdis
          iren      markO       mark1       mark3       mark_dg_base
          mark_dg_top           mark_stack          update_hpib_leds
    referenced by:  fifo
    modules needed: TERM        dgtop       intrp       markd       nathf
          mbnlo     stack
keys:
    entry pts:      bot_key_table       top_key_table
    referenced by:  mbnlo
lunpl:
    entry pts:      priv_ib_lun_table
    referenced by:  mbnlo
markd:
    entry pts:      mark_dg_base
    referenced by:  kerne       mbnlo
markn:
    entry pts:      cal_kit_erray       menbotton mentop    sine_cos
nathf:
    entry pts:      RDDCP       RDDFP       RODLF       RTAN        BESI
          COS       CPIMV       CPXnA       DADLF       DIVFP       EXP
```

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WBMLOAD.WORK.PDS510          THU, DEC 22, 1983, 10:45 AM    PAGE  7

        IFCRM     LLOBO     LLOR2     LLDMY     LDG2      MCPDIV
        MCPMP     MDBDG     MDDFR     MDFR      MDSFR     MINTP
        MPLDG     MPLOG     MPYPV     MPYDI     MPYFP     BPYLF
        MRLDG     MSMFT     MYMRM     Multinit1 Multinit2 Pi
        Pi2       Pi4       PiS       RDEXP     SIN       SUBCP
        SU9FP     SUBLF     Sqrt2     TEMI      TWOX      TwoPi
        XFM2P     XFM2Q     deg_to_radiens      exp_cmplx epeed_of_iight
        speed_of_light_air
    externals:    ABS2      ROD2      ROD2A     ADD2G     RDD2T
        CASE      CMP2A     CMP2G     CMV25     CMV52     DIV2
        DIV2M     OVR2I     ROD2G     MPY2      RPY2R     MPY2G
        MPY2M     BPY2T     NEG2      SBR2      SBR2G     SBR2M
        SORT      SUB2      SUB2R     SUB2G     SUB2M
    referenced by: CPX      FCTPI     FRT       kerne
    nodules needed: CASE    FLTPT     SQRT
mathl:
    entry pts:    atn_table leg_table sqrt_tbl
    referenced by: mbnlo
mbnlo:
    entry pte:    $RRR$
    externals:    CRLF      DIV3R     SK_LABEL  UMEX      UWex
        USTR      active_function_label         active_tables
        atn_table byte_list coupled_bitmap      coupled_chtable_indcx
        field     hilite_info       ib_link   init_mbn  kit_base
        kit_base2 last_state        mark_dg_base        mark_dg_top
        mark_etack          max_eave  min_save  priv_ib_lUn_table
        set_add_mbn         Unp_key_table       urt_mbn
    referenced by: kerne
    nodules needed: DIV3    TERR      alabe     alpha     atabl
        chdat     cpltb     dgtop     ibtre     keys      lunpl
        markd     matht     skey      skpos     stack     stdda
        xmbn
skey:
    entry pts:    LBL_IRDEX SK_LABEL  SK_MENU
    referenced by: mbnlo
skpos:
    entry pts:    blanks    field     sk_line1  sk_line2
    referenced by: mbnlo
stack:
    entry pts:    mark_stack
    referenced by: kerne      mbnlo
stdda:
    entry pts:    kit_base  kit_base2
    referenced by: mbnlo
strin:
    entry pts:    append_ch append_string       clear_string
        init_string
    referenced by: title
title:
    entry pts:    char_index          enter_title_char    erase_title
        select_title_char   write_title
    externals:    active_function     append_ch clear_string
        jnp       lb        novech    print_string        printch
        tell      title     title_line          urt_disp_str
    nodules needed: chdat     displ     dispr     strin
xmbn:
```

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MMBMLOAD.WORK.PDS510          THU, DEC 22, 1983, 10:45 AM    PAGE  8

    entry pts:      init_mbn  mbn_misc_status_reg mbn_prgm_start_add
        mbn_sub_prgm_sel    mamma_mbn read_boot_mbn       read_mbn
        set_add_mbn         status_mbn          test_mbn  urt_boot_mbn
        urt_mbn
    referenced by:  mbnlo

ENTRY POINTS <nodule name>:

$RAM$ <mbnlo>           ABS2 <FLTPT>            RBSR <QUAD>
ADD1 <CPX>              ROD1A <CPX>             ADD1G <CPX>
ADD1M <CPX>             ROD1I <CPX>             ROD2 <FLTPT>
ADD2A <FLTPT>           ADD2G <FLTPT>           RDD2M <FLTPT>
ADD2I <FLTPT>           ADDCP <mathf>           BODE <CPX>
ADGE_ptr <CPX>          ADDFP <mathf>           PDDLF <mathf>
AIAM <methf>            BESI <mathf>            CASE <CASE>
CMP2 <FLIPT>            CMP2B <FLTPI>           CMP2G <FLTPT>
CBP2M <FLTPI>           CMP2T <FLTPI>           CMPA <QUAD>
CMPAA <QUAD>            CMPAG <QUAD>            CMPAM <QUAD>
CMPAT <QUAD>            CMV13 <FLTPT>           CMV14 <FLTPT>
CMV15 <FLTPT>           CMV1E <CPX>             CMV1E_aave <CPX>
CMV23 <FLTPI>           CMV24 <FLTPT>           CMV25 <FLTPT>
CMV2R <QUAD>            CMV2E <CPX>             CMV31 <FLTPT>
CMV32 <FLTPI>           CMV3R <QUAD>            CMV41 <FLTPT>
CMV42 <FLTPI>           CMV4R <QUAD>            CMV51 <FLTPT>
CMV52 <FLTPT>           CMV5R <QUAD>            CMV92 <CMV9X>
CMV9A <CMV9X>           CMVA2 <QUAD>            CMVA3 <QUAD>
CMVA4 <QUAD>            CMVA5 <QUAD>            CMVE1 <CPX>
CMVE2D_1 <CPX>          CMVel <CPX>             COS <mathf>
CPIMV <mathf>           CPR2 <FLTPT>            CPR2A <FLTPT>
CPR2G <FLTPT>           CPR2M <FLTPT>           CPR2T <FLTPT>
CPRR <QUAD>             CPRRA <QUAD>            CPRRG <QUAD>
CPRRM <QUAD>            CPRRT <QUAD>            CPXMR <mathf>
CRLF <TERM>             DAOLF <mathf>           DIV1 <CPX>
DIY1R <CPX>             DIY1G <CPX>             DIV1A <CPX>
DIV1T <CPX>             DIV2 <FLTPT>            DIV2A <FLTPT>
DIV2G <FLTPI>           DIV2M <FLTPT>           DIV2I <FLTPT>
DIV3 <DIV3>             DIV3A <DIV3>            DIV3G <DIV3>
DIV3L <DIV3>            DIV3M <DIV3>            DIV3R <DIV3>
DIV3T <DIV3>            DIY9 <QUAD>             DIVA <QUAD>
DIVAA <QUAD>            DIVAG <QUAD>            DIVAM <QUAD>
DIVAT <QUAD>            DIVE <CPX>              DIVE_ptr <CPX>
DIVFP <mathf>           DVR1 <CPX>              DVR1A <CPX>
DVR1G <CPX>             DVR1M <CPX>             DVR1T <CPX>
DVR2 <FLTPT>            DVR2A <FLTPT>           DVR2G <FLTPT>
DVR2M <FLTPT>           DVR2T <FLTPT>           DVR3 <DIV3>
DVR3A <DIV3>            DVR3G <DIV3>            DVR3M <DIV3>
DVR3T <DIV3>            DVRA <QUAD>             DVRAA <QUAD>
DVRAG <QUAD>            DVRAM <QUAD>            DVRAT <QUAD>
DVRE <CPX>              DVRE_ptr <CPX>          EXP <mathf>
IFCRM <mathf>           LBL_INDEX <skey>        LOR2A <DIV3>
LOR2G <DIV3>            LOR2M <DIV3>            LOR2T <DIV3>
LORAA <QUAD>            LORAG <QUAD>            LORAM <QUAD>
LORAT <QUAD>            LLOAO <mathf>           LLOR2 <mathf>
LLOMY <mathf>           LOG2 <mathf>            MCPDIV <mathf>
MCPMP <mathf>           MDBDG <mathf>           MDDFR <mathf>
MDFR <mathf>            MDSFR <mathf>           MINTP <mathf>
```

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MOD2 <FLTPT>            MQD2A <FLTPT>           MOD2O <FLIPT>
MOD3 <DIV3>             MO03R <DIV3>            RDO3G <DIV3>
MPLDG <mathf>           MPLOG <mathf>           RPY1 <CPX>
RPYIA <CPX>             MPY1G <CPX>             MPY1M <CPX>
MPY1T <CPX>             RPY2 <FLTPT>            MPY2R <FLTPT>
MPY2G <FLTPT>           MPY2M <FLTPT>           MPY2T <FLTPT>
MPY3 <FLTPT>            MPY3A <FLTPT>           RPY3G <FLTPT>
MPY3L <FLTPT>           MPY3M <FLTPT>           RPY3T <FLTPT>
RPY9 <QUAD>             MPYA <QUAD>             MPYAA <QUAD>
MPYAG <QUAD>            MPTRm <QUAD>            MPYRT <QUAD>
MPYRV <mathf>           MPYDI <mathf>           BPYE <CPX>
MPYE_ptr <CPX>          MPYE_ptrs <CPX>         BPYFP <mathf>
BPYLF <mathf>           MRLDG <mathf>           RSMFT <mathf>
MYMRM <mathf>           Multinit1 <mathf>       Rultlnit2 <mathf>
MEC1 <CPX>              WED2 <FLTPT>            NEGA <QURD>
Pi <mathf>              Pi2 <mathf>             Pi4 <mathf>
Pi8 <mathf>             RMBS2 <FLTPT>           RCMAR <TERm>
RDEXP <mathf>           RMEG1 <CPX>             RMEG2 <FLTPT>
SBR1 <CPX>              SBR1A <CPX>             SBR1G <CPX>
SBR1M <CPX>             SBR1T <CPX>             SBR2 <FLTPT>
SBR2R <FLTPT>           SBR2G <FLTPT>           SAR2M <FLTPT>
SBR2T <FLTPT>           SBRE <CPX>              SBRE_ptr <CPX>
SIN <mathf>             SN_LABEL <skey>         SK_MEMU <skcy>
SORT <SQRT>             SUB1 <CPX>              SUBTR <CPX>
SUB1G <CPX>             SUR1m <CPX>             SUB1T <CPX>
SUB2 <FLTPT>            SUB2A <FLTPT>           SUB2G <FLTPT>
SUB2M <FLTPT>           SOB2T <FLTPT>           SUBCP <mathf>
SUBE <CPX>              SUBE_ptr <CPX>          SUBFP <mathf>
SUBLF <mathf>           Sqrt2 <mathf>           TEkl <mathf>
TWOX <mathf>            TwoPi <mathf>           WCMAR <TERR>
WCPX <TERM>             UMEX <TERM>             Wtex <TERM>
UMUM <TERM>             UOURD <TERM>            UREAL <TERR>
USTR <TERM>             XFM2P <mathf>           XFM2Q <mathf>
abort <kerne>           acquire <kerne>         active_function_label <alabe>
active_table_type <atabl>                       active_tables <atabl>
append_ch <strin>       append_string <strin>   array_update_fife <fifo>
atn_table <matht>       awaited <kerne>         bcd_of_int <FMT>
blanks <skpos>          bot_key_table <keys>    bytt_list <alpha>
cal_kit_array <narkn>   ch_cmdl_line <chdat>    ch_cmd2_line <chdat>
ch_table <chdat>        char_index <title>      clear_display <displ>
clear_string <strin>    conditional_acquire <kerne>
copy_user3 <CPX>        counter <kerne>         coupled_bitmap <chdat>
coupled_chtable_index <cpltb>                   coupled_chtable_size <cpltb>
create <kerne>          crlf <displ>            deg_to_radians <mathf>
delay <kerne>           dg_hex <displ>          dg_read <displ>
dg_read_xy <displ>      dg_write <displ>        display_alternate_value <atabl>
drau <displ>            elec_delay <chdat>      empty_fifo <fifo>
enter_title_char <title> erase_title <title>    exp_cmplx <mathf>
exp_overflow <CPX>      fetch_CMVE1 <CPX>       field <skpos>
format <chdat>          format_3_cmpx <FMT>     format_dooble <FRT>
format_integer <FMT>    format_quad <FMT>       format_real <FMT>
format_table <atabl>    hilite_bitmap <chdat>   hilite_info <chdat>
ib_link <ibtrm>         if_ref_gain <chdat>     if_test_gain <chdat>
init_display <displ>    init_fifo <fifo>        init_kernel <kerne>
init_mbn <xmbn>         init_string <strin:     intrpt_botton <kerne>
intrpt_delay_timer <kerne>                      intrpt_priv_ib_srq <kerne>
```

```
MMBMLORD.WORK.PDS510          THU, DEC 22, 1983, 10:45 AM    PAGE 10

intrpt_rpg <kerne>      intrpt_tick <kerne>     intrpt_top_key <kerne>
intrpt_uart <kerne>     irack <intrp>           iradr <intrp>
irclr <intrp>           irdis <intrp>           iren <intrp>
irint <intrp>           irirr <intrp>           irrdy <intrp>
irset <intrp>           jnp <displ>             jsr <displ>
keyboard_fifo <fifo>    kit_base <stdda>        kit_base2 <stdda>
last_state <chdat>      lb <displ>              limit <atabl>
link <kerne>            log_scale_div_3 <atabl> log_tabls <matht>
mark_dg_base <markd>    mark_dg_top <dgtop>     mark_stack <stack>
marker_state <chdat>    max_dump <chdat>        max_save <chdat>
mbn_misc_status_reg <xmbn>                      mbn_prgm_start_add <xmbn>
mbn_sub_prgm_sel <xmbn> membotton <markn>       mentop <markn>
min_save <chdat>        mkr_imag_format <atabl> mkr_imag_suffix <atabl>
mkr_real_format <atabl> mkr_real_suffix <atabl> mmen <ibtre>
move <displ>            move2 <displ>           movech <displ>
movtch2 <displ>         number_of_groups <chdat> oid_id <chdat>
parameter_descriptor <chdat>                    parms_mbn <xmbn>
pause <kerne>           pending <kerne>         plot <displ>
plot_quadrant <chdat>   plotter_gen <chdat>     preempt <kerne>
print_hex <displ>       printch <displ>         priv_ib_lun_table <lunpl>
public_ib_fifo <fifo>   read_boot_mbn <xmbn>    read_fife <fifo>
reed_mbn <xmbn>         ready <kerne>           ref_position <ehdat>
ref_value <chdat>       release <kerne>         resource_init <kerne>
rts <displ>             run <kerne>             running <kerne>
scale <chdat>           scale_factors <atabl>   select_title_char <title>
send <kerne>            set_add_mbn <xmbn>      setattribute <displ>
signal_init <kerne>     sine_cos <markn>        sk_line1 <skpos>
sk_line2 <skpos>        snapshot <kerne>        speed_of_light <mathf>
speed_of_light_air <mathf>                      sqrt_tbl <matht>
srq_mask_primary <chdat> srq_mask_secondary <chdat>
stack_top <kerne>       status_mbn <xmbn>       step_size <chdat>
suffix <atabl>          sweep_mode <chdat>      terminate <kerne>
test_mbn <xmbn>         title_line <chdat>      token_fifo <fifo>
top_key_table <keys>    trace_mode <chdat>      Unscale_factors <atabl>
wait <kerne>            waitio <kerne>          urite_fifo <fifo>
urite_title <title>     wrt_boot_mbn <xmbn>     urt_disp_byte <dispr>
urt_disp_dbl <dispr>    urt_disp_int <dispr>    urt_disp_quad <dispr>
urt_disp_real <dispr>   urt_disp_str <dispr>    urt_mbn <xmbn>
xdrau <displ>           ydrau <displ>

 WSPMAX=2 RSPMAX=4 SSPMAX=5926 BSPMAX=420 ESPMAX=565 FSPMAX=20
 LSPMAX=245 XSPMAX=18
ELAPSED TIME 1:20
CPU TIME 0:10
```

```
SNBNLOAD.WORK.PD8510          THU, DEC 22, 1983, 10:45 AM    PAGE  1


MODULE,"nbnload"
BEGIN

@FILE cchtable.work;
@FILE ccontvar.work;
@FILE cnbngr.work;
@FILE ctpngr.work;
@FILE cdatap.work;
@FILE fterm.work;                                          & DEBUG &
@FILE fterm2.work;                                         & DEBUG &
@FILE fnbn.work;
@FILE fchdata2.work;
@FILE fcpltbl.work;
@FILE fmarknen.work;
@FILE cstds2.work;                          & for cal_kit_array_size &
@FILE fetddata.work;
COMMENT
  These fileo ore for uncoupling and initializing hilights
  ;
@FILE creap.work;
@FILE estin.work;
@FILE cparona.work;
@FILE eformat.work;
@FILE edonmenu.work;
@FILE ccalnenu.work;
@FILE cstdnenu.work;
@FILE cdiep.work;
@FILE cplot.work;
@FILE enkr.work;
@FILE eayaten.work;

BYTE LEDa = #FFFFFEB1;
INTEGER pg, rag, lgth, i;
INTEGER ARRAY page_0 [0:31];
INTEGER POINTER save_addr;
DOUBLE save_sz_dbl, last_sz_dbl, junk;
INIEGER aave_eZ = eave_sz_dbl+2,
        last_sz = last_sz_dbl+2;
BOOLERN save_ok;
```

```
SNBNLOAD.WORK.PD8510          THU, DEC 22, 1983, 10:45 AM    PAGE  2


@EJECT;
SUBROUTINE force_load;
BEGIN
  EXTERNRL INTEGER atn_table.L;
  @FILE falphas.work;
  @FILE fakey.work;
  @FILE fakpos.work;
  @FILE fkeys.work;
  @FILE falabel.work;
  @FILE fibtree.work;
  @FILE fatables.work;
  & force linker loading of display RAM data modules &
  junk := RORS(atn_table);
  junk := RORSfbyte_list);
  junk := ADRS(SK_LABEL);
  junk := ADRS(field);
  junk := MORS(top_key_table);
  junk := RORS(ective_function_label);
  junk := ADRS(nark_stack);
  junk := ADRS(ib_link);
  junk := ADRS(active_tablce);
  junk := ADRS(coupled_chtable_index);
END force_load;

BOOLEAN SUBROUTINE init_bubble;
BEGIN
  LEDs := XFF;                                          & turn off LEDs &
  FOR i := 0 ID 31 DO page_0[i] := 0;
  page_0[31] := X5510;
  i := 0;
  IF init_nbn (1) THEN
    init_bubble := urt_nbn (ADRS(page_0), set_add_nbn(i,0,S3))
  ELSE
    init_bubble := FALSE;
END init_bubble;
```

```
SNBNLOAD.WORK.PDS510          THU, DEC 22, 1983, 10:45 AM    PAGE  3


@EJECT;
COMMENT
  uncouples softkey hilights
;
PROCEDURE uncouple_hilights (first,last);
  VALUE first,last;  INIEGER first,last;
BEGIN
  INTEGER nap,index,x,key_cnt;
  index := RIGHT(first,4)-1;          & first/16 to get bitnap index &
  key_cnt := last-first;              & number of keys in group &
  x := first RNO XOF;                 & 1st softkey bit to clear &
  IF key_cnt >= 0 THEN                & clear out hilights for group &
    DO BEGIN
      nap := coupled_bitnap [index:=index+1];  & scratch pad bit nap &
      DO nap:=RBIT(~~~~~)                      & one word at a time  &
      UNTIL ((x;=x+1)=16) OR ((key_cnt:=key_cnt-1)<0);
      coupled_bitnap [index] := nap;
      x := 0;
    END UNTIL (key_ent < 0);
END uncouple_hilights;

SUBROUTINE init_uncoupled;
BEGIN
  uncouple_hilighte (cnd_if_teet_port,cnd_if_ref_port);
  uncouple_hilights (cnd_if_no_gain,cnd_if_gain_auto);
  uncouple_hilights (cnd_user1,cnd_user4);
  uncouple_hilights (cnd_sur,cnd_real);
  uncouple_hilights (cnd_freq_donain,cnd_aux_donain);
  uncouple_hilights (cnd_tdr_etep,cnd_nin_tine_uindou);
  uncouple_hilights (cnd_nax_gate_uindou,cnd_nin_gate_uindou);
  uncouple_hilights (cnd_correction_on,cnd_correction_off);
  uncouple_hilights (cnd_data,cnd_nath);
  uncouple_hilights (cnd_nenory1,cnd_nenory4);
  uncouple_hilights (cnd_nenory_ch1,cnd_nemory_ch2);
  uncouple_hilights (cnd_d_plue_n,cnd_d_div_n);
  uncouple_hilights (cnd_pen1,cnd_pen2);
  uncouple_hilights (cnd_data,cnd_nath);
  uncouple_hilights (cnd_if_avg_on,cnd_if_avg_off);
  uncouple_hilights (cnd_enoothing_on,cnd_anoothing_off);
END init_uncoupled;
```

```
SnBnLORD.UORK.PD8510          THU, DEC 22, 1983, 10:45 Am    PAGE  4


@EJECT;
COnnENT
  initializea initial sofktey menu highlights
;
PROCEDURE hilight (softkey1,softkey2);
  VALUE softkey1,softkey2; INTEGER softkey1,softkey2;
BEGIN
  INTEGER bit_poa;
  hilite_info [0,(i:=RIGHT(softkey1,4))] :=
    SBII (hilite_info[0,i), eoftkey1 AND XOF);
  bit_poe := softkey2 RND XOF;
  hilite_info [1,(i:=RIGHT(eoftkey2,4))] :=
    SBIT (hilite_info[1,i], bit_poe);
END hilight;

SUBROUTINE init_highlights;
BEGIN
  hilight (cnd_if_avg_off,cnd_if_avg_off);
  hilight (cnd_anoothing_eff,cnd_onoothing_off);
  hilight (cnd_201_points,cnd_201_pointo);
  hilight (cnd_if_gain_auto,cnd_if_gain_auto);
  hilight (cnd_if_teet_port,cnd_if_teet_port);
  hilight (cnd_suept,cnd_swept);
  hilight (cnd_continuous,cnd_continuoue);
  hilight (cnd_couple_ptinulus,cnd_couple_etinulue);
  hilight (cnd_pouer_elope_off,cnd_pouer_elope_off);
  hilight (cnd_freq_donain,cnd_freq_donain);
  hilight (cnd_tdr_etep,cnd_tdr_etep);
  hilight (cnd_nornal_time_uindou,cnd_nornal_time_uindou);
  hilight (cnd_gate_off,end_gate_off);
  hilight (cnd_nornal_gate_uindou,cnd_nornal_gate_uindou);
  hilight (cnd_correction_off,cnd_correction_off);
  hilight (cnd_cal_kit_1,cnd_cal_kit_1);
  hilight (cnd_single_eh,cnd_single_ch);
  hilight (cnd_data,cnd_data);
  hilight (cnd_narker_off,cnd_narker_off);
  hilight (cnd_no_ref_nkr,cnd_no_ref_nkr);
  hilight (cnd_quadrant_full,end_quodrant_full);
  hilight (cnd_pen1,cnd_pen2);
  hilight (cnd_privib_renote,cnd_privib_renote);
  hilight (cnd_d_div_n,cnd_d_div_n);
  hilight (cnd_nenory1,cnd_nenory2);
END init_highlights;
```

```
SMBMLOAD.WORK.PD8510          THU, DEC 22, 1983, 10:45 RM     RAGE  5


%EJECT;
SUBROUTINE init_counts;
BEGIN
  reg := 0;
  LEDs := %FF;
  CRLF;
END init_counts;
```

```
SMBMLOAD.WORK.PD8510          THU, DEC 22, 1983, 10:45 Rm     PRGE  6


REJECT;
PROCEDURE init_cal_rege;
BEGIN
  INTEGER pg_cnt;
  pg := seg_etart;
  init_counte;
  WSTR("CRL SEGMERT:"); WHEX(seg_size*64); USTR(" bytes"); CRLF;
  DO BEGIN
    reg := reg + 1;
    pg_cnt := 0;
    USTR("Init pages"); WHEX(pg);
    DO UNTIL
      NOT (save_ok := urt_nbn(RDR5(page_0),set_add_nbn(pg,0,31)))
      OR  ((pg_cnt:=pg_cnt+1)=eeg_size) OR (pg=2043);
    WHEX(pg-1); USIR(" = reg"); WHEX(reg); CRLF;
    LEDs := RBIT (LEDs, reg-1);
  END UNTIL NOT save_ek bR (reg=8) OR (pg=2048);
  IF (reg < 8) THEN
  IF save_ok THEN
    BEGIN
      save_ok := FRLSE;
      CRLF;
      & error: cal aogments ere too large &
    END;
END init_cal_rege;
```

```
SnBnLORO.WORK.PD3510          THU, DEC 22, 1953, 10:45 Rn     PROE  7


REJECT;
PROCEDURE init_pages_left (page_bound);
  VRLUE page_bound: INTEGER page_bound;
BEGIN
  INTEGER bytes_left;
  init_counts;
  IF (bytes_left := (page_bound-pg)*G4) < 0 1NEN
    bytes_left := 0;
  WSTR("BYTES REMAINING:"); UNEK(bytes_left); CRLF;
  IF bytes_left > 0 THEN
    BEGIN
      USTR("Init pages"); UHEX(pg);
      DO BEGIN
        LEDs := NOT (RRIGHI(pg,3));
      END UNTIL
          NOT (save_6k := urt_nbn(RORS(pege_0),eet_edd_nbn(pg,0,31)))
          OR    (pg=page_bound);
      UNEX(pg-1); CRLF;
    END;
END init_pagee_left;
```

```
SMBnLORO.WORK.PD3510          THU, OEC 22, 1983, 10:45 Rn     PRGE  8


%EJECT;
PROCEDURE load_bubble_data (lgth);  VRLUE lgth;  DOUBLE igtn;
BEGIN
  INTEGER i;
  i := -1024;
  OO UNTIL
    NOT (aave_ok :=
          urt_nbn(RORS(save_addr[i:=i+1024]],
                  eet_add_nbn (pg,0,(IF lgth>2043 THEN 2047
                                                  ELSE lgth-1))))
    OR ((lgth:=lgth-2048) <= 0);
END load_bubble_data;
```

```
SMBMLOAD.WORK.PDSS1O          THU, DEC 22, 1983, 10:45 RM    PAGE  9

#EJECT;
SUBROUTINE load_cal_stds;
BECIN
  init_counts;
  WSTR("CAL STRNDRROS:"); WHEX(cal_kit_array_eize);
  WSTR(" bytes"); CRLF;
  STPHTR (save_addr, RDRS(kit_basal);
  DO BECIN
    WSTR("Loading pages "); WNEX(pg);
    load_bubble_data (cal_kit_array_size);
    STPHTR (save_addr, RDRS(kit_base2));
    WHEX(pg-T); WSTR(" = reg"); WHEX(reg+1); CRLF;
    LEDs := RBIT (LEDs, reg);
  END WNTIL NOT eave_ok OR ((reg:=reg+1) = 2);
END loed_cal_etds;
```

```
SMBMLORD.WORK.PD8510          THU, DEC 22, 1983, 10:45 RM    PRGE  10

#EJECT;
PROCEDURE load_hpib_addresses;
BEGIN
  #FILE flunpiue.work;
  init_counto;
  WSTR("HPIB RDDRESSES: 40 bytes");  CRLF;        & Fixed at 64 bytes &
  LEDs := RBIT (LEDs, reg);                       & enable 1et LED &
  save_ok := urt_nbn (RDRS(priv_ib_lun_table),set_add_nbn(pg,0,31));
  WSTR("Init page"); WHEX(pg-1); CRLF; CRLF;
END load_hpib_addreeeee;
```

```
SMBMLORD.WORK.PD8510          THU, DEC 22, 1983, 10:45 RM    PRCE  11

#EJECT;
PRCCEDURE load_nenory_traces;
BEGIN
  IKTEGER nen_size;
  nen_size := 240G+header_aize-1;
  init_counts;
  WSTR("NEMORY TRRCE:"); WHEX(nen_eize); WSTR(" bytes"); CRLF;
  DO BEGIN
    WSTR("Loading pages "); WNEX(pg);
    save_ok := (pg < 204E) RND
               urt_nbn (RDRS(page_0), set_add_nbn(pg,0,nen_size));
    WNEX(pg-1); WSTR(" = reg "); WHEX(reg+1); CR1F;
    LEDe := RBIT (LEDs, reg);
  END WNIIL NOT save_ok OR ((reg:=reg+t)=4);
END lead_nenory_trecas;
```

```
SMBMLORD.WORK.PDSS1O          THU, DEC 22, 1983, 10:45 RM    PRGE  12

#EJECT;
PROCEDURE load_display_ran;
BEGIN
  DOUBLE  dg_data_ez, dg_data_cnt;
  INTEGER dg_pgt = dg_dete_cnt + 2;
  dg_data_az := RDRS(nark_dg_tcp) - RDRS(nark_dg_base);
  dg_data_cnt := dg_data_az/64;
  IF (dg_data_ez AND X3F)<>0 THEN
    dg_pgs := dg_pgs + 1;
  init_counts;
  WSTR("DISPLRY RAM DRTR: "); WHex(dg_data_ez,8);
  WSTR(" bytes"); CRLF;
  WSTR("Display RRM boundaries:"); WHex(RDRS(nark_dg_beee),8);
  WHex(RDRS(nerk_dg_top),8); CRLF;
  IF NOT (eave_ok := (dg_pgs + pg) < seg_start) THEN
    BEGIN
      LEDs := 0;
      WSTR("ERROR:  DG RRM exceede available ");
      WSTR("data bubble space by "); WHEX((seg_etart-dg_pge)*64);
      WSTR(" bytes.");
    END
  ELSE
    BEGIN
      STPHTR (save_addr, RDRS(nark_dg_base));
      WSTR("Loading pages "); WHEX(pg);
      load_bubble_data (dg_data_sz);
      WHEX(pg-1);
    END;
  CRLF;
END load_display_ran;
```

```
SMBMLOAD.WORK.PD8510          THU, DEC 22, 1983, 10:45 RM     PAGE  13


%EJECT;

  init_uncoupled;
  init_highlights;
  save_ez_dbl := RORS(nex_save)-RORS(min_save);
  last_ez_dbl := ROR3(max_save)-RORS(last_state);
  STPNTR (save_addr, RORS(min_save));
  pg := 1;
  CRLF; WSTR("***** LOADING DATA BUBBLE (; *****"); CRLF;
  init_counts;

  WSTR("INSTRUMENT STATE:"); WHEX(save_sz); WSTR(" bytes"); CRLF;
  IF (save_ok := init_bubble) THEN
  DO BEGIN                & init bubble module 1 a/ & save/recall statee &
    reg := reg + 1;
    WSTR("Loading pages "); WHEX(pg);
    load_bubble_data (save_ez);
    WHEX(pg-1); WSTR(" = reg"); WHEX(reg); CRLF;
    LEDs := RBIT(LEDs,reg-1);          & indicate initialized register &
  END UNTIL NOT save_ok OR (reg=preset_state);
  IF save_ok THEN                                & init "last state" reg &
    BEGIN
      WSTR("Last state    "); WHEX(pg);
      STPNTR (save_addr, RORS(last_state));
      load_bubble_data (last_ez);
      WHEX(pg-1); CRLF;
      IF save_ok THEN
        load_cal_state;
      IF save_ok THEN
        load_hpib_addresses;
      IF save_ok THEN
        load_display_ram;
      IF save_ok THEN
        init_pages_left(seq_start);
      IF save_ok THEN
        init_cal_regs;
      IF save_ok THEN
        load_memory_traces;
      IF save_ok THEN                            & init 2nd half of bubble &
        init_pages_left (2045);
      IF save_ok THEN
        WSTR("done.")
      ELSE
        WSTR("bubble write error");
    END
  ELSE
    WSTR("Bubble Module 1 loading error.");
  IF save_ok THEN
    LEDs := 2FF;
  CRLF; CRLF;
  TRAP(15);   & return to monitor &

END$
```

```
SMBTEST.WORK.PD8510           THU, DEC 22, 1983, 10:46 RM     PAGE   1


%&KL,"MBTEST"
BEGIN

%FILE Fterm.work;
%FILE fmbn.work;


COMMENT
**********************************************************************
This program is for testing the error rate of MBM

It will save on the RAM a selected region of memory RefStart-RefEnd
It will also save a block of counters containing present results
        (this allows restarts after powerfail)
It will then repeatively read MBM and compair it to the orginal data in
   memory  -- this will continue for &ReadLoopRate times and
   then the whole cycle will repeat -- including the re-writing of MBM
     (This will test writes and allow the program to continue on
       nearfully after a hardfailure of MBM or RAM!!!)

Occansionally a status message will be printed out.

If an error occur the program will dump information that should allow
   one to trace the type of error
**********************************************************************
end of comment;


DOUBLE %ARRAY Counters(0:&3);
GLOBAL DOUBLE MBLoops=Counters[0],PrintMrtCount=Counters[1],
       MBReadErr=Counters[2],MBCompairErr=Counters[3],
       Restarts=Counters[4],C1=Counters[5],
       C2=Counters[6],C3=Counters[7];

DOUBLE CONSTANT  RefStart:=&100000, RefEnd:=X107CFF,
                 TestStart:= &10000,TestEnd:= &17CFF;
INTEGER CONSTANT CountersSaveMdd:=1020,TestSaveAdd:=1021,
                 ReadLoopRate:=25,PrintOutRate:=100;
LABEL MajorLoop;
INTEGER MBMAdd;
BOOLEAN Flag;
REAL Rtemp;
BYTE    Coldstart=XF0;


SUBROUTINE PrintData;
BEGIN
 WSTR("# of Loops "); WNUM(MBLoops);
     Rtemp:=RERL(MBLoops)*RERL(TestEnd-TestStart)*8.0;
     WSTR("     # of Bits "); WREAL(Rtemp);
     WSTR("    Restarts");  WNUM(Restarts);
     CRLF;
 WSTR("  Errors (Read/Compair) ");
     WNUM(MBReadErr); WNUM(MBCompairErr);
     WSTR("      Error Rate ");
```

```
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     WREAL( RERL(MBReadErr+MBCompairErr)/Rtemp );
     CRLF;
END PrintData;


%**********************************************************************%
IF NOT init_mbn(0) THEN BEGIN
            CRLF; WSTR("Init Failure"); CRLF; TRAP(15); END;

IF TBIT(Coldstart,0) THEN BEGIN
            Coldstart:=RBIT(Coldstart,0);
            CRLF; WSTR("Cold Start"); CRLF;
            MBLoops:=0;
            MBReadErr:=0;
            MBCompairErr:=0;
            Restarts:=0;
            C1:=C2:=C3:=0;
            PrintOutCount:=PrintOutRate;
     END ELSE BEGIN
            CRLF; WSTR("Warm Start"); CRLF;
            MBMAdd:=CountersSaveAdd;
            IF NOT read_mbn(RORS(Counters),
                  set_add_mbn(MBMAdd,RORS(Counters),RORS(Counters)) )
               THEN &Counters invalid T???&;
            Restarts:=Restarts+1;
            END;
 PrintData;


MajorLoop:
   MBMAdd:=TestSaveAdd;
   Flag:=wrt_mbn(RefStart,
                 set_add_mbn(MBMAdd,RefStart,RefEnd)  );

   MBMAdd:=CountersSaveAdd;
   Flag:=wrt_mbn(RORS(Counters),
                 set_add_mbn(MBMAdd,RORS(Counters),RORS(Counters)) );

   REPEAT ReadLoopRate DO BEGIN

          MBLoops:=MBLoops+1;

          MBMAdd:=TestSaveAdd;
          IF read_mbn(TestStart,
                 set_add_mbn(MBMAdd,TestStart,TestEnd)  ) THEN
             BEGIN
                 LABEL CompairLoop,CompairExit;
                    ASSEMBLE( MOVE.L RefStart,R9; MOVE.L TestStart,R10;
                              MOVE.L TestEnd,R11 );
                 CompairLoop:ASSEMBLE(
                              CMP.L  R10,R11;
                              BMI    CompairExit;
                              CMPm.W (R9)+,(R10)+;
                              BEQ    CompairLoop;
                              RDD.L #01,BBCompairErr; SCompair Err&
```

```
SMBTEST.WORK.PD8510           THU, DEC 22, 1983, 10:46 RM     PAGE   3


                              MOVE.W -(R9),R0;        SRef data first&
                              JSR    $WHEX;
                              MOVE.W -(R10),R0;       SMBR data seconds
                              JSR    $WHEX;
                              MOVE.W  R10,R0;         &Address&
                              JSR    $WHEX            );
                              CRLF;
                 CompairExit:ASSEMBLE( NOP );
             END ELSE
                BEGIN

                   MBReadErr:=MSReadErrs1;
                   PrintData;
                   IF NOT init_mbn(0) THEN BEGIN
                      CRLF; WSTR("Init Failure"); CRLF; TRAP(15); END;
                END;

          IF (PrintOutCount:=PrintOutCount-1) <=0 THEN BEGIN
                   PrintOutCount:=PrintOutRate;
                   PrintData;
                   END;
          END REPEAT ReadLoopRate;

 GO TO MajorLoop;

 END$
```

```
CMCMMGR.WORK.PD8510          THU, DEC 22, 1983, 10:46 AM    PAGE  1


INTEGER CONSTANT
  td_scr_arrays_id     := 0,
  td_gate_arrays_id    := 1,  & and 2 -- ch dependent &
  td_chirp_arraya_id   := 3,  & and 4 -- ch dependant &
  slids_load_arrayo_id := 5,
  temp_id              := 10,
  max_memory_id        := 10;
```

```
FMEMMOR.UORK.PD8510          THU, DEC 22, 1983, 10:46 AM    PAGE  1


%FILE cmemngr.uark;                                & for max_memory_id &

& Clear memory &
SUBROUTINE reset_memory;                                          EXTERNAL;

& Return memory address allocating byte_cnt bytes &
DOUBLE PROCEDURE requeat_memory (byte_cnt);
  VALUE byte_cnt; DOUBLE byte_cnt;                                EXTERNAL;
DOUBLE PROCEDURE request_array(byte_cnt);
   VALUE   byte_cnt;
   DOUBLE byte_cnt;                                               EXTERNAL;

& Release previouely allocated memory address &
PROCEDURE release_memory (memory_address);
  DOUBLE memory_address;                                          EXTERNAL;
PROCFOURE  releaec_4rray(array_address);
   DOUBLE  array_address;                                         EXTERNAL;

& Auxiliary memory management &
BOOLEAN PROCEDURE memory_stolen (addr, memory_id, byte_cnt);
  VALUE memory_id, byte_cnt;
  DOUBLE addr; INIEGER memory_id; DOUBLE byte_cnt;                 EXTERNAL;
PROCEDURE release_auxiliary_memory (addr, memory_id);
  VALUE addr, memory_id;
  DOUBLE addr;  INTEGER memory_id;                                EXTERNAL;
```

```
8MEMMGR.UORK.PD8510          THU, DEC 22, 1983, 10:46 AM    PAGE  1


MGBKL,P,"memngr"
BEGIN

%FILE fkernel.uork;
%file crims.uork;
%FILE fmarknen.uork;
%FILE cmeasage.uork;                    & for exceeded_available_memory &
%FILE futil2.uork;                                        & for fatal &
%FILE cdebug.uerk;
%FILE fterm.work;                                          & DEBUG &
%FILE fterm2.uork;                                         & DEBUG &
&FILE cmbngr.uork;                                  & for header_eize &
%FILE cmemngr.Wcrk;

INTEGER CONSTANT
  block_cnt := 511,                          & eize of memory block map &
  block_size := 512;                            & must be a power of 2 &

INTEGER ARRRY
  memory_id_status [0:max_memory_id],        & list of memory bh "loan" &
  memory_id_lgth   [0:max_memory_id);        & and Kblocke ocuupied     &
BYTE ARRAY
  memory_map [0:block_cnt);

DOUBLE
  memory_base,
  memory_eize, block_maek;

INTEGER
  block_max = block_mask + 2,       & number of memory blocks in memory &
  free_blk;                         & first available block in memory   &

BOOLERN
  aux_men_avail;
```

```
8MEMMGR.WORK.PD8510          THU, DEC 22, 1983, 10:46 AM    PAGE  2


%EJECT;
PROCEDURE dump_aux_status;                              & for DEUBG only &
BEGIN
  INTEGER i;
  USTB("Rux Ben ");
  FOR i := 0 TO max_memory_id DO
    UNEX(memory_id_status[i]); CRLF;
  USTR("Bux Lgth");
  FOR i := 0 TO max_memory_id OO
    UNEX(memory_id_lgth[i]); CRLF;
END dump_aux_etatus;
```

```
SMEMMGR.WORK.PD8510          THU, DEC 22, 1983, 10:46 PM    PAGE  3

#EJECT;
PROCEDURE dump_memory_status;                          & for debug only &
BEGIN
  INTEGER i,blk_start,blk_size;
  USTR("1st avail blk @"); UHEX(free_blk); CRLF;
  RSTR("Memory Status"); CRLF;
  blk_start := 0;
  DO BEGIN
    blk_size := memory_map[blk_start];
    IF blk_size > 0 THEN
      BEGIN
        UHEX(blk_size); USTR(" full @"); UHEX(blk_start); CRLF;
      END
    ELSE
      BEGIN
        i := blk_start-1;
        WHILE (memory_map[i:=i+1]=0) AND (i<block_max) DO
          blk_size := blk_size + 1;
        UHEX(blk_size); USTR(" EMPTY @"); UHEX(blk_start); CRLF;
      END;
    blk_start := blk_start + blk_size;
  END UNTIL (blk_start >= (block_max-1));
  CRLF;
END dump_memory_status;
```

```
SMEMMGR.WORK.PD8510          THU, DEC 22, 1983, 10:44 PM    PAGE  4

#EJECT;
COMMENT
$DOC+

NAME--
  free_memory_id
*****************************************************************************
*
* SHORT DESCRIPTION--
*   removes auxiliary memory from auxiliary memory tables
*
* EXTENDED DESCRIPTION--
*   This routine removes auxiliary memory from auxiliary memory tables
*   by setting the table value corresponding to a given memory ID to
*     -1 for table containing starting block of auxiliary memory
*      0 for table containing number of auxiliary memory blocks
*   The given memory ID indexes the tables.
*
*
* INPUTS--  Id = memory ID of auxiliary memory to be removed
*
* OUTPUTS-- none
*
* ROUTINES CALLED-- none
*
* ERROR CONDITIONS AND RECOVERY--
*   No range checking is done on the memory ID value that is passed.
*   Constant values found in CMEMMGR.WORK should be used.
*
* NOTES--
*   This is a local utility routine used by externally declared routines
*   found in this module.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set starting memory block corresponding to memory ID to -1
*   set number of memory blocks corresponding to memory ID to 0
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE free_memory_id (id);
  VALUE id;  INTEGER id;
&
$DOC-&

BEGIN
  memory_id_status [id] := -1;
  memory_id_lgth [id]   := 0;
```

```
SMEMMGR.WORK.PD8510          THU, DEC 22, 1983, 10:46 PM    PAGE  5

END free_memory_id;
```

```
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#EJECT;
COMMENT
$DOC+

NAME--
  reset_memory
*****************************************************************************
*
* SHORT DESCRIPTION--
*   initialize data memory, clear entire memory bitmap
*
* EXTENDED DESCRIPTION--
*   This routine initializes memory used for dynamic allocation and
*   its associated bitmaps and tables.  At the end of the routine, all
*   available memory has been de-allocated.
*
* INPUTS--  none
*
* OUTPUTS-- De-allocated dynamic memory
*
* ROUTINES CALLED--
*   acquire
*   release
*   free_memory_id
*
* ERROR CONDITIONS AND RECOVERY--
*   Any memory addresses acquired in previous memory allocation
*   requests cannot be invalidated and can therefore, be potentially
*   used again without warning.  That is, when memory is re-allocated
*   after a reset_memory, any routines using memory allocated before the
*   reset can still access that memory after the reset even if the
*   memory was not technically re-allocated to them.  This can cause
*   memory allocated to one routine to be overwritten or read by another
*   routine.  It is, therefore, the user's responsibility to re-allocate
*   memory after a memory_reset.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   Determine the total number of available memory blocks
*   Clear memory block allocation bitmap
*   Reset first available memory block for allocation
*   Initialize auxiliary memory tables
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE reset_memory;                                    ENTRY;
```

```
SMEMMGR.UORK.PD8510          THU, DEC 22, 1983, 10:46 AM    PAGE  7


&
$DOC-&

BEGIN
  acquire (memory_src);
  COMMENT since we cannot allocate mapping space dynamically,
          the constant, block_cnt, will have to be changed as
          more/less memory becomes available;
  block_mask := (RDRS(membotton) -
                 (memory_base:=RDRS(memtop))) / block_size;
  IF ((block_max) > block_cnt+1) OR (block_max < 0) THEN
    block_max := block_cnt+1;
  FOR free_blk := 0 TO block_max-1 DO          & init memory map &
    memory_map[free_blk] := 0;
  FOR free_blk := 0 TO max_memory_id DO        & init memory id info &
    free_memory_id (free_blk);
  free_blk := 0;                               & first available block &
  aux_mem_avail := FALSE;

  IF mem_debug THEN
    BEGIN USTR("MEMORY RESET @ "); UHex(memory_base,S);
          UHex(RDRS(membotton),S); CRLF;
          UHEX(block_max); USTR(" blks avail"); CRLF;
          dump_memory_status;
    END;
  release (memory_src);
END reset_memory;
```

```
SMEMMGR.UORK.PD8510          THU, DEC 22, 1983, 10:46 AM    PAGE  8


REJECT;
COMMENT
$DOC*

NAME--
  blocks_requested
**************************************************************************
*
* SHORT DESCRIPTION--
*   computes the number of memory blocks needed from a given byte count
*
* EXTENDED DESCRIPTION--
*   This routine returns the number of memory blocks that would be
*   occupied from a given number of bytes.  A "block" of memory contains
*   the number of bytes defined in the local CONSTANT block_size.
*
* INPUTS--  byte_cnt = number of bytes of memory needed
*
* OUTPUTS-- number of blocks of memory
*
* ROUTINES CALLED--
*   fatal
*
* ERROR CONDITIONS AND RECOVERY--
*   If the number blocks computed exceeds the total number of memory
*   blocks used for memory allocation then "we're in trouble..."
*   In other words, the system is killed (via fatal).
*
* NOTES--
*
* AUTHOR--
*
**************************************************************************
*
* INITIAL REFINEMENT--
*   Divide a memory block size into the number of bytes given
*   Add an extra memory block if it doesn't divide evenly
*   IF the computed number of memory blocks exceeds the total amount
*     of memory blocks used for allocation THEN
*       display a "fatal" message and hang the system
*
**************************************************************************
*
* REVISION LOG--
*
**************************************************************************
DECLARATION--
;
INTEGER PROCEDURE blocks_reques. ( by . cnt);
  VALUE byte_cnt; DOUBLE byte_cn.
&
&DOC-&

BEGIN
  INTEGER blocks_needed;
  blocks_needed := (byte_cnt/block_size);
```

```
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  IF (byte_cnt AND (block_size-1)) > 0 THEN
    blocks_needed := blocks_needed + 1;
  IF mem_debug THEN
    BEGIN
      USTR("REQUESTing"); UHex(byte_cnt,S); USTR(" bytes");
      UHEX(blocks_needed); USTR(" blks"); CRLF;
    END;
  IF blocks_needed > block_max THEN
    BEGIN
      fatal (exceeded_available_memory);
      blocks_needed := 0;
    END;
  blocks_requested := blocks_needed;
END blocks_requested;
```

```
SMEMMGR.UORK.PD8510          THU, DEC 22, 1983, 10:46 AM


REJECT;
COMMENT
$DOC*

NAME--
  first_fit
**************************************************************************
*
* SHORT DESCRIPTION--
*   searches for first available segment of memory large enough to
*   store a requested number of blocks
*
* EXTENDED DESCRIPTION--
*   This function returns the block number of the first block which
*   heads consecutive available memory blocks that will be able to
*   accomodate a requested number of blocks.  It does a "first fit"
*   type of search for a segment of memory that contains available
*   contiguous blocks.  A value of -1 is returned if a segment of memory
*   cannot be found containing the required number of blocks.
*
*   Allocated memory which has been designated as "auxiliary" by the
*   memory owner is released only when there is not enough contiguous
*   memory blocks available to satisfy a current memory request.
*
* INPUTS--
*   blocks_needed = number of blocks of available memory needed
*
* OUTPUTS--
*   starting blocks of available segment of memory
*
* ROUTINES CALLED--
*   free_memory_id
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*   When "auxiliary" memory is needed due to a shortage of available
*   memory, ALL "auxiliary" memory is released and considered to be
*   re-allocated (even if it doesn't end up getting used).
*
* AUTHOR--
*
**************************************************************************
*
* INITIAL REFINEMENT--
*   Count the number of contiguous unused memory blocks until the number
*     of contiguous memory blocks = requested number of memory blocks
*   IF there are not enough contiguous blocks available THEN
*     check auxiliary memory tables and release all auxiliary memory
*     re-count contiguous blocks until there are enough available
*   IF there wasn't enough available memory blocks THEN
*     return a -1
*   ELSE
*     return the first available memory block from a set of contiguous
*       blocks that can accomodate the requested number of blocks
*     update the pointer to the first available memory block
```

```
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!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! REVISION LOG--
!   3/15/83   -- Added capability of "borrowing" allocated memory which
!                has been conditionally released by memory owner and
!                marked as auxiliary memory.  This memory is used only
!                when there is not enough available memory to satisfy a
!                request for memory allocation.
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
DECLARATION--
;
INTEGER PROCEDURE first_fit (blocks_needed);
  VALUE blocks_needed; INTEGER blocks_needed;
&
$DOC-&

BEGIN
  INTEGER n,i;

  SUBROUTINE steal_memory;
  BEGIN
    INTEGER blk_cnt=REGISTER 5,
            stolen =REGISTER 6;
    blk_cnt := 0;
    FOR i := 0 TO max_memory_id DO
      IF (blk_cnt:=memory_id_status[i]) >= 0 THEN
        BEGIN
          free_memory_id (i);
          FOR stolen := blk_cnt TO (blk_cnt+memory_map[blk_cnt]-1) DO
            memory_map[stolen] := 0;
          IF blk_cnt < free_blk THEN     ! adjust ptr to 1st blk avail !
            free_blk := blk_cnt;
        END;
    aux_mem_avail := FALSE;
    IF mem_debug THEN
      BEGIN
        USTR("Steal memory"); CRLF;
        dump_aux_status;
      END;
  END steal_memory;

  SUBROUTINE count_blocks_avail;
  BEGIN
    n := 0;
    i := free_blk;
    UNTIL (i < block_max ) AND (n < blocks_needed) DO
      IF memory_map[i] = 0 THEN
        BEGIN
          n := 0;
          UNTIL (memory_map[i]=0) AND (i<bldck_max) AND
                (n<blocks_needed) DO
            BEGIN
              n := n+1;                          ! count contiguous blocks !
              i := i+1;                  ! update memory block pointer !
```

```
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            END;
        END
      ELSE
        i := i+1;
  END count_blocks_avail;

  count_blocks_avail;          ! variable n contains available blocks !
  IF n < blocks_needed THEN
  IF aux_mem_avail THEN
    BEGIN
      steal_memory;
      count_blocks_avail;
    END;
  first_fit := IF n >= blocks_needed THEN
                 i-n               ! starting block of allocated memory !
               ELSE
                 -1;               ! not enough blocks to allocate      !
  IF (i-n) = free_blk THEN         ! update first available block       !
    BEGIN
      UNTIL (i < block_max) AND (memory_map[i]<>0) DO
        i := i + 1;
      free_blk := i;
    END;
END first_fit;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  request_memory
**********!**********!**********!**********!**********!**********!**********!**********
!
! SHORT DESCRIPTION--
!   Dynamicelly allocates memory in block_size byte blocks
!
! EXTENDED DESCRIPTION--
!   This routine returns the address of an available segment of memory
!   which is based on the number of bytes requested that will "fit"
!   into the first available segment of memory.  An address of 0 is
!   returned if there is not sufficient memory available for allocation.
!   Blocks corresponding to and included in the memory segment that is
!   allocated will be marked as "occupied" in a memory allocation map.
!   (value of number of memory blocks occupied)
!
! INPUTS--
!   byte_cnt = number of bytes of memory needed
!
! OUTPUTS--
!   starting address of memory with byte_cnt available bytes
!
! ROUTINES CALLED--
!   acquire
!   release
!   blocks_requested
!   first_fit
!
! ERROR CONDITIONS AND RECOVERY--
!   Users of this function should check for a return value of address 0
!   before proceeding to read/write to the returned address value.
!   Disastrous results may occur when attempting to write into address
!   location 0.
!
! NOTES--
!   A memory "block" is currently defined in the CONSTANT block_size.
!
! AUTHOR--
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! INITIAL REFINEMENT--
!   Compute the number of memory blocks needed from the number of bytes
!     requested
!   Find the first set of contiguous memory blocks that can accomodate
!     the number of memory blocks needed
!   IF there are enough memory blocks available for allocation THEN
!     compute the starting address of the allocated memory
!     mark the allocated memory blocks as "occupied" in the memory
!       allocation map
!   ELSE
!     return a value of 0
```

```
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!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! REVISION LOG--
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
DECLARATION--
;
DOUBLE PROCEDURE request_memory (byte_cnt);
  VALUE byte_cnt; DOUBLE byte_cnt;                              ENTRY;
&
$DOC-&

BEGIN
  INTEGER next_avail_block,blocks_needed;
  acquire (memory_src);
  IF (blocks_needed:=blocks_requested(byte_cnt)) > 0 THEN
  IF (next_avail_block:=first_fit(blocks_needed)) >= 0 THEN
    BEGIN
      INTEGER i=REGISTER 6;
      request_memory := memory_base + (next_avail_block*block_size);
      FOR i := next_avail_block TO (next_avail_block+blocks_needed-1) DO
        memory_map [i] := blocks_needed;
      IF mem_debug THEN
        BEGIN
          USTR("Granted @ ");
          UHex(memory_base+(next_avail_block*block_size),8); CRLF;
          dump_memory_status;
        END;
    END
  ELSE
    request_memory := 0;
  release (memory_src);
END request_memory;
```

```
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!EJECT;
COMMENT
$DOC+
NAME--
  request_array
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! SHORT DESCRIPTION--
!   request_array is identical to request_memory except that a
!   succeteful memory allocatson returns the memory base address plus
!   header_size.
!
! EXTENDED DESCRIPTION--
!
! INPUTS--
!   byte_cnt = number of bytes of memory needed
!
! OUTPUTS--
!   starting address of (memory with byte_cnt available bytes) plus
!   header_sizt.
!
! ROUTINES CALLED--
!   request_memory
!
! ERROR CONDITIONS AND RECOVERY--
!   Users of this function should check for a return value of address 0
!   before proceeding to read/write to the returned address value.
!   Disastrous results may occur when attempting to write into address
!   location 0.
!
! AUTHOR--
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! INITIAL REFINEMENT--
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! REVISION LOG--
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
DECLARATION--
;
DOUBLE PROCEDURE request_array(byte_cnt);
  VALUE  byte_cnt;
  DOUBLE byte_cnt;                                        ENTRY;
&
$DOC-&

  BEGIN & request_array &
    DOUBLE addr;

    IF ( addr := request_memory(byte_cnt) ) = 0 THEN
      request_array := 0
    ELSE
      request_array := addr + header_size;
```

```
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  END;  & request_array &
```

```
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!EJECT;
COMMENT
$DOC+

NAME--
  start_release_block
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! SHORT DESCRIPTION--
!   returns the starting block of memory to be released
!
! EXTENDED DESCRIPTION--
!   This routine computes the starting block of memory to be released
!   from the given address.  The memory address passed is first checked
!   against the boundaries of memory that can be allocated.  Memory
!   addresses outside the memory allocation boundaries return a value
!   of -1 (indicating an invalid address).  Memory addresses within
!   bounds are divided by memory block size.  An even divide returns
!   the starting block otherwise the address is invalid since it is not
!   on a memory block boundary.
!
! INPUTS--
!   memory_address * address of allocated memory to be released
!
! OUTPUTS--
!   starting memory block to be released
!
! ROUTINES CALLED-- none
!
! ERROR CONDITIONS AND RECOVERY--
!   No checking is done (or can be done) to ensure that a memory address
!   that happens to fall on an even memory block boundary is in fact a
!   memory address that had been previously allocated.  It is therefore,
!   the user's responsibility to pass an address that was legitimately
!   allocated (via request_memory or stolen_memory).
!
! NOTES--
!
! AUTHOR--
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! INITIAL REFINEMENT--
!   IF given address is within memory allocation boundaries THEN
!     compute starting mtmory block by dividing memory block size into
!       relative address
!     IF result of division is on an even memory block boundary THEN
!       return starting mtmory block
!     ELSE
!       return -1
!   ELSE
!     return -1
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! REVISION LOG--
```

```
SMEMMGR.WORK.PD8510          THU, DEC 22, 1983, 10:46 AM    PAGE 18

!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
DECLARATION--
;
INTEGER PROCEDURE start_release_block (memory_address);
  DOUBLE memory_address;
&
$DOC-&

BEGIN
  DOUBLE address;
  INTEGER start_block=address+2;
  start_release_block := -1;
  IF (memory_address >= memory_base) AND
     (memory_address <= (memory_base+(block_size*block_max))) THEN
    BEGIN
      address := (memory_address-memory_base)/block_size;
      IF ((memory_address-memory_base) AND (block_size-1)) = 0  THEN
        start_release_block := start_block;
    END;
END start_release_block;
```

```
SMEMMGR.WORK.PD&S10          THU, DEC 22, 1983, 10:46 AM    PAGE 19

@EJECT;
COMMENT
$DOC+

NAME--
  release_memory
*******************************************************************************
*
* SHORT DESCRIPTION--
*   release a set of allocated memory blocks
*
* EXTENDED DESCRIPTION--
*   This routine releases memory that has been allocated.  The memory
*   to be released is determined from the memory address from which a
*   starting memory block is computed.  The starting memory block is
*   mapped into the memory allocation map which contain the number of
*   memory blocks allocated for that particular address.  These blocks
*   of memory are then marked as "available" (0 value).
*   If the starting memory block to be released is also found in the
*   auxiliary memory tables, they are also removed from these tables.
*   The memory address (which is passed by reference) is then set to 0,
*   and the pointer to the first available memory block is updated.
*
* INPUTS--
*   memory_address = address of memory to "release"
*
* OUTPUTS--
*   memory_address = 0   (passed by reference)
*
* ROUTINES CALLED--
*   acquire
*   release
*   start_release_block
*   free_memory_id
*
* ERROR CONDITIONS AND RECOVERY--
*   Any invalid memory addresses are ignored and no attempt is made to
*   to release it.  Only certain invalid addresses can be detected:
*     - addresses outside the memory allocation boundaries
*     - addresses not on even memory block boundaries
*
* NOTES--
*
* AUTHOR--
*
*******************************************************************************
*
* INITIAL REFINEMENT--
*   Compute the starting memory block of memory to be released
*   IF memory address is valid THEN
*     get number of memory blocks to release (from allocation map)
*     mark those blocks as "available" in allocation map
*     IF memory is also in auxiliary tables THEN
*       remove it from the tables
*     update the pointer to the next available memory block
*
```

```
SMEMMGR.WORK.PD&S10          THU, DEC 22, 1983, 10:46 AM    PAGE 20

*******************************************************************************
*
* REVISION LOG--
*
*******************************************************************************
DECLARATION--
;
PROCEDURE release_memory (memory_address);
  DOUBLE memory_address;                                        ENTRY;
&
$DOC-&

@BEGIN
  INTEGER start_block;
  acquire (memory_src);
  IF (start_block:=start_release_block(memory_address)) >= 0 THEN
    BEGIN
      INTEGER total_blks, i=REGISTER 6;
      total_blks := memory_map[start_block] RMO &OFF;
      FOR i := 0 TO max_memory_id DO        & clear any saved memory id &
        IF memory_id_status[i] = start_block THEN
          free_memory_id (i);
      IF total_blks > 0 THEN
        FOR i := start_block TO (total_blks+start_block-1) DO
          memory_map[i] := 0;
      IF mem_debug THEN
        BEGIN
          USTR("RELERSED @ "); %Hex(memory_address,8); CRLF;
          UHEX(total_blks); USTR(" blks @");
          UHEX(start_block); CRLF;
        END;
      memory_address := 0;
      IF start_block < free_blk THEN
        free_blk := start_block;
      IF mem_debug THEN
        dump_memory_status;
    END
  ELSE
    BEGIN
      USTR("Unable to release memory @ "); Uhex(memory_address,8);
      CRLF;
    END;
  release (memory_src);
END release_memory;
```

```
SMEMMGR.WORK.PD&S10          THU, DEC 22, 1983, 10:46 AM    PAGE 21

REJECT;
COMMENT
$DOC+

NAME--
  release_array
*******************************************************************************
*
* SHORT DESCRIPTION--
*   identical to release_memory, except the address is the base address
*   of the allocated memory plus header_size.
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*   array_address
*
* OUTPUTS--
*
* ROUTINES CALLED--
*   release_memory
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*******************************************************************************
*
* INITIAL REFINEMENT--
*
*******************************************************************************
*
* REVISION LOG--
*
*******************************************************************************
DECLARATION--
;
PROCEDURE  release_array(array_address);
   DOUBLE  array_address;                                       ENTRY;
&
$DOC-&

   BEGIN & release_array &
      DOUBLE array;

      IF array_address <> 0 THEN
         BEGIN & if &
            array := array_address - header_size;
            release_memory( array );
            IF array = 0 THEN                   & successful release &
               array_address := array;
         END;  & if &

   END;  & release_array &
```

```
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```

```
SMEMMGR.UORK.PDB510          THU, DEC 22, 1983, 10:46 AM    PAGE 23


REJECT;
COMMENT
$DOC+

NAME--
  release_auxiliary_memory
*****************************************************************
*
* SHORT DESCRIPTION--
*   conditionally "releases" allocated memory
*
* EXTENDED DESCRIPTION--
*   This routine conditionally "releases" allocated memory by setting up
*   a list (table) of auxiliary memories identified and indexed by a
*   memory ID.  The memory does not get officially released until there
*   isn't enough blocks of memory available to satisfy an incoming
*   request.  This also allows a routine to re-use memory if it never
*   got released and re-allocated.
*   There are 2 auxiliary memory tables storing information about the
*   auxiliary memory:
*     1- memory_id_status * contains the starting memory block of
*                           auxiliary memory
*     2- memory_id_lgth   * contains the number of memory blocks of
*                           auxiliary memory
*
* INPUTS--
*   addr      = memory address to be identified as "auxiliary"
*   memory_id * index into "auxiliary" memory tables
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   acquire
*   release
*
* ERROR CONDITIONS AND RECOVERY--
*   No range checking is done on the memory ID value that is passed.
*   Constant values found in CMEMMGR.UORK should be used.
*   Any invalid memory addresses are ignored and no attempt is made to
*   to "conditionally" release it.
*   Only certain invalid addresses can be detected:
*     - addresses outside the memory allocation boundaries
*     - addresses not on even memory block boundaries
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   Compute starting memory block
*   IF memory address is valid THEN
*     store starting memory block and number of memory blocks in
*       auxiliary memory tables
*
```

```
SMEMMGR.UORK.PDB510          THU, DEC 22, 1983, 10:46 AM    PAGE 24


*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE release_auxiliary_memory (addr, memory_id);
  VALUE addr, memory_id;
  DOUBLE addr;  INTEGER memory_id;                              ENTRY;
&
$DOC-&

BEGIN
  INTEGER start_block=REGISTER 6;
  acquire (memory_src);
  IF (start_block := start_release_block (addr)) >= 0 THEN
    BEGIN
      memory_id_status [memory_id] := start_block;
      memory_id_lgth [memory_id] := memory_map (start_block);
      aux_mem_avail := TRUE;
      IF mem_debug THEN
        BEGIN USTR("RELEASE AUX:"); UHex(addr,8); CRLF;
              dump_aux_status;
        END;
    END;
  release (memory_src);
END release_auxiliary_memory;
```

```
SMEMMGR.UORK.PDB510          THU, DEC 22, 1983, 10:46 AM    PAGE 25


REJECT;
COMMENT
$DOC+

NAME--
  memory_stolen
*****************************************************************
*
* SHORT DESCRIPTION--
*   checks if previously allocated memory has been re-allocated
*   (can also be used to allocate memory (via request_memory))
*
* EXTENDED DESCRIPTION--
*   This routine checks whether or not allocated memory which has been
*   "conditionally" released (marked at auxiliary memory in case of
*   memory allocation shortage) has been re-allocated.
*   The checking is determined from a table indexed by memory_id's
*   which contain the starting memory block of the each "auxiliary"
*   memory which has been conditionally released.  There is also a
*   corresponding table which contain the number of memory blocks per
*   "auxiliary" memory.
*
*   If the old memory address has not been re-allocated then it is
*   removed from the auxiliary memory list until it is released again as
*   auxiliary memory (release_auxiliary_memory).  The function returns
*   a FALSE value in this case.
*   However, if the requested number of memory blocks (computed from
*   byte_cnt) does not equal the original number of memory blocks
*   allocated then the corresponding memory blocks are "released",
*   the memory is re-allocated, and the function returns TRUE.
*   If the memory blocks have been re-allocated then a new memory
*   address is assigned and the function returns a TRUE value.
*
*   A value of -1 in the table of auxiliary memory indicates there is
*   no auxiliary memory corresponding to the memory ID.  A value of 0
*   in the corresponding table of memory blocks counts indicates there
*   that there are 0 auxiliary memory blocks for the corresponding ID.
*
* INPUTS--
*   addr     * previously allocated memory address (passed by reference)
*              could be changed if old address was re-allocated
*   memory_id= identifies owner of previously allocated memory, addr
*   byte_cnt = number of bytes of allocated memory needed
*
* OUTPUTS--
*   TRUE  * if allocated memory, "addr", has been re-allocated
*   addr  * new memory address allocated due to re-allocation
*
*   FALSE * if allocated memory, "addr", has not been re-allocated
*   addr  * same memory address originally allocated
*
* ROUTINES CALLED--
*   acquire
*   release
*   free_memory
*   release_memory
```

```
SMEMMGR.UORK.PDB510          THU, DEC 22, 1983, 10:46 AM    PAGE 26


*   request_memory
*
* ERROR CONDITIONS AND RECOVERY--
*   The parameter addr (passed by reference) and memory_id are not
*   linked together in any way.  That is, there is no checking done to
*   make sure that the memory_id identifies the original address, addr.
*
* NOTES--
*   This routine can also be used to do a "request_memory" using a
*   memory_id which has not yet released any auxiliary memory.
*
*   WARNING:  Any user of this routine must check for an return address
*   of 0 if a TRUE value is returned (indicating a new memory address
*   has been allocated).  Remember, an address value of 0 indicates that
*   that there is not enough memory available.
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   IF memory has not been re-allocated THEN
*     IF number of memory blocks needed = auxiliary number of blocks
*       THEN
*         remove corresponding information from auxiliary memory tables
*         return FALSE value
*       ELSE
*         release memory for re-allocation
*         return TRUE value
*   ELSE
*     return TRUE value
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
BOOLEAN PROCEDURE memory_stolen (addr, memory_id, byte_cnt);
  VALUE memory_id, byte_cnt;
  DOUBLE addr; INTEGER memory_id; DOUBLE byte_cnt;              ENTRY;
&
$DOC-&

BEGIN
  INTEGER mem_id;
  BOOLEAN stolen;
  acquire (memory_src);
  stolen := TRUE;
  IF (mem_id := memory_id_status [memory_id]) >= 0 THEN
  IF memory_id_lgth[memory_id] = blocks_requested(byte_cnt) THEN
    BEGIN
      free_memory_id (memory_id);
      stolen := FALSE;
    END;
```

```
$MEMMGR.WORK.PDS510          THU, DEC 22, 1983, 10:46 MT     PAGE  27


  release (memory_arc);
  IF stolen THEN
    BEGIN
      IF men_id >= 0 THEN              & allocated but Nae wrong lgth &
        release_memory (addr);
      addr := request_memory (byte_cnt);
    END;
  memory_stolen := stolen;
END memory_stolen;


END$
```

```
CMENU.UORK.PDS510            THU, DEC 22, 1983, 10:46 AM     PAGE  1


INTEGER CONSTANT

TAPE_MENU:= 0,
INIT_TAPE_MENU:= 1,
DIRECTORY_MENU:= 2,
DRTR2_MENU:= 3,
DRTR1_MENU:= 4,
ADDRT_MENU:= 5,
FILE_MENU:= 6,
REG_MENU:= 7,
RESPONSE_MENU:= 8,
IF_GRIN_MENU:= 9,
IF_GRIN_MENU2:= 10,
STIMULUS_MENU:= 11,
N_POINTS_MENU:= 12,
POUER_MENU:= 13,
STIMULUS2_MENU:= 14,
DEVICE_READY_MENU:= 15,
PARAM_MENU:= 16,
RCDEF_MENU:= 17,
REMEF_DRTVE_MENU:= 18,
REDEF_LOCK_MENU:= 19,
REDEF_MAM_MENU:= 20,
REDEF_NUM2_MENU:= 21,
REDEF_DENOM_MENU:= 22,
REDEF_CONV_MENU:= 23,
FORMAT_MENU:= 24,
DOMAIN_MENU:= 25,
LOW_PASS_FREQ:= 26,
TIME_SETUP_MENU:= 27,
GATE_SETUP_MENU:= 28,
GATE_SHAPE_MENU:= 29,
CAL_MENU:= 30,
MORE_CAL:= 31,
REF_PLANE_MENU:= 32,
CAL_TYPE_MENU:= 33,
PORT_ONE_REFL:= 34,
PORT_TUO_REFL:= 35,
CAL_MENU2:= 36,
REFLECTION_MENU:= 37,
TRANSMISSION_MENU:= 38,
ISOLATION_MENU:= 39,
CAL_MENU3:= 40,
SIMPLE_REFLECTION_MENU:= 41,
SIMPLE_TRANSMISSION_MENU:= 42,
SIMPLE_ISOLATION_MENU:= 43,
STO_CLASS_MENU:= 44,
SLIDING_LOAD_MENU:= 45,
MODIFY_CAL_KIT_MENU:= 46,
MODIFY_STDS_MENU:= 47,
DEFINE_OPEN_MENU:= 48,
DEFINE_SHORT_MENU:= 49,
DEFINE_LOAD_MENU:= 50,
SPECIFY_Z_MENU:= 51,
SPECIFY_OFFSET_MENU:= 52,
```

```
CMENU.UORK.PDS510            THU, DEC 22, 19E3, 10:46 AM     PAGE  2


SPECIFY_CLASS_MENU:= 53,
SPECIFY_CLASS_MENU2:= 54,
DISPLAY_MENU:= 55,
OURL_CN_MENU:= 56,
DISPLAY_DEFAULT_MENU:= 57,
MEMORY_MENU:= 58,
MATH_MENU:= 59,
COPY_MENU:= 60,
PLOTPARM_MENU:= 61,
PLOT_SETUP_MENU:= 62,
PEN_MENU:= 63,
COPY2_MENU:= 64,
MARKER_MENU:= 65,
DELTA_MARKER_MENU:= EE,
MARKER2_MENU:= 67,
SYSTEM_MENU:= 68,
TITLE_MENU:= 69,
MPIB_MENU:= 70,
SERVICE_MENU:= 71,
LAST_MENU := 72;
```

```
FMENU.UORK.PDS510            THU, DEC 22, 1983, 10:46 AM     PAGE  1


& fmenu3.work &
PROCEDURE process_softkey (num);  VALUE num;  INTEGER num;      EXTERNAL;
PROCEDURE blank_softkey (i);  VALUE i; INTEGER i;               EXTERNAL;
PROCEDURE change_softkey (new_line, cnd_token, line_no);
  VALUE new_line, end_token, line_no;
  ALPHA new_line; INTEGER end_token, line_no;                   EXTERNAL;
PROCEDURE highlight_menu;                                       EXTERNAL;
SUBROUTINE init_softkeys;                                       EXTERNAL;

& fmenu.work &
PROCEDURE previous_menu;                                        EXTERNAL;
PROCEDURE pop_menu (menu_num);
  VALUE menu_num;  INTEGER menu_num;                            EXTERNAL;
PROCEDURE gen_menu (num, level_incren);
  VALUE num, level_incren;  INTEGER num, level_ineren;          EXTERNAL;

EXTERNAL INTEGER menu_level;      & current menu level being displayed &
EXTERNAL INTEGER ARRAY
  level_info [0:5];               &contains menu # at corr. menu level&

& fmenu2.work &
PROCEDURE hilight_key (key_pos, first, last);
  VALUE key_pos, first, last;  INTEGER key_pos, first, last;    EXTERNAL;
PROCEDURE hilight_command (value);
  VALUE value;  INTEGER value;                                  EXTERNAL;
SUBROUTINE hilight_command_token;                               EXTERNAL;
PROCEDURE hilight_off (first, last);
  VALUE first, last;  INTEGER first, last;                      EXTERNAL;
PROCEDURE hilight_on (first, last);
  VALUE first,last;  INTEGER first,last;                        EXTERNAL;
```

```
SMENU.UORK.PD8510              THU, DEC 22, 1983, 10:46 AM     PAGE  1


M68KL,P,"menu"
BEGIN

%FILE ftern.uork;
%FILE cdebug.uork;
%FILE cmenu.uork;
%FILE fdisplay.uork;
%FILE fskey.uork;              & tablet of info. to generate softkeys  &
%FILE fscreen.uork;            & general constant display vectors      &
%FILE fskpos.uork;             & tables of softkey positioning vectors &
%FILE fconnand.uork;           & connand token/pending variables       &
%FILE fdispran.uork;           & changing softkey strings in display   &
%FILE fchdata2.uork;           & hilite bitnap information, hilite_info&
%FILE fchtable.uork;           & current entry channel for hilighting  &
%FILE cchconst.uork;           & ch 1 and ch 2 constant values         &

INTEGER CONSTANT
  hilite_nax:= 367,          & determincd fron hilite_bitnap entries   &
  nax_depth :* &;

GLOBAL
INTEGER
  nenu_level;                & current level sf nenu being displayed   #

GLOBAL                       & nake nax_depth change in fnenu.uork&
INTEGER ARRAY                & uith actual constant                   &
  levtl_info [0:nax_depth];  &contains nenu # at corr. nenu levels&

INTEGER ARRAY
  char_cnt[0:7],       & nax R chars to be highlighted in softkey  &
  keycode [0:7],       # contains keycode values of current nenu   &
  next_nenu [0:7];     & nenu nunber corresponding to neu nenu key &

INTEGER POINTER
  nenu_ptr;            & points to address sf current nenu         &

INTEGER
  nenu_hilite,
  nenu_config,         & 8 2-bit softkey nenu config * # lines/key &
  nenu_nap;            & nenu hilite and neu nenu softkey bitnap   &

BOOLERN nenu_on;       & nenu on/off toggle flag for [PREVIOUS] kty&
```

```
SMENU.UORK.PD8510              THU, DEC 22, 1983, 10:46 PM     PAGE  2


REJECT;
COMMENT
SDOC*

NAME--
  highlight_nenu
*****************************************************************************
*
* SHORT DESCRIPTION--
*   Hilightt certain softkeys of the current softkey nenu
*
* EXTENDED DESCRIPTION--
*   This routine hilights softkey nenus according to HILITE_BITRAP,
*   in uhich each bit corresponds te all softkey connand token values.
*   The hilighting characters are up to 10 underscores (ie: "_________").
*   These variable length hilighting characters are indexed fron a
*   local table in uhich the location of the character corresponds to
*   the length of the hilight.  The length of the hilight is determined
*   fron another table (global) containing the length of the longest
*   softkey annotation for each softkey for the currently displayed
*   nenu.
*   Display information starts at SR_HIGHLICHT_DISPLAY and uses
*   FSCREEK.UORK constants as x,y vectors.
*   Softkey nenu information uhich contains the nunber of lines per
*   softkey annotation indicates uhere the hilight character is to be
*   drawn.
*
* INPUTS--  none
*
* OUTPUTS--
*   display softkey highlighting
*
* ROUTINES CALLED--
*   nove
*   printch
*   jnp
*
* ERROR CONDITIONS RHO RECOVERY-- none
*
* NOTES--
*   This routine is also used for turning off hilights
*
* AUTHOR--
*
*****************************************************************************
*
* INITIRL REFINEMENT--
*   Clear softkey hilight display
*   IF a nenu is currently being displayed THEN
*     DO the following for each softkey:
*       IF a softkey is being displayed THEN
*         IF that softkey's bit is tet in the hilight bitnap THEN
*           display a hilight char for that softkey
*
*****************************************************************************
*
```

```
SMENU.UORK.PD8510              THU, DEC 22, 1983, 10:46 AM     PAGE  3


* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE highlight_nenu;                                          ENTRY;
&
$DOC-&

BEGIN
  INTEGER i;
  INTEGER y,lgth,disp;
  BYTE underline;
  BYTE TABLE hilite_char := 0,
    hilight_1, hilight_2, hilight_3, hilight_4, hilight_5,
    hilight_6, hilight_7, hilight_8, hilight_9, hilight_10;

  disp :* nove (sk_highlight_display, sk_x, sk11_y);
  IF nenu_on THEN
  FOR i:= 0 TO 7 DO
    IF (y:*keycode[i]) <> 0 THEN                    & valid softkey &
    IF (y > hilite_nax) THEN                        & DEBUG &
      BEGIN USTR("hilite bitnap overflow"); CRLF; END  & DEBUG &
    ELSE
      IF TBIT(hilite_info[currant_entry_ch-1,RIGHT(y,4)],y AND ZOF) THEN
        BEGIN
          underline :* hilite_char[lgth:*char_cnt[i]]; & hilight key   &
          y := sk_line2[i];                          & double line y pos'n  &
          IF TBIT(nenu_config,i*i) THEN
            y :* y + 64;                             & single line y pos'n  &
          disp := nove (disp, blanks(lgth], y);
          disp :* printch( disp, underline);
        END;
  disp :* jnp(disp,sk_highlight_display*tk_highlight_size);
END highlight_ntnu;
```

```
SMENU.UORK.PD8510              THU, DEC 22, 1983, 10:46 AM     PAGE  4


REJECT;
COMMENT
$DOC*

NAME--
  blank_softkey
*****************************************************************************
*
* SHORT DESCRIPTION--
*   blanks out softkty annotation on softkey nenu display
*
* EXTENDED DESCRIPTION--
*   Disables connand processing for softkey i and displays a blank
*   annotation for that softkey position (uhert i = 0..7
*
* INPUTS--
*   i = softkey position nunber (0..7)
*
* OUTPUTS--
*   blank softkey annotation for softkey position i.
*   nan-functional connand code value for softkty i
*
* ROUTINES CALLED--
*   print_ttring
*
* ERROR CONDITIONS RHO RECOVERY--
*   The valut of input i nust be 1..8.
*   There is no range checking includtd to enforce this since the
*   routine is very local and invoked fron controlled loops using
*   control variable values betueen 0 and 7 (inclusively).
*
* NOTES--
*   Used in blanking out/disabling entire softkey nenu or certain
*   softkeys that are not used in a nenu.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIRL REFINEMENT--
*   set connand code value corresponding to softkey i to 0
*   print 2 blank lines in softkey position i
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE blank_softkey (i);  VALUE i; INTEGER i;                  ENTRY;
&
#DOC-&

BEGIN
  keycode[i] := 0;
```

```
SMENU.WORK.PD$S10          THU, DEC 22, 1983, 10:46 AM    PAGE  5

  print_string(" ", sk1_size,field[i]);
  print_string(" ", sk2_size,field[i+8]);
END;
```

```
SDEMU.WORK.PD$S10          THU, DEC 22, 1983, 10:46 AM    PAGE  6

@EJECT;
COMMENT
$ODC+

NAME--
  kill_softkeys
*****************************************************************************
*
* SHORT DESCRIPTION--
*   inactivates current softkey menu information
*
* EXTENDED DESCRIPTION--
*   Disables all softkey command processing by setting corresponding
*   command code values to non-functional (0) and blanking out softkey
*   annotations.  Also initializes current softkey menu highlighting
*   bitmap and that indicates which currently displayed softkey(s) are
*   to be highlighted.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   non-functional softkey command codes
*   non-highlighting and menu bitmap
*
* ROUTINES CALLED--
*   blank_softkey
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   Used for blanking out outer level menu with [PREVIOUS] hard key from
*   the front panel, and as part of power up or instrument preset.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set all softkey command codes to 0
*   blank out all softkey annotations
*   reset current menu level to 0 (first level)
*   initialize current menu highlighting bitmap
*   eliminate any displayed highlights
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE kill_softkeys;  ENTRY;
&
$ODC-$
```

```
SMENU.WORK.PD$S10          THU, DEC 22, 1983, 10:46 AM    PAGE  7

@EGIN
  menu_on := FALSE;
  FOR menu_map := 0 TO 7 DO
    blank_softkey (menu_map);
  menu_level := menu_map := 0;
  highlight_menu;
END kill_softkeys;
```

```
SMENU.WORK.PD$S10          THU, DEC 22, 1983, 10:46 AM    PAGE  8

@EJECT;
SUBROUTINE init_softkeys;                                    ENTRY;
@EGIN
  FOR menu_map := 0 TO max_depth DO
    level_info[menu_map] := -1;
  kill_softkeys;
END init_softkeys;
```

```
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&EJECT;
COMMENT
%DOC+

NAME--
  change_softkey
*****************************************************************************
*
* SHORT DESCRIPTION--
*   changes a line in a softkey's annotation
*
* EXTENDED DESCRIPTION--
*   This routine replaces a softkey annotation line given the new
*   string, the corresponding softkey command code, and the line number
*   in which the string occurs.  Range checking and side effects are
*   described in ERROR CONDITIONS AND RECOVERY.
*   If the softkey annotation being modified is contained in a menu
*   being currently displayed, the modification will not be seen until
*   the menu is re-generated.
*
* INPUTS--
*   new_line = replacement string
*   end_code = command token value corresponding to softkey
*   line_no  = 1st or 2nd line of softkey to be changed
*
* OUTPUTS--  none
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*   Range checking and correction is done on softkey line number to
*   be changed and the maximum string length allowed per new line.
*   If not enough space was allocated for a softkey line to accomedate
*   the maximum string length then another softkey's annotation could
*   be potentially overwritten w/ new characters (one of which ends up
*   being the length byte of the overwritten string).  Fortunately,
*   this does not cause a software "crash" but one of the softkey menus
*   may contain unusually long strings.
*   No range checking is done on command token values that are passed
*   (which may cause unintentional modifications to parts of memory).
*   Therefore it behooves one to utilize the command token constants
*   created by CENSK in SKINFO!!!
*
* NOTES--
*   As a rule of thumb, softkey annotations that are apt to run-time
*   modifications, should be allocated the maximum number of characters
*   anticipated or allowed in a label.  This is pre-defined in the
*   SkinFO file which generates the softkey tables.  Currently, the
*   maximum string length allowed per softkey line is 10 characters.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
```

```
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*****************************************************************************
*
* REVISION LOG--
*   8-2-83    -- used "urt_disp_str" routine to change softkey labels
*                (general purpose routine for writing strings to display
*                 memory which is where the labels are located.)
*
*****************************************************************************
DECLARATION--
;
PROCEDURE change_softkey (new_line, cmd_token, line_no);
  VALUE new_line, end_token, line_no;
  ALPHA new_line; INTEGER end_token, line_no;                    ENTRY;
&
%DOC-&

BEGIN
  DOUBLE old_addr;
  ALPHA old_str=old_addr;
  BYTE POINTER new_str=new_line;
  INTEGER n;

  IF line_no >= 2 THEN          & restrict to only 1 to 2 lines/softkey &
    line_no := 1
  ELSE
  IF line_no <= 1 THEN
    line_no := 0;

  IF (n:=LBL_INDEX[2^(cmd_token-1)+line_no]) > 0 THEN
    BEGIN               & check for existing annotation in softkey line &
      IF new_str > sk2_size THEN                    & check string lgth &
        new_str := sk2_size;
    & old_str := RDRS(SK_LABEL)+n &
      old_str := SK_LABEL [n];
      urt_disp_str (old_addr, new_line);
    END;
END change_softkey;
```

```
SMENU.WORK.POSS10          THU, DEC 22, 1983, 10:46 RM    PAGE 11

REJECT;
COMMENT
%DOC+

NAME--
  hilight_off
*****************************************************************************
*
* SHORT DESCRIPTION--
*   turns off a all highlights in a set of softkey commands
*
* EXTENDED DESCRIPTION--
*   This routine will clear hilighting bits corresponding to a range of
*   given command token values from a set of softkey functions.
*   An integer array "write_bitmap" contain the softkey hilighting bits
*   to be cleared.  Integer divide by/modulo 16 is used to get the
*   correct bit in the array corresponding to a command token value.
*
* INPUTS--
*   first = lower limit of the command value set
*   last  = upper limit of the command value set
*
* OUTPUTS--  new hilight bitmap
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*   first > last --> no bits are read or cleared
*
* NOTES--
*   All hilighting bits corresponding to values from "first" to "last"
*   are all cleared.  Therefore, some thought should be given when
*   arranging softkey command functions in SKINFO.WORK so that sets of
*   particular functions occur contiguously.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   IF command values to be un-hilighted are within range THEN
*      clear corresponding bits in hilight bitmaps
*      Update hilighting on display
*
*****************************************************************************
*
* REVISION LOG--
*   3/29/23   -- added limit checks to if command values exceed the
*                maximum number of bits available in the hilight bitmap.
*   8/18/83   -- changed hilite_bitmap to a 2 dimensional array,
*                hilite_info to accomodate 2-channel coupled and
*                uncoupled softkey functions that are hilighted.
*                Added a coupled hilighting bitmap (coupled_bitmap) to
*                indicate whether or not a softkey is coupled/uncoupled.
*                Check the coupled bitmap and unhilight softkeys under
*                current entry channel for uncoupled softkeys or
```

```
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*                unhilight softkeys under both channels for coupled
*                softkeys.
*
*****************************************************************************
DECLARATION--
;
PROCEDURE hilight_off (first, last);
  VALUE first, last;  INTEGER first, last;                       ENTRY;
&
&DOC-&

BEGIN
  INTEGER index=REGISTER 6;
  INTEGER x,key_cnt,trash;
  INTEGER POINTER map1,map2;
  BOOLEAN all_coupled;
  IF first > hilite_max THEN
    first := hilite_max;
  IF last > hilite_max THEN
    last := hilite_max;
  index := RIGHT(first,4);              & first/16 to get bitmap index &
  key_cnt := last-first;                & number of keys in group &
  x := first AND 20F;                   & 1st softkey bit to clear &
  all_coupled := TBIT (coupled_bitmap [index], x);
  IF key_cnt >= 0 THEN                  & clear out hilights for group &
    BEGIN
      DO BEGIN
        IF all_coupled THEN             & point to bitmaps to unhilight&
          BEGIN    & for coupled softkeys &
            STPNTR (map1, RDRS(hilite_info [0,index]));
            STPNTR (map2, RDRS(hilite_info [1,index]));
          END
        ELSE
          BEGIN    & for uncoupled softkeys &
            STPNTR (map1, RDRS(hilite_info[current_entry_ch-1,index]));
            STPNTR (map2, RDRS(trash));
          END;
        DO BEGIN                        & unhilight 1  word at a time  &
          map1 := RBIT (map1, x);
          map2 := RBIT (map2, x);
        END UNTIL ((key_cnt:=key_cnt-1)<0) OR ((x:=x+1)=16);
        x := 0;
        index := index+1;
      END UNTIL (key_cnt < 0);
      highlight_menu;
    END;
  IF menu_debug THEN
    BEGIN
      USTR("hilite off:"); WHEX(first); WHEX(last); CRLF;
    END;
END hilight_off;
```

```
SMENU.WORK.PDS510          THU, DEC 22, 1983, 10:46 AM    PAGE 13

$EJECT;
COMMENT
$DOC+

NAME--
  hilight_command
*****************************************************************************
*
* SHORT DESCRIPTION--
*   sets hilighting corresponding to current command token value
*
* EXTENDED DESCRIPTION--
*   This routine hilights the command value passed as a parameter by
*   setting the corresponding bit in the hilight bitmap and updating
*   the display hilight.
*
* INPUTS--
*   value = softkey function command value to be hilighted
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   hilight_menu
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   If command value is within range THEN
*     set corresponding bit in hilight bitmap
*     update hilight display
*
*****************************************************************************
*
* REVISION LOG--
*   3/29/83   -- added hilight bitmap limit check
*   8/18/83   -- changed hilite_bitmap to a 2 dimensional array,
*                hilite_info to accomodate 2-channel coupled and
*                uncoupled softkey functions that are hilighted.
*                Added a coupled hilighting bitmap (coupled_bitmap) to
*                indicate whether or not a softkey is coupled/uncoupled.
*                Check the coupled bitmap and hilight softkey under
*                current entry channel for uncoupled softkey or
*                hilight softkey under both channels for coupled
*                softkey.
*
*****************************************************************************
DECLARATION--
;
PROCEDURE hilight_command (value);
```

```
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  VALUE value;  INTEGER value;                                    ENTRY;
&
$DOC-&

BEGIN
  INTEGER bit_pos;
  INTEGER POINTER ch1_pos, ch2_pos;
  IF value <= hilite_max THEN
    BEGIN
      menu_hilite := RIGHT (value,4);                  & value OTV 16 &
      bit_pos := ZOF @WD value;                        & value hOD 16 &
      IF menu_debug THEN
        BEGIN USTR("hilite end:"); UWEX(value); UWEX(menu_hilite);
              UWEX(bit_pos); END;
      STPNTR (ch1_pos, @ORS(hilite_info [0,menu_hilite]));
      STPNTR (ch2_pos, @ORS(hilite_inFo [1,menu_hilite]));
      IF TBIT (coupled_bitmap[menu_hilite],bit_pos) THEN
        BEGIN              & softkeys are coupled, hilight both channels &
          ch1_pos := SBIT(ch1_pos,bit_pot);
          ch2_pos := SBIT(ch2_pos,bit_pos);
          IF menu_debug THEN USTR(" coupled");
        END
      ELSE               & softkeys uncoupled, use current entry chan  &
        IF current_entry_ch = ch1 THEN
          ch1_pos := SBIT(ch1_pos, bit_pos)
        ELSE
          ch2_pos := SBIT(ch2_pos, bit_pos);
      highlight_menu;              & update current highlight display &
    END;
    IF menu_debug THEN CRLF;
END hilight_command;
```

```
SMENU.WORK.PDS510          THU, DEC 22, 1983, 10:47 AM    PAGE 15

$EJECT;
COMMENT
$DOC+

NAME--
  hilight_command_token
*****************************************************************************
*
* SHORT DESCRIPTION--
*   similar to hilight_command
*
* EXTENDED DESCRIPTION--
*   This routine uses hilight_command to hilight a softkey corresponding
*   to the current command_token value.
*
* INPUTS--  none
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   hilight_command
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   calls hilight_command with command_token as a parameter
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE hilight_command_token;                                 ENTRY;
&
$DOC-&

BEGIN
  hilight_command (command_token);
END hilight_command_token;
```

```
SMENU.WORK.PDS510          THU, DEC 22, 1983, 10:47 AM    PAGE 16

$EJECT;
COMMENT
$DOC+

NAME--
  hilight_on
*****************************************************************************
*
* SHORT DESCRIPTION--
*   hilights current command token softkey and unhilight a given set of
*   of command values
*
* EXTENDED DESCRIPTION--
*   This routines unhilights the range of given command values and
*   hilights the current command token value corresponding to a
*   softkey function. (In effect, the routines "hilight_off" and
*   "hilight_command_token" are called.)
*
* INPUTS--
*   first = lower limit of command values to unhilight
*   last  = upper limit of command values to unhilight
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   hilight_off
*   hilight_command_token
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   Calls hilight_off and hilight_command_token
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE hilight_on (first, last);
  VALUE first,last;  INTEGER first,last;                          ENTRY;
&
$DOC-$

BEGIN
  hilight_off (first, last);
  hilight_command_token;
END higlight_on;
```

```
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```

```
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REJECT;
COMMENT
$DOC+

NAME--
  hilight_key
*****************************************************************************
*
* SHORT DESCRIPTION--
*   similar to routine "hilight_on"
*
* EXTENDED DESCRIPTION--
*   This routine is identical to "hilight_on" except that the
*   current command_token value is not used and another command value
*   that is passed as a parameter instead corresponds to the softkey
*   function to be hilighted.
*
* INPUTS--
*   key_pos * softkey command value to be hilighted
*   first   = lower limit of command values to unhilight
*   last    * upper limit of command values to unhilight
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   hilight_off
*   hilight_command
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   Calls hilight_off and hilight_command
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE hilight_key (key_pos, first, last);
  VALUE key_pos, first, last;  INTEGER key_pos, First, last;      ENTRY;
&
$DOC-&

BEGIN
  hilight_off (first, last);
  hilight_command (key_pos);
END hilight_key;
```

```
SMENU.WORK.PDS51D              THU, DEC 22, 1983, 10:47 AM     PAGE  19


REJECT;
COMMENT
$DOC+

NAME--
  gen_menu
*****************************************************************************
*
* SHORT DESCRIPTION--
*   displays softkey menu identified by MENU_NUM
*
* EXTENDED DESCRIPTION--
*   Generates a softkey menu, MENU_NUM, whose constant values are found
*   found in RFILE [MENU.UDRK.  Updates current MENU_LEVEL (depth) and
*   its corresponding menu number in a menu depth table, INFO_LEVEL.
*   The softkey command code table, KEYCODE is updated with the new
*   menu's command codes found in that menu's information table.
*   When printing softkey label annotations on the display, single line
*   annotations are centered (via half LF char).  Unused softkeys are
*   annotated with a blank (this eliminates any previous menu annotation
*   in that position) and corresponding command codes are set to zero.
*   Menu hilight bitmap is updated using command code hilight bitmap.
*   Menu highlighting is invoked at the end to either eliminate previous
*   highlights or display highlights corresponding to the current menu.
*
* INPUTS--
*   menu_num     * number of softkey menu to be generated
*   level_incren * -n returning to a previous menu n levels up
*                  0 outermost level menu (hardkey generated)
*                  1 bringing up a new menu (softkey generated)
*
* OUTPUTS--
*   softkey menu annotations to display gen.
*
* ROUTINES CALLED--
*   blank_softkey
*   highlight_menu
*   print_string (external)
*   print_ch     (external)
*
* ERROR CONDITIONS AND RECOVERY--
*   Range checking is done for "bogus" MENU_NUM values and attempts to
*   return to previous menus from the outermost level, or bring up new
*   menus exceeding maximum menu depth, MAX_DEPTH.  This can be removed
*   to gain speed when we're sure all calls have valid menu numbers.
*   Invalid menu numbers and trying to return from outer level menus
*   aborts the routine.  Attempts to bring up menus exceeding the
*   maximum depth will store menu information on top of the deepest
*   menu information in LEVEL_INFO.
*
* NOTES--
*   Softkey annotation positioning vectors and display addresses are
*   initialized in SDISPLAY.UDRK
*
* AUTHOR--
*
```

```
SMENU.UDRK.PD8510              THU, DEC 22, 1983, 10:47 AM     PAGE  20

*****************************************************************************
*
* INITIAL REFINEMENT--
*   If invalid menu number values and menu depths then
*     Else
*   Update menu level
*   make entry in menu depth table
*   Using the current menu information table,
*     store command code value in current softkey command code table
*     get number of lines per softkey
*     center annotation if single line softkey
*     print softkey annotations on display
*     update menu hilight bitmap using command code hilight bitmap
*   highlight menu
*
*****************************************************************************
*
* REVISION LOG--
*  07-27-82:  Added code to right justify all softkey annotations
*  11-28-83:  Added check to prevent generating a menu identical to
*             the outermost menu on the stack.
*
*****************************************************************************
DECLARATION--
;
PROCEDURE gen_menu (num, level_incren);
VALUE num, level_incren;  INTEGER num, level_incren;              ENTRY;
&
$DOC-&

BEGIN

INTEGER CONSTANT max_lgth := 10;
ALPHA annot;
BYTE POINTER lgth=annot;
INTEGER i,                    & loop control variable to gen softkey menu &
  n1,n2,                      & label index to particular softkey line    &
  line2,                      & index to annotation table for 2nd line    &
  key;                        & softkey count (not 1 to 1 with position)  &
BYTE ch;                      & half_lf or null character &

  key := 1;
  IF NOT ((level_info[menu_level] = num)     & don't gen duplic. menu &
     AND (level_incren <> 0)) THEN
  IF (num >= 0) AND (num < LAST_MENU) THEN    & range check menu no.   &
  IF (menu_level:=menu_level+level_incren) < 0 THEN
    menu_level := 0
  ELSE
  BEGIN
    IF (level_incren = 0) OR NOT menu_on THEN
      menu_level := 0
    ELSE                                      & menu depth range check &
    IF menu_level > max_depth THEN
      menu_level := max_depth;
    menu_on := TRUE;
    STPNTR (menu_ptr, SK_MENU[num]);                & get menu address &
```

```
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    level_info[menu_level] := nun;                  & current menu no. &
    menu_nap := menu_ptr&[0]&;            & highlighting configuration  &
    menu_config := menu_ptr[1];           & number of lines per softkey &
    FOR i := 0 10 7 DO
    IF (RIGH1(menu_config,2*i) AND 203)>0 THEN
      BEGIN      & Fill in keycode table value and print softkey label &
        n1 := 2*((keycode[i]:=menu_ptr[key:=key+1])-1);
        IF (line2:=LBL_IRDEX[n1+1])=0 THEN          & center single line &
          ch := half_if                             & softkey annotation &
        ELSE
          ch := 0;                          & indicates 2 lines in softkey &
        printch (field[i]-1,ch);
      & annot := RORS(SK_LABEL)+LBL_INDEX[n1]  &
        annot := SK_LABEL[LBL_IKDEX[n1]];  & right justify 1st sk line &
        n1 := n2 := 0;
        IF (n1:=igth&[0]&)>max_lgth OR (n1<0) THEN n1 := max_lgth;
        IF ((lgth[n1] AND 2&F) < 5) THEN   & bracket character fix     &
          n1 := n1-1;                               & 1DD1Dxxx mask &
        move(ficld[i]-4,blanks[n1],sk_line1[i]);
        print_string (annot,sk1_size,field[i]);
      & annot := SK_LABEL+line2`5
        annot := SK_LABEL[line2];
        IF ch = 0 THEN                          & right justify 2nd line &
          BEDIN
            IF (n2:=lgth&[0]&)>max_lgth OR (n2<0) THEN n2 := max_lgth;
            IF (lgth[1]=(ch:=helf_vt)) THEN    & put half_vt in a byte &
              n2 := n2-1;
            movi (ficld[i*8]-2,klanks[n2],sk_line2[i]);
          END;
        print_string (annot,sk2_size,field[i*5]);
        IF TBI1(menu_nap,i+&) THEN
          next_nenu[i] := menu_ptr(key:=key+1];
        char_ent[i] := (IF n1 > n2 THEN n1 ELSE n2);    & longest line &
      END
    ELSE
      blenk_softkey(i);
    highlight_nenu;
  END;
END gen_nenu;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  process_softkey
*****************************************************************************
*
* SHORT DESCRIPTION--
*   extracts command code corresponding to the current softkey function
*
* EXTENDED DESCRIPTION--
*   This routine is called only be command in response to a softkey
*   being pressed on the front panel.  It extracts the command code
*   value corresponding to that softkey position from the current menu,
*   sets the command_pending flag to continue to executing commands off
*   the current command code value, and brings up any menu that is to be
*   generated from that softkey.
*
* INPUTS--
*   softkey position
*
* OUTPUTS--
*   command code value
*   new menu, if any
*
* ROUTINES CALLED--
*   gen_menu
*
* ERROR CONDITIONS AND RECOVERY--
*   softkey position ranges from 1..8 (no range checking done)
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set neu command token
*   set command_pending flag
*   if this softkey brings up a neu menu then
*     generate it on the display
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE process_softkey (nun);
VALUE nun;  INTEGER nun;                                          ENTRY;
&
$DOC-&
```

```
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BEGIN
  command_token := keycode[nun-1];
  command_pending := TRUE;
  IF TBIT[menu_nap,nun+7) THEN
    gen_nenu(next_nenu[nun-1],1];
END process_softkey;
```

```
SMENU.WORK.PDB51D              THU, DEC 22, 1953, 10:47 AM    PAGE 24

REJECT;
COMMENT
$DOC+

NAME--
  previous_nenu
*****************************************************************************
*
* SHORT DESCRIPTION--
*   brings up menu previous to current one if one exists, or a blank
*   menu otherwise
*
* EXTENDED DESCRIPTION--
*   This routine is function of the [PREVIOUS] Front panel key which
*   returns to the previously displayed menu which brought up the
*   current menu, or toggles (turn off/on) the outermost level menu
*   displays.  Once a menu display is off, the softkeys are no longer
*   activated (that is, they are functionless).
*
* INPUTS--  none
*
* OUTPUTS--  previous or no softkey menu
*
* ROUTINES CALLED--
*   gen_menu
*   hill_softkeys
*   print_string
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   For outernost level menus with dynamic labels (ie. SAVE/RECALL menu)
*   a special check is thrown in to re-display the dynamic annotations.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   If not outernost level menu then
*     generate previous softkey menu which brought it up
*   Else
*   If a menu is current up then
*     blank out current menu (should be outernost menu at this point)
*   Else
*     regenerate outernost level menu
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE previous_nenu;                                          ENTRY;
```

```
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&
$DOC-&

BEGIN
  %FILE fdatangr.work;                          & far gen_last_reg_menu &
  INTEGER prior_menu;
  IF (menu_level = 0) AND (menu_on) THEN
    kill_softkeys
  ELSE
  IF menu_level >= 0 THEN
    BEGIN
      prior_menu := level_info [IF menu_level > 0 THEN
                                  menu_level-1
                                ELSE
                                  menu_level];
      IF prior_menu = REG_MENU THEN
        gen_last_reg_menu
      ELSE
        gen_menu (prior_menu, (IF menu_level > 0 THEN -1 ELSE 0));
    END;
END previous_menu;
```

```
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REJECT;
COMMENT
&DOC*

NAME--
  pop_menu
**************************************************************************
*
* SHORT DESCRIPTION--
*   pop to given menu number within current softkey menu stack
*
* EXTENDED DESCRIPTION--
*   This routine gives the flexibility of popping to an arbitrary menu
*   from within the current menu stack w/o having to know how many
*   menu levels to back up to.  The current menu stack is scanned from
*   the most recent menu level to the outermost menu level until the
*   requested menu (MENU_NUM) is found.  If requested menu not found
*   within the menu stack becomes the outermost menu.  The menu stack
*   and related menu variables are automatically updated during the
*   menu search prior to displaying the requested menu.
*
* INPUTS--   menu_num = menu number to pop to
*
* OUTPUTS--  new softkey menu on display
*
* ROUTINES CALLED--
*   gen_menu
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   This routine will only generate previous menus displayed before the
*   current one.
*
* AUTHOR--
*
**************************************************************************
*
* INITIAL REFINEMENT--
*   IF current menu level > 0 THEN
*     scan previous menus and update menu stack pointer until
*       the requested menu number is found in the stack
*       or menu stack pointer points to the outermost menu
*     generate requested menu
*
**************************************************************************
*
* REVISION LOG--
*
**************************************************************************
DECLARATION--
;
PROCEDURE pop_menu (menu_num);
  VALUE menu_num;  INTEGER menu_num;                              ENTRY;
&
```

```
SMENU.UORK.PDS510          THU, DEC 22, 1983, 10:47 AM    PAGE 27


$DOC-&

BEGIN
  IKTEGER pop_cnt,
          menu_position=REGISTER 6;
  IF menu_level > 0 THEN
    BEGIN
      pop_cnt := 0;
      menu_posiiion := menu_level;
      DO  pop_cnt := pop_cnt-1
      UNTIL
        (menu_num = level_info (menu_position:=menu_nosition-1])  OR
        (menu_position = 0);
      IF (level_info[menu_nosition] = menu_num) THEN
        gen_menu (nepu_num, pop_cnt);
    END;
END pop_menu;


ENDt
```

```
CMESSAGO.WORK.PD8510       THU, DEC 22, 1983, 10:47 AM    PAGE  1


INTEGER CONSTANT
  null_message := 0,
  command_not_inplemented := 2,
  option_omitted := 26,
  invalid_command := 55,
  exceeded_available_memory := 71,
  c_file_1 := -1;
```

CMESSAG1.WORK.PD8S10 THU, DEC 22, 1983, 10:47 AM PAGE 1

```
INTEGER CONSTANT
  too_many_characters := 1406,
  syntax_error := 1436,
  deadlock := 1449,
  procese_creation_error := 1467,
  no_pretune_lock := 1490,
  pretune_fail := 1502,
  phase_lock_fail := 1514,
  phase_lock_lost := 1533,
  vto_over_range := 1549,
  sup_sync_err := 1564,
  if_overload := 1588,
  bad_bc_value := 1600,
  no_active_marker := 1620,
  inconsistent_operation := 1647,
  titling_instructions := 1689,
  title_function_not_active := 1733,
  test_set_overtemp := 1762,
  forward_device := 1784,
  reverse_device := 1825,
  illegal_test_set_operation := 1866,
  adc_cal_failed := 1903,
  if_cal_failed := 1918,
  adc_not_responding := 1932,
  autorange_cal_failed := 1951,
  smp_too_fast := 1972,
  ext_ref_unlocked := 1992,
  c_file_7 := -1;
```

CMESSAG2.WORK.PD8S10 THU, DEC 22, 1983, 10:47 AM PAGE 1

```
#FILE cmessag0.work;

INTEGER CONSTANT all_messages := -1;
```

CMESSAGE.WORK.PD8S10 THU, DEC 22, 1983, 10:47 AM PAGE 1

```
#FILE calphas.work;        & contains all #FILES for warn/tell messages &
```

CMKR.WORK.PD8S10 THU, DEC 22, 1983, 10:47 AM PAGE 1

```
INTEGER CONSTANT

cnd_marker_1 := 295,
cnd_marker_2 := 295,
cnd_marker_3 := 297,
cnd_marker_4 := 298,
end_marker_5 := 299,
cnd_marker_off := 300,
end_delta_marker := 301,
cnd_ref_mkr1 := 302,
cnd_ref_mkr2 := 303,
cnd_ref_mkr3 := 304,
cnd_ref_mkr4 := 305,
cnd_ref_mkr5 := 306,
cnd_no_ref_mkr := 307,
cnd_mkr_to_min := 308,
cnd_mkr_to_max := 309,
cnd_group9 := 0;
```

```
FNKR.WORK.PD8510          THU, DEC 22, 1983, 10:47 AM    PAGE  1


COMMENT
  This is a software generated file !!!
  Changes must be made in SKIMFO.UORK
  Run GENSK.LRNI to re-generate file;

SUBROUTINE proc9;  ENTRY;
SEGIN

CASE command_token-295 OF
BEGIN
% 295 %
select_narker(1);
% 296 %
select_narker(2);
% 297 %
select_narker(3);
% 298 %
select_narker(4);
% 299 %
select_narker(5);
% 300 %
select_narker(0);
% 301 %
BEGIN END;
% 302 %
select_ref_narker( 1 );
% 303 %
select_ref_narker( 2 );
% 304 %
select_ref_narker( 3 );
% 305 %
select_ref_narker( 4 );
% 306 %
select_ref_narker( 5 );
% 307 %
select_ref_narker( 0 );
% 308 %
narker_to( nkr_to_nin );
% 309 %
narker_to( nkr_to_nax );
END;
END proc9;
```

```
SNONITOR.WORK.PD8510          THU, DEC 22, 1983, 10:47 AM    PAGE  1


M68KL,R,"nonitor"
bEGIn
USE REGISTER 0-11;
COMMENT
**********************************************************************
*
*                        85101 MONITOR
*   FILE:SMONITOR.UORK.PD8510   Dec   8 1983        VERISION: M13
*
*              FOR THE 85101 MC6S000 PROCESSOR
**********************************************************************
*  VERSION R.03  -- 7/20/80 -- Added DGInit
*                 - Added Terminal Abort via BREAK
*                 - Added Nenory Refresh routine
*  VERSION R.04  -- 8/10/80 -- LOAD and GO on Power up
*  VERSION R.05  -- 9/3/80 -- Added better exception messages
*                 - Will output "A" even w/o nemory
*                 - Direct tape record/load of display char set
*                 - Change Nonitor Stack to 000FFFE fron 7FFE
*                       and User Stack to 000FD80
*  VERSION H.06  -- 11/14/80 --Change Display Intialize from NOP to E0D
*                 - Added IMimplemented Instruction Traps
*                 - Set  TermMode Flag so that ANORT doesnot latch up
*                 - Remove Assemble patch for GOM at High Memory X80000
*                 - Change Nonitor Stack to FFFFF800 (Gleeals till
*                                                     FFFFF612
*                 - Set BM 100 as default next command after ZP
*  VERSION I     -- 12/1/80 -- Corrected Set OM 100 to work
*                 - Converted to final MC68000 instruction set
*                 - Added more delay in ACIR initializion
*                 - Fixed "CR" for PCTR=1 ie CR 10FE
*  VERSION R1    -- 12/18/80 -- Removed Tape buffer
*                 - Added Tape error codes
*                 - Changed use of TgrnMedc Flag to 10device Flag
*                 - Change Records/Loads to Use Three(3) blocks
*                 - PowerOn Zeroed 00C0-00ff for uses as debug flags
*                 - Added Bubble Nenory RB/lb/LoadGo on power on
*                 - Added minnual CHAR Set 0-9,@,A-Z,CR,LF
*                 - Added Keyboard entry to Nonitor
*  VERSION R2    - 1/4/81 -- Activated the bubble software (INTEL)
*                       to use on board software
*                 - Ignore Trap15 if first instruction after GO
*                 - Set SRaave:=22700 if GO had paraneters
*  VERSION R3    - 1/24/81 -- Added TRPEntry
*                   Fixed CR (again) so on return only NO printed
*                 - Added Preset pulse a start of nonitor
*                 - Moved a copy of $RAMS doun to Loc 0
*  VERSION R4    -- 2/20/81 -- Autonatic DA100 on RA,LA,RB,LB
*                 - Rodified ZP ta accept 24 bit address
*                 - Increased KeyBuffer size
*  VERSION R5    -- 5/25/81
*                 - Roved RAM to 1FFFEH (overlapping IO space,
*  VERSION R6    -- 7/1/81
*                 - Change address tested for Refresh fron X90000
*                 - Change coding so HI on CRT will appear u/e IO board
```

```
SNOKITOR.WORK.PD8510          Thu, DEC 22, 1983, 10:47 AM    PAGE  2


*                 - Change SXMBM to work u/o proto 3 hardwere
*                 - Fixed TRACE to work with CR input,and not effect SR
*                 - Fixed a nissing .L on the restore G reg in TRPEntry
*  VERSION R7     - Deleted use of reg 13 by nonitor, nonitor's G reg
*                       is change (by assenble edit) to reg 12
*                       (no conflict between user progran and nonitor)
*                 - Certain variable changed to absoulte adrress, not G
*                 - Restored nonitor stack immediately after saving reg
*  VERSION R8     -- 9/20/81
*                 - Added TPseek
*                 - Deleted overhead to support physical nulti-filetape
*  VERSION R9     -- 10/8/81
*                 -  Fixed AB srewups
*  VERSION B1     -- 10/12/81
*                 - Reset version nunber
*                 - upgraded to neu init_nbn and set_add_nbn
*  VERSION B2     -- 10/13/81
*                 - Added Multiplier busy routine (Hull exception)
*                 - Changed TPready
*  VERSION B3     -- 12/16/81
*                 - Read HPIB Status2 to elear interrupt if set
*                 - Disable Interrupts immediately entering nonitor
*                 - Refresh clears its ISR bit
*                 - Refresh changed to interrupt R1 fron R13
*                 - Change BOOLEANS to BITFIELDS
*                 - Added Proto2 test
*                 - Autoclear watchdog circuit if not proto2 hardware
*  VERSION B4     -- 2/4/82
*                 - Properly initialize BRCount
*                 - Buadrate hardware change--Buadcount nunber changed
*  VERSION B5     -- 2/10/82
*                 - Set 64K words of display nemory to E0D
*                 - Added null char to CRLF for 9600 Buad pad
*  VERSION B6     -- 2/25/82
*                 - Refresh restores Status(IR level) while refreshing
*
*  VERSION B7     -- ADD SELF TEST LINK FROM RECALL KEY
*
*  VERSION C1     -- May 5 1982
*                 - Changed Tape and bubble record linits
*                 - hove nonitor display Ran fron X107000 to X105D00
*  VERSION C2     -- hay 16 1982
*                 - Add tape narking function
*                 - Inproved tape seek
*                 - Again neu fix for 9600 buad
*  VERSION C3     -- July 8 1982
*                 - Expanded default record parans
*                 - Rave "RC" ( Sel1 Test link )software to bubble tuo
*  VERSION D1     -- JULY 28 1982
*                 - Change to 9600 BAUD
*  VERSION X1     - Checksun added to zapp (zappnon) nou in self test
*                 - Stuck key test added to self test
*  VERSION X2     - Revised for new keyboard,nonitor nenu shortened
*                 - all nonitor functions are still available fron
*                 - terminal except "RC" which has been deleted as
*                 - all self test cu is nou in prom.
```

```
SNOMITOR.WORX.PD8510          Thu, DEC 22, 1983, 10:47 Ah    PAGE  3


*  VERSION O3     - NOV  12 1982 -- HI BILL
*                 - Fix problen in setting track1 on tape
*                 - Changed record nenory linits
*  VERSION D4     - CORRECTED READ STRTEMENTS FOR NEU COMPILER
*                 - CHANGED STACK POINTER TO hFO SO MONIIOR DOESN'T
*                 - CLOBBER USERS CODE
*
*   12-2-82 X2    -MOVED SOFTKEYS TO RESTOREMONVALUES AND MOVED
*                  RESTOREMONVALUES TO MONBAILOUT<O TO GET RID OF
*                  PROSLEM USING GO AFTER BREAK.DON'T UNDERSTAND WHY
*                  THIS WAS NECESSARY BUT CALLING SOFTKEYS DURING
*                  EXCEPTION PROCESSING OF BREAK SCREUS UP THE STACK.
*  VERSION X3     - Dec 28 1982
*                 - Change Startup user stack to IFO
*                 - Fixed read statements to work uith neu compiler
*  VERSION X4     - ADDED V10 PRETUNE TO BBTEST FOR FRONT END CHECKING
*                 - UITH MANUAL SOURCE
*                 - REPLACED RESTOREMONVALUES IN ENTERMONITOR AS THIS
*                 - WAS REMOVED FOR X2 REV IN ERROR . THIS ROUTINE IS
*                 - NEEDED FOR TRAP EXCEPTIONS WITH TRACE ON.
*                 - MAKING TUO TRIPS THRU EXITMONITOR UITHOUT RESTORING
*                 - THE BREAKPOINT INSTRUCTION LEAVES THE TRAP
*                 - IN BOTH BRINS RAD AT @WORD.
*
*  VERSION X5     -CHANGED BBNLDMD MESSAGE FROM HI TO SYSTEA BEING
*                 -INITIALIZED.REMOVED RESTOREMONVALUES FROM HOW
*                 -BAILOUT AS IT IS NOT NEEDED AFTER X4 REV.DID
*                 -GENERAL HOUSEKEEPING TO REDUCE CODE AS UE ARE
*                 -UITHOUT ROOM FOR MUCH BUG FIXING.
*
*  VERSION X6     -ADDED MONBAILOUT(10) FOR IHIT_MBN FAILURE
*                 -CONDITIONS IN GETMAIN AND AT @@RMAL LOAD AND GO
*                 -CHANGED OGINIT MESSAGE FROM 'HI' TO 'TESTING'.
*                 -CHANGED RECORD LIMITS TO AGREE UITH FEB 5.
*                 -VERSION OF PASS1 SU.
*  VERSION X7     -ADDED SERVICE MENU ENTRY FOR MAIN SU VIR TRAP15
*                 -CHANGED TO MAPPER MULTIPLY ROUTINE USED BY MAIN
*                 -SW FOR MULTIPLIER TEST.ALSO ADDED SYMBOLIC
*                 -ADDRESSING SO MAPPER CHANGES UILL NOT REQUIRE
*                 -REVISITING THIS SOURCE.
*                 -ECHOED TEST AND ERROR NUMBERS AT ADDRESSES XF2,XF4.
*                 -CHANGED OG DATA TEST ERROR NUMBERS TO AGREE UITH
*                 -TEST SEQUENCE.
*                 -TURNED OFF OPER SELECT FLAG PRIOR TO MBN LOAD.UHEN
*                 -ON AND MBN LORD FAILED,EXIT HAS THRU MONBAILOUT
*                 -TO TEST MENU.
*                 -TP18 TEST SELECT WAS CHANGED FROM MANTEST TO
*                 -KEYTEST FOR FRONT PANEL TROUBLESHOOTING.
*                 -CHANGED MONITOR MENU,DELETED DM,RG,BR,VM AND RB
*                 -ACCESS IS STILL AVAILABLE FROM TERMINAL.
*                 -RB IS AVAILABLE BY STORING $510M IN LOCATION
*                 -OF6H,THEN PRESSING LA.THIS SHOULD PROVIDE ADAQUATE
*                 -PROTECTION OF MBN DATA FROM CASUAL KEYSTROKING.
*                 -A NEU MONITOR KEY "SM" (SHOU MEMORY) DOES A SINGLE
*                 -HEX READ FROM THE SELECTED LOCATION.
*                 -MOVED CONTINOUS HEX R/U FROM TEST MENU TO MONITOR
```

```
SMONITOR.IKHK.PD8510          THU, DEC 22, 1983, 10:47 AM    PAGE  4

*                -MENU.MNEMONICS ARE CU AND CB FOR R/U CONTINOUS.
*                -KEYSTROKE RAILOUT IS TOTAL REVIMO FROM THESE
*                -TWO OPERATIONS.
*                -MONITOR SOFTKEY LABELS AND MNEMONICS FROM FRONT
*                -PANEL ARE AS FOLLOUS,ORIGINAL COMMANDS ARE STILL
*                -AVAILABLE FROM HPIB OR TERMINAL.
*                -THE ONLY EXCEPTION IS (CR) CALL SUBROUTINE WHICH
*                -HAS BEEN DELETED.
*                -
*                -          SOFTKEYS
*
*                -   LABEL             MNEMONIC
*                -     GO                GO
*                -   SMOU                SM
*                - URITE                 MR
*                - CSMOU                 CB
*                - CURITE                CU
*                -   LORD                LM
*                -   RECD                RM
*
*                -NEU RECORD LIMITS FOR BUBBLE-
*                - 100,16AFF,FFFF8000,FFFFDCFF,106000,1097FF
*
*                - ADDED CHARS '?' AND '=' TO MONITOR
*
*                -RODEO 'PM' (PRIOR MENU) KEY TO MONITOR-
*                -THIS RETURNS TO TEST MENU SO THAT MAIN SU
*                -CAN BE LOADED OR OTHER TEST ROUTINES RUN
*                -UITHOUT PRESSING 'TEST' SUITCH ON FRONT
*                -PANEL.
*
* VERSION X8     - FIXED HEX ERROR REVIND PROBLEM.MODIFIED
*                - TEST MENU TO CLARIFY ENTRY KEYSTROKES.
*                - IN 'DGIKIT' CHANGED MESSAGE FROM USING
*                - 'USTR' TO USING LINDDI3P OF CHARS.THIS
*                - USES MORE RAM,BUT IS NOT DEPENDANT ON
*                - THE CONDITION OF THE IO.
*
* VERSION X9     - RODEO 'EOD' TO SOFTKEYS TO ELIMINATE OLD
*                - TEST MENU BEING DISPLAYED IF BREAK CARE
*                - FROM TERMINAL.
*
*  ##### RELEASED TO PRODUCTION ##########################################
*
* VERSION X10    - REMOVED "CLEARSCREEN FROM DG DATA TEST TO
*                -ELIMINATE OCCASIONAL FLASH OF TEST MENU IN
*                - REPERT TEST MODE.
*
* VERSION X11    -- 10/19/83  -- 3TB back at it
*                -  Streanline code to pick up space and readablility
*                -  "DN" eleinated, "LM" and "RM" removed from softkey
*                -  Hidden "RM" via "LR" and password removed
*                -  Removed proto2 and 8291a test
*                -  DIV ERROR removed
*                -  Added Detection of no RCIA and therefore no use of
*                -  Created a neu memory location with the value of
```

```
SMONITOR.WORK.PD8510          THU, DEC 22, 1983, 10:47 AM    PAGE  6

REJECT
*****************************************************************
*
*   The 85101 Monitor the power-on booter and system debug monitor.
* It contains the Tape, RBM, RCIA, and PUBLIC HP-IB (minimum) Utilities
* It will reside in PROM on the processor board and will exctpt inputs
* from the FP Keyboard, RS-232 Terminal and PUBLIC HP-IB.
*
*  MONITOR is presently at ROM location S0000Hex and Uses
*         2E0Hex Ram Bytes plus run time stack (allou a total oF380hex)
*              for now 1FFFE to 1FE40 is MONITOR RAM and Stack
*         NOTE: Certain items have fixed address and others are
*               addressed via the G-mode approach
*         NOTE: At power on the Hardware locates the ROM 8 0 Hex
*               and the monitor itself moves itt mapping to higher mem
*
*      See MONITOR INSTRUCTIONS for operating information.
*
*  Monitor Commands
*    GO (Add)              -- Exit monitor and GO to Add
*    BR (Add(,Count))      --Set Breakpoint
*    TR (Add(,LouAdd(,HiAdd))--Single Step Tract
*    CR (Add(,Parms(,...)))--Call Subroutine
*    RG (Reg#(,Value(,...)))--Display or change Processor Registers
*    Vn (Add(,Value))      --Display and change Memory
*    SM (Add)              --Display Memory
*    CB (Add)              --Centinous Display Memory
*    MM (Add(,Value))      --Modify Memory
*    CU (Add(,Value))      --Continous Modify Memory
*    DR (Add(,Add1))       --Display Memory
*    ZP (KP Absolute data) --Zapp (Load) Memory
*    LM                    --Load fron Frontpanel Tape into memory
*    RM 0,(nbn0_blks,(nbn1_pages))--Record memory into Frontpanel Tape
*       also RS,RI,RU,RD
*    LB                    --Load fron RBM into memory
*    RB                    --Record memory into RBM              (3 blks)
*    CS                    --Clear Status
*    PM                    --Bring up the self test menu
*    SO,OS                 --Dunny commands for use with ZAPP
*
*    UP or CRLF            --Repeat Operation at next Address
*    DN                    --Repeat Operation at next louer Address
*
*            All Address, Values, etc are in ASCII HEX
*****************************************************************
```

```
SMONITOR.MXXX.POS510          THU, DEC 22, 1983, 10:47 AM    PAGE  5

*                  last started  test. Therefore if a test causes a
*                  PROC, INSTR, ROD, ttc error during the power Up
*                  test before it has written to the error lads,
*                  one can dcternine what test failed ( Hf8 )
*              -  Removed status readout on MB errors
*              -  Removed the Debug message from MCIR on turnon
*              -  Added Bottom box address check
*              -  Added MBM ron checksum
*
* VERSION X12     -- 11/28/83
*              -  Added program load and record security
*              -  Added program load and record fron self test menu
*              -  Deleted "UR" and replaced it with "MM"
*              -  Changed parms of "XM" command, Added RI,RU,RD,RS
*              -  Added MB INIT ERROR message
*              -  Added URI PROTECT ERROR message
*
* VERSION X13     -- 12/8/83
*              -  Added NO TAPE ERROR messagt
*              -  Changed the Self Test entry statenent
*              -  Added RAM Address checking
*              -  Fixed some minor problems in X12
*
*  ##### RELEASED TO PRODUCTION ##########################################
*
************************************************************************
```

```
SMONITOR.WORK.PD8510          THU, DEC 22, 1983, 10:47 AM    PAGE  7

REJECT
    out of date
*****************************************************************
*  Global Variables
*    BufPTR -- Pointer to the next Buffer(BUF) position
*    BUF    -- Buffer storage area for keyboard and terminal input
*    Parm[] -- Storage for inputted Parneters (also called Parm1 or 2)
*              Note: Parm1 is usually a menory address
*    PCTR   -- Number of actual parneters entered
*    CMD    -- Tuo packed ASCII of Command entered
*    OldCmD -- Saved value of CMD for repeat operations
*    DispAdd-- Index to next available Display location
*    OldfirstDisp -- User program's valut of Display X100002
*    Temp1,2,3,4 -- Temporary values
*    BRINS  -- Instruction at breakpoint location
*    BRCount - Breakpoint counter
*    BRCountSave - Breakpoint counter saved for reseting BRCount
*    BRBOO  -- Breakpoint Address
*    ExceptionTYPE -- Flag to type of exception
*    IB2STA -- Public HP-IB status
*    IB2Status--Public HP-IB chip status
*    TRACE  -- Trace command flag -- dcternine exception respond
*    BufReady -Keyboard or RS-232 Buffered input complete and ready
*    IOdevice- I/O Flag - Set by Source of Command -- Use for Output
*                         Bit 0=Term, 1=Keyboard, 2=IB2
*    CHR    -- Temporary byte holding last input
*    RGSave -- Storage location for user programs registers
*              Specific regs are also named -- ie SPSave,PCSavt
*                USSPSavc,SSPSave, and SRSave
*    Parm   -- Input Command parameters
*    TraceLoLin -- Lou Trace Adress linit
*    TraceHiLin -- High Trace Adress Linit
*****************************************************************
end of comment;
```

```
SMONITOR.WORK.PDS510          THU, DEC 22, 1983, 10:47 AM    PAGE  5

REJECT; COMMENT  Fix memory and hardware locations;

EXTERNAL INTEGER  mbn_sub_prgm_eel.L, mbn_prgm_start_add.L;
DOUBLE I&MCEVector=X24,MBBRTVecti=X3C,BBBRTVec12=X6C,TRPP15Vector=X8C,
       MULTIBUSYVector=X7C,
       REFRSHVctr1   =I84,
       REFRSHVector  =XB4,StartMAdress =X104,
       IKSTR1Ovector =X28,INSTR15Vector=X2C,TAPEVector=X64,
       INSTRVector   =X10,AODRESSVector=X0C;
INTEGER FarstDiepLoc=X100002,
        RelMemOffset= X9001E,  RelPreset =X9001A,
        SetPreaet   = X90018, proc_hud_tp=X9001A,
        IO =XFFFFFE00,
        Bot=XFFFFFD00;

INTEGER IRCMD1= IO+X82,   LEDS    = IO+X80,
     Clr_Natchdog=IO+XR8, ir_test =  IO+XA8,
     mplctl  =Bot+X16, MploFF    = Bot+X1S, ptfreq   = Bot+X20,
     ptctl   =Bat+X26,                      adchk    = Bot+X76,
     BBURITE =Bot+X7C, BBREAD    = Bot+X7A, BBURITE1 = Bot+X56,
     BBREAD1 =Bot+X5S, iFcnt     = Bot+X2B, tetpha   = Bot+X54;


BYTE IB2DATA  = IO+X21, IB2IR1    = IO+X23, IB2MBSK1  = IO+X23,
     IB2BBSK2 = IO+X25, IB2SP     = IO+X27, IB2AODMO  = IO+X29,
     IB2CMD   = IO+X2B, IB2AOD    = IO+X2D,
     IB1CMD   = IO+X+A, IB1SP     = IO+X47,
     ACIACMO  = IO+X3B, ACIAORIA  = IO+X89, ACIASC    = ACIACMO,
     CN10     = IO+X51, CNT1      = IO+X63,
     BUAOCLK  = IO+X65, TIMERCMD  = IO+X67,
     TopKeycnd= IO+X83, lopKeydata= IO+XS1, lopKeystat=TopKeycnd,
     BotKeycnd=Bot+X63, BotKeydata=Bot+X65, &otKeystat=Bot+X67;
```

```
SMONITOR.WORK.PDB510          THU, DEC 22, 1983, 10:47 AM    PAGE  10

REJECT; COMMENT Constants;

BYTE CONSTANT IB2bit     :=  4,  Ktybit   :=  2,     Ternbit:=1,
              Space      := ' ,  ascii    := '0, aecii_hex := 55,
                BS       :=X08,  Conna    := ',,  pronpt   := '?,
                CR       := 13,  LF       := 10,  byte_zero:=  0,
           EWAOCLKMODE:=XB6,ACIARESET  :=X40,  MCIBAODE :=X4E,
            ACIAENABLE:=X15,
            Keynod    :=X02, TopKeyclk :=X23, BotKeyclk :=X2C,
            Keyout    :=X40, Keyclr    :=XC1,
            Keyscan   :=X04, ReedSensor:=X50,
            LR        :=X55,  LB       :=XAA;
INTEGER CONSTANT TRAP15  :=X4E4F, zero    :=  0,
                 TRACEBit:=15,    BO      :=  1,   BI      :=  0,
                 IBZ ——:= 2,  Key       :=  1,   Tern    :=  0,
                 TRRP15Ex:= 1,  TRACEEx   :=  2,   RBORTEx :=  3,
                 BufEmpty:=0,   eenaor_bit:=  6,
                 ACIATx  :=0,   ACIARx    :=  1,    Break  :=   E,
                 JMPCODE :=XF100, NULLChr :=X2400, EDO     :=XB00,
                 Keoftkey:=X5EB0,Yeoftkey:=X4FDO,Yatepsoftkey:=X214,
                 MonDispSize:=750,
                 MaxMonDisp:=MonDispSize-60,
                 JmpMonDisp:=(C000)+(X6000-2*MonDispSize)/2;
DOUBLE CONSTANT  MonDisp   :=(X106000-(2*MonDispSize));
                                              & Fix MonJmpDisp &
```

```
SMONITOR.WORK.PDS510          THU, DEC 22, 1983, 10:47 AM    PAGE  11

REJECT; COMMENT     tables   ;

INTEGER TABLE MBMDATA.L := X55E5, XAAAA, &6666, X9999, X1111,
                           &2222, X4444 ,X&S8S, XEEEE, XODOD,
                           XBB88, X7777 , 0000, XFFFF, X1248;
INTEGER TABLE DATI.L:=  EOD, XO100, XOF03, XO700, X4000, X4000,
                      XOE00, X5665, X5666, X5FFF, X5FFF,   EOD;
INTEGER TABLE KeyTable:='R,'9,'8,'7,0  ,0   ,"OO","CB",
                        'B,'G,'5,'4,X5800,0   ,0   ,"CW",
                        'C,'3,'2,'1, 0  ,0   ,"SM", 0  ,
                        'D,'E,'F,'0,XZ0 ,"PM","MM", 0  ,
                        0  ,XOO  &X+C&&,&,0  ;

ALPHA TABLE TT6L:=
"TEST   DESCRIPTION"+LF,          &0&
"A11 PROM",
"A11 RAM",
"A15 DATA BUS",
"A14 RAM",
"A14 DATA",                       &5&
"B16 TIMER",
"A15 PUBLIC HPIB",
"A15 SYSTEM BUS",
"IKIERUPT SYSTEM",
"Bti MULTIPLIER",                 &10&
"B15 TAPE CONTROLLER",
"B13 MBM",
"IF DETECTOR DATA",
"KEYBOARD",
"RUN MAIN PROGRAM"+LF,            S15&
"REMORY OPERATIONS",
"RERUN SELF",
"REPEAT TEST LOOP"+LF,
"LOAD PROGBAM TAPE",
"RECORD PROGRAM TAPE",            &20&
"INITIALIZE TAPE"+LF,
"ENTER SELECTION   THEN PRESS =RRRKER";


ALPHA TABLE MES:=" ERROR","HEX","CMD","VAL",
                 "LOAD","REC","PROC","RDO","IMSTR","ID",
                 "MB IORO","MB REC","MB IHIT","URT PROTECT","NO TAPE";

ALPHA TABLE KeyLabel:="GO","  ","SHOW","URITE","CSHOW","CWRITE";

ALPHA TABLE MES1:=" B ","ABORT","TRACE","BREAK";

LABEL OTHERException,TRAP15Exception,TRACEException,ABORTException,
      ExceptionBailout,IHSTRException,BDDRESSException,
      WaitCMD,ExitModitorTRACE,ExitMonitor,EMterMonitor,RestoreREG,
      AutoExitMonitor,NullException;
LABEL MONITOR,GONOW;

COMMENT
   =DECLARATIONS FOR TEST SW;
```

```
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INTEGER FLAG,TEST,EM;


INTEGER RPTCOUNT,GOODCOUNT,BADCOUNT,KEYSTUCK;

BYTE BA,BB;

INTEGER B,C,O,E,F,J,K,loop,TN,J,LONG_IT;
INTEGER POINTER LOC,LOC1;

DOUBLE OR,OB,OC,OD;


LABEL AUTO,LRO,LA1,LA2;


BOUBLE RAMSI,RAMEO;

INTEGER MEMMOD;

DOUBLE RAMSTART,RAMEND;
```

```
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REJECT;
COMMENT ******* START of Subroutines and Procedures ********;

$FILE fintrpt.work;                          & iriat, iradr, irack &

$FILE MPYTABLE.WORK;

$FILE CDEBUG.WORK;

$FILE STRCO.work;

$FILE FBBM.work;
$FILE CMBMGR.work;                           & seg_start  &

$FILE CM2QUICK.work;

COMMENT ***** FORWARD DECLARATIONS;
PROCEDURE USTR(SR);VALUE SR;ALPHA SR;                              FORWARD;
PROCEDURE UNex(NUM,UIDTH); VALUE NUM,UIDTH; INTEGER UIDTH; DOUBLE NUM;
                                                                   FORWARD;
SUBROUTINE CRLF;                                                   FORWARD;
PROCEDURE TLBL(I);VALUE I;INTEGER I;                               FORWARD;
PROCEDURE GET(J,K);INTEGER J,K;                                    FORWARD;
PROCEDURE BSTEST(J,L);INTEGER J,L;                                 FORWARD;
PROCEDURE INC(FLAG,TN,L);INTEGER FLAG,TN,L;                        FORWARD;
PROCEDURE FPANEL(J,L);INTEGER J,L;FORWARD;
PROCEDURE NonBailout(MESNUM); VALUE MESNUM; INTEGER MESNUM;        FORWARD;
SUBROUTINE GetUpshiftByte;                                         FORWARD;
```

```
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REJECT;COMMENT;
SUBROUTINE Refrsh;      ENTRY;
BEGIN
LABEL refresh_loop;
COMMENT This is the main memory
            refresh exception (interrupt) routine
     This routine is called both by TRAP and Interrupt --
       The status register is restore to allow higher interrupts - yadc.
       The clear ISR instruction will not cause a problem even when
       called by a trap because the ISR bit of the 9519 is not set
       except during the IACK cycle, and if set the interrupt would
       process and then the TRAP finish -- got that !!;

    ASSEMBLE(  MOVE (S),SR );
refresh_loop:ASSEMBLE(  TST.W RelPreset; BPL refresh_loop );
    ASSEMBLE(  BOVE #H79,IRCMD1;  RTE );
END;


COMMENT
*Intialize of the S251A RCIA and BUAD Clock divider (TimerN2 of S253);
SUBROUTINE ACIAInit;
 BEGIN
    TIMERCMD:=BURDCLKMODE;&TIMER=2,MODE 3(SQ WAVE DIV),LSB THEN MSB,BINA
    BUROCLK:=X00;&LSB&      BURDCLK:=byte_zero;&MSB&
              &Clk=X34  ... 2400 baud&
              &   =X1R  ... 4800 baud&
              &   =X11  ??? 7200 baud&
              &   =X00  ... 9600 baud&
    ASSEMBLE( MOVE.L #020,R1); & LSL's ARE USED AS DELAYS &
    ACIBCMD:=XS3; ASSEMBLE( LSL.L  R1,RO);
    ACIACRD:=XS3; ASSEMBLE( LSL.L  R1,RO);
    ACIACMD:=XS3; ASSEMBLE( LSL.L  R1,RO);
    ACIACMD:=ACIARESET; ASSEMBLE( LSL.L  R1,RO);
    ACIACMD:=ACIAMODE; &1 STOP,NO PARITY,8 BIT DATA,X16 CLK&
              ASSEMBLE( LSL.L R1,RO);
    RCIACMD:=ACIAENABLE; &ENABLE TX,RX,  AND RESET ERRORS
    CMR:=RCIRDATA; &CLEAR RECIEVER&
    ACIADATA:=XAA;       & '*' ID TERM   &
    IF ACIASCNXFF THEN
       BEGIN
       IOdevice:=Termbit;
       ACIB_avail :* 1;
       END acia present
     ELSE
       BEGIN
       IOaevice:=Keybit;
       BCIA_avail := 0;
       END no acia present;
 END ACIAInit;


SUBROUTINE delay;     REPEAT 100 DO TRAP(13);
```

```
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REJECT;COMMENT
Intializes keyboards to K-key rollover encoded scan 20ms debounce
end of comment;

SUBROUTINE topkey_init;
   WRITE( ADRS( TopKeycnd ) , Keynod, TopKeyclk, Keyout, Keyclr );

SUBROUTINE botkey_init;
   WRITE( ADRS( BotKeycnd ) , Keynod, BotKeyclk, Keyout, Keyclr );


PROCEDURE KEY_TEST;                                          ENTRY;
BEGIN
LABEL LL;

   topkey_init;

   J:=0;loop:=0;
   &BTEST(J,loop);   & VERIFY BOTTOM BOX DATA BEFORE TESTING KEYBOARD &
   IF J=0 THEN  botkey_init;

   loop:=1;          & return to single test mode &

   I:=23;TLBL(I); & ENTER DATA MESSAGE &
LL:
   IF(TopKeystat AND XOF)NO THEN
      BEGIN
      TLBL(I);
      UNex( INTEGER( TopKeydata ) ,2);
      CRLF;
      END;

   IF J=0 THEN GO TO LL; & NO BOTTOM BOX &

   IF (BotKeystat AND XOF)RO THEN
      BEGIN
      TLBL(1);
      UNex( INTEGER( BotKeydata ) ,2);
      CRLF;
      END;

GO TO LL;
END key_tast;
```

```
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&EJECT;
PROCEDURE bailout_if_key_pressed;                                    ENTRY;
BEGIN
INTEGER I;
IF (TopKeystat AND %F)#0 THEN
   BEGIN
   I:=0;

   DO BEGIN
        88:=TopKeydata;I:=I+1;   & BRD STATUS BAILOUT &
        IF I=200 THEN BEGIN loop:=0;
          J:=%10;TN:=14;INC(J,TN,loop); %   REPORT FAILURE &
          loop:=1;FPANEL(J,loop);END;&GO TO IO DATA TEST/STAY THERE &
   END UNTIL ((TopKeystat AND %F)=0);

   IF (CMD="CW" OR CMD="CB") THEN loop:=0; & RETURN TO URITCMD &

   IF loop&0 THEN GO TO MONITOR; & RESTART FROM BEGINNING &

   END if;
END bailout_if_key_pressed ;

PROCEDURE DATA_TEST;&W7RY;
BEGIN
& DATA TEST FOR BUBBLE &
   MBMADD:=2047;
   RAMSTART:=%#500;RAMEND:=%851C;
   IF NOT read_mbn(RAMSTART,set_add_mbn(M&MADD,RAMSIBRT,RAMEND ) )
      THEN BEGIN IF I=0 THEN J:=%25
                        ELSE J:=%36 END
    ELSE BEGIN
        DR:=0;
        UHILE DR<=28  DO
          BEGIN
          STPNTR(LOC,RAMST+DR);STPNTR(LOC1,RAMSTART+DR);
          IF (J=0 AND (LOCKLOC1)) THEN
              BEGIN J:=(LOC XOR LOC1);  GET(J,J);  END;
          DR:=DR+2;
          END;
        END;
END DATA_TEST;
```

```
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&EJECT;COMMENT;
BOOLEAN SUBROUTINE urt_mbn_test;
 urt_mbn_teet := urt_mbn(RAMST,set_add_mbn(MBMADD,RAMST,RAMED) );

PROCEDURE MBNTEST(J,loop);INTEGER J,loop;ENTRY;
BEGIN
DOUBLE POINTER  dp;
INTEGER POINTER ip;
DOUBLE  sum;
INTEGER block, adr;
LABEL SIT;

SIT:IF loop#0 THEN BEGIN Z:=T4;TLBL(I);END;

    J:=0;
    FLAG:=0;
    & MBN BOH checksum &
    sum := 0;
    FOR block := 0 TO 15 DO
       BEGIN
       mbn_sub_prgm_sel := block;  &block select/chip select not needed&
       FOR adr := 0 STEP 2 TO %FE 00
          BEGIN
          STPNTR( ip, BORS( mbm_prgm_start_add ) + adr );
          IF ( block < 15 ) OR ( adr < %FC ) THEN
             sum  := sum + ( DOUBLE( ip ) AND %0FFFF );
          END adr loop;
       END  block loop;
    STPNTR( dp, RORS( mbn_prgm_start_add ) + %FC );
    IF sum & dp THEN  J:= 9;
    mbn_sub_prgm_sel := zero ;

    FLAG:=J;

    IF FLAG = 0 THEN
       BEGIN                & no ram errors , safe to do other tests &
       RAMST:=(ADRS(RBRDATA));RAMED:=RAMST+28;
       J:=0;
       I:=0;
       MBMADD:=2047;
       IF NOT init_mbn(0) THEN J:=%21

        ELSE IF NOT urt_mbn_test
               THEN J:=%22
          ELSE  DATA_TEST;
       IF JR0 THEN J:=J+%10;
       FLAG := J;
    &  DO SECOND BUBBLE  &

       J:=0;
       I:=1;
       MBMADD:=2047;

       IF NOT init_mbn(1) THEN J:=%13
        ELSE IF NOT urt_mbn_test
             THEN J:=%14
```

```
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            ELSE DATA_TEST;
      IF JR0 THEN J:=J+%20;
      END ram was OK, and other test done;
   IF FLAG#0 THEN J:=FLAG;                  & RETURN FIRST ERROR in  J&
   bailout_if_key_pressed;
   IF loop#0 THEN GO TO SIT;

END MBNTEST ;
```

```
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&EJECT;COMMENT;
PROCEDURE BBTEST(J,loop);INTEGER J,loop;ENTRY;
BEGIN
LABEL BB;
INTEGER data, mask, result, error_offset;

   SUBROUTINE check;
   BEGIN
   IF(((J=0) AND ((result AND mask)R data)) OR (loop#0)) THEN BEGIN
     J:=((result XOR data) AND mask); GET(J,J); J := J+error_offset;END;
   END;

   J:=0;
   IF loop#0 THEN BEGIN I:=15;TLBL(I);END;

BB:error_offset := 0;
   BBWRITE1:=%55; data :=%55;  mask := %FF;     result := BBREAD1 ;
   check;
   BBWRITE1:=%AA; data :=%AA;                   result := BBREAD1 ;
   check;

  &   TEST UPPER BYTE  &
   BBWRITE:=%5500;data:=%5500;  mask := %FF00;  result := BBREAD ;
   check;
   BBWRITE:=%AA00;data:=%AA00;                  result := BBREAD ;
   check;

  & address lines check &
   error_offset := %10 ;
   data   := ifent; data :=%5500; mask :=%7F00;  result := adchk;
   check;
   tatpha := data;  data :=%2A00;                result := adchk;
   check;

&   PRETUNE VTO TO 120MHZ   &
& THIS STIMULAS ALLOWS VERIFY OF FRONT END WITH SOURCE
   IN NAKURL 100MH2 SOURCE PRODUCES 20MH2 IF &

   mpictl:=%2F;  &  SET PRETUNE MODE  8
   mploff:=zero; &  MPLOFF8=0  &
   ptfreq:=%9180;  & VTOBCO FOR 120 MHZ A118 8.
   ptctl :=4;    &  SAMPLE MODE 8

   bailout_if_key_pressed;
   IF loop#0 THEN GO TO BB;
END BBTEST;
```

```
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$EJECT;COMMENT  approx 50 bytes could be save combining MPIB and MPIB1;
PROCEDURE MPIB(FLAG,loop);INTEGER FLAG,loop;ENTRY;
BEGIN
LABEL PIG;

    IF loop#0 THEN BEGIN I:=8;TLBL(I):END;
PIG:FLAG:=0;
    IB2CMD:=2;IB2CMD:=byte_zero;
    IB2SP:=X55;
    FLAG:=INTEGER(IB2SP XOR X55);

   & DO CMD THING &
   & MPIB#2 PUBLIC  &

   & FLAG = BAD BITS &
   IB2SP:=XAA;

   IF FLAG=0 THEN                          & GET FIRST MPIB ERROR &
          FLAG:=INTEGER( IB2SP XOR $AA);    & FLAG = BAD BITS &
   FLAG := FLAG AND XOFF;
   IF FLAG#0 THEN GET(FLAG,FLAG);

   bailout_if_key_pressed;
   IF loop#0 THEN GO TO PIG;

END MPIB;

COMMENT  approx 50 bytes could be save combining MPIB and MPIB1;
PROCEDURE MPIB1(FLAG,loop);INTEGER FLAG,loop;ENTRY;
BEGIN
LABEL P1;

    IF loop#0 THEN BEGIN
                I:=10;ILBL(I);END;
P1; FLAG:=0;

    IB1CMD:=2;IB1CMD:=byte_zero;
    IB1SP:=X55;
    FLAG:=INTEGER(IB1SP XOR I55);
 & FLAG = BAD BITS &

    IB1SP:=XAA;
    IF FLAG=0 THEN                        & GET FIRST MPIB ERROR &
          FLBG:=INTEGER(IB1SP XOR XAA);     & FLAG = BAD SITS &
    FLAG := FLAG AND XOFF;
    IF FLAG#0 THEN GET(FLAG,FLAG);          & GET BIT NUMBER &

    bailout_if_key_pressed;
    IF loop#0 THEN GO TO P1;
END MPIB1;
```

```
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$EJECT;
&    BG RAM TEST  &
PROCEDURE BG1(FLAG,loop);INTEGER FLAG,loop;                    ENTRY;
BEGIN
LABEL P3;

   IF loop#0 THEN BEGIN I:=6;ILBL(I);END;

P3:FLAG:=0;   &  CLEAR FLAG FOR TEST &
   FOR B:=%D STEP 2 UNTIL %7FFE DO
      BEGIN
      STPNTR(LOC,(B+X100000));


      C:=LOC;  &  GET DATA  &
      LOG:=NOT C;   &  STORE COMPLEMENT  &
      IF FIBG=0 THEN BEGIN FLBG:=(C AND LOC);
                     IF FLAG#0 THEN GET(FLAG,FLAG); END;
      &  RESTORE IT  &
      LOC:=C;
      END LOOP;

   bailout_if_key_pressed;
   IF loop#0 THEN GO TO P3;
END BG1 ;
```

```
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$EJECT;COMMENT
     DG DATA AND ATTRIBUTE TEST
     Note: No IN A%R DATA meassge because test overurites;
PROCEDURE DG2(FLAG,loop);INTEGER FLAG,loop;                    ENTRY;
BEGIN
LABEL P4;

INTEGER ARRAY DAT[0:11];

   INTEGER SUBROUTINE DOIT;BEGIN
      STPNTR(LOC1,X140000);
      STPNTR(LOC,X100000);
      DAT[3]:=B;
      DAT[4]:=C;
      DAT[5]:=D;
      DAT[7]:=E:

      MOVE LOC := DAT,+(12);

      REPEAT 30 DO delay;     $DELAY FOR NEW PIC TIMER &
      DOI1:=LOC1;   &READ AND RETURN DATR &
      END DOIT;

BB=BRT ON/OFF &
&C=X ATTRIBUTE&
&D=Y ATTRIBUTE &
&E=DATA&

   MOVE DAT:=DATT,+(12);
   FLAG:=0;

P4:DOIT;DOIT;DOIT;  & WRITE 3 VECTORS TO SYNC DG AND LINE GEN &
   B:=X0700;C:=X50C0;D:=XB000;E:=X5555;
   IF DOIT#(X2555) THEN FLAG:=1;
                              & X,Y ATTRIBUTES =0  &

   B:=0;C:=X7000;D:=X6000;E:=X5BBB:
   IF ((DOITRXSBBB) AND (FLAG=0))  THEN FLAG:=2;

   B:=0;C:=X5000;D:=X5000;E:=X5BAA;
   IF ((DOITRXFBAA) AND (FLAG=0))  THEN FLAG:=3;
   B:=0;C:=X6000;D:=X6000;E:=X5555;
   IF ((DOITRX0555) AND (FLAG=0))  THEN FLAG:=4;
   B:=0:C:=X4000;D:=X4000; E:=X5555;
   IF ((DOITRX4555) AND (FLAG=0))  THEN FLAG:=5;

bailout_if_key_pressed;
IF loop#0 THEN GO TO P4;
STPNTR(LOC,ADRS(FirstDispLoc));
LOC:=EOD:                          &stop display of dg test vectors&

END;
```

```
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$EJECT;COMMENT;
PROCEDURE TIMER(FLAG,loop);INTEGER FLAG,loop;ENTRY;
BEGIN
LABEL P7;

  BYTE J,K;

   IF loop#0 THEN BEGIN I:=8;TLBL(I);END;
P7:FLAG:=zero;  &HELLO&
   B:=LEDS;  &  TRIGGER FOR SCOPE  &

   B:=200;
   &   SET MODES   &
   TIMERCMD:=X3B;  & MODE4 2 BYTES CNTR 0  &

   &   DO CNTR 0 FIXED VALUES &
   CNTO:=LA;CNTO:=byte_zero;

   TIMERCMD:=byte_zero;  &  LATCHIT  &
   UNTIL BNO DO BEGIN
      BB:=CNTO; &  READ LSB &
      BB:=CNTO;  & READ MSB  &
      B:=B-1;         &  DECREMENT LOOP  &

      IF (BR = X55) THEN B:=0; & KILL LOOP &
      END;
   IF (SAMX55)OR(BBMbyte_zero) THEN FLAG:=1;
   B:=200;
   TIMERCMD:=X3B;  & MODE4 2 BYTES CNTR 0  &
   CNTO:=LB;CNTO:=byte_zero;

   TIMERCMD:=byte_zero;
   UNTIL BRO DO BEGIN
      BA:=CNTO;
      BB:=CNTO;
      B:=B-1;     & DECREMENT LOOP  &

      IF (BA = XAA) THEN B:=0;
      END;
   IF (FLAG=0 BND ((BAMXAA)OR(BBMbyte_zero))) THEN FLAG:=2;

&  DO CNTR2 &
   TIMERCMD:=XB8;    & MODE& 2 BYTE CNTR2 &
   BURDCLK:=LR;BURDCLK:=byte_zero;
   TIMERCMD:=X80;
   BA:=SURDCLK;BB:=BURDCLK;

   IF FLAG=0 THEN BEGIN
         IF ((BR=X55) OR (BA<X50) OR (BBMbyte_zero)) THEN FLAG:=3;END;
         &*****  TIMER WILL DECREMENT DUE TO CLOCK RATE*** &

   TIMERCMD:=XB8;   & MODE4 2 BYTE CNTR2 &
   BURDCLK:=LB;BURDCLK:=byte_zero;
   TIMERCMD:=X80:
   BR:=BURDCLK;BB:=BURDCLK;
```

```
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   IF FLAG=0 THEN BEGIN
        IF ((DA=ZAA) OR (BA<ZB5) OR (BBBbyte_zero)) THEN FLAG:=4;END;
     &** TIMER WILL DECREMENT DUE TO CLOCK RATE **&

&RESTORE BAUDRATE &
   TIMERCMD:=ZS6;BUADCLK:=ZOD;BURDCLK:=byte_zero;
   B:=LEDS; & STOP PULSE FOR SCOPE TEST WAVEFORMS &

bailout_if_key_pressed;
IF loop=0 THEN GO ID P7;

END TIMER;
```

```
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&EJECT;COMMENT;
PROCEDURE TACO(J,loop);INTEGER J,loop;ENTRY;
BEGIN

LABEL AA;
   I:=13;
   IF loop=0 THEN TLBL(I);
AA:J:=0;
   TPINT;    & INITIALIZE TACO &

   delay;
   TACOtacH:=Z5555;  &  SET PATTERN IK TACH REG  &
   delay;
   J:=(TACOtach XOR Z5555);
   TACOtacH:=ZAAAA;  &  STORE COMPLEMENT  &
   delay;
   IF J=0 THEN J:=(TACOtacH XOB XAAAA);
   GET(J,J); & IDENTIFY BAD BIT &

   IF J=0 THEN BEGIN
                        & DO DATA REG &
      TACOdata:=X5555;
      delay;
      J:=(TACOdata XOR Z5555);
      TACOdata:=ZAAAA;
      delay;
      IF J=0 THEN J:=(TACOdata XOR ZAAAA);
      IF J=0 THEN BEGIN GET(J,J);J:=J+Z10;END;
      END;


bailout_if_key_pressed;
IF loop=0 THEN GO TO AA;
END TACO;
```

```
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#EJECT;COMMENT;
PROCEDURE GET(J,K);INTEGER J,K;ENTRY;
BEGIN
INTEGER index = REGISTER 7;
INTEGER bit = REGISTER 6;

    index:=J; &  GET INPUT DATA &
          &  J=DATA   &
    bit:=1;      &  K=BIT  NO.  &
    WHILE index=0 DO
      BEGIN
      IF TBIT(index,0) = 0 THEN  BEGIN index:=0; K:=bit; END;
      index:=RICHT(index,1);
      bit:=bit+1;
      END;

END GET ;
```

```
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#EJECT;COMMENT;
INTERRUPT SERV;ENTRY;BEGIN &  RESET IRQ &
irack(1$);
LEDS:=Z0055; & SEI TEST PATTERN &
END;


PROCEDURE TINTER(FLAG,loop);INTEGER FLAG,loop;ENTRY;
BEGIN  LABEL T,TT;

   OA:=TRAP16Vector;
   I:=11;
   IF loop=0 THEN TLBL(I);

IT:FLAG:=0;
   LEDS:=Z&B;  & SET TEST PATTERN FOR IRQ &
   irint;& INITIALIZE &
   iradr(RORS(SERV),15);
   RSSEMBLE( ANDI #NFOFF,SR);&TURK 6&000 IR ON&
T: WRITE( RORS(ir_teat), zero, ZSO, zero );
   RSSEMBLE( NOP;                    &  delay -- wait For IR &
             ORI #H0700,SR);         &  DISABLE   IRD       &
   TRAP15Vector:=OA;                 &  RESTORE CELL &
   IF (LEDS AND ZFF)=Z55 THEN FLAG:=1;
   LEOS:=ZFF;  &  TURN OFF ERROR INDICATION  &

   bailout_if_key_praased;
   IF loop=0 THEN GO TO TT;
END TINTER;
```

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BEJECI;COMMEKT;
          &  ERROR REPORT ROUTINE  &
SUBROUTINE ERRS;
BEGIN
DOUBLE  RET=REGISTER9;  &RESERVE R9 FOR RETURN &
INTEGER B=REGISTER2;   &  ERROR NO. &
INTEGER C=REGISTER3;   & RDDRESS COUNTER &
INTEGER E=REGISTER5;    & TEST NO  &
INTEGER O=REGISTER4;    &  TEMP VARIABLE &
INTEGER POINTER LOC=REGISTER11;

   B:=(B AND X3F);
   C:=(6 MOD 2);
   STPNTR(LOC,X90002-2*C);
   B:=LOC; &  RCCESS X1 &
   C:=(B MOD 4)/2;
   STPNTR(LOC,X90006-2*C);
   B:=LOC;  & RCCESS X2  &
   C:=(B MOD &)/4;
   STPNTR(LOC,X9000R-2*C);
   D:=LOC;  & RCCESS X4  &
   C:=(B ROD 16)/8;
   STPNTR(LOE,X9000E-2*C);
   B:=LOC;  &  RCCESS X8  &
   C:=(B BOD 32)/16;
   STPNTR(LOC,X90012-2*C);
   B:=LOC;  &  RCCESS X16  &
   C:=B/32;
   STPNTR(LOC,X9001S-2*C);
   B:=LOC;  &  RCCESS X32  &
&  DO FRONT PANEL BUISNESS  &

   E:=(E AND 1F);
   LEDS:=NOT(E*X10);  & URITE TEST NO TO FP LEDS &

   ASSEMBLE(JRP (R9) );

END ERRS;


PROCEDURE ERROR(SET,EN,loop);INTEGER SET,EN,loop;ENTRY;
BEGIN
INTEGER B=REGISTER2; & ERROR NO.  &
IKTEGER E=REGISTER5;  &  TEST NO. &

   B:=EN;E:=SET;
   ASSEMBLE(LER $P6.L,R9);   ERRS;
   ASSEMBLE( "$F6 EQU *" );
END ERROR ;
```

```
SMONIIOR.UORK.PDSS10          THU, DEC 22, 1983, 10:47 AM    PRGE 29


REJECT;COMMENT;
PROCEDURE TMM(FLAG,lmOp);INTEGER FLBG,loop;ENTIY;
BEGIN
DOUBLE I=REGTSTER9; & RDDRESS COUNTER &
INTEGER R=REGISTER4; & SIT DETECTOR &
INTEGER B=REGISTER2;  & ERROR NUMBER &
INTEGER J=REGISTER5;  &  TEST NUMSCR  &
INTEGER POINTER I_ptr=I;
LABEL GO1;

   IF loopNO THEN BEGIN I:=4;TLBL(I);END;

    B:=O;
GO1:I:=X0000;
    UNILE IRI17FFE OO
      BEGIN
      LABEL PP;

   PP:J:=I_ptr;     &  GET STORED DATR  &

      J:=(NOT J);   &COMPLEMENT DATR&
      I_ptr:=J;     &STORE COMPLEMENT &
      K:=I_ptr;     & RCRD BEMORY &
      S:= B OR  (K &OR J);

      J:=(NOT J);
      I_ptr:=J;     &  RESTORE DRTR  &
      &:=I_ptr;     & RERD MEMORY &
      B:= & OR  (K &OR J);

      I := I + 2;
      END;

   IF B=O THEN              &RRM ROORESSING CHECK -- OVERURITES MEM &
        BEGIN    BSSEMBLE(
            MOVE.L =N100, I ;
         LO: MOVE.U  I , (I)+;
            CMP.L  =N17&00, I;
            BLT     LO;
            CLR     K;
            MOVE.L =K100, I;
         L1: MOVE.L  I,  RO;
            CHP.U   (I)+,  RO;
            SNE     RO;
            OR.B    RO, K;
            CMP.L  =N17&00, I;
            BLT     L1      );
         IF KNO THEN B:= 33;
         END;

   I:=1;K:=O;
   UNILE BNO DO  &  DO IF RRN FRILED  &
      BEGIN
      IF TBIT(B,O)NO THEN BEOIN B:=I;      & STOP SERRCH &
         3:=2;
         RSSEMSLE (LER $GO_ON.L,R9);   ERRS;  &R9=RETURN RDDRESS&
```

```
SMOKITOR.UORK.PD8510          THU, DEC 22, 1983, 10:47 AM    PAGE 30


         RSSEMBLE("$GO_OK EOU *");K:=B;B:=O;
         END;
      B:=RIGHT(B,1);
      I:=I+1;
      END;

   IF (loopNO)  THEN  Bailout_if_key_preseed;
   IF (K R O) OR (loopRO)  INEN GO TO GO1;
END RRM ;
```

```
SMONITOR.UORK.PD&S10          THU, DEC 22, 1983, 10:47 AM    PAGE 31


NEJECT;COMMENT;
SUBROUTINE CHEK_SOM;
BEGIN
DOUBLE RET=REGISTER9; & RETURN RDDRESS &
OOUBLE OR=REGISTER3; & RCCURULRTOR &
IXTEGER K=REGISTER5;  & TEST NO. &
INTEGER B=REGIS(ER2;  &  ERROR NO. &
INTEGER POINTER LOC=REGISTER11;  & ROORESS POINTER &
DOUBLE RCCKSR=X30008; &   RECORDED CNECKSUR IN PROMS  &
LABEL CKSM;
CKSM:
   STPNTR(LOC,X3000N);
   DR:=O;B:=O;
   UNILE RDRS(LOC)<X3FFE DO BEGIN
      STPKTR(LDC,RDRS(LOC)+2);
      OR:=DR+(DOUBLE(LOC)RNO 20FFFF);
      END;
   IF DRRRCCKSM    TNEN BEGIN
      B:=1;  &  SET ERROR FLRG &
      K:=1;
      RSSEMSLE(LER IRET.L,R9);
      ERRS;        &  URITE ERRORS TO 1EDS &
      RSSEMSLE("$RET EQU *");
      COMMENT  IF (lopKeyetat RNDIF)RO THEN Bailout_if_key_pressed;
      GO TO CKSM;          & *** SET REPERT RODE ** &
      END;
   RSSERBLE(JMP (R9) );

END chek_sum ;


PROCEDURE CHECKSUM(J,loop);INTEGCR J,loop;CNTRY;
BEGIN
LABEL LOOP;
   C:=O;
LOOP:BSSEMBLE(LER BRRI.L,R9);
   CHEK_SUM;
   RSSEMBLE("$RAT EQU *");
   IF CNO INEN BEGIN Bailout_if_key_pressed;GO TO LOOP;EKD;
   IF loopNO TNEN BEGIN I:=3;TLBL(1);C:=1;GO TO LOOP;END;
END checkaun ;
```

```
SMONITOR.UORK.PDB51D            THU, DEC 22, 1983, 10:47 PM     PAGE  32

#EJECT;COMMENT;
PROCEDURE FPANEL(I,loop);INTEGER J,loop;ENTRY;
BEGIN
LABEL P2;

   IF  loop#0 THEN BEGIN I:=5;TLBL(I);END;

P2:
   LEDS:=XFF55;
   IF (LEDS AND XFF)#X55 THEN BEGIN
      J:=((LEDS AND XFF) XOR X55);&  SET ERROR  &
      END;
   LEDS:=XAA;
   IF (LEDS AND XFF)#XAA THEN BEGIN J:=((LEDS AND XFF) XOR XAA);
      END;
   IF JRD THEN GET(J,J);  & GET BAD BIT &
   LEDS:=XFF;  & TURN OFF ERROR INDICATION  &
   IF  loop#0 THEN BEGIN ;bailout_if_key_pressed;GO TO P2;END;

END FPANEL;
```

```
SMONITOR.UORK.PDB51D            THU, DEC 22, 1983, 10:47 AM     PAGE  33

#EJECT;COMMENT;
PROCEDURE ACPMPY(FLAG,loop);INTEGER FLAG,loop;ENTRY;
BEGIN
DOUBLE ptr = REGISTER 11;
LABEL TT;
  I:=12;
  IF loop#0 THEN ILBL(I);
TT:
  OA:=X56781234;
  DC:=XABCDDEAF;
                & DA:=X5678;DA:=LEFT(DA,1G);
                  DB:=X1234;DB:=(DB AND XFFFF);DA:=(DA OR DB);
                  DB:=0;
                  OC:=XABCD;DC:=LEF7(DC,1G);
                  DB:=XDEAF;DB:=(DB AND XFFFF);DC:=(DC OR DB);  &

  ASSEMBLE( LEA  MCPMP, R11;
            MOVE.L DA, (R11)+;
            MOVE.L DC, (R11)+  );
  FLAG := 0;                  & OFF error indicator &
  ASSEMBLE( MOVE.U (R11)+,  5; &get exp &
            MOVE.L (R11),  DD  & get mantissa &     );

  IF(S AND XDFF)#XDFF THEN FLAG:=1;  &  VERIFY EXPONENT  &
  IF (DORX#DDA6349 AND FLAG=0) THEN FLAG:=2;  &  SET ERROR FLAG  &
  bailout_if_key_pressed;
  IF loop#0 THEN GO TO TT;
END acpmpy ;
```

```
SMONITOR.UORK.PDB51D            THU, DEC 22, 1983, 10:47 AM     PAGE  34

#EJECT;COMMENT;
PROCEDURE INC(FLAG,TN,loop);INTEGER FLAG,TN,loop;ENTRY;
BEGIN

   IF TN=0 THEN BEGIN EN:=0;& no Failures have occurred &   TEST:=0;END;
   IF FLAG=0 THEN BEGIN     & FIRST ERROR LOOP  &
      IF EN=0 THEN BEGIN
         TEST:=TN;                & CAPTURE TEST NO. &
         DR:=1;loop:=2;
         EN:=X3F;CRROR(EN,EN,loop);
         UNTIL EN<XFFF DO BEGIN
            TRAP(13);EN:=EN+1;END; & LED CHECK &
         EN:=0;

         ERROR(EN,EN,loop); &  CLEAR PREVIOUS DISPLAY &
         EN:=FLAG; & ASSIGN FLAG TO ERROR NO.  &

         ERROR(TN,TN,loop);   &  REPORT TEST NO. IN PROCESSOR LEDS &
         REPEAT 500   DO delay;                                 &  DISPLAY DELAY  &
         ERROR(TN,EN,loop);END;  &CAPTURE FIRST ERROR &
      END;
   TN:=TN+1;
   IF loop=6 THEN BEGIN ERROR(TEST,EN,loop); &RESTORE ERROR DISPLAY &
      FLAG:=TEST; & RETURN ANY ERROR  &
      test_num:=TEST; & RETURN TEST NUMBER IN ADDRESS MF2 &
      err_num:=EN;  & RETURN ERROR NUMBER IN ADDRESS MF4 &
      END;

   loop:=0;
END;
```

```
SMONITOR.UORK.PDB51D            THU, DEC 22, 1983, 10:47 AM     PAGE  35

#EJECT;COMMENT;
SUBROUTINE reset_DispMem;
BEGIN
   STPNTR(DispMem,MonDisp+2^DispRdd );
   DispRdd:=0;
END reset_DispMem;


PROCEDURE LoadDisp(Data); VALUE Data; INTEGER Data;
BEGIN
    DispMem[DispRdd]:=Data;
    DispRdd:=DispRdd+1;
END LoadDisp;

SUBROUTINE MAKESTROKES;
BEGIN
   STPNTR(DispMem,X1D6DDD);
   DispMem[Temp1]:=DispRdd+JMPCODE;
   STPNTR(DispMem,X10G2DD);
   STPNTR(BytePtr,RDRS(johnsfun));
   DO BEGIN
      Temp3:=BytePtr[Temp2];
      LoadDisp( LCFT( (Temp3 AND 7), 12) +
                     ( IF TBIT(Temp3,2) THEN (Temp3 AND XOFF8 )
                       ELSE  LEFT( (Temp3 AND XF0), 4) )  );
      Temp2:=Temp2+1;
   END UNTIL Temp3=66;
END;
```

```
3MONITOR.WORK.PDBS10          THU, DEC 22, 1983, 10:47 AM     PAGE  36


%EJECT;COMMENT Intializes OG memory to all COD'e
        Then set up a character jump table and atroke table for
            selected chars
end of comment;
SUBROUTINE OGInit;        ENTRY;
BEGIN
 LABEL DGloop;
  ASSEMBLE( MOVE #NOBOD,R0;  MOVE.L #N100000,R1;  MOVE.L #N120000,R8 );
  OGloop:ASSEMBLE( MOVE R0,-(R5); CMP.L R1,R8; BGT DGloop );

  STPNTR(DispMem,%106000);
   FOR Temp1:=0 TO 255 DO DispMem[Temp1]:=NULLChr;
   Temp2:=0;
   DispAdd:=0;
   Temp1:=10;%MAKESTROKES;
   Temp1:=13;%MAKESTROKES;
   Temp1:=32;%MAKESTROKES;
   FOR Temp1:=48 TO 90 DO
      IF Temp1>=83 OR Temp1<=57 OR Temp1=61 THEN %MAKESTROKES;
   DispAdd:=0;
  STPNTR(DispMem,MORS(FirstDispLoc));
    LoadDisp(%100);
    LoadDisp(%378);
    LoadDisp(%2800);
    IOdevice:=%syexit;
  &  MSTR("IESIIKG");  see Version 22 message -- PERMBRS a tools &
    LoadDisp(%B054);
    LoadDisp(%B045);
    LoadDisp(%B053);
    LoadDisp(%B054);
    LoadDisp(%B049);
    LoadDisp(%B04E);
    LoadDisp(%B047);
END OGInit;
```

```
3MONITOR.WORK.PDBS10          THU, DEC 22, 1983, 10:47 AM     PAGE  37


%EJECT;COMMENT Labels the softkeys with monitor commands and set up
        display pointers for monitor display
end of comment;
SUBROUTINE SoftKeys;
BEGIN
    FirstDispLoc:=JmpMonDisp;
    DispAdd:=0;
    reset_DispMem;
    Temp2:=Yoeftkey;
    FOR Temp1:=0 TO 5 DO
       BEGIN
          LoadDisp(%a0ftkey);
          LoadDisp(Temp2);
          Temp2:=Temp2-Ystepsoftkey;
          STPNTR(RTable,MORS(KeyLabel));
          %STR(RTable[Temp1]);
       END;
    LoadDisp(%5000);
    LoadDisp(%4F00);
    reset_Diaphen;
    LoadDisp(E00);DispRdd:=0;
END SoftKey;
```

```
3MONITOR.WORK.PDBS10          THU, DEC 22, 1983, 10:47 AM     PAGE  38


%EJECT;COMMENT
*Intializion of the PUBLIC HP-IB -- 8291 @ HP-IB Adresses 16 and 24;
SUBROUTINE IB2Init;
 BEGIN
    IB2CMD:=%2;   &RESET&
    IB2MASK1:=byte_zero;
    IB2MASK2:=byte_zero;
    IB2SP:=byte_zero; IB2STA:=0; &CLEAR SERIAL POLL AND STR BYTE&
    IB2ADDMD:=%7;
    IB2MOD:=%E; IB2ADD:=%95; &SET 1G AND 24 AS ADDRESS&
    IB2CMD:=%25; &SET CLOCK 5 MH7&  IB2CMD:=byte_zero;  &CLEPR RESET&
 END IB2Init;


COMMENT
*Sets the IB2Status word ;
SUBROUTINE ChkIB2status;
 BEGIN
 BYTE temp=REGISTER 2;
   temp:=IB2MASK2;
   IB2Status:=(IB2Status AND %3) OR IB2IR1;
 END ChkIB2status;
```

```
3MONITOR.WORK.PDBS10          THU, DEC 22, 1983, 10:47 AM     PAGE  39


%EJECT;COMMENT
*Gets a single byte from IB2 -- assume BI True and resets it
*     also inhibits any further interaction with terminal;
BYTE SUBROUTINE GetIB2;
 BEGIN IOdevice:=TB2bit; IB2Status:=RBIT(IB2Status,0I);
       GetIB2:=IB2ORTA;
 END GetIS2;


COMMENT
*Outputs a single byte to IB2 -- Assume BO true and resets it;
PROCEDURE PUTIB2(OUTBYTE);  VALUE OUTBYIE;  BYTE OUTBYTE;
 BEGIN
    IB2Status:=RBIT(IB2Status,B0);
    IB2ORTA:=OUTBYTE;
 END PUIIB2;


COMMENT
*Sallous the BO signifing the last item has outputted
*Only called when there is no more output (till address to talk again);
SUBROUTINE UaitClrBO;
 BEGIN
 OO ChkIB2status UNTIL (TBIT(IB2Status,B0) OR NOT TBIT(IB2ADDMO,1))&TA&;
  IB2Status:=RBIT(IB2Status,B0);
 END UaitClrBO;


COMMENT
*Output IB2 status byte in response to Unexpected BO,
    Clear next BO, and then error out;
SUBROUTINE UnexpectedBO;
 BEGIN
    PUTIB2(IB2STA);  UaitClrBO;   MonBailout(0);
 END UnexpectedBO;
```

```
SMONITOR.UORK.PD8510          THU, DEC 22, 1983, 10:47 AM    PAGE 40

#EJECT;COMMENT
*Loops till byte outputted to selected IOdevice;
& deleted keystroke bailout &
PROCEDURE UCHAR(C);VALUE C;BYTE C;
 BEGIN
  UCHARI;
    ChkIB2status;
                                        &termbit set only if acia_avail&
   IF TBIT(IOdevice,Term)  AND TBIT(ACIASC,ACIMTx)
              THEN ACIADATA:=C
    ELSE IF TBIT(IOdevice,Key) THEN BEGIN
              LoadDisp(INTEGER(C)+XB000);
              LoadDisp(E00);
              DispAdd:=DispAdd +
                (IF (C=BS OR DispAdd>=MaxMonDisp) THEN -2 ELSE -1);
                        END
    ELSE IF (TBIT(IOdevice,IB2) AND TBIT(IB2Status,D0)) THEN PUTIB2(C)
     ELSE GO TO UCHARI;
END UCHAR;


COMMENT
*Outputs a string;
PROCEDURE USTR(SR);VALUE SR;ALPHA SR;
  BEGIN
   DOUBLE SRAdr=SR;
   BYTE POINTER BP;
   INTEGER CharCount;
     STPNTR(BP,SRAdr);
     IF NOT TBIT(IOdevice,IB2) THEN
              FOR CharCount:=1 TO SP[0] DO UCHAR(BP[CharCount]);
  END USTR ;


PROCEDURE UNUM(n);  VALUE n; INTEGER n;
BEGIN
INTEGER tens;

IF ( tens := n/10 ) = 0 THEN UCHAR( Space ) ELSE UCHAR( tens + ascii );
UCHAR( n - ( 10 * tens ) + ascii );
UCHAR( Space );
END UNUM ;


SUBROUTINE CRLF;
 BEGIN
   UCHAR(CR);
   UCHAR(LF);
   IF TBIT(IOdevice,IS2) THEN UaitClrBO;
   IF TBIT(IOdevice,Term) THEN
      BEGIN REPEAT 2000 DO RSSEMBLE( ROL.L #32,RD); END;19600 pad char&
 END CRLF;
```

```
SMONITOR.UORK.PMBG10          THU, DEC 22, 1983, 10:47 AM    PAGE 41

#EJECT;COMMENT
*Output in ASCII HEX , Rdigits = Width, with a leading space the
  value supplied, and Fill with leading zeroe ;
PROCEDURE UHex(HUM,UIDTH; INTEGER UIDTH; DOUBLE HUM;
 BEGIN
  BYTE  MCHAR;
    UCHBR(I20);
    HUM:=RLEFI(HUM,4*(9-UIDTH));
    REPEAT UIDTH DO BEGIN
      MCHAR:=HUM AND 2F;
      UCHAR(MCHAR+ (IF MCHAR<10 THEN ascii ELSE ascii_hex));
      HUM:=RLEFT(HUM,4);    END;
 END UHex ;


PROCEDURE IB2ERROR(HUM); VALUE HUM; INTEGER HUB;
BEGIN
IF (HUM<>3 AND HUM>>1) THEN DO GetUpshiftByte UNTIL CHR=LF;
END IB2ERROR;

SUBROUTINE RestoreMonValues;
BEGIN
INTEGER t=REGISTER 2;
   IF INTEGER(REAB(BRRD0)) = TRRP1S THEN URITE(BRUR0,BRIR3);
   IF FiretDispLocRJmpMonDisp THEN BEGIN
              OldFirmtDisp:=FiretDispLoc; firatDispLoc:=JmpMonDisp; END;
   t:=Clr_Uatchdog;
   IF LORD_IT=0 THEN BEGIN IOdevice:=Keybit;SoftKey=;
     END ELSE LORD_II:=0;

END RestoreMonValue;
```

```
SMONITOR.UORK.PD8S10          THU, DEC 22, 1983, 10:47 AM    PAGE 42

#EJECT;COMMENT;
PROCEDURE MonBailout(MESNUM); VALUE MESNUM; INTEGER MESNUM;
BEGIN

  IF TBIT(IOdevice,IB2) THEN IS2ERROR(MESNUM)


  ELSE IF MESNUM <0 THEN  BEGIN
             STPNTR(ATable,ADRS(MES1)); USTR(ATable[-MESNUM));
                USTR(MES1);
                UHex(PCSave,6); CRLF;
                OldCMD:="TR";  Parm):=PCSave;   END
  ELSE IF MESNUM>0 THEN
          BEGIN   STPNTR(ATable,ADRS(MES)); USTR(RTable[MESNUM]);
                USTRMES);
                IF MESNUM=4 OR MESNUM=5 THEN UHex(TPstatus,4);
                CRLF;
                IF (loop=-1 AND MESNUM=1)THEN GO TO LAO;
                END;

   IF loop # 0 THEN GO TO LA2  & occured in self test menu &
     ELSE          GO TO UaitCMD;
END;
```

```
SMONITOR.UORK.PD8510          THU, DEC 22, 1983, 10:47 AM    PAGE 43

REJECT;COMMENT Takes inputted char  and adds to buffer
       Determines if char is a backspace and does approirate action
       Then determines if char has terminated entry or buffer full
       Else Echos char
end of comment;
PROCEDURE SuildBuf(NeuChar); VALUE NeuChar; BYTE NeuChar;
BEGIN
  BUF[BufPTR]:=NeuChar;
     IF NeuCharRBS THEN BufPTR:=BufPTR+1
        ELSE IF  BufPTR>BufEnpty  THEN BEGIN
                 BuffTR:=BufPIR-1; DispAdd:=DispAdd-1;  END;
     IF NeuChar=CR OR BufPTR>=BufSize THEN
        BEOIN CRLF; BUF[BufPTR]:=LF;
              BufPTR:=0;  BufReedy:=1; END
      ELSE UCHRR(NeuChar);
END BuildBuf;

COMMENT
*Get a input byte fron either HP-IB or Terminal Buffer or Keyboard
*Normally entered uith Term selected
*Abort if HP-IB is requesting output
*If no HP-IB input and Buffer empty,
*       start building a buffer if RCIA has input, terminate on CR;
BYTE SUBROUTINE GetByte;
 BEGIN
  GetByteStart:
   ChkIB2status;
   IF TBIT(IB2Status,BI) THEN  GetByte:=GetIB2
   ELSE IF TBII(IB2Status,B0) THEN  UnexpectedBO
   ELSE IF ( (NOT TBIT(IOdevice,IB2)) AND SufReady ) THEN
          BEGIN  IF ( GetByte:=BUF[BufPTR]) = LF
                    THEN SEGIN BufReady:=0;  BufPTR:=-1; END
                 ELSE  BufPTR:=BufPIR+1;   END
   ELSE BEGIN
        IF NOT TBIT(IOdeviee,IB2) THEN
           BEGIN
           IF BufPTR<0 THEN BEGIN UCHAR(prompt); BufPTR:=0; END;
           IF RCIA_avail AND IBIT(ACIRSC,BCIRRx) THEN
                BEGIN IOdevice:=Termbit; BuildBuF(ACIADATA); END;
           IF (lopKeystat AND 2F )#0 THEN
                BEGIN IOdevice:=Keybit;
                           & decode 1/2 byte keys &
                      SIPNTR(IntPtr,AORS(KeyTable));
                      IF IntPtr[CNR:=IopKeydata)>2FF THEN
                         BuildBuf(RIGNT( IntPtr(CNR], 8) );
                      BuildBuf(IntPtr[CNR]);
                END;
           END;
        GO TO GetByteStart;
        END;

  END GetByte;
```

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REJECT;COMMENT
*Get a Byte --Clear parity, up shift any lowercase letters,
    and ignore all nonprinting except LF;
SUBROUTINE GetUpshiftByte;
  BEGIN
    DO BEGIN
        CHR:=GetByte;
        CHR:= %7F AND (IF TBIT(CHR,6) THEN RBIT(CHR,5) ELSE CHR );
      END  UNTIL (CHR=LF OR CHR>=Space);
  END;

COMMENT
*Convert a series af RSCII HEX chars to a Parm[], and if succesful
*  increment PCTR  also accept UP
*Will error out if invalid input
*If result is a 16bit result sign extend;
PROCEDURE GetHex;
 BEGIN
  INTEGER DIGITCTR;
  DOUBLE TempParm;

    DIGITCTR:=0;
    DO GetUpshiftByte UNTIL CHR=Space;

 GetHexLoop:
   IF (CHR=LF OR CHR=Space OR CHR=Comma ) THEN GO TO GetHexExit;
   IF CHR='U THEN BEGIN GetUpshiftByte; GetUpshiftByte;
                        GO TO GetHexExit; END;
   IF (CHR>=%30 AND CHR<=%39) OR (CHR>=%41 AND CHR<=%46)
        THEN BEGIN
             IF (DIGITCTR:=DIGITCTR+1)=1 THEN TempParm:=0;
             TempParm:= HLEFT(TempParm,4) + CHR
                        + (IF CHR<%40 THEN -%30 ELSE -%37);
             GetUpshiftByte;
             GO TO GetHexLoop;
             END;
   NonBailout(1); & Invalid input&

  GetHexExit:
   IF DIGITCTR # 0 THEN Parm[PCTR:=PCTR+1] :=
        (IF DIGITCTR = 4 THEN DOUBLE(INTEGER(TempParm)) ELSE TempParm);
                                    & SIGN EXTEND &
 END GetHex ;
```

```
SMONITOR.UORK.PDS510          THU, DEC 22, 1983, 10:48 RM     PAGE  45


REJECT;COMMCN1
*Fetch supplied Parm[] till none;
SUBROUTINE GetParms;
 BEGIN
   IF PCTR=0 THEN
     DO GetHex UNTIL ( (CHR=Space AND CHR#Comma) OR PCTR>=MaxParm );
   IF CMD="RG" THEN Parm1:=RBIT(Parm1,0); &ONLY EVEN ROORESSES&
 END GetParms;

COMMENT Special GetParms for GO/TR -- if PCTR=0 act PGeeve and SRsave
          Else use values in user registers
        Prevents interrupts From becoming activated upon return to
          User program if Pctr=0
end of comment;
SUBROUTINE GetParmsGO;
 BEGIN
        GetParms;
        IF PCTR > 0 THEN BEGIN  PCSeve:=Parm1;
                                IF CMD="GO" THEN  SRSave:=%2700; END;
 END GetParaaGO;

COMMENT Special GetParm for Record function -- acts defaults and
          aane temps
        The Defaults are set and overridden if entry by GetParms
                        Record Lengths
              Black       Tape     IntelMDM
                0           1         1
                1         347        1448
                2          58        372
                3          76        226
              TEST                    1   ( LAST PAGE )

                          ----      ----
                          512       2048
              SPARE       330          0
end of comment;
SUBROUTINE SetParmsRecord;
BEGIN
   Parm2:=    %1GAFF;
   Parm3:= %FFFFB000;
   Parm4:= %FFFF0CFF;
   Parm5:=   %10C000;
   Parm6:=   %1097FF;
   GetParms;
   IF PCTR=0 THEN   Parm1 := %100;
   record_blks := 3;
END GetParmsRscord;
```

```
SMONITOR.UORK.PDS510          THU, DEC 22, 1983, 10:48 RM     PAGE  46


REJECT;COMMENT
*Intialize input routines, then build a two char command code
*    will ignore non-letters
*if input is (CR)IF or UP , Restore OldCRD and modified Parm1;
SUBROUTINE GetCMD;
 BEGIN
    IF RCIR_avail THEN IOdevice := Termbit;
    loop:=0;
    IRRCE:=0; BufReady:=0;
    IF DispRdd>200 THEN DispRdd:=0;
    BufPTR:=-1;
    DO BEGIN GetUpshiftByte; CMD:=CHR; END UNTIL CMD>'@ OR CMD=LF;
    IF CMD=LF THEN CMD:="UP"
      ELSE BEGIN GetUpshiftByte; CRD:=LEFT(CMD,8)+INTEGER(CHR); END;
    IF CMD="UP" THEN
       BEGIN
         PCTR:=1;
         CMD:=OldCMD;
       END ELSE PCTR:=0;
    OldCMD:=CMD;
 END GetCMD;


COMMENT
*Dump Parm1, and Contents of memory from Parm1 to Parm1+14;
SUBROUTINE DMSub;
 BEGIN
   UHex(Parm1,6);
   REPEAT & DO BEGIN UHex(INTEGER(REAO(Parm1)),4);
                Parm1:=Parm1+2;  END;
   CRLF;
 END DMSub;

COMMENT
Sets the Old Cmd to "DM 100 " ;
SUBROUTINE SetDM100oldcmd;
  BEGIN
   PCTR:=1; OldCMD:="DM";  Parm1:=%100;
  END;

COMMENT
Displays the DM100 contents;
SUBROUTINE DM100;
BEGIN
  SetDM100oldcmd;
  DMSub;
END;
```

```
SMONIIOR.UORK.PDS510          THU, DEC 22, 1983, 10:48 RM     PAGE  47


REJECT;COMMENT
*Staring at supplied adress --Display adrast, read and display prcaent
*       memory value if "VM", request new value, if supplied then
*   change memory else go to next memory location
*Loop till error out in GetHex
a
*LOOP CNTR DISABLED TO ELIMINATE NEED FOR ERROR OUT IN %7 MON ;

SUBROUTINE ModMEMSub;
 BEGIN
   GetParms;
ModMEMloop:
   IF NOT TEST(IOdevice,IB2) THEN UHex(Parm1,6);
   IF CMD="VM" THEN BEGIN UHex(INTEGER(REAO(Parm1)),4);
                          IF TBIT(IOdevice,IB2) THEN CRLF;  END;
   PCTR:=1;
   GetHex;
   I:=DispRdd;
   loop:=1;
rptloop:IF PCTR>1 THEN UAITE(Parm1,INTEGER(Parm2));
   IF (CMD="CU" AND loopMO) THEN BEGIN
       DispRdd:=I;bailout_if_key_pressed;GO TO rptloop; END;
   loop:=0;
   Parm1:=Parm1+2;
 END ModMEMSub;
```

```
$MONITOR.WORK.PD8510          THU, DEC 22, 1983, 10:48 AM     PAGE  48


%EJECT;COMMENT;
PROCEDURE SetParmTemp(adr);       VALUE adr;     DOUBLE adr;
BEGIN
INTEGER POINTER ptr = adr;
 MOVE Parm[1] := ptr[ ( blk_ctr + 1 ) * 4 ), e(2);%move 2 doubles%
END SetParmTemp;

SUBROUTINE set_parms;
BEGIN  Parm1 := %100;
       Parm2 := Parm1 + ALEFT(DOUBLE(Tape_1_num_pages), 6 %64%) - 1;END;


SUBROUTINE cHeck_cart_in;
BEGIN
   IF IBIT(TPstatus,Cartout) THEN MonBailout(14) ;
END cHeck_cart_in;

SUBROUTINE wrt_tape_error;
 BEGIN
 check_cart_in;
 IF IBIT(TPstatus,WPR) THEN MonBailout(13) ELSE MonBailout(5);
 END;

SUBROUTINE wrt_tape_header;
 IF NOT TPWRT(BOBS(Tape_buf),64) THEN wrt_tape_error;


PROCEDURE read_tape( adr ); VALUE adr;     DOUBLE adr;
  IF NOT ( TPRED( adr, Temp3 ) AND (Temp3 = 0) ) THEN
                        BEGIN check_cart_in;  MonBailout(4);  END;

SUBROUTINE tape_blk_read;
BEGIN
   DO BEGIN
      read_tape( Parm1 );
      Parm1 := Parm1 + 256;
      END UNTIL Parm1 >= Parm2;
END tape_blk_read;


SUBROUTINE tape_blk_wrt;
BEGIN
   DO BEGIN
      IF NOT TPWRT( Parm1, 256 ) THEN wrt_tape_error;
      Parm1 := Parm1 + 256;
      END UNTIL Parm1 >= Parm2;
END tape_blk_wrt;
```

```
$MONITOR.WORK.PD8510          THU, DEC 22, 1983, 10:48 AM     PAGE  49
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$MONITOR.WORK.PD8510          THU, DEC 22, 1983, 10:48 AM     PAGE  50
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$MONITOR.WORK.PD8510          THU, DEC 22, 1983, 10:48 AM     PAGE  51
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SMONITOR.WORK.PO8510          THU, DEC 22, 1983, 10:48 AM     PAGE  52
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```
SMONITOR.WORK.PO8510          THU, DEC 22, 1983, 10:48 AM     PAGE  53

NEJECT;COMMENT;
FORCEWORE recordtape(type);          VALUE type;     INTEGER type;
BEGIN
INTEGER blks, pages;
  OldCMD := 0;
  blks := G @newR;     pages := seg_start;
  IF TBIT(IOdevice,Term)  THEN
     BEGIN
     GetParms;
     IF PCTR > 1 THEN blkt := Parm2;
     IF PCTR > 2 THEN pages:= Parm3;
     END;

  read_mbn_header;
  MOVE tape_buf := MBN_buf,*(32);
  Tape_pgm_type := type;
  Tape_1_mbn_pages := pages;
  IF blks  < MBN_0_mbn_blkt  THEN Tape_0_mbn_blks  := blks;

  IF NOT(( type = IOed_pgm ) AND ( MBN_pgm_type = IOed_pgm )) THEN
     IF BCIR_avail AND NOT IBIT(IOdevice,Key) THEN   & factory only &
        BEGIN
        IF type = correlce_pgm THEN Tape_1_mbn_pages := 0
         ELSE IF type = IOed_pgm THEN  & AND mbn is not &
              compute_boot_codes;
         @ &emb parameters  would be handled here &
        END
      ELSE ThenBailout ( 8 );  & tape recording  not allowed &

  TPINT;
  REW;

  wrt_tape_header;
  init_mbn_0;
  mbn_page := 1;
  FOR blk_ctr:=1 UNTILE (blk_ctr<=Tape_0_mbn_blks) DO
     BEGIN
     SetParmTemp(ROWS(MBN_buf));
     read_mbn_parm;
     tape_blk_wrt;
     END mbn_0 blk loop;
  IF Tape_1_mbn_pages N 0 THEN
     BECIN
     set_parms;
     init_mbn_1;
     mbn_page := 1;
     read_mbn_parm;
     tape_blk_wrt;
     END mbn_1 blk;

   REW ;

END recordtape;
```

```
SMONITOR.WORK.POS510          THU, DEC 22, 1983, 10:45 AM     PAGE  54

&FJECT:COMMENT;
SUBROUTINE CLEAR_SCREEN;
   BEGIN
   FirstDispLoc:=JmpMonDisp;
   DispAdd:=0;
   reset_DispMem;
   LoadDisp(%5000);LoadDisp(%4F00);
   reset_DispMem;
   END CLEAR_SCREEN;


PROCEDURE TIBL(I);VALUE I;INTEGER I;ENTRY;
BECIN
   CLEAR_SCREEN;
   STPNTR(RTable,ROWS(?TBL));
   IF (I&23) THEN BEGIN
      WSTR("IN ");WSTR(RTable[1-2]);WSTR(" TEST");
      END
   ELSE WSTR("ENTER KEY");
   CRLF;
END;

PROCEDURE test( J, case, loop ); VALUE case; INTEGER case, J, loop;
BEGIN
   testing := case;  & set memory location for debug if problem occured&
   CASE case
      BEGIN
      ;
      CHECKSUM(J,loop);
      RAM(J,loop);
      FPRNEL(J,loop);
      DGT(J,loop);
      DG2(J,loop);
      TIMER(J,loop);
      MPIB(J,loop);
      MPIB1(J,loop);
      TINTER(J,loop);
      RCPMPY(J,loop);
      TRCO(J,loop);
      MSMTEST(J,loop);
      BBTEST(J,loop);
   END case;

END test;
```

```
SMONITOR.WORK.PO8510          THU, DEC 22, 1983, 10:48 AM     PAGE  55

REJECT; COMMENT
*Start OF MAIN
end of comment;
MONITOR:

ASSEMBLE(  CLR.L R0; MOVE R0,MultInit1;   MOVE MultInit2,R0;
           MOVE #DS0,R0;
           RSR SetPreset;
ResetLoop: DBRR R0,ResetLoop; &DELAY&
           RSR RelMemOffset;     RSR RelPreset );

RPTCOUNT:=0;GOODCOUNT:=0;&RDCOUNT:=0;
LORD_IT:=0;


GOMOW:   & ENTRY FOR REPEAT TEST MODE &

bitflags:=0;   &set BCIR_avail,TRACE,BufReady = 0/FALSE&

COMMENT
*   AT THIS POINT IT IS NECESSARY TO VERIFY RAM OPERATION
*   AND PROM CHECKSUM
end of comment;
J:=0;loop:=0; & IF THESE TWO CELLS ARE AND THE RAM TEST
                WILL FIND THEM ANYWAY &
 ASSEMBLE( LEA &RBT.L,A5);
 CMEM_SUM;
 ASSEMBLE("&RB1 EQU *");

TN:=2;RAM(J,loop);
```

```
SMONITOR.WORK.PDBS10          &WU, DEC 22, 1983, 10:45 M1    PAGE  56


@FJECI;
ACIRInit;
I82Init;
OGInit;
DRADD:=0; IBZStatue:=0; OiaCMD:=0; BRCount:=0; BRCountSave:=0;
1receLoLin:=Z3O0C0000;      &receHiLin:=Z7FFFFFFF;


R3SEMBLE ( 1ER    $RAM8.L,03;
           MOVE.L (#3)+,0 ;
           BOVE.L (R&)+,4 );
STPNTR(OP,0);
FOR Tenp1:=2  UNTIL 47 OO OP[Tenp1]:=RORS(DTMEREception);
FOP Tenp1:=48 UNTIL 63 OO OP[Tenp1]:=0;   &Locations for BEBUG Flogs&
  ADRRESSVector:=RORS(ARDRESSException);
  IWSTR1SVecter:=INS1R1OVector;=
  &KSTRVector  :=RORS(IKSTREception);
  IRRCEVector  :=RORS(IRRCEEception);
  RBORTVect1   :=RBORTVect2;=RORS(RSORTException);
  TRAP1SVector :=RORS(IRAP16Exception);
  REFRSMVctrl  ::
  BEFRSRVeetor :=ROR3(RefreH);
  NULTIBUSTVector:=RORS(NullExceptimp);
  TAPEVector   :=RORS(TRPEntry);

STPNTR(RGSave,RORS(RG));
FOP Tenp1:=0 TO 19 OO RGSave[Tenp1]:=0;
SPSeve:=USPSeve:=&F0;      & lamp IKTIRLIZATIOK TO PREVENT USE OF ZERO&
SRSeve:=&2700;
```

```
SMONITOR.UORK.PD8S10          THU, DEC 22, 1983, 10:4& PR    PAGE  57


&EJECT;
I:=0;J:=I40;1N:=0;
loop:=0;
ERRRR(J,1,I);J:=0; &  CLEAR ERROR DISPLAY &
INC(J,J,J);    & INITIALIZE ERROR BETECT &

&   CHECK FOR STUCK KEY &

URITE( RORS(TopKeycnd),  Keyacen, TopKeyclk, ReadSensor, Keyclr );
                &    SENSOR NATRI& TODE RUTO INC  &

REPEAT 50 OO delay; & SETUP BELAY  allow a Full keyboard ecen&


KEYSIUCK:=0;
IF TOITflepKeyitat , eenear_bit) THEN BEOIN
   REPEAT S OO BEGIN
      K:=IRTEGER(IepKeydate RHO IOFF);
    & GET RDDR  &
     IF J=0 THEN GET(K,J);END;
  KEYSIUCK:=J;
  END;
topkey_init;REPERI 50 BO delay;

& CHECK FOR BAD 10 DATA OR STUCK STATUS &

IF (LEDS AND &FF)RIFF THEN BEGIN
   J:=NOT(LEDS);
   J:=(J AND IFF); & NRSK LOUER S BITS &
 BET(J,J);TN:=3;IKC(J,TN,loop); & REPORT BAD BIT &
  loop:=1;FPAREL(J,leog);& STICK IN 10 DRTR TEST &
  EHD;
```

```
SMONITOR.WORK.PDSS10          THU, DEC 22, 1983, 10:48 RM    PAGE  58


REJECT;
&  TEST FOR GROUNDED TP  &

J:=RIGHT(proc_hud_tp,S);
J:=(NOT(J));J:=(J AND I3F);
CET(J,J);
IF(J AND I3F)#O THEN BEGIN
   loop:=1;J:=J-1;

   CASE J BEGIN
      KEY_TEST;      &  1P29 &
      FPANEL(J,loop);   &  1P30 &
      CHECKSUM(J,loop); &  1P32 &
      RAM(J,loop);      &  1P28  &
      TINTER(J,loop);   &  1P27  &
      BCPMPY(J,loop);   &  1P31  &
      END tp loop caae;
   END;


J:=0;loop:=0;
```

```
SMONITOR.UORK.PD8S10          1 4  DEC 22, 1983, 10:48 RM    PAGE  59


REJECT;COMMENT ****ENTRY FOR RUTO [c.  **  ,
IOdevice:=Keybit;

OiapAdd:=0;
reeet_DiepMen;


  &SET RUTO TEST NODE&
TN:=2;          & TEST NUMBER=2 &
INC(J,IN,loop);

DO BEGIN
   test( J, TN, loop );
   INC(  J, IN, loop);
   END UNTIL TN=14;


IF KEYSTUCKHO THEN IKC(KEYSIUCK,IN,loop); & REPORT STUCK KEY &

loop:=6;INC(J,TN,loop);loop:=0; & RESTORE ANY ERROR DISPLAY &
UNILE RPTCOUNTRO DO BEGIN
   CLEAR_SCREEN;
   USTR("REPEAT LOOP"+CR+LF);
   IF JRO THEN BEGIN BRDCOUKT:=BRDCOUNT+1; END
     ELSE BEGIN GOODCOUNT:=GOODCOUNT+1;EKD;
   USTR("PASSED ");UNex(GOODCCUNT,4);CRLF;
   USTR("FAILED ");UNex(BRDCOUNT,4);CRLF;
   GO TO UaitCMO;
   END;
```

```
SMONITOR.WORK.PDS510          THU, DEC 22, 1983, 10:48 AM     PAGE 60

@EJECT;
IOdevice:=Keybit;

    & LOAD AND GO MAIN SW AFTER TESTING &
IF LOAD_IT=1 THEN BEGIN
        LOAD_IT:=X00;GO TO AUTO;END;

IF JAD THEN BEGIN CLEAR_SCREEN;
WSTR("SELF TEST FAILURE"+CR+LF);
   GO TO LA1;END;

AUTO:CLEAR_SCREEN;
STPNTR(DispMem,ADDS(FirstDispLoc));
LoadDisp(X0100);
LoadDisp(X5D0D);
LoadDisp(840BB);
IOdevice:=Keybit;
WSTR("SYSTEM INITIALIZATION IN PROGRESS"+CR+LF);

 &********* AUTO LOAD AND GO ****************** &

    Iemp:=0; & TURN OFF OPIA, DELFCT TLUG &

    IF Init_pdn_0 THEN BEGIN PCTR;=1;Parm1:=X100;loadNUM;
                                        GO TO AutoExitMonitor;   END;
```

```
SMONITOR.WORK.PDS510          THU, DEC 22, 1983, 10:48 AM     PAGE 61

@EJECT;COMMENT;
LAO:CLEAR_SCREEN;

LA1: Iemp:=0;Bailout_if_key_pressed;  & CLEAR ANY PREVIOUS FIFO DATA &
Iemp:=-1;  & RETURN TO THIS MENU IF INPUT ERRORS &


STPNTR(RTable,ADDS(TTIL));
I:=0;
WHILE I<=22 DO BEGIN        & DISPLAY TEST MENU &
   IF (I>=1 AND I<=21)THEN BEGIN
        WNUM( I ); WSTR(RTable[I]);
        IF (I<=14 OR I=17) THEN WSTR(" TEST");
        IF  I =14 THEN CRLF;     END
    ELSE WSTR(RTable[I]);                        I
   CRLF;
   I:=I+1;
   END;
C:=DispRdm;
LA2:
BufReady:=0;
BufPTR:=0;   & Initialize input buffer &
PCTR:=0;
GetHex;
B:=INTEGER(Parm1);

 & DEC/HEX CONVERT &
B:= ( RIGHT( ( B AND XOFF ) , 4 ) * 10 )  + ( B AND XOF );
PCTR:=0;


IF ((B>21) OR B<=0)  THEN  GO TO LAO;
DispRdd:=C;
WNUM(S); CRLF;
Iemp:=1;
IF B  <= 13 THEN test( 3, B, Iemp )
 ELSE BEGIN
      CASE ( B-14 )
         BEGIN
        &B=14 & KEY_TEST;
        &B=15 & BEGIN & fall thru & END;                 &LOAD FROM BUBBLE &
        &B=16 & TRAP(15);
        &B=17 & GO TO MONITOR;
        &B=18 & BEGIN RP1COUNT:=1;GO TO WaitCMD;END;
        &B=19 & BEGIN LoadTape;  END;
        &B=20 & BEGIN recordtape( IDes_pdn);  END;
        &B=21 & BEGIN IF NOT TPmark THEN wrt_tape_error; GO TO LAO; END;
         END case;
      LOAD_IT:=1;GO TO GONON;   & LOAD FROM BUBBLE &
      END else;
```

```
SMONITOR.WORK.PDS510          THU, DEC 22, 1983, 10:48 AM     PAGE 62

@EJECT;COMMENT
**********************************************************************
Start OF MAIN MONITOR
end of comment;


WaitCMD:
  ASSEMBLE(
          MOVE.L #MONU.L,3;
          MOVE.L S,R ;       &RI  =H2700,SR  );
       IF RPICOUNT=0 THEN GO TO GONOW;
    IF trap_15_type=service_trap THEN BEGIN    & SERVICE MENU &
            trap_15_type:=0;GO TO LAO;END;


SetCMD;
```

```
SMONITOR.WORK.PDS510          THU, DEC 22, 1983, 10:48 AM     PAGE 63
```

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SMONIIOR.WORK.PD&S10          THU, DEC 22, 1983, 10:48 AM    PAGE 64
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SMONIIOR.WORK.PD&S40          THU, DEC 22, 1983, 10:48 AM    PAGE &S
```

```
SMONITOR.WORK.PD&S10          THU, DEC 22, 1983, 10:48 AM    PAGE 66

@EJECT;
COMMENT
****************** MONITOR ENTRY AND EXIT ROUTINES  ******************
;
COMMENT
*Return to Moniter --- eevee the user registers
*Removes any break points
*IF a breakpoint (1RRP1S) decraments counter and checks if <0
*          if not returns to user program
*IF a trace exception but TRACE False then use a single step past
*          breakpoint, as return to user program
*IF no reason to return to user program then return to monitor
*IF break occur From Terminal - Initailize ACIA -- Send meaaages to Term
end of comment;
EnterMonitor:
 &Save RECSS
  ASSEMBLE(
         ORI    #H2700,SR;        &TURN OFF INTERRUPTS&
         MOVE.L S,SPSave;
         LEA    SPSave,S;
         MOVEM.L R0-R14,-(S);
         MOVE.L SPSave,R8;
         MOVE.U (R&)+,SRSave;
         MOVE.L (R8)+,PCSave;
         MOVE.L RS,SPSave;
         MOVE.L R8,SSPSave;
         MOVE.L USP,RS;
         MOVE.L RS,USPSave;
         MOVE.L &RAMS.L,S;
         MOVE.L S,C              );

RestoreMonValues;
              RPTCOUNT:=0; &  TURK OFF TEST REPEAT MODE &
              loop:=0;    & TURK OFF LOOP MODE &


  IF ExceptionTYPE = TRAP15Ex THEN BECIN


            IF TBIT(3RSave,TRACEBit) THEN GO TO ExitMonitor;
            PCSave:=PCSave-2;
            IF (BRCount:=BRCount-1) > 0 THEN GO TO ExitMonitorTRRCE
                ELSE MonBailout(-3);  END;
  IF ExceptionTYPE = TRRCEEx THEN
             IF TRACE THEN BECIN
                  IF ( (PC3ave<TraceLoLim) OR (PCSave>TraceHiLim])
                         THEN GO TO ExitMonitorTRACE
                         ELSE MonBailout(-2); END
                ELSE GO TO ExitMonitor;
                          &WMS AN 1 UORD TRACE BND CONTINUES
  IF ACIA_avail AND TBIT(RCIRSC,Break) THEN
    BECIM DO UNTIL NOT IBIT(RCIRSC,Break); ACIAInit; S1OPNOU;&tape&END;
  CRLF;
  MonBailout(-1);  & ABORT &
```

```
SMONIIOR.WORK.PDSSI0          THU, DEC 22, 1983, 10:4& AM    PROE 67

&GO TO UaitCMO -- OCCURS IBPLICITLY IN MonBailout &


COMMENT
*Return to user program, set either TRACE or Breakpoints if any
* restore user regs:
ExitMonitorTRACE: SRSave:=SBII(SRSave,IRACEBit);
                  GO TO RestoreREG;
AutoExitMonitor:  RSSEMBLE( MOVE.L StartAddress,PCSave );
                  SRSave:=%2700;
                  SPSave:=%FO;                  & Temp IRTIALIZATION &
ExitMonitor:
                  SRSave:=RBIT(SRSave,IRACE&it);
                  IF BRADD @ 0  THEN  BECIN
                       BRIMS:=READ(BRADD);
                       URITE(BRROD,TRAP15); END;
RestoreREC:FirstDispLoc:=OldFirstDisp;
     RSSEMBLE(
         BOVE.L USPSave,R&;
         MOVE.L RS,USP;
         LEA    RC,S;
         MOVEM.L (S)+,R0-R14;
         MOVE.L SPSave,S;
         MOVE.L PCSave,-(S);
         MOVE.U SRSave,-(S);
MullExeeption:RTE       );
```

```
$MONITOR.WORK.PDB510          THU, DEC 22, 1983, 10:48 AM    PAGE  68


%EJECT;
COMMENT ********** EXCEPTION ROUTINES **********
*
*If unexpected exception then dump stack and error out-- good luck
&
*if af expected type, save type, and go to EnterMonitor to determine
*   if to entermonitor or return to user;

INSTRException:   ExceptionTYPE:=8; GO TO ExceptionBailout;
ADDRESSException: ExceptionTYPE:=7; GO TO ExceptionBailout;
OTHERException:&ALL OUT TRAP15 AND TRACE AND ABORT&
               &STACKPOINTER AND REGS GARBAGE -- CORRECT??&
        ExceptionTYPE:=6;
ExceptionBailout:


        %ASSEMBLE ( MOVE.L %@DA8.L,G; MOVE.L S,Parm1;   BRI =N2700,SR );
        RestoreRunValues;
        DMSub;
        MonBailout(ExceptionTYPE);

TRAP15Exception:
                ExceptionTYPE:=TRAP15Ex;
                GO TO EnterMonitor;

TRACEException:
                ExceptionTYPE:=TRACEEx;
                GO TO EnterMonitor;

ABORTException:
                ExceptionTYPE:=ABORTEx;
                GO TO EnterMonitor;


END$
```

```
CMSGCAL.WORK.PDB510           THU, DEC 22, 1983, 10:48 AM    PAGE  1

INTEGER CONSTANT
  no_e_coeffs := 2024,
  cal_not_for_param := 2059,
  not_finished_caling := 2097,
  turn_correct_off := 2125,
  no_cal_in_progress := 2158,
  connect_std := 2195,
  slide_load := 2235,
  connect_thru := 2278,
  simulate_ports := 2324,
  press_done := 2371,
  press_save := 2410,
  cal_aborted := 2446,
  comp_cal_coeff := 2477,
  measuring_sts := 2504,
  select_cal_set := 2535,
  select_delete_cal_set := 2560,
  more_slides_needed := 2601,
  specify_std := 2620,
  exceeded_std_elems_limit := 2646,
  specify_std_class := 2677,
  select_std_class := 2724,
  e_file_8 := -1;
```

```
CMSGIB.WORK.PDB510            THU, DEC 22, 1983, 10:48 AM    PAGE  1

INTEGER CONSTANT
  no_output_selection := 1142,
  illegal_output_selection := 1187,
  no_input_selection := 1227,
  gpib_thru_disabled := 1272,
  gpib_thru_invalid := 1298,
  block_input_error := 1324,
  block_input_length_error := 1342,
  array_unavailable := 1367,
  e_file_6 := -1;
```

```
CMSGNBN.WORK.PDB510           THU, DEC 22, 1983, 10:48 AM    PAGE  1

INTEGER CONSTANT
  save_prompt := 813,
  saving_data := 830,
  data_saved := 839,
  save_error := 847,
  recall_prompt := 865,
  recalling_data := 884,
  data_recalled := 896,
  recall_error := 907,
  no_reg_data := 928,
  preset_macro := 939,
  last_state_macro := 952,
  data_overflow := 963,
  no_last_state := 977,
  delete_prompt := 991,
  deleting_data := 1010,
  cal_reg_cleared := 1021,
  cal_clear_error := 1033,
  nn_init_nbn := 1055,
  bubble_init_error := 1056,
  loading_data := 1057,
  invalid_nbn_data := 1070,
  e_file_4 := -1;
```

CMSGPLOT.UORK.PD8510 THU, DEC 22, 1583, 10:48 AM PAGE 1

```
INTEGER CONSTANT
  no_printer := 1087,
  plot_aborted := 1105,
  no_plotter := 1121,
  c_file_5 := -1;
```

CMSGPRIV.WORK.PD8510 THU, DEC 22, 1983, 10:49 AM PAGE 1

```
INTEGER CONSTANT
  source_ib_err := 107,
  test_set_ib_err := 127,
  priv_ib_add_err := 149,
  priv_ib_srq_err := 174,
  c_file_2 := -1;
```

CMSGTAPE.UORK.PD8510 THU, DEC 22, 1983, 10:49 AM PAGE 1

```
INTEGER CONSTANT
  no_tape := 195,
  loading_tape := 212,
  no_file_found := 225,
  initializing_tape := 240,
  tape_init := 258,
  init_aborted := 275,
  using_backup := 293,
  load_aborted := 310,
  select_tape_data := 334,
  file_error := 351,
  file_aborted := 364,
  record_macro := 379,
  rettore_macro := 386,
  delete_macro := 394,
  undelete_macro := 401,
  select_record := 410,
  select_restore := 434,
  select_file_record := 458,
  select_file_rettore := 482,
  select_file_delete := 507,
  abort_restore := 531,
  rtcording_file := 562,
  file_recorded := 677,
  no_tape_room := 591,
  deleting_file := 615,
  file_deleted := 629,
  file_undeleted := 642,
  undeleting_file := 657,
  rettoring_file := 673,
  file_rs=tored := 688,
  restore_pte_error := 702,
  restore_401_nacro := 729,
  rt=tore_201_nacro := 733,
  restore_101_nacro := 737,
  restore_51_nacro := 741,
  tape_errors := 744,
  format_nacro := 752,
  tape_urive_naero := 764,
  urite_protect_nacro := 775,
  checksun_nacro := 789,
  parity_nacro := 798,
  unknown_nacro := 805,
  c_file_3 := -1;
```

CMSGTERP.UORK.PD8510 THU, DEC 22, 1983, 10:49 AM PAGE 1

```
INTEGER CONSTANT
  invalid_nbn_data := 1116,
  plotter_stack_overflou := 1133,
  c_file_5 := -1;
```

CRSGTIME.WORK.PD8510 THU, DEC 22, 1983, 10:49 AM PAGE 1

```
INTEGER CONSTANT
  comp_time_coeff := 2757,
  eeqn_gate_coeff := 2785,
  tdr_freq_cHange := 2813,
  c_file_9 := -1;
```

CNEWLINE.WORK.PD8510 THU, DEC 22, 1983, 10:49 AM PAGE 1

```
INTEGER CONSTANT Newline      := 10; & RSCII If &
```

FNUMBER.WORK.POSS10 THU, DEC 22, 1983, 10:49 AM PAGE 1

```
INTEGER PROCEDURE get_number(token);
   VALUE token;
   INTEGER token;                                    EXTERNAL.L;
```

SNUMBER.WORK.PD8510 THU, DEC 22, 1983, 10:49 AM PAGE 1

```
M68kL,P,"number"
BEGIN

#FILE fscreen.work;
#FILE fstring.work;
#FILE ftopnisc.work;
#FILE ffifo.work;
#FILE ffifos.work;
#FILE ckeye.work;                                & for ..._token &
#FILE ccndcase.work;                  & for end_enter and end_u4 &
```

```
$NUMBER.WORK.PO&S10            THU, DEC 22, 1983, 10:49 AM    PAGE  2

$EJECT;
$YTE    &CONSTANT space         :=  ' ',
                  zero          :=  '0',
                  decpt         :=  '.',
                  minus         :=  '-',
                  backspace     :=  &;
INTEGE& CONSTANT sign_position  :=  1,
                 firstdigit     :=  2;
```

```
$NUMBER.WORK.PO&E10            THU, DEC 22, 1983, 10:49 AM    PAGE  3

&EJECT;
INTEGER PROCEDURE get_number(token);
  VALUE token;
  INTEGER token;                                              ENTRY;
  BEGIN  & get_number &
    BOOLEAN decimal;          & TRUE if a decimal has been entered  &
    &NTEGER lastch;           & location of last character in string &
    &YTE    ch;               & temporary character variable         &

    decimal  := FALSE;
    entry := clear_string(entry);
    entry := append_ch(entry, space);
    & fill new string &
    print_big_string( entry,
                      entry_size,
                      &F entry_flip_flop THEN entry_display
                                         ELSE entry2_display
                    );
    entry_flip_flop := NOT entry_flip_flop;
    & turn off old string &
    print_string( "",
                  entry_size,
                  IF entry_flip_flop THEN entry_display
                                     ELSE entry2_display
                );

    WHILE token < 0 DO    & these keys require parsing (0-9,., etc.) S
      BEGIN  & while &

        IF token <= nine_token THEN         & already know >= ztro &
          BEGIN  & numeric digit &
            lastch := entry_array[0];
            IF ((entry_array[lastch] = zero) AND
                (lastch = firstdigit)) THEN
              & do not duplicate leading zeros &
              entry_array[0] := lastch - 1;
            ch := token + zero - zero_token;  & convert to ascii &
            entry := append_ch(entry, ch);
          END numeric digit

        ELSE IF ((token = decimal_token) AND (NOT decimal)) THEN
          &EGIN  & if decimal &
            decimal := TRUE;
            entry := append_ch(entry,decpt);
          END if decimal

        ELSE IF token = backspace_token THEN
          BEGIN  & if backspace &
            ch := entry_array[ entry_array[0] ];
            entry := append_ch(entry,backspace);
            IF ch = decpt THEN
              decimal := FALSE;
            IF entry_array[0] = 0 THEN
              & always leave room for sign &
              entry := append_ch(entry,space);
          END if backspace
```

```
$NUMBER.WORK.PO&S10            THU, DEC 22, 1983, 10:49 AM    PAGE  4

        ELSE IF token = minus_token THEN
          & accept a sign at any time (complement) &
          BEGIN  & if minus &
            IF entry_array[sign_position] = minus THEN
              entry_array[sign_position] := space
            ELSE
              entry_array[sign_position] := minus;
          END if Minus

        ELSE
          & signal, but otherwise ignore multiple "."s            &
          beep(error_tone);

        & fill new string &
        print_big_string( entry,
                          entry_size,
                          IF entry_flip_flop THEN entry_display
                                             ELSE entry2_display
                        );
        entry_flip_flop := NOT entry_flip_flop;
        & turn off old string &
        print_string( "",
                      entry_size,
                      IF entry_flip_flop THEN entry_display
                                         ELSE entry2_display
                    );
        token := read_fifo( keyboard_fifo );
      END while;

    &F ((token <= end_ut) AND (token >= end_entry)) THEN
      get_number := token
    ELSE                        & abort number and return new token &
      BEGIN & else &
        & fill new string &
        print_big_string( clear_string(entry),
                          entry_size,
                          IF entry_flip_flop THEN entry_display
                                             ELSE entry2_display
                        );
        entry_flip_flop := NOT entry_flip_flop;
        & turn off old string &
        print_string( "",
                      entry_size,
                      &F entry_flip_flop THEN entry_display
                                         ELSE entry2_display
                    );
        get_number := token;
      END;  & else &

  END get_number;

&END$
```

```
LOADMAP.WORK.PO&S10            THU, DEC 22, 1983, 10:49 AM    PAGE  1
```

```
LOADSORI.WORK.PD8510          THU, DEC 22, 1983, 10:51 AM    PAGE
```


```
LOADSORI.WORK.PD8510          THU, DEC 22, 1983, 10:51 AM    PAGE
```


```
LOADSORT.WORK.PD8510          THU, DEC 22, 1983, 10:51 AM    PAGE
```

```
SORTMAN.WORK.PD8510           THU, DEC 22, 1983, 10:51 AM    PAGE  1


!JOB jobisbn,LISOR.PD8510,work;PRI=C3;CNTCLASS=,1
!MG&KP SwtBA.work  ,RwMBA.work  ,,15
!BG&KP SIMBA.work  ,RIRBA.work  ,,15
!MB&KP SIIBMO.work ,RIMBMO.work ,,15
!MG&KP SIMBA2.work ,RIMBK2.work ,,15
!MG3KP SIMMA3.work ,RIMBA9.work ,,15
!BB3KP SIMAIM.work ,KIMBA4.work ,,15
!BG&KF SIMAA5.work ,RIMBA5.work ,,15
!MB&KP SIMBA6.work ,RIMBA6.work ,,15
!MB&KP SIM&M8.work ,RIBM8.work ,,15
!MG3KP SIM&MA.work ,RIMBAA.work ,,15
!MB&KP SIMBAC.work ,RIMOAC.work ,,15
!LIMK88K OIMMA.work,,MBMMAP,13
RIMBA.work,
RIMBMO.work,
RIMMA2.work,
RIMBA3.work,
MIBBAA.work,
&IMEM5.work,
RIMBA6.work,
RIMBA8.work,
&IMBA9.work,
RIMBAC.work,
/E
&OA=&OOM RAM=&OOH;
IMBA:   MOLOAD;
IMBMO: RMIN=OFFEH;       &FE MA FC SIRRTING ROORESS DEPEND OK IF  &
IMBA2: MAIN=11FCH;       &COMPLIER BWARCH R 31A&1 OF CODE IS LONG  &
IMBA3: MBIN=12FCH;       &OR SMORT -- ENTRY POINTS SHOULD BE ON OO &
IMBAA: MAIN=13FCH;
IMBA5: MRIN=14FEH;
IMBA6: MRIN=15FCH;
IMBA8: MAIN=17FEH;
IMBAA: MRIN=19FCH;
IMBAC: MBIK=1BFCH;
!TELL JTB.PD8510 --- MBA job done
!TELL LIMBA.PD8510 --- MBA job Mone
```

```
JOBRON.WORK.PDBS10              THU, DEC 22, 1983, 10:51 AM     PAGE  1


!JOB jobnon,LIBRN.PDSS10,work ;OUTCLASS=,1;PRI=CS
!BP    caasbig.work
!KP    intrpt.work
!M68KP SXT8CO.work,RX18CO.work
#PURGE RMONTENP
!BUILD RMONtenp.work;OISC=T27,32,1;REC=-1276,,V,RSCII
!FILE M6SKOLLR=M68KDLLR.M68K.UPSOFT
!EXECUTE M68KL.M6SK.UPSOFT,SMONITOR.work,inontenp.work,$NULL,15
!EO
E RMONtenp.work
/RSM8,L/
S/RSM8,L/RSM6/
/G REG 13/
S/G REG 13/G REG 12/
/BSS 8/
S/BSS 8/BSS 12/
/$RRM8,$/
S/$RRM$,$/$RAM8.L,3/
U RMONtenp.work
D
#R3M6SK RMONtenp.work,RMONITOR.work,$NULL
!LINK6SK ONONITOR.work,,MUNMAP,10
RMDBIIOR.work,
RCOMM.work,
RINTRPT.work,
RCRSFBIG.work,
/E
RDB=BOOOOH RAM=1FF7OH;
!PURGE RDBMtenp
!TELL jtb.PDBS10       ****  RMNITOR COMPLETED  *****
!TELL librn.PDBS10      ****  MONIIOR COMPLETED  *****
```

```
MONMAP.WORK.PD8510              TMU, DEC 22, 1983, 10:51 PM     PAGE  1


M68KLDR(9.6.83)     FRI, DEC  9, 1983,  3:29 PM
 NAME   NRIN LIMIIS        BASE PAGE            RAM

 monit 080000C 0S3E36       080000 080000C       000000 00027R
       FRI, DEC  9, 1983,  3:27 PM  LIBRN   PD8510

 xmbn  083E36 083E9R        080000 080000C       00027N 00027R
       FRI, DEC  9, 1983,  7:13 RM  LIBRN   PD8510

 intrp 0S3E9R 083FD2        080000 080000C       00027R 00027R
       FRI, DEC  9, 1983,  3:21 PM  LIBRN   PD8510

 bigca 083FD2 083FER        080000 080000C       00027R 00027R
       FRI, DEC  9, 1983,  3:21 PM   MAKE CRLL PEL ONM LONG


       LATEST DATE: FRI, DEC  9, 1983,  3:27 PM

       INITIAL STACK POINTER / GLOBAL REG = 01FCF6


 $RAM$       080000  ACPRPY      081D7E  RODCP       FFF80E  RDOFP       FFF836
 ADDLF       FFF918  BBIES1      0812EE  CASE        083FD2  CMEC$SUM    081CA4
 CPIMV       FFF9CC  CPKNR       FFF9RR  DRDLF       FFF9E0  DRTR_TEST   0810BC
 DG1         081524  OG2         081580  OGInit      081F9E  OIVFP       FFF91E
 ERROR       081B6E  FPRMEL      081CE8  GET         0819R8  MPIB         081424
 MPIB1       0814R4  IFCRM       FFF976  IMC         081E08  RET_TEST     080F2E
 LLDRO       FFF906  LLDR2       FFF90R  LLDMY       FFT90E  MBMTEST     08115C
 BCPDIV      FFF992  MCPMP       FFF98E  MDBDG       FFF926  MDOFR       FFF86C
 MDFR        FFF8dA  MOSFR       FFF894  MIMIP       FFF800  MPLOG       FFF942
 MPLOG       FFF8CB  MPYRV       FFF9R4  RPYDI       FFFSFR  hPYFP       FFF82E
 MPYLF       FFF914  RRLDG       FFF930  B3HFT       FFF950  fMNRM       FFF922
 Multinit1   FFFS16  Multinit2   FFF81C  RAM         081B8E  BOEXP       FFF912
 REU         080BFd  Reed_body   000254  Refrah      080EC2  SERV        08190R
 SUBCP       FFF81E  SUBFP       FFF840  SUBLF       FFT91R  TRCO        0S18D4
 TRCObodyck  000278  TRCOcheekeunFFFE00  TRCOcnd     FFFE04  TRCOdata    FFFE06
 TRCOheadck  000274  TRCOstatup  FFFE04  TRCOtach    FFFE02  TRCOthres   FFFE00
 TIMER       081732  TINTER      0819FR  TLSL        OS2EB4  TPCnd       00025C
 TPError     000262  TPINT       080458R TPIna       00025R  TPRED       0806C0
 TPURI       080710  IPbodyck    000276  IPerrnun    00026R  TPFileud    00026C
 TPheadck    000272  TPlenud     000270  TPreedy     OS04CB  TPrec       0002E8
 TPrecud     00026E  TPatatue    000265  Tach        00025E  Uait        000260
 XFM2P       FFF8R4  XFR2Q       FFF3DR  bailout_iF_MOS100Cs bitflaga   00002C
 init_nbn    083E3B  irack       083FRE  iradr       OS3F2C  irclr       OS3F9E
 irdia       083F96  iren        083F8E  irint       083E9E  irirr       083FC2
 irrdy       OS3F86  iraet       OS3FR6  nbn_nice_etaFFFC00g nbn_grgn_ataF9FC00
 nbn_sub_prgnFFFC00  parne_nbn   OS3E5E  read_boot_nb083ES6  read_nbn    083E76
 eet_add_nbn 083E66  ptatue_nbn  083E6E  test_nbn    083E56  wrt_boot_nbn083E8E
 urt_nbn     083E7E

 NSPMAX=2 MSPMRX=4 SSPMRN=1394 BSPMAN=109 ESPMAX=120 FSPMAX=4
 LSPMAX=28 MSPMAX=0
ELAPSED TIME 0:09
CPU TIME 0:01
```

```
FOUTIB.UORK.PD8510              TMU, DEC 22, 1983, 10:51 RM     PAGE  1


PROCEDURE output_status;                                    EXTERNAL.L;
PROCEDURE output_block (arc, src_Fermat, deat_format);
  VALUE orc,ire_format,dest_Format; OOUBLE arc;
  INTEGER arc_format, dest_format;                          EXTERNAL.L;
PROCEDURE wrt_pubib_string (etring);
  VRLUE etring;  ALPHA string;                              EXTERNAL.L;
BOOLEAN SUBROUTINE next_efer_ready;                         EXTERNAL.L;
BOOLEAN PROCEDURE etring_out_ok (etring);
  VALUE etring;  ALPHA etring;                              EXTERNAL.L;
PROCEDURE hpib_talker;                                      EXTERNAL.L;
```

```
SOUTIB.UORK.PD8510              IMU, DEC 22, 1983, 10:51 RM     PAGE  1


M68KL,P,"outI8"

BEGIN

#FILE Ftern.work;  $ debug &
#FILE cdebug.work; $ debug &
#FILE futil.work;  & renove when all output connands arc inplenented $
#FiLE futil2.work; $ will need cneeaage.work iF FUTIL.UORK ie renoved $
#FILE cide.work;
#FILE crine.work;
#FILE Fconnand.work;
#FILE fkernel.work;
#FILE fkernel4.work;
#FILE FFifo.work;
#FILE FFifoe.work;
#FILE Fpubib.work;
#FILE fnenngr.work;
#FILE faiee.work;
#FILE fdiapran.work;
#FILE cparaer.work;
#FILE coutput.work;

GLOBAL INTEGER
  outbuf_ptr,                   & output data block buffer pointer    &
  block_out_lgth;               $ output data block length (# bytee)  &

GLOBAL 6YIE POINTER
  outbuf;                       $ output data block urite arce. (talk) &

BYTE
  io_baae           = XFFFFFE01,
  eerial_poll_reg   = io_baee+X26,
  data_out_reg      = io_base+Z20;


GLOBAL BOOLEAN
  byte_avail,                   & flag to atart blocking BO interrupts &
  device_clear;                 $ Flag indicating DVC interrupt eent   $
```

```
$OUTIB.WORK.PD8510          THU, DEC 22, 1983, 10:51 AM    PAGE  2

$EJECT;
COMMENT
$DOC+

NAME--
  string_out_ok
*****************************************************************************
*
* SHORT DESCRIPTION--
*   outputs a string of ASCII bytes over public HPIB
*
* EXTENDED DESCRIPTION--
*   This routine outputs a string over public HPIB by setting the
*   byte count to be transferred (block_out_lgth) and the pointer to
*   each byte of the string to be written to the chip.  It writes the
*   first byte to the chip which, when read from the chip, enables
*   successive bytes (up to block_out_lgth bytes) to be written via the
*   interrupt routine (public_HPIB).  It then waits on the signal,
*   block_write_done, which indicates that either block_out_lgth bytes
*   were written (successful string output) or a device clear was done
*   (unsuccessful string output), and returns the status of the string
*   transfer accordingly.
*
* INPUTS--  string = output string
*
* OUTPUTS--  status of string transfer (TRUE=successful, FALSE=failed)
*
* ROUTINES CALLED--
*   wait
*   send
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*   This routine is used to output active function strings, learn
*   strings, and ASCII formatted data point values, etc.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set number of bytes to be output (block_out_lgth)
*   set byte pointer to first byte of string (outbuf_ptr)
*   write first byte of string to chip
*   if block_out_lgth > 1 then
*     wait for block_write_done signal
*     set return value of routine (successful/unsuccesful transfer)
*     if device clear then
*       send dvc_done signal to indicate string transfer aborted
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
```

```
$OUTIB.WORK.PD8510          THU, DEC 22, 1983, 10:51 AM    PAGE  3

DECLARATION--
;
BOOLEAN PROCEDURE string_out_ok (string);
  VALUE string;  ALPHA string;                                  ENTRY;
&
$DOC-&

BEGIN
  DOUBLE ttr_addr=string;
  STPNTR (outbuf,str_addr);
  & get length byte of string and mask out sign extension &
  block_out_lgth := (block_out_lgth:=outbuf[0&]) AND X00ff;
  IF BD_debug THEN
  BEGIN
    WHEX(block_out_lgth); WSTR(" >"); WSTR(string); WSTR("<");
    CRLF;
  END;
  IF block_out_lgth > 0 THEN
    BEGIN
      outbuf_ptr := 1;
      IF byte_avail THEN
        data_out_reg := outbuf [1];              & write out 1st byte &
      IF block_out_lgth > 1 THEN
        BEGIN
          wait (block_write_done);
          IF device_clear THEN
            send (bvc_done);
        END;
    END;
  IF BD_debug THEN
    BEGIN WSTR("end string"); CRLF; END;
  string_out_ok := byte_avail AND NOT device_clear;
END string_out_ok;
```

```
$OUTIB.WORK.PD8510          THU, DEC 22, 1983, 10:51 AM    PAGE  4

$EJECT;
COMMENT
$DOC+

NAME--
  wrt_pubib_string
*****************************************************************************
*
* SHORT DESCRIPTION-- outputs a string to HPIB
*
* EXTENDED DESCRIPTION--
*   This routine is invoked by command upon parsing a command which
*   requires a string to be written to a remote controller (via HPIB).
*   After acquiring the public HPIB resource an output flag, byte_avail,
*   is set prior to interrupts which allows successive output bytes to
*   be written to the chip.  The output string is then sent to a string
*   outputting routine which returns the status of the string transfer
*   over HPIB (TRUE = successful, FALSE = unsuccessful).
*
* INPUTS--
*   string = output string to be written to HPIB
*
* OUTPUTS--
*   output string to HPIB
*
* ROUTINES CALLED--
*   acquire
*   release
*   string_out_ok
*
* ERROR CONDITIONS AND RECOVERY--
*   The parameter, string, must include a line feed as the last
*   character, otherwise depending on the controller, the bus will
*   continually wait for the next byte to be sent.
*   An output string should not exceed ?? bytes in length.
*   A null string parameter will issue an SRQ ????
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   acquire public HPIB resource
*   set flag to process byte out interrupts (byte_avail)
*   if string was output successfully then
*     reset byte_avail flag to stop processing byte out interrupts
*   release public HPIB resource
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
```

```
$OUTIB.WORK.PD8510          THU, DEC 22, 1983, 10:51 AM    PAGE  5

;
PROCEDURE wrt_pubib_string (string);
  VALUE string;  ALPHA string;                                  ENTRY;
&
$DOC-&

BEGIN
  acquire (pubib_output);
  byte_avail := TRUE;
  string_out_ok(string);
  byte_avail := FALSE;
  release (pubib_output);
END wrt_pubib_string;
```

```
$OUTIB.WORK.PD8510              THU, DEC 22, 1983, 10:51 AM     PAGE   5


%EJECT;
COMMENT
$DOC+

NAME--
  output_ob
*****************************************************************************
*
* SHORT DESCRIPTION--
*   outpute a buffer of data
*
* EXTENDED DESCRIPIION--
*   This function outpute a data buffer addreeeed by outbuf and
*   outbuf_ptr.  The buffer aize ia determined by block_out_lgth bytee.
*   It uritee the firet byte to the HPIB chip uhich initiates a aeriea
*   of interrupts until block_out_lgth bytee fron outbuf have been
*   written.  The function rcturne IRUE if all bytee are output success-
*   fully, and fALSE if otheruiae (i.e. device clear).
*
* IMPUTS--  none
*
* OUTPUTS--
*   TRUE  = all bytes transferred successfully
*   fALSE = incomplete data $ransfer
*
* ROUTIMES CALLED--
*   wait
*   aend
*
* ERROR CBNDITIONS RNO RECOVERY--
*
* NOTES--
*   This routine ie ueed for high apeed data transfers to HPIB.
*   The buffer (outbuf) can be an individual string, preamble data block
*   length uord, postamble data block information, partial or entire
*   data blocks.
*
* ROTHOR--
*
*****************************************************************************
*
* IWITIAL REFIWEMENT--
*   eet buffer pointer (outbuf_ptr) to 0 (Tet data byte)
*   urite firet data byte to HPIB
*   IF buffer size (block_out_lgth) > 0 THEN
*     uait until all bytee are traneferred or
*     data tranefer ia aborted
*     IF devcie clear occured THEN
*       aend aignal to acknouledge the device clear
*   aaaign atatua of data buffer transfer to function result
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
```

```
SOUTIB.WORK.PD8510              TNU, DEC 22, 1983, 10:51 RM     PAGE   7


DECLARATION--
;
BOOLEAN SUBROUTIME output_ok;
&
$DOC-&

BEGIN
  IF byte_avail THEN
  BEGIN
    outbuf_ptr := 0;                & reset ptr for outputting buffer &
    data_out_reg :* outbuf&0&;      & urite iet data byte to chip     &
    IF block_out_lgth > 0 THEN
    BEGIN
      uait (block_urite_done);
      IF device_clear THEN
        send (dve_done);
    END;
    IF BO_debug THEN
      BEGIN UHEX(block_out_lgth); USTR(" bytee out"); CRLF; END;
  END;
  output_ok := byte_avail;
END output_ok;
```

```
$OUTIB.WORK.PD8510              TNU, DEC 22, 1583, 10:51 RM     PAGE   8


%EJECT;
COMMENT
SDOC+

WRNE--
  next_afer_ready
*****************************************************************************
*
* SHORT DESCRIPIION--
*
* ENTENDED DESCRIPTION--
*
* IKPUTS--
*
* OUTPUIS--
*
* ROUTIMES CALLED--
*
* ERROR CONDITIONS RNO RECOVERY--
*
* NOTES--
*
* RUTHOR--
*
*****************************************************************************
*
* INIIIAL REFIWEMENT--
*
*****************************************************************************
*
* REVISION LDC--
*
*****************************************************************************
DECLARATION--
;
BOOLEAN SUBROUIIME next_afer_ready;                             ENTRY;
&
$DOC-&

BECIN
  & uait for BO interrupt after last byte of last afer &
  bO
  UhTIL (outbuf_ptr>block_out_lgth) OR
    NOT byte_avail OR device_clear;
  next_afer_ready := byte_avail AND NOT device_clear;
  IF out_ib_debug THEN
    BEGIN
      IF NOT byte_avail OR device_clear THEN
        USTR("abort block afer")   ELSE
        USTR("ready for block afer");
      CRLF;
    END;
END next_afer_ready;
```

```
SOUTIB.UORK.PD8510              TKU, DEC 22, 1983, 10:51 RM     PAGE   9


%EJECT;
COMMENT
$DOC+

WRNE--
  output_preanble
*****************************************************************************
*
* SNORT OESCRIPIION--
*   Outpute data block preenble information
*
* EXTENDED DESCRIPTION--
*   This routine outpute preenble information indicating that a block of
*   data ie to follou.  It contains "RR" followed by the nunber of bytee
*   the data block contains.  Thia followa the IEEE 728 etandard for
*   outputting a block of data.
*
* IMPUTS--
*   lgth * nunber of bytes of data to be output
*
* OUTPUTS--
*   TRUE  = if preenble information uae succeeafully output ever the
*           public bue and there are nore than zero bytes to output
*   FALSE * if preenble information failed to be output or no bytee of
*           data are to be output
*
* ROUTIMES CALLED--
*   output_ok
*   next_afer_ready
*
* ERROR CONDITIONS RNO RECOVERY--
*
* NOTES--
*   Thia routine ehould only be invoked by output routinea uhich use the
*   IEEE 728 data block I/O protocol.  The routinea uhich output 8510
*   internal binary format (3-uord conplex) or IEEE 32- or B4-bit
*   floating point format use thia nethod of traneferring data over the
*   public HP-IB.
*
* RUTHOR--
*
*****************************************************************************
*
* INIIIRL REFIWEMENT--
*   eetup 4 bytes for preenble information (preenble)
*   put "RR" in the upper 2 bytes
*   put nunber of data bytes in louer 4 bytes
*   set the nunber of bytes to be output to 4  (block_out_lgth)
*   set the data output pointer to the preenble information (outbuf_ptr)
*   set flag that indicates a block transfer   (byte_avail)
*   call routine to output preenble information
*   IF preanble information is output successully and nunber of data
*     data bytes to transfer > 0 THEN
*       return TRUE
*     ELSE
*       return FALSE
```

```
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!
!*************************************************************************
!
! REVISION LOG--
!
!*************************************************************************
DECLARATION--
;
BOOLEAN PROCEDURE output_preamble(lgth); VALUE lgth; INTEGER lgth;
&
$DOC-&

BEGIN
  DOUBLE preamble;
  IF BD_debug THEN
    BEGIN
      WSTR("output lgth"); WHEX(lgth); CRLF;
    END;
  preamble := %23%10000 OR lgth;          ! NR (%2341) followed by lgth &
  block_out_lgth := 3;
  STPNTR (outbuf, ADRS(preamble));
  byte_avail := TRUE;
  output_preamble := IF output_ok AND (lgth > 0) THEN
                       next_xfer_ready
                     ELSE
                       FALSE;
END output_preamble;
```

```
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!EJECT;
COMMENT
$DOC+

NAME--
  dump_binary
!*************************************************************************
!
! SHORT DESCRIPTION--
!
! EXTENDED DESCRIPTION--
!
! INPUTS--
!
! OUTPUTS--
!
! ROUTINES CALLED--
!
! ERROR CONDITIONS AND RECOVERY--
!
! NOTES--
!
! AUTHOR--
!
!*************************************************************************
!
! INITIAL REFINEMENT--
!
!*************************************************************************
!
! REVISION LOG--
!
!*************************************************************************
DECLARATION--
;
PROCEDURE dump_binary (src,lgth);
  VALUE src, lgth; DOUBLE src; INTEGER lgth;
&
$DOC-&

BEGIN
  STPNTR (outbuf,src);
  block_out_lgth := lgth-1;
  output_ok;
END dump_binary;
```

```
SOUTIB.WORK.PD8S10              THU, DEC 22, 1983, 10:51 AM     PAGE  12

!EJECT;
COMMENT
$DOC+

NAME--
  dump_ieee
!*************************************************************************
!
! SHORT DESCRIPTION--  output IEEE binary floating point format
!
! EXTENDED DESCRIPTION--
!   This routine will convert our internal binary floating point
!   representations to IEEE binary floating format, buffer the converted
!   values, and output each buffer until the requested data block has
!   been converted.  The 2 binary floating point representations that
!   can be converted to IEEE format are our 3-word complex (48 bits) and
!   our 32-bit reals.  Integer values are output as straight binary
!   2's complement format (via dump_binary).
!
!   The IEEE binary floating point format will be output in either
!   32 bits or 64 bits depending on the desired IEEE output format.
!
!   Removal of IEEE floating pt. buffer will slow the data transfer
!   rate by a factor of at least 3.
!
! INPUTS--
!   src      ! address of data block to be output
!   lgth     ! number of points in data block (src)
!   src_type = internal data type of each point (i.e. 32/48-bit format)
!   dest_type= IEEE output width (i.e. 32-bit single, 64-bit double)
!
! OUTPUTS--
!   IEEE binary floating point representation of outputted data block
!
! ROUTINES CALLED--
!   dump_binary
!   output_ok
!
! ERROR CONDITIONS AND RECOVERY--
!
! NOTES--
!   IEEE (single precision) binary floating point format is as follows:
!
!       +-----------------------------------------+
!       | +/- |    exponent     |     mantissa      |
!       +-----------------------------------------+
!         31   30               23 22               0
!
!   32-bit format w/ 1-bit sign, 8-bit biased exponent, 23-bit fraction
!   whose complete value n is interpreted as follows:
!       (a) if exp=255 and mant<>0 then n=not a number
!       (b) if exp=255 and mant=0  then n=(-1)^s*(infinity)
!       (c) if 0<exp<255 then n=(-1)^s*2^(exp-127)*(1.mant)
!       (d) if exp=0 and mant<>0 then n=(-1)^s*2^(-126)*(0.mant)
!       (e) if exp=0 and f=0 then n=(-1)^s*0
!
```

```
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!   IEEE (double precision) binary floating point format is as follows:
!
!       +-----------------------------------------+
!       | +/- |    exponent     |     mantissa      |
!       +-----------------------------------------+
!         63   62               52 51               0
!
!   64-bit format w/ 1-bit sign, 11-bit biased exponent, 52-bit fraction
!   whose complete value n is interpreted as follows:
!       (a) if exp=2047 and mant<>0 then n=not a number
!       (b) if exp=2047 and mant=0  then n=(-1)^s*(infinity)
!       (c) if 0<exp<2047 then n=(-1)^s*2^(exp-1023)*(1.mant)
!       (d) if exp=0 and mant<>0 then n=(-1)^s*2^(-1022)*(0.mant)
!       (e) if exp=0 and f=0 then n=(-1)^s*0
!
!   (re: COMPUTER, March 1981, pp 51-62 (IEEE journal))
!
! AUTHOR--
!
!*************************************************************************
!
! INITIAL REFINEMENT--
!
!*************************************************************************
!
! REVISION LOG--
!
!*************************************************************************
DECLARATION--
;
PROCEDURE dump_ieee (src,lgth,src_type,dest_type);
  VALUE src,lgth,src_type,dest_type;
  DOUBLE src; INTEGER lgth,src_type,dest_type;
&
&DOC-&

BEGIN

  INTEGER CONSTANT max_buf := 512;        ! # bytes of buffer &
  INTEGER POINTER data_blk=src;
  DOUBLE data_base, data_buffer;
  DOUBLE hi_word, lo_word;
  INTEGER mantissa=lo_word+2,
          iten_cnt,  ! tracks the number of points converted  &
          i,         ! pointer to current value in data block &
          x,         ! pointer to current byte in data buffer &
          width,     ! # bytes per IEEE value                 &
          i_debug,
          bias, shft, exp_copy, exponent = hi_word;
  BYTE sign_ext;
  BOOLEAN max_exp, neg_mant, buffer_ok;

  !-------------------------------------------------------------!

  SUBROUTINE deer_exp;
  BEGIN
```

```
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    nantissa := LEFT (nantissa,1);
    exponent :* exponent - 1;
  END decr_exp;

  &-------------------------------------------------------------&

  BOOLERH SUBROUTIME neu_fornat;
  BEGIN
    IF nantissa=0 THEH
      exponent := 0
    ELSE
      BEGIN
        IF (neg_nant:*(nantissa < 0)) THEH
          BEGIN
            IF nantissa = %8000 THEH     & nax. neg. nantissa (-32768) &
              BEGIN                       & fix nantissa to be negated &
                nantissa := ARIGHT (nantiosa,1);     & to pos. value &
                exponent := exponent + 1;            & adjust exponent &
              EHD;
            nantissa :* -nantisea;     & negate to get positive nunber &
          EHD;
        nantissa := LEFT(nantissa,1);              & shift out sign bit &
        IF nax_exp THEH                & fix sign/nag. nantissa fornat &
          nantissa := RIGHT(nantissa,1);       & for nax. neg. exponent &
        WHILE HOT TBIT(nantissa,15) AHD (exponent > 0) DO
          decr_exp;
        IF (exponent > 0) THEH
          decr_exp;                    & shift out implicit 1   &
        lo_uord :* LEFT (lo_uord,shft);          & align nantissa &
        hi_uerd := LEFT (hi_uord,shft);          & align exponent &
        IF neg_nant THEH               & sign bit for nantissa  &
          hi_word := SBIT (hi_uord, 31);
        hi_uord := hi_uord OR lo_uord;  & combine exp. and nant. &
      EHD;
    data_buffer := urt_diep_dbl (data_buffer, hi_word);
    x := x+4;
    IF dest_type = output_ieee_double THEH
      BEGIN                            & pad out precision w/ 0 &
        data_buffer :* urt_diep_dbl (data_buffer, 0);
        x := x+4;
      EHD;
    IF out_ib_debug THEH
      BEGIN
        FOR i_debug := i TO i+2 DO
          UHEH(data_blk[i_debug]);
        WHEH(iten_cnt); WHex(hi_word,8); CRLF;
      EHD;
    hi_uord := lo_uord := 0;
    IF (iten_cnt=lgth) OR (x=nax_buf) THEH
      BEGIN                          & buffer full or end of data block &
        black_out_lgth := x-1;
        STPHTR (outbuf, data_base);
        new_format := cutput_ok;
        data_buffer := data_base;      & reset to beginning of buffer &
        x := 0;
      EHD
```

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    ELSE
      new_fornat := TRUE;
  EHD new_fornat;

  &-------------------------------------------------------------&

  IF BO_debug THEH
    BEGIH USTR("IEEE output"); CRLF; EHD;
  IF (data_base:=data_buffer:=request_nenory(nax_buf)) = 0 THEH
    fatal (exceeded_available_nenory)
  ELSE
    BEGIH
      hi_uord := lo_uord :=0;
      i := x := iten_cnt := 0;
      buffer_ok:=TRUE;
      IF dest_type = output_ieee_double THEH
        BEGIH
          bias := 1023;
          shft := 4;
          uidth:= 8;
        EHD
      ELSE  & output_ieee_single = 32-bit format 8
        BEGIH
          bias :* 127;
          shft := 7;
          uidth:= 4;
        EHD;
      IF src_type = output_fron_integer THEH
        dunp_binary (src,lgth)
      ELSE
      IF sre_type = output_fron_user3 THEH
        BEGIH
          WHILE (iten_cnt < lgth) AHD buffer_ok DO
          BEGIH
            exponent :* (sign_ext:=data_blk[i+2]) + bias;
            IF (nax_exp := (exponent < 0)) THEH
              exponent := exponent + t;      & nax ieee exponent value &
            exp_copy :* exponent;
            nantissa :* data_blk[i+1];   & get nantissa of real nunber &
            iten_cnt := iten_ent + uidth;  & point to next real number &
            IF (buffer_ok:=neu_fornat) THEH
              BEGIH
                exponent := exp_copy;
                nantissa := data_bik[i];      & get inag part of value &
                iten_cnt := iten_ent + uidth;
                buffer_ok := neu_fornat;
              EHD;
            i := i+3;                & point to next 3-word conplex   &
          EHD;
        EHD;
      release_nenory (data_base);
    EHD nenory request ok;

END dunp_ieee;
```

```
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$EJECT;
COMMENT
$DOC+

HAME--
  dunp_ascii
*****************************************************************************
*
* SHORT DESCRIPTION--
*   output data block in ASCII fornat
*
* EXTENDED DESCRIPTION--
*   This routine uill output a block of data in uhich each data point
*   will be output as an RSCII string (separated by linefeeds).
*   Each data point uill be individually converted to RSCII strings and
*   output to HPIB.  Complex data points uill be output as a string of
*   real/inag pairs.
*
* IMPUTS--
*   src     = address of data block to output
*   lgth    = nunber of ASCII strings being output
*   src_type = internal fornat of data block to convert to ASCII
*
* OUTPUTS--
*   ASCII bytes to HPIB
*
* ROUTIHES CALLED--
*   next_xfer_ready
*   append_ch
*   fornat_3_cnpx
*   format_real
*   format_integer
*
* ERROR CONDITIONS AND RECOVERY--
*
* HOTES--
*   Strings output contain 18 characters (this includes decinal point,
*   sign, and exponent).
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFIKEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARRATION--
;
PROCEDURE dunp_ascii (src,lgth,src_type);
  VALUE src,lgth,src_type;  DOUBLE src;  INTEGER lgth,src_type;
&
$DOC-&
```

```
SOUTIB.UORK.PDS510          THU, DEC 22, 1983, 10:51 RM     PAGE 17


BEGIH

  WFILE ffnt.uork;
  WFILE fstring.work;
  IHTEGER COHSTRHT nax_lgth := 40;
  DOUBLE COHSTAHT fnt_code := X3000120R;              & str uidth = 18 &
  INTEGER data_ptr;
  BYTE ARRAY ascii [-1:nax_lgth];
  RLPHR str_value;

  BOOLEAH SUBROUTINE string_sent;
  BEGIH
    append_ch (str_value,10);          & append LF &
    IF (byte_avail := next_xfer_ready) THEH
      string_sent := string_out_ok (str_value)
    ELSE
      string_sent := FRLSE;
  EHD string_sent;

  IF SO_debug THEH
    BEGIH USTR("ASCII output"); CRLF; EHD;
  ascii[-1] :* nax_lgth;
  str_value := RORS(ascii);
  data_ptr := outbuf_otr := 0;
  block_out_lgth := -1;
  byte_avail := TRUE;
  IF src_type = output_fron_user3 THEH
  BEGIH
    USER3 POINTER data_blk = src;
    lgth := lgth*3;                              & 4 pts*6 = Hpts*2(r/i)*3 &
    DO
      ctr_value:=format_3_cnpx(data_blk[data_ptr],str_value,fnt_code)
    UHTIL HOT string_sent OR ((data_ptr:=data_ptr+6) >= lgth);
  EHD
  ELSE
  IF sre_type = output_fron_integer THEH
  BEGIH
    IHTEGER POINTER data_blk = src;
    OO
      str_value:=format_integer(data_blk[data_ptr],str_value,fnt_code)
    UHTIL HOT string_sent OR ((data_ptr:=data_ptr+1) >= lgth);
  EHD;
EHD dunp_ascii;
```

```
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#EJECT;
COMMENT
$DOC+

NAME--
  output_block
*****************************************************************************
*
* SHORT DESCRIPTION--
*   outputs a block of data over HPIB to a system controller
*
* EXTENDED DESCRIPTION--
*   This routine will output a requested block of data from the 8510 to
*   a system controller over HPIB.  Data transfers will occur at a high
*   speed, approximately 100 usec/byte depending one of the following
*   output formats for each data point:
*
*     S510 internal binary data format
*       - 3-word complex (16-bit imag, 16-bit real, 16-bit exponent)
*       - 32-bit floating pointing point
*       - 16-bit integer
*     IEEE floating point binary (converted from 8510 internal format)
*       - 32-bit format (8-bit exponent, 15-bit mantissa sign/mag)
*       - 64-bit format (11-bit exponent, 52-bit mantissa sign/mag)
*     ASCII (converted from S510 internal format)
*
*   The first word output will be a length containing the number of
*   bytes being output. For example, 1206 bytes for a 201-pt. complex
*   data block output in binary format, or 3216 bytes for a 210-pt.
*   complex data block output in IEEE 64-bit floating point format.
*
*   A postamble is output depending on the requested output block format
*   indicated by the user command (i.e. CRC, checksum at end of block).
*
* INPUTS--
*   src          = address of data block to output
*   lgth         = number of bytes in data block
*   src_format   = internal format of each data point
*   dest_format  = output format of each data point
*
* OUTPUTS--
*   causes data to be output to HPIB
*
* ROUTINES CALLED--
*   acquire
*   release
*   output_preamble
*   output_postamble
*   dump_binary
*   dump_ascii
*   dump_ieee
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*   ASCII block transfers contain 18 characters per data point (real,
```

```
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*   integer, quad) and 37 characters per real/imag data point.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   acquire public HPIB resource
*   compute length word depending on desired output format
*   output length word (sets HPIB "block mode" output flag, BYTE_AVAIL)
*   output data block depending on desired output format
*   IF output format specifies a postamble THEN
*     output postamble information at end of data transfer
*   clear HPIB "block mode" output flag, BYTE_AVAIL
*   release public HPIB resource
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE output_block (src, src_format, dest_format);
  VALUE src,src_format,dest_format; DOUBLE src;
  INTEGER src_format, dest_format;                              ENTRY;
&
$DOC-&

BEGIN
  INTEGER item_cnt;
  acquire (pubib_output);
  IF dest_format = output_binary THEN
    item_cnt := array_size
  ELSE
    BEGIN
      item_cnt := number_of_points;
      IF src_format = output_from_user3 THEN
        item_cnt := 2*item_cnt;
    END;
  IF dest_format = output_ieee_single THEN
    itm_cnt := RLEFT(item_cnt,2)    & Npts * 4 = IEEE 32-bit complex &
  ELSE
  IF dest_format = output_ieee_double THEN
    item_cnt := RLEFT(item_cnt,3);   & Npts * 8 = IEEE 64-bit complex &

  IF DO_debug THEN
    BEGIN USTR("output addr = "); UHex(src,8); CRLF; END;

  IF dest_format = output_ascii THEN    & do not output block preamble &
    dump_ascii (src, itcn_cnt, src_format)
  ELSE
  IF output_preamble (item_cnt) THEN
  BEGIN
    IF dest_format = output_binary THEN
      dump_binary (src, item_cnt)
```

```
$OUTIB.UORK.PD8510          THU, DEC 22, 1983, 10:51 AM     PAGE 20

    ELSE   & IEEE format &
      dump_ieee (src, item_cnt, src_format, dest_format)
  END;
  byte_avail := FALSE;
  IF DO_debug THEN
  BEGIN
    USTR("end output"); CRLF;
  END;
  release (pubib_output);
END output_block;
```

```
$OUTIB.UORK.PD8510          THU, DEC 22, 1983, 10:51 AM     PAGE 21


#EJECT;
COMMENT
$DOC+

NAME--
  output_status
*****************************************************************************
*
* SHORT DESCRIPTION--
*   outputs status word over public HPIB
*
* EXTENDED DESCRIPTION--
*   This routine outputs the status word (primary status byte and
*   extended status byte) to the controller.  It then clears the status
*   word (serial_poll_status) and clears the chip's serial poll register
*   as if a serial poll had been done.  This allows the user to service
*   an SRQ either by a serial poll or outputting the status word.
*   However, a serial poll will only clear the primary status byte of
*   the status word (MSByte) and leave the extended status byte alone.
*
*   A reserve status word which may contain any current status after
*   an SRQ has been asserted but not serviced will be copied into the
*   actual status word and issue any pending SRQ's found in that
*   reserved status.
*
* INPUTS--    none
*
* OUTPUTS--   public HPIB status word
*
* ROUTINES CALLED--
*   acquire
*   release
*   output_ok
*   get_serial_poll
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   acquire public HPIB resource
*   output status word
*   clear status word and HPIB status register
*   IF reserve status word has bits set THEN
*     copy reserve status word into actual status word
*     and issue any applicable SRQ's (via SET_SERIAL_POLL)
*
*****************************************************************************
*
* REVISION LOG--
*   July 18/83 - Output status as 2 byte values in ASCII form seperated
*                by a comma:  EX --> 1457 (base 10) = "005,177"<LF>
```

```
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*              Output status string in the following order:
*              "<status byte>,<extended status byte>"
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
OCCLRRATION--
;
PROCEDURE output_status;                                          ENTRY;
&
$DOC-&

BEGIN
  BYTE POINTER status_ptr;
  BYTE RRRRY   status_array [0:8];
  RLPNR        status_string;
  IKTEGER      status_part;
  acquire (pubib_output);
  STPNTR  (status_ptr, RORS(serial_poll_status));
  status_string := RORS(status_array);
  status_array[0] := 8;    & length byte &
  status_array[4] := ',';   & seperator &
  status_array[5] := 10;   & line feed &
  status_part := INTEGER(status_ptr&0&) AND %OOFF; & LSByte, nask extn &
  status_array[1] := (status_part/100) + 48;
  status_array[2] := ((status_part MOD 100)/10) + 48;
  status_array[3] := (status_part MOD 10) + 48;
  status_part := INIEGER(status_ptr[1]) AND %OOFF; & MSByte, nask extn &
  status_array[5] := (status_part/100) + 48;
  status_array[6] := ((status_part MOD 100)/10) + 48;
  status_array[7] := (status_part MOD 10) + 48;
  IF spoll_debug THEN
    BEGIN
      WSTR("OS=");
      WSTR(status_string);
      UHEX(serial_poll_status);
      CRLF;
    END;
  byte_avail := TRUE;
  string_out_ok (status_string);
  serial_poll_status := serial_poll_reg := 0;      & clear status uord &
  byte_avail := FALSE;
  release (pubib_output);
  IF serial_poll_ext <> 0 THEN
    set_serial_poll (0);                          & get neu status, if any &
END output_status;
```

```
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REJECT;
COMMENI
$DOC+

NAME--
  output_tape
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIP1ION--
*
* INPUTS--
*
* OU1PUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS RND RECOVERY--
*
* NOTES--
*
* RUTHOR--
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* INIIIRL REFI@ENENT--
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* REVISION LOG--
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
DCCLRRAIION--
;
PROCEDURE output_tape (file_type, file_id);
  VRLUE file_type, file_id;  INTEGER file_type, file_id;          ENTRY;
&
$DOC-&

BEGIN
  $FILE ftpngr.uork;
  INIEGER CONSTRNT record_ez := 256;
  acquire (pubib_output);
  release (pubib_output);
END output_tape;
```

```
SOUTIB.UORK.PD8510          TNU, DEC 22, 1983, 10:51 BR     PAGE  24


REJECT;
COMMENT
$DOC+

NAME--
  hpib_talker
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS RND RECOVERY--
*
* NOTES--
*
* RUTHOR--
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* INIIIRL REFINEMENI--
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
*
* REVISION LOG--
*
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
DECLRRRTION--
;
PROCEDURE hpib_talker;                                            ENTRY;
&
$DOC-&

BEGIN
  byte_avail := FRLSE;
  signal_init (block_read_done,0);
  signal_init (hpib_byte_out,0);
  signal_init (dvc_done,0);
  resource_init (pubib_output);

loop:
    uait(hpib_byte_out);
    IF BO_debug THEN
      BEGIN WSTR("urite FIFO hpib_tlk"); CRLF; END;
    urite_fifo (public_ib_fifo, hpib_tlk);
  GO TO loop;

END bpib_talker;
```

```
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END@


* OLD VERSION OF OUTPUT_STATUS ---
*   output integer value in 2 bytes
*
*PROCEDURE output_status;                                          ENTRY;
*BEGIN
*  acquire (pubib_output);
*  IF spoll_debug THEN
*    BEGIN WSTR("outout status"); WHEN1serial_poll_status); CRLF; END;
*  STPNTR (outbuF, PDRS(serial_poli_status));
*  block_out_lgth := 1;
*  byte_avail := TRUE;
*  output_ok;
*  serial_poll_status := serial_poll_reg := 0;     & clear status uord &
*  byte_avail := FRLSE;
*  release (pubib_output);
*  IF serial_poll_ext <> 0 THEN
*    set_serial_poli (0);                        & get neu status, if any &
*END output_status;
```

```
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EXTERNRL INTEGER
  outbuf_ptr.L,                & output data block buffer pointer     &
  block_out_Igth.L;            & output date block length (0 bytes)   &
EXTERNRL BYTE POINTER
  outbuf.L;                    & output deta block urite srce. (talk) &
EXTERNRL BOOLERN
  byte_avaii.L,
  device_clear.L;
```

```
COU1PUT.WORK.PDB510            INU, DEC 22, 1983, 10:52 AM     PAGE   1


COMMENI
   Constants nust correspond to cases in $OUTPUT.
;
INIEGER CONSTANT  no_output              :=   0,   & output_selection &
                  active_output          :=   1,
                  etatus_output          :=   2,
                  formatted_output       :=   3,
                  data_output            :=   4,
                  rau1_output            :=   5,
                  rau2_output            :=   6,
                  rau3_output            :=   7,
                  raw4_output            :=   8,
                  nenory_output          :=   9,
                  error_output           :=  10,
                  plot_output            :=  11,
                  id_output              :=  12,
                  DG_p1p2_output         :=  13,
                  eerkar_output          :=  14,
                  cal_coeff1_output      :=  15,
                  cal_coeff2_output      :=  16,
                  cal_coeff3_output      :=  17,
                  cal_coeff4_output      :=  18,
                  cal_coeff5_output      :=  19,
                  cal_eoeff6_output      :=  20,
                  cal_coeff7_output      :=  21,
                  cal_eeeff8_output      :=  22,
                  cal_coeff9_output      :=  23,
                  cal_coeff10_output     :=  24,
                  cal_coeff11_output     :=  25,
                  cal_coeff12_output     :=  26,
                  hey_output             :=  27;

INTEGER CONSIANT  no_input               :=   0,   & input_eelection  &
                  formatted_input        :=   1,
                  data_input             :=   2,
                  rau1_input             :=   3,
                  rau2_input             :=   4,
                  reu3_input             :=   5,
                  raw4_input             :=   6,
                  nenory_input           :=   7,
                  plot_input             :=   8,
                  cal_eoeff1_input       :=   9,
                  cal_coeff2_input       :=  10,
                  cal_coeff3_input       :=  11,
                  cal_coeff4_input       :=  12,
                  cal_coeff5_input       :=  13,
                  cal_coeff6_input       :=  14,
                  cal_coeff7_input       :=  15,
                  cal_coeff8_input       :=  15,
                  eal_coeff9_input       :=  17,
                  cal_coeff10_input      :=  13,
                  cal_coeff11_input      :=  19,
                  cal_coeff12_input      :=  20;

IWTEGER CONSTRNT  output_binary          :=   0,       & output_typc &
```

```
COUTPU1.UORK.PDS510            INU, DEC 22, 1983, 10:52 RM     PAGE   2


                  ootput_ieee_single     :=   1,
                  output_ieee_double     :=   2,
                  output_ascii           :=   3;
INTEGER CONSTRNT  output_fron_integer    :=   1,     & eource of data &
                  output_fron_real       :=   2,
                  output_fron_uoer3      :=   3,
                  output_fron_quad       :=   4;
```

```
FOUTPUT.UORK.POS510            TNU, OEC 22, 1933, 10:52 RM     PAGE   1


RFILE coutput.uork;

PROCEDURE  block_output( address );
   VALUE   address;
   DOUBLE  address;                                          EXTERNRL.L;
PROCEDURE  null_block_output;                                EXTERNAL.L;
PROCEDURE  pub_ib_output_select( selection );
   VRLUE   selection;
   INTEGER selection;                                        EXTERNRL.L;
PROCEDURE  pub_ib_format_select( type );
   VALUE   type;
   INTEGER type;                                             EXTERNRL.L;
SUBROUTINE pub_ib_output;                                    EXTERNRL.L;
PROCEDURE  pub_ib_input_select( selection );
   VALUE   eelection;
   INTEGER selection;                                        EXTERNRL.L;
SUBROUTINE pub_ib_input;                                     EXTERNRL.L;
```

```
$OUTPUT.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  1


%G$KL,P,"output"
BEGIN

%FILE eoutput.work;
%FILE factive2.work;
%FILE cnegib.work;
%FILE futil3.work;
%FILE futil2.work;
%FILE cchtable.work;
%FILE fchtable.work;
%FILE fcbdata.work;
%FILE fcontvar.work;
%FILE foutib.work;
%FILE fpubib.work;
%FILE fplotter.work;
%FILE fscreen.work;                                  & for entry_array &
%FILE fkernel.work;                                        & for send &
%FILE crins.work;    & for entry_string_ready and block_input_complete &
%FILE fcontrol.work;                                 & for abort_sweep &
%FILE ctrace0.work;                 & for update_f and update_d &
%FILE ftrace0.work;                                  & for partial &
%FILE fatables.work;                           & for format_table &
%FILE fmarker.work;                          & for mkr_amplitude &
%FILE fstring.work;
%FILE ffnt.work;                                   & for format_real &
%FILE ftopkbd.work;                                 & for key_token &
%FILE fcal.work;                                & for cal_array_addr &


INTEGER CONSTANT string_size      := 64;

INTEGER CONSTANT bytes_per_complex :=  8,
                 bytes_per_display :=  4;

INTEGER  output_selection,
         prior_output_selection,
         input_selection,
         transfer_type;
```

```
$OUTPUT.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  2


REJECT;
COMMENT                                                          init_output
**************************************************************************
*
**************************************************************************
;
SUBROUTINE init_output;                                            ENTRY;
   BEGIN & init_output &
      prior_output_selection := output_selection := no_output;
      transfer_type    := output_binary;
      input_selection  := no_input;
   END;  & init_output &
```

```
$OUTPUT.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  3


REJECT;
COMMENT                                                       block_output
**************************************************************************
*
**************************************************************************
;
PROCEDURE  block_output( address );
   VALUE   address;
   DOUBLE  address;                                                ENTRY;
   BEGIN & block_output  &

      output_block( address,
                    output_from_user3,
                    transfer_type
                  );

   END;  & block_output  &
```

```
$OUTPUT.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  4


REJECT;
COMMENT                                                    null_block_output
**************************************************************************
*
**************************************************************************
;
PROCEDURE  null_block_output;                                      ENTRY;
   BEGIN & null_block_output  &


   END;  & null_block_output  &
```

```
$OUTPUT.WORK.PDBS10            THU, DEC 22, 1983, 10:52 AM    PAGE  5


%EJECT;
COMMENT                                                    array_output
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  array_output( source );
   VALUE   source;
   INTEGER source;
   BEGIN & array_output  &

      block_output( entry_ch_double( source ) );

   END;  & array_output  &
```

```
$OUTPUT.WORK.PDBS10            THU, DEC 22, 1983, 10:52 AM    PAGE  6


%EJECT;
COMMENT                                                  output_marker_value
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  output_marker_value;
   BEGIN & output_marker_value &
      BYTE ARRAY output_array[-1:string_size];
      BLPHR      output_string;

      & initialize string &
      output_string := ADRS( output_array );
      output_string := init_string( output_string, string_size );

      Hrt_pubib_string( append_string( format_3_cnpu( nkr_value,
                                                      output_string,
                                                      format_table(
                                                          output_format
                                                              ]
                                                      ),
                                       newline
                                     )
                      );

   END;  & output_marker_value &
```

```
$OUTPUT.WORK.PDBS10            THU, DEC 22, 1983, 10:52 AM    PAGE  7


%EJECT;
COMMENT                                                      output_key
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  output_key;
   BEGIN & output_key &
      BYTE ARRAY output_array[-1:string_size];
      ALPHA      output_string;

      & initialize string &
      output_string := ADRS( output_array );
      output_string := init_string( output_string, string_size );
      urt_pubib_string( append_ch( format_integer(
                                      key_token,
                                      output_string,
                                      format_table[output_integer_format]
                                                  ),
                                   newline
                                 )
                      );
   END;  & output_key &
```

```
$OUTPUT.WORK.PDSS10            THU, DEC 22, 1983, 10:52 AM    PAGE  8


%EJECT;
COMMENT                                                      output_rau
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  output_rau( array_number );
   VALUE   array_number;
   INTEGER array_number;
   BEGIN & output_rau  &
      INTEGER param_index,
              array_count;

      array_count := 0;
      param_index := first_acquisition_param;

      UHILE ( ( param_index <= last_acquisition_param ) AND
              ( array_count <> array_number )
            ) DO
         BEGIN & uhile &
           . IF TBIT[ ch[param_index], current_entry_ch - 1 ) THEN
               array_count := array_count + 1;
            param_index := param_index + 1;
         END;  & while &

      IF array_count = array_number THEN
         block_output( rau_base[param_index-1] )
      ELSE
         BEGIN & else &
            usrm( array_unavailable );
            null_block_output;
         END;  & else &

   END;  & output_rau  &
```

```
SOUTPUT.WORK.PO8510          THU, DEC 22, 1983, 10:52 RM    PAGE  9


#EJECT;
COMMENT                                                output_cal_coeff
**********************************************************************
*
**********************************************************************
;
PROCEDURE  output_cal_coeff( array_number );
   VALUE   array_number;
   INTEGER array_number;
   BEGIN & output_cal_coeff  &
      DOUBLE block_address;

      IF ( block_address := cal_array_addr(array_number - 1) ) <> 0 THEN
         block_output( block_address )
      ELSE
         BEGIN & else &
            warn( array_unavailable );
            null_block_output;
         END;  & else &

   END;  & output_cal_coeff  &
```

```
SOUTPUT.WORK.PO8510          THU, DEC 22, 1983, 10:52 RM    PAGE  10


#EJECT;
COMMENT                                                pub_ib_output_select
**********************************************************************
*
**********************************************************************
;
PROCEDURE  pub_ib_output_select( selection );
   VALUE   selection;
   INTEGER selection;                                              ENTRY;
   BEGIN & pub_ib_output_select &
      prior_output_selection := output_selection;
      input_selection  := no_input;
      output_selection := selection;
   END;  & pub_ib_output_seleet &
```

```
SOUTPUT.WORK.POS510          THU, DEC 22, 1583, 10:52 8M    PRGE  11


#EJECT;
COMMENT                                                pub_ib_format_select
**********************************************************************
*
**********************************************************************
;
PROCEDURE  pub_ib_format_select( type );
   VALUE   type;
   INTEGER type;                                                   ENTRY;
   BEGIN & pub_ib_format_select &
      transfer_type := type;
   END;  & pub_ib_format_select &
```

```
SOUTPUT.WORK.PO8510          THU, DEC 22, 1983, 10:52 RM    PAGE  12


#EJECT;
COMMENT                                                pub_ib_output
**********************************************************************
*
**********************************************************************
;
SUBROUTINE pub_ib_output;                                          ENTRY;
   BEGIN & pub_ib_output &
      COMMENT
         Cases must correspond to constants declared in COUTPUT.
      ;
      CASE output_selection OF
         BEGIN & case &
&  0 &      warn( no_output_selection );
&  1 &      output_active;
&  2 &      output_status;
&  3 &      array_output( ch_f_base );
&  4 &      array_output( ch_d_base );
&  5 &      output_rau(1);
&  6 &      output_rau(2);
&  7 &      output_rau(3);
&  8 &      output_rau(4);
&  9 &      array_output( ch_n_base );
& 10 &      output_error;
& 11 &      output_plot;
& 12 &      output_identifier;
& 13 &      BEGIN                    & OP for DG pass thru output    &
               wrt_pubib_string ("0,0,4095,4095 ");
               output_selection := prior_output_selection;
            END;
& 14 &      output_marker_value;
& 15 &      output_cal_coeff( 1 );
& 16 &      output_cal_coeff( 2 );
& 17 &      output_cal_coeff( 3 );
& 18 &      output_cal_coeff( 4 );
& 19 &      output_cal_coeff( 5 );
& 20 &      output_cal_coeff( 6 );
& 21 &      output_cal_coeff( 7 );
& 22 &      output_cal_coeff( 8 );
& 23 &      output_cal_coeff( 9 );
& 24 &      output_cal_coeff( 10 );
& 25 &      output_cal_coeff( 11 );
& 26 &      output_cal_coeff( 12 );
& 27 &      output_key;
         END   & case &
      ELSE
         fatal( no_output_selection );

      output_selection := no_output;       & reset selection once done &

   END;  & pub_ib_output &
```

```
$OUTPUT.WORK.PO8510          THU, DEC 22, 1983, 10:52 AM    PAGE  13


%EJECT;
COMMENT                                                    block_input
*************************************************************************
*
*************************************************************************
;
PROCEDURE  block_input( address, update );
   VALUE   address, update;
   DOUBLE  address;
   INTEGER update;
   BEGIN % block_input %
      INTEGER hpib_size;
      BYTE    hpib_size_msb = hpib_size,
              hpib_size_lsb = hpib_size + 1;

% entry %
      % get block size sent from controller %
      hpib_size_msb := entry_array[1];
      hpib_size_lsb := entry_array[2];

      abort_sweep;
      IF NOT( input_block( address,
                           hpib_size,
                           output_from_user3,
                           transfer_type
                         )
            ) THEN
         warn( block_input_error )                 % transfer failure %
      ELSE
         partial( update );

   END;  % block_input %
```

```
$OUTPUT.WORK.PO8510          THU, DEC 22, 1983, 10:52 AM    PAGE  14


%EJECT;
COMMENT                                                    array_input
*************************************************************************
*
*************************************************************************
;
PROCEDURE  array_input( destanation, update );
   VALUE   destination, update;
   INTEGER destination, update;
   BEGIN % array_input %

      block_input( entry_ch_double(destination), update );

   END;  % array_input %
```

```
$OUTPUT.WORK.PO8510          THU, DEC 22, 1983, 10:52 AM    PAGE  15


%EJECT;
COMMENT                                                    input_raw
*************************************************************************
*
*************************************************************************
;
PROCEDURE  input_raw( array_number );
   VALUE   array_number;
   INTEGER array_number;
   BEGIN % input_raw  %
      INTEGER param_index,
              array_count;

      array_count := 0;
      param_index := first_acquisition_param;

      WHILE ( ( param_index <= last_acquisition_param ) AND
              ( array_count <> array_number )
            ) DO
         BEGIN % while %
            IF TBIT( ch[param_index], current_entry_ch - 1 ) THEN
               array_count := array_count + 1;
            param_index := param_index + 1;
         END;  % while %

      IF array_count = array_number THEN
         block_input( raw_base[param_index-1], update_raw_array )
      ELSE
         warn( array_unavailable );

   END;  % input_raw  %
```

```
$OUTPUT.WORK.PO8510          THU, DEC 22, 1983, 10:52 AM    PAGE  16


%EJECT;
COMMENT                                                    input_cal_coeff
*************************************************************************
*
*************************************************************************
;
PROCEDURE  input_cal_coeff( array_number );
   VALUE   array_number;
   INTEGER array_number;
   BEGIN % input_cal_coeff  %
   END;  % input_cal_coeff  %
```

```
SOUTPUT.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  17


%EJECT;
%COMMENT                                                pub_ib_input_select
****************************************************************************
*
****************************************************************************
;
PROCEDURE  pub_ib_input_select( selection );
   VALUE  selection;
   INTEGER selection;                                                ENTRY;
   BEGIN & pub_ib_input_select &
      output_selection := no_output;
      input_selection := selection;
   END;  & pub_ib_input_select &
```

```
SOUTPUT.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  18


%EJECT;
%COMMENT                                                      pub_ib_input
****************************************************************************
*
****************************************************************************
;
SUBROUTINE pub_ib_input;                                              ENTRY;
   BEGIN & pub_ib_input &
      COMMENT
         Cases must correspond to constants declared in OUTPUT.
      ;
      CASE input_selection OF
         BEGIN & case &
&  0 &      warn( no_input_selection );
&  1 &      array_input( ch_f_base, update_f );
&  2 &      array_input( ch_d_base, update_d );
&  3 &      input_raw( 1 );
&  4 &      input_raw( 2 );
&  5 &      input_raw( 3 );
&  6 &      input_raw( 4 );
&  7 &      ; & input_memory; &
&  8 &      ; & input_plot; &
&  9 &      input_cal_coeff( 1 );
& 10 &      input_cal_coeff( 2 );
& 11 &      input_cal_coeff( 3 );
& 12 &      input_cal_coeff( 4 );
& 13 &      input_cal_coeff( 5 );
& 14 &      input_cal_coeff( 6 );
& 15 &      input_cal_coeff( 7 );
& 16 &      input_cal_coeff( 8 );
& 17 &      input_cal_coeff( 9 );
& 18 &      input_cal_coeff( 10 );
& 19 &      input_cal_coeff( 11 );
& 20 &      input_cal_coeff( 12 );
         END   & case &
      ELSE
            fatal( no_input_selection );

      input_selection := no_input;          & reset selection once done &
      eend( entry_string_ready );           & so parser can resume      &

   END;  & pub_ib_input &

END$
```

```
FPRRAM.WORK.PD8510           THU, DEC 22, 1983, 10:52 AM    PAGE  1


PROCEDURE  new_parameter(new_paran);
   VALUE  ntu_paran;
   INTEGER new_paran;                                    EXTERNAL,L;
```

```
SPARRM.WORK.PD8510           THU, DEC 22, 1983, 10:52 AM    PAGE  1


?68KL,P,"paran"
BEGIN

%FILE cnenu.work;
%FILE cparans.work;
%FILE ccndcase.work;
%FILE fconmand.work;                              & for conmand_token &
%FILE fchtable.work;
%FILE cchtable.work;
%FILE fcontvar.work;
%FILE fcontv2.work;                                    & for rebuild &
%FILE fcontrol.work;
%FILE fannot.work;
%FILE fkernel.work;
%FILE crine.work;
%FILE cdatap.work;        & for nax_format -- nust cone before fchpfr. &
%FILE ftrace0.work;
%FILE fpfr.wark;
%FILE fchpfr.work;
%FILE fnenu.work;
%FILE cyadc.work;               & for parameter redefinition constants &
%FILE futil.work;               & for warn and conmand_not_inplincnted &
%FILE fcal0.work;                        & for paran_correction_change &
%FILE Ftestset.work;                          & for redefine_test_set &

PROCEDURE  new_format_partial;                                EXTERNAL;
```

```
SPARRM.WORK.POS510          THU, DEC 22, 1983, 10:52 AM    PAGE  2


REJECT;
COMMENT                                                    new_parameter
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  new_parameter(new_paran);
   VALUE   new_paran;
   INTEGER new_paran;                                          ENTRY;
   BEGIN & new_parameter &
      IF new_paran <> entry_ch_integer(ch_param) THEN
         BEGIN & if &
            & This test keeps cal fron hilighting keys in the cal menu &
            IF new_paran > s22 THEN
               hilight_on( cnd_user1, cnd_user4)
            ELSE
               hilight_off( cnd_user1, cnd_user4);
            abort_sweep;
            acquire( control_variables );
            set_entry_ch_integer( new_paran, ch_param );
            annotate_parameter;
            recall_pfr;
            rebuild := TRUE;
            new_format_partial;                  & updates pfr values &
            release( control_variables );
            @aran_correction_change( new_paran ); & correction change? &
            restare_sweep;
         END;  & if &
   END;  & new_parancter &
```

```
SPARRM.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  3


REJECT;
COMMENT                                                    redefine_paran
*****************************************************************************
*
*   Redefines the currently selected parameter descriptor to the
*   specified value.
*
*****************************************************************************
;
PROCEDURE  redefine_paran( redef_descriptor, descriptor_value );
   VALUE   redef_descriptor, descriptor_value;
   INTEGER redef_descriptor, descriptor_value;
   BEGIN & redefine_paran &

      abort_sweep;
      acquire( control_variables );

      parameter_descriptor[ entry_ch_integer( ch_paran ),
                            redef_descriptor
                          ] := descriptor_value;

      IF redef_descriptor = parameter_conversion THEN
         set_entry_ch_integer( descriptor_value, ch_paran_conversion );
      redefine_test_set;
      rebuild := TRUE;                          & part def'e nay change &
      partial(update_proc_vars);

      release( control_variables );
      restart_sweep;
      pop_menu( REDEF_MENU );

   END;  & redefine_paran &


@FILE fparams.work;

END$
```

```
CPARRMS.WORK.PD8510         THU, DEC 22, 1983, 10:52 AM    PAGE  1


INTEGER CONSTANT

cnd_user1 := 83,
cnd_user2 := 84,
cnd_user3 := 85,
cnd_user4 := 86,
cnd_redefine_paran := 87,
cnd_label_parameter := 93,
cnd_redefine_done := 94,
cnd_convert_off := 118,
cnd_convert_recip := 119,
cnd_convert_to_z := 120,
cnd_convert_to_y := 121,
cnd_group5 := 0;
```

```
FPRRRMS.WORK.PD8510         THU, DEC 22, 1983, 10:52 AM    PAGE  1


COMMENT
  This is a software generated file !!!
  Changes must be made in SKINFO.WORK
  Run GENSK.LRWI to re-generate file;

SUBROUTINE proc5;  ENTRY;
BEGIN

CASE command_token-83 OF
BEGIN
& 83 &
new_parancter( user1 );
& 84 &
new_parameter( user2 );
& 85 &
new_parameter( user3 );
& 86 &
new_parametcr( user4 );
& 87 &
BEGIN END;
& 88 &
BEGIN END;
& 89 &
BEGIN END;
& 90 &
BEGIN END;
& 91 &
BEGIN END;
& 52 &
BEGIN END;
& 93 &
warn( command_not_inplenented );
& 94 &
pop_menu( PRRRM_MENU );
& 95 &
redefine_paran( driven_port, driven_a1 );
& 96 &
redefine_paran( driven_port, driven_a2 );
& 97 &
redefine_paran( drivcn_port, driven_none );
& 98 &
redefine_paran( phase_lock_port, lock_to_a1 );
& 99 &
redefine_paran( phase_lock_port, lock_to_a2 );
& 100 &
redefine_paran( phase_lock_port, lock_donot_care );
& 101 &
redefine_paran( numerator_port, nun_b1 );
& 102 &
redefine_paran( numerator_part, nun_b2 );
& 103 &
redefine_paran( numerator_port, nun_a1 );
& 104 &
redefine_paran( numerator_port, nun_a2 );
& 105 &
```

```
FPARRAMS.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  2


BEGIN END;
& 106 &
redefine_param( numerator_port, num_100khz_eal );
& 107 &
redefine_param( numerator_port, num_ref_100khz_cal );
& 108 &
redefine_param( numerator_port, num_detectcr_gnd );
& 109 &
redefine_param( numerator_port, num_adc_gnd );
& 110 &
redefine_param( numerator_port, num_vcal );
& 111 &
redefine_param( numerator_port, num_vref );
& 112 &
redefine_param( numerator_port, num_temp1 );
& 113 &
redefine_param( numerator_port, num_temp2 );
& 114 &
redefine_param( denominator_port, denon_a1 );
& 115 &
redefine_param( denominator_port, denon_a2 );
& 116 &
redefine_param( denominator_port, denon_b1 );
& 117 &
redefine_param( denominator_port, denon_no_ratio );
& 118 &
redefine_param( parameter_conversion, conv_off );
& 119 &
redefine_param( parameter_conversion, conv_reciprocal );
& 120 &
redefine_param( parameter_conversion, conv_a_to_z );
& 121 &
redefine_param( parametar_conversion, conv_a_tc_y );
END;
END proc5;
```

```
FPARmTBL.WORK.PDS510          THU, DEC 22, 1983, 10:52 AM    PAGE  1


SUBROUTINE list_op_params;                              EXTERNAL.L;
SUBROUTINE list_sys_params;                             EXTERNAL.L;
SUBROUTINE next_op_param;                               EXTERNAL.L;
SUBROUTINE list_op_param_page;                          EXTERNAL.L;
PROCEDURE list_trace_values;                            EXTERNAL.L;
```

```
SPRRMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  1


M68KL,P, "parmtbl"

BEGIN

%FILE ftern.work;  &DESUG&
%FILE cdebug.work;
%FILE cmsgplot.work;
%FILE futil3.work;
%FILE factive.work;
%FILE factive2.work;
%FILE facttbl.work;
%FILE fstimuli.work;
%FILE fdisplay.work;
%FILE cscreen.work;
%FILE cchtable.work;
%FILE fchtable.work;
%FILE fchtab2.work;
%FILE fchdata.work;
%FILE fchdata2.work;
%FILE cdomain.work;
%FILE fstring.work;
%FILE ffnt.work;
%FILE fsize.work;
%FILE fcommand.work;       & for command_token value &
%FILE cplot.work;
%FILE fplotter.work;
%FILE fprivib.work;
%FILE fprivib2.work;       & for get_priv_ib_lun() &
%FILE ftpmgr2.work;        & for directory_on (alternate display) &
%FILE falphas.work;        & for printing data trace list header  &
%FILE cprtdata.work;       &  "    "     "   "    "    "     "     &

INTEGER CONSTANT
  parm_display    := 0,
  parm_printer    := 1,
  x               := 2,
  x1              := 27,
  x2              := 42,
  string_size     := 25,
  short_string    := 8,
  long_string     := 50;

ALPHA param_line,                          & parameter description &
      ch1_line, ch2_line,                  & channel 1,2 values    &
      meas_unit1, meas_unit2,              & units of measurement  &
      col_string;

DOUBLE param_fmt1,              & numerical display format for ch 1 &
       param_fmt2;              & numerical display format for ch 2 &

BYTE ARRAY str0 [-1:string_size];
BYTE ARRAY str1 [-1:string_size];
BYTE ARRAY str2 [-1:long_string];
BYTE ARRAY nu1 [-1:short_string];
BYTE ARRAY nu2 [-1:short_string];
```

```
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BYTE ARRAY col_info [-1:string_size];

INTEGER dg_parms,                          & display memory pointer &
        parm_output,                  & parameter output destination  &
        channel,                      & index to channel table values &
        y_pos;                     & y row position for listing params &

BOOLEAN op_param1;                 & page switching for op. parameters &
```

```
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$EJECT;
COMMENT
$DOC+

NAME--                                                output_print_string
*****************************************************************************
*
* SHORT DESCRIPTION--
*   print a string to an HP-IB printer
*
* EXTENDED DESCRIPTION--
*   This routine is a utility function that prints a given string to
*   an HP-IB printer and tabs a computed number of spaces to the next
*   column (to achieve columnar format).  The number of spaces is based
*   on the difference between the length of the given string and the
*   given column width (which includes the string's characters).
*   Trailing blanks are printed from the last character of the given
*   string and the column width.
*
*   A column width with a value less the given string's length will not
*   print trailing blanks.
*
* INPUTS--
*   string = string to be printed
*   column = number of spaces to tab from the beginning of the string
*
* OUTPUTS--
*   printed string
*
* ROUTINES CALLED--
*   wrt_priv_ib
*   append_ch
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   send given string to be printed on the printer
*   replace ohm symbol with "ohms" and degree symbol with "deg."
*   compute number of trailing blanks to print after string
*   IF number of trailing blanks > 0 THEN
*     print number of trailing blanks computed
*
*****************************************************************************
*
* REVISION LOG--
*   Nov 14-83 -- Added a check for special symbolic characters used as
*                terminators, specifically ohms and degrees, and
*                replaced them with spelled out words for printing
*                purposes.
```

```
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*
*****************************************************************************
$DOC-;
PROCEDURE output_print_string (string, column);
  VALUE string, column; ALPHA string; INTEGER column;
BEGIN
  DOUBLE str_addr = string;
  BYTE POINTER str_ptr;
  BYTE special_ch;
  INTEGER i, blanks;
  STPNTR (str_ptr, str_addr);
  IF ((i := str_ptr[str_ptr]) AND %OFF) = omega THEN
    BEGIN
      str_ptr := str_ptr-1;
      append_string (string, "ohms");
    END
  ELSE
  IF (i AND %OFF) = degree THEN
    BEGIN
      str_ptr := str_ptr-1;
      append_string (string, "deg.");
    END;
  col_info[0] := 0;
  wrt_priv_ib (printer, no_fun, string);
  IF (blanks := column - str_ptr[0&]) > 0 THEN
    BEGIN
      FOR i := 1 TO blanks DO
        append_ch (col_string, blank_char);
      wrt_priv_ib (printer,no_fun,col_string);  ! space to next column !
    END;
END output_print_string;
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  5


$EJECT;
COMMENT
$DOC+

NAME--
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE print_CRLF;
  wrt_priv_ib (printer, no_fun, cr+" ");
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  6


$EJECT;
COMMENT
$DOC+

NAME--
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE formfeed;
BEGIN
  % assumes col_string is pointing to ADRS(col_info) &
  col_info [0] := 1;
  col_info [1] := 12;    & form feed &
  wrt_priv_ib (printer, no_fun, col_string);
END formfeed;
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  7

$EJECT;
COMMENT
$DOC+

NAME--
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE skip_line;
&
$DOC-&

BEGIN
  IF parm_output = parm_printer THEN
    REPEAT 2 DO print_CRLF
  ELSE
    y_pos := y_pos + 1
END skip_line;
```

```
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$EJECT;
COMMENT
$DOC+

NAME--
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE print_parms;
BEGIN
  output_print_string (" ", short_string);              & indentation &
  output_print_string (parm_line, string_size);
  output_print_string (ch1_line, string_size-10);
  output_print_string (ch2_line, 0);
END print_parms;
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE  9

$EJECT;
COMMENT
$DOC+

NAME--
  disp_parm
*****************************************************************************
*
* SHORT DESCRIPTION--
*   outputs parameter lines to display
*
* EXTENDED DESCRIPTION--
*   This routine puts the newly computed parameter line in display
*   memory.  A parameter line consists of a parameter description and
*   its channel 1 and channel 2 values.  This information is displayed
*   in 3 columns, therefore constant x vectors are used to position
*   each part of the parameter line.
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE disp_parm;
&
$DOC-&

BEGIN
  dg_parms := novech (dg_parms, y_pos, x);
  dg_parms := lb (dg_parms, parm_line);
  dg_parms := novech (dg_parms, y_pos, x1);
  dg_parms := lb (dg_parms, ch1_line);
  dg_parms := novech (dg_parms, y_pos, x2);
  dg_parms := lb (dg_parms, ch2_line);
END disp_parm;
```

```
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$EJECT;
COMMENT
$DOC+

NAME--
  setup_parm_lines
*****************************************************************************
*
* SHORT DESCRIPTION--
*   get parameter description string and its measurement suffix
*
* EXTENDED DESCRIPTION--
*   This routine initializes the parameter description string and the
*   measurement suffix string.  The parameter description is indexed
*   from an externally defined table.  The measurement suffix is
*   returned from an externally defined function.
*   The channel table index for that parameter is also assigned to a
*   global variable to be used by proceeding routines that are called
*   to extract the channel 1 and 2 values from the channel table.
*
* INPUTS--
*   index * active function constant value used as:
*           1) parameter for external routine that returns measure-
*              ment suffices
*           2) an index to an external table of parameter description
*              strings
*           3) an index to an external table of channel table indices
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   get_active
*   get_ch_table_index
*   append_string
*   append_term
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   A plot string terminator is appended to the measurement suffix
*   for outputs to the plotter.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   get parameter description string
*   get parameter measurment suffix string
*   get parameter channel table index
*
*****************************************************************************
*
* REVISION LOG--
```

```
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!*************************************************************************
DECLARATION--
;
PROCEDURE setup_param_lines (index); VALUE index; INTEGER index;
&
$DOC-&

BEGIN
  ttr0[0] := str1[0] := str2[0] := nu1[0] := nu2[0] := 0;
  channel    := get_active( get_chtable_index, index );
  param_fntt := ch_active_format (index,ch1);
  param_fnt2 := ch_active_format (index,ch2);
  append_string (param_iinc, active_function_label[index]);
  append_string (meas_unitt, ch_active_suffix(index,ch1));
  append_string (meas_unit2, ch_active_suffix(index,ch2));
END setup_param_lines;
```

```
SPARMTBL.UORK.PD8510          THU, DEC 22, 1983, 10:52 AM     PAGE  12

$EJECT;
COMMENT
$DOC+

NAME--
  output_param_lines
!*************************************************************************
!
! SHORT DESCRIPTION--
!   output parameter line te appropriate output destination
!
! EXTENDED DESCRIPTION--
!   This routine appends the appropriate measurement unit (suffix) to
!   parameter string values for channel 1 and 2, and then outputs these
!   strings to the selected output destination (display, printer,
!   plotter).
!
! INPUTS--  none
!
! OUTPUTS-- none
!
! ROUTINES CALLED--
!   plot_params
!   disp_params
!
! ERROR CONDITIONS AND RECOVERY--
!   none
!
! NOTES--
!   Measurement suffices are extracted from an externally defined
!   table in uhich some suffices are nothing more than null strings.
!
! AUTHOR--
!
!*************************************************************************
!
! INITIAL REFINEMENT--
!   append measurement suffix to channel 1 string value
!   append measurement suffix to channel 2 string value
!   output strings to selected destination
!
!*************************************************************************
!
! REVISION LOG--
!
!*************************************************************************
DECLARATION--
;
SUBROUTINE output_param_lines;
&
$DOC-&

BEGIN
  IF NOT abort_command THEN
    BEGIN
      append_string (ch1_line, meas_unit1);
```

```
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      append_string (ch2_line, meas_unit2);
      IF parm_output = parm_printer THEN
        print_params
      ELSE
        disp_param;
      skip_line;
    END;
END output_param_lines;
```

```
SPARMTBL.UORK.PD8510          THU, DEC 22, 1983, 10:52 AM     PAGE  14

$EJECT;
COMMENT
$DOC+

NAME--
!*************************************************************************
!
! SHORT DESCRIPTION--
!
! EXTENDED DESCRIPTION--
!
! INPUTS--
!
! OUTPUTS--
!
! ROUTINES CALLED--
!
! ERROR CONDITIONS AND RECOVERY--
!
! NOTES--
!
! AUTHOR--
!
!*************************************************************************
!
! INITIAL REFINEMENT--
!
!*************************************************************************
!
! REVISION LOG--
!
!*************************************************************************
$DOC-;
SUBROUTINE init_strings;
BEGIN
  str0[-1]:=str1[-1]:=col_info[-1]:=string_size;
  nu1[-1]:=nu2[-1]:=short_string;
  str2 [-1] := long_string;
  str0[0] := str1[0] := str2[0] := nu1[0] := nu2[0] := col_info[0] := 0;
  param_line := ADRS (str0);
  ch1_line   := ADRS (str1);
  ch2_line   := ADRS (str2);
  meat_unit1 := ADRS (nu1);
  meas_unit2 := ADRS (nu2);
  col_string := ADRS (col_info);
END init_strings;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  disp_header
*****************************************************************************
*
* SHORT DESCRIPTION--
*   initializes parameter strings and header listing information
*
* EXTENDED DESCRIPTION--
*   This routine sets up the parameter strings used to output to the
*   display or plotter/printer and outputs the header information which
*   indicates the type of parameter listing (operating or system) and
*   headers for corresponding channel 1 and channel 2 information.
*   A flag indicating the output destination is set depending on the
*   last command token processed.  This identifies whether to output to
*   the plotter, printer, or display.
*   Y coordinate vectors are also initialized and will be modified for
*   each line that is output.  X coordinate vectors are constants since
*   the list is columnarized.
*
*   Set up for display output consists of turning off the regular
*   display and initializing the display memory buffer that is to be
*   filled with parameter strings and displayed.
*
*   Set up for plotting output consists of sending scaled absolute
*   plotting vectors 0,0 to the plotter followed by a command to plot
*   text.  Scaling and character size are set up in a routine that is
*   3 levels up.
*
*   Example of header:
*
*      OPERATING PARAMETERS          Channel 1          Channel 2
*
* INPUTS--
*   head_line  = a string containing the parameter list type:
*                "OPERATING" or "SYSTEM"
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   append_string
*   append_term
*   jmp
*   lb
*   select_active_function
*   skip_line
*   output_param_lines
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
```

```
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* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   initialize parameter output strings
*   determine output device and output appropriate header information
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE disp_header (head_line); VALUE head_line; ALPHA head_line;
&
$DOC-&

BEGIN
  init_strings;
  param_line := append_string (param_line, head_line);
  ch1_line   := append_string (ch1_line, "Ch 1");
  ch2_line   := append_string (ch2_line, "Ch 2");
  IF command_token = cmd_print_params THEN
    BEGIN
      parm_output := parm_printer;
      REPEAT 4 DO skip_line;
    END
  ELSE
    BEGIN
      parm_output := parm_display;
      y_pos := 8;
      IF NOT directory_on THEN
        BEGIN
          directory_on := TRUE;
          select_active_function (active_off);
          jmp (jump_all, end_position);
        END;
      dg_parms := lb (text_display, " ");
      IF plot_debug THEN
        HMEX(dg_parms);
    END;
  output_param_lines;
  skip_line; skip_line;
END disp_header;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  end_param_list
*****************************************************************************
*
* SHORT DESCRIPTION--
*   concludes parameter listing
*
* EXTENDED DESCRIPTION--
*   This routine is used to end a list of parameters being displayed or
*   plotted/printed.  A jump to the end of the display buffer is added
*   to end a display listing and plot commands to store the pen is sent
*   at the end of a plot.
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   urt_priv_ib
*   jmp
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   IF ending a plot THEN send plot command to store pen
*   IF ending a display THEN insert a "jmp" to the end of display in
*     display memory
*   IF ending a print THEN ????
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE end_param_list;
&
$DOC-&

BEGIN
  IF parm_output = parm_display THEN
    BEGIN
      dg_parms := jmp (dg_parms, entry_aux_position);
      IF abort_command THEN
```

```
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        COMMENT warn (print_aborted);
    END
  ELSE
    formfeed;
END end_param_list;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  real_paran
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE real_paran (index); VALUE index; INTEGER index;
&
$DOC-&

BEGIN
  setup_paran_lines (index);
  ch1_line := format_real (ch_real (channel,1), ch1_line, paran_fnt1);
  ch2_line := format_real (ch_real (channel,2), ch2_line, paran_fnt2);
  output_paran_lines;
END real_paran;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  quad_paran
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE quad_paran (index); VALUE index; INTEGER index;
&
$DOC-&

BEGIN
  setup_paran_lines (index);
  ch1_line := format_quad (ch_quad (channel,1), ch1_line, paran_fntt);
  ch2_line := format_quad (ch_quad (channel,2), ch2_line, paran_fnt2);
  output_paran_lines;
END quad_paran;
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE 21


%EJECT;
COMMENT
$DOC+

NAME--
  dual_paran
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE dual_paran (active_index, ch_mode, ch_index);
  VALUE active_index, ch_mode, ch_index;
  INTEGER active_index, ch_mode, ch_index;
&
$DOC-&

BEGIN
  BOOLEAN real_paran_value;

  SUBROUTINE no_mess_unit;
    mu1[0] := mu2[0] := 0;

  real_paran_value := (ch_mode=ch_smoothing_mode) OR
                      (ch_mode=ch_power_slope_mode);
  setup_paran_lines (active_index);
  IF ch_integer (ch_mode, 1) = 0 THEN
    BEGIN
      no_mess_unit;
      append_string (ch1_line, "OFF")
    END
  ELSE
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE 22


    IF real_paran_value THEN
      ch1_line := format_real (ch_real(ch_index,1),ch1_line,paran_fnt1)
    ELSE
      ch1_line := format_integer (ch_integer(ch_index,1),
                                  ch1_line, paran_fnt1);
  IF ch_integer (ch_mode, 2) = 0 THEN
    BEGIN
      no_mess_unit;
      append_string (ch2_line, "OFF")
    END
  ELSE
    IF real_paran_value THEN
      ch2_line := format_real (ch_real(ch_index,2),ch2_line,paran_fnt2)
    ELSE
      ch2_line := format_integer (ch_integer(ch_index,2),
                                  ch2_line, paran_fnt2);
  output_paran_lines;
END dual_paran;
```

```
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REJECT;
COMMENT
$DOC=

NAME--
  indep_param
*****************************************************************************
*
* SHORT DESCRIPTION--
*   handles parameters that are channel independent
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE indep_param (index, value);
  VALUE index, value;  INTEGER index, value;
$
$DOC-&

BEGIN
  setup_param_lines (index);
  ch1_line := format_integer (value, ch1_line, param_fnt1);
  MOVE str2 := str1, #(str1#1);
  output_param_lines;
END indep_param;
```

```
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REJECT;
COMMENT
$DOC=

NAME--
  addr_param
*****************************************************************************
*
* SHORT DESCRIPTION--
*   handles HP-IB addresses
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE addr_param (index, addr, addr2);
  VALUE index, addr, addr2;  INTEGER index, addr, addr2;
&
$DOC-&

BEGIN
  setup_param_lines (index);
  ch1_line := format_integer (get_priv_ib_lun(addr),
                              ch1_line, param_fnt1);
  ch2_line := format_integer (get_priv_ib_lun(addr2),
                              ch2_line, param_fnt1);
  output_param_lines;
END addr_param;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
*****************************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
SUBROUTINE list_op_param2;
BEGIN
  disp_header ("OPERATING PRRRM.");
  quad_param (active_gate_start);
  quad_param (active_gate_stop);
  skip_line;
  real_param (active_phase_offset);
  real_param (active_magnitude_slope);
  real_param (active_magnitude_offset);
  real_param (active_stimulus_slope);
  real_param (active_stimulus_offset);
  skip_line;
  real_param (active_ref_plane_1);
  real_param (active_ref_plane_2);
  skip_line;
  real_param (active_system_z0);
  end_param_list;
  IF plot_debug THEN
    BEGIN WHEX(dg_parms); USTR(" <<< op parm 2"); CRLF; END;
END list_op_param2;
```

```
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REJECT;
COMMENT
$DOC=

NAME--
  list_op_params
*****************************************************************************
*
* SHORT DESCRIPTION--
*   lists operating parameters to display, printer, or plotter
*
* EXTENDED DESCRIPTION--
*   This routine consists of a series of calls to format and list
*   the operating parameters on the display or to a plotter or printer.
*   It is invoked by either the softkey which corresponds to displaying
*   the operating parameters or the softkeys which correspond to
*   printing or plotting the operating parameters.
*
*   Operating parameters consist of measurement information that is
*   not annotated on the display:
*       marker values 1-5
*       sweep time
*       power level
*       electrical length
*       averaging factor
*       smoothing aperture
*       ...and anything else that will fit
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   skip_line
*   real_param
*   quad_param
*   indep_param
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   call routine to display header
*   call various routines to format and output parameters
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
```

```
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DECLARATION--
;
SUBROUTINE list_op_params;                                    ENTRY;
&
$DOC-B

BEGIN
  op_param1 := TRUE;
  disp_header ("OPERATING PARAM.");
  real_param (active_sweep_time);
  real_param (active_source_power);
  real_param (active_electrical_length);
  dual_param (active_power_slope,ch_power_slope,ch_power_slope);
  dual_param (active_if_avg_factor,ch_average_mode,ch_average_factor);
  dual_param (active_smoothing_aperture,ch_smoothing_mode,
              ch_smoothing_aperture);
  skip_line;
  real_param (active_atten_port1);
  real_param (active_atten_port2);
  skip_line;
  quad_param (active_marker1);
  quad_param (active_marker2);
  quad_param (active_marker3);
  quad_param (active_marker4);
  quad_param (active_marker5);
  end_param_list;
  IF plot_debug THEN
    BEGIN UHEX(dg_parms); USTR(" <<<op parm 1"); CRLF; END;
END list_op_params;
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE 28


$EJECT;
SUBROUTINE list_op_param_page;                                ENTRY;
BEGIN
  IF op_param1 THEN
    list_op_params
  ELSE
    list_op_param2;
END list_op_param_page;

SUBROUTINE next_op_param;                                     ENTRY;
BEGIN
  op_param1 := NOT op_param1;
  list_op_param_page;
END next_op_param;
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE 29


$EJECT;
COMMENT
$DOC*

NAME--
  list_sys_params
*******************************************************************************
*
* SHORT DESCRIPTION--
*   lists system parameters to display, printer, or plotter
*
* EXTENDED DESCRIPTION--
*   This routine consists of a series of calls to format and list
*   the system parameters on the display or to a plotter or printer.
*   It is invoked by softbar the softkey which corresponds to displaying
*   the system parameters or the softkeys which correspond to  printing
*   or plotting the system parameters.
*
*   System parameters consist of general 8510 system information:
*      major HPIB address
*      minor HPIB address
*      test set address
*      source address
*      plotter address
*      primary SRQ mask
*      secondary SRQ mask
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   disp_header
*   skip_line
*   end_param_list
*   addr_param
*   indep_param
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*******************************************************************************
*
* INITIAL REFINEMENT--
*   call routine to display header
*   call various routines to format and output parameters
*
*******************************************************************************
*
* REVISION LOG--
*
*******************************************************************************
```

```
SPARMTBL.WORK.PD8510          THU, DEC 22, 1983, 10:52 AM    PAGE 30


DECLARATION--
;
SUBROUTINE list_sys_params;                                   ENTRY;
&
$DOC-A

BEGIN
  disp_header ("SYSTEM PARAM.");
  addr_param (active_8510_hpib_addr, major, major);
  addr_param (active_system_bus_hpib_addr, minor, minor);
  addr_param (active_source_hpib_addr, source, source_2);
  addr_param (active_testset_hpib_addr, test_set, test_set_2);
  addr_param (active_plotter_hpib_addr, plotter, plotter);
  addr_param (active_printer_hpib_addr, printer, printer);
  addr_param (active_ch_gnd_hpib_addr, user_device_1, user_device_2);
  addr_param (active_pass_thru_hpib_addr, priv_ib_pass, priv_ib_pass);
  skip_line;
  indep_param (active_srq_mask_primary, srq_mask_primary);
  indep_param (active_srq_mask_secondary, srq_mask_secondary);
  end_param_list;
  IF plot_debug THEN
    BEGIN UHEX(dg_parms); USTR(" <<< sys parm"); CRLF; END;
END list_sys_params;
```

```
SPARMTBL.UORK.PDS510          THU, DEC 22, 1983, 10:52 AM     PAGE  31


@EJECT;
COMMENT
$DOC+

NAME--                                                  list_trace_values
*****************************************************************************
*
* SHORT DESCRIPTION--
*   lists values and frequencies at each data-point of trace
*
* EXTENDED DESCRIPTION--
*   This routine lists the values and frequencies at each data point
*   of the trace in the currently active channel to an HP-IB printer.
*   The number of points listed corresponds to the current number of
*   points.  The listing is formatted as follows:
*
*   header line -->   NO.      FREQUENCY (units)       REAL,IMAG (units)
*
*   list of pts -->    n       f                       real, imag
*
*   The first column lists the number for each point 0..n (n=50,100,200)
*   The second column lists, depending on the domain, the frequency,
*   time, or auxiliary component.  The third column lists the value of
*   each point, seperated into its imaginary and real components.
*   Formats without imaginary values print a value of zero.
*
*   The format of each value printed is in a fixed floating point format
*   with a signed exponent and 2 significant digits to the left of the
*   decimal and 10 digits to the right.
*
*   The measurement units are defined at the header line in terms of
*   Hz, Units, dB, Sec, Volts, and other applicable standard units.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   hardcopy list of trace values
*
* ROUTINES CALLED--
*   append_string
*   entry_ch_integer
*   entry_ch_double
*   active_suffix
*   format_integer
*   format_quad
*   format_3cnpx
*   print_CRLF
*   formfeed
*
* ERROR CONDITIONS AND RECOVERY--
*   The domain status of the trace is checked thru calling
*   entry_ch_integer.  No range checking is done to verify that the
*   domain status is within indexing range into the domain string table
*   which generates the appropriate header string.
*   The correct description must be added in the input file IALPHPS
```

```
SPARMTBL.UORK.PDS510          THU, DEC 22, 1983, 10:52 AM     PAGE  32


*   under @prtdata and correspondingly in the domain string table in
*   order to accomodate another domain string.
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   initialize strings and data trace pointers
*   get address of the data trace
*   get header information and measurement units for frequencies and
*     amplitudes
*   print header information
*   FOR the current number of points
*     format and print the frequency and amplitude (real,imag)
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
$DOC-;
PROCEDURE list_trace_values;                                        ENTRY;
BEGIN
  INTEGER data_pt, i;
  DOUBLE  data_addr;
  USER3 POINTER data_blk=data_addr;
  DOUBLE CONSTANT
    int_fmt  := %01000000,
    data_fmt := %300012OR;              ! 18 char fixed sci. notat. !
  INTEGER TABLE domain_str :=           ! corresponds to cdomain.work !
    ! freq_domain !  print_freq,
    ! time_domain !  print_time,
    ! TDR         !  print_time,
    ! aux_domain  !  print_aux;

  SUBROUTINE print_line;
  BEGIN
    output_print_string (param_line, 8);
    output_print_string (ch1_line, 28);
    output_print_string (ch2_line, 0);
    print_CRLF;
  END print_line;

  init_strings;
  data_addr  := entry_ch_double (ch_f_base);
  data_pt    := 0;
  append_string (param_line, "NO.");
  append_string (ch1_line, ADRS(byte_list) +
                           domain_str [entry_ch_integer (ch_domain)]);
  append_string (ch1_line, active_suffix (active_start));
  append_ch     (ch1_line, ');
  append_string (ch2_line, "  REAL, IMAG (");
  append_string (ch2_line, active_suffix (active_ref_value));
```

```
SPARMTBL.UORK.PDS510          THU, DEC 22, 1983, 10:52 AM     PAGE  33


  append_ch     (ch2_line, '));
  print_line;  print_CRLF;
  FOR i := 0 STEP step_size UNTIL 800 DO
    BEGIN
      param_line := format_integer (data_pt/6, str0, int_fmt);
      ch1_line := format_quad(entry_stimulus_at_point(i),str1,data_fmt);
      ch2_line := format_3_cnpx (data_blk[data_pt], str2, data_fmt);
      data_pt := data_pt + 6;               ! next 3 word complex value !
      print_line;
    END;
  formfeed;
END list_trace_values;


END$
```

```
CPARSER.UORK.PDB510           THU, DEC 22, 1983, 10:52 AM     PAGE   1


INTEGER CONSTANT  hpib_eoi := %0100,          ! hpib end (eoi)          !
                  hpib_dcl := %0101,          ! hpib device clear (dcl)!
                  hpib_tlk := %0102,          ! hpib ready for output   !
                  hpib_pass_thru := %3F00;    ! command pass thru       !
```

```
FPARSER.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  1


SUBROUTINE init_public_ib_fifo;                              EXTERNAL;
PROCEDURE parser;                                            EXTERNAL;
```

```
SPARSER.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  1


MSBXL,P,"parser"
BEGIN

@FILE sdebugcG.work;                                          & DEBUG &
@FILE fkernel.work;
@FILE factive.work;
@FILE cide.work;
@FILE crlns.work;
@FILE fintrpt.work;
@FILE fscreen.work;
@FILE fchdata2.work;                                & for title_line &
@FILE fibtree.work;                              & for nnen mod ib_link &
@FILE cendcase.work;                          & for a few cnd_... constants &
@FILE cmtin.work;                                    & for end_n_sweeps &
@FILE ffifo.work;
@FILE ffifoe.work;
@FILE fpubib.work;
@FILE eparser.work;
@FILE fcommand.work;                              & for abort_command &
@FILE ftitle.work;                                 & for write_title &

ALPHA PROCEDURE clear_string(string);
   VALUE string;
   ALPHA string;                                              EXTERNAL;
ALPHA PROCEDURE append_ch(string,ch);
   VALUE string,ch;
   ALPHA string;
   BYTE  ch;                                                  EXTERNAL;

INTEGER CONSTANT  max_block_length := 32;                     & DEBUG &
GLOBAL BYTE ARRAY block_buffer[0:max_block_length);           & DEBUG &


BYTE CONSTANT anychar     := '@,        & parser wild-card characters &
              anydigit    := '~,             @ any digit or space    &
              anyar       := '$,             & ,|:|If|hpib end(eoi)   @
              dtchar      := '|;             & the "DT" string term'r &

BYTE CONSTANT zero        := '0,
              nine        := '9,
              comma       := ',,
              semicolon   := ';,
              space       := ' ,
              special     := %14;        & ASCII DC4                 &

BYTE     dt;       & the terminator char specified by the "DT" command &
BOOLEAN  string_acquired,
         eoi,
         dcl;
                                                              & DEBUG &
INTEGER CONSTANT max_debug_string := 31; & must be 2^n - 1 &  @ DEBUG &
BYTE ARRAY debug_string[0:max_debug_string];                  & DEBUG &
INTEGER    debug_string_index;                                & DEBUG &
BYTE ARRAY debug_string_print[0:max_debug_string+1];          & DEBUG &
ALPHA      debug_string_alpha;                                & DESUC &
```

```
SPARSER.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  2


BOOLEAN    syntax_error;                                      & DEBUG &


SUBROUTINE init_public_ib_fifo;                                 ENTRY;
   BEGIN & init_public_ib_fifo &
      FOR debug_string_index := 0 UNTIL max_debug_string DO    & DEBUG &
         debug_string[ debug_string_index ] := ' ';            & DEBUG &
      debug_string_index := 0;                                 & DEBUG &
      debug_string_alpha := ADRS( debug_string_print );        & DEBUG &
      debug_string_print[0] := max_debug_string + 1;           & DEBUG &
      init_fifo( public_ib_fife,
                 public_ib_fifo_size,
                 pub_ib_fifo,
                 pub_ib_fifo_not_full,
                 pub_ib_fifo_not_empty
               );
   END;  & init_public_ib_fifo &
                                                               & DEBUG &
                                                               & DEBUG &
                                                               & DEBUG &
PROCEDURE  enter_debug( char );                                & DEBUG &
   VALUE   char;                                               & DEBUG &
   BYTE    char;                                               & DEBUG &
   BEGIN & enter_debug &                                       & DEBUG &
      INTEGER i;                                               & DEBUG &
                                                               & DEBUG &
      IF NOT syntax_error THEN                                 & DEBUG &
         BEGIN & if not syntax error &                         & DEBUG &
            IF char < ' ' THEN                                 & DEBUG &
               char := '_;                                     & DEBUG &
            debug_string[ debug_string_index ] := char;        & DEBUG &
            debug_string_index := (debug_string_index + 1) AND & DEBUG &
                                  max_debug_string;            & DEBUG &
            FOR i := 0 UNTIL max_debug_string DO               & DEBUG &
               debug_string_print[i+1] := debug_string[        & DEBUG &
                   (debug_string_index+i) AND max_debug_string & DEBUG &
                                                         ];    & DEBUG &
            print_string( debug_string_alpha,                  & DEBUG &
                          title_size,                          & DEBUG &
                          title_display                        & DEBUG &
                        );                                     & DEBUG &
         END;  & if not syntax error &                         & DEBUG &
   END;  & enter_debug &                                       & DEBUG &


BYTE PROCEDURE next_char;
   BEGIN & next_char &
      LABEL   try_char;
      INTEGER ch;

      ch := read_fifo(public_ib_fifo);

try_char:
      IF ch > 200FF THEN
```

```
SPARSER.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  3


      BEGIN & if ch > 200FF &
         IF parser_debug THEN                                  & DEBUG &
            enter_debug('&);                                   & DEBUG &
         IF ch = hpib_eoi THEN
            BEGIN & if eoi &
               eoi := TRUE;
               dcl := FALSE;
               next_char := special;
            END   & if eoi &
         ELSE IF ch = hpib_dcl THEN
            BEGIN & else if dcl &
               dcl := TRUE;
               eoi := FALSE;
               abort_command := TRUE;
               next_char := special;
            END   & else if dcl &
         ELSE IF ch = hpib_tlk THEN
            BEGIN & else if tlk &
               write_fifo( token_fifo, end_hpib_talk );
               DO
                  ch := read_fifo(public_ib_fifo)
               UNTIL ch <> hpib_tlk;
               GO TO try_char;
            END   & else if tlk &
         ELSE IF (ch AND %FF00) = hpib_pass_thru  THEN
            BEGIN & else if pass thru &
               DO
                  BEGIN
                     write_fifo(token_fifo, ch);
                     ch := read_fifo( public_ib_fifo );
                  END
               UNTIL (ch AND %FF00) <> hpib_pass_thru;
               GO TO try_char;
            END   & else if pass thru &
         ELSE
            BEGIN & else &                    & should never happen &
               write_fifo( token_fifo, end_illegal );
               dcl := TRUE;
               eoi := FALSE;
               next_char := special;
            END;  & else &
      END   & if ch > 200FF &
   ELSE & ch <= 200FF &
      BEGIN & else ch <= 200FF &
         IF parser_debug THEN                                  & DEBUG &
            enter_debug(ch);                                   & DEBUG &
         eoi := dcl := FALSE;
         next_char := ch;
      END;  & else ch <= 200FF &

   END;  & next_char &


BYTE PROCEDURE simple(ch);
   VALUE ch;
```

```
SPARSER.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  4


   BYTE  ch;
   BEGIN  & simple &
      ch := ch AND %77;
      IF ((ch >= 'a) AND (ch <= 'z)) THEN                    & upshift &
         simple := ch AND %5F
      ELSE
         simple := ch;
   END simple;


INTCCCR PROCEDURE op(next,ch);        & This procedure is a temp patch &
   VALUE  next,ch;
   INTEGER next;
   BYTE    ch;
   BEGIN & pp &
      INTEGER CONSIBNT print_none  := 0,
                       print_title := 1,
                       prant_entry := 2;
      INTEGER print_cnd,
              opcode;
      INTEGER POINTER ore,
                      det;

      opcode := ib_link[next];

      IF opcode < 0 THEN
         BEGIN & if &
            op := opcode OR %FD00;
            opcode := -opcode;
         END   & if &
      ELSE
         op := opcode AND %DFFF;

      print_end := print_none;
      CASE RIGHT(opcode,12) OF
         BEGIN  & case &
:& 0 &      ;
& 1 &       BEGIN & 1 &
               title := clear_string(title);
               print_end := print_title;
            END;  & 1 &
& 2 &       BEGIN & 2 &
               title := append_ch(title,ch);
               print_cnd := print_title;
            END;  & 2 &
& 3 &       BEGIN & 3 &
               string_acquired := TRUE;
               acquire( entry_string );
               entry := clear_string(entry);
               entry := append_ch(entry,ch);
            END;  & 3 &
& 4 &       BEGIN & 4 &
               entry := append_ch(entry,ch);
            END;  & 4 &
& 5 &       BEGIN & 5 &
```

```
SPARSER.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  5


               string_acquired := TRUE;
               acquire( entry_string );
               entry := clear_string(entry);
               entry := append_ch(entry,ch);
            END;  & 5 &
& 6 &       BEGIN & 6 &
               entry := append_ch(entry,ch);
            END;  & 6 &
         END case;

      IF print_end <> print_none THEN
         BEGIN & if &
            print_string(title,title_size,title_display);
            write_title;  & move to instrument state in dg RAM &
         END;  & if &
         & use code located after end to display numbers as received &

   END;  & op &


PROCEDURE parser;  & a process &                                  ENTRY;
   BEGIN  & parser &
      BYTE char,
           simplechar,
           expect;
      INTEGER next;
      INTEGER block_length;

      dt := newline;
      string_acquired := FALSE;
      syntax_error := FALSE;

get_new_token:                          & after accepting previous token &
      char := simple( next_char );

      UNTIL (  (char = space     ) OR
               (char = cr        ) OR
               (char = comma     ) OR
               (char = semicolon ) OR
               (char = newline   ) OR
               eoi                 OR
               dcl
            ) DO
         char := simple( next_char );
      next := op(char,char);;

      UNTIL next > 0 DO
         BEGIN  & while next &
            expect := next[next];
            char :=  next_char;
            IF dcl THEN
               GO TO get_new_token;
            simplechar := simple(char);

            UNTIL (
```

```
SPARSER.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  6


                     (expect <> simplechar) AND
                     (expect <> anychar   ) AND
                     (
                       (expect <> anydigit) OR NOT(
                          (
                            (simplechar <= nine) AND (simplechar >= zero)
                          ) OR
                          (simplechar = space)
                                                )
                     ) AND
                     (
                       (expect <> space) OR NOT(simplechar = cr)
                     ) AND
                     (
                       (expect <> anysr) OR NOT(
                          (simplechar = comma) OR
                          (simplechar = semicolon) OR
                          (simplechar = cr) OR
                          (simplechar = newline) OR
                          eoi
                                                )
                     ) AND
                     (
                       (expect <> dtchar) OR NOT(
                         (char = dt) OR
                         eoi
                                                )
                     )
                  ) DO
               BEGIN  & while expect &
                  COMMENT
                     char doesn't match expected char so look farther
                     an illegal next character will match the wild card
                     at the end of the list of characters to test.;
                  next := next + 1;
                  expect := next[next];
               END while expect;

            next := op(next,char);

         END while next;                                          & DEBUG &
      IF parser_debug THEN                                        & DEBUG &
         enter_debug('|');                                        & DEBUG &

      write_fifo( token_fifo, -next );

      IF ( ((-next) >= end_enter) AND
           ((-next) <= cnd_w4   )
         ) OR
         ( ((-next) = cnd_block_a)
         ) THEN
         wait( entry_string_ready );            & wait until processed &

      IF string_acquired THEN
         BEGIN & if &
```

```
SPARSER.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  7


            string_acquired := FALSE;
            entry := clear_string( entry );
            release( entry_string );
         END;  & if &

      IF (-next) = end_illegal THEN
         BEGIN & if &                                             & DEBUG &
            syntax_error := TRUE;                                 & DEBUG &
            WHILE NOT dcl DO          & eat up chars until device clear &
               char := next_char;
            syntax_error := FALSE;                                & DEBUG &
         END;  & if &                                             & DEBUG &

      GO TO get_new_token;

   END parser;

END$
```

```
JPASSt.UORK.PD8510          THU, OEE 22, 1983, 10:53 AM     PAGE  1


!job pass1,librm.pd8510,pass1;outclass=,1
!tell wcc.pd8510; "================ PASS1 release ==================="
!tell wcc.pd8510; "flake sure a complete recompile has been nade,"
!tell wcc.pd8510; "works, and is serialized with a 0 revision suffix."
!tell wcc.pd8510; "=============================================="
!tell librm.pd8510; "================ PASS1 release ==================="
!tell librm.pd8510; "flake surt a complete recompile hae been nade,"
!tell librm.pd8510; "uorks, and is serialized with a 0 revision suffix."
!tell librm.pd8510; "=============================================="
!tell jtb.pd8510; "================ PASS1 release ==================="
!tell jtb.pd8510; "Make sure a complete recompile has been nade,"
!tell jtb.pd8510; "uorks, and it serialized with a 0 revision suffix."
!tell jtb.pd8510; "=============================================="
!tell lani.pd8510; "================ PASS1 release ==================="
!tell lani.pd8510; "flake sure a complete recompile has been nade,"
!tell lani.pd8510; "norks, and is serialized with a 0 revision suffix."
!tell lani.pd8510; "=============================================="
!file pdtape;dev=tape
!file syslist;dev=lp
!store @.pass1.pd8510,@.work.pd8510,@.m68k.upsoft;*pdtape;show
!purge dscreen
!purge loadnap
!purge loadsort
!purge nbmmap
!purge nnbnload
!purge obj
!purge lnain
!purge ochartet
!purge oinbn
!purge onbnload
!purge ononitor
!purge sibtbl
!purge skinfo
!purge frint
!purge fids
!purge fdebug
!purge cdtngr
!purge cretp
!purge cstin
!purge cparans
!purge cformat
!purge ccalncnu
!purge cdisp
!purge cplot
!purge cnkr
!purge csysten
!purge cendcase
!purge schanget
!purge dcniable
!purge dcnddecl
!purge dscreen
!purge dalphas
!fcopy
from=dscreen.work;to=dscreen;new
from=lcadnap.work;to=loadnap;new
```

```
JPASS1.UORK.PD8510          THU, DEC 22, 1983, 10:53 AM     PAGE  2


from=leadsort.work;to=loadsort;new
from=nbmmap.work;to=nbmmap;new
from=nnbnload.work;to=nnbnload;new
from=obj.work;to=obj;new
From=lnain.work;to=lnasn;new
from=ocharett.work;to=ocharset;new
from=oinbn.work;to=oinbn;new
from=onbnload.work;to=snbnload;new
from=ononitor.work;to=enonitar;new
from=sibtbl.work;to=sibtbl;new
from=skinfo.work;to=skinfo;new
from=crint.work;to=frins;new
from=cide.work;to=fids;new
from=cdebug.work;to=fdebug;new
from=cdtngr.work;to=cdtngr;new
from=cresp.work;to=cresp;new
from=cstin.work;to=cstin;new
from=cparans.work;to=cparans;new
from=cformat.work;to=cformat;new
from=ccalmenu.work;to=ccalmenu;new
from=cdisp.work;to=cdisp;new
from=cplot.work;to=cplot;new
from=cnkr.work;to=cnkr;new
from=csytten.work;to=csysten;new
from=ccndcass.work;to=ccasdcase;new
from=schanges.work;to=schanges;new
from=dchtable.work;to=dchtable;new
from=dbnodecl.work;to=dcnddecl;new
from=dscrten.work;to=dscreen;new
from=dalphas.work;to=dalphas;new
exit
!eod
!eoj
```

```
FPFR.UORK.PD8510            THU, OEC 22, 1983, 10:53 AM     PRCE  1


PROCEDURE  recall_pfr;                              EXTERNAL.L;
PROCEDURE  configure;                               EXTERNAL.L;
```

```
SPFR.UORK.PD8510            THU, DEC 22, 1983, 10:53 AM     PAGE  1


A68KL,P,"pfr"
BEGIN

#FILE fgratic.work;                          & for trace_and_graticule &
#FILE cdatap.work;                                    & for nax_format &
#FILE ccontvar.work;                        & includes nax_paranater &
#FILE cchtable.work;                                & includes nax_cb &
#FILE fchpfr.work;      & after nax_format/nax_parameter/nax_ch decl'a &
#FILE fchtable.work;

BYTE TABLE basis_paran :=                    & indexed by paraneter &
      0,
      s11,        & s11   &
      t21,        & s21   &
      s12,        & s12   &
      s22,        & s22   &
      s11,        & z1    &
      s22,        & s2    &
      s11,        & y1    &
      s22,        & y2    &
      null_paran, & user1 &
      null_paran, & user2 &
      null_paran, & user3 &
      null_paran; & user4 &

BYTE TABLE refl_trans  :=                    & indexed by paraneter &
      refl,       & s11   &
      trans,      & s21   &
      refl,       & s12   &
      trans,      & s22   &
      refl,       & z1    &
      refl,       & s2    &
      rtfl,       & y1    &
      refl,       & y2    &
      null_paran, & user1 &
      null_paran, & ueer2 &
      null_paran, & user3 &
      null_paran; & user4 &
```

```
SPFR.UORK.PD8510              THU, DEC 22, 1983, 10:53 RM     PAGE  2


%EJECT;
COMMENT                                                        recall_pfr
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  recall_pfr;                                              ENTRY;
   BEGIN & recall_pfr &
      INTEGER temp_domain,
              temp_parameter,
              temp_format;

      & get new values from parameter-format-response memory &
      temp_domain    := entry_ch_integer( ch_domain );
      temp_parameter := entry_ch_integer( ch_param );
      temp_format    := format[ temp_domain,
                                temp_parameter,
                                current_entry_ch
                              ];
      set_entry_ch_integer(temp_format, ch_format);
      set_entry_ch_integer(basis_param[temp_parameter],
                           ch_basis_s_param
                          );
      set_entry_ch_integer(refl_trans[temp_parameter], ch_refl_trans);
      set_entry_ch_integer(parameter_descriptor[ temp_parameter,
                                                 parameter_conversion
                                               ],
                           ch_param_conversion
                          );
      IF type_of_grat[ temp_format ] <> rectangular THEN
         temp_format := fmt_log_polar;    & all polars use same values &
      set_entry_ch_real( scale[ temp_format,
                                temp_parameter,
                                current_entry_ch
                              ],
                         ch_scale
                        );
      set_entry_ch_real( ref_position[ temp_format,
                                       temp_parameter,
                                       current_entry_ch
                                     ],
                         ch_ref_position
                        );
      set_entry_ch_real( ref_value[ temp_format,
                                    temp_parameter,
                                    current_entry_ch
                                  ],
                         ch_ref_value
                        );
      set_entry_ch_real( elec_delay[ temp_parameter,
                                     current_entry_ch
                                   ],
                         ch_elec_delay
                        );
   END;  & recall_pfr &
```

```
SPFR.UORK.PD8510              THU, DEC 22, 1983, 10:53 RM     PAGE  3
```

```
SPFR.UORK.PD8510              THU, DEC 22, 1983, 10:53 RM     PAGE  4


%EJECT;
COMMENT                                                        configure
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  configure;                                               ENTRY;
   BEGIN & configure &
      INTEGER i;

      & PARAMETER DESCRIPTOR &              & to be read from test-set &

      FOR i := 1 UNTIL max_parameter_entry DO
         BEGIN & for &
            parameter_descriptor[z1,i]      :=
            parameter_descriptor[y1,i]      :=
                                            parameter_descriptor[s11,i];
            parameter_descriptor[z2,i]      :=
            parameter_descriptor[y2,i]      :=
                                            parameter_descriptor[s22,i];
         END;  & for &
      parameter_descriptor[z1,parameter_conversion]   := conv_s_to_z;
      parameter_descriptor[z2,parameter_conversion]   := conv_s_to_z;
      parameter_descriptor[y1,parameter_conversion]   := conv_s_to_y;
      parameter_descriptor[y2,parameter_conversion]   := conv_s_to_y;

   END;  & configure &

END$
```

```
CPLOT.UORK.PD8510             THU, DEC 22, 1983, 10:53 RM     PAGE  1

INTEGER CONSTANT

cmd_plot_all := 268,
cmd_plot_trace := 269,
cmd_plot_graticule := 270,
cmd_plot_marker := 271,
cmd_plot_text := 272,
cmd_ch1_pen := 274,
cmd_list_trace := 276,
cmd_system_params := 277,
cmd_op_params := 278,
cmd_quadrant_11 := 279,
cmd_quadrant_21 := 280,
cmd_quadrant_12 := 281,
cmd_quadrant_22 := 282,
cmd_quadrant_full := 283,
cmd_pen1 := 284,
cmd_pen2 := 285,
cmd_pen3 := 286,
cmd_pen4 := 287,
cmd_pen5 := 288,
cmd_pen6 := 289,
cmd_pen7 := 290,
cmd_pen8 := 291,
cmd_print_params := 292,
cmd_plot_params := 293,
cmd_next_op_param := 294,
cmd_group2 := 0;
```

```
FPLOT.WORK.PD8510              THU, DEC 22, 1983, 10:53 AM     PAGE  1


COMMENT
  This is a software generated file !!!
  Changes must be made in SKIBFD.WORK
  Run CENSK.UNKI to re-generate file;

SUBROUTINE proc2;  ENTRY;
BEGIN

CASE command_token-268 OF
BEGIN
% 268 %
select_plot_buffer (all);
% 269 %
select_plot_buffer (trace);
% 270 %
select_plot_buffer (grid);
% 271 %
select_plot_buffer (markers);
% 272 %
select_plot buffer (annotations);
% 273 %
BEGIN END;
% 274 %
BEGIN END;
% 275 %
BEGIN END;
% 276 %
IF printer_connected THEN
  BEGIN
    abort_sweep;
    list_trace_values;
    restart_sweep;
  END;
% 277 %
select_plot_param (sys_params);
% 278 %
select_plot_param (op_params);
% 279 %
select_plot_quadrant (upper_left);
% 280 %
select_plot_quadrant (lower_left);
% 281 %
select_plot_quadrant (upper_right);
% 282 %
select_plot_quadrant (lower_right);
% 283 %
select_plot_quadrant (full_page);
% 284 %
select_pen(1);
% 285 %
select_pen (2);
% 286 %
select_pen (3);
% 287 %
select_pen (4);
```

```
FPLOT.WORK.PD8510              THU, DEC 22, 1983, 10:53 AM     PAGE  2


% 288 %
select_pen (5);
% 289 %
select_pen (6);
% 290 %
select_pen (7);
% 291 %
select_pen (8);
% 292 %
IF printer_connected THEN
  output_parameters;
% 293 %
dump_to_plotter;
% 294 %
next_op_param;
END;
END proc2;
```

```
SPLOT.WORK.PD8510              THU, DEC 22, 1983, 10:53 AM     PAGE  1


M68KL,P, "plot"

BEGIN

%FILE cdebug.work;
%FILE ftern.work;
%FILE ffnt.work;
%FILE fstring.work;
%FILE fcnv9x.work;
%FILE cdatap.work;
%FILE fchdata.work;
%FILE fchdats2.work;
&FILE cchconst.work;
%FILE fchtable.work;
%FILE fprivib.work;
%FILE foutib.work;
&FILE foutib2.work;
&FILE fconnand.work;
%FILE fparntbl.work;
%FILE ftpngr2.work;
%FILE cnenu.work;
&FILE fmenu.work;
%FILE fcontrol.work;
&FILE cscreen.work;
&FILE cplot.work;
&FILE fdispran.work;
%FILE crins.work;
%FILE fkernel.work;
&FILE fgratic.work;
&FILE fdguser.work;

% The following &FILES are for error messages %

%FILE cnsgplot.work;
&FILE cnsgpriv.work;
%FILE futil3.work;
&FILE futil2.work;

BYTE CONSTANT
  eonna       := &4,
  ttrn        := 59,            % semi-colon terminator              %
  CR          := 13,
  LF          := 10;

INTEGER CONSTANT
  string_size := 25,
  all         := 0,             % choice of 5 display buffers to plot %
  entry_info  := 0,
  tract       := 1,
  grid        := 2,
  narkers     := 3,
  annotations := 4,
  op_parant   := 5,
  sys_parans  := 6,
  dg_user     := 0,
```

```
SPLOT.WORK.PD8510              THU, DEC 22, 1983, 10:53 AM     PAGE  2


  softkeys    := 7,
  full_page   := 0,             % indices into x/y offset table used  %
  lower_left  := 1,             % to plot to a particular quadrant    %
  lower_right := 2,
  upper_left  := 3,
  upper_right := 4;

DOUBLE CONSTANT
  x_min := -260,
  x_max := 3835,
  y_min := -50,
  y_max := 4045,
  %tring_format := %D7000600;    % integer to ascii conversion format  %

INTEGER TABLE buffer_start :=
  % entry info %   start_display+1, start_display+1,
  % trace info %   trace1_position, trace2_position,
  % graticule  %   graticule1_position, graticule2_position,
  % narkers    %   nkr11_position, nkr21_position,
  % annotations%   paran1_position, paran2_position,
  % parans     %   text_position, text_position,
  % user disp. %   user_display, user_display,
  % softkeys   %   sk11_position, sk11_position;

INTEGER TABLE buffer_end :=
  % entry info %   entry_aux_position + entry_aux_size,
                  entry_aux_position + entry_aux_size,
  % trace info %   trace1n_display + trace_size,
                  trace2n_display + trace_size,
  % graticule  %   ref_line1_display+ref_line_size,
                  ref_line2_display+ref_line_size,
  % narkers    %   nkr15_display+nkr_size, nkr28_display+nkr_size,
  % annotations%   end_ch1_position, end_ch2_position,
  % parans     %   sk11_position, sk11_position,
  % user disp. %   character_set, character_set,
  % softkeys   %   sk_highlight_position+sk_highlight_size,
                  sk_highlight_position+sk_highlight_size;

ALPHA TABLE pen_number :=
  "0;","1;","2;","3;","4;","5;","6;","7;","8;";

INTEGER
  plot_buffer,
  new_pen,
  current_pen;

GLOBAL BOOLEAN
  plot_to_hpib;             % flag to send HPGL conmands to public HPIB %

BOOLEAN
  service_plot,             % flag to copy entire display for document'n%
  abort_plot;

BYTE ARRAY
  xtra_string [-1:6],
  plot_string [-1:tring_size];
```

```
SPLOT.UORK.P08510          THU, DEC 22, 1983, 10:53 AM    PAGE  3


ALPHA
  aux_string,
  xy_string;
```

```
SPLOT.WORK.P08510          THU, DEC 22, 1983, 10:53 AM    PAGE  4


REJECT;
COMMENT
$DOC+

NAME--
  init_strings
*****************************************************************************
*
* SHORT DESCRIPTION--
*   initializes plotting strings
*
* EXTENDED DESCRIPTION--
*   This routine initializes strings used to send commands to the
*   plotter.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY-- none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set maximum string length byte
*   set address of string to point to a byte array
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE init_strings;
&
$DOC-&

BEGIN
  plot_string [-1] := string_size;
  xtra_string [-1] := 6;
  aux_string:= ADRS (xtra_string);
  xy_string := ADRS (plot_string);
END init_strings;
```

```
SPLOT.UORK.P08510          THU, DEC 22, 1983, 10:53 AM    PAGE  5


$EJECT;
COMMENT
$DOC+

NAME--
  plotter_connected
*****************************************************************************
*
* SHORT DESCRIPTION--
*   checks if a plotter is connected to the 8510
*
* EXTENDED DESCRIPTION--
*   This routine checks if a plotter is connected on the private bus of
*   the 8510 by writing a command to the plotter's address that sets the
*   plotter's default state.  If the attempt to write to the plotter
*   fails then an error message is displayed indicating that a plotter
*   is not connected.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   TRUE  = plotter is connected
*   FALSE = plotter is not connected
*
* ROUTINES CALLED--
*   urt_priv_ib
*   clear_message
*   warn
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   A call to "clear_message" is made before displaying the error
*   message because a general private HP-IB bus error message is also
*   displayed when an attempt to write to a device on the private bus
*   fails.  In order to display the most recent error message, any
*   previous error message must be cleared.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   IF writing to the plotter fails THEN
*     clear general private HP-IB error message
*     display unconnected plotter error message
*     return a value of FALSE
*   ELSE
*     return a value of TRUE
*
*****************************************************************************
*
* REVISION LOG--
*
```

```
SPLOT.UORK.P08510          THU, DEC 22, 1583, 10:53 AM    PAGE  5


*****************************************************************************
$DOC-;
BOOLEAN SUBROUTINE plotter_connected;
BEGIN
  IF NOT urt_priv_ib (plotter, no_fun, "DF;" &default conditions&) THEN
    BEGIN
      clear_message (priv_ib_add_err);
      warn (no_plotter);
      plotter_connected := FALSE;
    END
  ELSE
    plotter_connected := TRUE;
END plotter_connected;
```

```
SPLOT.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  7


%EJECT;
COMMENT
%DOC+

NAME--
  printer_connected
*****************************************************************************
*
* SHORT DESCRIPTION--
*   checks if a printer is connected to the 8510
*
* EXTENDED DESCRIPTION--
*   This routine checks if a plotter is connected on the private bus of
*   the 8510 by writing a linefeed to the printer's address.  If the
*   attempt to write to the printer fails, then an error message is
*   displayed indicating that a printer is not connected.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   TRUE  = printer is connected
*   FALSE = printer is not connected
*
* ROUTINES CALLED--
*   urt_priv_ib
*   clear_message
*   warn
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   A call to "clear_message" is made before displaying the error
*   message because a general private HP-IB bus error message is also
*   displayed when an attempt to write to a device on the private bus
*   fails.  In order to display the most recent error message, any
*   previous error message must be cleared.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   IF writing to the printer fails THEN
*     clear general private HP-IB error message
*     display unconnected printer error message
*     return a value of FALSE
*   ELSE
*     return a value of TRUE
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
```

```
SPLOT.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  8


%DOC-;
BOOLEAN SUBROUTINE printer_connected;
BEGIN
  IF NOT urt_priv_ib (printer, clr_fun, "  ") THEN
    BEGIN
      clear_message (priv_ib_add_err);
      warn (no_printer);
      printer_connected := FALSE;
    END
  ELSE
    printer_connected := TRUE;
END printer_connected;
```

```
SPLOT.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  9


%EJECT;
COMMENT
%DOC+

NAME--
  plot
*****************************************************************************
*
* SHORT DESCRIPTION--  plots a segment of display RAM on plotter
*
* EXTENDED DESCRIPTION--
*   This routine reads from the display gen. RAM from a starting
*   address and translates each display generator control word to
*   HPGL strings to be sent to an external plotter via the private
*   HPIB. Each display RAM word is translated into one of the following:
*
*       - attribute          = absolute/relative plotting
*       - jump to new addr.  = general purpose branch around
*       - subroutine branch  = drawing characters
*       - subroutine return  = return from drawing characters
*       - x/y coordinate     = x,y coordinate w/ pen up or down
*
*   X,Y vectors are always forced into x,y pairs such that if a
*   jump word (or any other control word) were to follow an x vector,
*   then the next vector encountered would be designated as the x
*   vector.  Each x,y pair is then converted into a string seperated by
*   commas, and sent out to the plotter via the private HPIB.
*   These vectors are all plotted absolute to the 0,0 vector since the
*   relative stroking of vectors in the display generator uses values
*   that require modula 4095 in the negative direction.  This requires
*   a running sum of x and y coordinates be kept as each relative x/y
*   vector is read and added to the sum.  A modula 4095 is done on each
*   x/y sum in order to get the absolute x/y position.
*
*   A mini-stack is created for each jump to subroutine word which holds
*   the next display word to return to.
*
* INPUTS--
*   start_pos = starting address of display RAM to dump to plotter
*   end_pos   = ending address of diaplay RAM to dump to plotter
*
* OUTPUTS--
*   hardcopy plot
*
* ROUTINES CALLED--
*   urt_priv_ib
*   append_ch
*   append_string
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   All character text is stroked from the display gen. to the plotter
*   through the JSRs to individual character vector sets in display
*   memory (therefore the plotter's character set is not used).
```

```
SPLOT.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE 10


*
*   Any plot in progress can be aborted by pressing any front panel key.
*   This sets a global flag which is checked after each access to a
*   display word.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   pick up plotter pen
*   loop until plot is aborted OR end of display segment is read:
*     check 2 MSBs of each display word for the following control bits
*       0: attribute/return from character subroutine
*            pick up/put down plotter pen for blank/non-blank attribute
*            return to calling display word and read next display word
*       1: x/y coordinate
*            collect x,y pair
*            convert to string and dump to plotter
*       2: branch to character subroutine
*       3: jmp to given address
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE plot (start_pos, end_pos);
  VALUE start_pos, end_pos;  INTEGER start_pos, end_pos;
&
%DOC-&

 BEGIN

  DOUBLE CONSTANT
    DG_base := %100000,          & display gen. vectors              &
    CH_base := %106000;          & character set vectors             &
  INTEGER CONSTANT
    max_RTNs    := 4,            & hardware stack size for display RTNs&
    EOD_pattern := %0B00,
    NOP_pattern := %0R00,
    PR_pattern  := %0300,
    INC_pattern := %0500,
    RTS_bit     := 13,
    blank_bit   := 12,
    neg_bit     := 11;
  INTEGER POINTER
    DG_ptr;                      & contents of display memory word   &
  DOUBLE
    end_of_display_buffer,
    DG_address = DG_ptr;
  DOUBLE ARRAY
    RTN_address [0:max_RTNs];    & return address stack for display  &
  INTEGER
```

```
SPLDT.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  11

    x_abs, y_abs,
    X, Y,                          & x/y coordinate display vector      &
    x_plot_offset, y_plot_offset,& x,y offsets for quadrant plotting  &
    RTN_ptr,                       & return address stack pointer      &
    attribute;
  BOOLEAN
    EOD_found,
    blank_vector,
    char_rel,
    xy_rel,
    plot_rel,
    x_vector,
    pen_up;

  COMMENT
    The following tables contain offsets for plotting one of the &
    possible quadrants or a full page.  They are indexed by constants
    which describe which quadrant is being plotted
  ;
  INTEGER TABLE
    x_offset := 0,-100,1950,-100,1950;
  INTEGER TABLE
    y_offset := 0,-50,-50,2050,2050;

  &-------------------------------------------------------------------&

  SUBROUTINE RTS;
  BEGIN
    IF RTN_ptr >= 0 THEN
      BEGIN
        & return to calling address and advance to next display word &
        STPNTR (DG_ptr, RTN_address[RTN_ptr]);
        RTN_ptr := RTN_ptr - 1;
      END
    ELSE
      BEGIN & debug &
        USTR("ERROR:  RTS from "); NHex(DG_address,8);
        USTR(" = "); NHex(DG_ptr,8); CRLF;
        STPNTR (DG_ptr, end_of_display_buffer);
      END;
  END RTS;

  &-------------------------------------------------------------------&

  SUBROUTINE JMP;
  BEGIN
    STPNTR (DG_ptr, DG_base+RLEFT(DG_ptr AND %3FFF,1));
    x_vector := TRUE;
    plot_rel := (xy_rel AND (DG_address<CH_base)) OR (char_rel);
  END JDP;

  &-------------------------------------------------------------------&

  SUBROUTINE JSR;
  BEGIN
    RTN_address[RTN_ptr:=RTN_ptr+1) := DG_address;
```

```
SPLDT.WORK.PD8510          THU, DEC 22, 1983, 10:53 AM    PAGE  12

    JMP;
  END JSR;

  &-------------------------------------------------------------------&

  SUBROUTINE load_xy;
  BEGIN
    IF x_vector THEN                       & compute x display vector &
      BEGIN
        x_vector := FALSE;
        x_abs := (DG_ptr + (IF plot_rel THEN x_abs ELSE 0)) AND %0FFF;
        X := (IF plot_quadrant=full_page THEN x_abs ELSE
            (RLEFT(x_abs,2)/9) + x_plot_offset);      & DIV 2.25      &
        blank_vector := TBIT (DG_ptr, blank_bit);
      END
    ELSE
      BEGIN          & compute y display vector and output x,y vectors &
        x_vector := TRUE;
        y_abs := (DG_ptr + (IF plot_rel THEN y_abs ELSE 0)) AND %0FFF;
        Y := (IF plot_quadrant=full_page THEN y_abs ELSE
            (RLEFT(y_abs,2)/9) + y_plot_offset);      & DIV 2.25      &
        plot_string [0] := 0;
        COMMENT
        IF plot_to_hpib OR service_plot THEN
          BEGIN
            X := M - x_min
            Y := Y - y_min
          END;
        IF blank_vector AND NOT pen_up THEN
          BEGIN
            pen_up := TRUE;
            append_string (xy_string, ";PU;PR");
          END
        ELSE
        IF NOT blank_vector AND pen_up THEN
          BEGIN
            pen_up := FALSE;
            append_string (xy_string, ";PD;PR");
          END
        ELSE
        IF plot_to_hpib THEN    & LF terminated last x,y pair over bus &
          append_string (xy_string,"PR")
        ELSE
          append_ch (xy_string, conna);     & delimiter after last x,y &
        & convert X and Y values to strings &
        append_string (xy_string, append_ch (
                       format_double (X, aux_string, string_format),
                       conna));
        append_string (xy_string,
                       format_double (Y, aux_string, string_format));
        IF NOT plot_to_hpib THEN
          urt_priv_ib (plotter, pa, xy_string)
        ELSE
          BEGIN
            append_ch(xy_string,10);      & append LF &
            abort_plot :=
```

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            NOT (string_out_pk (xy_string) AND next_xfer_ready);
          END;
      END;
    STPNTR (DG_ptr, DG_address+2);      & advance to next display word &
  END load_xy;

  &-------------------------------------------------------------------&

  SUBROUTINE load_attribute;
  BEGIN
    IF NOT (EOD_found:=(attribute:=DG_ptr AND %0F0D)=EOD_pattern) THEN
      BEGIN
        IF DG_address < CH_base THEN
          xy_rel := attribute=PR_pattern;
        char_rel := attribute=INC_pattern;
        IF TBIT (DG_ptr, RTS_bit) THEN
          RTS;
        STPNTR (DG_ptr, DG_address+2);
        plot_rel := (xy_rel AND (DG_address<CH_base)) OR (char_rel);
      END;
  END load_attribute;

  &-------------------------------------------------------------------&

  IF NOT abort_plot THEN
    BEGIN
      acquire( trace_marks );
      x_abs := y_abs := 0;
      X := Y := 0;
      RTN_ptr := -1;
      EOD_found:=blank_vector:=char_rel:=xy_rel:=plot_rel:= FALSE;
      x_vector := pen_up := TRUE;
      STPNTR (DG_ptr, DG_base+ (2*start_pos));
      end_of_display_buffer := DG_base + (2*end_pos);
      x_plot_offset := x_offset (plot_quadrant);
      y_plot_offset := y_offset (plot_quadrant);
      IF NOT plot_to_hpib THEN
        urt_priv_ib (plotter, pa, ";PU;PA0,0");
      IF plot_debug THEN
        BEGIN
          USTR("PLOT START="); UHex(DG_address,8); UHEX(start_pos);
          CRLF; USTR('PLOT END @: "); UHex(end_of_display_buffer,8);
          NHEX(end_pos); CRLF;
        END;
      DO BEGIN
        & debug for display words inserted here &
        CASE RIGHT (DG_ptr,14) OF                & get display opcode &
          BEGIN
            load_attribute;                              & 0 &
            load_xy;                                     & 1 &
            JSR;                                         & 2 &
            JMP;                                         & 3 &
          END case;
        abort_plot := abort_plot OR abort_command;
      END UNTIL EOD_found OR abort_plot OR
              ((DG_address >= end_of_display_buffer) AND
```

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              (DG_address < CH_base));
      release( trace_marks );
    END;
  END plot;
```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  do_plot_setup
*****************************************************************
*
* SHORT DESCRIPTION--
*   picks up act up pen color and plots display buffer
*
* EXTENDED DESCRIPTION--
*   This routine executes the set up plot corresponding to the
*   channel of the display buffer(s) to be plotted.  The pen for that
*   channel is picked up and a plot routine is called to plot the
*   chosen display buffer.
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED-- none
*
* ERROR CONDITIONS AND RECOVERY-- none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE do_plot_setup (channel, buffer);
  VALUE channel, buffer;
  INTEGER channel, buffer;
%BEGIN
  IF NOT abort_plot THEN
  IF display_5510_on OR (buffer = dg_user) THEN
  %BEGIN
    IF (new_pen:=pletter_pen[channel]) <> current_pen THEN
      %BEGIN
        urt_priv_ib (plotter, no_fun, "SP");
        urt_priv_ib (plotter, no_fun, pen_number[current_pen:=new_pen]);
      END;
    buffer := 2*buffer + channel-1;
    plot (buffer_start(buffer), buffer_end[buffer]);
  END;
END do_plot_setup;
```

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```

```
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%EJECT;
COMMENT
$DOC+

NAME--
  case_plot_buffer
*****************************************************************
*
* SHORT DESCRIPTION--
*   selects display buffer(s) to be plotted
*
* EXTENDED DESCRIPTION--
*   This routine does a case selection on which display buffer(s) to
*   plot.  Flags are first set depending on whether channel 1 and 2
*   display information is being displayed (since display "jumps" are
*   not embedded to jump-around either of the channel displays for
*   single channel cases).  These flags are then used to determine
*   whether one or both channel displays are plotted.
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   plot
*   abort_sweep
*   restart_sweep
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   The sweep is aborted prior to calling the plot routines and is
*   restarted after all plotting has been completed or aborted.
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   set flags determining which channels are displayed
*   select current display buffer(s) to plot:
*     all of display
*     traces
*     graticule
*     markers
*     text
*   (For traces, graticules, markers, text:  check flags to indicate
*    which channels are being display.)
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
```

```
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;
PROCEDURE case_plot_buffer;
&
$DOC-&

%BEGIN
  BOOLEAN plot_ch1, plot_ch2;

  SUBROUTINE plot_trace;
  %BEGIN
    IF plot_ch1 THEN
      do_plot_setup (ch1, trace);
    IF plot_ch2 THEN
      do_plot_setup (ch2, trace);
  END;

  SUBROUTINE plot_graticule;
  %BEGIN
    IF plot_ph1 THEN
      do_plot_setup (ch1, grid);
    IF plot_ch2 THEN
      IF NOT ((trace_mode = overlay) AND
              (graticule_type(ch1)=graticule_type(ch2))) THEN
        do_plot_setup (ch2, grid);
  END;

  SUBROUTINE plot_markers;
  %BEGIN
    IF plot_ph1 THEN
      do_plot_setup (ch1, markers);
    IF plot_ph2 THEN
      do_plot_setup (ch2, markers);
  END;

  SUBROUTINE plot_text;
  %BEGIN
    IF plot_ph1 THEN
      do_plot_setup (ch1, annotations);
    IF plot_ph2 THEN
      do_plot_setup (ch2, annotations);
  END;

  SUBROUTINE plot_entry_stuff;
    do_plot_setup (current_entry_ph, entry_info);

  & main case_plot_buffer &

  current_pen :* 0;
  plot_ch1 := (trace_mode <> single_ch) OR (current_entry_ch = ch1);
  plot_ch2 := (trace_mode <> single_ch) OR (current_entry_ch = ch2);
  abort_sweep;
  IF directory_on THEN          & op/sys parameters or tape directory &
    do_plot_setup (current_entry_ch, op_params)
  ELSE
  CASE plot_buffer OF
    %BEGIN
```

```
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      BEGIN   & everything but softkeys except on external HP-IB plots &
        IF service_plot THEN
          do_plot_setup (current_entry_ch, softkeys);
        do_plot_setup (current_entry_ch, dg_user);
        plot_entry_stuff;
        plot_trace;
        plot_graticule;
        IF marker_state <> 0 THEN
          plot_markers;
        plot_text;
      END;
      plot_trace;                 & traces &
      plot_graticule;             & graticule &
      plot_markers;               & markers &
      BEGIN                       & annotations &
        plot_entry_stuff;
        plot_text;
      END;
    END;
  restart_sweep;
END case_plot_buffer;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  dump_to_plotter
*******************************************************************************
*
* SHORT DESCRIPTION--
*   sets up initial plotter information and determines a segments of
*   display gen. RAM to output to plotter
*
* EXTENDED DESCRIPTION--
*   This routine sets up the following plotting conditions to send to
*   the plotter via the private HPIB:
*       - pen color
*       - plotting quadrant (upper left, upper right, etc.)
*       - scaling units
*   The pen color and plotting quadrant are based on the user's
*   selection from the softkeys (or their default values are used).
*   The scaling factors are computed from the plotter's P1,P2 values
*   (plot unit limits) through nested subroutines COMPUTE_SCALE and
*   CHANGE_SCALE.  A 4x5 aspect ratio along the respective X and Y axes
*   are computed in the scaling units such that 4095 x 4095 scaled units
*   are centered within the P1,P2 boundary.
*
*   example:   +-------+-------------+------+ P2
*              |     ^ |             |      |
*              |     | | 4096 x 4096 |      |       x = (5/4)y
*              |     y |   scaled    |      |       y = (4/5)x
*              |     | |   units     |      |
*              |     v |             |      |
*           P1 +-------+-------------+------+
*                       <------x------>
*
*   After the scaled unit limits have been output to the plotter, the
*   PLOT routine is called with the starting and ending address of the
*   segment(s) of display gen. RAM vectors to be sent to the plotter.
*   These segment(s) of display RAM are determined by the user from a
*   softkey selection (has a default value) of displays to plot:
*
*       - all       = (default) all of disply except softkeys and error
*       - trace     = data traces
*       - graticule
*       - markers
*       - text      = annotations and active function lines
*                       --+
*       - operating parameters |  channel and measurement information
*       - system parameters    |  (presented in text format)
*                       --+
*   These individual display choices allows the user to change pen
*   colors for different parts of the display.
*
* INPUTS--  none
*
* OUTPUTS-- none
```

```
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*
* ROUTINES CALLED--
*   clr_priv_ib
*   wrt_priv_ib
*   append_string
*   append_ch
*   CMV9R
*   warn
*
* ERROR CONDITIONS AND RECOVERY--
*   An initial attempt is made to output to the plotter in order to
*   detect whether or not a plotter is connected to the system.  This
*   enables the routine to initiate or abort a plot, in which case an
*   error message is displayed indicating that a plotter is not
*   connected to the system.
*
* NOTES--
*   A plot in progress can be aborted by pressing any front panel key.
*
*   Plotting functions will interface with plotter models including and
*   manufactured after the MP9872B (ie: SS72C,7470A). This is due to the
*   use of the scaling (SC) feature implemented by these plotters.
*
* AUTHOR--
*
*******************************************************************************
*
* INITIAL REFINEMENT--
*   reset plot abort flag
*   set up output strings to plotter
*   IF plotter is not connected THEN
*     display warning message
*   ELSE
*     compute and output scaling units to plotter
*     output current pen color selection to plotter
*     IF plot hat not been aborted THEN
*       call plotting routine (PLOT) w/ starting and ending display
*       address parameters of display segment(s) to be plotted
*     output command to plotter to store pen
*     IF plot was aborted THEN
*       display warning message
*
*******************************************************************************
*
* REVISION LOG--
*
*******************************************************************************
DECLARATION--
;
PROCEDURE dump_to_plotter;
&
$DOC-&

BEGIN
  DOUBLE
    p1x, p1y, p2x, p2y,
```

```
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    x_range, y_range,
    x_scale, y_scale;
  INTEGER
    index;
  BYTE ARRAY outp1p2 [-1:string_size];
  ALPHA p1p2_string;

  &-------------------------------------------------------------&

  SUBROUTINE compute_scale;
  BEGIN
    y_scale := (RLEFT((k_range:=ABS(p2x-p1x)),2)*2)/5;  & +2 to round &
    IF y_scale > (y_range:=ABS(p2y-p1y)) THEN
      BEGIN   & x = y*(5/4) &
        x_scale := IF (y_range AND %F0000000)=0 THEN
                     BRIGHT (y_range*5+2, 2)
                   ELSE
                     ARIGHT (y_range*2,2) * 5;
        p1x := ARIGHT (x_range-x_scale, 1);      & extra x units DIV 2 &
        p1x := IF (p1x AND %FFFC0000)=0 THEN     & * 4K if enough bits &
                 (RLEFT(p1x,12)*ARIGHT(x_scale,1)) / x_scale   & round &
               ELSE                              & avoid overflow      &
                 RLEFT (DOUBLE (REAL(p1x)/REAL(x_scale)),12);
        p2x := x_max + p1x;
        p1x := x_min - p1x;
        p2y := y_max;
        p1y := y_min;
      END
    ELSE      & y = x*(4/5) &
      BEGIN
        p1y := ARIGHT (y_range-y_scale, 1);      & extra y units DIV 2 &
        p1y := IF (p1y AND %FFFC0000)=0 THEN     & * 4K if enough bits &
                 (RLEFT(p1y,12)*ARIGHT(y_scale,1)) / y_scale   & round &
               ELSE                              & avoid overflow      &
                 RLEFT (DOUBLE (REAL(p1y)/REAL(y_scale)),12);
        p2y := y_max + p1y;
        p1y := y_min - p1y;
        p2x := x_max;
        p1x := x_min;
      END;
  END compute_scale;

  &-------------------------------------------------------------&

  DOUBLE SUBROUTINE get_next_number;
    get_next_number := CMV9R (ADRS(outp1p2), index);

  &-------------------------------------------------------------&

  SUBROUTINE append_next_number;
    append_string (p1p2_string, aux_string);

  &-------------------------------------------------------------&

  SUBROUTINE change_scale;
  BEGIN
```

```
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    p1p2_string := read_eriv_ib (plotter, aa_fun, "OP;", p1p2_string);
    IF plot_debug THEN
      BEGIN WSTR("OP: "); WSTR(p1p2_string); CRLF; END;
    & convert P1/P2 string to doubles to compute scaling units &
    p1x := get_next_number;
    p1y := get_next_number;
    p2x := get_next_number;
    p2y := get_next_number;
    compute_scale;
    & convert scaling units to string form to output to plotter &
    append_ch (format_double (p1x, p1p2_string, string_format), comma);
    append_ch (format_double (p2x, aux_string, string_format), comma);
    append_next_number;
    append_ch (format_double (p1y, aux_string, string_format), comma);
    append_next_number;
    append_ch (format_double (p2y, aux_string, string_format), term);
    append_next_number;
    IF plot_debug THEN
      BEGIN WSTR("new scale: "); WRITR(p1p2_string); CRLF; END;
  END change_scale;

  &------------------------------------------------------------&

  index := 1;
  abort_plot := plot_to_gpib := FALSE;
  init_strings;
  outp1p2[-1] := string_size;
  p1p2_string := ADRS (outp1p2);
  IF plotter_connected THEN
    BEGIN
      service_plot := FALSE;
      change_scale;
      clr_eriv_ib (plotter);
      wrt_eriv_ib (plotter, clr_fun, "DC");
      wrt_eriv_ib (plotter, no_fun, p1p2_string);
      IF NOT (abort_plot:=abort_command) THEN
        case_plot_buffer;
      wrt_eriv_ib (plotter, clr_fun, ";PU;SP0;PR-260,-50;DF;");
    END; & if plotter is hooked up &
  IF abort_plot THEN
    warn (plot_aborted);
END dump_to_plotter;
```

```
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EJECT;
COMMENT
$DOC+

NAME--
  select_pen
*****************************************************************************
*
* SHORT DESCRIPTION--
*   update pen color variable
*
* EXTENDED DESCRIPTION--
*   This routine updates the pen color to be used by the plotter.
*   It is invoked by the softkey functions corresponding to selecting
*   one of 8 possible plotter pen colors.  Firmware for each plotter
*   handles pen color numbers that are out of range (ie: selecting pen
*   color 7 on a 2-color plotter will modulo 2 on the pen selection).
*   The previous menu is generated after the pen color is selected.
*
* INPUTS--   pen_color : (1..8)
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   hilight_en
*   previous_menu
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   Hilight softkey corresponding to pen selected
*   Set global variable with pen number of pen selected
*   Return to the previous softkey menu
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE select_pen (number);
  VALUE number; INTEGER number;
&
$DOC-&

BEGIN
  hilight_en (end_pen1, end_pen8 );
  wrt_disp_int (ADRS(plotter_pen[current_entry_ch]),(new_pen:=number));
```

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  previous_menu;
END select_pen;
```

```
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EJECT;
COMMENT
$DOC+

NAME--
  select_plot_buffer
*****************************************************************************
*
* SHORT DESCRIPTION--
*   update display buffer to be plotted
*
* EXTENDED DESCRIPTION--
*   This routine updates the display buffer to be plotted by the
*   plotter.  It is invoked by the softkey functions corresponding to
*   a selection of display areas to be plotted:
*       all of display
*       trace only
*       graticule only
*       markers only
*       text only
*
* INPUTS--   display buffer constant
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   wrt_disp_int
*   dump_to_plotter
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   The selection of individual display buffers allows for creating
*   multi-color plots (by selecting a pen color prior to a plot buffer).
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   Hilight display buffer selected to be plotted
*   Set global variable containing current display buffer with value of
*     selected display buffer
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE select_plot_buffer (buffer);
  VALUE buffer; INTEGER buffer;                              ENTRY;
&
$DOC-&
```

```
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BEGIN
  plot_buffer := buffer;
  dump_to_plotter;
  pop_menu (COPY_MENU);
END;
```

```
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$EJECT;
COMMENT
$DOC+

NAME--
  select_plot_param
*****************************************************************************
*
* SHORT DESCRIPTION--
*   update parameter list to printed/plotted
*
* EXTENDED DESCRIPTION--
*   This routine updates the parameter list to be printed or plotted
*   and put up on the display.
*   It is invoked by the softkey corresponding to the parameter list
*   selected:  operating or system parameters
*
* INPUTS--   parameter list constant
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   list_op_params
*   list_sys_params
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   Set global variable containing parameter list to value of parameter
*     list selected
*   Display parameter list selected
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE select_plot_param (param);
  VALUE param; INTEGER param;
&
$DOC-&

BEGIN
  plot_to_hpib := FALSE;
  plot_buffer := param;
  abort_sweep;              & sweep restarted when display is turned off &
  IF param = op_params THEN
```

```
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    list_op_param
  ELSE
    BEGIN
      blank_softkey(7);   & delete [NEXT PAGE] softkey for system parm S
      list_sys_params;
    END;
END;
```

```
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$EJECT;
COMMENT
$DOC+

NAME--
  select_plot_quadrant
*****************************************************************************
*
* SHORT DESCRIPTION--
*   updates and determines position to plot display
*
* EXTENDED DESCRIPTION--
*   This routine determines the position to plot a selected display
*   buffer.  It is invoked by a softkey corresponding to one of 5 areas
*   of the total available plotting area to plot:
*        full page
*        upper left quadrant
*        lower left quadrant
*        upper right quadrant
*        lower right quadrant
*   Upon selection of one of the above choices to plot, a local routine
*   is called to starting plotting the display buffer selected prior
*   to choosing a plotting quadrant.
*
* INPUTS--  plotting quadrant constant
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   hilight_on
*   dump_to_pletter
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   Hilight selected plot quadrant
*   Set global variable containg plot quadrant to value of selected
*     plotting quadrant
*   Call routine to plot to selected plot quadrant
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE select_plot_quadrant (quadrant);
  VALUE quadrant; INTEGER quadrant;
```

```
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&
%DOC-&

BEGIN
  hilight_on (cmd_quadrant_11, cud_quadrant_full);
  wrt_disp_int (RDRS(plot_quadrant), quadrant);
  previous_menu;
END;
```

```
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%EJECT;
SUBROUTINE output_parameters;
BEGIN
  IF plot_buffer = op_params THEN
    list_op_param_page
  ELSE
    list_sys_params;
END output_parameters;
```

```
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%EJECT;
COMMENT
%DOC+

NAME--
  output_plot
*******************************************************************************
*
* SHORT DESCRIPTION--
*   sends plot strings to an external controller
*
* EXTENDED DESCRIPTION--
*   This routine is used to set up and send plot strings (normally
*   written directly to the plotter) to an external controller via
*   public HP-IB.  R flag is set indicating to the local plotting
*   routines that strings containing HPGL plot commands are to be
*   sent over the public bus instead of the private bus (directly to
*   plotter).
*
*   Plotting quadrant information is saved prior to calling the local
*   plot routines.  It is then set to a full page plot in order to
*   eliminate scaling x,y coordinates for quadrant plotting, and
*   restored after returning from the plotting routines.
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   acquire
*   release
*   init_strings
*   case_plot_buffer
*   warn
*   string_out_ok
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   The string "PU"+LF is the last string output.  This currently
*   acts as a terminator for the OUTPUT PLOT command.
*
* AUTHOR--
*
*******************************************************************************
*
* INITIAL REFINEMENT--
*   acquire use of public HPIB resource
*   initialize plot strings
*   call routine to setup and do external plot
*   IF plot was aborted THEN
*     display warning message
*   ELSE
*     send a "PU" (pen up) command    {terminator ???}
*   release use of public HPIB resource
```

```
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*
*******************************************************************************
*
* REVISION LOG--
*
*******************************************************************************
DECLARATION--
;
PROCEDURE output_plot;                                          ENTRY;
&
%DOC-&

BEGIN
  INTEGER old_quadrant;
  acquire (pubib_output);
  init_strings;
  byte_avail := plot_to_hpib := TRUE;
  abort_plot := FALSE;
  old_quadrant := plot_quadrant;          ! save current plot_quadrant &
  wrt_disp_int (RDRS(plot_quadrant), full_page);
  abort_sweep;
  plot (start_display+1, character_set);
  restart_sweep;
  wrt_disp_int (RDRS(plot_quadrant), old_quadrant);
  IF abort_plot THEN
    warn (plot_aborted);
  string_out_ok ("PU ");
  byte_avail := abort_command := plot_to_hpib := FALSE;
  release (pubib_output);
END output_plot;
```

```
SPLOT.WORK.PD8510          THU, DEC 22, 1983, 10:54 AM    PAGE  35


$EJECT;
PROCEDURE documentation_plot;                                   ENTRY;
BEGIN
  INTEGER old_buffer;
  IF plotter_connected THEN
    BEGIN
      clr_priv_ib (plotter);
      service_plot := TRUE;
      old_buffer := plot_buffer;
      plot_buffer := all;
      case_plot_buffer;
      plot_buffer := old_buffer;
    END;
END documentation_plot;


$FILE fplot.work;

END$
```

```
FPLOTTER.WORK.PD8510       THU, DEC 22, 1983, 10:54 AM    PAGE  1


PROCEDURE select_plot_buffer (buffer);
  VALUE buffer; INTEGER buffer;                          EXTERNAL;
PROCEDURE output_plot;                                   EXTERNAL;

EXTERNAL BOOLEAN plot_to_hpib;
```

```
CPRIVIR.WORK.PD8510        THU, DEC 22, 1983, 10:54 AM    PAGE  1


& priv_ib_lun_tablt indicee &
INTEGER CONSTANT  not_used_lun :=  0,     & private HP-IB luna.      &
                  source       :=  1,
                  test_tet     :=  2,
                  plotter      :=  3,     & nuat coordinate constants &
                  printer      :=  4,     & with others in $LUNPLOS   &
                  priv_ib_pass :=  5,     & that share a bubble array.&
                  source_2     :=  5,
                  test_set_2   :=  7,
  & SYNTAB prob   lo_source    :=  8,     n/u&
  & SYNTAB prob   lo_source_2  :=  9,     n/u8
                  user_device_1:= 10,
                  user_device_2:= 11,
            & linited to 16 actual luns &
                  major        := 16,     & non-private HP-IB luns    &
                  minor        := 17,
                  illegal_lun  := 31,

                  lun_max      := 31;     & MUST BE UPDATED !!!!!!!!! &

                  COMMENT  user display index and user display address
                           ueee 31  (declared in cdguser.work)
                           ;


& active functions for private hp_ib devices -- MUST AGREE WITH SPRIVIBS
                                  &aourcee&
INTEGER CONSTANT  no_fun       := -1, & doesn't change active function &
                  clr_fun      := -2, & forces next function to be sent&
                                  &sources&
                  fa           := 0,  & start frequency &
                  fb           := 1,  & stop frequency  &
                  cf           := 2,  & center frequency &
                  df           := 3,  & delta frequency / span &
                  st           := 4,  & sweep tine &
                  pi           := 5,  & power level &
                  cu           := 6,  & c.u. frequency &
                  sv           := 7,  & save  - sane as test-set &
                  rc           := 8,  & recall - sane as test-set &
                  sn           := 9,  & manual sweep frequency &
                  sf           := 10, & frequency step size &
                  tl           := 11, & sweep tine linit &
                  sn           := t2, & nunber of points, step sweep &
                  sl           := 13, & swept node &
                  su0          := 14, & swap to nost recent RLN state &
                  su1          := 15, & swap opposite sul &
                  display_off  := 16, & turn off source displays &
                  display_on   := 17, & turn on  source displays &
                  sl1          := 18, & power slope on &
                  sl0          := 19, & power slope off &
                                  &  test-set &
                  di           := 20, & output id string (test set) &
                  pe           := 21, & port enable (test set) &
                  ic           := 22, & instrunent configure (test set)&
                  mx           := 23, & max recall state (test set) &
```

```
CPRIVIB.WORK.PD8510        THU, DEC 22, 1983, 10:54 AM    PAGE  2


                  atten1       := 24, & attenuator 1 &
                  atten2       := 25, & attenuator 2 (test set) &
                  rn           := 26, & service request nask (teat aet)&
                                  & plotter &
                  pa           := 27,
                  pr           := 28;
```

```
FMAIVIE.WORK.PO8510          THU, DEC 22, 1983, 10:54 AM    PAGE  1


$FILE cprivib.work;

PROCEDURE clr_priv_ib(lun); VALUE lun; INTEGER lun;          EXTERNAL;
BOOLEAN PROCEDURE art_priv_ib_source(fun,str); VALUE fun,str;
   INTEGER fun; ALPHA str;                                   EXTERNAL;
BOOLEAN PROCEDURE urt_priv_ib(lun,fun,str); VALUE lun,fun,str;
   INTEGER lun,fun; ALPHA str;                               EXTERNAL;
ALPHA PROCEDURE read_priv_ib(lun,fun,outstr,instr);
   VALUE lun,fun,outstr,instr;  INTEGER lun,fun;
   ALPHA outstr,instr;                                       EXTERNAL;
```

```
3PRIVIb.WORK.PO8510          THU, DEC 22, 1983, 10:54 AM    PAGE  1


$68KL,P,"privib"
BEGIN
COMMENT
%%%%%%%%%%%%%%%%%%%%%%%%  FILE: SPRIVIB  %%%%%%%%%%%%%%%%%%%%%%%%%%
%
%                  private HP-IB Interface drivers
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%   OCT 1981          JOHN BARK
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% The 8510 is THE controller on a private hp_ib bus. This bus is used
% for control of the accessory instruments needed to make a measurement.
% i.e. - source, test set, plotters, and etc. The 8510 is THE controller
% and will not pass control. It is either the talker or the listener on
% all data transfers. It has the capablitily to respond to SRQ and will
% do a serial poll in response.
%
% 8510 HP-IB compatilblity code
%    C1,C2,C3,C4,C28,SH1,AH1,TalkerOnly,ListenerOnly,SRQ,RL0,PP0,DC0,DT0
% Requires of connected instruments
%    C0,SH1,AH1,T2/4,L2,SRQ/1,*L0/1/2,PPx,DC1,DT0/1
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%ENTRYS
% init_priv_ib    -- initializes private hp-ib and sends IPC
% sct_priv_ib_lun -- sets the actual priv hp_ib address for a LUN
% sa1_priv_ib_lun -- get the actual priv hp-ib address for a LUN
% clr_priv_ib     -- sends selected device clr (SDC) to priv hp_ib dev
% trig_priv_ib    -- sends group execute trigger (GET) to priv hp-ib dev
% set_ren_priv_ib -- sets REN and sends local lockout(LLO) to priv hp-ib
% clr_ren_priv_ib -- clears REN and LLO for priv hp_ib
% poll_priv_ib    -- serial poll of a single priv hp-ib device
% intrpt_priv_ib  -- interrupt routine for byte-in(SI) and byte-out(BO)
% priv_ib_srq --interrupt process routine for priv hp-ib service request
% urt_priv_ib     -- outputs strings to private hp-ib
%                    returns boolean false if no listening device
% urt_priv_ib_source -- outputs strings to private hp-ib source
%                    returns boolean false if no listening device
% read_priv_ib    -- outputs a request to private hp_ib/awaits respond
% syntax_check_priv_ib -- checks if string (a function) if valid syntax
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%  The private hp-ib is NOT A PROCESS, it runs on the stack of the call-
% ing or interrupted process. The private hp-ib is a shared resource and
% at the time when it is requested, its avaliblity will be check.
% If not available, the calling process will be suspended. (see kernel
% description -- accquire and release). The actual I/O will be done
% by interrupt I/O of buffers. The calling procedure will be suspended
% till I/O buffer is finished (awaiting a "signal"). The interrupt
% routine will sent the signal when the buffer is finish.
%
%  The private hp_ib_srq is handled seperate from the private hp_ib. The
% hardware is acrperate and in manys ways the function is also.
% R private hp_ib srq when serviced will cause the priv_ib_srq
```

```
SPRIVIB.WORK.PO8510          THU, DEC 22, 1983, 10:54 AM    PAGE  2


% PROCESS to start, which will poll the private ib and determine the
% cause.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%  The device identifing will be via a logical unit table (LUN) were the
% actual private hpi-ib address held.  This allows changes of addresses
% to occur at a single point and the calling routines to use constant
% values.
%
%   The private hp-ib will before doing a addressing sequence checking
% what happen in the past and if the no changes are need it will skip
% the addressing sequence and save time.
%
%   Also, there is an active function table for each priv hp-ib device
% so that they are signified by constants and not strings, and if
% requested function is the active function, it will not be send.
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   The drivers below will set up a series of commands and buffers
% that contain the sequence of events to occur on the private hp-ip
% Once these commands and buffers are setup, the driver procedures
% will start the interrupt program and the drivers will wait tilled
% signaled. The interrupt program will,on each interrupt, decide what
% next to be done, and do it until the command list is exhausted, when
% it will send the finished signal.
%   The commands are 1)send address data, 2)read data, 3)write data,
% 4)null, and 5)finished. There can and normally will be more than
% one command in a sequence. The buffers are the source or destenation
% for data if any.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
end of comment;
```

```
SPRIVIB.WORK.PO8510          THU, DEC 22, 1983, 10:54 AM    PAGE  3


$EJECT;
$FILE eprivib.work;
$FILE fkernel.work;
$FILE fkernel2.work;
$FILE fkernel3.work;
$FILE fkernel4.work;
$FILE ffifo.work;
$FILE fintrpt.work;
$FILE cids.work;
$FILE crins.work;
$FILE cdebug.work;
$FILE ftern.work;                                          $debug$
$FILE futil.work;                                          $debug$
$FILE flunplus.work;                          $ for priv_ib_lun_table $
$FILE fnbngr.work;                          $ for save_ and recall_lunplus $
```

```
$PRIVIB.WORK.PD8510          THU, DEC 22, 1983, 10:54 AM    PAGE  4


REJECT;
COMMENT
*****************************************************************************
*INTERNAL SPEC for variable used by priv_ib
*
* valid_listener       boolean flag for returning hp_ib bus errors
* priv_ib_command      array holding info on nature of information trans
* cmd_ton              array(str) holding address sequence where private
*                        hp_ib is talker and  someone else is listener
* cmd_lon              array(str) holding address sequence where private
*                        hp_ib is listener and someone else talker
* cmd_spd              array(str) holding address sequence for spd
* cmd_ctr              index for priv_ib_command
* iten_ctr             index for iten in data arrays (priv_ib_data_ptr)
* priv_ib_ptr_buf      contains address of buffers of data(in/out)
* priv_ib_data_ptr     pointer use to address data buffers
* priv_ih_iaet_address storage location of last address device
* priv_ib_lun_table    lookup table of lun to actual address
* priv_ib_act_fun_table table of last active function for given lun
* priv_ib_fun_table    table of address to active fun number to string
*                        lookup tables for given lun
* fifo_sup_brk         fifo storage area for storage of srq sweep
*                        status message from source
*
*  IMPLICIT VARIABLES
* lun   -- logical unit number -- values range from 1 to lun_nax
*                                   0=null (issues '? as listen add)
* fun   -- active function number -- values range from 1 to ??
*                                  -1=no active function selection
*                                     (doesn't change active fun)
*                                  -2=no active function selection
*                                     (next active fun won't match)
*****************************************************************************
end of comment;

INTEGER CONSTANT commands_nax:=5;
BOOLEAN  valid_listener;
GLOBAL INTEGER  valid_priv_luns;
BYTE ARRAY priv_ib_command[0:commands_nax];
BYTE ARRAY end_ton[0:5],cmd_lon[0:3],cmd_spd[0:3];
INTEGER end_ctr,iten_ctr;
DOUBLE ARRAY priv_ib_ptr_buf[0:commands_nax-1];
BYTE POINTER priv_ib_data_ptr;
BYTE priv_ib_last_address;
BYTE CONSTANT    set_latn:=1,set_ton:=2,ascii_data:=4;
INTEGER CONSTANT latn_bit:=0,ton_bit:=1,ascii_bit:=2;
BYTE CONSTANT    null_cnd:=%FF,finish_cnd:=0,
                 send_address:=ascii_data + set_ton  +  set_latn,
                 write_data:=  ascii_data + set_ton,
                 read_data:=   ascii_data;
BYTE CONSTANT    finish_handshake:=3,handshake_holdoff_on_eoi_eos:=%86,
                 handshake_holdoff_on_eoi:=%82,
                 handshake_holdoff_on_all:=%51,
                 talker_only:=%30,listen_only:=%40;
BYTE CONSTANT    power_on_clr:=0,power_on_reset:=2,clk_4Mhz:=%24,
                 enable_bi_bo_err:=7;
```

```
$PRIVIB.WORK.POS510          THU, DEC 22, 1983, 10:54 AM    PAGE  5

BYTE CONSTANT    untalk:=%5F,unlisten:='?,spe:=%18,spd:=%19,lf:=10;
INTEGER CONSTANT sdc:=%4,lle:=%11,get:=%8;

ALPHA TABLE priv_ib_fun_list :=
                        "FR","f8","CF","OF","ST","PL","CU", &source&
                        "SV","RC","S3","SF","TL","SW","SI",
                        "SW0","SW1","DUD","DU1","SL1","SL0",
                        "DI","PE","IC","nX","R1","R2","RM", &test set&
                        "PR","PR";                          &plotter&

BYTE ARRAY priv_ib_act_fun_table[1:lun_nax];

INTEGER CONSTANT null:=0;
BYTE CONSTANT byte_zero:=0;

INTEGER CONSTANT sup_brk_fifo_size:=5;
GLOBAL INTEGER ARRAY fifo_sup_brk[-6:sup_brk_fifo_size];

BYTE io=%FFFFFE01;
BYTE BITFIELD xisc_io_status=io+%R0:
              priv_ib_lsrq_sense,priv_ib_ldav_sense,
              nisc_io_status_not_used(3);
EXTERNAL BYTE BITFIELD flag1_save:
              priv_ib_latn,priv_ib_lren,priv_ib_lifc;

BYTE flag1=io+%R5;
BYTE priv_ib=io+%40;
BYTE priv_ib_data=priv_ib+%0,
     priv_ib_status1=priv_ib+%2,priv_ib_status2=priv_ib+%4,
     priv_ib_ir_mask1=priv_ib+%2,priv_ib_ir_mask2=priv_ib+%4,
     priv_ib_serial_poll_status=priv_ib+%6,
     priv_ib_add_status=priv_ib+%8,priv_ib_add_mode=priv_ib+%8,
     priv_ib_aux=priv_ib+%R,
     priv_ib_address0=priv_ib+%C,priv_ih_address1=priv_ib+%E,
     priv_ib_eos_code=priv_ib+%E;


PROCEDURE get_next_cnd;                                   FORWARD;
```

```
$PRIVIB.WORK.PD8510          THU, DEC 22, 1983, 10:54 AM    PAGE  6


REJECT;
COMMENT ***************************************************************************
* acquire_priv_ib and release_priv_ib are for doing the kernel functions
* and handling the enable/disabling of priv_ib_srq. This must be done
* to prevent a priv_ib_srq from being serviced while the priv_ib is
* being used -- possible suspend of the active process
*
* The disable must be done before and after the acquire because it is
* an interruptable operation that could re_enable the srq after the
* the disenable but before the acquire finished
*****************************************************************************
end of comment;
SUBROUTINE acquirt_priv_ib;
    BEGIN irdis(private_ib_srq_vctr);
          acquire(priv_ib_resource);
          irdis(private_ib_srq_vctr);
          cnd_ctr:=0;
    END  acquire_riv_ib;


SUBROUTINE release_priv_ib;
    BEGIN
          release(priv_ib_rsource);
          preempt;
          iren(private_ib_srq_vctr);
    END release_priv_ib;
```

```
$PRIVIB.WORK.POS510          THU, DEC 22, 1983, 10:54 AM    PAGE  7


REJECT;
COMMENT
*****************************************************************************
* start_and_wait_priv_ib does the final setup of the command lists for
*    the interrupt handler of private hp_ib.
*
*  Set all unused commands in the command list to the finish_cnd.
*  Initialize cnd_ctr and call get_next_cnd which will start up the
*    interrupt handler -- if needed.
*  Wait for the finished signal.
*  Set up cnd_ctr so that another command list could be generated.
*****************************************************************************
end of comment;
SUBROUTINE start_and_wait_priv_ib;
    BEGIN
    UNTIL end_ctr <= commands_nax  DO
        BEGIN
        priv_ib_command[cnd_ctr]:=finish_cnd;
        end_ctr:=cnd_ctr + 1;
        END until;
    cmd_ctr:=-1;

    get_next_cnd;

    wait(priv_ib_signal);
    cnd_ctr:=0;
    END start_and_wait_priv_ib;

COMMENT
*****************************************************************************
* start_wait_and_release_priv_ib does a start_and_wait and went finish
*        releases the private hp_ib.
*
*****************************************************************************
end of comment;
SUBROUTINE start_wait_and_release_priv_ib;
    BEGIN
    start_and_wait_priv_ib;
    release_priv_ib;
    END start_wait_and_release_priv_ib;
```

```
SPRIVIB.UORK.PO8510          THU, DEC 22, 1983, 10:54 AM     PAGE  8


@EJECT;
COMMENT
*****************************************************************
* ton_priv_ib sets up the needed private hp_ib commands in the command
*    list, so that a private hp_ib device is addressed to listen and
*    the priv_ib is ready to talk -- it will also sent an universal
*    command, if requested.
*
* NOTE: if listening device is already addressed, the re-addressing
*       will be skipped.
*****************************************************************
* Look up and create the proper ascii addressing code for the logic
*    unit number requested.
* IF address code has changed since last time
*    THEN create a proper adressing sequence
*         save new address for checking next time
* ELSE place the null action code in the command list
* IF an univeral command request
*    THEN tack the code request on the end of the address sequence
*         in case the command code was null,make it send_addressing
* bump the command counter by 1
*****************************************************************
end of comment;
PROCEDURE ton_priv_ib(lun,extra_end); VALUE lun,extra_end;
                                      INTEGER lun,extra_end;
   BEGIN
   BYTE priv_ib_address,extra_cmd_byte=extra_cmd + 1;

   priv_ib_ptr_buf[end_ctr]:=ADDRS(cmd_ton);
   priv_ib_address:=TURN(priv_ib_lun_table[lun],%E0,%20);
   IF priv_ib_address#priv_ib_last_address THEN
      BEGIN
      cmd_ton[1]:=unlisten;
      end_ton[2]:=(priv_ib_last_address:=priv_ib_address);
      end_ton[3]:=untalk;
      end_ton[0]:=3;
      priv_ib_command[cmd_ctr]:=send_address;
      END IF
   ELSE
      BEGIN
      cmd_ton[0]:=0;
      priv_ib_command[cmd_ctr]:=null_end;
      END else;
   IF extra_cmd#0 THEN
      BEGIN
      cmd_ton[0]:=cmd_ton[0]+1;
      cmd_ton[cmd_ton[0]]:=extra_cmd_byte;
      priv_ib_command[cmd_ctr]:=send_address;
      IF priv_ib_out_debug THEN BEGIN USTR("IBcmd:");          &debug&
            UHex( lun , 2 ); UHex( extra_end , 2 ); CRLF; END; &debug&
      END if;
   cmd_ctr:=cmd_ctr+1;
   END ton_priv_ib;


COMMENT
```

```
SPRIVIB.UORK.PO8510          THU, DEC 22, 1983, 10:54 AM     PAGE  9

*****************************************************************
* lon_priv_ib sets up the neccessary commands in the command list
*    so that the request device on the private hp_ib will become a
*    talker.
*
* NOTE: if the device is already a talker, the raddressing sequence
*       will be skipped.
*****************************************************************
* Look up and create the proper ascii addressing code for the logic
*    unit number requested.
* IF address code has changed since last time
*    THEN create a proper adressing sequence
*         save new address for checking next time
* ELSE place the null action code in the command list
* Bump the command counter by 1
*****************************************************************
end of comment;
PROCEDURE lon_priv_ib(lun); VALUE lun; INTEGER lun;
   BEGIN
   BYTE priv_ib_address;

   priv_ib_ptr_buf[cmd_ctr]:=ADDRS(cmd_lon);
   priv_ib_address:=TURN(priv_ib_lun_table[lun],%E0,%40);
   IF priv_ib_address#priv_ib_last_address THEN
      BEGIN
      end_lon(1):=unlisten;
      end_lon(2):=(priv_ib_last_address:=priv_ib_address);
      cmd_lon[0]:=2;
      priv_ib_command[cmd_ctr]:=send_address;
      END IF
   ELSE  priv_ib_command[cmd_ctr]:=null_cmd;
   cmd_ctr:=cmd_ctr+1;
   END lon_priv_ib;
```

```
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@EJECT;
COMMENT
*****************************************************************
* get_priv_priv_ib_lun and set_priv_ib_lun allow access to the outer
*    world of the mapping of lun to actual private hp_ib adresses.
*
* these functions are used for a few other items that art tied to the
*    instrument, and not to save/recall or preset states, such as
*    public hp-ib addresses, request mask, etc.
*
*****************************************************************
end of comment;
INTEGER PROCEDURE get_priv_ib_lun(lun); VALUE lun; INTEGER lun; ENTRY;
   get_priv_ib_lun:=priv_ib_lun_table[lun];

PROCEDURE set_priv_ib_lun(lun,new_add); VALUE lun,new_add;
                                        INTEGER lun; BYTE new_add;ENTRY;
   BEGIN & set_priv_ib_lun &
      IF lun <= lun_max THEN
        priv_ib_lun_table[lun] := new_add;
      save_lunplus;                          & save the priv_ib_lun_table &
   END;  & set_priv_ib_lun &


COMMENT
*****************************************************************
* reset_priv_ib_act_funs clears the memory on the last active function
* sent to a particular lun -- need for power on and should be cleared
* if any priv_ib pass though is donc( devices effected but not table )
*****************************************************************
end of comment;
PROCEDURE reset_priv_ib_act_funs;                          ENTRY;
   BEGIN
   INTEGER index;
   FOR index := 1 TO lun_max DO
      priv_ib_act_fun_table[ index ] := no_fun ;
   END reset_priv_ib_act_funs;
```

```
SPRIVIB.UORK.PO8510          THU, DEC 22, 1983, 10:54 AM     PAGE 11


@EJECT;
COMMENT
*****************************************************************
* EXTERNAL SPEC for clr_priv_ib
*
*    FUNCTION: sent a selective device clear to selected priv_ib device
*
* DECLARATION INFO:
*    PROCEDURE clr_priv_ib(lun)
*         VALUE lun   INTEGER lun
*       INPUT: lun  -- logical unit number on the private hp_ib
*
*  EXTERNAL EFFECTS:
*     The private hp_ib will be acquired for duration, and the calling
*        process will be suspended also for duration.
*     The selected device will be effect in tone way ??
*     The active device may be changed.
*****************************************************************
* INTERNAL SPEC
*  acquire the private hp_ib
*  set up the needed addressing sequence with a selective device clr
*  transmit and when done return and release priv_ib
*****************************************************************
end of comment;
PROCEDURE clr_priv_ib(lun); VALUE lun; INTEGER lun;              ENTRY;
   BEGIN
   acquire_priv_ib;
   ton_priv_ib(lun,sdc);
   start_wait_and_release_priv_ib;
   END clr_priv_ib;

COMMENT
*****************************************************************
* EXTERNAL SPEC for trig_priv_ib
*
*    FUNCTION: sent a group execute trigger to selected priv_ib device
*
* DECLARATION INFO:
*    PROCEDURE trig_priv_ib(lun)
*         VALUE lun   INTEGER lun
*       INPUT: lun  -- logical unit number on the private hp_ib
*
*  EXTERNAL EFFECTS:
*     The private hp_ib will be acquired for duration, and the calling
*        process will be suspended also for duration.
*     The selected device will be effect in some way ??
*     The active device may be changed.
*****************************************************************
* INTERNAL SPEC
*  acquire the private hp_ib
*  set up the needed addressing sequence with a group execute trigger
*  transmit and when done return and release priv_ib
*****************************************************************
end of comment;
PROCEDURE trig_priv_ib(lun); VALUE lun; INTEGER lun;             ENTRY;
   BEGIN
```

```
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   acquire_priv_ib;
   ton_priv_ib(lun,get);
   start_wait_and_release_priv_ib;
   END trig_priv_ib;
```

```
SPRIVIB.WORK.PDBS10            THU, DEC 22, 1983, 10:54 AM    PAGE 13


REJECT;
COMMENT
*****************************************************************
* EXTERNAL SPEC for set_ren_priv_ib
*
*    FUNCTION: set ren true and sent a local lockout to priv_ib
*
* DECLARATION INFO:
*    SUBROUTINE set_ren_priv_ib
*
*  EXTERNAL EFFECTS:
*     The private hp_ib will be acquired for duration, and the calling
*        process will be suspended also for duration.
*     The priv_ib now has REN tue and future address sequence will cause
*        devices to go to remote and return to local inhibited (llo).
*****************************************************************
* INTERNAL SPEC
*  acquire the private hp_ib
*  set up the needed sequence to sent local lockout - no addressing need
*  transmit and when done return and release priv_ib
*****************************************************************
end of comment;
SUBROUTINE set_ren_priv_ib;                                    ENTRY;
   BECIN
   acquire_priv_ib;
   priv_ib_lren:=0; flag1:=flag1_save;
   ton_priv_ib(not_used_lun,llo);
   start_wait_and_release_priv_ib;
   END set_ren_priv_ib;


COMMENT
*****************************************************************
* EXTERNAL SPEC for clr_ren_priv_ib
*
*   FUNCTION: clr (set false) SEN -- which also clears local lockout
*
* DECLARATION INFO
*    SUBROUTINE clr_ren_priv_ib
*****************************************************************
end of comment;
SUBROUTINE clr_ren_priv_ib;                                    ENTRY;
   BEGIN
   priv_ib_lren:=1; flag1:=flag1_save;
   END set_ren_priv_ib;
```

```
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REJECT;
COMMENT
*****************************************************************
*EXTERNAL SPEC for poll_priv_ib
*
*   FUNCTION:conducts a serial poll on the selected private hp_ib device
*
*   DECLARATION INFO
*      INTEGER PROCEDURE poll_priv_ib(lun)
*        VALUE lun    INTEGER lun
*       INPUT: lun  -- logical unit number on the private hp_ib
*       OUTPUT:poll_priv_ib -- return value -- serial poll status
*
*  EXTERNAL EFFECTS:
*     The private hp_ib will be acquired for duration, and the calling
*        process will be suspended also for duration.
*     The active device may be changed.
*     The status byte of the lun will be read and probably cleared
*****************************************************************
* INTERNAL SPEC
*  acquire private hp_ib
*  set_up an addressing sequence including Serial Poll Enable
*  set up read buffer location in command list
*  set up Serial Poll Disable command sequence
*  start sequences and wait till finish
*  return value
*  release private hp_ib
*****************************************************************
* TIMING INFO 1mS highlevel interrupt and get_next_cmd
end of comment;
INTEGER PROCEDURE poll_priv_ib_sub(lun); VALUE lun; INTEGER lun;
   BEGIN
   BYTE ARRAY poll_result(-1:2);

   priv_ib_last_address:=unlisten;
   lon_priv_ib(lun);
   cmd_lon[0]:=3;
   cmd_lon[3]:=cmd_lon[2];
   cmd_lon[2]:=spe;

   poll_result[-1]:=1;
   priv_ib_command[cmd_ctr]:=read_data;
   priv_ib_ptr_buf(cmd_ctr]:=ADRS(poll_result);
   cmd_ctr:=cmd_ctr + 1;

      &cmd_spd setup in init&
   priv_ib_command[cmd_ctr):=send_address;
   priv_ib_ptr_buf[cmd_ctr):=ADRS[cmd_spd);
   cmd_ctr:=cmd_ctr+1;

   start_and_wait_priv_ib;

   & accumulate status bits?? &
   IF priv_ib_poll_debug THEN BEGIN USTR("Poll:");UHEX(lun);     $debug&
                              UHEX(poll_result[1]); CRLF;END;&debug&
```

```
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   poll_priv_ib_sub:=INTEGER(poll_result[T]) AND ZOFF;
   END poll_priv_ib_sub;


COMMENT
*****************************************************************
end of comment;
INTEGER PROCEDURE poll_priv_ib(lun); VALUE lun; INTEGER lun;     ENTRY;
   BEGIN
   INTEGER response;

   acquire_priv_ib;
   IF TBIT( valid_priv_line , lun )
      THEN response :* poll_priv_ib_sub( lun )
   ELSE
      BEGIN
         usrn(priv_ib_add_err);
         response := 0;
      END;
   release_priv_ib;
   poll_priv_ib :* response ;
   END poll_priv_ib;
```

```
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&EJECT;
COMMENT
*****************************************************************************
INTERNAL SPEC for get_next_end
*   determine for command list what the state of the private hp_ib
*     harduare should be in or if finished send the finish signal
*
*   NOTE:these harduare commands will cause interrupts to occur
*        and the interrupts will transfer the buffer contents
*****************************************************************************
*   search command list for next non-null_cmd
*   if next_cmd is finished THEN sent finished signal and preempt
*                                ( make sure all regs are pushed )
*   ELSE set RTN true to prevent bus activity
*        depending on nature of command set talker only or listener only
*                set end on eos and eoi or just eoi
*                set atn true or false
*        enable bi_bo_err interrupts
*****************************************************************************
xxxxxxx TIMING INFO 250uS -- BSSEMBLE CODE ?????*************************
end of comment;
PROCEDURE get_next_end;
   BEGIN
   BYTE next_cmd;

   DO end_ctr:=cmd_ctr+1
      UNTIL (next_end:=priv_ib_command[cmd_etr]) & null_cmd;

   iten_etr:=0;


   IF next_end = finish_end THEN
      BEGIN
      priv_ib_ir_mask1:=byte_zero;
      send(priv_ib_signal);
      preempt;
      END
   ELSE
      BEGIN
      STPNTR(priv_ib_data_ptr,priv_ib_ptr_buf[end_ctr]);
      DO &null& UNTIL priv_ib_ldav_senex; &let previous talker finish&
      priv_ib_latn:=0; flag1:=flag1_save;

      priv_ib_aux:=finish_handshake;
      IF TBIT(next_cmd,ton_bit) THEN priv_ib_add_mode:=talker_only
                                     &will cause immediate bo&
                                     &however priv_ib interrupts should&
                                     &be disable/inhibited at this time&
      ELSE priv_ib_add_mode:=listen_only;
      priv_ib_aux:=peuer_on_clr;

      IF TBIT(next_cmd,ascii_bit) THEN
         BEGIN
         priv_ib_eos_code:=1f;
         priv_ib_aux:=handshake_holdoff_on_eoi_eos;
         END if
```

```
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      ELSE priv_ib_aux:=handshake_holdoff_on_eoi;

      IF TBIT(next_cmd,latn_bit) THEN priv_ib_latn:=0
      ELSE priv_ib_latn:=1;
      flag1:=flag1_seve;

      priv_ib_ir_maskl:=enable_bi_bo_err;
      END else;

   END get_next_cmd;
```

```
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&EJECT;
COMMENT
*****************************************************************************
* INTERNAL SPEC for intrpt_priv_ib
*  Service the private hp_ib interrupts and signal uaiting processes
*       uent done
*****************************************************************************
* read private hp_ib status and re_enable m68000 interrupts (note:
*       9519 fence is still set so that lower interrupts are inhibited
* IF bi is cause THEN
*    THEN update buffer length
*         if buffer is full -- inhibit future inputs
*         fetch and store data into buffer -note- neu bi may nou occur
* ELSE IF err THEN
*            not vaild_listner -- therefore terminate output
*            send uarning message
* ELSE *must have been bo -- only bi,bo enabled/cannot? occur together*
*     IF buffer not enpty THEN output next byte -neu be may nou occur
* IF end condition has occur 1)EOI on input , 2)input buffer full
*                            3)output buffer empty
*     get next command fron command list
* acknouldge priv_ib interrupt -- dropping 9519 fence
*****************************************************************************
* TIMING INFO
*      approx 100 uSec/byte out/in
*         interrupt          6+          to inprove assenble code
*         save reg/setup M   20          the coding section
*         code               50          MMD cut down on the reg/M
*         irack               5          save  -- need about 4
*         restore reg/n      20          Ilould need to be careful
*         RTE                 5          about BSR/JSR reg uee
*  get_next_command is about 250uS and needs inprovenent
*****************************************************************************
                        < QUESTIONS:
                          1. Should CR/LF be deleted ( or eny nonprint
                              ing Char) fron input data? (in RSCII node
                          2. Should EOI be sent (in RSCII node) on EOS
end of comment;
INTERRUPT intrpt_priv_ib;                                          ENTRY;
   BEGIN
   INTEGER bug_mark = XOCR;  &DEBUG&
   BYTE BITFIELD status_temp:end,dec,err,bo,bi;

   bug_mark := X1234;        &DEBUG&
   status_temp:=priv_ib_status1;
   RSSEMBLE( RNDI #NFSFF,SR); &enable higher interrupts&
   status_temp:=status_temp OR priv_ib_status1; &pickup end bit&

   iten_etr:=iten_ctr+1;


   IF bi THEN
      BEGIN
      priv_ib_data_ptr[0]:=iten_ctr;
      IF iten_ctr>=priv_ib_data_ptr[-1] THEN
         BEGIN
```

```
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         end:=1;
         priv_ib_aux:=handshake_holdoff_on_all;
         END if;
      priv_ib_data_ptr[iten_ctr]:=priv_ib_data;
      END if bi
   ELSE IF err THEN
      BEGIN
      end:=1;
      valid_listener := FRLSE;
      uarn(priv_ib_add_err);
      priv_ib_aux:=power_on_clr;    &temp ??&
      END else err
   ELSE &must be bo ?&
      BEGIN
      IF iten_ctr<=priv_ib_data_ptr[0] THEN
         priv_ib_data:=priv_ib_data_ptr[iten_ctr]
      ELSE end:=1;
      END else bo;

& error checking for no listener at this addreee ???? &

   IF end THEN get_next_end;

   bug_mark := 0;             &OCBUG&
   RSSEMBLE( ORI #H0700,SR);     &DISRBLE  INTERRUPTS TILL RTE&
   irack(private_ib_vctr);

   END intrpt_priv_ib;
```

```
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$EJECT;
COMMENT
*****************************************************************
* EXTERNAL SPEC for init_priv_ib
*
* FONCTION: initalize the private hp_ib after power on or restart
*           to function as the controller on the private hp_ib bus
*
* DECLARRTION INFO
*      PROCEDURE init_priv_ib
*        INPUT/OUTPUT: none
*
* EXTERNAL EFFECTS
*      halts and resets the private hp_ib
*      sends an IFC to all private hp_ib devices -- unaddressing them
*      resets the active fun tables, priv_ib resource id and signals
*****************************************************************
* INTERNAL SPEC
*     set the private at 4Mhz clock with bi_bo irq NOT enabled
*     REN and ATN set true and IFC pulsed true
*     clear out active function tables, and setup cnd_spd
*     initailize signals and resources and fifos
*****************************************************************
end of comment;
PROCEDURE init_priv_ib;                                    ENTRY;
   BEGIN

   priv_ib_aux:=power_on_reset;
   priv_ib_ir_nask1:=byte_zero;
   priv_ib_ir_nask2:=byte_zero;
   priv_ib_aux:=clk_4hnz;
   priv_ib_aux:=power_on_clr;

   priv_ib_lren:=0;
   priv_ib_latn:=0;

   priv_ib_lifc:=0;       flag1:=flag1_save;
   REPEAT 25 DO TRAP(refresh_vctr); & min IFC pulse width  >100uS &
   priv_ib_lifc:=1;   flag1:=flag1_save;

   recall_lunplus;                        & recall the priv_ib_lun_table &
   priv_ib_last_address:=unlisten;
   valid_priv_luns  := 0;
   reset_priv_ib_act_funs;
   cnd_spd[0]:=2;
   cnd_spd[1]:=spd;
   cnd_spd[2]:=untalk;         &is this needed?&
   signal_init(priv_ib_signal,0);
   resource_init(priv_ib_resource);

   END init_priv_ib;
```

```
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$EJECT;
COMMENT
*****************************************************************
*  EXTERNAL SPEC for urt_priv_ib
*     FUNCTION:an active function,if selected and str (usually data)
*              is written via private hp_ib to selected device
*
*  DECLARATION INFO
*     BOOLEAN PROCEDURE urt_priv_ib(lun,fun,str)
*           VALUE lun,fun,str
*           INTEGER lun,fun   ALPHA str
*     INPUT: lun  -- logical unit number on the private hp_ib
*            fun  -- active function select code
*            str  -- str to be outputted after active function and
*     OUTPUT: urt_priv_ib
*                 false if no listening device, True if there is
*
*  EXTERNAL EFFECTS:
*     The private hp_ib will be acquired for duration, and the calling
*        process will be suspended also for duration.
*     The active device and its active function may be changed.
*****************************************************************
* INTERNAL SPEC
* acquire  private hp_ib
* set boolean flag true
* setup the address sequence need for a write
* IF active request is valid and different then last time
*    THEN set up coreund list for active fun
*         look up in active function table apporiate str to output
*         remember new acrive function for next time
* ELSE set command list e null function
* IF str has length -- not null
*    THEN set up command list to output string
* ELSE set command list to null function
* bump connand list counter by 1
* start transmitting command list and wait till finish
* release private hp_ib
* Return boolean
*****************************************************************
end of comment;
PROCEDURE urt_priv_ib_sub(lun,fun,str); VALUE lun,fun,str;
                  INTEGER lun,fun; ALPHA str;
   BEGIN
   DOUBLE fun_adr;
   ALPHA  fun_ptr = fun_adr;
   DOUBLE address_str=str;

   ton_priv_ib(lun,null);

   IF fun>=0 AND fun # priv_ib_act_fun_table[lun]  THEN
      BEGIN
         priv_ib_act_fun_table[lun]:=fun;
         priv_ib_command[cnd_ctr]:=urite_data;
         fun_ptr :=  priv_ib_fun_list(fun) ;
         priv_ib_ptr_buf[cnd_ctr]:=fun_adr;
         IF priv_ib_out_debug THEN SEGIN USTR("fun=");          &debug&
```

```
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                                    USTR(fun_ptr); END;   &debug&
      END
   ELSE IF fun = clr_fun THEN
      BEGIN & else if &
         priv_ib_act_fun_table[lun] :* no_fun;
         priv_ib_command[cnd_ctr]:*null_end;
      END & else if &
   ELSE
      priv_ib_command[cnd_ctr]:=null_cnd;
   cnd_ctr:=cnd_ctr+1;

   IF LENGTH(str)NO THEN
      BEGIN
         priv_ib_command[cnd_ctr]:=urite_data;
         priv_ib_ptr_buf[cnd_ctr]:=address_str;
         IF priv_ib_out_debug THEN BEGIN USTR(str); CRLF; END;   &debug&
      END if
   ELSE  priv_ib_command[cnd_ctr]:*null_cnd;
   cnd_ctr:*cnd_ctr+1;
   END urt_priv_ib_sub;


BOOLEAN PROCEDURE urt_priv_ib(lun,fun,str); VALUE lun,fun,str;
                  INTEGER lun,fun; ALPHA str;              ENTRY;
   BEGIN
   acquire_priv_ib;
   valid_listener := TRUE;
   urt_priv_ib_sub(lun,fun,str);
   start_and_wait_priv_ib;
   IF valid_listener THEN valid_priv_luns :=SBIT( valid_priv_luns, lun )
                     ELSE valid_priv_luns :=RBIT( valid_priv_luns, lun);
   urt_priv_ib    := valid_listener;
   release_priv_ib;
   END urt_priv_ib;

BOOLERN PROCEDURE urt_priv_ib_source(fun,str);      VRLUE fun,ctr;
                  INTEGER fun; ALPHA str;                  ENTRY;
   BEGIN
   urt_priv_ib_source := urt_priv_ib(sourte,fun,str);
   END ;
```

```
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$EJECT;
COMMENT
*****************************************************************
*  EXTERNRL SPECICATION FOR read_priv_ib
*
*  FUNCTION: will request an output iten fron the private HP_IB device
*            and read as string the response.
*
*  DECLARATION INFO:
*     ALPHA PROCEDURE read_priv_ib(lun,fun,outstr,instr)
*           VALUE lun,fun,outstr,instr
*           INTEGER lun,fun   ALPHA outstr,instr
*     INPUT: lun  -- logical unit number on the private hp_ib
*            fun  -- active function select code
*            outstr -- str to be outputted after active function and
*                      before reading begins
*            instr  -- str where the result is to be stored
*     OUTPUT:read_priv_ib -- str where the result was stored
*                            same as instr
*
*  EXTERNAL EFFECTS:
*     The private hp_ib will be acquired for duration, and the calling
*        process will be suspended also for duration.
*     The active device and its active function may be changed.
*****************************************************************
*  INTERNAL SPEC
*  after acquiring the private hp_ib , the command list for outputting
*      the active function and any extra output string will be done
*  then the connand list for the read operation is set_up
*  After the total connand list is set_up, the transfer is started
*****************************************************************
end of connent;
RLPHR PROCEDURE read_priv_ib(lun,fun,outstr,instr);
                  VALUE lun,fun,outstr,inttr;  INTEGER lun,fun;
                        ALPHA outstr,instr;                ENTRY;
BEGIN
   DOUBLE add_instr = inttr;
   BYTE POINTER bp  = instr;

   acquire_priv_ib;
   urt_priv_ib_sub(lun,fun,outstr);

   lon_priv_ib(lun);

   priv_ib_connand[cnd_ctr]:=read_data;
   priv_ib_ptr_buf[cnd_ctr]:*add_instr;
   end_ctr:=cnd_ctr+1;
   IF TBIT( valid_priv_luns , lun )
         THEN start_and_uait_priv_ib
    ELSE
         BEGIN
         uarn(priv_ib_add_err);
         bp[ 0 ] := 0;
         END;

   IF priv_ib_in_debug THEN USTR(instr);                   &debug&
```

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```
    release_priv_ib;
    read_priv_ib:=inatr;
    END read_priv_ih;
```

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```
#EJECT;
COMMENT
************************************************************************
*
* ENTERNAL SPEC for syntax_check_priv_ib
*
* FUNCTION:  verifies that the HP_IB listner
*            understand a particular command string. Used in determining
*            capabilities of device  -- phase_lock vs open_looped source
*
* DECLARATION INFO
*       BOOLEAN PROCEDURE syntax_check_priv_ib(lun,str)
*         VALUE lun,str
*         INTEGER lun    ALPHA str
*
*       INPUT: lun  -- logical unit number on the private hp_ib
*              str  -- atr containing syntax to be check
*       OUTPUT: syntax_check_priv_ib -- calling name returns if
*                   a syntax error was not caused
*
*  ENTERNAL EFFECTS:
*     The private hp_ib will be acquired for duration, and the calling
*         process will be suspended also for duration.
*     The active device may be changed.
************************************************************************
* INTERNAL SPEC
*
* output to the selected device, the desired string
* output addition spaces (blanks) to force hardware delay till the
*        prevoius string has been completely processed
* via serial poll check the syntax invalid status bit
* send selective device clear to clear syntax error, output requests,
*        or whatever caused by the outputted string
************************************************************************
end of comment;
BOOLEAN PROCEDURE syntax_check_priv_ib(lun,str);
                              VALUE lun,str;  INTEGER lun; ALPHA str;
                                                                ENTRY;
   BEGIN
   acquire_priv_ib;
   urt_priv_ib_sub(lun,no_fun,str);
   start_and_wait_priv_ib;
   urt_priv_ib_sub(lun,no_fun,"  ");&makt ture recieving device has str&
   start_and_wait_priv_ib;
   syntax_check_priv_ib:=NOT TBIT( poll_priv_ib_sub(lun) ,5);
                             &bit number may not be valid for all lun&
   ton_priv_ib(lun,sdc);
   priv_ib_act_fun_table[lun]:=no_fun;
   start_wait_and_release_priv_ib;
   END syntax_check_priv_ib;
```

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```
#EJECT;
COMMENT
end of comment;
PROCEDURE priv_ib_srq;                    &priv_ib_srq process& ENTRY;
   BEGIN
   INTEGER poll,
           count;
   INTEGER CONSTANT rev              := 6,
                    source_settied    := 3,
                    source_syntax_err := 5,
                    test_set_temp_err := 0,
                    test_set_unable   := 2,
                    test_set_settled  := 3,
                    test_set_syntax_err := 5;
   INTEGER CONSTANT max_count := 10;

   iradr(RORS(intrpt_priv_ib_srq),private_ib_srq_vetr);
                                                        & DEBUG &
   COMMENT needs to be able to handle SRQ asserted upon entry.  As it
   is now, it will not service an SRQ until all SRQs art unasserted and
   then one or more are reasserted.;

loop:
   waitio(private_ib_srq_vctr);

   count := 0;

   DO  & must loop until no srq since srq is wired-cr &
      BEGIN
      IF NOT priv_ib_lsrq_sense THEN                     & 0 = TRUE &
         IF TBIT( (poll := poll_priv_ib(source)), rev ) THEN
            BEGIN
            IF TBIT(poll,source_settled)
               THEN write_fifo(fifo_sup_brk,poll);
            IF TBIT(poll,source_syntax_err)
               THEN warn(source_ib_err);
            END;

      IF NOT priv_ib_lsrq_sente THEN                     & 0 = TRUE &
         IF TBIT( (poll := poll_priv_ib(test_set)), rev ) THEN
            BEGIN & test set &
            IF TBIT( poll, test_set_settled ) THEN
               send( test_set_ready );
            IF TBIT( poll, test_set_syntax_err ) THEN
               warn( test_set_ib_err );
            IF TBIT( poll, test_set_temp_err ) THEN
               warn( test_set_overtemp );
            IF TBIT( poll, test_set_unable ) THEN
               warn( illegal_test_set_operation );
            END;  & test set &

      count := count + 1;
      END
   UNTIL ( priv_ic_lsrq_sense OR (count > max_count) );   & _sense is &
                                                          &  0 true. &
   IF NOT priv_ib_lsrq_sense THEN                         &  0 = TRUE &
```

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```
      warn( priv_ib_srq_err );

   & acculmulate status bits &

   & BE CAREFUL not to poll a device that is not connected &

   GO TO loop;

   END priv_ib_srq;


SUBROUTINE init_sup_brk_fifo;                                   ENTRY;
   BEGIN
      init_fifc( fifo_sup_brk,
                 sup_brk_fifo_size,
                 sup_brk_fifc,
                 sup_brk_fifo_not_full,
                 sup_brk_fifo_not_empty );
   END;

ENDS
```

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```
PROCEDURE set_priv_ib_lun(lun,new_add); VALUE lun,new_add;
                        INTEGER lun; BYTE new_add;      EXTERNAL;
INTEGER PROCEDURE get_priv_ib_lun(lun); VALUE lun; INTEGER lun;EXTERNAL;
PROCEDURE trig_priv_ib(lun); VALUE lun; INTEGER lun;    EXTERNAL;
SUBROUTINE set_ren_priv_ib;                             EXTERNAL;
SUBROUTINE clr_ren_priv_ib;                             EXTERNAL;
INTERRUPT intrpt_priv_ib;                               EXTERNAL;
PROCEDURE priv_ib_srq;              &priv_ib_srq process&  EXTERNAL;
PROCEDURE reset_priv_ib_act_funs;                       EXTERNAL;
```


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```
PROCEDURE reset_priv_ib_act_funs;                       EXTERNAL;
INTEGER PROCEDURE poll_priv_ib(lun); VALUE lun; INTEGER lun;  EXTERNAL;
BOOLEAN PROCEDURE syntax_check_priv_ib(lun,str);
                        VALUE lun,str;  INTEGER lun; RLPHR str;
                                                      EXTERNAL;
```

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```
SUBROUTINE proc0;       EXTERNAL;
SUBROUTINE proc1;       EXTERNAL;
SUBROUTINE proc2;       EXTERNAL;
SUBROUTINE proc3;       EXTERNAL;
SUBROUTINE proc4;       EXTERNAL;
SUBROUTINE proc5;       EXTERNAL;
SUBROUTINE proc6;       EXTERNAL;
SUBROUTINE proc7;       EXTERNAL;
SUBROUTINE proc8;       EXTERNAL;
SUBROUTINE proc9;       EXTERNAL;
SUBROUTINE proc10;       EXTERNAL;
SUBROUTINE proc11;       EXTERNAL;
SUBROUTINE proc12;       EXTERNAL;
  IF (command_token <= 465) AND (command_token > 334) THEN
    proc0 ELSE
  IF (command_token <= 43) AND (command_token > 0) THEN
    proc1 ELSE
  IF (command_token <= 294) AND (command_token > 267) THEN
    proc2 ELSE
  IF (command_token <= 59) AND (command_token > 43) THEN
    proc3 ELSE
  IF (command_token <= 82) AND (command_token > 59) THEN
    proc4 ELSE
  IF (command_token <= 121) AND (command_token > 82) THEN
    proc5 ELSE
  IF (command_token <= 129) AND (command_token > 121) THEN
    proc6 ELSE
  IF (command_token <= 208) AND (command_token > 152) THEN
    proc7 ELSE
  IF (command_token <= 267) AND (command_token > 245) THEN
    proc8 ELSE
  IF (command_token <= 309) AND (command_token > 294) THEN
    proc9 ELSE
  IF (command_token <= 334) AND (command_token > 309) THEN
    proc10 ELSE
  IF (command_token <= 152) AND (command_token > 129) THEN
    proc11 ELSE
  IF (command_token <= 245) AND (command_token > 208) THEN
    proc12 ELSE
  warn(invalid_command);
```

CPR1DATR.WORK.PD8510 THU, DEC 22, 1983, 10:54 RM PAGE 1

```
INTEGER CONSTANT
  print_freq := 2857,
  print_time := 2871,
  print_aux := 2880,
  c_file_IO := -1;
```

```
CPUBIB.UORX.PD8510              THU, DEC 22, 1983, 10:54 RM     PAGE  1


COMMENT
  Values for setting serial poll bits for possible SRQ's.
  Each value (power of 2) has a bit set corresponding to
  its SRQ bit.  There are up to 16 possible SRQ reasons.
;
INTEGER CONSTANT

  bit0   := 1,
  hty_pressed_srq   := 2,
  bit2   := 4,
  bit3   := 8,
  bit4   := 210,
  hardware_fail_srq := 220,
  bit6   := %40,
  bit7   := %80,
  problem_srq       :0 %100,
  entry_complete_srq:0 %200,
  power_on_srq      := %400,
  op_failed_srq     := %800,
  op_complete_srq   := %1000,
  syntax_error_srq  := %2000,
  RQS_srq           := %4000,
  extended_status_srq:=%8000;
```

```
FPUBIb.UORX.PD8510              THU, DEC 22, 1983, 10:55 AM     PAGE  1


EXTERNAL INTEGER
  serial_poll_status.L,         & 2 bytes of serial poll status       &
  serial_poll_ext.L;            & backup status for pending SRQ       &

SUBROUTINE clear_serial_poll;                                   EXTERNAL.L;
PROCEDURE set_serial_poll (status);
  VALUE status; INTEGER status;                                 EXTERNAL.L;
PROCEDURE request_mask (spoll_mask);
  VALUE spoll_mask; INTEGER spoll_mask;                         EXTERNAL.L;

BOOLEAN PROCEDURE input_block(dest,length,src_type,datt_type);
  VALUE dest,src_type,dest_type;
  DOUBLE dest; INTEGER length,src_type,dest_type;               EXTERNAL.L;

EXTERNAL BOOLEAN remote;
SUBROUTINE local_bay;                                           EXTERNAL.L;
SUBROUTINE update_hpib_lads;                                    EXTERNAL.L;
PROCEDURE set_major_address (addr); VALUE addr; BYTE addr;      EXTERNAL.L;
PROCEDURE set_minor_address (addr); VALUE addr; BYTE addr;      EXTERNAL.L;

PROCEDURE pass_thru_command (cmd_char);
  VALUE cmd_char;  BYTE cmd_char;                               EXTERNAL.L;

PROCEDURE hpib_listener;                                        EXTERNAL.L;
```

```
SPUBIS.UORK.PDS510              THU, DEC 22, 1983, 10:55 RM     PAGE  1


BEGIN

RFILE ftern.uork;                                               & DEBUG &
RFILE ftern2.uork;                                              & DEBUG &
RFILE cdebug.uork;                                              & DEBUG &
RFILE futil3.uork;
#FILE cmessag0.uork;
#FILE emsgib.uork;
#FILE foutib2.uork;
#FILE fprivib.uork;
#FILE fprivib2.uork;
#FILE flunplus.uork;
#FILE cdguser.uork;
#FILE fcontrol.uork;
#FILE ffifo.uork;
#FILE ffifos.uork;
#FILE cids.uork;
#FILE crins.uork;
#FILE fkernel.uork;
#FILE fkernel4.uork;
#FILE fdguscr.uork;
#FILE cparsar.uork;
#FILE coutput.uork;
#FILE fdispran.uork;
#FILE fsize.uork;

BYTE CONSTANT irack_iten := %78+public_ib_vctr;

INTEGER CONSTANT
     BI   := 0,
     BO   := 1,
     ERR  := 2,
     DVC  := 3,
     EOI  := 5,
     RSV  := 6,
     REMC := 1,
     LLOC := 2,
     SPC  := 3,
     RED  := 4,
     LLO  := 5,
     MLNN := 0,
     TA   := 1,
     LA   := 2,

     ext_status    := 7,        % bit indicating extended status byte &

     remote_LED    := 0,
     listen_LED    := 1,
     talk_LED      := 2,
     SRQ_LED       := 3;

GLOBAL INTEGER
  serial_poll_status,           & 2 bytes of serial poll status       &
```

```
SPUBIB.UORK.PD8510              THU, DEC 22, 1983, 10:55 RM     PAGE  2


  serial_poll_ext;              & backup status for pending SRQ       &

INTEGER
  inbuf_word,                   % word buffer to write to display RAM  &
  serial_poll_mask,             % mask bits to enable serial poll SRQs &
  inbuf_ptr,                    & input data block buffer pointer     &
  block_in_lgth;                & input data block length (# bytes)   &

INTEGER POINTER inbuf;          & input data block read dest. (listen) &

BYTE io_base            = XFFFFFE01,
     int_status1_enable = io_base%22,
     int_status2_enable = io_base+%24,
     int_status1_reg    = io_base+%22,
     int_status2_reg    = io_base+%24,
     serial_poll_reg    = io_base+%25,
     aux_register       = io_base+%2A,
     data_in_reg        = io_base+%20,
     data_out_reg       = io_base+%20,
     address_mode       = io_base+%23,
     address_status     = io_base+%28,
     address_reg        = io_base+%2C,
     HPIB_LEDs          = io_base+%B0,

     MSByte_in          = inbuf_word,
     LSByte_in          = inbuf_word+1,

     SP_byte            = serial_poll_status,
     SP_mask            = serial_poll_mask;

BOOLEAN
  EOI_found,                    & flag indicating EOI found w/ data   &
  BI_pending,                   & flag indicating residual data byte  &
  stop_parse,                   & flag  to stop parsing BI bytes      &
  block_io;                     & flag to buffer BI data bytes        &

GLOBAL BOOLEAN
  command_pass_thru,            & flag indicating pass thru option    &
  remote;                       & determines remote/local state       &

COMMENT
  The following variables are used by the public HPIB interrupt routine
  in order to speed up interrupt processing by using in-line calls to
  the send(signal) subroutine
;
EXTERNAL INTEGER ARRAY counter(0:max_cin);
EXTERNAL BYTE ARRAY link(0:max_cin);
EXTERNAL INTEGER ready;         & change to DOUBLE if max_process > 15 &
INTEGER POINTER talker,listener;
INTEGER talk_process, listen_process;
```

```
SPUBIB.WORK.PO8510          THU, DEC 22, 1983, 10:55 RM    PAGE  3


%EJECT;
& DEBUG SUBROUTINES &

SUBROUTINE output_debug;
BEGIN
  WSTR("Rbort blk out:"); WHEX(outbuf_ptr); CRLF;
END output_debug;

PROCEDURE block_in_debug (dest, lgth);
  VALUE dest, lgth;  DOUBLE dest;  INTEGER lgth;
BEGIN
  WSTR ("INPUT BLOCK @ "); WHex (dest,8); WHEX(lgth);
  WSTR(" bytes"); CRLF;
END block_in_debug;
```

```
SPUBIB.WORK.PO8510          THU, DEC 22, 1983, 10:55 RM    PAGE  4


%EJECT;
COMMENT
$DOC+

NAME--
  update_hpib_leds
*****************************************************************************
*
* SHORT DESCRIPIION--
*   turns on/off talk/listen HPIB LEDs
*
* EXTENDED DESCRIPIION--
*   Updates the "talk" and "listen" LEDs according to the HPIB chip's
*   (8291) address status register.  HPIB address state changes are not
*   triggered by interrupts in efforts to speed up other public HPIB
*   interrupts and bypass the extra check for addressing changes.
*   Instead, a clock routine, INTRPT_TIC, calls this routine every
*   ??? msecs to turn on/off the talk/listen LEDs according to the
*   chip's address status register, ADDRESS_STATUS (memory mapped).
*
* INPUTS--  none
*
* OUTPUTS--  none
*
* ROUTINES CALLED-- none
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*   68K registers should not be used unless they are saved and
*   restored in INTRPT_TIC.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   Check address status register of 8291:
*   If listen bit is set then turn on listen LED
*   Else turn off listen LED
*   If talk bit is set then turn on talk LED
*   Else turn off talk LED
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE update_hpib_leds;                                    ENTRY;
&
$DOC-&

BEGIN
  IF TBIT(address_status,LA) THEN
```

```
SPUBIB.WORK.PO8510          THU, DEC 22, 1983, 10:55 RM    PAGE  5


    HPIB_LEDs := RBIT(HPIB_LEDs,listen_LED)  % turn on listen LED &
  ELSE
    HPIB_LEDs := SBIT(HPIB_LEDs,listen_LED); & turn off listen LED&
  IF TBIT(address_status,TA) THEN
    HPIB_LEDs := RBIT(HPIB_LEDs,talk_LED)    & turn on talk LED  &
  ELSE
    HPIB_LEDs := SBIT(HPIB_LEDs,talk_LED);   & turn off talk LED &
END update_hpib_leds;
```

```
SPUBIB.WORK.PO8510          THU, DEC 22, 1983, 10:55 RM    PAGE  6


%EJECT;
COMMENT
$DOC+

NAME--
  set_major_address
*****************************************************************************
*
* SHORT DESCRIPTION--
*   set major address in HPIB chip (8291)
*
* EXTENDED DESCRIPTION--
*   Sets the major talk/listen address, RDDR, which is written to the
*   chip's address register, ADDRESS_REG (memory mapped byte variable).
*
* INPUTS--
*   RDDR = byte value parameter representing the major address
*
* OUTPUTS--
*   modified local global, RDDRESS_REG with value of RDDR.
*
* ROUTINES CALLED-- none
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* RUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   set chip's address register to value of RDDR
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE set_major_address (addr); VALUE addr; BYTE addr;      ENTRY;
$
$DOC-&

BEGIN
  address_reg := addr;
END set_major_address;
```

```
SPUBIB.WORK.PO8510          THU, DEC 22, 1983, 10:55 AM    PAGE  7


&EJECT;
COMMENT
&DOC+

NAME--
  set_minor_address
*****************************************************************
*
* SHORT DESCRIPTION--
*   set minor address in HPIB chip (8291)
*
* EXTENDED DESCRIPTION--
*   Sets the minor talk/listen address, RDDR, which is written to the
*   chip's address register, ADDRESS_REG (memory mapped byte variable).
*   The &th bit (bit 7) of ADDRESS_REG is set to indicate that a minor
*   address is being set.
*
* INPUTS--
*   RDDR = byte value parameter representing the minor address
*
* OUTPUTS--
*   modified local global, ADDRESS_REG with value of RDDR.
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   Set chip's address register with value of ADDR OR'd with 60hex
*   to indicate the minor talk/listen address.
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE set_minor_address (addr); VALUE addr; BYTE addr;        ENTRY;
&
&DOC-&

BEGIN
  address_reg :# %5D OR addr;
END set_minor_address;
```

```
SPUBIB.WORK.PO8510          THU, DEC 22, 1983, 10:55 AM    PAGE  8


REJECT;
COMMENT
&DOC+

NAME--
  set_serial_poll
*****************************************************************
*
* SHORT DESCRIPTION--
*   act SRQ status bits for public HPIB serial polling
*
* EXTENDED DESCRIPTION--
*   This routine collects incoming SRQ bits that are to be set in the
*   status byte and generate service requests (SRQs) depending on the
*   bits set in the service request mask.  The following variables are
*   used in handling and processing SRQs:
*
*     serial_poll_status: MSByte = status that goes on chip
*                         LSByte = extended status bits
*     serial_poll_mask:   MSByte = status mask assoc. w/ chip
*                         LSByte = extended status mask bits
*     serial_poll_ext:    pending status used to accumulate status bits
*                         while RSV bit set in current status word
*     serial_poll_reg:    R/W byte on chip
*     SP_status:          MSByte of serial_poll_status that goes to chip
*     SP_mask:            MSByte of serial_poll_mask
*
*   If a mask bit unmasks a corresponding status bit then an SRQ is
*   generated by setting the RSV bit in the chip's serial poll register.
*   Since a new status cannot be written to the chip until its SRQ has
*   been serviced (serial polled), then a pending status word,
*   serial_poll_ext, accumulates status bits until the current status
*   byte has been read.
*
* INPUTS--  status = bit pattern of status bits to be written
*
* OUTPUTS--  SRQ on bus if SRQ mask enables any set status bits
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   if SRQ pending then
*     save serial poll bits in pending status, serial_poll_ext
*   else
*     collect serial poll bits from current and pending status and
*       status just passed in parameter, status
*     clear pending status
*     write current collection of status bits to chip
```

```
SPUBIB.WORK.PO8510          THU, DEC 22, 1983, 10:55 AM    PAGE  9


*     if status mask unmasks any SRQ bit then
*       check and set extended bit if reason in extended status byte
*       assert SRQ
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE set_serial_poll (status);
  VALUE status;  INTEGER status;                                  ENTRY;
&
&DOC-&

BEGIN
  IF 1BIT(SP_byte,RSV) THEN
  BEGIN
    serial_poll_ext :# serial_poll_ext OR status;
    IF spoil_debug THEN
      BEGIN USTR("Pending stat ="); UHEX(serial_poll_ext); CRLF; END;
  END
  ELSE
    BEGIN
      serial_poll_status :# serial_poll_status OR status OR
                            serial_poll_ext;
      IF spoil_debug THEN
      BEGIN
        USTR("curr stat ="); UHEX(serial_poll_status); CRLF;
        USTR("stat to set  ="); UHEX(status); CRLF;
        USTR("pending stat ="); HHEX(serial_poll_ext); CRLF;
      END;
      serial_poll_ext :# 0;                  & clear copy of status word &
      serial_poll_reg := SP_byte;                & write status to chip &
      IF (serial_poll_mask AND serial_poll_status)<>0 THEN
        BEGIN
          IF spoil_debug THEN
            BEGIN USTR("send SRQ"); CRLF; END;
          IF (SP_byte AND SP_mask)=0 THEN
            & set bit indicating reason in extended bit &
            SP_byte := SBIT (SP_byte, ext_status);
          serial_poll_reg :# SP_byte := SBIT (SP_byte,RSV);
        END;
    END;
END set_serial_poll;
```

```
SPUBIB.WORK.PO8510          THU, DEC 22, 1983, 10:55 AM    PAGE 10


REJECT;
COMMENT
&DOC+

NAME--
  clear_serial_poll
*****************************************************************
*
* SHORT DESCRIPTION--
*   clears serial poll SRQ variables
*
* EXTENDED DESCRIPTION--
*   This routine clears the current status byte, extended status byte,
*   and the chip's serial poll register from which the status byte is
*   read, then reissues a new status (if any is in the pending status
*   word, serial_poll_ext.
*
* INPUTS--  none
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   set_serial_poll
*
* ERROR CONDITIONS AND RECOVERY--  none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   clear status word (primary and extended)
*   clear serial poll register (primary status byte on chip)
*   If new serial poll status pending then
*     set new serial poll status
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
SUBROUTINE clear_serial_poll;                                     ENTRY;
&
&DOC-&

BEGIN
  serial_poll_reg :# serial_poll_status :# 0;
  serial_poll_ext :# 0;
  IF spoil_debug THEN
    BEGIN USTR("status cleared"); CRLF; END;
END;
```

```
SPUBIB.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE 11


REJECT;
COMMENT
$DOC+

NAME--
  request_mask
*****************************************************************************
*
* SHORT DESCRIPTION--
*   sets serial polling mask for SRQs
*
* EXTENDED DESCRIPTION--
*   This routine sets the current status mask used to issue SRQs on
*   certain bits set in the status word.  The mask requested is passed
*   as a 16-bit integer whose MSByte contain the primary status byte
*   mask corresponding to the HPIB chip's serial poll register, and the
*   LSByte contain extended information bits which did could not be put
*   the primary status byte.  ANDing the status mask (serial_poll_mask)
*   and the current status word (serial_poll_status) will cause an SRQ
*   on non-zero results.
*
* INPUTS--   spoll_mask = mask used to issue SRQs
*
* OUTPUTS--  serial_poll_mask = mask used to issue SRQs
*
* ROUTINES CALLED-- none
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* EXITIAL REFINEMENT--
*   assign input parameter (spoll_mask) to serial_poll_mask
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE request_mask (spoll_mask);
  VALUE spoll_mask; INTEGER spoll_mask;                          ENTRY;
&
$DOC-$

BEGIN
  serial_poll_mask := spoll_mask;
  IF spoll_debug THEN
    BEGIN USTR("request mask ="); WHEX(spoll_mask); CRLF; END;
END request_mask;
```

```
SPUBIB.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE 12


REJECT;
COMMENT
$DOC+

NAME--
  init_pub_hpib
*****************************************************************************
*
* SHORT DESCRIPTION--  initialize HPIB chip (8291) and variables
*
* EXTENDED DESCRIPTION--
*   Initialize various registers in the chip to reset the input line,
*   enable certain interrupts, match the chip's clock speed, set itself
*   to talker/listener addressing mode, enable holdoff on device clear
*   (stop handshake to be later resumed by 68K processor), and execute
*   power on.  Local global (module) variables for serial polling and
*   flagging talk/listen states are also initialized, and HPIB LEDs
*   are all turned off.
*
*   The following interrupts are enabled:
*     GET = group execute trigger      (status1, bit 5)
*     DVC = device clear               (status1, bit 3)
*     ERR = interface error            (status1, bit 2)
*     BO  = byte out                   (status1, bit 1)
*     BI  = byte in                    (status1, bit 0)
*     SPC = serial poll complete       (status2, bit 3)
*     LLOC= local lockout change       (status2, bit 2)
*     REMC= remote/local change        (status2, bit 1)
*
*   This routine is called on power up/instrument preset by the public
*   HPIB listener process, hpib_listener, created by the operating
*   system kernel.
*
* INPUTS--  none
*
* OUTPUTS--
*   Initialized memory mapped 8291 registers:
*     aux_register
*     int_status1_enable
*     int_status2_enable
*     address_mode
*   Initialized HPIB addressing LEDs:
*     HPIB_LEDs
*   Initialized local global variables:
*     remote
*     BI_pending
*     EOI_found
*     device_clear
*
* ROUTINES CALLED--
*   clear_serial_poll
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
```

```
SPUBIB.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE 13


*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   pulse RESET input line on chip
*   write interrupt masks to interrupt registers to enable interrupts
*   set chip to talker/listener addressing mode
*   match chip's clock rate to that of the processor
*   enable handshake holdoff on device clear
*   reset chip to power up state
*   clear serial poll register and variables
*   clear talker/listener flags
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE init_pub_hpib;
&
$OOC-&

BEGIN
  aux_register := 2;          & pulse RESET input line &
  int_status1_enable := 12F;  & set interrupt masks    &
  int_status2_enable := 1FE;
  address_mode := 1;          & mode 1 addressing      &
  serial_poll_ext := 0;
  clear_serial_poll;
  aux_register := 128;        & match clock            &
  aux_register := 2B0;        & enable RFD hold on DVC &
  aux_register := 0;          & power on chip          &
  HPIB_LEDs := 1FF;           & turn off HPIB LEDs &
  command_pass_thru :=
    remote := BI_pending := EOI_found := device_clear := FALSE;
  & initialize in-line SEND(signal) for interrupt rtn. &
  STPWTR (talker, ADRS(counter[hpib_byte_out]));
  STPWTR (listener, ADRS(counter[hpib_cmd_ready]));
  talk_process := SBIT (20000, pub_ib_out_id);
  listen_process := SBIT (20000, pub_ib_in_id);
END init_pub_hpib;
```

```
SPUBIB.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE 14


REJECT;
COMMENT
$DOC+

NAME--                                                    buffer_DG_word
*****************************************************************************
*
* SHORT DESCRIPTION--
*   buffers 2 data input bytes read from HP-IB data register
*
* EXTENDED DESCRIPTION--
*   This routine reads input data bytes from the HP-IB data register
*   and buffers 2 bytes at a time in order to write a word into the
*   memory destination located in display RAM (since bytes cannot be
*   written into display RAM).  This routine is used mainly by input
*   data block routines that transfer a block of data from a remote
*   controller to the 8510.  The destination data array generally
*   resides in display RAM.
*
* INPUTS--
*   data_in_reg = (global) input data byte from HP-IB
*
* OUTPUTS--
*   inbuf array = (global) destination array for input data bytes
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   Temporary variables are allocated to duplicate global variables
*   that are used by the public HP-IB interrupt so that a copy of
*   these values exist when the interrupt routine changes them
*   after the data byte is read.
*
*   The duplicated variables are INBUF_PTR and INBUF_WORD which
*   respectively points to the next word in the display memory
*   destination and contains the value of that next word.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE buffer_DG_word;
&
```

```
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$DOC-&

DECIK
  INTEGER temp_ptr, temp_word;
  BYTE temp_byte_in = temp_word + 1;
  temp_ptr := inbuf_ptr;
  IF TDIT(temp_ptr,0) THEH
    BECIN
      temp_word := inbuf_word;
      temp_byte_in := data_in_reg;
      inbuf[temp_ptr/2] := temp_word;
    EHD
  ELSE
    MSByte_in := data_in_reg;
EHD buffer_DG_word;
```

```
SHOBIB.WORK.PD8510          IHU, DEC 22, 1985, 10:55 AM    PROE 16


$EJECT;
COMMENT
$DOC+

HAME--
  empty_parser_FIFO
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*
* SHORT DESCRIPTION-- empty out public HPIB parser FIFO
*
* EXTENDED DESCRIPTION--
*   This function is a local routine which reads the public HPIB parser
*   FIFO, public_ib_fifo, and writes the value read (lower byte) into an
*   input buffer, INBUF, until the FIFO is empty, the maximum number of
*   input data bytes has been read from the FIFO, or an EOI value,
*   hpib_eoi, had been read from the FIFO.
*   This function is primarily used during a block mode input when the
*   public HPIB is addressed to LISTEN and leading bytes of input data
*   are written into the parser's FIFO before they can be flagged and
*   detoured to be written immediately into the input data buffer.
*
* INPUTS--  none
*
* OUTPUTS--
*   Returns TRUE if an EOI character is encountered in the parser FIFO,
*   returns FALSE otherwise.
*
* ROUTINES CALLED--
*   empty_fifo
*   read_fifo
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   When emptying the parser's FIFO, only the lower byte of each word
*   read from the FIFO is written to the input buffer.
*
* AUTHOR--
*
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*
* INITIAL REFINEMENT--
*   While parser FIFO is not empty and EOI value not read do
*     Read FIFO value and put into input buffer, INBuf.
*   Return TRUE if EOI value read, FALSE otherwise.
*
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*
* REVISION LOG--
*
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
DECLARATION--
;
BOOLEAN PROCEDURE empty_parser_FIFO;
$
```

```
SPUBIB.WORK.PD8510          IHU, DEC 22, 1983, 10:55 AM    PROE 17


$DOC-&

BEGIN
  INTEGER fifo_val;
  & empty public_ib_fifo into destination address &
  fifo_val := 0;
  WHILE NOT empty_fifo(public_ib_fifo) AND (fifo_val <> hpib_eoi) DO
    IF ((inbuf_ptr+inbuf_ptr+1) <= block_in_lgth) THEN
    BEGIN
      IF (fifo_val:=read_fifo(public_ib_fifo))<>hpib_eoi THEN
        & inbuf[inbuf_ptr] := fifo_val --> pair up bytes for DC RAM &
        IF TBIT(inbuf_ptr,0) THEN
          BECIN
            LSByte_in := fifo_val;
            inbuf[inbuf_ptr/2] := inbuf_word;
            IF blk_mode_debug THEN
              BEGIN
                WSTR(" FIFO="); WHEX(inbuf_ptr); WHEX(inbuf_word); CRLF;
              EHD;
          END
        ELSE
          MSByte_in := fifo_val;
    END;
  empty_parser_FIFO := (fifo_val=hpib_eoi);
EHD empty_parser_FIFO;
```

```
SFUBIB.WORK.PD5510          THU, DEC 22, 1983, 10:55 AM    PRGE 18


$EJECT;
COMMENT
$DOC+

HAME--
  read_hpib
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*
* SHORT DESCRIPTION-- read input data byte from HPIB chip (8291)
*
* EXTENDED DESCRIPTION--
*   This is a local routine invoked only when public HPIB is addressed
*   to listen and is in an input data block mode.  It updates the input
*   buffer pointer, INBUF_PTR, and checks if the value is less than the
*   specified data block size, BLOCK_IN_LGTH.  If the pointer does not
*   equal or exceed the number of input data bytes, then the DATA IN
*   register is read from the chip and written to the input data buffer,
*   otherwise a signal is sent to indicate the end of the data transfer.
*   This signal is waited for in the input data block routine,
*   INPUT_BLOCK, invoked by the parser upon parsing an input data block
*   command.
*
* INPUTS--   none
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
k   send
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*   The last input data byte is read after the signal has been received
*   indicating the end of the data block has been reached.  At this
*   point, block mode flags are cleared to resume regular parsing and
*   buffer pointers are reset.  (See input_block)
*
* AUTHOR--
*
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*
* INITIAL REFINEMENT--
*   increment input data buffer pointer
*   if input data buffer pointer < input data block length then
*     read input data byte from chip and put into input data buffer
*   else
*     send signal indicating the end of input data block
*
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*
* REVISION LOG--
*
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
DECLARATION--
;
SUBROUTINE read_hpib;
```

```
SPUBIB.bORK.PD8510          IMU, BEC 22, 1983, 10:55 AM    PAGE 19


&
$OOC-&

BCOIN
  IF ((inbuf_ptr:=inbuf_ptr+1) < block_in_lgth) AMO
     MOI TBIT(address_status,EOI) THEN
    buffer_DG_word
  ELSE
  IF inbuf_ptr = block_in_lgth THEN
    eend (block_reed_done)
  ELSE
    BI_pending := TRUE;
END read_hpib;
```

```
SPUBIB.WORK.PD8510          IMU, DEC 22, 1983, 10:55 RM    PAGE 20


REJECT;
SUBROUTINE input_date;
BEGIN
  IF BI_pending THER
    BEGIN
      BI_pending := FRLSE;
      read_hpib;
    END;
  wait (block_read_pone);
  buffer_DG_word;
  IF NOT IBIT(block_in_lgth,0) THEM
    inbuf(biock_in_lgth/2] := inbuf_word;
  IF device_plear THEN
    aend (dvc_done);
END input_data;
```

```
.3PUBIB.UORK.PDS510         THU, OEC 22, 1983, 10:55 Rn    PRGE 21


REJECT;
BOOLERH PROCEDURE binary_input (dett, length);
  VRLUE deet;  DOUBLE deat;  INTEGER length;
BEGIN
  BOOLEAN EOI_in_FIFO;
  STPNTR(inbuf,dest);
  inbuf_ptr := -1;
  block_in_lgth := length -1;
  IF NOT (EOI_in_FIFO:=enpty_pareer_FIFO) OR
     (inbuf_ptr < block_in_lgth) THEN
    BEGIN
      block_io := IRUE;
      input_data;
    EMD;
  binary_input := TBIT(address_etatue,EOI) OR EOI_in_FIFO
                  OR (inbuf_ptr >= length-1);
END binary_input;
```

```
SFUBIB.WORK.PDS510          IMU, DEC 22, 1983, 10:55 AM    PAGE 22


#EJECT;
COMMENT
  Inputs IEEE formatted data points fron controller to
  8510 in either 3-uord complex or real format (binary).
  IEEE to binary conversion is done on each point after coning over
  the hue and prior to storing the value in its destination array
;
BOOLEAN PROCEDURE IEEE_input (dest, lgth, arc_fornat, dest_format);
  VALUE dest, lgth, sre_format, dest_format;
  DOUBLE dett;  INTEGER lgth, arc_fornat, dest_format;
BEGIN
  BOOLEAN
    neg;                          & flag indicating negative value    &
  INTEGER
    debug_lgth,
    bias,                         & IEEE exponent bias for dbl/single  &
    shft,                         & nunber of bits to shift exponent   &
    exp_eize;                     & IEEE dbl/single exponent size      &
  DOUBLE ARRAY
    IEEE_value[0:1];              & conversion buffer for each point    &
  REAL real_value, real_part, inag_part;
  DOUBLE
    exponent,
    dbl_real = real_value,
    nantiosa = IEEE_value[0],
    lou_nant = IEEE_velue[1];
  INTEGER exp = exponent+2, nSUord = IEEE_value[0);
  INTEGER MSreal = real_value, LSreal = real_value + 2;

  &-------------------------------------------------------------------&

  SUBROUTINE buffer_data_bytee;
  BEGIN
    inbuf_ptr := -1;
    IF NOT block_io THEN
      BEGIN
        enpty_parser_FIFO;
        IF (block_io := (inbuf_ptr < block_in_lgth)) THEN
          input_data;
      END
    ELSE
      input_data;
    IF blk_node_debug THEN
      BEGIN
        WHEX (debug_lgth - lgth);
        iSTR(" ieee:"); WHex(nantissa,S); Uhex(lov_nant,8);
      END;
  END buffer_data_bytes;

  &-------------------------------------------------------------------&

  REAL SUBROUTINE convert_to_real;     & fron IEEE floating pt. format &
  BEGIN
    buffer_data_bytes;
    IF (nantissa = 0) AND (lou_nant = 0) THEN
      real_value := 0.0
```

```
$PUBIB.WORK.PD8510          THU, DEC 22, 1983, 10:55 AM    PAGE 23

    ELSE
      BEGIN
        IF (neg := TBIT (RSWord,15)) THEN
          RSWord := RBIT (RSWord,15);          & clear sign bit &
        exp := RIGHT (RSWord, shft) - bias;
        IF (exp < -128) THEN                   & set to max. neg. value &
          real_value := %80000080
        ELSE
        IF (exp > 127) THEN                    & set to max. pos. value &
          real_value := %7FFFFF7F
        ELSE
          BEGIN
            mantissa := (LEFT (mantissa, exp_size)) OR
                        (RIGHT (low_mant, 32-exp_size));
            mantissa := RBIT (mantissa,31);    & clear sign bit &
            mantissa := SBIT (mantissa,30);    & shift back implicit 1 &
            dbl_real := (mantissa AND %FFFFFF00) OR
                        (exponent AND %0FF);
            IF neg THEN
              real_value := -real_value;       & floating pt. negate &
          END;
      END;
    convert_to_real := real_value;
    IF blk_mode_debug THEN
      BEGIN USTR(" real:"); Wdmx(dbl_real,8); CRLF; END;
  END convert_to_real;

  &-------------------------------------------------------------------&

  SUBROUTINE convert_to_3_words;
  &BEGIN
    real_part := convert_to_real;
    imag_part := convert_to_real;
    & JSR CMV1E_save --- converts 2 reals to 3-word complex &
    ASSEMBLE(
      MOVE.L  real_part,R0;
      MOVE.L  imag_part,R1;
      MOVE.L  dest,R&;
      JSRX    CMV1E_save;
      MOVE.L  R&,dest
    );
  END convert_to_3_words;

  &-------------------------------------------------------------------&

  BOOLEAN SUBROUTINE block_read_complete;
  BEGIN
    block_read_complete := ((lgth:=lgth-1)<=0) OR device_clear;
  END block_read_complete;

  &-------------------------------------------------------------------&

  debug_lgth := lgth;
  $IPNTR (inbuf, ADRS(IEEE_value));
  & check destination formats &
  IF src_format = output_ieee_single THEN
```

```
$PUBIB.WORK.PD8510          THU, DEC 22, 1983, 10:55 AM    PAGE 24

    BEGIN
      block_in_lgth := 3;   & byte 0-3 &
      bias := 126;          & -1 for implied 1 shifted back in mant. &
      exp_size := shft := 7;
    END
  ELSE
  IF src_format = output_ieee_double THEN
    BEGIN
      block_in_lgth := 7;   & byte 0-7 &
      bias := 1022;         & -1 for implied 1 shifted back in mant. &
      exp_size := 10;
      shft := 4;
    END;
  IF dest_format = output_from_user8 THEN
    DO
      convert_to_3_words
    UNTIL block_read_complete
  ELSE
  IF dest_format = output_from_integer THEN
    binary_input (dest, lgth)
  ELSE
    warn (command_not_implemented);
  IEEE_input := (lgth <= 0);
END IEEE_input;
```

```
$PUBIB.WORK.PD8510          THU, DEC 22, 1983, 10:55 AM    PAGE 25

%EJECT;
COMMENT
&DOC+

NAME--
  input_block
*********************************************************************
*
* SHORT DESCRIPTION-- input data block from public HPIB
*
* EXTENDED DESCRIPTION--
*   This is a global function which is called by the public HPIB parser
*   upon parsing a data block mode command.  It sets up block mode flags
*   which prevent data bytes from being written to the parser FIFO and
*   causes them to be written directly into the input data buffer,
*   INBUF.  It also sets up the input data buffer address to be written
*   to via INBUF, and the maximum number of bytes to be written,
*   block_in_lgth.  Reading data bytes which were written to the FIFO
*   before these flags could be set up are read from the FIFO and
*   written to INBUF via the function empty_parser_FIFO.
*
*   If an EOI value is found in the FIFO or the number of data bytes
*   written equals block_in_lgth (empty_parser_FIFO = TRUE) then
*   all block mode flags, buffers, and pointers are reset, and the
*   routine returns the status of the block transfer.  Otherwise, a
*   signal, hpib_read_done, is waited for prior to the afore mentioned
*   re-initializations and status return.  While waiting for the signal
*   signal indicating the completion of the data block transfer, public
*   HPIB "byte in" interrupts (data byte to be read from chip) are
*   processed through the interrupt routine (writes data byte read
*   to INBUF instead of parser FIFO) until an EOI is found or the
*   maximum number of data bytes has been read.
*
* INPUTS--
*   dest = address of input data buffer pointed to by INBUF
*   lgth = max. number of input bytes allowed assigned to BLOCK_IN_LGTH
*
* OUTPUTS--
*   status of block transfer:
*     lgth = variable parameter returning number of actual bytes read
*     input_block = boolean function value indicating whether or not
*       EOI was included in the input data block
*
* ROUTINES CALLED--
*   empty_parser_FIFO
*   wait
*   send
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   If the entire input block was not read from the FIFO, then the
*   last data byte is read after the hpib_read_done signal is received
*   and all flags and pointers have been reset.  This holds off further
*   "byte in" interrupts until the end of the routine before returning
```

```
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*   to the public HPIB parser.
*   If the device clear flag is set then a signal is sent at the end of
*   the routine indicating that the data block transfer is complete
*   regardless of whether or not all the input data bytes have been
*   transferred.
*
* AUTHOR--
*
*********************************************************************
*
* INITIAL REFINEMENT--
*   set up input data buffer and maximum block length (in bytes)
*   set flags to write data from chip to input buffer instead of parser
*   empty parser FIFO into input buffer
*   if end of data block then reset flags and pointers
*   else wait for end of data block and then reset flags and pointers
*
*********************************************************************
*
* REVISION LOG--
*
*********************************************************************
DECLARATION--
;
BOOLEAN PROCEDURE input_block(dest,length,dest_type,src_type);
  VALUE dest,dest_type,src_type;
  DOUBLE dest; INTEGER length,dest_type,src_type;                ENTRY;
&
&DOC-&

BEGIN
  INTEGER save_lgth,                              & # points being input &
          byte_factor;              & & bytes to divide to get # points &
  input_block := FALSE;
  stop_parse := TRUE;
  IF blk_mode_debug THEN
    block_in_debug (dest, length);
  IF (src_type = output_binary) THEN
    input_block := binary_input (dest, length)
  ELSE
  IF src_type = output_ascii THEN
    warn (command_not_implemented)
  ELSE  & IEEE format &
    BEGIN
      byte_factor := IF src_type=output_ieee_single THEN 4 ELSE &;
      IF dest_type = output_from_user3 THEN
        byte_factor := 2*byte_factor    & complex IEEE needs real/imag &
      ELSE
      IF dest_type = output_from_integer THEN
        byte_factor := 2;
      save_lgth := length := length/byte_factor;
      IF length <> number_of_points THEN
        warn (block_input_length_error)
      ELSE
        BEGIN
          input_block := IEEE_input (dest,length,src_type,dest_type);
```

```
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        IF length < 0 THEN length := 0;
      END;
    & return in "length" the number of bytes actually input &
    length := byte_factor * (save_lgth-length);
  END;
 etop_parse := block_io := FALSE;
 IF (BI_pending) OR (inbuf_ptr > block_in_lgth) THEN
   BEGIN                        & non-input data byte in chip &
     BI_pending := FALSE;
     send (hpib_end_ready);
   END;
 IF blk_mode_debug THEN
   BEGIN USTR("end input"); CRLF; END;
END input_block;
```

```
SPUBIB.UORK.PD8510          IHU, DEC 22, 1983, 10:55 AM     PAGE 28


$EJECT;
COMMENT
$DOC+

NAME--
  pass_thru_command
*****************************************************************************
*
* SHORT DESCRIPTION--
*   passes data byte from public HPIB through to private HPIB
*
* EXTENDED DESCRIPTION--
*   (still going thru changes in definition/inplementation)
*   -1 = pass thru to plot to user display
*
* INPUTS--   public HPIB data in register
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE pass_thru_command (end_char);
  VALUE end_char;  BYTE end_char;                              ENTRY;
&
$DOC-&

BEGIN
  BYTE TABLE end_byte := 1,0;
  end_byte[1] := end_char;
  IF NOT command_pass_thru THEN
    BEGIN
      command_pass_thru := TRUE;
      abort_sweep;                          & stop private bus activity &
      COMMENT
      IF system is in 'local' THEN  ???
        put system in 'remote'      ???
      ;
    END;
  IF priv_ib_lun_table[priv_ib_pass] = user_display_address THEN
```

```
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    pause_user_graphics (end_char)
  ELSE
    urt_priv_ib (priv_ib_pass, no_fun, ADRS(end_byte));
  IF pass_thru_debug THEN
    BEGIN
      NSTR("pass thru: "); UCHAR(end_byte[1]);
      CRLF;
    END;
END pass_thru_command;
```

```
SPU8I9.UORK.PD8510          IHU, DEC 22, 1983, 10:55 AM     PAGE 30


REJECT;
SUBROUTINE pass_thru_done;
BEGIN
  & put system back in remote ???? &
  command_pass_thru := FALSE;
  reset_priv_ib_act_func;   & is this done on a 'local' ??? &
  restart_sweep;
  IF pass_thru_debug THEN
    BEGIN USTR("end pass thru"); CRLF; END;
END;
```

```
SPUBIB.WORK.PB8510          THU, DEC 22, 1983, 10:55 AM    PAGE 31


%EJECT;
COMMENT
%DOC+

NAME--
  public_HPIB
*****************************************************************
*
* SHORT DESCRIPTION-- processes interrupts from public HPIB
*
* EXTENDED DESCRIPTION--
*   This interrupt routine reads the two interrupt status registers from
*   the HPIB chip (S291), saves them in temporary variables and checks
*   the following bits for the interrupt reason and responds accordingly
*
*     DVC  = (status 1, bit 3)   device clear
*            set device clear flag
*            &send signal, hpib_end_ready, to listener process,
*            HPIB_listener
*     BO   = (status 1, bit 1)   byte out
*            if output byte in chip then write another one to chip
*            (addressed to talk = acts 1st byte out interrupt, therefore
*            wait for 1st byte to be written by another routine before
*            before writing another byte to the chip)
*     BI   = (status 1, bit 0)   byte in
*            if block mode then
*              read data byte from chip &o input data buffer
*            else
*              send signal, hpib_end_ready, to listener process,
*              HPIB_listener
*     REMC = (status 2, bit 1)   remote/local change
*            set remote flag and light remote LED if in remote
*            otherwise turn off remote LED
*     SPC  = (status 2, bit 3)   serial poll complete
*            clear primary status byte
*
*   Sending signals via "send" routine are done in-line in order to
*   minimize the speed of processing interrupts.
*
* INPUTS--  none
*
* OUTPUTS--  none
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   No subroutince/procedures calls are made from this routine unless
*   they use only registers 0,7-9.
*   Address state change interrupts are not enabled in order to gain
*   speed in processing more important interrupts and bypassing the
*   extra interrupt bit check used primarily to turn on/off HPIB LEDs.
*   Since access to the chip's address status register does not destroy
*   that register's contents, the system clock routine is used to update
```

```
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*   the talk/listen LEDs according to the talk/listen bits set in that
*   register.
*   Unfortunately, there is no way of treating remote/local state
*   changes similarly since that information is found in the interrupt
*   status word whose value is reset once it is read.
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   read interrupt status registers 1 and 2
*   if device clear bit is set then
*     set device clear flag and send signal to listening process
*   if byte in bit is set then
*     read chip if block mode is in effect
*     otherwise send signal to listenening process (which reads chip)
*   if byte out bit is set then
*     write to chip if chip has already been written to
*   if remote/local change then
*     set remote flag and light remote LED if remote bit set
*     otherwise turn off remote LED
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
%ECLARATION--
;
%DE REGISTER 0,2-9;

INTERRUPT public_hpib;
&
%DOC-&

%EGIN

  BYTE status1,status2, ircnd1 = io_base+892;
  INTEGER loc2 = %OCR,
          loc1 = %OCC,
          loc0 = %OCS;
  loc1 := %R&CD;
  status1 := int_status1_reg;
  status2 := int_status2_reg;
  IF pub_ib_debug THEN
  %EGIN
    %STR("START 1 ="); %HEX(status1);
    %STR(" START 2 ="); %HEX(status2); CRLF;
    %STR("ROOR STRT A"); %HEX(address_status);
    %STR("SER POLL ="); %HEX(serial_poll_reg); CRLF;
  END;

  IF %BIT (status1, DVC) THEN
    %EGIN
      IF ib_int_debug THEN
```

```
SPUBIB.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE 33


        %EGIN %STR("DVC"); CRLF; END;
      device_clear := TRUE;
      & send (hpib_end_ready) &
      IF (listener := listener+1) <= 0 THEN
        ready := ready OR listen_process;    & must be uninterruptible &
    END;

  IF %BIT (status1,BI) THEN
    %EGIN
      IF ib_int_debug THEN
        %EGIN %STR("BI"); CRLF; END;
      COMMENT --- may not be needed
      IF (%BIT (address_status, %JAM)) THEN
        %O TO pass_end;
      IF byte_avail THEN
        %EGIN  & abort block output transfer &
          byte_avail := FALSE;
          status1 := %BIT (status1,BO);
          IF outbuf_ptr < block_out_lgth THEN
          %EGIN
            & send (block_write_done) &
            IF (counter[block_write_done]:=counter[block_write_done]+1)
              <= 0 THEN
              %EGIN
                ASSEMBLE( MOVE   SR,-(S) );    & save status word &
                ASSEMBLE( ORI    #H0700,SR);   & disable interrupts &
                ready := SBIT (ready,link(block_write_done));
                ASSEMBLE( MOVE   (S)+,SR );    & restore status word &
              END;
            outbuf_ptr := block_out_lgth;
          END;
        END;
      IF block_io THEN   & input data block &
      %EGIN
        IF ((inbuf_ptr:=inbuf_ptr+1) < block_in_lgth) AND
          NOT TBIT(address_status,EOI) THEN
          & inbuf[inbuf_ptr] := data_in_reg &
          IF TBIT(inbuf_ptr,0) THEN
            %EGIN
              LSByte_in := data_in_reg;
              inbuf[inbuf_ptr/2] := inbuf_word;
            END
          ELSE
            MSByte_in := data_in_reg
        ELSE
        IF inbuf_ptr = block_in_lgth THEN
          & send (block_read_done) &
          %EGIN
            IF (counter[block_read_done]:=counter[block_read_done]+1)<=0
            THEN
            %EGIN
              ASSEMBLE( MOVE   SR,-(S) );    & save status word &
              ASSEMBLE( ORI    #H0700,SR);   & disable interrupts &
              ready := SBIT (ready,link(block_read_done));
              ASSEMBLE( MOVE   (S)+,SR );    & restore status word &
            END;
```

```
SPUBIB.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE 34


          END
        ELSE
          BI_pending := TRUE;
      END
      ELSE
      pass_end:
        & send (hpib_end_ready) &
        IF (listener := listener+1) <= 0 THEN
          ready := ready OR listen_process;  & must be uninterruptible &
    END;

  IF %BIT (status1,BO) THEN
  %EGIN
    IF ib_int_debug THEN
      %STR("dO:");
    IF byte_avail THEN
    %EGIN
      IF (outbuf_ptr:=outbuf_ptr+1) < block_out_lgth THEN
        data_out_reg := outbuf[outbuf_ptr]
      ELSE
      IF outbuf_ptr = block_out_lgth THEN
        %EGIN
          data_out_reg := outbuf[outbuf_ptr];
          & send (block_write_done) &
          IF (counter[block_write_done]:=counter[block_write_done]+1)<=0
            THEN
            %EGIN
              ASSEMBLE( MOVE   SR,-(S) );    & save status word &
              ASSEMBLE( ORI    #H0700,SR);   & disable interrupts &
              ready := SBIT (ready,link[block_write_done]);
              ASSEMBLE( MOVE   (S)+,SR );    & restore status word &
            END;
        END;
      IF &O_debug THEN
        IF outbuf_ptr > block_out_lgth THEN
        %EGIN
          %STR("?");
          CRLF;
        END;
    END
    ELSE
      & send(hpib_byte_out) &
      IF (talker:=talker+1) <= 0 THEN
        ready := ready OR talk_process;      & must be uninterruptible &
  END;

  IT TBIT (status2, REMC) THEN
  %EGIN
    IF ib_int_debug THEN
      %EGIN %STR("REMC"); CRLF; END;
    IF (remote:=TBIT (status2, REM)) THEN
      HPIB_LEDs := RBIT(HPIB_LEDs,remote_LED)   & turn on remote LED &
    ELSE
      HPIB_LEDs := SBIT(HPIB_LEDs,remote_LED);   & turn off remote LED &
  END;
```

```
SPUBIB.UORK.PDS510              THU, DEC 22, 1983, 10:55 RM     PAGE  35


  IF TBIT (status2, SPC) THEN
  BEGIN  & generated only in response (read serial poll status) to SRQ &
    IF ib_int_debug THEN
      BEGIN WSTR("SPC"); CRLF; END;
    SP_byte := serial_poll_reg := 0;              & clear status byte &
    IF serial_poli_ext <> 0 THEN                  & get new status    &
      BEGIN
        serial_poll_status := serial_poll_status OR serial_poll_ext;
        serial_poll_reg := SP_byte;
        serial_poll_ext := 0;
        IF (serial_poll_nask RND serial_poll_status) <> 0 THEN
          serial_poll_reg := SP_byte := SBIT(SP_byte,RSV);
      END;
  END;

  loc1 := 0;
  ircndl := irack_iten;                     & re_enabie HPIB interrupts &
END pub_hpib;

USE REGISTER 0-13;
```

```
SPUBIB.WORK.PDS510              THU, DEC 22, 1983, 10:55 RM     PAGE  36


NEJECT;
COnnENT
$DOC+

NRME--
  reset_hpib
*************************************************************************
*
* SHORT DESCRIPTION--
*   processes device clear interrupt
*
* EXTENDED DESCRIPTION--
*   This is a local routine uhich aborts any HPIB block I/O in progress,
*   writes a device clear value to the public HPIB parser FIFO, clears
*   serial poll information, and finishes the handshake held off by the
*   device clear interrupt.
*   R uait en the signal, dvc_done, allous any current data block
*   transfers to finish and return to calling parser routines whether or
*   not all bytes were transferred before finishing the handshake
*   between controller and addressee.
*
* INPUTS--  none
*
* OUTPUTS--
*   possible inconplete data block transfer
*
* ROUTINES CALLED--
*   send
*   wait
*   urite_fifo
*   eltar_oerial_poll
*
* ERROR CONDITIONS RND RECOVERY--
*   none
*
* NOTES--
*   Signals are sent to abort data block transfers since waits for these
*   signals are set up inmediatciy after data block I/O flaga have been
*   set to read/write directly to/fron chip on each BI/BO interrupt.
*   Therefore, partial data block transfers nay result if a device clear
*   were to occur before the transfer is completed.
*
* RUTHOR--
*
*************************************************************************
*
* INITIRL REFINEMENT--
*   IF inputting data block then
*     send block_read_done signal to abort data transfer and
*     wait for signal indicating data transfer has been aborted
*   IF outputting data block then
*     send block_urite_done signal to abort data transfer and
*     wait for signal indicating data transfer has been aborted
*   write device clear value to public HPIB career FIFO
*   clear serial poll information
*   conplete handshake between controller and talker/listener
```

```
SPUBIB.UORK.PD8510              THU, DEC 22, 1983, 10:55 RM     PAGE  37


a
*************************************************************************
*
* REVISION LOG--
*
*************************************************************************
DECLARRTION--
;
SUBROUTINE reset_hpib;
&
$DOC-&

BEGIN
  IF bleck_io RND (inbuf_otr < block_in_lgth) THEN
    BEGIN      & abort_receiving data block &
      send (block_reab_done);
      wait (dvc_done);
      IF blk_node_debug THEN
        BEGIN USTR("Input aborted"); CRLF; END;
    END;
  IF byte_avail THEN
    BEGIN
      byte_avail := FRLSE;
      IF outbuf_ptr < block_put_lgth THEN
        BEGIN      & abort sending data block &
          send (block_urite_done);
          wait (dvc_done);
          block_out_lgth := 0;
          IF blk_node_debug THEN
            BEGIN USTR("Output aborted"); CRLF; END;
        END
    END;
  urite_fifo (public_ib_fifo, hpib_dcl);
  device_clear := FRLSE;
  clear_serial_poll:
  oerial_joll_nask := serial_poll_ext := 0;
  aux_register := IOF;              & continue fron RFO hoidoff &
END reset_hpib;
```

```
SPUBIB.UORK.PD8510              THU, DEC 22, 1983, 10:55 RM     PAGE  38


NEJECT;
COnnENT
$DOC+

NRME--
  local_key
*************************************************************************
*
* SHORT DESCRIPTION--  responds to [LOCRL] key entry
*
* EXTENDED DESCRIPTION--
*   Sets HPIB chip (S291) to return to local node, then clears the
*   chip to enable it to exit local node once it is addressed to listen.
*   This is all done by setting control and command bits in tht chip's
*   auxiliary register, RUX_REGISTER (nenory napped byte variable):
*     1101 = return to local,  0101 = clear local
*
* INPUTS--   none
*
* OUTPUTS--  none
*
* ROUTINES CRLIED-- none
*
* ERROR CONDITIONS RND RECOVERY-- none
*
* NOTES--
*
* RUTHOR--
*
*************************************************************************
*
* INITIRL REFINEMENT--
*   set return to local node on S291 via auxiliary register
*   tst exit local node on 8291 via auxiliary register
*
*************************************************************************
*
* REVISION LOG--
*
*************************************************************************
DECLARRTION--
;
SUBROUTINE local_key;                                          ENTRY;
&
tDOC-&

BEGIN
  aux_register := XD;  & return to local &
  aux_register := X5;  & clear local node&
  IF byte_avail THEN
    BEGIN                                & abort block output transfer &
      byte_avail := FRLSE;
      IF outbuf_ptr < block_out_lgth THEN
        BEGIN
          send (block_urite_done);
          block_out_lgth := 0;
```

```
SPUBIB.WORK.PB1510          THU, DEC 22, 1983, 10:55 AM    PAGE  39


      END;
    IF BD_debug THEN
      output_debug;
  END
ELSE
IF block_io AND (inbuf_ptr < block_in_lgth) THEN  & abort input xfer &
  send (block_read_done);
& flush out parser fifo here ??? &
write_fifo (public_ib_fifo, hpib_del);
IF command_pass_thru THEN
  pass_thru_done;
END;
```

```
SPUBIB.WORK.PB851D          THU, DEC 22, 1983, 10:55 AM    PAGE  40

%EJECT;
COMMENT
$DOC+

NAME--
  hpib_listencr
*****************************************************************************
*
* SHORT DESCRIPTION--
*   processes HPIB device clear and byte in interrupts
*
* EXTENDED DESCRIPTION--
*   This routine is a scheduled process created by the main host
*   software.  It initializes various public HPIB variables through
*   calls to initialization routines and then goes into an idle loop
*   which waits on the signal, hpib_cnd_ready, sent by the public HPIB
*   interrupt routine on interrupts from device clear and byte in.
*
*   A device clear interrupt invokes the routine, reset_hpib.
*
*   The byte in interrupts handled by this routine are primarily HPIB
*   command mnemonics which are read from the HPIB chip and put into
*   the public HPIB parser FIFO, public_ib_fifo.  Any pending signal
*   received after block mode is in effect either puts the data byte
*   from the chip into the input block buffer after the data bytes still
*   left in the parser FIFO, or sets a flag (byte_straggler) which
*   indicates that a data byte is still in the chip.  This flag will
*   inform the block mode routine (input_block), invoked by the parser,
*   that a data byte still needs to be read from the chip into the
*   input buffer (this also allows successive data bytes being sent from
*   the controller to be read).
*
* INPUTS--  none
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   reset_hpib
*   wait
*   send
*   empty_parser_FIFO
*   read_hpib
*   write_fifo
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*   The HPIB interrupt routine sends a signal to this process so that
*   it can return immediately from interrupt and not spend extra time
*   possible process swapping to handle the interrupt reason.
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
```

```
SPUBIB.WORK.PD3510          THU, DEC 22, 1983, 10:55 AM    PAGE  41

*   initialize public HPIB variables, flags, and signals
*   loop forever:
*     wait for hpib_cnd_ready signal
*     if device clear then call device clear routine, reset_hpib
*     else
*     if block mode then
*       if data in parser fifo then empty into input buffer and
*         read data byte from chip into input buffer
*       else set flag indicating data byte still in chip
*     else
*       check for eoi
*       write data byte from chip into parser fifo
*       if eoi found then write eoi value into parser fifo
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE hpib_listener;                                    ENTRY;
&
$DOC-&

BEGIN

  PROCEDURE iradr(Adrs,bit);
    VALUE Adrs,bit; DOUBLE Adrs; BYTE bit;                  EXTERNAL;

  init_pub_hpib;                                & public HPIB init's   &
  stop_parse := block_io := FALSE;
  signal_init (block_write_done,0);
  signal_init (hpib_cnd_ready,0);               & signal initialization&
  iradr (ADRS(public_hpib),public_ib_vctr);     & interrupt init's     &

loop:                                           & idle loop process:   &
    wait (hpib_cnd_ready);                      & BI interrupt sent    &
    IF device_clear THEN
      reset_hpib
    ELSE
    IF stop_parse THEN                          & in block mode routine &
      BEGIN
        IF blk_mode_debug THEN
          BEGIN
            USTR("BI pending"); WHEX(inbuf_ptr); CRLF;
          END;
        IF block_io THEN
          read_hpib
        ELSE
          BI_pending := TRUE;
      END
    ELSE                                & public hPIb command mnemonics &
      BEGIN
        EOI_found := TBIT (address_status,EOI);
        IF TBIT (address_status, MJHW) THEN
```

```
SPUBIB.WORK.PD8510          THU, DEC 22, 1983, 10:55 AM    PAGE  42

          write_fifo (public_ib_fifo, (hpib_pass_thru OR data_in_reg))
        ELSE
          BEGIN
            IF command_pass_thru THEN
              pass_thru_done;
            write_fifo (public_ib_fifo, data_in_reg);
          END;
        IF EOI_found THEN
          write_fifo (public_ib_fifo, hpib_eoi);
        IF block_io THEN    & process pending signal during block mode &
          IF empty_parser_FIFO OR (inbuf_ptr=block_in_lgth) THEN
            send (block_read_done);
      END;
  GO TO loop;

END hpib_listener;


END$
```

```
MPYTAWLE.UORK.POSSTO          TMU, DEC 22, 1983, 10:55 AM     PAGE  1


COMMENT
GLOBAL INTEGER MPYCP=XFFFFF8D0;
GLOBAL INTEGER MODEP=XFFFFF8DE;
GLOBAL INTEGER BuiltInit1 = XFFFFFS16;          & need to add to source &
GLOBAL INTEGER BuiltInit2 = XFFFFF81C;          & need to add to source &
GLOBAL INTEGER SUBCP=XFFFFFS1E;
GLOBAL INTEGER MPYFP=XFFFFF82E;
GLOBAL INTEGER AODFP=XFFFFFS36;
GLOBAL INTEGER SUBFP=XFFFFF840;
GLOBAL INTEGER MDFR=XFFFFF84A;
COMMENT
GLOBAL INTEGER XXXXX=XFFFFF856;
GLOBAL INTEGER MODFR=XFFFFFS6C;
GLOBAL INTEGER MOSFR=XFFFFF894;
GLOBAL INTEGER XFM2P=XFFFFF8A4;
GLOBAL INTEGER MPLOG=XFFFFF8CS;
GLOBAL INTEGER BINTP=XFFFFF8DO;
GLOBAL INTEGER XFM2Q=XFFFFFSOA;
GLOBAL INTEGER MPYDI=XFFFFF8FA;
GLOBAL INTEGER LLOAO=XFFFFF906;
GLOBAL INTEGER LLOA2=XFFFFF90A;
GLOBAL INTEGER LLOMY=XFFFFF90E;
GLOBAL INTEGER ADEXP=XFFFFF912;
GLOBAL INTEGER MPVLF=XFFFFF914;
GLOBAL INTEGER AODLF=XFFFFF918;
GLOBAL INTEGER JUBLF=XFFFFF91A;
GLOBAL INTEGER BJVFP=XFFFFF91E;
GLOBAL INTEGER MVWRM=XFFFFF922;
GLOBAL INTEGER MDBOG=XFFFFF926;
GLOBAL INTEGER MRLOO=XFFFFF930;
GLOBAL INTEGER MPLNG=XFFFFF942;
GLOBAL INTEGER MSMFT=XFFFFF950;
COMMENT
GLOBAL INTEGER RPVDV=XFFFFF956;
COMMENT
GLOBAL INTEGER RPCPX=XFFFFF95R;
COMMENT
GLOBAL INTEGER MPDVR=XFFFFF962;
COMMENT
GLOBAL INTEGER IFCRL=XFFFFF966;
GLOBAL INTEGER IFCRM=XFFFFF976;
GLOBAL INTEGER BCPDIV = IFCRM + 28;
GLOBAL INTEGER MPVRV=XFFFFF9A4;
GLOBAL INTEGER CPXMR=XFFFFF9BA;
GLOBAL INTEGER MCPMP=XFFFFF9BE;
GLOBAL INTEGER CPIMV=XFFFFF9CC;
GLOBAL INTEGER DAOLF=XFFFFF9EO;
```

```
MQUAD.UORK.PO8510             TMU, DEC 22, 1983, 10:55 AM     PAGE  1


RSMB,R
      MED OUAD
      MBM OUAD,7,"JTB 23.10.81"
*
      ENT MPYA,OIVA,OVRR,MPY9,OIV9
      EN1 ABSA,NEGA,CMPA,CPRA
      ENT MPYAA,MPYAM,MPYAT,BPYAG
      ENT DIVAA,OIVAM,OIVAT,DIVAG
      ENT DVRAA,DVRAM,DVRAT,DVRAG
      ENT CMPAA,CMPAM,CMPAT,CMPAG
      ENT CPRAA,CFRAM,CPRAT,CPRAG
      ENT LDRAA,LDRAM,LDRAT,LDRAG
      ENT CNV5A,CNV4A,CNV3A,CNV2A
      ENT CNVA5,CNVM4,CNVM3,CNVA2
*
      EXT CNV32,CNV23
*
RO    REG 0
R1    REG 1
R2    REG 2
R3    REG 3
R4    REG 4
RS    REG 5
R6    REG 6
R8    REG 8
RS    REG 9
R10   REG 10
R11   REG 11
G     REG 13
M     REG 14
S     REG 15
*
ABSA  TST.L  RO
      BGE    NEGX
NEGA  NEG.L  R1
      NEGX.L RO
NEGX  RTS
*
*
CBPAA BSR    LDRAA    21.6 / 25.75 uS
      BRR    CMPA
CMPAG BSR    LDRAG    21.75 / 26 uS
      BRA    CBPA
CMPAM BSR    LDRAM    21.75 / 26 aS
      BRA    CRPA
CRPAT BSR    LDRAT    22.25 / 27 uS
      BRA    CMPA
CPRAA BSR    LDRAA    23 / 27.25 uS
      BRA    CPRA
CPRAG BSR    (DRAG    23.25 / 27.5 uS
      BRR    CPRA
CPRAM BSR    LDRAM    23.25 / 27.5 aS
      BRA    GPRA
CPRAT BSR    LDRAT    22.5 / 26.75 uS
CPRA  EXG    RO,R2    5.5 / 9.75 aS
```

```
MQUAD.UORK.PO8510             TMU, DEC 22, 1983, 10:55 AM     PAGE  2


      EXG    R1,R3
CMPA  CMP.L  R2,RO    COMPARE MSH 4 / 8.25 uS
      BNE    CMPAO    IN NOI EOUAL THEN DONE
      CMP.L  R3,R1    CHECK LSH
      BEO    CMPAO    DONE IF EQUAL
      BHI    CMPA3    TREAT SECOND COMPARE AS UNSIGNED
      MOVE   H9,CCR   SET CONDITION GODE LESS THAN
CMPAO RTS
CMPA3 MOVE   RO,CCR   SET CONDITION CODE GREATER THAN
      RTS
*
*    LDRAT   = 14.5  uS
*    LDRAR   = 13.75 uS
*    LDRAG   = 14    aS
*    LDRAM   = 14    uS
*
LDRAT MOVEM.L S(S),R2-R3  FETCH OPERAND FROM STACK  14.5 uS
      MOVE.L 4(S),12(S)   FIX UP STACK
      MOVE.L (S),8(S)
      ADDO.L W8,S         DELETE GARBAGE FROM STACK
      RIS
*
LDRAA EXG    R3,R9     SAVE R9;R3=GARBAGE  13.75 uS
      MOVE.L 4(S),R9   GET ADDRESS OF POINTER
      ADD    (R9),R9   ADD INDEX
      MOVEM.L (R9),R2/R9  FETCH OPERAND
      EXG    R3,R9     RESTORE R9
      ADDO.L W2,4(S)   INCREMENT RETURN ADRS
      RIS
*
LDRAG EXG    R3,R9     SAVE R9;R3=GARBAGE  14 uS
      MOVE.L 4(S),R9   GET ADRS OF POINTER
      MOVE   (R9),R9   GET OFFSET FROM G
      MOVEM.L (R9),R2/R9  FETCH OPERAND
      EXG    R3,R9     RESTORE R9
      ADDO.L R2,4(S)   INCREMENT RETURN ADRS
      RTS
*
LDRAM EXG    R3,R9     SAVE R9   14 uS
      MOVE.L 4(S),R9   GET ADRS OF POINTER
      DOVE   (R9).R9   GET OFFSET FROM M
      MOVEM.L O(M,R9),R2/R9  FETCH OPERAND
      EXG    R3,R9     RESTORE R9
      ADDO.L W2,4(S)   INCREMENT RETURN ADRS
      RTS
*
*
MFY9  BOVE.L RO,-(S)
      BPL    MY910     POSITIVE SO SKIP
      NEG.L  R1
      NEGX.L RO
MY910 EOR.L  R2,(S)    SET SIGN OF RESULT
      IST.L  R2
      BPL    MY920     SKIP IF PLUS
      NEG.L  R3
      NEGX.L R2
```

```
MQUAD.UORK.PO8510             TMU, DEC 22, 1583, 10:55 AM     PAGE  3


MY920 CMP.L  R2,RO     SELECT SMALLER OPERAND
      BLI    MY935     FOR RO-R1
      BHE    MY930
      CMP.L  R3,R1     COMPARE 2ND HALF
      BLS    MY935
MY930 EXG    RO,R2
      EXG    R1,R3
MY935 MOVEM.L RO-R3/R8-R10,-(S) PUT OPERANDS ON STACK
*
*  STACK:
*  R10
*  R9
*  RS
*  MULTIPLICAND LSH
*  MULTIPLICAND MSH
*  BULTIPLIER   LSH
*  BULTIPLIER   MSH
*
      LEA    8(S),R8
      MOVE.L S,R9      SET POINTERS FOR MPY
MY945 MOVEQ  #0,R2
      MOVE.L R2,-(S)    CLEFR RRER IN STACK
      MOVE.L R2,-(S)    CLEAR RRER IN STACK
      ROVE.L R2,-(S)    CLEAR RRER IN STACK
      MOVE.L R2,-(S)    FOR RESULT
      MOVE.L S,R10      RESULT POINTER
      MOVED  R3,R3      MAJOR LOOP COUNTER
MY950 MOVED  R3,R2      MINOR LOOP COUNTER
MY951 MOVE   (R9)+,RO  FETCH MULTIPLIER UORD
      BNE    MY952     SKIP IF NOT ZERO
      ADDO.L R2,R10
      DBRA   R3,MY951  TRY NEXT UORD
      BRA    BY954
MY952 MOVE   (RS)+,R1  GET MULTIPLICAND UORD
      BEO    BY953     SKIP IF ZERO
      AULU   RO,R1
      ROD.L  R1,(R10)  ROD TO PARTIAL PRODUCT
      BCC    MY953
      RDDQ.L R1,-4(R10)
      BCC    MY953
      ADDO.L W1,-8(R1D)
      BCC    MY953
      RDDO.L R1,-12(R10)
MY953 AOOD.L W2,R10     INCREMENI POINTER
      DBRA   R2,MY952  LOOP TO NEXT UORD
      SUBO.( AS,RS     RESET POINTER
      LER    -5(R10),R10 RESET
      DBRA   R3,MY950  LOOP UNTIL ALL UORDS DONE
MY954 MOVEM.L (S)+,RO-R3  FETCH RESULT
      LEA    16(S),S   DELETE OPERANDS
      MOVEM.L (S)+,R8-R10 RESTORE REGISTERS
      TST.L  (S)+
      BPL    MY955     CHECK SIGN FOR RESULT
      NEG.L  R3
      NEGX.L R2
      NEGX.L R1
```

```
MQUAD.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE  4

      NEGX.L R0
MY955 RTS
*
*
*     64 / 64  BINARY DIVIDE
*
DIV9  CLR    -(S)
      TST.L  R0
      BPL    DIV91
      NEG.L  R1
      NEGX.L R0
      NOT    (S)
DIV91 TST.L  R2
      BPL    DIV92
      NEG.L  R3
      NEGX.L R2
      NOT.B  (S)
DIV92 MOVEM.L R0-R6/R8,-(S)  PUT OPERANDS ON STACK
      CLR.L  -(S)
      CLR.L  -(S)      ZERO MSW OF DIVIDEND
*
DIV93 MOVE.L S,R8         INITIALIZE POINTER
      MOVEQ  #15,T4
DV950 MOVE.B (R8)+,R0
      DBNE   R4,DV950
      LSL    #3,R4       NPY BY 8
      BMI    ZERORESULT
DV952 RDDQ   #1,R4
      LBR.B  #1,R0       MOV FIRO THE BIT
      BNE    DV952       R4=# BITS IN DIVIDEND/RETHAINDER
      LEA    16(S),R8
      MOVEQ  #7,R5
DV954 MOVE.B (R8)+,R0     FIND NON-ZERO BYTE
      BNNE   R5,DV954
      LSL    #3,R5       NPY BY 8
      BMI    DIVBY2ERO
DV955 RDDQ   #1,R5
      LSR.B  #1,R0       MOV FIND BIT
      BNE    DV965       R5=# BITS IN DIVISOR
      MOVE   R4,R6       NAW CORPUTE # BITS FOR QUOTIENT
      SUB    R5,R6       R6=# BITS IN QUOT-1
      BMI    ZERORESULT
      CMP    #D64,R6     CHECK FOR OVERFLOW
      BGE    DIVBYZERO     BAIL OUT IF OVERFLOW
      CMP    #D16,R5
      BLS    DIV16       CRN DO UITH 16 BIT DIVIDES
      CMP    #D31,R5
      BLS    DIV32       CRN DO UITH 32 BIT DIVIDES
DIV64 RDD    B64,R5    REQUIRES R 64 BIT DIVIDE
      SUB    R4,R5       CORPUTE # BITS TO PRESHIFT REMAINDER
      MOVEQ  #7,R3
      RND    R5,R3
      RDD    #3,R6       ROD 0-7 TO # BITS TO GENERATE
      LSR    #4,R5       SHIFT BIT 3 INTO CARRY
      MOVEM.L (S)+,R0-R3 GET DIVIDEND
      BCC    DV64A
```

```
MQUAD.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE  5

      ROL.L  #8,R0
      ROL.L  #8,R1
      ROL.L  #5,R2
      ROL.L  #8,R3
      MOVE.B R1,R0
      MOVE.B R2,R1
      MOVE.B R3.R2
      CLR.B  R3
      BRR    DV64A
DV64B SURP   R0
      SURP   R1
      SURP   R2
      SURP   R3
      MOVE   R1,R0
      MOVE   R2,R1
      MOVE   R3,R2
      CLR    R3
DV64A DBRR   R5,DV64B
      MOVEM.L (3)+,R4-R5  GET DIVISOR
      BRA    DV642
DV640 LSL.L  #1,R3       SHIFT REMAINDER/QUOT 1 BIT
      ROXL.L #1,R2
      ROXL.L #1,R1
      ROXL.L R1,R0
DV642 CMP.L  R4,R0       CHECK FOR LOGICAL LESS THAN
      BACC   R5,DV640    LOOP UNTIL HIGH OR EQUAL
      BHI    DV643       HIGH SO GO DO IT
      BOS    DV645       SKIP IF LOOP COUNT EXHAUSTED
      CMP.L  R5,R1       CHECK LOU REG IF =
      BBCC   R6,DV640    LOOP BACK IF LOU
      BCS    DV645       SKIP IF LOOP EXIT
DV643 SUB.L  R5,R1       SUBTRACT DIVISOR FROM REMAINDER
      SUBX.L R4,R0
      WDDQ   #1,R3       INSERT QUOTIENT BIT
      DBRA   R6,DV640
DV645 EXG    R0,R2
      EXG    R1,R3       R0 = QUOTIENT
DV646 MOVEM.L (S)+,R4-R6/R5  RESTORE REGISTERS
      TSI.B  1(S)        CHECK REMAINDER SIGN
      BPL    DV647
      NEG.L  R3
      NEGX.L R2
DV647 IST    (S)+        GET SIGN OF RESULT
      BPL    DV64B       RESULT SIGN
      NEG.L  R1
      NEGX.L R0
DV64B RTS
*
DIV16 MOVE   22(S),R2    16 BIT DIVISOR
      MOVEQ  #0,R3
      MOVEQ  #7,R1
      MOVE.L S,R8
DV1G0 MOVE   (R8)+,R3    TRY R UORD
      OBNE   R1,DV160    LOOP UNTIL NON-ZERO
      CMP    R2,R3       SEE IF LESS THAN DIVISOR
      BHI    DV166       GO DO DIVIDE
```

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MQUAD.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE  6

      BNE    DV161       SKIP IF LOGICAL LESS
      MOVEQ  #1,R3
      BRA    DV167
DV151 SURP   R3
      BRR    DV167
DV165 MOVE   (R8)+,R3
DV166 DIVU   R2,R3
DV167 MOVE   R3,-2(RS)
      DBRR   R1,DV165   LOOP UNTIL DONE
      CLR    R3
      SNAP   R3
      MOVEQ  #0,R2      REMAINDER COMPLETE
DV160 ADDQ.L #S,S        DELETE MSW OF REMAINDER
      MOVEM.L (S)+,R0-R1  GET RESULT
      RDDQ.L #S,S       DELETE DIVISOR
      BRA    DV646      GO DO SIGN STUFF
*
DIV32 MOVE.L S,R5
      MOVEQ  R3,R6
      MOVEQ  #0,R2
DV320 MOVE.L (R8)+,R0   GET FIRST DOUBLE UORD OF REMRIMDER
      DBNE   R6,CV320
      CMP.L  20(S),R0
      BHI    DV326      GO DO DIVIDE IF > DIVISOR
      BNE    DV321
      MOVEQ  R1,R0
      MOVEQ  #0,R1
      BRR    DV327
DV321 MOVE.L R0,R1       MOVE DIVIDEND TO REMAINDER
      MOVEQ  #0,R0      CLEAR QUOTIENT
      BRA    DV327      GO TRY NEXT DOUBLE WORD
DV325 MOVE.L (R5)+,R0   FETCH NEXT OPERAND
DV326 ROVED  R32,R3     BIT COUNTER FOR DIV3L
      MOVE.L 20(S),R1   GET DIVISOR
      PEA    DV327      PUSH RETURN ROORESS
      MOVEM.L R2-R3,-(S) SAVE REGISTERS FOR DIV3L
      CLR    -(S)       SIGN OF RESULT FOR DIV3L
      JMPX   DIV3L
DV327 MOVE.L R0,-4(R8)   SIORE QUOTIENT PORTION
      MOVE.L R1,R2      POSITION REMRIMDER FOR NEXT DIVIDE
      DBRR   R6,OV325   GO DO NEXT DOUBLE WORD
      MOVEQ  #0,R3
      EXG    R2,R3      REMAINDER NOU SET UP
      BRA    DV16S      GO GET RESULT AND FIXUP SIGNS
*
*  STACK:
*  SIGN RESULT,SIGN REMAINDER   (ONE BYTE EACH)
*  R8
*  RE
*  R5
*  R4
*  DIVISOR LSW
*  DIVISOR MSW
*  QUOTIENT LSW
*  QUOTIENT MSW
*  REMRIMDER LSW
```

```
MXMAD.WORK.PDS510          THU, DEC 22, 1983, 10:55 PM    PAGE  7

*  REMAINDER MSW
*
*
DIV5YZERO  MOVE.L =H19999999.R0
      MOVE.L WINES,R1
      BRA    ZERDR
WINES HEX 9999,9999
*
ZERORESULT  MOVEQ #0,R0
      MOVEQ  #0,R1
ZERDR ADDQ.L #8.S          DELETE MSW REMAINDER
      MOVEM.L (S)+,R2-R3   GET REMAINDER
      RDDQ.L #8,S          DELETE DIVISOR
      BRA    DV646
*
*
MPYAA ISR    LDRAA
      BRR    MPYA           NOTE COULD CHANGE BRA TO JMP'S
MPYAG JSR    LDRAG
      BRR    MPYA
MPYAM JSR    LBRAM
      BRA    MPYA
MPYAT JSR    LDRRT
MPYA  JSR    MPY9             128 BIT RESULT
      MOVE.L R2,R0            64 BIT RESULT IS IN R2/R3
      MOVE.L R3,R1
      BTS
*
DIVAA JSR    LDRAA
      BRA    DIVA
DIVAG JSR    LDRAG
      BRR    DIVA
DIVAM JSR    LDRAM
      BRA    DIVA
DIVAT JSR    LDRRT
DIVA  JMP    DIV9
*
DVRRR JSR    LDRAA
      BRA    DVRA
DVRRG JSR    LDRAG
      BRR    DVRA
DVRRM JSR    LDRAM
      BRA    DVRA
DVRRT JSR    LDRRT
*
DVRA  EXG    R2,R0
      EXG    R3,R1
      JMP    DIV9
*
*
*
*
CMV5A EXTS   R0
CMV4A EXTS.L R0
CMV3A TST.L  R0
      BHI    R1
```

```
RQURD.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE  8


      EXTS   R1
      EXTS.L R1
*
CNVRS:CNVR4:CNVR3   EXG R0,R1
      RTS
*
*
*
CNV2A TST.B  R0         ZERO?
      BLT    UNFLW
      CMP.B  #D54,R0    TOO LARGE ?
      BGE    OVFLW
      MOVE.W R2,-(S)     OPERATING SPACE
      CLR.W  R2          need word for DBRR Loop
      CMP.B  #032,R0     TOO BIG FOR R DOUBLE ?
      BLT    CONV        NO
      MOVE.B R0,R2       YES -- COPY EXP always positive no EXTS needed
      MOVE.B #031,R0     NOW BIG TOO BIG
      SUB.B  R0,R2       Result is always 1 to 32 -- R2 will be a word
CONV  JSR    CNV23
      JSR    CNV3A
      TST.W  R2          WAS DOUBLE OK
      BLE    CEXIT       YES
      SUB.W  R1,R2
CLOOP LSL.L  #1,R1       NO --TWO REG SHIFT -- SLOW
      ROXL.L #1,R0
      DBRR   R2,CLOOP
CEXIT MOVE.W (S)+,R2      RESTORE REG
      RTS
*
UNFLW CLR.L  R0
      CLR.L  R1
      RTS
OVFLW TST.L  R0
      BLT    OVFLWNEG
      MOVE.L #H7FFFFFFF,R0
      MOVE.L #0-1,R1
      RTS
OVFLWREG MOVE.L#H80000000,R0
      CLR.L R1
      RTS
*
*
*
CNVR2 MOVE   R2,-(S)     NEED TEMP STORAGE
      CLR    R2          EXP NORMALIZING COUNTER
NRMR2 TST.L  R1          NORMALIZE TOP BIT OF R1 = ALL BITS OF R0  SLOW!!
      BMI    NRMNG
      TST.L  R0
      BEQ    NRMFI       R0 ALL ZERO RND R1 SIGN POSTIVE
      BRR    NRMLP
NRMNG CMP.L  #0-1,R0
      BEQ    NRMFI       R0 ALL ONES RND R1 SIGN NEGATIVE
NRMLP ROD    #1,R2       INC SHIFT COUNT
      ASR.L  #1,R0       TWO REG ARITHMITIC SHIFT
      ROXR.L #1,R1
```

```
RQURD.WORK.PDS510          THU, DEC 22, 1983, 10:55 AM    PAGE  9


      BRR    NRMR2
*
NRMFI MOVE.L R1,R0
      JSR    CNV32
      ROD.B  R2,R0     DENORMALIZE RESULT
      MOVE   (S)+,R2
      RTS
      END
```

```
CRECALL.WORK.PDS510        THU, DEC 22, 1983, 10:55 AM    PAGE  1

%INTEGER CONSTANT
      power_on_recall := 0,
      test_recall     := 1,
      preset_recall   := 2,
      normal_recall   := 3;
```

```
FRECALL.WORK.PDS510        THU, DEC 22, 1983, 10:55 AM    PAGE  1

%FILE crecall.work;

EXTERNAL INTEGER recall_type;

PROCEDURE  do_recall;                                  EXTERNAL;
```

```
SRECALL.WORK.FOB810          1HU, BEC 22, 1983, 10:55 NN    PAGE  1


%BBEL,P,"recall"
BEDIN

@FILE erecall.work;                                  & for recoil types &
@FILE cchtable.work;                                      & For th_... &
&FILE cmesaag2.work;                                 & for all_meaaagca &
@FILE cyadc.work;                                      & for test_port &
@FILE fannot.work;
&FILE fbreak.work;                                  & for coupled_break &
@FILE fehdeta.work;                                & for number_of_groups &
@FILE fchdata2.work;
@FILE fchtab3.work;
@FILE fchtable.work;
@FILE fcontvar.work;
@FILE cdiaploy.work;
@FILE fdioplay.work;
@FILE fgratic.work;
@FILE fifgain.work;
&FILE finit.work;
@FILE fpfr.work;                          & for recall_pfr and configure &
@FILE fpubib.work;
@FILE facrecnD.work;                      & for blank_ and enable_dioplay &
@FILE foereen1.work;                                  & for title_array &
@FILE ftitle.work;                                    & for write_title &
@FILE faire.work;
@FILE fstimali.work;
@FILE ftrace.work;
@FILE futil2.work;                                & for partial_set_domain &
@FILE fdowain.work;                              & for init_coupled_status &
@FILE fcoupie.work;                                    & for reset_memory &
@FILE fuemmgr.HorH;                                     & correction_off &
@FILE fcal0.work;                                  & for major and minor &
@FILE eprivih.Hork;                                & for get_priv_ib_lun &
@FILE fprivib2.work;                               & for preset_test_set &
@FILE fteateet.uerk;                             & for select_active_function &
@FILE factive.work;

INTEGER CONSTANT  single_ch := 2;            & duplicated from tsatsp &

PROCEDURE  annotate_format;                                    EXTERNAL;

SLOBRL INTEGER recall_typt;
```

```
SRECRLL.WORK.PD8510          THU, BEC 22, 1583, 10:55 RM    PAGE  2


&EJECT;
COMMENT                                                          ch_recall
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@
*   That portion of do_recall that is similar for both channels.
*
*************************************************************************
;
PROCEDURE  ch_recall;
   BEGIh & ch_recall &
      DOUBLE trace_base,
             trace_n_base;
      DURD   temp_quad;

      temp_quad := entry_ch_quad( ch_gate_center );
      temp_quad := temp_ipwd *
                   temp_quad -
                   entry_ch_quad(ch_gate_start);
      set_entry_ch_quad( temp_quad, ch_gate_step );

      partial_set_domain;

      update_start_stop_center_span;
      init_ch_stimuli;
      carrection_off;

      init_group_control_vars;  & Do it this nou.   Repeated thereafter&
                                &    before each group begins.          &
      reeall_pfr;
      annotate_ref_value;
      annotate_ref_position;
      annotate_acalc;
      anvotate_garameter;
      annotate_format;
      init_trace;                  & includes annotate_nath_and_menory &

   END;  & ch_recall &
```

```
SRECALL.WORK.PDS510          THU, BEC 22, 1953, 10:55 RM    PAGE  3


&EJECT;
COMMENT                                                          do_rtcall
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
*
* BE CAREFUL OF THE ORDER IN UHICH OPERATIONS ARE PERFORMED !!!
*
*************************************************************************
;
PROCEDURE  do_recall;                                            ENTRY;
   BEGIN & do_recall &
      INTEGER tenp_nunber_of_groups,
              i;
      DURD    half_span;

      blank_display;

      tenp_number_of_groups := number_of_groups;
      number_of_groups := 0;
      init_coupled_status;
      preset_test_set;       & should be befort preset_source (uhy?) &
      IF recall_type <> normal_recall THEN
         preset_soures;

      reset_acquisition_descriptor;
      rtest_nenory;        & release all data arrays for re-allocation &

      configure;
      init_break;
      partial_seltct_entry_ch( 1 );
      init_correction;     & needs current_entry_ch to be initialized &
      init_etde;
      init_stinuli;        & sets step_size and indirectly calls build &


      & CHANNEL-INDEPENDENT PARAMETERS S.

      & these are stored, but must be overridden except for power on &

      set_major_address( get_priv_ib_lun(major) );
      set_minor_address( get_priv_ib_lun(minor) );

      srq_mask_grinery := 0;
      srq_mask_secondary := 0;
      request_nask( LEFT(srq_nash_prinary,S) OR
                    (srq_nask_secondary AND %DDfF)
                  );

      neu_if_sain_port( test_port );       & also highlights soft keys &


      & CHANNEL 1 DEPENDENT PARAMETERS &

      ch_recall;


      & CHANNEL 2 DEPENDENT PARAMETERS &
```

```
SRECALL.UORK.PD8510          THU, BEC 22, 1953, 10:55 RM    PAGE  4


      partial_select_entry_ch( 2 );    & must be different than below &
      ch_recall;


      & GENERAL INITIALIZATION &

      select_entry_ch( 1 );    & different than above -- forces update &
      IF trace_node <> single_ch THEN
         trace_and_graticule;
&     ELSE
         select_entry_ch already did it.
&
      init_output;
      init_narkers;

      & Compute ch_gate_stop -- used for gate narker display purposes. &
      half_span := entry_ch_quad(ch_gate_center) -
                   entry_ch_quad(ch_gate_start);
      set_entry_ch_quad( entry_ch_quad(ch_gate_start) +
                         half_span +
                         half_span,
                       ch_gate_stop
                     );

      MOVE title_array := title_line, +( 1 + title_line[-1] );
      write_title;
      clear_nessagc( all_messages );              & clear message line &
      select_active_function( IF ( (recall_type = normal_recall) OR
                                   (recall_type = preset_rtcall)
                                 ) THEN
                                 active_off
                              ELSE
                                 activt_revision
                            );
      enable_display;
      number_of_groups := tenp_number_af_groups;

   END;  & do_recall &

END&
```

851

```
FRECRLi2.WORK.PD8510          THU, DEC 22, 1983, 10:56 Rh     PAGE  1

%PROCEDURE  ch_recall;                                  EXTERNAL.L;
```

852

```
CRESP.WORK.PD8510             THU, DEC 22, 1983, 10:56 RM     PAGE  1

INTEGER CONSTANT

cnd_elect_delay := 44,
cnd_auto_delay := 45,
cnd_phase_offset := 46,
cnd_if_avg_on := 48,
cnd_if_avg_off := 49,
end_enoothing_on := 50,
cnd_onoothing_off := 51,
cnd_if_test_port := 52,
cnd_if_ref_port := 53,
cnd_if_no_gain := 54,
cnd_if_12db_gain := 65,
end_if_24db_gain := 56,
cnd_if_36db_gain := 57,
end_if_48db_gain := 58,
end_if_gain_auto := 59,
end_group3 := 0;
```

```
FRESP.WORK.PD8510             THU, DEC 22, 1983, 10:56 Rh     PAGE  1

COMMENT
  This is a software generated file !!!
  Changes must be made in SKINFO.WORK
  Run GENSK.LANI to re-generate file;

SUBROUTINE proc3;  ENTRY;
BEGIN

CASE command_token-44 OF
BEGIN
& 44 &
select_active_function( active_electrical_length );
& 45 &
warn( command_not_implemented );
& 46 &
oelect_active_function( active_phase_offset );
& 47 &
warn( command_not_implemented );
& select_active_function( active_magnitude_offset ); &
& 48 &
if_average_on;
& 49 &
if_average_off;
& 50 &
display_enoothing_on;
& 51 &
display_enoothing_off;
& 52 &
new_if_gain_port( test_port );
& 53 &
new_if_gain_port( ref_port );
& 54 &
new_if_gain( if_no_gain );
& 55 &
@ew_if_gain( if_12do_gain );
& 56 &
new_if_gain( if_24db_gain );
& 57 &
new_if_gain( if_36db_gain );
& 58 &
oew_if_gain( if_48db_gain );
& 59 &
new_if_gain( auto_range );
END;
END proc3;
```

```
SRESPONS.WORK.PD8510          THU, DEC 22, 1983, 10:56 Rh     PAGE  1

n68KL,P,"reaponae"
BEGIN

NFILE fconnand.work;        & command_token &
NFILE factive.work;
NFILE creep.work;
NFILE futil.work;
NFILE fmenu.work;
NFILE cyadc.work;
NFILE fifgain.work;
NFILE faverage.work;

GLOBAL                                          & used by IFGAIN      &
BYTE TABLE cnd_if_goin :=  cnd_if_gain_auto,    & nap if gain to end_ &
                           cnd_if_no_gain,      &   dec creep and     &
                           cnd_if_12db_gain,    &       cyadc.        &
                           end_if_24db_gain,
                           cnd_if_36db_gain,
                           cnd_if_43db_gain;
GLOBAL                                          & used by IFGAIN      &
BYTE TABLE cnd_if_port :=  cnd_if_test_port,    & nap port to cnd_    &
                           end_if_ref_port;     &   see creep and     &
                                                &       cyadc.        &

%FILE freap.work;

END$
```

```
SRETRACE.WORK.PDBS10          THU, DEC 22, 1983, 10:58 AM     PAGE  1


BE8KL,P,"retract"
BEGIN

&FILE crins.work;
&FILE fkernel.work;
&FILE fkernel4.work;



SUBROUTINE init_retrace;                                        ENTRY;
   BEGIN & init_retrace &

      signal_init(enable_group_ready, 0);
      signal_init(group_ready, 0);

   END;  & init_retrace &



PROCEDURE retract;      & a process &                           ENTRY;
   BEGIN & retrace &

loop:
      wait(enable_group_ready);      & 'central' is ready to begin    &
                                     &    the next group.             &
COMMENT ...rau_ready signals art not initialized the first past thru.
      UNILE pending(ch1_rau_ready) OR pending(ch2_rau_ready) DO
         preempt;                    & Wait until all data is displayed&
      send(group_ready);             & This will not be               &
                                     &    done until all data         &
                                     &    processing (higher priority) &
                                     &    is complete.                &
COMMENT this it time depenedent on yadc processing the data quickly.  We
      should perfarn retrace synchronizatien some other way.
      ;
      GO TO loop;

   END;  & retrace &

END$
```



```
CRINS.UORK.PDBS10             THU, DEC 22, 1983, 10:58 AM     PAGE  1

COMMENT                          resource identification numbers (rin)
R resource number is used as a semaphore to limit accest to a reecurce
to only one process at a time.  A resource is acquired by calling
acquire(rin) and released by calling release(rin).  The numerical
order of resource numbers is not significant.  Resource members are also
used as signals for communicating between modules.  Resource numbers may
also be used for coordination of producer-consumer situations, including
handling limited buffer sizes.

All resource numbers must be initialized.
  Initialize shared resources by calling    resource_init(rin)
  Initialize signals by calling             signal_init(rin,0)
  Initialize the "... _not_full" signal
       by calling                           signal_init(rin,buffersize)
  Initialize the "... _not_empty" signal
       by calling                           signal_init(rin,0)

                  measures                                  using
                --- name ---                              --- module ---
                minimum value       := %10
;
INTEGER CONSTANT min_rin            := %10,         % kernel     %
                token_buffer        := %10,         & command    &
                token_buffer_not_full := %11,       & command    &
                take_buffer_not_empty := %12,       & consumd    &
                control_variables   := %13,         & control    &
                acquisition_variables := %14,       & takound    &
                processing_variables := %15,        & command end &
                                                    &  processing %
                delay_timer_resource := %16,        & kernel     %
                priv_ib_resource    := %17,         &  priv_ib   &
                priv_ib_signal      := %18,         &  priv_ib   &
                swp_brk_fifo        := %19,         & sweep_break &
                swp_brk_fifo_not_full := %1A,       & sweep_break &
                swp_brk_fifo_not_empty := %1B,      & sweep_break &
                pause_list          := %1C,         & kernel     &
                ch1_rau_ready       := %1D,         & contvar    %
                ch2_rau_ready       := %1E,         & contvar    &
                rau_ready_bit_bucket := %1F,        & contvar    &
                enablt_group_ready  := %20,         & retrace and &
                                                    &    control  &
                group_ready         := %21,         & retrace and &
                                                    &    control  &
                keybd_fifo          := %22,         & botkbd and  &
                                                    &    topkbd   &
                keybd_fifo_not_full := %23,         & botkbd and  &
                                                    &    topkbd   %
                keybd_fifo_not_empty := %24,        & botkbd and  &
                                                    &    topkbd   &
                hpib_cmd_ready      := %25,         & pub HPIB endS
                pub_ib_fifo         := %2E,         & hpibend and &
                                                    &    pubib    %
                pub_ib_fifo_not_full := %27,        & hpibcmd end &
                                                    &    pubib    &
                pub_ib_fifo_not_empty := %28,       & hpibend and &
```

```
CRINS.UORK.PDBS10             THU, DEC 22, 1983, 10:56 AM     PAGE  2

                                                    &    pubib    &
                active_function_rin := %29,         d active     &
                entry_string_rtady  := %2A,         &parser,output&
                                                    &topkbd,active&
                block_read_done     := %2B,         & HPIB blk rd.&
                entry_tring         := %2C,         &parter,topkbd&
                                                    &  and active &
                block_write_donc    := %2D,
                hpib_byte_out       := %2E,         & pubib 80 int&
                aborted             := %2F,         & control and &
                                                    &    break.  &
                dvc_done            := %30,         & device clear&
                group_ready_rin     := %31,
                pubib_output        := %32,
                memory_trc          := %33,         & memory alloc&
                trace_MARKs         := %34,         & marker     &
                continue_signal     := %35,
                array_fifo          := %36,         & array      &
                array_fifo_not_full := %37,         & array      &
                array_fifo_not_empty := %3S,        & array      &
                take_sweep_done     := %39,         & active and &
                                                    &    control &
                test_set_ready      := %3A,         & privib and &
                                                    &    teattet &

                max_rin             := %3B;         & kernel     &
COMMENT
                    IMPORTANT !!!

  ---------- UPDATE max_rin above when adding a new rin ! ------------
  ---------- and recompile 'kernel' to allocate new array ------------
  ---------- sizes.                                       ------------
;
```

```
SRPG.UORK.PDSS10              THU, DEC 22, 1983, 10:56 AM     PAGE  1


M68KL,P,"rpg"
BEGIN

MFILE cids.work;
&FILE fiocnfig.work;
@FILE fkernel2.work;
&FILE fkernel3.work;
@FILE fintrpt.work;
&FILE crins.work;
@FILE ffifo.work;
@FILE ffifos.work;
&FILE fpubib.work;

   INTEGER rpg_dat = ie + %C0;

   BYTE CONSTANT rpg_tin_msb := %70,    & timer#1=msb0, binary,      &
                                        &   load lsb first           &
                 rpg_tin_lsb := %10,    & lsb = fraction ( 10000/256 ) &
                 rpg_tin_nsb := %27;    & msb =      msb ( 10000/256 ) &
   BYTE CONSTANT zero := 0;

   BYTE rpg_clr = io + 289,
        rpg_tin = io + 263,
        tin_cnd = io + %67;


   SUBROUTINE reset_rpg;                                        ENTRY;
      BEGIN
         & %253 does not allow timer loading to be interrupted per    &
         & Intel Information Sheet 1-2-79 "How the S253 Really Works". &
         RSSEMBLE( MOVE SR,    -(S) );          & Push status word   &
         RSSEMBLE( ORI  #N0700, SR  );        & Disable interrupts &

         rpg_clr := zero;
         tin_cnd := rpg_tin_msb;
         rpg_tin := rpg_tin_lsb;
         rpg_tin := rpg_tin_nsb;

         RSSEMBLE( MOVE (S)+,   SR   );          & Restore status word&
      END reset_rpg;



   PROCEDURE rpg;       & a process &                           ENTRY;
   BEGIN

         reset_rpg;
         iradr( ADRS(intrpt_rpg), rpg_vctr );

loop:    waitio(rpg_vctr);
         IF NOT remote THEN
            write_fifo( token_fifo, (-rpg_dat) OR %FF00 );
               & "-rpg_dat" because RPG is wired reverse of RPO counter &
         reset_rpg;
```

```
SRPG.WORK.PD8510          THU, DEC 22, 1983, 10:56 AM    PAGE  2

        GO TO loop;

    END rpg;

EIRS
```

```
CSCREEN.WORK.PD8510       THU, DEC 22, 1983, 10:56 AM    PAGE  1

@FILE cscreen2.work;          & soft-key and menu character constants &

INTEGER CONSTANT
    longest_function_label := 26,
    words_per_ch   := 28,                       & see character set    &
                                                & statistics, 6 Oct 83 &
    ch1_annot_col  := 3,                           & screen positions &
    ch2_annot_col  := 28,
    title_row      := 5,
    title_col      := ch1_annot_col,
    error_row      := 6,
    error_col      := 4,
    function_row   := 8,
    function_col   := 4,
    entry_row      := 9,
    entry_poi      := 6,
    entry_aux_row  := 10,
    entry_aux_col  := ch1_annot_col,
    xgrat          := 128,                                & for graticule &
    ygrat          := 384,                                & for graticule &
    max_grat       := 3200,                               & for graticule &
    enhancement_pol:= 1,
    dirty_row      := 6,
    correction_row := 7,
    averaging_row  := 8,
    smoothing_row  := 5,
    gating_row     := 10,
    math_row       := 11,
    delay_row      := 12,
    external_row   := 13,
    offset_row     := 14,
    sk_x           := 3424,                    & soft key coordinates &
    sk11_y         := 3966,
    sk12_y         := 3838,
    sk21_y         := 3418,
    sk22_y         := 3290,
    sk31_y         := 2870,
    sk32_y         := 2742,
    sk41_y         := 2322,
    sk42_y         := 2194,
    sk51_y         := 1774,
    sk52_y         := 1646,
    sk61_y         := 1226,
    sk62_y         := 1098,
    sk71_y         := 678,
    sk72_y         := 550,
    sk81_y         := 130,
    sk82_y         := 2,
    trace1_x       := xgrat,
    trace1_y       := ygrat + max_grat/2,
    trace1n_x      := xgrat,
    trace1n_y      := ygrat + max_grat/2,
    trace2_x       := xgrat,
    trace2_y       := ygrat + max_grat/2,
    trace2n_x      := xgrat,
```

```
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    trace2n_y      := ygrat + max_grat/2,
    param_row      := 1,
    param1_col     := ch1_annot_col,
    param2_col     := ch2_annot_col,
    format1_col    := ch1_annot_col + 11,
    format2_col    := ch2_annot_col + 11,
    ref_row        := 2,
    ref1_col       := ch1_annot_col,
    ref2_col       := ch2_annot_col,
    scale_row      := 3,
    scale1_col     := ref1_col + 4,
    scale2_col     := ref2_col + 4,
    mkr_row        := 4,
    mkr1_col       := ch1_annot_col,
    mkr1_real_col  := mkr1_col + 2,
    mkr1_imag_col  := mkr1_col + 13,
    mkr2_col       := ch2_annot_col,
    mkr2_real_col  := mkr2_col + 2,
    mkr2_imag_col  := mkr2_col + 13,
    mkr_stin_row   := 30,
    mkr1_stin_col  := ch1_annot_col,
    mkr2_ctin_col  := ch2_annot_col,
    start_row      := 31,
    start_col      := (ch1_annot_col+ch2_annot_col)/2,
    start1_col     := ch1_annot_col,
    start2_col     := ch2_annot_col,
    stop_row       := 32,
    stop_col       := start_col,
    stop1_col      := start1_col,
    stop2_col      := start2_col,


& display block allocations. &

    start_display := 0,
    start_size    := 10,                        & fixed by "init_screen" &

& error &
    error_position := start_display + start_size,
    error_display  := error_position + 4,
    error_size     := 48,

& title &
    title_position := error_display + error_size,
    title_display  := title_position + 4,
    title_size     := 50,                              & change also schdata &

& blank screen &
    blank_screen       := title_display + title_size,

& function &
    function_position := blank_screen + 1,
    function_display  := function_position + 4,
    function_itring_size := longest_function_label,
    function_size     := function_string_size *
```

```
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    words_per_ch,

& text (overlays function) &
    text_position      := function_position,
    text_display       := function_display,
    text_size          := function_size,

& entry &
    entry_position     := function_display + function_size,
    entry_display      := entry_position + 4,
    entry_string_size  := 20,
    entry_size         := entry_string_size * words_per_ch,
    entry2_position    := entry_display + entry_size,
    entry2_display     := entry2_position + 4,

& entry_aux &
    entry_aux_position := entry2_display + entry_size,
    entry_aux_display  := entry_aux_position + 4,
    entry_aux_size     := title_size + 4,      & title is longest use.   &
                                               & 4 extra for title arrow &
& enhancement annotation &
    dirty_position     := entry_aux_display + entry_aux_size,
    dirty_display      := dirty_position + 4,
    enhancement_size   := 1,
    gating_position    := dirty_display + enhancement_size,
    gating_display     := gating_position + 2,
    correction_position := gating_display + enhancement_size,
    correction_display := correction_position + 2,
    averaging_position := correction_display + enhancement_size,
    averaging_display  := averaging_position + 2,
    smoothing_position := averaging_display + enhancement_size,
    smoothing_display  := smoothing_position + 2,
    delay_position     := smoothing_display + enhancement_size,
    delay_display      := delay_position + 2,
    math_position      := delay_display + enhancement_size,
    math_display       := math_position + 2,
    external_position  := math_display + enhancement_size,
    external_display   := external_position + 2,
    offset_position    := external_display + enhancement_size,
    offset_display     := offset_position + 2,

& sk11 &
    sk11_position := offset_display + enhancement_size,
    sk11_display  := sk11_position + 6,
    sk1_size      := 11,                & sk2_size + 1 for sk_packet_n &
& sk12 &
    sk12_position := sk11_display + sk1_size,
    sk12_display  := sk12_position + 4,
    sk2_size      := 10,                          & must be even # bytes &
& sk21 &
    sk21_position := sk12_display + sk2_size,
    sk21_display  := sk21_position + 6,
& sk22 &
    sk22_position := sk21_display + sk1_size,
    sk22_display  := sk22_position + 4,
& sk31 &
```

```
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    sk31_position := sk22_display + sk2_size,
    sk31_display  := sk31_position + 8,
& sk32 &
    sk32_position := sk31_display + sk1_size,
    sk32_display  := sk32_position + &,
& sk41 &
    sk41_position := sk32_display + sk2_size,
    sk41_display  := sk41_position + 6,
& sk42 &
    sk42_position := sk41_display + sk1_size,
    sk42_display  := sk42_position + 4,
& sk51 &
    sk51_position := sk42_display + sk2_size,
    sk51_display  := sk51_position + 6,
& sk52 &
    sk52_position := sk51_display + sk1_size,
    sk52_display  := sk52_position + 4,
& sk61 &
    sk61_position := sk52_display + sk2_size,
    sk61_display  := sk61_position + 6,
& sk62 &
    sk62_position := sk61_display + sk1_size,
    sk62_display  := sk62_position + 4,
& sk71 &
    sk71_position := sk62_display + sk2_size,
    sk71_display  := sk71_position + 6,
& sk72 &
    sk72_position := sk71_display + sk1_size,
    sk72_display  := sk72_position + 4,
& sk81 &
    sk51_position := sk72_display + sk2_size,
    sk51_display  := sk81_position + 6,
& sk82 &
    sk82_position := sk81_display + sk1_size,
    sk82_display  := sk82_position + 4,
& sk_highlight &
    sk_hilight_off := sk82_display + sk2_size,

    sk_highlight_position := sk_hilight_off + 1,
    sk_highlight_display  := sk_highlight_position + 4,
    sk_highlight_size     := 30,

& hop skip and jump &
    jump_all := sk_highlight_display + sk_highlight_size,

& CHANNEL 1 &
    channel1_position := jump_all + 1,

& jump over channel 1 &
    jump_channel1 := channel1_position,

& trace update mark &
    update_mark1_position := jump_channel1 + 1,
    update_mark1_display  := update_mark1_position + 4,
    update_mark_size      := 6,
```

```
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& traces &
    trace1_position := update_mark1_display + update_mark_size,
    trace1_display  := trace1_position + 4,
    trace_size      := &10,

& trace id mark &
    trace_mark1_position := trace1_display + trace_size,
    trace_mark1_display  := trace_mark1_position + 4,
    trace_mark_size      := 9,

& end trace 1 &
    end_trace1 := trace_mark1_display + trace_mark_size,

& memory trace &
    trace1n_position := end_trace1,
    trace1n_display  := trace1n_position + 4,

& marker 1 &
    mkr11_position := trace1n_display + trace_size,
    mkr11_display  := mkr11_position + 4,
    mkr_size       := 7,

& marker 2 &
    mkr12_position := mkr11_display + mkr_size,
    mkr12_display  := mkr12_position + 4,

& marker 3 &
    mkr13_position := mkr12_display + mkr_size,
    mkr13_display  := mkr13_position + 4,

& marker 4 &
    mkr14_position := mkr13_display + mkr_size,
    mkr14_display  := mkr14_position + &,

& marker 5 &
    mkr15_position := mkr14_display + mkr_size,
    Mkr15_display  := mkr15_position + &,

& marker 6 - gate start &
    mkr16_position := mkr15_display + mkr_size,
    mkr16_display  := mkr16_position + 4,

& marker 7 - gate center &
    mkr17_position := mkr16_display + mkr_size,
    mkr17_display  := mkr17_position + &,

& marker & - gate stop &
    mkr15_position := mkr17_display + mkr_size,
    mkr18_display  := mkr15_position + 4,

& channel 1 graticule &
    graticule1_position := mkr18_display + mkr_size,
    graticule1_display  := graticule1_position + 4,
    graticule_size      := 2000,

& channel 1 reference line &
```

```
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    ref_line1_position := graticule1_display + graticule_size,
    ref_line1_display  := ref_line1_position + &,
    ref_line_size      := 10,

    hilight_ch1 := ref_line1_display + ref_line_size,

& parameter 1 &
    param1_position := hilight_ch1 + 1,
    param1_display  := param1_position + 4,
    param_size      := &,

& math 1 &
& no position vectors -- follows param1 immediatly &
    math1_display  := param1_display + param_size,
    math_size      := &,

& format 1 &
    format1_position:= math1_display + math_size,
    format1_display := format1_position + 4,
    format_size     := 9,

& reference value label 1 &
    ref1_label_position := format1_display + format_size,
    ref1_label_display  := ref1_label_position + 4,
    ref_label_size      := 4,

& reference value 1 &
& no position vectors -- follows ref1_label immediately &
    ref1_display := ref1_label_display + ref_label_size,
    ref_size     := 14,

& reference suffix 1 &
& no position vectors -- follows ref1 immediately &
    ref1_suffix_display := ref1_display + ref_size,
    ref_suffix_size     := 6,

& scale/div 1 &
    scale1_position := ref1_suffix_display + ref_suffix_size,
    scale1_display  := scale1_position + 4,
    scale_size      := 13,

& scale suffix 1 &
& no position vectors -- follows scale1 immediately &
    scale1_suffix_display := scale1_display + scale_size,
    scale_suffix_size     := 7,

& marker value label 1 &
    mkr1_label_position := scale1_suffix_display + scale_suffix_size,
    mkr1_label_display  := mkr1_label_position + 4,
    mkr_label_size      := 6,

& marker real value 1 &
    mkr1_real_position := mkr1_label_display + mkr_label_size,
    mkr1_real_display := mkr1_real_position + 4,
    mkr_display_size  := 15,
```

```
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& marker imag value 1 &
    mkr1_imag_position := mkr1_real_display + mkr_display_size,
    mkr1_imag_display  := mkr1_imag_position + 4,

& marker stimulus value 1 &
    mkr1_stim_position := mkr1_imag_display + mkr_display_size,
    mkr1_stim_display  := mkr1_stim_position + 4,
    stim_size          := 15,

& marker stimulus suffix suffix 1 &
& no position vectore -- followi mkr1_stim_display immediately &
    mkr1_stim_suffix_display := mkr1_stim_display + stim_size,
    stim_suffix_size         := 5,

& start/center mode 1 &
    start1_mode_position := mkr1_stim_suffix_display + stim_suffix_size,
    start1_mode_display  := start1_mode_position + 4,
    stim_mode_size       := 6,

& start/center 1 &
& no position vectors -- follows start1_mode immediately &
    start1_display  := start1_mode_display + stim_mode_size,

& start/center suffix 1 &
& no position vectore -- follows start1_display immediately &
    start1_suffix_display := start1_display + stim_size,

& step/span mode 1 &
    stop1_mode_position := start1_suffix_display + stim_suffix_size,
    stop1_mode_display  := stop1_mode_position + 4,

& stop/span 1 &
& no position vectors -- follows stop1_mode immediately &
    stop1_display  := stop1_mode_display + stim_mode_size,

& stop/span suffix 1 &
& no position vectors -- follows stop1_display immediately &
    stop1_suffix_display := stop1_display + stim_size,

    hilight_ch1_off := stop1_suffix_display + stim_suffix_size,

& end of channel 1 &
    end_ch1_position := hilight_ch1_off + 1,

& CHANNEL 2 &                  & size constants are same as channel 1 &
    channel2_position := end_ch1_position,

& jump over channel 2 &
    jump_channel2 := channel2_position,

& trace update mark &
    update_mark2_position := jump_channel2 + 1,
    update_mark2_display  := update_mark2_position + &,

& traces &
    trace2_position := update_mark2_display + update_mark_size,
```

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   trace2_display  := trace2_position + 4,

& trace id mark -- no position vector, uses last trace point &
   trace_mark2_display  := trace2_display + trace_size,

   end_trace2           := trace_mark2_display + trace_mark_size,

& memory trace &
   trace2m_position := end_trace2,
   trace2m_display  := trace2m_position + 4,

& marker 1 &
   mkr21_position := trace2m_display + trace_size,
   mkr21_display  := mkr21_position + 4,

& marker 2 &
   mkr22_position := mkr21_display + mkr_size,
   mkr22_display  := mkr22_position + 4,

& marker 3 &
   mkr23_position := mkr22_display + mkr_size,
   mkr23_display  := mkr23_position + 4,

& marker 4 &
   mkr24_position := mkr23_display + mkr_size,
   mkr24_display  := mkr24_position + 4,

& marker 5 &
   mkr25_position := mkr24_display + mkr_size,
   mkr25_display  := mkr25_position + 4,

& marker 6 - gate start &
   mkr26_position := mkr25_display + mkr_size,
   mkr26_display  := mkr26_position + 4,

& marker 7 - gate center &
   mkr27_position := mkr26_display + mkr_size,
   mkr27_display  := mkr27_position + 4,

& marker 8 - gate stop &
   mkr28_position := mkr27_display + mkr_size,
   mkr28_display  := mkr28_position + 4,

& channel 2 graticule &
   graticule2_position := mkr28_display + mkr_size,
   graticule2_display  := graticule2_position + 4,

& channel 2 reference line &
   ref_line2_position := graticule2_display + graticule_size,
   ref_line2_display  := ref_line2_position + 4,

   hilight_ch2 := ref_line2_display + ref_line_size,

& parameter 2 &
   param2_position := hilight_ch2 + 1,
   param2_display  := param2_position + 4,
```

```
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& math 2 &
& no position vectors -- follows perm2 immediately &
   math2_display  := param2_display + param_size,

& format 2 &
   format2_position:= math2_display + math_size,
   format2_display := format2_position + 4,

& refence value label 2 &
   ref2_label_position := format2_display + format_size,
   ref2_label_display  := ref2_label_position + 4,

& reference value 2 &
& no position vectors -- follows ref2_label immediately &
   ref2_display := ref2_label_display + ref_label_size,

& reference suffix 2 &
& no position vectors -- follows ref2 immediately &
   ref2_suffix_display := ref2_display + ref_size,

& scale/div 2 &
   scale2_position := ref2_suffix_display + ref_suffix_size,
   scale2_display  := scale2_position + 4,

& scale suffix 2 &
& no position vectors -- follows scale2 immediately &
   scale2_suffix_display := scale2_display + scale_size,

& marker value label 2 &
   mkr2_label_position := scale2_suffix_display + scale_suffix_size,
   mkr2_label_display  := mkr2_label_position + 4,

& marker real value 2 &
   mkr2_real_position := mkr2_label_display + mkr_label_size,
   mkr2_real_display := mkr2_real_position + 4,

& marker imag value 2 &
   mkr2_imag_position := mkr2_real_display + mkr_display_size,
   mkr2_imag_display  := mkr2_imag_position + 4,

& marker stimulus value 2 &
   mkr2_stim_position := mkr2_imag_display + mkr_display_size,
   mkr2_stim_display  := mkr2_stim_position + 4,

& marker stimulus suffix suffix 2 &
& no position vectore -- follows mkr2_stim_display immediately &
   mkr2_stim_suffix_display := mkr2_stim_display + stim_size,

& start/center mode 2 &
   start2_mode_position := mkr2_stim_suffix_display + stim_suffix_size,
   start2_mode_display  := start2_mode_position + 4,

& start/center 2 &
& no position vectors -- follows start2_mode immediately &
   start2_display  := start2_mode_display + stim_mode_size,
```

```
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& start/center suffix 2 &
& no position vectore -- follows start2_display immediately &
   start2_suffix_display := start2_display + stim_size,

& stop/span mode 2 &
   stop2_mode_position := start2_suffix_display + stim_suffix_size,
   stop2_mode_display  := stop2_mode_position + 4,

& stop/span 2 &
& no position vectors -- follows stop2_mode immediately &
   stop2_display  := stop2_mode_display + stim_mode_size,

& stop/span suffix 2 &
& no position vectors -- follows stop2_display immediately &
   stop2_suffix_display := stop2_display + stim_size,

   hilight_ch2_off := stop2_suffix_display + stim_suffix_size,

& end of channel 2 &
   end_ch2_position := hilight_ch2_off + 1,

& update rau marks &
   update_rau_position := end_ch2_position,
   update_rau_display  := update_rau_position + 4,
   update_rau_size     := 3,

& user display &
   user_display := update_rau_display + update_rau_size,

& end position &
   end_position  := X2FFF,

& character set &
   character_set := X3000;
```

```
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    n    2n   nh  2nH  addr   discription

    0     0 0000 0000 100000 = start_display
   10    20 000A 0014 100014 = error_position
   14    28 000E 001C 10001C = error_display
   62   124 003E 007C 10007C = title_position
   66   132 0042 0084 100084 = title_display
  116   232 0074 00E8 1000E8 = blank_screen
  117   234 0075 00EA 1000EA = function_position
  121   242 0079 00F2 1000F2 = function_display
  117   234 0075 00EB 1000EB = text_position
  121   242 0079 00F2 1000F2 = text_display
  848  1698 0351 0EA2 1006A2 = entry_position
  853  1706 0355 0BAA 1006AA = entry_display
 1413  2826 0555 0B0A 100B0A = entry2_position
 1417  2834 0589 0B12 100B12 = entry2_display
 1977  3954 07B9 0F72 100F72 = entry_aux_position
 1981  3962 07BD 0F7A 100F7A = entry_aux_display
 2035  4070 07F3 0FE6 100FE6 = sk11_position
 2041  4082 07F9 0FF2 100FF2 = sk11_display
 2052  4104 0804 1008 101008 = sk12_position
 2055  4112 0808 1010 101010 = sk12_display
 2066  4132 0812 1024 101024 = sk21_position
 2072  4144 0818 1030 101030 = sk21_display
 2083  4166 0823 104E 101046 = sk22_position
 2087  4174 0827 104E 10104E = sk22_display
 2037  4194 0831 1062 101062 = sk31_position
 2103  4206 0837 106E 10106E = sk31_display
 2114  4228 0842 1084 101084 = sk32_position
 2118  4236 0846 108C 10108C = sk32_display
 2128  4256 0850 10A0 1010A0 = sk41_position
 2134  4268 085E 10AC 1010FC = sk41_display
 2145  4290 0861 10C2 1010C2 = sk42_position
 2145  4298 0865 10CA 1010CA = sk42_display
 2159  4318 086F 100E 1010DE = sk51_position
 2165  4330 0875 10EA 1010EA = sk51_display
 2176  4352 0880 1100 101100 = sk52_position
 2180  4360 0884 1108 101108 = sk52_display
 2190  4380 088E 111C 10111C = sk61_position
 2196  4392 0894 1128 101128 = sk61_display
 2207  4414 089F 113E 10113E = sk62_position
 2211  4422 08A3 1146 101146 = sk62_display
 2221  4442 08A0 115A 10115A = sk71_position
 2227  4454 08B3 1166 101166 = sk71_display
 2238  4476 08BE 117C 10117C = sk72_position
 2242  4484 08C2 1184 101184 = sk72_display
 2252  4504 08CC 1198 101198 = sk81_position
 2258  4516 08D2 11A4 1011B4 = sk81_display
 2269  4538 08D0 116A 1011BB = sk82_position
 2273  4546 08E1 11C2 1011C2 = sk82_display
 2283  4566 08EB 1106 101106 = sk_hilight_off
 2284  4568 08EC 1108 1011D8 = sk_highlight_position
 2288  4576 08F0 11E0 1011E0 = sk_highlight_display
 2318  4636 090E 121C 10121C = jump_all
 2319  4638 090F 121E 10121E = channel1_position
```

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```
 2319  4638 090F 121E 10121E = jump_channcl1
 2320  4640 0910 1220 101220 = update_mark1_position
 2324  4648 0914 1228 101228 = update_mark1_display
 2330  4660 0918 1234 101234 = trace1_position
 2334  4668 091E 123C 10123C = trace1_display
 3144  6238 0C48 1890 101890 = trace_mark1_position
 3148  6296 0E4C 1898 101898 = trace_mark1_display
 3157  6314 0C55 18AA 1018AA = end_trace1
 3157  6314 0C55 18AA 1018AA = tracaim_position
 3161  6322 0G59 18B2 1018B2 = tracein_display
 3971  7942 0F83 1F06 101F06 = mkr11_position
 3975  7950 0F87 1F0E 101F0E = mkr11_display
 3982  7964 0F8E 1F1C 101F1C = mkr12_position
 3986  7972 0F92 1F24 101F24 = mkr12_display
 3993  7988 0F99 1F32 101F32 = mkr13_position
 3997  7994 0F9B 1F3A 101F3A = mkr13_display
 4004  8008 0FA4 1F48 101F48 = mkr14_position
 4008  8018 0FA8 1F50 101F50 = mkr14_display
 4015  8030 0FAF 1F5E 101F5E = mkr15_position
 4019  8038 0FB3 1F66 101F66 = mkr15_display
 4026  8052 0FBA 1F74 101F74 = mkr16_position
 4030  8060 0FBE 1F7C 101F7C = mkr16_display
 4037  8074 0FE5 1F8A 101F8A = mkr17_position
 4041  8082 0FC9 1F92 101F52 = mkr17_display
 4048  8096 0FD0 1FA0 101FB0 = mkr18_position
 4052  8104 0F04 1FA8 101FA8 = mkr18_display
 4059  8118 0F08 1FB6 101FB6 = graticule1_position
 4063  8126 0F0F 1FBE 101FBE = graticule1_display
 6063 12128 17AF 2F5E 102F5E = ref_line1_position
 6067 12134 17B3 2F66 102F66 = ref_line1_display
 6077 12154 17B0 2F78 102F78 = kilight_ch1
 6078 12156 17AE 2F7C 102F7C = param1_position
 6082 12164 17C2 2F84 102FA8 = param1_display
 6090 12150 17CA 2F94 102F94 = math1_display
 6098 12196 1702 2FB4 102FA4 = format1_position
 6102 12204 1704 2FBC 102FBC = format1_display
 6111 12222 170F 2FBE 102FBE = ref1_label_position
 6115 12230 17E3 2FC6 102FC6 = ref1_label_display
 6119 12238 17E7 2FCE 102FCE = ref1_display
 6133 12266 17F5 2FE8 102FEA = rtf1_suffix_display
 6139 12278 17FA 2FF6 102FF6 = scale1_position
 6143 12286 17FF 2FFE 102FFE = scale1_display
 6156 12312 150C 3018 10301A = scale1_suffix_display
 6163 12326 1813 3026 103026 = mkr1_label_position
 6167 12334 1817 302E 10302E = mkr1_label_display
 6173 12346 181D 303A 10303A = mkr1_real_position
 6177 12354 1821 3042 103042 = mkr1_real_display
   15    30 000F 001E 10001E = mkr_display_size
 6192 12384 1830 3060 103060 = mkr1_imag_position
 6196 12392 1834 3068 103068 = mkr1_imag_display
 6211 12422 1843 3086 103086 = start1_mode_position
 6215 12430 1847 308E 10308E = start1_mode_display
 6221 12442 184D 309A 10309A = start1_display
 6236 12472 185C 30B8 1030B8 = start1_suffix_display
 6241 12482 1861 30C2 1030C2 = stop1_mode_position
 6245 12490 1865 30CA 1030CA = stop1_mode_display
```

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```
 6251 12502 1866 3006 103006 = stop1_display
 6266 12532 1878 30F4 1030F4 = atop1_suffix_display
 6271 12542 187F 30FE 1030FE = hilight_ch1_pff
 6272 12544 1880 3100 103100 = end_ph1_position
 6272 12544 1880 3100 103100 = channol2_position
 6272 12544 1880 3100 103100 = jump_pharme12
 6273 12546 1881 3102 103102 = updett_psrk2_position
 6277 12554 1885 310A 10310A = update_mark2_display
 6283 12566 1888 3116 103116 = tract2_position
 6287 12574 188F 311E 10311E = tracc2_display
 7097 14194 1B89 3772 103772 = tract_mark2_display
 7106 14212 1BC2 37B4 103764 = end_tract2
 7106 14212 1BC2 3784 103784 = tract2n_position
 7110 14220 1BC6 378C 10378C = trace2n_display
 7920 15840 1EF0 30E0 1030E0 = mkr21_position
 7924 15848 1EF4 30E8 1030E8 = mkr21_display
 7931 15862 1EF8 38F6 1030F6 = mkr22_position
 7935 15870 1EFF 30FE 1030FE = mkr22_display
 7942 15884 1F06 3E0C 103E0C = mkr23_position
 7946 15892 1F0A 3E14 103E14 = mkr23_display
 7953 15906 1F11 3E22 103E22 = mkr24_position
 7957 15914 1F15 3E2A 103E2A = mkr24_display
 7964 15928 1F1C 3E38 103E38 = mkr25_position
 7968 15936 1F30 3E40 103E40 = mkr25_display
 7975 15950 1F27 3E4E 103E4E = mkr26_position
 7979 15958 1F2B 3E56 103E56 = mkr26_display
 7986 15972 1F32 3E64 103E64 = mkr27_position
 7990 15980 1F36 3E6C 103E6C = mkr27_display
 7997 15994 1F30 3E7P 103E78 = mkr28_position
 8001 16002 1F41 3E82 103E82 = mkr28_display
 8008 16016 1F48 3E90 103E90 = graticula2_position
 8012 16024 1F4C 3E98 103E9A = graticule2_display
10012 20024 271G 4E38 104E38 = ref_line2_position
10016 20032 2720 4E40 104E40 = ref_line2_display
10026 20052 2728 4E54 104E54 = hilight_ph2
10027 20054 2728 4E56 104E56 = param2_position
10031 20062 272F 4E5E 104E5E = param2_display
10039 20078 2737 4E6E 104E6E = math2_display
10047 20094 273F 4E7E 104E7E = format2_position
10051 20102 2743 4E86 104E80 = format2_display
10060 20120 274C 4E98 104E98 = ref2_label_position
10064 20128 2750 4EA0 104EA0 = ref2_label_display
10068 20136 2754 4EA8 104EA8 = ref2_display
10082 20164 2762 4EC4 104EC4 = rmf2_suffix_display
10088 20176 2768 4E00 104E00 = scale2_position
10092 20184 276C 4E08 104E08 = scale2_display
10105 20210 2779 4EF2 104EF2 = scale2_suffix_display
10112 20224 2780 4F00 104F00 = mkr2_label_position
10116 20232 2784 4F08 104F08 = mkr2_label_display
10122 20244 278A 4F14 104F14 = mkr2_real_position
10126 20252 278E 4F1C 104F1C = mkr2_real_display
10141 20282 2790 4F3A 104F3A = mkr2_imag_position
10145 20290 27A1 4F42 104F42 = mkr2_imag_display
10160 20320 2700 4F60 104F60 = start2_mode_position
10164 20328 2794 4F68 104F68 = otart2_mode_display
10170 20340 27AA 4F74 104F74 = start2_display
```

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```
10185 20370 27C9 4F92 104F92 = atart2_suffix_display
10190 20380 27CE 4F9C 104F9C = stop2_mode_position
10194 20388 2702 4FA4 104FA4 = stop2_mode_display
10200 20400 2708 4FB0 104FB0 = stop2_display
10215 20430 27E7 4FCE 104FCE = stop2_suffix_display
10220 20440 27EC 4FD8 104FD8 = hilight_ph2_pff
10221 20442 27ED 4FDA 104FDA = end_ph2_position
10221 20442 27ED 4FDA 104FDA = update_rau_position
10225 20450 27F1 4FE2 104FE2 = updatt_rau_display
10224 20448 27F0 4FE0 104FE0 = user_display
12287 24574 2FFF 5FFE 105FFE = end_position
```

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```
$FILE cscreen.work;                    $ for screen constants &
$FILE FscmreeO.work;          $ for print_string, blank_display, etc. &
$FILE fscrotnl.work;                   $ for string arreys and alphas &
```

```
JSCREEN.WORK.PD8510            THU, DEC 22, 1983, 10:56 AM     PAGE   1

!job screen,librn.pd8S10,uork;outclass=,1
!continue
!purge yscreen
!build yscreen;rec=-1276,,v,ascii
!ed
a csereen.uork
f xscreen
v/{{_display|_position|junp_[blank_screen}}/d
v/^INTEGER COHSTRHT/d
1,$s/IHTEGER COHSTRNT //
1,$s/[^R-Z^a-z^0-9^_}.*$//
1,$s/#/,/
$s/,/;/
0a
N68KL,P BEGIN
#FILE escreen.uork;
BLIST;
INTEGER TABLE yecreen :=
.
$a
END*
.
uq xscreen
!con6&k xscreen,,yscreen
1ed
e yscrecn
}u usereen.uork
uq xsereen
!purge dscreen
!build dscreen;rec=-1276,,v,ascii;nocctl
!file input=xscreen
!file sutput*dscreen,old
!run pscreenp.uork
!purge xscreen
!purge yacreen
!ed
e dscreen
uq
!tell librn.pd8510; ============== jscreen done ===================
!tell ucc.pd8510; ================ jscreen done ===================
!eoj
```

```
SSCREEN.WORK.PO8510            THU, DEC 22, 1983, 10:56 AM     PAGE   1

N68K1,P,"screen"
DEGIN

#FILE cdisplay.uork;
#FILE fdisplay.uork;
#FILE fdisply2.uork;
#FILE fdiaptbl.uork;
#FILE cscreen.uork;
#FILE fiocnfig.uork;
#FILE cactive2.uork;                        & for keypad_suffix_size &

ALPHA PROCEDURE init_string(string, nax_length);
   VALUE string, nax_length;
   ALPHA string;
   BYTE  nax_length;                                          EXTERNAL;

& title &
GLOBAL  BYTE ARRAY title_array[-1:title_size];
GLOBAL  ALPHA title;

& error &
GLOBAL  BYTE ARRAY error_array[-1:error_size];
GLOBAL  ALPHA error;

& function &
GLOBAL  BYTE ARRAY function_array[-1:function_string_size];
GLOBAL  ALPHA function;

& entry &
GLOBAL  BYTE ARRAY entry_array[-1:entry_string_aize+keypad_suffix_size];
GLOBAL  ALPHA entry;
GLOBAL  BOOLEAN entry_flip_flop;

& entry_aux &
GLOBAL  BYTE ARRAY entry_aux_arrey[-1:entry_aux_aize];
GLOBAL  ALPHA entry_aux;
```

```
SSCREEN.WORK.PO8510            THU, DEC 22, 1983, 10:56 AM     PAGE   2

#EJECT;
COMMENT                                                         screen_table
****************************************************************************
*
****************************************************************************
;
INTEGER TABLE screen_tabie :=

& error &
dg_novech2_neu_adr, error_poiition, error_rou, error_col,
dg_jnp_neu_adr, srrcr_display, error_display+errcr_size,

& title &
dg_novech2_neu_adr, title_position, title_rou, title_col,
dg_jnp, title_display+title_size,

& blank screen &
dg_setattribute_neu_adr, blank_screen, eod,
dg_setattribute_neu_adr, 1, nop,

& function &
dg_novech2_neu_adr, function_position, function_rou, function_col,
dg_jnp_neu_adr, function_display, function_display+function_size,

& entry &
dg_novech2_neu_adr, entry_position, entry_rou, entry_col,
dg_jnp_neu_adr, entry_display, entry_display+entry_size,
dg_novech2_neu_adr, entry2_position, entry_rou, entry_col,
dg_jnp_neu_adr, entry2_display, entry2_display+entry_size,

& entry aux &
dg_novech2_neu_adr, entry_aux_position, entry_aux_rou, entry_aux_col,
dg_jnp_neu_adr, entry_aux_display, entry_aux_display+entry_aux_size,

& enhancenent annotation &
dg_novech2_neu_adr, dirty_porition, dirty_rou, enhancenent_col,
dg_printch, ' ',

dg_novech_neu_adr, gating_position, gating_rou, enhancenent_col,
dg_printch, ' ',

dg_novech_neu_adr, correction_position, correction_rou, enhancenent_col,
dg_printch, ' ',

dg_novech_neu_adr, averaging_position, averaging_rou, enhancenent_col,
dg_printch, ' ',

dg_novech_neu_adr, snoothing_position, snoothing_rou, enhancenent_col,
dg_printch, ' ',

dg_novech_neu_adr, delay_position, delay_rou, enhancenent_col,
dg_printeh, ' ',

dg_novech_neu_adr, nath_cosition, nath_rou, enhancenent_col,
dg_printch, ' ',
```

```
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dg_novech_nou_adr, external_poeition, external_rou, enhancenent_col,
dg_printch, ' ',

dg_novech_neu_adr, offset_position, offset_rou, enhancenent_col,
dg_printch, ' ',


& SOFT KEYS &

& sk11 &
dg_nove2_neu_adr, sk11_position, sk_x, sk11_y,
dg_printch, null,
dg_printch, null,
dg_jnp_neu_adr, sk11_display, sk11_display+sk1_size,
& sk12 &
dg_nove2_neu_adr, sk12_position, sk_x, sk12_y,
dg_jnp_neu_adr, sk12_display, sk12_display+sk2_size,

& sk21 &
dg_nove2_neu_edr, sk21_position, sk_x, sk21_y,
dg_printch, null,
dg_printch, null,
dg_jnp_neu_adr, sk21_display, sk21_display+sk1_size,
& sk22 &
dg_nove2_neu_adr, sk22_position, sk_x, sk22_y,
dg_jnp_neu_adr, sk22_display, sk22_display+sk2_size,

& sk31 &
dg_nove2_neu_adr, sk31_position, sk_x, ak31_y,
dg_printch, null,
dg_printch, null,
dg_jnp_neu_adr, sk31_display, sk31_display+sk1_size,
& sk32 &
dg_nove2_neu_adr, sk32_position, sk_x, sk32_y,
dg_jnp_neu_adr, sk32_display, sk32_display+sk2_size,

& sk41 &
dg_nove2_neu_adr, ak41_position, sk_x, ak41_y,
dg_printch, null,
dg_printch, null,
dg_jnp_neu_adr, sk41_display, sk41_display+sk1_size,
& sk42 &
dg_nove2_neu_adr, sk42_position, sk_x, sk42_y,
dg_jnp_neu_adr, sk42_display, sk42_display+sk2_size,

& sk51 &
og_nove2_neu_adr, sk51_position, sk_x, sk51_y,
dg_printch, null,
dg_printch, null,
dg_jnp_neu_adr, sk51_display, sk51_display+sk1_size,
& sk52 &
dg_nove2_neu_adr, sk52_position, sk_x, sk52_y,
dg_jnp_neu_adr, sk52_display, sk52_display+sk2_size,

& sk61 &
dg_nove2_neu_adr, sk61_position, sk_x, sk61_y,
```

```
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dg_erintch, null,
dg_erintch, null,
dg_jmp_neu_adr, sk61_display, sk61_display+sk1_size,
& sk62 &
dg_move2_neu_adr, sk62_position, sk_n, sk62_y,
dg_jmp_neu_adr, sk52_display, sk62_display+sk2_size,

& sk 71 &
dg_move2_neu_adr, sk71_position, sk_x, sk71_y,
dg_erintch, null,
dg_erintch, null,
dg_jmp_neu_adr, sk71_display, sk71_display+sk1_size,
& sk72 &
dg_move2_neu_adr, sk72_position, sk_s, sk72_y,
dg_jmp_neu_adr, sk72_display, sk72_display+sk2_size,

& sk81 &
dg_move2_neu_adr, sk81_position, sk_s, sk81_y,
dg_erintch, null,
dg_erintch, null,
dg_jmp_neu_adr, sk31_display, sk11_display+sk1_size,
& sk32 &
dg_move2_neu_adr, sk12_position, sk_x, sk32_y,
dg_jmp_neu_adr, sk12_display, sk32_display+sk2_size,

& sk_highlight &
dg_setattribute_neu_adr, sk_hilight_off, dimoff,
dg_move2_neu_adr, sk_highlight_position, sk_s, sk32_y,
dg_jmp_neu_adr, sk_highlight_display,
   sk_highlight_display+sk_highlight_size,


& jump all &
dg_setattribute_neu_adr, jump_all, nop,


& CHANNEL 1 &

&jump1 &
dg_setattribute_neu_adr, jump_channel1, nop,

& trace1 &
dg_nave2_neu_adr, trace1_position, trace1_x, trace1_y,
dg_jmp_neu_adr, trace1_display, trace1_display+trace_size,
& trace mark1 &
dg_jmp_neu_adr,trace_mark1_position,trace_mark1_display+trace_mark_size,
& trace update mark &
dg_jmp_neu_adr, update_mark1_position,
   update_mark1_display+update_mark_size,

& trace1n &
dg_move2_neu_adr, trace1n_position, trace1n_s, trace1n_y,
dg_jmp_neu_adr, trace1n_display, trace1n_display+trace_size,

& markers &
dg_jmp_neu_adr, mkr11_position, mkr11_display+mkr_size,
```

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dg_jmp_neu_adr, mkr12_position, mkr12_display+mkr_size,
dg_jmp_neu_adr, mkr13_position, mkr13_display+mkr_size,
dg_jmp_neu_adr, mkr14_position, mkr14_display+mkr_size,
dg_jmp_neu_adr, mkr15_position, mkr15_display+mkr_size,
dg_jmp_neu_adr, mkr16_position, mkr16_display+mkr_size,
dg_jmp_neu_adr, mkr17_position, mkr17_display+mkr_size,
dg_jmp_neu_adr, mkr18_position, mkr18_display+mkr_size,

& graticule 1 &
dg_move2_neu_adr, graticule1_position, xgrat, ygrat,
dg_jmp_neu_adr, graticule1_display, graticule1_display+graticule_size,

& ref line 1 &
dg_jmp_neu_adr, ref_line1_position, ref_line1_display+ref_line_size,

& hilight 1 &
dg_setattribute_neu_adr, hilight_ch1, dimoff,

& parameter 1 &
dg_movech2_neu_adr, param1_position, param_row, param1_col,
dg_jmp_neu_adr, param1_display, param1_display+param_size,

& math 1 &
dg_jmp_neu_adr, math1_display, math1_display+math_size,

& format 1 &
dg_movech2_neu_adr, format1_position, param_row, format1_col,
dg_jmp_neu_adr, format1_display, format1_display+format_size,

& reference value label 1 &
dg_movech2_neu_adr, ref1_label_position, ref_row, ref1_col,
dg_jmp_neu_adr, ref1_label_display, ref1_label_display+ref_label_size,
& reference value 1 &
dg_jmp_neu_adr, ref1_display, ref1_display+ref_size,
& reference suffix 1 &
dg_jmp_neu_adr, ref1_suffix_display,ref1_suffix_display+ref_suffix_size,

& scale 1 &
dg_movech2_neu_adr, scale1_position, scale_row, scale1_col,
dg_jmp_neu_adr, scale1_display, scale1_display+scale_size,
& scale suffix 1 &
dg_jmp_neu_adr, scale1_suffix_display,
   scale1_suffix_display+scalc_suffix_size,

& marker display 1 &
dg_movech2_neu_adr, mkr1_label_position, mkr_row, mkr1_col,
dg_jmp_neu_adr, mkr1_label_display, mkr1_label_display+mkr_label_size,
& marker real value &
dg_movech2_neu_adr, mkr1_real_position, mkr_row, mkr1_real_col,
dg_jmp_neu_adr, mkr1_real_display, mkr1_real_display+mkr_display_size,
& marker imaginary value &
dg_movech2_neu_adr, mkr1_imag_position, mkr_row, mkr1_imag_col,
dg_jmp_neu_adr, mkr1_imag_display, mkr1_imag_display+mkr_display_size,

& marker 1 stimulus value &
dg_movech2_neu_adr, mkr1_stim_position, mkr_stim_row, mkr1_stim_col,
```

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dg_jmp_neu_adr, mkr1_stim_display,
   mkr1_stim_display+stim_size,
& marker 1 stimulus suffix &
dg_jmp_neu_adr, mkr1_stim_suffix_display,
   mkr1_stim_suffix_display+stim_suffix_size,

& start/center mode 1 &
dg_movech2_neu_adr, start1_mode_position, start_row, start1_col,
dg_jmp_neu_adr, start1_mode_display, start1_mode_display+stim_mode_size,
& start/center1 &
dg_jmp_neu_adr, start1_display, start1_display+stim_size,
& start/center suffix 1 &
dg_jmp_neu_adr, start1_suffix_display,
   start1_suffix_display+stim_suffix_size,

& stop/span mode &
dg_movech2_neu_adr, stop1_mode_position, stop_row, stop1_col,
dg_jmp_neu_adr, stop1_mode_display, stop1_mode_display+stim_mode_size,
& stop/span 1 &
dg_jmp_neu_adr, stop1_display, stop1_display+stim_size,
& stop/span suffix &
dg_jmp_neu_adr, stop1_suffix_display,
   stop1_suffix_display+stim_suffix_size,

& hilight 1 off &
dg_setattribute_neu_adr, hilight_ch1_off, dimoff,

& CHANNEL 2 &

& jump2 &
dg_setattribute_neu_adr, jump_channel2, nop,

& trace2 &
dg_move2_neu_adr, trace2_position, trace2_s, trace2_y,
dg_jmp_neu_adr, trace2_display, trace2_display+trace_size,
& trace2 mark &
dg_jmp_neu_adr, trace_mark2_display,trace_mark2_display+trace_mark_size,
& trace2 update mark &
dg_jmp_neu_adr, update_mark2_position,
   update_mark2_display+update_mark_size,

& trace2n &
dg_move2_neu_adr, trace2n_position, trace2n_n, trace2n_y,
dg_jmp_neu_adr, trace2n_display, trace2n_display+trace_size,

& markers &
dg_jmp_neu_adr, mkr21_position, mkr21_display+mkr_size,
dg_jmp_neu_adr, mkr22_position, mkr22_display+mkr_size,
dg_jmp_neu_adr, mkr23_position, mkr23_display+mkr_size,
dg_jmp_neu_adr, mkr24_position, mkr24_display+mkr_size,
dg_jmp_neu_adr, mkr25_position, mkr25_display+mkr_size,
dg_jmp_neu_adr, mkr26_position, mkr26_display+mkr_size,
dg_jmp_neu_adr, mkr27_position, mkr27_display+mkr_size,
dg_jmp_neu_adr, mkr23_position, mkr28_display+mkr_size,

& graticule 2 &
```

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dg_move2_neu_adr, graticule2_position, xgrat, ygrat,
dg_jmp_neu_adr, graticule2_display, graticule2_display+graticule_size,

& ref line 2 &
dg_jmp_neu_adr, ref_line2_position, ref_line2_display+ref_line_size,

& highlight 2 &
dg_setattribute_neu_adr, hilight_ch2, dimoff,

& parameter 2 &
dg_movech2_neu_adr, param2_position, param_row, param2_col,
dg_jmp_neu_adr, param2_display, param2_display+param_size,

& math 2 &
dg_jmp_neu_adr, math2_display, math2_display+math_size,

& format 2 &
dg_movech2_neu_adr, format2_position, param_row, format2_col,
dg_jmp_neu_adr, format2_display, format2_display+format_size,

& reference value label 2 &
dg_movech2_neu_adr, ref2_label_position, ref_row, ref2_col,
dg_jmp_neu_adr, ref2_label_display, ref2_label_display+ref_label_size,
& reference value 2 &
dg_jmp_neu_adr, ref2_display, ref2_display+ref_size,
& reference suffix 2 &
dg_jmp_neu_adr, ref2_suffix_display,ref2_suffix_display+ref_suffix_size,

& scale 2 &
dg_movech2_neu_adr, scale2_position, scale_row, scale2_col,
dg_jmp_neu_adr, scale2_display, scale2_display+scale_size,
& scale suffix 2 &
dg_jmp_neu_adr, scale2_suffix_display,
   scale2_suffix_display+scale_suffix_size,

& marker display 2 &
dg_movech2_neu_adr, mkr2_label_position, mkr_row, mkr2_col,
dg_jmp_neu_adr, mkr2_label_display, mkr2_label_display+mkr_label_size,
& marker real value &
dg_movech2_neu_adr, mkr2_real_position, mkr_row, mkr2_real_col,
dg_jmp_neu_adr, mkr2_real_display, mkr2_real_display+mkr_display_size,
& marker imaginary value &
dg_movech2_neu_adr, mkr2_imag_position, mkr_row, mkr2_imag_col,
dg_jmp_neu_adr, mkr2_imag_display, mkr2_imag_display+mkr_display_size,

& marker 2 stimulus value &
dg_movech2_neu_adr, mkr2_stim_position, mkr_stim_row, mkr2_stim_col,
dg_jmp_neu_adr, mkr2_stim_display,
   mkr2_stim_display+stim_size,
& marker 2 stimulus suffix &
dg_jmp_neu_adr, mkr2_stim_suffix_display,
   mkr2_stim_suffix_display+stim_suffix_size,

& start/center mode 2 &
dg_movech2_neu_adr, start2_mode_position, start_row, start2_col,
dg_jmp_neu_adr, start2_mode_display, start2_mode_display+stim_mode_size,
```

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& start/center 2 &
dg_jmp_new_adr, start2_display, start2_display+stin_size,
& start/center suffix 2 &
dg_jmp_new_adr, start2_suffix_display,
   start2_suffix_display+stin_suffix_size,

& stop/span node 2 &
dg_movech2_new_adr, stop2_node_position, stop_row, stop2_col,
dg_jmp_new_adr, stop2_node_display, stop2_node_display+stin_node_size,
& stop/span 2 &
dg_jmp_new_adr, stop2_display, stop2_display+stin_size,
& stop/span suffix 2 &
dg_jmp_new_adr, stop2_suffix_display,
   stop2_suffix_display+stin_suffix_size,

& hilight 2 off &
dg_setattributt_new_adr, hilight_ch2_eff, dinoff,

& update raw mark &
dg_jmp_new_adr, update_raw_position,
   update_raw_display+update_raw_size,

& user display &
dg_jmp_new_adr, user_display, end_position,

dg_stop;
```

```
SSCREEN.WORK.PD8510          THU, DEC 22, 1983, 10:57 AM    PAGE  9


REJECT;
COMMENT                                                    print_string
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR print_string                                   *
*                                                                           *
* FUNCTION: to write a string into the display memory, taking care of       *
*           all jump linkages between display blocks.                       *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*    PROCEDURE  print_string(string,blocklength,block)                      *
*       VALUE   string,blocklength,block                                    *
*       INTEGER blocklength,block                                           *
*       ALPHA   string                                                      *
*                                                                           *
*    INPUT:   block       integer     word offset of block from start       *
*                                     of display ram.                       *
*             blocklength integer     max number of words in block.         *
*             string      alpha       string to be displayed.               *
*                                                                           *
*    OUTPUT:  none                                                          *
*                                                                           *
* EXTERNAL EFFECTS:  none                                                   *
*                                                                           *
* COMMENTS:  The blocks are defined in file FSCREEN.  Each block is         *
*            preceeded by a positioning vector.  Each block is              *
*            is expected to terminate with a display jump to the            *
*            location immediately following the block                       *
*            (block+blocklen = positioning vector for the next block).      *
*            Note that the jump is not required if the string fills         *
*            the entire block, since it has the same result.                *
*                                                                           *
*            In order to avoid extraneous vectors on the display            *
*            during the write operation, the terminating jump should        *
*            be entered first, and the string entered from last             *
*            character to first.                                            *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR print_string                                        *
*                                                                           *
* MODULES CALLED: printch                                                   *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
*    IF string_length < blocklength THEN                                    *
*       block[string_length + 1] := display jump to block+blocklength.     *
*    FOR index := end_of_string TO beginning_of_string DO                   *
*       block[index] := string[index].  & watch for string_length=0 &       *
*                                                                           *
*****************************************************************************
;
PROCEDURE print_string(string,blocklength,block);
   VALUE string,blocklength,block;
   INTEGER blocklength,block;
   ALPHA string;                                                    ENTRY;
```

```
SSCREEN.WORK.PD8510          THU, DEC 22, 1983, 10:57 AM    PAGE 10


   BEGIN  & print_string &
      COMMENT does not check to make sure string length is not greater
         than blocklength;
      INTEGER i,a;
      BYTE POINTER ptr;
      DOUBLE stringaddr = string;

      STPNTR(ptr,stringaddr);

      i := ptr[0];
      IF i >= blocklength THEN                  & seldom >= blocklength &
         BEGIN & if &
            IF i > blocklength THEN             & ELSE is faster than   &
               i := blocklength;                &    THEN portion.      &
         END & if &
      ELSE                                      & usually < blocklength &
         a := jmp(block+i, block+blocklength);
      UNTIL i > 0 DO
         BEGIN  & while &
            a := printch(block+i-1, ptr[i]);
            i := i-1;
         END while;
   END; & print_string &
```

```
SSCREEN.WORK.PD8510          THU, DEC 22, 1983, 10:57 AM    PAGE 11


REJECT;
COMMENT                                                  print_big_string
*****************************************************************************
*
* allow about 10 locations in "block" for each character.
*
* will not handle characters that contain jumps or jump subroutines.
*
*****************************************************************************
;
PROCEDURE  print_big_string(string,blocklength,block);
   VALUE   string,blocklength,block;
   INTEGER blocklength,block;
   ALPHA   ttring;                                                  ENTRY;
   BEGIN & print_big_string &
      INTEGER CONSTANT jmp_table  := %3000;& offset to base of jmp tbl &
      INTEGER CONSTANT jump       := %C000,
                       loadxy     := %4000,
                       return     := %2000,
                       op_mask    := %C000,
                       rtn_op_mask:= %E000,
                       jump_mask  := %3FFF;
      INTEGER     i,
                  ch,
                  block_end,
                  coord,                          & x or y coordinate &
                  from,      & display generator address in char. set &
                  to;        & display generator destination address  &
      INTEGER dg_data;
      INTEGER POINTER  dg_ptr;
      BYTE POINTER str;
      DOUBLE stringaddr = string;

      STPNTR(str,stringaddr);
      STPNTR(dg_ptr, ADRS(dgram) );

      block_end := block + blocklength; & not testing for excess length&
      to := jmp(block, block_end);              & skip over until done &

      IF str(0) > 0 THEN
         FOR i := 1 TO str[0] DO
            BEGIN & for &
               ch := %00FF AND INTEGER( str[i] );      & get character &
               dg_data := dg_ptr[jmp_table+ch];     & get table's jump &

               IF (dg_data AND op_mask) = jump THEN
                  BEGIN & if &
                     from := dg_data AND jump_mask;
                     dg_data := dg_ptr[from];

                     WHILE ( ((dg_data AND rtn_op_mask) <> return)
                             AND (to <= (block_end-2))  & room for RTS &
                           ) DO
                        BEGIN & while &
                           IF (dg_data AND op_mask) = loadxy THEN
                                       & multiply coordinate and    &
```

```
SSCREEN.UORK.PD8510          THU, DEC 22, 1983, 10:57 AM    PAGE 12

                                & keep opcode and attributes &
                            BEGIN & if &
                               coord := dq_data AND %0FFF;
                               & 12-bit sign extension &
                               IF coord > %07FF THEN
                                  coord := coord OR %F000;
                               & npy coordinate by 1.375 &
                               dq_data := ( ( coord + #RIGHT(coord,1)
                                              - #RIGHT(coord,3)
                                            ) AND %0FFF
                                          ) OR (dq_data AND %F000);
                            END;  & if &
                         dq_ptr[to] := dq_data;
                         to := to + 1;
                         dq_data := dq_ptr[from:=from+1];
                      END;  & while &

                   IF ((dq_data AND rtn_op_mask) = return) THEN
                      BEGIN & if &
                         & mask off return opcode but leave attributes&
                         dq_ptr[to] := dq_data AND %1FFF;
                         to := to + 1;
                      END   & if &
                   ELSE & stopped in the middle of a character &
                      to := ottattribute(to, charincroff);& to:=to+1 &

                END;  & if &
             END;  & for &

       IF to < block_end THEN              & jump over unused locations &
          to := jmp(to, block_end);
       setattribute(block, nop);           & allow it to be displayed &

    END;  & print_big_string &
```

```
SSCREEN.UORK.PD8510          THU, DEC 22, 1983, 10:57 AM    PAGE 13

%EJECT;
COMMENT                                                        blank_display
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE blank_display;                                          ENTRY;
   BEGIN & blank_display &
      setattribute( blank_screen, cod );          & blank the display &
   END;  % blank_display &
```

```
SSCREEN.UORK.PD8510          THU, DEC 22, 1983, 10:57 AM    PAGE 14

%EJECT;
COMMENT                                                       enable_display
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE enable_display;                                         ENTRY;
   BEGIN & enable_display &
      setattribute( blank_screen, nop );          & reenable the display &
   END;  & enable_display &
```

```
SSCREEN.UORK.PD8510          THU, DEC 22, 1983, 10:57 AM    PAGE 15

%EJECT;
COMMENT                                                        init_screen
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE init_screen;                                             ENTRY;
   BEGIN  & init_screen &
      INTEGER i;                                                & DEBUG &
      INTEGER addr;

      addr := init_display;
      addr := jmp( addr, start_display+start_size );
      & any changes must also be reflected in "start_size " in CSCREEN &

      & enter position vector prefixes for each block &
      & and initialize associated strings, if any     &
      addr := display_from_table( addr, ROWS(screen_table) );

      addr := lb(title_display, "SYSTEM INITIALIZATION IN PROGRESS");
      addr := jmp(addr,title_display+title_size);

      error := #ROWS(error_array);
      error := init_string(error,error_size);

      title_array[-1] := title_size;
      title_array[0]  := 0;
      title := ROWS(title_array);     & initialized from machine state &

      function := ROWS(function_array);
      function := init_string(function,function_string_size);

      entry_flip_flop := TRUE;
      entry := ROWS(entry_array);
      entry := init_string(entry,entry_string_size);

      entry_aux := ROWS(entry_aux_array);
      entry_aux := init_string(entry_aux,entry_aux_size);


   & ANNOTATION &

      print_string("REF ", ref_label_size, ref1_label_display);
      print_string("REF ", ref_label_size, ref2_label_display);

   END init_screen;

ENDS
```

```
USCREEN.WORK.PDB510          THU, DEC 22, 1983, 10:57 AM    PAGE  1


1
1,/ DEC /-2d
$
? DEC ?
a
.,&d
1,$s/^ *[0-9]* *//
1,$s/^.* DEC /DEC /
1,$s/^ *//
1,$s/[,;]//
g/DEC /.-1,.j
1,$s/ *DEC */ =    /
1,$s/ *$//
1,$s/^\([^ ]*\).*\([ 0-9]{5,5}\)$/\2 = \1/
```

```
XSCREEN.WORK.PDB510          THU, DEC 22, 1983, 10:57 AM    PAGE  1


M68K1,P BEGIN
NFILE cscreen.work;
@LIST;
INTEGER TABLE yscreen :=
ENDS
```

```
YSCREEN.WORK.PDB510          THU, DEC 22, 1983, 10:57 AM    PAGE  1


 M68KL:(23.8.83)         THU, DEC 22, 1983,  6:03 AM
   1  M68KL,P BEGIN
   4  INTEGER TABLE yscreen :=
   5    ORG
   5  END$
   6  $yscreen:
   5  END$
        ^
  ERROR 2
missing NUMBER

  1 ERRORS
 KSPMAX=3 MSPMAX=9 SSPMAX=7191 $SPMMX=1 CSPMAX=0 DSPMAX=1
 FSPMAX=0 PSPMAX=0 RSPMAX=0 OSPMAX=0
ELAPSED TIME 0:10
CPU TIME 0:03
```

```
FSCREENO.WORK.PDB510         THU, DEC 22, 1983, 10:57 AM    PAGE  1


PROCEDURE  print_string(string,blocklength,block);
   VALUE   string,blocklength,block;
   INTEGER blocklength,block;
   RLPMA   string;                                    EXTERNAL.L;
PROCEDURE  print_big_string(string,blocklength,block);
   VALUE   string,blocklength,block;
   INTEGER blocklength,block;
   RLPMA   string;                                    EXTERNAL.L;
SUBROUTINE blank_display;                             EXTERNAL.L;
SUBROUTINE enable_display;                            EXTERNAL.L;
```

```
FSCREEN1.WORK.PD8510          THU, DEC 22, 1983, 10:57 PM    PAGE  1


& CHANGES MUST BE DUPLICATED IN f/sactv2.work &

& title &
EXTERNAL BYTE ARRAY title_array[-1:1];
EXTERNAL RLPNA title;

& error &
EXTERNAL BYTE ARRAY errpr_array[-1:1];
EXTERNAL RLPNA error;

& function &
EXTERNAL BYTE PNARY function_array[-1:1];
EXTERNAL RLPNA function;

& entry &
EXTERNAL BYTE ARRRY entry_array[-1:1];
EXTERNAL RLPNA entry;
EXTERNAL BOOLEAN entry_flip_flop;

& entry aux &
EXTERNAL BYTE ARRAY entry_aux_array[-1:1];
EXTERNAL RLPNA entry_aux;
```

```
CSCREEN2.UORK.PD8510          &HU, DEC 22, 1983, 10:57 AM    PAGE  1


&FILE echara.work;

INTEGER CONSTANT Hilight_1      := 128,
                 hilight_2      := 129,
                 hilight_3      := 130,
                 hilight_4      := 131,
                 hilight_5      := 132,
                 hilight_6      := 133,
                 hilight_7      := 134,
                 hilight_8      := 135,
                 hilight_9      := 136,
                 hilight_10     := 137,
                 sk_indicator   := 144,
                 ok_hracket_2   := 145,
                 sk_bracket_3   := 146,
                 sk_bracket_4   := 147,
                 ok_bracket_5   := 148,
                 ok_bracket_6   := 149,
                 ok_brachet_7   := 150,
                 ok_bracket_8   := 151;
```

```
FSCREEN2.UORK.PD3510          THU, DEC 22, 1983, 10:57 AM    PAGE  1


COMMENT these include offset for harduare inclusion of ldxy instruction;
EXTERNAL INTEGER trace1_baee.L,
                 trace2_base.L,
                 trace1_n_base.L,
                 trace2_n_base.L;
```

```
SSCREEN2.UORK.PD5510          THU, DEC 22, 1983, 10:57 AM    PAGE  1


%68KL,P,"scrn2"
BEGIN

#FILE fiocnfig.uorh;                                  & for dg_ldxy &
NFILE cscreen.uork;                    & for trace..._display constants &

COMMENT these include offset for harduare inclusion of ldxy instruction;
GLOBAL INTEGER trace1_base.L    = dg_ldxy + 2^trace1_display,
               trace2_base.L    = dg_ldxy + 2^trace2_display,
               trace1_n_bate.L  = dg_ldxy + 2^trace1n_display,
               trace2_n_base.L  = dg_ldxy + 2^trace2n_display;

END&
```

```
SSCREENP.WORK.PD8510          THU, DEC 22, 1983, 10:57 RM    PAGE  1


$LIST OFF$
&WSLIN1I$
PROGRAM screen_constants( input, output );

{ senvarta a number (including leading blanks) in the first 5 characters
  of a line to four numbers -- n, 2^n, hex(n), hex(2^n) -- and outputs
  the expanded line.
}

CONST
   hex_chars  = '0123456789ABCDEF';
   line_max   = 80;  {maximum length of an input line}
   hex_max    = 4;   {maximum length of a hex string}

TYPE
   line_index = 0..line_max;
   line_type  = STRING[line_max];
   hex_index  = 0..hex_max;
   hex_type   = STRING[hex_max];

VAR
   line_in,
   line_out   : line_type;
   number     : integer;
   dummy      : line_index;

FUNCTION  hex( number:integer ):hex_type;
   VAR
      position : hex_index;
      temp_string : hex_type;
   BEGIN (hex)
      position := hex_max;
      temp_string := strrpt( '0', hex_max );
      WHILE ( (number > 0) AND (position > 0) ) DO
         BEGIN (while)
            temp_string[position] := hex_chars[ 1 + (number MOD 16) ];
            number := number DIV 16;
            position := position - 1;
         END;  {while}
      hex := temp_string;
   END;  {hex}

BEGIN (screen_constants)

writeln( output, 'n':6, '2n':6, 'nH':5, '2nH':5, 'addr':7,
                 'description':14 );
writeln( output );

WHILE NOT eof( input ) DO
   BEGIN (while)

      readln( input, line_in );
      line_in := strrtrim( line_in );

      strread( line_in, 1, dummy, number );
```

```
SSCREENP.WORK.PD8510          THU, DEC 22, 1983, 10:57 RM    PAGE  2


      strdelete( line_in, 1, dummy-1 );

      writs(output, number:6, (2^number):6 );
      write(output, hex(number):5, hex(2^number):5 );
      write(output, ' 10', hex(2^number):4 );
      writeln( output, line_in );

   END;  {while}

END.  {screen_constants}
```

```
FSIZE.WORK.PD8510             THU, DEC 22, 1983, 10:57 RM    PAGE  1


INTEGER SUBROUTINE number_of_points;                    EXTERNAL;
INTEGER SUBROUTINE array_size;                          EXTERNAL;
INTEGER SUBROUTINE block_size;                          EXTERNAL;
```

```
SSIZE.WORK.PD8510             THU, DEC 22, 1983, 10:57 RM    PAGE  1


M68KL,P,"size"
BEGIN

%FILE fchdata.work;
%FILE cnbngr.work;                                  & for header_size &

INTEGER TABLE   data_array_size :=                  & indexed by step_size &
&  0           &    0,                          & # bytes per complex data array &
&  1 = 801 pts &  801 * 6,
&  2 = 401 pts &  401 * 6,
&  3           &    0,
&  4 = 201 pts &  201 * 6,
&  5           &    0,
&  9           &    0,
&  7           &    0,
&  8 = 101 pts &  101 * 6,
&  9           &    0,
& 10           &    0,
& 11           &    0,
& 12           &    0,
& 13           &    0,
& 14           &    0,
& 15           &    0,
& 16 =  51 pts &   51 * 6;

INTEGER TABLE   data_block_size :=                  & indexed by step_size &
&  0           &    0,                          & # bytes per storage data block &
&  1 = 801 pts &  (((801 * 8) + header_size) OR %003F) + 1,
&  2 = 401 pts &  (((401 * 6) + header_size) OR %003F) + 1,
&  3           &    0,
&  4 = 201 pts &  (((201 * E) + header_size) OR %003F) + 1,
&  5           &    0,
&  6           &    0,
&  7           &    0,
&  8 = 101 pts &  (((101 * 6) + header_size) OR %003F) + 1,
&  9           &    0,
& 10           &    0,
& 11           &    0,
& 12           &    0,
& 13           &    0,
& 14           &    0,
& 15           &    0,
& 16 =  51 pts &  ((( 51 * 6) + header_size) OR %003F) + 1;

INTEGER TABLE   number_of_pts :=                    & indexed by step_size &
&  0 &    0,
&  1 &  801,
&  2 &  401,
&  3 &    0,
&  4 &  201,
&  5 &    0,
&  6 &    0,
&  7 &    0,
&  8 &  101,
&  9 &    0,
```

```
SSIZE.WORK.PD8510          THU, DEC 22, 1983, 10:58 AM    PAGE  2


& 10 &    0,
& 11 &    0,
& 12 &    0,
& 13 &    0,
& 14 &    0,
& 15 &    0,
& 16 &   51;
```

```
SSIZE.UORK.PD8510          THU, DEC 22, 1983, 10:58 AM    PAGE  3


%EJECT;
COMMENT                                                    number_of_points
*************************************************************************
*
*************************************************************************
;
INTEGER SUBROUTINE number_of_points;                              ENTRY;
   BEGIN & number_of_points &
      number_of_points := nonber_of_pts[step_size];
   END;  & number_of_points &
```

```
SSIZE.UORK.PD8510          THU, DEC 22, 1983, 10:58 AM    PAGE  4


%EJECT;
COMMENT                                                      array_size
*************************************************************************
*
*************************************************************************
;
INTEGER SUBROUTINE array_size;                                    ENTRY;
   BEGIN & array_size &
      array_size := data_array_size[step_size];
   END;  & array_size &
```

```
SSIZE.UORK.PD3510          THU, DEC 22, 1983, 10:58 AM    PAGE  5


%EJECT;
COMMENT                                                      block_size
*************************************************************************
*
*************************************************************************
;
INTEGER SUBROUTINE block_size;                                    ENTRY;
   BEGIN & block_size &
      block_size := data_block_size[step_size];
   END;  & block_size &

END$
```

FSK.WORK.PD8510 THU, DEC 22, 1983, 10:58 AM PAGE 1

```
sbatkbd
scommand
scontrol
scontvar
smarker
sparam
sparser
sresparm
stopAbd
```

USK.UORK.PD8510 IHU, DEC 22, 1983, 10:58 AM PAGE 1

```
)i off
c skanfo.uork
1
/^\$/
1,.d
v/^[0-9A-Z]/d
1,$s/^./#FILE c/
1,$s/$/:/
1,$s/\.L;/;/
uq ccnddec1.uork
```

BSKEY.UORK.PD8510 THU, DEC 22, 1983, 10:58 AM PAGE 1

DSKEY.UORK.PD8510 THU, DEC 22, 1983, 10:58 AM PAGE 2

```
HE3ECT;
COMMENT
SODC*

NAME--
  skey
*************************************************************************
*
* SHORT DESCRIPTIOH--
*   contains tables uhich configure softkey nenus
*
* EXTENDED DESCRIPTION--
*   This is a seperately conpiled nodule uhich contains the following
*   tables of information used to generated softkey nenus:
*
*     - softkey nenu tables, SKSO..SKSn (uhere n=nunber of nenus)
*     - table of addresses to softkey nenu configuration tables
*     - table of softkey annotations
*     - table of indices to table of softkey annotations
*       (indexed by connand code value of each softkey)
*
*   These tables are generated by a pre-proceaaor uhich uses an input
*   file containing the actual softkey nenu information in a nodifiable
*   and pictureeque format.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CRLLED--
*   none
*
* ERROR CONDITIONS RND RECOVERY--
*   none
*
* NOTES--
*   Rny changes to be nade in these tables nust be nade in the input
*   file (SKINFO) to the progran (GENSN) uhich generates these tables.
*
* RUTHOR--
*
*************************************************************************
*
* INITIRL REFINEMENT--
*   NR
*
*************************************************************************
*
* REVISION LOG--
*
*************************************************************************
DECLARRTION--
  INTEGER TABLE SKSO..SKSn
  DOUBLE TABLE MENU
```

```
DSKEY.WORK.PDSS1D              THU, DEC 22, 1983, 10:58 AM     PAGE   3


  INTEGER TABLE LBL_INDEX
  ALPHA TABLE SK_LABEL

$DOC-;
```

```
DSKEY.WORK.PD8S1D              THU, DEC 22, 1983, 10:58 AM     PAGE   4


REJECT;
COMMENT
$DOC+

NAME--
  SKS0..SKSn
*****************************************************************************
*
* SHORT DESCRIPTION--
*   Tables of softkey menu configuration
*
* EXTENDED DESCRIPTION--
*   Each menu table is variable in length depending on the number of
*   softkeys per menu and how many of those softkeys bring up other
*   menus.  The tables are configured as follows:
*
*      +-----------------------------------------+
*      | B15 | B14 | B13 |....| B2 | B1 | B0 | softkey position bitmap
*      +-----------------------------------------+
*      | B15 | .... | B8  |   not used          | "next menu" bitmap
*      +-----------------------------------------+
*      |  softkey command token value            |
*      +-----------------------------------------+
*      |  "next-menu" number based on bitmap     |
*      +-----------------------------------------+
*                        :
*                        :
*      +-----------------------------------------+
*      |  softkey command token value            | up to 8 possible softkeys
*      +-----------------------------------------+
*      |  "next menu" number based on bitmap     | up to 8 "next menu" ptrs
*      +-----------------------------------------+
*
*   The first word of each table contains 8 bit pairs (B0/B1..B14/B15)
*   corresponding to 8 softkey positions on the display (top to bottom).
*   Each pair of bits can contain a value indicating the following:
*      0 = no active softkey in this softkey position
*      1 = active softkey containing 1 line of annotation
*      2 = active softkey containing 2 lines of annotation
*
*   The most significant byte (B8..B15) of the second word contains a
*   bitmap where each set bit corresponds to softkeys which bring up
*   another menu.  The least significant byte of this word it not used
*   as part of the configuration.
*
*   The rest of the words in each table are command token values
*   corresponding to each active softkey as they occur in the softkey
*   position bitmap.  These words are followed by softkey menu numbers
*   only if the "next menu" bitmap indicates another menu is to be
*   brought up by that softkey.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
```

```
DSKEY.WORK.PD851D              THU, DEC 22, 1983, 10:58 AM     PAGE   5


*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
**********^--**************************************************************
*
* INITIAL REFINEMENT--
*   NA
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************

DECLARATION--

  INTEGER TABLE SKS0
        :
        :
  INTEGER TABLE SKSn

$DOE-;
```

```
DSKEY.WORK.PD851D              THU, DEC 22, 1983, 10:58 AM     PAGE   6


REJECT;
COMMENT
$DOC+

NAME--
  SK_MENU
*****************************************************************************
*
* SHORT DESCRIPTION--
*   Table of softkey menu addresses
*
* EXTENDED DESCRIPTION--
*   This table contains the addresses of each softkey menu configuration
*   table.  Each menu configuration is identified by an integer constant
*   which is used as an index into this table in order to access the
*   corresponding address for that menu.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   NA
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************

DECLARATION--

  DOUBLE TABLE SK_MENU

$DOC-;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  SK_LABEL
*****************************************************************
*
* SHORT DESCRIPTION--
*   Table of softkey annotations
*
* EXTENDED DESCRIPTION--
*   This table contains strings from 1 to 10 characters long which are
*   used to label softkeys.  Each string is unique and occurs only once
*   in this table.  Softkeys which share common strings or simply have
*   unique strings use this table to look up the labels needed to
*   display the annotated menu.
*
*   The table is indexed using a pair of values from another table.
*   These values index the strings which correspond to the first and
*   second line (if any) of each softkey function.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   NA
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--

  GLOBAL ALPHA TABLE SK_LABEL

$DOC-;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
. LBL_INDEX
*****************************************************************
*
* SHORT DESCRIPTION--
*   Table of indices to table of softkey labels
*
* EXTENDED DESCRIPTION--
*   This table contain indices which occur in pairs used to index the
*   table of softkey labels (SK_LABEL) in order to access the first and
*   second line (if any) of each softkey.  If a softkey contains only
*   one line, then the second index of the index pair will be 0 (which
*   indexes a blank line).
*
*   The index pairs are arranged in order of softkey command token
*   values.  This enables a command token value multiplied by 2 to
*   to index into the location of an index pair.
*
* INPUTS--
*   None
*
* OUTPUTS--
*   none
*
* ROUTINES CALLED--
*   none
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   NA
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************

DECLARATION--

  GLOBAL INTEGER TABLE LBL_INDEX

$DOC-;
```

```
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EXTERNAL DOUBLE TABLE SK_MENU.L;
EXTERNAL ALPHA TABLE SK_LABEL.L;
EXTERNAL INTEGER TABLE LBL_INDEX.L;
```

```
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M68KL,P,"skey" BEGIN

%FILE cntnu.work;
%FILE cscreen.work;
COMMENT
  Configures bit pairs to correspond to softkeys that are used.
  SKnn = softkey position n contains n lines.
  BSKn = softkey position n that brings up another menu
  n    = 1..8
  n    = 0..2
;
INTEGER CONSTANT
  SK11 := 1,
  SK12 := 2,
  SK13 := 3,
  SK21 := 4,
  SK22 := 8,
  SK23 := 12,
  SK31 := %10,
  SK32 := %20,
  SK33 := %30,
  SK41 := %40,
  SK42 := %50,
  SK43 := %60,
  SK51 := %100,
  SK52 := %200,
  SK53 := %300,
  SK61 := %400,
  SK62 := %800,
  SK63 := %C00,
  SK71 := %1000,
  SK72 := %2000,
  SK73 := %3000,
  SK81 := %4000,
  SK82 := %8000,
  SK83 := %C000,
  BSK1 := %100,
  BSK2 := %200,
  BSK3 := %400,
  SSK4 := %800,
  BSK5 := %1000,
  BSK6 := %2000,
  BSK7 := %4000,
  BSK8 := %8000;
COMMENT
      The rest of this file is software generated by GENSK.LANI,
      Any changes must be made to the input file, SKINFO.WORK.
      ********************************************************
      The following are softkey menu tables configured as follows:
        word 1 = MSByte: corresponding keys that bring up new menus
                 LSByte: menu's highlight bitmap
        word 2 = menu configuration using constants SKnn
        word 3 = keycode number corresponding to softkey1 used
          etc.
        word K = up to 10 keycode values
```

```
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;
INTEGER TABLE SKS0 :=       & TAPE_MENU &
0SK#+0,
SK11+SK21+SK31+SK41+SKS1+SKS2+0,
  1,   & "DIRECTORY"   &
  2,   & "STORE"   &
  3,   & "LOAD"   &
  4,   & "DELETE"   &
  5,   & "UN-DELETE"   &
  6,   & "INIIIRLIZE" "IAPE" &
INIT_IRPE_MENU;


INTEGER TABLE SKS1 :=       & INIT_TAPE_MENU &
0,
SK12+&K21+0,
  7,   & "INIT TAPE?" "YES" &
  8;   & "NO"   &


INTEGER TABLE SKS2 :=       & DIRECTORY_MENU &
0,
3K12+SK42+SK52+Sk72+SKS2+0,
  9,   & "RESTORE" "DISPLAY" &
 10,   & "NEXT" "PAGE" &
 11,   & "PREVIOUS" "PAGE" &
 12,   & "FIRST" "PAGE" &
 13;   & "LAST" "PAGE" &


INTEGER TABLE SKS3 :=       & DATA2_MENU &
0,
SK12+SK21+SK32+SKS2+SK82+0,
 14,   & "RAW" "DATA" &
 15,   & "DATA"   &
 16,   & "FORMATTED" "DATA" &
 17,   & "USER" "DISPLAY" &
 1&;   & "MACHINE" "DUMP" &


INTEGER TABLE 5KS4 :=       & DATA1_MENU &
0SKS+0,
SK12+SK22+SK32+SK42+SK51+SK62+SK71+SK81+0,
 19,   & "INSTRUMENT" "STATE" &
 20,   & "INSTPUMENI" "STATES 1-5" &
 21,   & "MEMORY" "TRACE" &
 22,   & "MEMORY" "TRACES 1-4" &
 23,   & "CRL SET"   &
 24,   & "CRL SETS" "1-S" &
 25,   & "CRL KII"   &
 26,   & "MORE"   &
DATA2_MENU;


INTEGER TABLE SKS5 :=       & ABORT_MENU &
0,
```

```
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SK11+0,
 27;   & "ABORT"   &


INTEGER TABLE SKS6 :=       & FILE_MENU &
0,
SK12+SK22+SK32+5K42+SK52+SK62+SK72+SK82+0,
 28,   & "DATA TYPE " "1 FILE 1" &
 29,   & " " "1 FILE 2" &
 30,   & " " "1 FILE 3" &
 31,   & " " "1 FILE 4" S
 32,   & " " "1 FILE 5" &
 33,   & " " "1 FILE 6" &
 34,   & " " "1 FILE 7" &
 35;   & " " "1 FILE 8" &


INTEGER TABLE 3K37 :=       & REG_MENU &
0,
SK12+SK22+SK32+3K42+SK52+SK62+SK72+SK82+0,
 36,   & "DATA TYPE " "1 1 " &
 37,   & " " "1 2 " &
 38,   & " " "1 3 " &
 39,   & " " "1 & " &
 40,   & "(POWER HP)" "1 5 " &
 41,   & " " "1 6 " &
 42,   & " " "1 7 " &
 43;   & " " "LAST STATE" &


INTEGER TABLE SKS& :=       & RESPONSE_MENU &
0,
5K12+SK21+SK32+3K42+SK52+SK61+SK72+SK81+0,
 44,   & "ELECTRICAL"+sk_bracket_2 "DELAY" &
 45,   & "AUTO DELAY"   &
 &&,   & "PHASE" "OFFSET" &
 47,   & "MAGNITUDE  "OFFSET" &
 48,   & "AVERRGING"+sk_bracket_2 "ON/RESTART" &
 49,   & "OFF"   &
 50,   & "SHOOTMING"+sk_bracket_2 "ON " &
 51;   & "OFF"   &


INTEGER TABLE SK39 :=       & IF_GAIN_MENU &
0SK1+0SK2+0,
3K12+SK22+0,
 52,   & "TEST"+sk_bracket_2 "AMP. GAIN" &
IF_GAIN_MENU2,
 53,   & "REFERENCE" "AMP. GAIN" &
IF_GAIN_MENU2;


INTEGER TABLE 3K310 :=      & IF_GAIN_MENU2 &
0,
SK12+SK21+SK31+SK41+SKS1+SK61+0,
 54,   & "GAIN"+sk_bracket_6 "0 (BIN.)" &
```

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 55,   & " 1 "   &
 56,   & " 2 "   &
 57,   & " 3 "   &
 58,   & "4 (MRK.)"   &
 59;   & "RUIO"   &


INTEGER TABLE SKS11 :=      & STIMULUS_MENU &
0SK1+0SK3+0SKS+0,
SK12+3K22+3K32+SKS2+SK61+SK71+SK81+0,
 60,   & "POWER" "MEKU" &
POWER_MENU,
 61,   & "SUEEP" "TIME" &
 62,   & "NUMBER of" "POIMIS" &
M_POINTS_MENU,
 63,   & "SINGLE"+sk_bracket_3 "POINT" &
 64,   & "RAMP"   &
 65,   & "STEP"   &
 26,   & "MORE"   &
STIMKILUS2_MENU;


INTEGER TABLE SKS12 :=      & K_POINTS_MENU &
0,
SM12+SK21+SK31+SK41+0,
 66,   & "POINTS:"+sk_bracket_4 "51 " &
 67,   & "101"   &
 68,   & "201"   &
 69;   & "401"   &


INTEGER TABLE SKS13 :=      & POWER_MENU &
0,
SK11+SK32+SK41+SK62+SK71+0,
 70,   & "POWER"   &
 71,   & "SLOPE"+sk_bracket_2 "ON " &
 72,   & "OFF"   &
 73,   & "ATTENUATOR"+sk_bracket_2 "PORT 1" &
 74;   & "PORT 2"   &


INTEGER TABLE SKS14 :=      & STIMULUS2_MENU &
0,
SK11+SK21+SK32+SK41+SK52+SK71+SK81+0,
 75,   & sk_bracket_4 half_vt"HOLD" &
 76,   & "SINGLE"   &
 77,   & "NUMBER of" "GROUPS" &
 78,   & "CONTINUAL"   &
 79,   & "STIMULUS" "OFFSET" &
 80,   & sk_bracket_2 half_vt"CH1 = Ch2" &
 81;   & "Ch1 "+1E3+" Ch2"   &


INTEGER IABLE SKS15 :=      & DEVICE_REROY_MENU &
0,
SK22+0,
```

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 82;   & "PRESS TO" "CONTINUE" &


INTEGER TABLE SKS16 :=      & PARAM_MENU &
0SK7+0,
SK11+SK21+SN31+SK41+SK72+0,
 83,   & "a"+177+sk_bracket_4   &
 84,   & "b"+178   &
 85,   & "a"+178   &
 86,   & "b"+177   &
 87,   & "REDEFINE" "PARAMETER" &
REOEF_MENU;


INTEGER TABLE SKS17 :=      & REDEF_MENU &
0SK1+0SK2+0SK3+0SK4+0SK5+0,
SK12+SK21+SK31+SK42+SKS1+SK62+SK82+0,
 &&,   & "REDEFINE"+sk_bracket_6 "DRIVE" &
REDEF_DRIVE_MENU,
 89,   & "PHASE LOCK"   &
REDEF_LOCK_MENU,
 90,   & "NUMERATOR"   &
REDEF_NUM_MENU,
 91,   & "DENOMI-" "NRTOR" &
REDEF_DENUM_MENU,
 92,   & "CONVERSION"   &
REDEF_CONV_MENU,
 93,   & "PRRAMETER" "LABEL" &
 94;   & "REDEFINE" "DONE" &


INTEGER TABLE 3KS18 :=      & REDEF_DRIVE_MENU &
0,
SK12+SK21+SK31+0,
 95,   & "DRIVE"+sk_bracket_3 "PORT 1" &
 96,   & "PORT 2"   &
 97;   & "NONE"   &


INTEGER TABLE SKS19 :=      & REDEF_LOCK_MENU &
0,
SK12+SK21+SK31+0,
 98,   & "LOCK to"+sk_bracket_3 "at " &
 99,   & "a2 "   &
100;   & "NONE"   &


INTEGER TABLE SKS20 :=      & REDEF_NUM_MENU &
0SK5+0,
SK12+SK21+SK31+SK41+SK62+0,
101,   & "NUMERRTOR"+sk_bracket_5 "b1 " &
102,   & "b2 "   &
103,   & "a1 "   &
104,   & "a2 "   &
105,   & "SERVICE" "SELECTIONS" &
REDEF_KUM2_MENU:
```

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INTEGER TABLE SKS21 :=      & REDEF_NUM2_MENU &
0,
SK12+SK22+SK32+SK41+SK51+SK61+SK71+SKS1+0,
106,  & "100 kHz"+sk_bracket_8 "TEST CHL" &
107,  & "100 kHz" "REF CHL" &
108,  & "OE1ECIOR" "GROUND" &
109,  & "RDC GROUND"  &
110,  & "VCRL"  &
111,  & "VREF"  &
112,  & "TEMP. 1"  &
113;  & "TEMP. 2"  &


INTEGER TRBLE SKS22 :=      & REDEF_OENOD_MENU &
0,
SK12+SK21+SK31+SK41+0,
114,  & "OENOM."+sk_bracket_4 "at " &
115,  & "a2 "  &
116,  & "b1 "  &
117;  & "NO RATIO"  &


INTEGER TABLE SKS23 :=      & REDEF_CONV_MENU &
0,
SK12+SK21+SK31+SK41+0,
118,  & "CONVERT"+ak_bracket_4 "to   S" &
119,  & "to 1/S"  &
120,  & "to  Z"  &
121;  & "to  Y"  &


INTEGER TABLE SKS24 :=      & FORMAT_MENU &
0,
SK11+SK22+SK32+SK42+SK52+SK62+SK71+SKS1+0,
122,  & ek_bracket_8 half_vt+"SWR" &
123,  & "LINERR" "RAGNITUDE" &
124,  & "POLRR w/" "LIN MKR" &
125,  & "POLAR w/" "LOG MKR" &
126,  & "POLAR w/" "Re/Im MKR" &
127,  & "INVERTED" "SMITH" &
128,  & "IMAGINARY"  &
129;  & "REAL"  &


INTEGER TABLE SKS25 :=      & DONRIN_MENU &
BSK2+BSK6+BSK7+0,
SK11+SK22+SK32+SK42+SK62+SK71+0,
130,  & +k_bracket_4 half_vt+"FREQUENCY" &
131,  & "TIME" "LOU PASS" &
LOU_PASS_FRED,
132,  & "TIME" "BRNO PASS" &
133,  & "RUK. VOLT" "OUTPUT" &
134,  & "SPECIFY"+ek_bracket_2 "TIME" &
TIME_SETUP_MENU,
```

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135,  & "GATE"  &
GRIE_SEIUP_BENU;


INTEGER TRBLE 3KS26 :=      & LOU_PASS_FRED &
0,
SK22+0,
136;  & "SET FRED." "(LOW PASS)" &


INTEGER 1ABLE SKS27 :=      & TIME_SETUP_MENU &
0,
SK12+SK21+SK52+SK61+SK71+0,
137,  & "LOW PASS:"+sk_bracket_2 "STEP" &
138,  & "IMPULSE"  &
139,  & "UINODU:"+ok_bracket_3 "MAKIMUM" &
140,  & "NORMAL"  &
1&1;  & "MINIMUM"  &


INTEGER TABLE SKS28 :=      & GRIE_SETUP_MENU &
BSK7+0,
SK12+SK21+SK32+SK41+SK51+SK51+SK71+0,
142,  & "GATE"+sk_bracket_2 "ON" &
143,  & "OFF"  &
144,  & "GATE"+sk_bracket_4 "START" &
145,  & "STOP"  &
146,  & "CENTER"  &
147,  & "SPAN"  &
148,  & "GATE SHAPE"  &
GRTE_SHAPE_MENU;


INTEGER TABLE SKS29 :=      & GATE_SHAPE_MENU &
0,
SK52+SK61+SK71+SKS1+0,
149,  & "GRIE SHAPE"+sk_bracket_4 "MAKIMUM" &
150,  & "WIDE"  &
151,  & "NORMAL"  &
152;  & "MINIMUM"  &


INTEGER TABLE SKS30 :=      & CRL_MENU &
BSK8+0,
SK12+SK21+SK32+SK52+SK62+SK72+SK81+0,
153,  & "CORRECTION"+sk_bracket_3 "ON" &
154,  & "OFF"  &
155,  & "SELECT" "CRL SET" &
156,  & "CALIBRATE"+sk_bracket_3 "( KII #1 )" &
157,  & "CALIBRATE" "( KII N2 )" &
158,  & "RESUME CAL" "SEQUENCE" &
 26,  & "BORE"  &
MORE_CAL;


INTEGER TABLE SKS31 :=      & MORE_CAL &
```

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BSK1+BSK5+BSK6+0,
SK12+SK21+SK32+SK52+SK62+SK82+0,
159,  & "REFERENCE" "PLANES" &
REF_PLRNE_MENU,
160,  & "SET Z"+176  &
161,  & "CAL SWEEP" "VOLTAGE" &
162,  & "MODIFY KII"+sk_bracket_2 "( KII #1 )" &
MODIFY_EBL_KIT_MENU,
163,  & "MODIFY KIT" "( KII N2 )" &
MODIFY_CAL_KI1_MENU,
164;  & "DELETE R" "CRL SET" &


INTEGER TABLE SKS32 :=      & REF_PLRNE_MENU &
0,
SK31+SK41+0,
165,  & ek_bracket_2 half_vt+"PLRNE 1" &
166;  & "PLRNE 2"  &


INTEGER TABLE SKS33 :=      & CRL_TYPE_MENU &
0,
SK22+SK42+SK52+SK62+SK72+SK82+0,
167,  & "SE1 FREQ." "(LOU PASS)" &
168,  & "FREQDENCY"+ek_bracket_5 "RESPONSE" &
169,  & "S"+177+177+"  " "1-PORT" &
170,  & "S"+178+178+"  " "1-PORT" &
171,  & "ONE-PATH" "2-PORT" &
172;  & "FULL" "2-PORT" &


INTEGER TABLE SKS34 :=      & PORT_ONE_REFL &
0,
SK12+SK21+SK31+SK82+0,
173,  & "S"+177+177+"  "+ek_bracket_3 "PORT1 STD1" &
174,  & "PORT1 STD2"  &
175,  & "PORT1 STD3"  &
176;  & "SRVE" "S"+177+177+" CRL" &


INTEGER TRBLE SKS35 :=      & PORT_TWO_REFL &
0,
SK12+SK21+SK31+SK82+0,
177,  & "S"+178+178+"  "+sk_bracket_3 "PORT2 STD1" &
178,  & "PORT2 S1D2"  &
179,  & "PORT2 STD3"  &
180;  & "SAVE" "S"+17B+178+" CAL" &


INTEGER TABLE SKS36 :=      & CAL_MENU2 &
BSK1+BSK2+BSK3+0,
SK11+SK22+SK31+SK82+0,
181,  & sk_bracket_3 half_vt+"REFLECI'N" &
REFLECTION_MENU,
182,  & "TRANS-" "MISSION" &
TRANSMISSION_MENU,
```

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183,  & "ISOLATION"  &
ISOLRTION_MENU,
184;  & "SAVE" "2-PORT CRL" &


INTEGER TRBLE SKS37 :=      & REFLECTION_MENU &
0,
SK12+SK21+SK31+SK42+SK51+SK61+SKS2+0,
173,  & "S"+177+177+"  "+sk_bracket_3 "PORT1 STO1" &
174,  & "PORT1 STD2"  &
175,  & "PORT1 STD3"  &
177,  & "S"+178+178+"  "+sk_bracket_3 "PORT2 SID1" &
178,  & "PORT2 STD2"  &
179,  & "PORT2 S1D3"  &
185;  & "REFLECT'N" "DONE" &


INTEGER TRBLE SKS38 :=      & TRANSMISSION_MENU &
0,
SK22+SK32+SK42+SK52+SKS2+0,
186,  & "FUD.TRANS." "FWD_TRANS_" &
187,  & "FUD.MATCH" "FUD_MATCH_" &
188,  & "REV.TRANS." "REV_TRANS_" &
189,  & "REV.MATCH" "REV_MATCH_" &
190;  & "TRANS." "DONE" &


INTEGER TRBLE SKS39 :=      & ISOLRTION_MENU &
0,
SK32+SK52+SK52+SK82+0,
191,  & "OMIT" "ISOLRTION" &
192,  & "FUO ISOL'N" "FUD_ISOLN_" &
193,  & "REV ISOL'N" "REV_ISOLN_" &
194;  & "ISOLATION" "DONE" &


INTEGER TRBLE SKS40 :=      & CRL_MENU3 &
BSK1+BSK2+BSK3+0,
SK11+SK22+SK31+SK82+0,
195,  & sk_bracket_3 half_vt+"REFLECT'N" &
SIMPLE_REFLECTION_MENU,
196,  & "TRANS-" "MISSION" &
SIMPLE_TRANSMISSION_MENU,
197,  & "ISOLRTION"  &
SIMPLE_ISOLATION_MENU,
184;  & "SRVE" "2-PORT CRL" &


INTEGER TRBLE SKS41 :=      & SIMPLE_REFLECTION_MENU &
0,
SK12+SK21+SK31+SK82+0,
173,  & "S"+177+177+"  "+sk_bracket_3 "PORT1 S1D1" &
174,  & "PORT1 S1D2"  &
175,  & "PORT1 STD3"  &
198;  & "REFLECT'N" "DONE" &
```

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INTEGER TRBLE SKS&2 :=       & SIMPLE_TRANSMISSION_MENU &
0,
SK22+SK32+SK82+D,
186,   & "FUD.TRANS." "FWD_TRANS_" &
187,   & "FUD.MATCM" "FUO_MATCM_" &
190;   & "TRANS." "DONE" &


INTEGER TRBLE SKS43 :=       & SIMPLE_ISOLBIIAN_BENU &
0,
SK32+SK52+SKS2+0,
191,   & "OMIT" "ISOLATION" &
192,   & "FUD ISOL'M" "FUD_ISOLM_" &
194;   & "ISOLRTION" "DONE" &


INTEGER TABLE SKS&4 :=       & STD_CLASS_MENU &
0,
S#t1+SK21+SK31+SK41+SK51+SK61+SK71+SK82+D,
199,   & "STANDARD 1"   &
200,   & "SIRNORRD 2"   &
201,   & "STIBDARD 3"   &
202,   & "SIRNDORD 4"   &
203,   & "BTANDARD 5"   &
204,   & "SIANDARD 6"   &
205,   & "STPNORD 7"    &
206;   & "STANDARDS " "DONE" &


INTEGER TABLE SKS45 :=       & SLIDING_LOAD_MENU &
0,
SK12+SK82+0,
207,   & "SLIDE IS" "SET" &
20&;   & "SLIDING" "LOAD DONE" &


INTEGER TABLE SKS46 :=       & DODIFY_CRL_KIT_MENU &
BSK3+0,
SK12+SK32+SK42+SK82+SK82+D,
209,   & "SELECT" "STANDRRD" &
210,   & "SPECIFY" "SID CLASS" &
SPECIFY_CLRSS_MENU,
211,   & "LABEL" "STD CLASS" &
212,   & "LABEL" "CAL KII" &
213;   & "DONE" "(DEFINED)" &


INTEGER TRBLE SKS47 :=       & MODIFY_STDS_MENU &
BSK1+BSK2+BSK3+SSK4+BSK5+D,
SK12+SK21+SK31+SK42+SK52+D,
214,   & "STD TYPE"+sk_bracket_5 "OPEN" &
DEFINE_OPEN_MENU,
215,   & "SHORT"   &
DEFINE_SMORT_MENU,
216,   & "LORD"    &
```

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DEFINE_LORD_MENU,
217,   & "DELRY/" "TMRU" &
SPECIFY_OFFSET_MENU,
21&,   & "ARBITRARY" "IBPEDRNCE" &
SPECIFY_2_MENU;


INTEGER TRBLE SKS4S :=       & DEFINE_OPEN_MENU &
BSK6+0,
SK11+SK21+SK31+SK62+SK71+SK&2+0,
219,   & " C"+176+" "   &
220,   & " C"+177+" "   &
221,   & " C"+17S+" "   &
222,   & "SPECIFY" "OFFSET" &
SPECIFY_OFFSET_MENU,
223,   & "LABEL STD"   &
224;   & "DONE" "(DEFINED)" &


INTEGER TRBLE SKS49 :=       & DEFINE_SMORT_MENU &
BSK6+0,
SK62+SK71+SK82+D,
222,   & "SPECIFY" "OFFSET" &
SPECIFY_OFFSET_MENU,
223,   & "LABEL SID"   &
224;   & "DONE" "(DEFINED)" &


INTEGER TABLE SK350 :=       & DEFINE_LORD_MENU &
SSK6+0,
SK41+SK51+SK62+SK71+SKS2+D,
225,   & &k_bracket_2 half_vt+"FIXED" &
226,   & "SLIDING"   &
222,   & "SPECIFY" "OFFSET" &
SPECIFY_OFFSET_MENU,
223,   & "LABEL STD"   &
224;   & "DONE" "(DEFINED)" &


INTEGER TRBLE SKS51 :=       & SPECIFY_2_MENU &
RSK6+0,
SK11+SK21+SK31+SK41+SK51+SK62+SK71+SKS2+0,
219,   & " C"+176+" "   &
220,   & " C"+177+" "   &
221,   & " C"+178+" "   &
225,   & pk_bracket_2 half_vt+"FIXED" &
226,   & "SLIDING"   &
222,   & "SPECIFY" "OFFSE1" &
SPECIFY_OFFSET_MENU,
223,   & "LABEL STD"   &
224;   & "DONE" "(DEFINED)" &


INTEGER TRBLE SK352 :=       & SPECIFY_OFFSET_MENU &
0,
SK12+SK22+SK32+SK42+SK52+SK61+SK71+SK82+D,
```

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227,   & "OFFSET" "DELAY" &
22S,   & "OFFSET" "LOSS" &
229,   & "OFFSET" " Z"+176+" " &
230,   & "LOUER" "FREQUEMCY" &
231,   & "UPPER" "FREQUENCY" &
232,   & sk_bracket_2 half_vt+"CORK" &
233,   & "URVEGUIDE"   &
234;   & "DONE" "(DEFINED)" &


INTEGER TRBLE SKS53 :=       & SPECIFY_CLASS_MENU &
BSK7+0,
SK12+SK21+SK31+SK42+SK51+SK61+SK71+SKS2+0,
235,   & "S"+177+177+":  " "1st STD" &
236,   & "2nd STD"   &
237,   & "3rd STD"   &
238,   & "S"+178+178+":  " "1st STD" &
239,   & "2nd STD"   &
2&0,   & "3rd STD"   &
241,   & "MORE"   &
SPECIFY_CLASS_MENU2,
242;   & "DONE" "(SPEC'D)" &


INTEGER TRBLE SKS54 :=       & SPECIFY_CLRSS_MENU2 &
0,
SK12+SK21+SK42+SKS2+D,
243,   & "TRMS.:" "FUD STD" &
244,   & "REV SID"   &
245,   & "FREQUENCY" "RESP. STD" &
242;   & "DONE" "(SPEC'D)" &


INTEGER TABLE SKS55 :=       & DISPLAY_MENU &
DSK2+BSK7+0,
SK12+SK22+SK31+SK41+SK52+SK62+SK72+SKS2+D,
246,   & "SINGLE "+sk_bracket_2 "CMANNEL" &
247,   & "DUAL   " "CMANNEL" &
DUAL_CM_MENU,
248,   & sk_brackt_4 half_vt+"DRIM" &
249,   & "MEMORY"   &
250,   & "DATA "+3S "MEMORY" &
251,   & "MATM" "(...)" &
252,   & "SELECT" "DEFAULTS" &
DISPLAY_DEFRULT_MENU,
253;   & "DATA "+169 "MEMORY" &


INTEGER TRBLE SKS5E :=       & DUAL_CM_MENU &
0,
SK12+SK22+D,
254,   & "2 CMANNEL"+sk_bracket_2 "OVERLAY" &
255;   & "2 CMANNEL" "SPLIT" &


INTEGER TRBLE SKSS7 :=       & DISPLAY_DEFAULT_MENU &
```

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SSKEY.UORK.PO&51O              IMU, DEC 22, 1983, 10:58 RM    PRGE  13


BSK5+BSK7+D,
3K12+SK21+SK31+SK41+SK51+SK72+D,
256,   & "MEMORY"+pk_bracket_5 " 1 " &
257,   & " 2 "   &
258,   & " 3 "   &
259,   & " 4 "   &
260,   & "MORE"   &
MEMORY_MENU,
261,   & "MATM" "OPERATIONS" &
MATM_MENU;


IKTEGER TRBLE SKS58 :=       & MEMORY_MENU &
0,
SK52+SK62+D,
262,   & "DATA from"+sk_bracket_2 "CMANNEL 1" &
263;   & "OR1R from" "CMANNEL 2" &


INTEGER TABLE SKS59 :=       & MATM_MENU &
0,
3K42+SK52+SK62+SK72+D,
264,   & "DRTA"+sk_bracket_4 "+ MEMORY" &
265,   & "DATA" "- MEMORY" &
266,   & "DATA" mpy_char+" MEMORY" &
267;   & "DRTR" "/ MEMORY" &


INTEGER TRBLE SKS60 :=       & COPY_MENU &
BSK6+BSK7+BSK8+D,
SK12+SK21+SK31+SK41+SK51+SK62+SK72+SK81+0,
268,   & "PLOI"+sk_bracket_5 "ALL" &
269,   & "TRACE"   &
270,   & "GRATICULE"   &
271,   & "MARKER(S)"   &
272,   & "TEKT"   &
273,   & "SELECT" "DURDRRKT" &
PLOT_SETUP_MENU,
274,   & "SELECT" "PEN COLOR" &
PEN_MENU,
275,   & "MORE"   &
PLOTPRRM_MENU;


INTEGER TABLE SKS61 :=       & PLOTPARM_MENU &
BSK7+6SK8+D,
SK12+SK72+SKS2+0,
276,   & "LIST TRACE" "VALUES" &
277,   & "SYSTEM"+sk_bracket_2 "PARAMETERS" &
COPY2_MENU,
278,   & "OPERATING" "PARAMETERS" &
COPY2_MENU;


INTEGER TABLE SKS62 :=       & PLOT_SETUP_MENU &
0,
```

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SK22+3K32+SK42+SK52+SK62+D,
275,   & "K -   LEFT"+sk_bracket_5 "- -  UPPER" &
280,   & "- -   LEFT" "K -  LDUER" &
281,   & "- K  RIGHT" "- -  UPPER" &
282,   & "- -  RIGHT" "- K  LDUER" &
283;   & "K K   FULL" "K K   PAGE" &


IMTEGER TRBLE SKS63 :=       &. PEM_MEMU &
0,
SK12+SK21+SK31+SK41+SK51+SK61+SK71+SK81+0,
284,   & "PEN"+sk_bracket_8 " 1 " &
285,   & " 2 "   &
286,   & " 3 "   &
287,   & " 4 "   &
288,   & " 5 "   &
289,   & " 6 "   &
290,   & " 7 "   &
291;   & " 8 "   &


IMTEGER TRBLE SKS64 :=       & COPY2_MEMU &.
0,
3K12+SK21+SK31+SK81+D,
  9,   & "RESTORE" "DISPLAY" &.
292,   & sk_bracket_2 half_vt+"PRIMT" &
293,   & "PLDT"   &
294;   & "MEKT PRGE"   &


IMTEGER TRBLE SKS65 :=       & MARKER_MENU &
BSK7+BSK8+D,
SK12+SK21+SK31+SK41+SK51+SK62+SK72+SKS1+D,
295,   & "MARKER"+sk_bracket_6 "         1 " &
295,   & "         2 "   &
297,   & "         3 "   &
298,   & "         4 "   &
299,   & "         6 "   &
300,   & "ALL" "OFF" &
301,   & delta_char+" RODE" "MENU" &
DELTA_BARKER_MEKU,
 26,   & "MORE"   &
BARKER2_MENU;


IMTEGER TABLE SKS66 :=       & DELTA_MRRKER_MEMU &
0,
SK11+SK21+SK31+SK41+SK51+SK62+D,
302,   & sk_bracket_6 half_vt+delta_char+" REF = 1" &
303,   & delta_char+" REF = 2"   &
304,   & delta_char+" REF = 3"   &
305,   & delta_char+" REF = 4"   &
306,   & delta_char+" REF = 5"   &
307;   & delta_char+" MODE" "OFF" &
```

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IKTEGER TRBLE SKS67 :=       & MARKER2_MENU &
0,
SK72+SK81+D,
308,   & "MARKER tc"+sk_bracket_2 "MIMIMUM" &
309;   & "MAKIMUM"   &


IMTEGER TRBLE SKS62 :=       & SYSTEM_MEMU &
BSK1+BSK2+BSK8+D,
SK11+SK22+SK32+SK82+0,
310,   & "TITLE"   &
TI1LE_MENU,
311,   & "HP-IB" "ADDRESSES" &
MPIB_MENU,
312,   & "CRT" "OFF" &
313,   & "SERVICE" "FUNCIIOMS" &
SERVICE_MEMU;


INTEGER TRBLE SKS69 :=       & TITLE_MEMU &
0,
SK12+SK31+SK41+SK62+SK81+0,
314,   & "SELECT" "LETTER" &
315,   & "SPRCE"   &
316,   & "BRCKSPRCE"   &
317,   & "ERRSE" "TITLE" &
31S;   & "DONE"   &


INTEGER TRBLE &RS70 :=       & MPIB_MENU &
0,
SK12+SK21+SK31+SK41+SK51+SK61+SK71+SK81+0,
319,   & "8510 HP-IB"+sk_bracket_8 "ADDRESS" &
320,   & "SYSTEM BUS"   &
321,   & "SOURCE"   &
322,   & "TEST SET"   &
323,   & "PLOTTER"   &
324,   & "PRINTER"   &
325,   & "AUTO CMD"   &
326;   & "PASS TMRU"   &


INTEGER TRBLE SKS71 :=       & SERVICE_MENU &
BSK4+D,
3K12+SK22+SK31+SK41+SK51+SK61+SK71+SK81+D,
327,   & "SOFTWARE" "REVISION" &
328,   & "SYSTEM BUS"+sk_bracket_2 "'LOCRL'" &
329,   & "'REMOTE'"   &
330,   & "IF GRIM"   &
IF_GRIM_MENU,
331,   & sk_bracket_3 half_vt+"LOCRIION" &
332,   & "PEEK"   &
333,   & "POKE"   &
334;   & "TEST MENU"   &
```

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COMMENT  Softkey menu table containing addresses of
         softkey menus indexed by menu number;

GLOBRL DOUBLE TABLE SK_MENU :=
  RDRS(SKS0),
  RDRS(SKS1),
  RORS(SKS2),
  MRKS(SKS3),
  RORS(SKS4),
  RORS(SKS5),
  RDRS(SKS6),
  RDRS(SKS7),
  RDRS(SKS8),
  BDRS(SKS9),
  ADRS(SKSID),
  RDRS(SKS11),
  RORS(SKS12),
  RDRS(SKS13),
  RORS(SKS14),
  BDRS(SKS15),
  RORS(SKS16),
  BDRS(SKS17),
  RDRS(SKS1S),
  BDRS(SKS19),
  BDRS(SKS20),
  RDRS(SKS21),
  BDRS(SKS22),
  BDRS(SKS23),
  RORS(SKS24),
  RORS(SKS25),
  RORS(SKS2E),
  RORS(SKS27),
  RDRS(SKS28),
  BDRS(SKS29),
  RDRS(SKS30),
  RDRS(SKS31),
  RORS(SKS32),
  BDRS(SKS33),
  RDRS(SKS34),
  RORS(SKS35),
  RDRS(SKS36),
  BDRS(SKS37),
  RORS(SKS38),
  RORS(SKS39),
  RDRS(SKS40),
  BDRS(SK541),
  RDRS(SKS42),
  RDRS(SKS43),
  RORS(SKS44),
  BDRS(SKS45),
  RDRS(SKS46),
  RDRS(SKS47),
  RORS(SKS48),
  BDRS(SKS49),
  RDRS(SKS50),
  RDRS(SKS51),
```

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  RORS(SKS52),
  RDRS(SKS53),
  RDRS(SKS54),
  RDRS(SKS55),
  RDRS(SKS56),
  ADRS(SKS57),
  RORS(SKS5S),
  RORS(SKS59),
  RDRS(SKS60),
  RDRS(SKS61),
  RDRS(SKS62),
  RDRS(SKS63),
  RDRS(SKS64),
  RDRS(SKS65),
  RDRS(SKS65),
  RORS(SKS67),
  RORS(SKSG8),
  RDRS(SKS69),
  RDRS(SKS70),
  RORS(SKS71),
  0;


COMMENT  Softkey labels accessed by key label tables;

GLOBAL RLPHA TABLE SK_LABEL :=
  &   0 &   " ",
  &   1 &   "DIRECTORY",
  &   2 &   "STORE",
  &   3 &   "LOAD",
  &   4 &   "DELETE",
  &   5 &   "UN-DELETE",
  &   6 &   "INITIRLIZE",
  &   7 &   "TAPE",
  &   8 &   "INIT TAPE?",
  &   9 &   "YES",
  &  10 &   "NO",
  &  11 &   "RESTORE",
  &  12 &   "DISPLAY",
  &  13 &   "NEXT",
  &  14 &   "PAGE",
  &  15 &   "PREVIOUS",
  &  16 &   "FIRST",
  &  17 &   "LAST",
  &  18 &   "RAW",
  &  19 &   "DATA",
  &  20 &   "FORMATTED",
  &  21 &   "USER",
  &  22 &   "MACHINE",
  &  23 &   "DUMP",
  &  24 &   "INSTRUMENT",
  &  25 &   "STATE",
  &  26 &   "STATES 1-5",
  &  27 &   "MEMORY",
  &  28 &   "TRACE",
  &  29 &   "TRACES 1-4",
```

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```
& 30 &  "CAL SET",
& 31 &  "CAL SETS",
& 32 &  "1-8",
& 33 &  "CAL KIT",
& 34 &  "MOKE",
& 35 &  "MODR1",
& 35 &  "DATA TYPE ",
& 37 &  "* FILE 1",
& 38 &  " "
& 39 &  "* FILE 2",
& 40 &  "* FILE 3",
& 41 &  "* FILE 4",
& 42 &  "* FILE 5",
& 43 &  "* FILE 6",
& 44 &  "* FILE 7",
& 45 &  "* FILE 8",
& 46 &  "* 1 ",
& 47 &  "* 2 ",
& 48 &  "* 3 ",
& 49 &  "* 4 ",
& 50 &  "(POWER UP)",
& 51 &  "* 5 ",
& 52 &  "* 6 ",
& 53 &  "* 7 ",
& 54 &  "LAST STATE",
& 55 &  "ELECTRICAL"+ek_bracket_2,
& 56 &  "DELAY",
& 57 &  "AUTO DELAY",
& 58 &  "PHASE",
& 59 &  "OFFSET",
& 60 &  "MAGNITUDE",
& 61 &  "AVERAGING"+ek_bracket_2,
& 62 &  "ON/RESTART",
& 63 &  "OFF",
& 64 &  "SMOOTHING"+ek_bracket_2,
& 65 &  "ON ",
& 66 &  "TEST"+ek_bracket_2,
& 67 &  "RMP. GAIN",
& 68 &  "REFERENCE",
& 69 &  "GAIN"+ek_bracket_6,
& 70 &  "0 (MIN.)",
& 71 &  " 1 ",
& 72 &  " 2 ",
& 73 &  " 3 ",
& 74 &  "4 (MAX.)",
& 75 &  "AUTO",
& 7E &  "POWER",
& 77 &  "MENU",
& 78 &  "SWEEP",
& 79 &  "TIME",
& 80 &  "MARKER of",
& 81 &  "POINTS",
& 82 &  "SINGLE"+ek_bracket_3,
& 33 &  "POINT",
& 84 &  "RAMP",
& 85 &  "STEP",
```

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```
& 86 &  "POINTS:"+ek_bracket_4,
& 87 &  "51 ",
& 88 &  "101",
& 89 &  "201",
& 90 &  "401",
& 91 &  "SLOPE"+ek_bracket_2,
& 92 &  "ATTENUATOR"+ek_bracket_2,
& 93 &  "PORT 1",
& 94 &  "PORT 2",
& 95 &  ek_bracket_4,
& 96 &  Half_vt+"HOLD",
& 97 &  "SINGLE",
& 95 &  "GROUPS",
& 99 &  "CONTINUAL",
& 100 &  "STIMULUS",
& 101 &  ek_bracket_2,
& 102 &  Half_vt+"Ch1 = Ch2",
& 103 &  "Ch1 "+163+" Ch2",
& 104 &  "PRESS TO",
& 105 &  "CONTINUE",
& 106 &  "a"+177+ek_bracket_4,
& 107 &  "b"+178,
& 108 &  "a"+178,
& 109 &  "b"+177,
& 810 &  "REDEFINE",
& 111 &  "PARAMETER",
& 112 &  "REDEFINE"+ek_bracket_6,
& 113 &  "DRIVE",
& 114 &  "PHASE LOCK",
& 115 &  "NUMERATOR",
& 116 &  "DENOMI-",
& 117 &  "RATOR",
& 118 &  "CONVERSION",
& 119 &  "LABEL",
& 120 &  "DONE",
& 121 &  "DRIVE"+ek_bracket_3,
& 122 &  "MODE",
& 123 &  "LOCK to"+ek_bracket_3,
& 124 &  "a1 ",
& 125 &  "a2 ",
& 126 &  "NUMERATOR"+ek_bracket_5,
& 127 &  "b1 ",
& 128 &  "b2 ",
& 129 &  "SERVICE",
& 130 &  "SELECTIONS",
& 131 &  "100 kHz"+ek_bracket_8,
& 132 &  "TEST CAL",
& 133 &  "100 kHz",
& 134 &  "REF CAL",
& 135 &  "DETECTOR",
& 136 &  "GROUND",
& 137 &  "ROC GROUND",
& 138 &  "VCAL",
& 133 &  "VREF",
& 140 &  "TEMP. 1",
& 141 &  "TEMP. 2",
```

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```
& 142 &  "DENOM."+ek_bracket_4,
& 143 &  "NO RATIO",
& 144 &  "CONVERT"+ek_bracket_4,
& 145 &  "to  S",
& 146 &  "to 1/S",
& 147 &  "to  Z",
& 148 &  "to  Y",
& 149 &  ek_bracket_8,
& 150 &  Half_vt+"SUR",
& 151 &  "LINEAR",
& 152 &  "POLAR ∠/",
& 153 &  "LIN MKR",
& 154 &  "LOG MKR",
& 155 &  "Re/Im MKR",
& 156 &  "INVERTED",
& 157 &  "SKITH",
& 158 &  "IMAGINARY",
& 159 &  "REAL",
& 160 &  Half_vt+"FREQUENCY",
& 161 &  "LOW PASS",
& 162 &  "BAND PASS",
& 163 &  "AUX. VOLT",
& 164 &  "OUTPUT",
& 165 &  "SPECIFY"+ek_bracket_2,
& 166 &  "GATE",
& 167 &  "SET FREQ.",
& 168 &  "(LOW PASS)",
& 169 &  "LOW PASS:"+ek_bracket_2,
& 170 &  "IMPULSE",
& 171 &  "WINDOW:"+ek_bracket_3,
& 172 &  "MAXIMUM",
& 173 &  "NORMAL",
& 174 &  "MINIMUM",
& 175 &  "GATE"+ek_bracket_2,
& 176 &  "ON",
& 177 &  "GATE"+ek_bracket_4,
& 178 &  "START",
& 179 &  "STOP",
& 190 &  "CENTER",
& 181 &  "SPAN",
& 182 &  "GATE SHAPE",
& 183 &  "GATE SHAPE"+ek_bracket_4,
& 184 &  "WIDE",
& 185 &  "CORRECTION"+ek_bracket_3,
& 186 &  "SELECT",
& 187 &  "CALIBRATE"+ek_bracket_3,
& 188 &  "( KIT #1 )",
& 189 &  "CALIBRATE",
& 190 &  "( KIT #2 )",
& 191 &  "RESUME CAL",
& 192 &  "SEQUENCE",
& 193 &  "PLANES",
& 194 &  "SET Z"+176,
& 195 &  "CAL SWEEP",
& 196 &  "VOLTAGE",
& 197 &  "MODIFY KIT"+ek_bracket_2,
```

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```
& 198 &  "MODIFY KIT",
& 199 &  "DELETE #",
& 200 &  half_vt+"PLANE 1",
& 201 &  "PLANE 2",
& 202 &  "FREQUENCY"+ek_bracket_5,
& 203 &  "RESPONSE",
& 204 &  "S"+177+177+"  ",
& 205 &  "1-PORT",
& 206 &  "S"+175+178+"  ",
& 207 &  "ONE-PATH",
& 208 &  "2-PORT",
& 209 &  "FULL",
& 210 &  "S"+177+177+"  "+ek_bracket_3,
& 211 &  "PORT1 STD1",
& 212 &  "PORT1 STD2",
& 213 &  "PORT1 SIO3",
& 214 &  "SAVE",
& 215 &  "S"+177+177+" CAL",
& 216 &  "S"+178+178+"  "+ek_bracket_3,
& 217 &  "PORT2 STD1",
& 218 &  "PORT2 STD2",
& 219 &  "PORT2 STD3",
& 220 &  "S"+175+178+" CAL",
& 221 &  ek_bracket_3,
& 222 &  Half_vt+"REFLECT'N",
& 223 &  "TRANS-",
& 224 &  "MISSION",
& 225 &  "ISOLATION",
& 226 &  "2-PORT CAL",
& 227 &  "REFLECT'N",
& 228 &  "FWD.TRANS.",
& 229 &  "FWD_TRANS_",
& 230 &  "FWD.MATCH",
& 231 &  "FWD_MATCH_",
& 232 &  "REV.TRANS.",
& 233 &  "REV_TRANS_",
& 234 &  "REV.MATCH",
& 235 &  "REV_MATCH_",
& 236 &  "TARNS.",
& 237 &  "ObIT",
& 238 &  "FWD ISOL'N",
& 239 &  "FWD_ISOLN_",
& 240 &  "REV ISOL'N",
& 241 &  "REV_ISOLN_",
& 242 &  "S"+177+177+ek_bracket_3,
& 243 &  "STANDARD 1",
& 244 &  "STANDARD 2",
& 245 &  "STANDARD 3",
& 246 &  "STANDARD 4",
& 247 &  "STANDARD 5",
& 245 &  "STANDARD 6",
& 249 &  "STANDARD 7",
& 250 &  "STANDARDS ",
& 251 &  "SLIDE IS",
& 252 &  "SET",
& 253 &  "SLIDING",
```

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```
  S 254 &   "LORD DONE",
    & 255 &   "STRNDRRD",
    & 256 &   "SPECIFY",
    & 257 &   "STD CLASS",
    & 258 S   "(DEFINED)",
    & 259 &   "SID TYPE"+sk_bracket_5,
    & 260 &   "OPEN",
    & 261 &   "SHORT",
    & 262 &   "DELRY/",
    & 263 &   "THRU",
    & 264 &   "ARBITRARY",
    & 265 &   "IMPEDANCE",
    & 266 &   " C"+176+" ",
    & 267 &   " C"+177+" ",
    & 268 &   " C"+178+" ",
    & 269 &   "LABEL STD",
    & 270 &   half_vt+"FIXED",
    & 271 &   "LOSS",
    & 272 &   " Z"+176+" ",
    & 273 &   "LOWER",
    & 274 &   "FREQUENCY",
    & 275 &   "UPPER",
    & 276 &   half_vt+"COAX",
    & 277 &   "WAVEGUIDE",
    & 278 &   "S"+177+177+":  ",
    & 279 &   "1st SID",
    & 280 &   "2nd SID",
    & 281 &   "3rd STD",
    & 282 &   "S"+178+178+":  ",
    & 283 &   "(SPEC'D)",
    & 284 &   "TRANS.:",
    & 285 &   "FWD STD",
    & 286 &   "REV STD",
    & 287 &   "RESP. STD",
    & 288 &   "SINGLE "+sk_bracket_2,
    & 289 &   "CHANNEL",
    & 290 &   "DUAL  ",
    & 291 &   half_vt+"DATA",
    & 292 &   "DATA "+38,
    & 293 &   "MATH",
    & 294 &   "(...)",
    & 295 &   "DEFAULTS",
    & 296 &   "DATA "+169,
    & 297 &   "2 CHANNEL"+sk_bracket_2,
    & 298 &   "OVERLAY",
    & 299 &   "2 CHANNEL",
    & 300 &   "SPLIT",
    & 301 &   "MEMORY"+sk_bracket_5,
    & 302 &   " 4 ",
    & 303 &   "OPERATIONS",
    & 304 &   "DATA from"+sk_bracket_2,
    & 305 &   "CHANNEL 1",
    & 306 &   "DATA from",
    & 307 &   "CHANNEL 2",
    & 308 &   "DATA"+sk_bracket_4,
    & 309 &   "+ MEMORY",
```

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```
    & 310 &   "- MEMORY",
    & 311 &   mpy_char+" MEMORY",
    & 312 &   "/ MEMORY",
    & 313 &   "PLOT"+sk_bracket_5,
    & 314 &   "ALL",
    & 315 &   "GRATICULE",
    & 316 &   "MARKER(S)",
    & 317 &   "TEXT",
    & 318 &   "QUADRANT",
    & 319 &   "PEN COLOR",
    & 320 &   "LIST TRACE",
    & 321 &   "VALUES",
    & 322 &   "SYSTEM"+sk_bracket_2,
    & 323 &   "PARAMETERS",
    & 324 &   "OPERATING",
    & 325 &   "X -   LEFT"+sk_bracket_5,
    & 326 &   "- -  UPPER",
    & 327 &   "- -   LEFT",
    & 328 &   "X -  LOWER",
    & 329 &   "- X  RIGHT",
    & 330 &   "- -  RIGHT",
    & 331 &   "- X  LOWER",
    & 332 &   "X X   FULL",
    & 333 &   "X X   PAGE",
    & 334 &   "PEN"+sk_bracket_8,
    & 335 &   " 5 ",
    & 336 &   " 6 ",
    & 337 &   " 7 ",
    & 338 &   " 8 ",
    & 339 &   half_vt+"PRINT",
    & 340 &   "PLOT",
    & 341 &   "NEXT PAGE",
    & 342 &   "MARKER"+sk_bracket_6,
    & 343 &   "       1 ",
    & 344 &   "       2 ",
    & 345 &   "       3 ",
    & 346 &   "       4 ",
    & 347 &   "       5 ",
    & 348 &   delta_char+" MODE",
    & 349 &   ok_bracket_6,
    & 350 &   half_vt+delta_char+" REF = 1",
    & 351 &   delta_char+" REF = 2",
    & 352 &   delta_char+" REF = 3",
    & 353 &   delta_char+" REF = 4",
    & 354 &   delta_char+" REF = 5",
    & 355 &   "MARKER to"+sk_bracket_2,
    & 356 &   "TITLE",
    & 357 &   "HP-IB",
    & 358 &   "ADDRESSES",
    & 359 &   "CRT",
    & 360 &   "FUNCTIONS",
    & 361 &   "LETTER",
    & 362 &   "SPACE",
    & 363 &   "BACKSPACE",
    & 364 &   "ERASE",
    & 365 &   "S510 HP-IB"+sk_bracket_8,
```

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```
    & 366 &   "ADDRESS",
    & 367 &   "SYSTEM BUS",
    & 368 &   "SOURCE",
    & 369 &   "TEST SET",
    & 370 &   "PLOTTER",
    & 371 &   "PRINTER",
    & 372 &   "RUIO CMD",
    & 373 &   "PASS THRU",
    & 374 &   "SOFTWARE",
    & 375 &   "REVISION",
    & 376 &   "SYSTEM BUS"+sk_bracket_2,
    & 377 &   "'LOCAL'",
    & 378 &   "'REMOTE'",
    & 379 &   "IF GAIN",
    & 380 &   half_vt+"LOCATION",
    & 381 &   "PEEK",
    & 382 &   "POKE",
    & 383 &   "TEST MENU",
    & 999 &   " ";


COMMENT  Softkey label indexed for each softkey;

GLOBRL INTEGER TABLE LBL_INDEX :=
    1,  0,   & "DIRECTORY"    &
    2,  0,   & "STORE"    &
    3,  0,   & "LORD"    &
    4,  0,   & "DELETE"    &
    5,  0,   & "UN-DELETE"    &
    6,  7,   & "INITIALIZE" "TAPE"  &
    8,  9,   & "INIT TAPE?" "YES"  &
   10,  0,   & "NO"    &
   11, 12,   & "RESTORE" "DISPLAY"  &
   13, 14,   & "NEXT" "PAGE"  &
   15, 14,   & "PREVIOUS" "PAGE"  &
   16, 14,   & "FIRST" "PAGE"  &
   17, 14,   & "LAST" "PAGE"  &
   18, 19,   & "RAW" "DATA"  &
   19,  0,   & "DATA"    &
   20, 19,   & "FORMATTED" "DATA"  &
   21, 12,   & "USER" "DISPLAY"  &
   22, 23,   & "MACHINE" "DUMP"  &
   24, 25,   & "INSTRUMENT" "STATE"  &
   26, 26,   & "INSTRUMENT" "STATES 1-5"  &
   27, 28,   & "MEMORY" "TRACE"  &
   27, 29,   & "MEMORY" "TRACES 1-4"  &
   30,  0,   & "CAL SET"    &
   31, 32,   & "CAL SETS" "1-5"  &
   33,  0,   & "CAL XII"    &
   34,  0,   & "MORE"    &
   35,  0,   & "ABORT"    &
   36, 37,   & "DATA TYPE " "* FILE 1"  &
   38, 39,   & " " "* FILE 2"  &
   38, 40,   & " " "* FILE 3"  &
   38, 41,   & " " "* FILE 4"  &
   38, 42,   & " " "* FILE 5"  &
```

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```
   38, 43,   & " " "* FILE 6"  &
   38, 44,   & " " "* FILE 7"  &
   38, 45,   & " " "* FILE 8"  &
   36, 46,   & "DATA TYPE " "* 1 "  &
   38, 47,   & " " "* 2 "  &
   38, 48,   & " " "* 3 "  &
   38, 49,   & " " "* 4 "  &
   50, 51,   & "(POWER UP)" "* 5 "  &
   38, 52,   & " " "* 6 "  &
   38, 53,   & " " "* 7 "  &
   38, 54,   & " " "LAST STATE"  &
   55, 56,   & "ELECTRICAL"+sk_bracket_2 "DELAY"  &
   57,  0,   & "RUIO DELAY"    &
   58, 59,   & "PHASE" "OFFSET"  &
   60, 59,   & "MAGNITUDE" "OFFSET"  &
   61, 62,   & "AVERAGING"+sk_bracket_2 "OK/RESTART"  &
   63,  0,   & "OFF"    &
   64, 65,   & "SMOOTHING"+sk_bracket_2 "ON "  &
   63,  0,   & "OFF"    &
   66, 67,   & "TEST"+ok_bracket_2 "AMP. GAIN"  &
   68, 67,   & "REFERENCE" "AMP. GAIN"  &
   69, 70,   & "GAIN"+sk_bracket_6 "0 (DIN.)"  &
   71,  0,   & " 1 "    &
   72,  0,   & " 2 "    &
   73,  0,   & " 3 "    &
   74,  0,   & "4 (MAX.)"    &
   75,  0,   & "RUIO"    &
   76, 77,   & "POWER" "MENU"  &
   78, 79,   & "SWEEP" "TIME"  &
   80, 81,   & "NUMBER of" "POINTS"  &
   82, 83,   & "SINGLE"+sk_bracket_3 "POINT"  &
   84,  0,   & "RAMP"    &
   85,  0,   & "STEP"    &
   86, 87,   & "POINTS:"+sk_bracket_4 "51 "  &
   88,  0,   & "101"    &
   89,  0,   & "201"    &
   90,  0,   & "401"    &
   76,  0,   & "POWER"    &
   91, 65,   & "SLOPE"+sk_bracket_2 "ON "  &
   63,  0,   & "OFF"    &
   92, 93,   & "ATTENUATOR"+sk_bracket_2 "PORT 1"  &
   94,  0,   & "PORT 2"    &
   95, 96,   & ok_bracket_4 half_vt+"HOLD"  &
   97,  0,   & "SINGLE"    &
   80, 98,   & "NUMBER of" "GROUPS"  &
   99,  0,   & "CONTINUAL"    &
  100, 59,   & "STIMULUS" "OFFSET"  &
  101,102,   & sk_bracket_2 half_vt+"Ch1 = Ch2"  &
  103,  0,   & "Ch1 "+163+" Ch2"    &
  104,105,   & "PRESS TO" "CONTINUE"  &
  106,  0,   & "a"+177+sk_bracket_4    &
  107,  0,   & "b"+178    &
  108,  0,   & "a"+178    &
  109,  0,   & "b"+177    &
  110,111,   & "REDEFINE" "PARAMETER"  &
  112,113,   & "REDEFINE"+sk_bracket_6 "DRIVE"  &
```

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```
      END
```

902

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```
M68KL,P,"stack"
BEGIN

COMMENT  This is a dunny to allow reassignment of RAM pointer for stack;
GLOBAL LABEL mark_stack;

mark_stack:

END$
```

USTACK.UORK.PDS510 THU, DEC 22, 1983, 10:59 AM PAGE 1

```
1,$s/^.//
g/MESSAGE/s/^.*MESSPGE/^/
s/SPMARK/s/^^/
v/^/d
1
/===*/,$d
1,$s/SPMARK//g
1,$s/^[ ^]*//
g/^f=/.-1,.j
g/O=/s/^\(.*\)\(S=.*\)\(D=.*\)\(F=.*\)/\1\3\2\4/
Oa
MAX STACK SIZES
M68KL
K=250 N=400 O=800  S=18000 B=15  C=15  F=24  P=64  R=54  O=16
RSM58K
K=25  M=25  O=3000 S=32000

.
)ts 7,13,20,28,34,40,46,52,58
1,$s/ +/\t/g
```

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```
EXTERNAL INTEGER kit_basc.L;
EXTERNAL INTEGER kit_bsse2.L;
```

```
SSTDDRTR.WORK.POS5TO          THU, DEC 22, 1853, 10:59 AM     PAGE  1


M6SKL,P,"stddata"
BECIN

#FILE cstds.work;                                   & type2 values  &
#FILE ccal.work;                                    & for std_type'e &

COMMENT                                             cal_kit_descriptor
*****************************************************************
*
*****************************************************************
FIRST STD KIT
;
& calibration Kit label &
BYTE    TRBLE a00 := 10,07,'(,' ,'7,'n,'n,' ,'),' ,' ,' ; & hit label &
& ciaoa liate of calibration otendarde &
BYTE    TABLE b00 :=  1, 2, 0, 0, 0, 0, 0, 0,          & port1_lot_etd &
                      1, 1, 0, 0, 0, 0, 0, 0,          & port1_2nd_etd &
                      3, 9,10,12, 0, 0, 0, 0,          & port1_3rd_std &
                      1, 9, 0, 0, 0, 0, 0, 0,          & iooln_fud_ttd &
                      1,11, 0, 0, 0, 0, 0, 0,          & natch_fud_atd &
                      1,11, 0, 0, 0, 0, 0, 0,          & trana_fud_atd &
                      1, 2, 0, 0, 0, 0, 0, 0,          & port2_1st_atd &
                      1, 1, 0, 0, 0, 0, 0, 0,          & port2_2nd_atd &
                      3, 9,10,12, 0, 0, 0, 0,          & port2_3rd_etd &
                      1, 9, 0, 0, 0, 0, 0, 0,          & isaln_rav_atd &
                      1,11, 0, 0, 0, 0, 0, 0,          & natch_rev_etd &
                      1,11, 0, 0, 0, 0, 0, 0,          & trana_rev_atd &
                      3, 1, 2,11, 0, 0, 0, 0;          & freq_reep_etd &
& ciata labels &
BYTE    TABLE c00 := 10,05,'0,'P,'E,'M,' ,' ,' ,' ,' ,' , & port1_1at_ &
                     10,05,'S,'H,'O,'R,'T,' ,' ,' ,' ,' , & port1_2nd_ &
                     10,05,'L,'O,'R,'D,'S,' ,' ,' ,' ,' , & port1_Srd_ &
                     10,10,'I,'S,'D,'L,'',''M,' ,'S,'T,'D, & iooln_fud_ &
                     10,DR,'T,'H,'R,'U,' ,' ,' ,' ,' ,' , & natch_fud_ &
                     10,04,'T,'H,'R,'U,' ,' ,' ,' ,' ,' , & trane_fud_ &
                     10,05,'O,'P,'E,'M,' ,' ,' ,' ,' ,' , & port2_1tt_ &
                     10,05,'S,'H,'O,'R,'T,' ,' ,' ,' ,' , & port2_2nd_ &
                     10,05,'L,'O,'R,'O,'S,' ,' ,' ,' ,' , & pprt2_3rd_ &
                     10,10,'I,'S,'O,'L,'',''M,' ,'S,'T,'D, & iooln_rev_ &
                     10,04,'T,'H,'R,'U,' ,' ,' ,' ,' ,' , & natch_rev_ &
                     10,04,'T,'H,'R,'U,' ,' ,' ,' ,' ,' , & trane_rev_ &
                     10,05,'R,'E,'S,'P,'O,'M,'S,'E,' ,' ; & frea_reap_ &

& etd N  1 &
RERL    TRBLE a01 := 0, 999@9,                          & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, looa &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterninal &
BYIE    TABLE c01 := 10,06,' ,'S,'H,'O,'R,'T,' ,' ,' ,' ;     & label &
BYTE    TABLE d01 := etd_short, 0;                      & std_type, type2&
& std #  2 &
REAL    TABLE a02 := 0, 999@9,                          & fnin, fnae &
                     50.0, 0.0, 0.0,                  & Zo, delay, locs &
                     90.5.0.0,78.5, 0.0;         &c0, c1, c2, Zterninal&
BYTE    TRBLE c02 := 10,06,' ,'O,'P,'E,'N,' ,' ,' ,' ,' ;     & label &
BYTE    TABLE d02 := atd_open , 0;                      & etd_type, type2&
```

```
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& std #  3 &
RERL    TRBLE a03 := .749@9,  2.001@9,                  & fnin, fnax &
                     S0.0,&4.998cn&166.7684#-12, 5@8,  &Zo, delay, loss&
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c03 := 10,08,' ,'S,'H,'O,'R,'T,'@,'3,' ,' ;     & label &
BYTE    TRBLE d03 := atd_short, 0;                      & std_type, type2&
& std #  4 &
REAL    TABLE a04 := 1.999@9, 4.001@9,                  & fnin, fnax &
                     50.0,&2.495cn& &3.2522@-12, 5@8,  &Zo, delay, logs&
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c04 := 10,08,' ,'S,'H,'O,'R,'T,'H,'4,' ,' ;     & label &
BYTE    TRBLE d04 := otd_short, 0;                      & std_type, type2&
& std #  5 &
REAL    TABLE a0S := 3.999@9,  $.001@5,                 & fnin, fnax &
                     $0.0,&1.2459cn& 41.5720@-12,5@8,  &Zo, delay, lotoa&
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c05 := 10,08,' ,'S,'H,'O,'R,'T,'H,'5,' ,' ;     & label &
BYTE    TABLE d05 := std_short, 0;                      & atd_type, type2&
& std #  6 &
REAL    TABLE a06 := 7.999@3, 12.001@9,                 & fnin, fnax &
                     $0.0,&.73152cn& 24.4087@-12,5@8,  &Zo, delay, loss&
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c06 := 10,08,' ,'S,'H,'O,'R,'T,'H,'6,' ,' ;     & label &
BYTE    TABLE d06 := otd_ehort, 0;                      & std_type, type2&
& std #  7 &
REAL    TABLE a07 := 11.999@9, 1&.601@5,                & fniM, fnax &
                     50.0,&.$224&cn& 17.4336@-12,5@8,  &Zo, delay, lote&
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c07 := 10,08,' ,'S,'H,'O,'R,'T,'8,'7,' ,' ;     & label &
BYTE    TABLE d07 := std_short, 0;                      & ttd_type, type2&
& std #  8 &
REAL    TABLE a0S := 16.999@9,32.501@9,                 & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Z0, delay, loes &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c0S := 10,08,' ,'S,'H,'O,'R,'T,'H,'8,' ,' ;     & label &
BYTE    TABLE d0S := std_ohort, 0;                      & std_type, type2&
& std #  9 &
RERL    TRBLE a09 := 0, 99@9,                           & fniM, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, looo &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c09 := 10,09,'B,'R,'O,'A,'D,'B,'A,'N,'O,' ;     & label &
BYTE    TABLE d09 := std_load,  0;                      & std_type, type2&
& std # 10 &
RERL    TABLE a10 := 1.99@9,999.0000@9,                 & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loea &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c10 := 10,07,'S,'L,'I,'D,'I,'N,'6,' ,' ;        & label &
BYTE    TABLE d10 := std_load,  eliding;                & std_type, type2&
& std # 11 &
RERL    TABLE a11 := 0, 99@9,                           & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loss &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c11 := 10,06,' ,'T,'H,'R,'U,' ,' ,' ,' ;        & label &
BYTE    TABLE d11 := std_thru,  0;                      & std_type, type2&
& std # 12 &
REAL    TRBLE a12 := 0,2.001@9,                         & fnin, fnax &
```

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                     50.0, 0.0, 0.0,                  & Zo, delay, loea &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TRBLE c12 := 10,07,'L,'O,'U,'B,'A,'H,'O,' ,' ;        & label &
9YIE    TRBLE d12 := std_load,  0;                      & std_type, type2&
& std # 13 &
RERL    TABLE a13 := 0, 999@9,                          & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loss &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c13 := 10,09,'(,'L,'O,'R,'D,' ,'N,'5,'),' ;     & label &
BYTE    TABLE d13 := std_load,  0;                      & etd_type, type2&
& std # 14 &
REAL    TABLE a14 := 0. 999@9,                          & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loae &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TRBLE c14 := 10,09,'(,'L,'O,'R,'D,' ,'N,'6,'),' ;     & label &
BYTE    TRBLE d14 := atd_load,  0;                      & std_type, type2&
& std # 15 &
REAL    TABLE a15 := 0, 999@9,                          & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loss &
                     90.5,0.0,78.5, 0.0;         &c0, c1, c2, Zterminal&
BYTE    TABLE c15 := 10,09,'(,'D,'P,'E,'N,' ,'N,'1,'),' ;     & label &
BYTE    TABLE d15 := std_open,  0;                      & std_type, type2&
& std # 16 &
REAL    TRBLE a16 := 0, 59@9,                           & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, lOoa &
                     79.4,0.0,40.0, 0.0;         &c0, c1, c2, Zterminal&
BYTE    TABLE c16 := 10,08,'a,'l,'d,' ,'O,'P,'E,'N,' ;        & label &
BYTE    TRBLE d16 := std_open,  0;                      & std_type, typt2&
& std # 17 &
RERL    TRBLE a17 := 0, 99@9,                           & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loss &
                     0.0, 0.D, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYIE    TABLE c17 := 10,09,'(,'D,'P,'E,'N,' ,'N,'3,'),' ;     & label &
BYTE    TABLE d17 := std_open,  0;                      & std_type, type2&
& std # 18 &
REAL    TABLE a18 := 0, 999@9,                          & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loes &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYIE    1A5LE c18 := 10,09,'(,'O,'P,'E,'N,' ,'N,'4,'),' ;     & label &
BYTE    TRBLE d18 := std_open,  0;                      & otd_type, type2&
& std # 19 &
RERL    TABLE a19 := 0, 999@9,                          & fnin, fnax &
                     60.0, 0.0, 0.0,                  & Zo, delay, loea &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c19 := 10,09,'(,'T,'H,'R,'U,' ,'a,'1,'),' ;     & label &
BYTE    TABLE d19 := std_thru,  0;                      & std_type, type2&
& std a 20 &
RERL    TABLE a20 := 0, 999@9,                          & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loss &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
BYTE    TABLE c20 := 10,09,'(,'T,'H,'R,'U,' ,'a,'2,'),' ;     & label &
BYTE    TABLE d20 := std_thru,  0;                      & std_type, type2&
& std # 21 &
RERL    TABLE a21 := 0, 999@9,                          & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loss &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
```

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BYTE    TABLE c21 := 10,09,'(,'T,'h,'R,'U,' ,'N,'3,'),' ;     & label &
BYTE    TRBLE d21 := std_thru,  0:                      & std_type, type2&
& std a 22 &
RERL    TABLE a22 := 0, 999@9,                          & fnin, fnax &
                     50.0, 0.0, 0.0,                  & Zo, delay, loss &
                     0.0, 0.0, 0.0, 0.0;       & c0, c1, c2, Zterminal &
bYTE    TABLE c22 := 10,09,'(,'T,'H,'R,'U,' ,'a,'4,'),' ;     & label &
BYTE    TABLE d22 := std_thru,  0;                      & std_type, type2&

& filler &
BYTE    TABLE e22 := 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                     0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                     0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                     0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0;


COMMENT                                             cal_kit_descriptor
*****************************************************************1***
*
*****************************************************************
SECOND STD KIT
;
& calibration kit label &
BYTE    TABLE a50 := 10,09,'(,' ,'3,'..'5,'n,'n,' ,'),' ;
& claas lists of calibration standards &
BYTE    TRBLE b50 :=  1, 2, 0, 0, 0, 0, 0, 0,          & port1_1st_std &
                      1, 1, 0, 0, 0, 0, 0, 0,          & port1_2nd_std &
                      3, 9,10,12, 0, 0, 0, 0,          & port1_3rd_std &
                      1, 9, 0, 0, 0, 0, 0, 0,          & isoln_fud_std &
                      1,11, 0, 0, 0, 0, 0, 0,          & natch_fud_std &
                      1,11, D, 0, 0, 0, 0, 0,          & trans_fud_std &
                      1, 2, 0, 0, 0, 0, 0, 0,          & port2_1st_std &
                      1, 1, 0, 0, 0, 0, 0, 0,          & port2_2nd_std &
                      3, 9,10,12, 0, 0, 0, 0,          & port2_3rd_std &
                      1, 9, 0, 0, 0, 0, 0, 0,          & isoln_rev_std &
                      1,11, 0, 0, 0, 0, 0, 0,          & natch_rev_std &
                      1,11, 0, 0, 0, 0, 0, 0,          & trans_rev_std &
                      3, 1, 2,11, 0, 0, 0, 0;          & freq_resp_std &
& class labels &
BYTE    TRBLE c50 := 10,05,'O,'P,'E,'M,' ,' ,' ,' ,' ,' , & port1_1st_ &
                     10,05,'S,'H,'O,'R,'T,' ,' ,' ,' ,' , & port1_2nd_ &
                     10,05,'1,'O,'R,'D,'S,' ,' ,' ,' ,' , & port1_3rd_ &
                     10,10,'1,'S,'O,'1,'',''M,' ,'S,'T,'D, & isoln_fud_ &
                     10,04,'T,'H,'R,'U,' ,' ,' ,' ,' ,' , & natch_fud_ &
                     10,04,'T,'H,'R,'O,' ,' ,' ,' ,' ,' , & trans_fud_ &
                     10,05,'O,'P,'E,'M,' ,' ,' ,' ,' ,' , & port2_1st_ &
                     10,05,'S,'H,'O,'R,'T,' ,' ,' ,' ,' , & port2_2nd_ &
                     10,05,'1,'O,'R,'O,'S,' ,' ,' ,' ,' , & port2_3rd_ &
                     10,10,'I,'S,'D,'1,'',''M,' ,'S,'T,'D, & isoln_rev_ &
                     10,04,'T,'H,'R,'U,' ,' ,' ,' ,' ,' , & natch_rev_ &
                     10,04,'T,'H,'R,'U,' ,' ,' ,' ,' ,' , & trans_rev_ &
                     10,05,'R,'E,'S,'P,'O,'M,'S,'E,' ,' ; & freo_resp_ &

& std #  1 &
REAL    1RBLE a51 := 0, 999@9,                          & fnin, fnax &
```

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SSKEY.WORK.PDS510          THU, DEC 22, 1983, 10:58 AM    PAGE 26

  114,  0,   & "PHASE LOCK"    &
  115,  0,   & "NUMERATOR"     &
  116,117,   & "DENOMI-" "NATOR"  &
  118,  0,   & "CONVERSION"    &
  111,119,   & "PARAMETER" "LABEL"  &
  110,120,   & "MODIFIE" "DONE"  &
  121, 93,   & "DRIVE"+sk_bracket_3 "PORT 1"  &
   94,  0,   & "PART 2"    &
  122,  0,   & "NONE"      &
  123,124,   & "LOCK to"+sk_bracket_3 "a1 "  &
  125,  0,   & "a2 "       &
  122,  0,   & "NONE"      &
  126,127,   & "NUMERATOR"+sk_bracket_5 "b1 "  &
  128,  0,   & "b2 "       &
  124,  0,   & "a1 "       &
  125,  0,   & "a2 "       &
  129,130,   & "SERVICE" "SELECTIONS"  &
  131,132,   & "100 kHz"+sk_bracket_8 "IESI CAL"  &
  133,134,   & "100 kHz" "KEF CAL"  &
  135,136,   & "DETECTOR" "GROUND"  &
  137,  0,   & "ADC GROUND"    &
  138,  0,   & "VCRL"      &
  139,  0,   & "V&EF"      &
  140,  0,   & "TEMP. 1"   &
  141,  0,   & "TEMP. 2"   &
  142,124,   & "DEMOM."+sk_bracket_4 "a1 "  &
  125,  0,   & "a2 "       &
  127,  0,   & "b1 "       &
  143,  0,   & "RO RATIO"    &
  144,145,   & "CONVERT"+sk_bracket_4 "to   S"  &
  146,  0,   & "to 1/S"    &
  147,  0,   & "to   2"    &
  148,  0,   & "to   Y"    &
  149,150,   & sk_bracket_8 half_vt+"SUR"  &
  151, 60,   & "LINERR" "MAGNITUDE"  &
  152,153,   & "POLAR a/" "LIK MKR"  &
  152,154,   & "POLAR w/" "LOG MKR"  &
  152,155,   & "POLAR w/" "Re/In MKR"  &
  156,157,   & "INVERTED" "SMITH"  &
  158,  0,   & "IMAGINARY"    &
  159,  0,   & "REAL"      &
   95,160,   & sk_bracket_4 half_vt+"FREQUENCY"  &
   78,161,   & "TIME" "LOW PASS"  &
   78,162,   & "TIME" "WARD PASS"  &
  163,164,   & "AUX. VOLT" "OUTPUT"  &
  165, 79,   & "SPECIFY"+sk_bracket_2 "TIME"  &
  166,  0,   & "SATE"      &
  167,168,   & "SET FREQ." "(LOW PASS)"  &
  169, 85,   & "LOW PASS:"+sk_bracket_2 "STEP"  &
  170,  0,   & "IMPULSE"    &
  171,172,   & "WINDOW:"+sk_bracket_3 "MAXIMUM"  &
  173,  0,   & "NORMAL"     &
  174,  0,   & "MINIMUM"    &
  175,176,   & "WATE"+sk_bracket_2 "OM"  &
   63,  0,   & "OFF"      &
  177,178,   & "GATE"+sk_bracket_4 "START"  &
```

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SSKEY.WORK.PDS510          THU, DEC 22, 1983, 10:59 AM    PAGE 27

  179,  0,   & "STOP"     &
  180,  0,   & "CENTER"     &
  181,  0,   & "SPAN"     &
  182,  0,   & "GATE SHAPE"    &
  183,172,   & "DATE SHAPE"+sk_bracket_& "MAXIMUM"  &
  184,  0,   & "WIDE"     &
  173,  0,   & "NORBAL"     &
  174,  0,   & "MINIMUM"    &
  185,176,   & "CORRECTION"+sk_bracket_3 "OR"  &
   63,  0,   & "OFF"      &
  186, 30,   & "SELECT" "CRL SET"  &
  187,188,   & "CALIBRATE"+sk_bracket_3 "( &II &1 )"  &
  189,190,   & "CALIBRATE" "( KIT &2 )"  &
  191,192,   & "RESUME CAL" "SEQUENCE"  &
   &&,193,   & "REFERENCE" "PLANES"  &
  194,  0,   & "SET Z"+17G    &
  195,196,   & "CRL SWEEP" "VOLTAGE"  &
  197,188,   & "MODIFY KIT"+sk_bracket_2 "( &II &1 )"  &
  198,190,   & "MODIFY KIT" "( KIT &2 )"  &
  199, 30,   & "DELETE A" "CAL SET"  &
  101,200,   & ok_bracket_2 half_vt+"PLANE 1"  &
  201,  0,   & "PLANE 2"    &
  167,168,   & "SET FREQ." "(LOW PASS)"  &
  202,203,   & "FREQUENCY"+sk_bracket_5 "RESPONSE"  &
  204,205,   & "S"+177+177+"  " "1-PORT"  &
  206,205,   & "S"+178+178+"  " "1-PORT"  &
  207,208,   & "ONE-PRIM" "2-PORT"  &
  209,208,   & "FULL" "2-POR1"  &
  210,211,   & "S"+177+177+"  "+sk_bracket_3 "PORT1 SIO1"  &
  212,  0,   & "PORTI STO2"    &
  213,  0,   & "PORT1 STO3"    &
  214,215,   & "SAVE" "S"+177+177+" CRL"  &
  216,217,   & "S"+178+178+"  "+sk_bracket_3 "PORI2 STD1"  &
  218,  0,   & "PORT2 STO2"    &
  219,  0,   & "PORT2 STO3"    &
  214,220,   & "SAVE" "S"+178+178+" CRL"  &
  221,222,   & ok_bracket_3 half_vt+"REFLECT'N"  &
  223,224,   & "TRANS-" "MISSION"  &
  225,  0,   & "ISOLATION"    &
  214,226,   & "SAVE" "2-PORT CAL"  &
  227,120,   & "REFLECT'N" "DONE"  &
  228,229,   & "FWD.TRANS." "FWD_TRANS_"  &
  230,231,   & "FWD.MATCH" "FWD_MATCH_"  &
  232,233,   & "REV.TRANS." "REV_TRANS_"  &
  234,235,   & "REV.MATCH" "REV_MATCH_"  &
  236,120,   & "TRANS." "DONE"  &
  237,225,   & "OMIT" "ISOLATION"  &
  238,239,   & "FWD ISOL'N" "FWD_ISOLN_"  &
  240,241,   & "REV ISOL'N" "REV_ISOLN_"  &
  225,120,   & "ISOLATION" "DONE"  &
  221,222,   & ok_bracket_3 half_vt+"REFLECT'N"  &
  223,224,   & "TRANS-" "MISSION"  &
  225,  0,   & "ISOLATION"    &
  227,120,   & "REFLECT'N" "DONE"  &
  243,  0,   & "STANDARD 1"    &
  244,  0,   & "STANDARD 2"    &
```

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SSKEY.WORK.PDS510          THU, DEC 22, 1983, 10:59 AM    PAGE 28

  245,  0,   & "STANDARD 3"    &
  246,  0,   & "STANDARD 4"    &
  247,  0,   & "STANDARD 5"    &
  248,  0,   & "STANDARD E"    &
  249,  0,   & "STANDARD 7"    &
  250,120,   & "STANDARDS " "DONE"  &
  261,252,   & "SLIDE IS" "SET"  &
  253,254,   & "SLIDING" "LOAD DONE"  &
  186,255,   & "SELECT" "STANDARD"  &
  256,257,   & "SPECIFY" "SID CLASS"  &
  119,257,   & "LABEL" "SID CLASS"  &
  119, 33,   & "LABEL" "CRL KIT"  &
  120,258,   & "DONE" "(DEFINED)"  &
  259,260,   & "SID TYPE"+sk_bracket_5 "OPEN"  &
  261,  0,   & "SHORT"----&
    3,  0,   & "LOAD"     &
  262,263,   & "DELAY/" "THRU"  &
  264,265,   & "ARBITRARY" "IMPEDANCE"  &
  266,  0,   & " C"+176+"  "    &
  267,  0,   & " C"+177+"  "    &
  268,  0,   & " C"+178+"  "    &
  256, 59,   & "SPECIFY" "OFFSET"  &
  269,  0,   & "LABEL STD"    &
  120,258,   & "DONE" "(DEFINED)"  &
  101,270,   & ok_bracket_2 half_vt+"FIXED"  &
  253,  0,   & "SLIDING"    &
   59, 56,   & "OFFSET" "DELAY"  &
   59,271,   & "OFFSET" "LOSS"  &
   59,272,   & "OFFSET" " Z"+176+"  "  &
  273,274,   & "LOWER" "FREQUENCY"  &
  275,274,   & "UPPER" "FREQUENCY"  &
  101,276,   & ok_bracket_2 half_vt+"CORX"  &
  277,  0,   & "WAVEGUIDE"    &
  120,258,   & "DONE" "(DEFINED)"  &
  278,279,   & "S"+177+177+":  " "1st STD"  &
  280,  0,   & "2nd STD"    &
  281,  0,   & "3rd STD"    &
  282,279,   & "S"+178+178+":  " "1st STD"  &
  280,  0,   & "2nd STD"    &
  281,  0,   & "3rd STD"    &
   34,  0,   & "MORE"     &
  120,283,   & "DONE" "(SPEC'D)"  &
  284,285,   & "TRANS.:" "FWD STD"  &
  286,  0,   & "REV STD"    &
  274,287,   & "FREQUENCY" "BESP. STD"  &
  258,289,   & "SINGLE "+sk_bracket_2 "CHANNEL"  &
  290,289,   & "DUAL   " "CHANNEL"  &
   95,291,   & ak_bracket_4 half_vt+"DATA"  &
   27,  0,   & "MEMORY"     &
  292, 27,   & "DATA "+38 "MEMORY"  &
  293,294,   & "M&TH" "(...)"  &
  186,295,   & "SELECT" "DEFAULTS"  &
  296, 27,   & "DATA "+169 "MEMORY"  &
  297,298,   & "2 CHANNEL"+ak_bracket_2 "OVERLAY"  &
  299,300,   & "2 CHANNEL" "SPLIT"  &
  301, 71,   & "MEMORY"+sk_bracket_5 " 1 "  &
```

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SSKEY.WORK.PDS510          THU, DEC 22, 1983, 10:59 AM    PAGE 29

   72,  0,   & " 2 "     &
   73,  0,   & " 3 "     &
  302,  0,   & " 4 "     &
   34,  0,   & "BORE"     &
  293,303,   & "MATH" "OPERATIONS"  &
  304,305,   & "DATA from"+sk_bracket_2 "CHANNEL 1"  &
  306,307,   & "DATA from" "CHANNEL 2"  &
  308,305,   & "DATA"+sk_bracket_4 "+ MEMORY"  &
  19,310,    & "DATA" "- MEMORY"  &
  19,311,    & "DATA" mpy_char+" MEMORY"  &
  19,312,    & "DATA" "/ MEMORY"  &
  313,314,   & "PLOT"+sk_bracket_5 "ALL"  &
   28,  0,   & "TRACE"     &
  315,  0,   & "GRATICULE"    &
  316,  0,   & "MARKER(S)"    &
  317,  0,   & "TEXT"      &
  186,318,   & "SELECT" "QUADRANT"  &
  186,319,   & "SELECT" "PEN COLOR"  &
   34,  0,   & "MORE"     &
  320,321,   & "LIST TRACE" "VALUES"  &
  322,323,   & "SYSTEM"+sk_bracket_2 "PARAMETERS"  &
  324,323,   & "OPERATING" "PARAMETERS"  &
  325,326,   & "X -   LEFT"+sk_bracket_6 "- -  UPPER"  &
  327,328,   & "- -   LEFT" "X -  LOWER"  &
  329,326,   & "- X  RIGHT" "- -  UPPER"  &
  330,331,   & "- -  RIGHT" "- X  LOWER"  &
  332,333,   & "X X   FULL" "X X   PAGE"  &
  334, 71,   & "PEN"+sk_bracket_& " 1 "  &
   72,  0,   & " 2 "     &
   73,  0,   & " 3 "     &
  302,  0,   & " 4 "     &
  335,  0,   & " 5 "     &
  336,  0,   & " 6 "     &
  337,  0,   & " 7 "     &
  338,  0,   & " & "     &
  101,339,   & ak_bracket_2 half_vt+"PRINT"  &
  340,  0,   & "PLOT"      &
  341,  0,   & "NEXT PAGE"    &
  342,343,   & "MARKER"+sk_bracket_6 "        1 "  &
  344,  0,   & "         2 "    &
  345,  0,   & "         3 "    &
  346,  0,   & "         4 "    &
  347,  0,   & "         5 "    &
  314, 63,   & "ALL" "OFF"  &
  348, 77,   & delta_char+" MODE" "MENU"  &
  349,350,   & sk_bracket_6 half_vt+delta_char+" REF = 1"  &
  351,  0,   & delta_char+" REF = 2"    &
  352,  0,   & delta_char+" REF = 3"    &
  353,  0,   & delta_char+" REF = 4"    &
  354,  0,   & delta_char+" REF = 5"    &
  348, 63,   & delta_char+" MODE" "OFF"  &
  355,174,   & "MARKER to"+sk_bracket_2 "ALKIMUM"  &
  172,  0,   & "MAXIMUM"    &
  356,  0,   & "TITLE"     &
  357,358,   & "MP-IB" "ADDRESSES"  &
  359, 63,   & "CRT" "OFF"  &
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SSKEY.UORK.POSS10              THU, DEC 22, 1983, 10:59 AM     PAGE  30


  129,360,   & "SERVICE" "FUNCTIONS"  &
  186,361,   & "SELECT" "LETTER"  &
  362,  0,   & "SPACE"    &
  363,  0,   & "BACKSPACE"    &
  364,356,   & "ERASE" "TITLE"  &
  820,  0,   & "DONE"    &
  365,366,   & "S510 MP-IB"+sk_bracket_8 "ADDRESS"  &
  367,  0,   & "SYSTEM BUS"    &
  368,  0,   & "SOURCE"    &
  369,  0,   & "TEST SET"    &
  370,  0,   & "PLOTTER"    &
  321,  0,   & "PRINTER"    &
  372,  0,   & "RUN CMD"    &
  373,  0,   & "PASS THRU"    &
  374,375,   & "SOFTWARE" "REVISION"  &
  376,377,   & "SYSTEM BUS"+sk_bracket_2 +"'LOCAL'"  &
  378,  0,   & +"REMOTE'"    &
  379,  0,   & "IF GRIN"    &
  221,380,   & sk_bracket_3 half_vt+"LOCATION"  &
  381,  0,   & "PEEK"    &
  382,  0,   & "POKE"    &
  383,  0,   & "TEST MENU"    &
    0;

END$
```

```
FSKPBS.UORK.PDS510             THU, DEC 22, 1983, 10:59 AM     PAGE  1


EXTERNAL
INTEGER TABLE field.L;              & softkey maximum field width  &
EXTERNAL
INTEGER TABLE blanks.L;             & 64*n blanks added to sk_x    &
EXTERNAL
INTEGER TABLE sk_line1.L;           & y pos for 1st line of softkey8
EXTERNAL
INTEGER TABLE sk_line2.L;           & y pos for 2nd line of softkey&
```

```
SSKPOS.UORK.PDB510             THU, DEC 22, 1983, 10:59 AM     PAGE  1


ASSEMBLE,P,"skpos" BEGIN

RFILE eecreen.uork;

GLOBAL
INTEGER TABLE field :=              & softkey maximum field width  &
  sk11_display,sk21_display,sk31_display,sk41_display,sk51_display,
  sk61_display,sk71_display,sk81_display,
  sk12_display,sk22_display,sk32_display,sk42_display,sk52_display,
  sk62_display,sk72_display,sk82_display;

GLOBAL
INTEGER TABLE blanks :=             & 64*n blanks added to sk_x    &
  sk_x+640, sk_x+576, sk_x+512, sk_x+448, sk_x+384,
  sk_x+320, sk_x+256, sk_x+192, sk_x+128, sk_x+64, sk_x;

GLOBAL
INTEGER TABLE sk_line1 :=           & y pos for 1st line of softkey&
  sk11_y, sk21_y, sk31_y, sk41_y, sk51_y, sk61_y, sk71_y, sk81_y;

GLOBAL
INTEGER TABLE sk_line2 :=           & y pos for 2nd line of softkey&
  sk12_y, sk22_y, sk32_y, sk42_y, sk52_y, sk62_y, sk72_y, sk82_y;

END$
```

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RSQRT.UORK.PDB510              THU, DEC 22, 1983, 10:59 AM     PAGE  1


ASMB,L
      MED MESK SQUARE ROOT ROUTINE
      NAM SQRT,7,"FIX 27.8.80"
      ENT SQRT
R0    REG 0
R1    REG 1
R2    REG 2
R3    REG 3
S     REG 15
*
*   SQRT(REAL)     420 uS EXECUTION TIME
*
SQRT  TST.L R0
      BGE  SQ05      ERROR IF ARG<=0
      JSRX NEG2
SQ05  MOVEM.L R1-R3,-(S)  SAVE REGISTERS
      MOVE.B R0,R2 GET EXPONENT
      CLR.B R0     ZERO EXPON FIELD IN A
      BTST  #0,R2  EXPON EVEN
      BEQ  SQ10    JUMP IF YES
      RSR.L R1,R0  EXPON ODD, SHIFT MANTISSA
      RDDO.6 #1,R2 AND INCREMENT EXPONENT
SQ10  RSR.B #1,R2  DIVIDE EXPONENT BY 2
      MOVE R2,-(S) SAVE NEW EXPONENT ON STACK
      CLR.L R1     INITIALIZE ROOT TO ZERO
      EXG  R0,R1
      MOVEQ =D22,R3  INITIALIZE LOOP COUNTER FOR 15 BITS
      CLR.L R2     CLEAR M
      LSL.L R1,R1  SHIFT R LEFT 1 TO DELETE SIGN
SQ25  LSR.L R1,R0  DELETE TEST BIT FROM ROOT
      LSL.L R1,R1  SHIFT R LEFT 1 BIT
      ROXL.L R1,R2 APPEND BIT TO M
      LSL.L R1,R1  GET SECOND BIT FOR M
      ROXL.L R1,R2 APPEND TO B
      RSL.L #2,R0  MPY R BY 4
      RDDQ.L #1,R0   AND ADD 1
      CMP.L R2,R0   COMPARE RESULTS
      BGT  SQ35
      SUB.L R0,R2    COMPUTE NEW M
      RDDQ.L #2,R0 SET ROOT BIT TO 1
SQ35  SUBQ #1,R3     GO DO NEXT BIT  (15.75 uS/LOOP)
      BGE  SQ25
      LSL.L #7,R0  DELETE EXTRANEOUS BIT
      CLR.B R0     CLEAR EXPONENT AREA
      MOVE (S)+,R2 GET EXPONENT
      TST.L  R0    RESULT=0?
      BEQ    SQ46  YES.
SQ40  BTST #30,R0  NORMALIZE RESULT
      BNE  SQ45    BIT <>0
      LSL.L #1,R0
      SUBQ.B #1,R2 DECREMENT EXPONENT
      BRA  SQ40
SQ45  MOVE.B R2,R0
SQ46  MOVEM.L (S)+,R1-R3  RESTORE REGISTERS
      RTS
```

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SS1DOR1R.UORK.PD8510          THU, DEC 22, 85&3, 10:59 AM    PAGE  5


                    50.0,&.5000en& 16.6&39E-12, 1E9,  &Zo, delay, loss&
                    0.0, 0.0, 0.0, 0.0:        & c0, c1, c2, Zterminal &
BYTE    TABLE c51 := 10,06,'S,'M,'O,'R,'T,' ,' ,' ,' ;      & label &
BYTE    TABLE d51 := std_short, 0;                          & std_type, type2&
& std # 2 &
REAL    TABLE a52 := 0, 99989,                              & fnin, fnax &
                    60.0,&.4340cn& 14.44&1E-12, 1E9,  &Zo, delay, loss&
                    48.0,300.0,15,0.0;          &c0, c1, c2, Zterminal&
BYTE    TABLE c52 := 10,06,'O,'P,'E,'H,' ,' ,' ,' ,' ;      & label &
BYTE    TABLE d52 := std_epen,  0;                          & std_type, type2&
& std # 3 &
REAL    TABLE a53 := .74989, 2.001E9,                       & fnin, fnax &
                    50.0,&5.49&cn&1e3.4520E-12, 1E9,  &Zo, delay, loss&
                    0.0, 0.0, 0.0, 0.0:        & c0, c1, c2, Zterminal &
BYTE    TABLE c53 := 10,07,'S,'H,'O,'R,'T,'R,'3,' ,' ,' ;   & label &
BYTE    TABLE d53 := std_short, 0;                          & std_type, type2&
& std # 4 &
REAL    TABLE a54 := 1.99989, 4.001E9,                      & fnin, fnax &
                    50.0,&2.995en& 99.9357E-12, 1E9.  &Zo, delay, loss&
                    0.0, 0.0, 0.0, 0.0:        & c0, c1, c2, Zterminal &
BYTE    TABLE c54 := 10.07,'S,'H,'O,'R,'T,'R,'4.' ,' ,' ;   & label &
BYTE    TABLE d54 := std_short, 0;                          & std_type, type2&
& std # 5 &
REAL    TABLE a55 := 3.99989, 8.001E9,                      & fnin, fnax &
                    50.0,&1.7459cn& 5&.2545E-12, 1E9, &Zo, delay, loss&
                    0.0, 0.0, 0.0, 0.0:        & c0, c1, c2, Zterminal &
BYTE    TABLE e55 := 10,07,'S,'H,'O,'R,'T,'R,'5,' ,' ,' ;   & label &
BYTE    TABLE d55 := std_short, 0;                          & std_type, type2&
& std # 6 &
REAL    TABLE a56 := 7.99989, 12.001E9,                     & fnin, fnax &
                    50.0,&1.2315cn& 41.0922E-12, 1E9, &Zo, delay, loss&
                    0.0, 0.0, 0.0, 0.0:        & c0, c1, c2, Zterminal &
BYTE    TABLE c56 := 10,07,'S,'H,'O,'R,'T,'R,'&,' ,' ,' ;   & label &
BYTE    TABLE d56 := std_short, 0;                          & std_type, type2&
& std # 7 &
REAL    TABLE a57 := 11.99989,18.501E9,                     & fnin, fnax &
                    50.0,&1.0225cn& 34.1171E-12, 1E9, &Zo, delay, loss&
                    0.0, 0.0, 0.0, 0.0:        & c0, c1, c2, Zterminal &
BYTE    TABLE c57 := 10,07,'S,'H,'O,'R,'T,'R,'7,' ,' ,' ;   & label &
BYTE    TABLE d57 := std_short, 0;                          & std_type, type2&
& std # 8 &
REAL    TABLE a58 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c58 := 10,10,'(,'S,'H,'O,'R,'T,' ,'R,'8,');   & label &
BYTE    TABLE d58 := std_short, 0;                          & std_type, type2&
& std # 9 &
REAL    TABLE a59 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c59 := 10,09,'R,'R,'O,'B,'D,'&,'R,'N,'D,' ;   & label &
BYTE    TABLE d59 := std_load,  0;                          & std_type, type2&
& std # 10 &
REAL    TABLE a60 := 3.99989,999.0008,                      & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
```

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BYTE    TABLE cG0 := 10,07,'S,'L,'T,'D,'1,'H,'G,' ,' ,' ;   & label &
BYTE    TABLE dG0 := std_load,  sliding;                    & std_type, type2&
& std # 11 &
REAL    TABLE aG1 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c61 := 10,06,' ,'T,'H,'R,'U,' ,' ,' ,' ;      & label &
BYTE    TABLE d61 := std_thru,  0;                          & std_type, type2&
& std # 12 &
REAL    TABLE aG2 := 0, &.001E9,                            & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c62 := 10,07,'L,'O,'H,'B,'B,'H,'D,' ,' ,' ;   & label &
BYTE    TABLE d62 := std_load,  0;                          & std_type, type2&
& std # 13 &
REAL    TABLE a63 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c63 := 10.09.'(,'L,'O,'R,'S,' ,'R,'5,'),' ;   & label &
BYTE    TABLE d63 := std_load,  0;                          & std_type, type2&
& std # 14 &
REAL    TABLE a64 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c64 := 10,09,'(,'L,'O,'R,'D,' ,'R,'6,'),' ;   & label &
BYTE    TABLE d64 := std_load,  0;                          & std_type, type2&
& std # 15 &
REAL    TABLE a65 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    48.0,300.0,15.0, 0.0;       &c0,c1,c2, Zterminal&
BYTE    TABLE c65 := 10,09,'(,'O,'P,'E,'R,' ,'R,'1,'),' ;   & label &
BYTE    TABLE d65 := std_open,  0;                          & std_type, type2&
& std # 16 &
REAL    TABLE a66 := 0, 99989,                              & fnin, fnax &
                    50.0,&.50000cn& 16.6&39E-12, 1E9, &Zo, delay, loss&
                    -9.7,2150.0,-39.0,0.0:     &c0, c1, c2, Zterminal&
BYTE    TABLE c66 := 10,0B,'n,'a,'1,'e,'O,'P,'E,'H,' ,' ;   & label &
BYTE    TABLE d66 := std_open,  0;                          & std_type, type2&
& std # 17 &
REAL    TABLE a67 := 0, 99989,                              & fnin, fnax &
                    50.0,&.50000cn& 16.6&35E-12, 1E9, &Zo, delay, loss&
                    21.0, -760.0, 0.0,  0.0;   &c0, c1, c2, Zterminal&
BYTE    TABLE c67 := 10,10,'F,'e,'n,'a,'1,'e,'O,'P,'E,'H;   & label &
BYTE    TABLE d67 := std_opcn,  0;                          & std_type, type2&
& std # 18 &
REAL    TABLE a68 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c68 := 10,09,'(,'O,'P,'E,'H,' ,'R,'4,'),' ;   & label &
BYTE    TABLE d68 := std_open,  0;                          & std_type, type2&
& std # 19 &
REAL    TABLE a69 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c69 := 10,09,'(,'T,'H,'R,'U,' ,'R,'1,'),' ;   & label &
BYTE    TABLE d69 := std_thru,  0;                          & std_type, type2&
```

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& std # 20 &
REAL    TABLE a70 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c70 := 10,09,'(,'T,'H,'R,'U,' ,'R,'2,'),' ;   & label &
BYTE    TABLE d70 := std_thru,  0;                          & std_type, type2&
& std # 21 &
REAL    TABLE a71 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c71 := 10,09,'(,'T,'H,'R,'U,' ,'R,'3,'),' ;   & label &
BYTE    TABLE d71 := std_thru,  0;                          & std_type, type2&
& std # 22 &
REAL    TABLE a72 := 0, 99989,                              & fnin, fnax &
                    50.0, 0.0, 0.0,                    & Zo, delay, loss &
                    0.0, 0.0, 0.0, 0.0:       & c0, c1, c2, Zterminal &
BYTE    TABLE c72 := 10,09,'(,'T,'K,'R,'U,' ,'R,'4,'),' ;   & label &
BYTE    TABLE d72 := std_thru,  0;                          & std_type, type2&

& filler &
BYTE    TABLE e72 := 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                     0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                     0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                     0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0;



GLUBAL TNTEGER kit_base = 800;
OLOBAL TNTECER kit_base2= 850;

END$
```

```
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TNTEGER CONSTANT

cnd_select_std := 209,
cnd_specify_classes := 210,
cnd_label_classes := 211,
cnd_label_cal_kit := 212,
cnd_cal_klt_defined := 213,
end_define_open := 214,
cnd_define_short := 215,
cnd_definc_ldad := 216,
cnd_define_air_line := 217,
cnd_define_z := 218,
cnd_opsn_c0 := 219,
cnd_open_c1 := 220,
end_open_c2 := 221,
end_specify_offeet := 222,
cnd_label_cal_std := 223,
end_cal_etd_defined := 224,
end_fsxod_load := 225,
cnd_sliding_load := 226,
cnd_offeet_delay := 227,
end_offeet_loes := 225,
end_offset_z0 := 229,
end_effect_nin_f := 230,
esd_offset_nax_f := 231,
end_coax := 232,
cnd_uaveguide := 233,
cnd_port1_1et_etd := 235,
cnd_port1_2nd_etd := 236,
end_port1_3rd_etd := 237,
end_port2_1st_etd := 238,
cnd_port2_2nd_etd := 239,
end_port2_3rd_etd := 240,
cnd_std_elass_Upecified := 242,
cnd_trans_fud_etd := 243,
cnd_trans_rev_etd := 244,
end_freq_resp_etd := 246,
cnd_grnup12 := 0;
```

```
FSTDMENU.UDWX.PD8510          THU, DEC 22, 1983, 10:59 AM    PAGE  1


COMMENT
  This is a software generated file !!!
  Changes must be made in SKINFO.UORK
  Run GENSK.LANI to re-generate file;

SUBROUTINE proc12;  ENTRY;
BEGIN

CASE command_token-209 OF
BEGIN
% 209 %
select_active_function( active_std_id );
% 210 %
tell( select_std_class );
% 211 %
warn( command_not_implemented );
% 212 %
warn( command_not_implemented );
% 213 %
cal_kit_defined;
% 214 %
define_std( std_open );
% 215 %
define_std( std_short );
% 216 %
BEGIN
   hilight_load_type;
   define_std( std_load );
END;
% 217 %
BEGIN
   hilight_offset_type;
   define_std( std_thru );
END;
% 218 %
BEGIN
   hilight_load_type;
   define_std( std_z );
END;
% 219 %
select_active_function( active_open_c0 );
% 220 %
select_active_function( active_open_c1 );
% 221 %
select_active_function( active_open_c2 );
% 222 %
hilight_offset_type;
% 223 %
warn( command_not_implemented );
% 224 %
pop_menu( MODIFY_CAL_KIT_MENU );
% 225 %
define_type2( fixed );
% 226 %
define_type2( sliding );
```

```
FSTDMENU.UORK.PD8510          THU, DEC 22, 1983, 10:59 AM    PAGE  2


% 227 %
select_active_function( active_offset_delay );
% 228 %
select_active_function( active_offset_loss );
% 229 %
select_active_function( active_offset_z0 );
% 230 %
select_active_function( active_offset_min_freq );
% 231 %
select_active_function( active_offset_max_freq );
% 232 %
define_type2( coax );
% 233 %
define_type2( waveguide );
% 234 %
previous_menu;
% 235 %
std_class( port1_1st_std );
% 236 %
std_class( port1_2nd_std );
% 237 %
std_class( port1_3rd_std );
% 238 %
std_class( port2_1st_std );
% 239 %
std_class( port2_2nd_std );
% 240 %
std_class( port2_3rd_std );
% 241 %
BEGIN END;
% 242 %
pop_menu(MODIFY_CAL_KIT_MENU);
% 243 %
std_class( trans_fwd_std );
% 244 %
std_class( trans_rev_std );
% 245 %
std_class( freq_resp_std );
END;
END proc12;
```

```
CSTDS.WORK.PD8510             THU, DEC 22, 1983, 10:59 AM    PAGE  1


INTEGER CONSTANT                                  % std_characteristic %
      coax              := 0,                 % bit 0 = coax/waveguide %
      waveguide         := 1,
      fixed             := 0,                 % bit 1 = fixed/sliding %
      sliding           := 2;
INTEGER CONSTANT                                  % classes of standards %
      port1_1st_std     := 0,
      port1_2nd_std     := 1,
      port1_3rd_std     := 2,
      iosln_fwd_std     := 3,
      natch_fwd_std     := 4,
      trans_fwd_std     := 5,
      port2_1st_std     := 6,
      port2_2nd_std     := 7,
      port2_3rd_std     := 8,
      isoln_rev_std     := 9,
      natch_rev_std     :=10,
      trans_rev_std     :=11,
      freq_resp_std     :=12,
      port_offset       := port2_1st_std - port1_1st_std,
      port_size         := port_offset;
INTEGER CONSTANT
      f_min_index       :=  0, % REAL %
      f_max_index       :=  1, % REAL %
      z0_index          :=  2, % REAL %
      delay_index       :=  3, % REAL %
      loss_index        :=  4, % REAL %
      c0_index          :=  5, % REAL %
      c1_index          :=  6, % REAL %
      c2_index          :=  7, % REAL %
      z_index           :=  8, % REAL %
      type_index        := 48, % BYTE %
      type2_index       := 49; % BYTE %
```

```
FSTOS.UORK.PD8510             THU, DEC 22, 1983, 10:59 AM    PAGE  1


RFILE cstds.work;

EXTERNAL INTEGER last_class_element;

SUBROUTINE hilight_last_class;                          EXTERNAL;
SUBROUTINE hilight_last_element;                        EXTERNAL;
PROCEDURE  select_cal_kit( kit );
   VALUE   kit;
   INTEGER kit;                                         EXTERNAL;
PROCEDURE  init_stds;                                   EXTERNAL;
PROCEDURE  set_element( element );
   VALUE   element;
   INTEGER element;                                     EXTERNAL;
PROCEDURE  annotate_std_classes;                        EXTERNAL;
PROCEDURE  set_std_class( class );
   VALUE   class;
   INTEGER class;                                       EXTERNAL;
INTEGER PROCEDURE std_measured( f_min, f_max, class );
   % by reference %
   REAL    f_min, f_max;
   INTEGER class;                                       EXTERNAL;
BOOLEAN PROCEDURE frequency_covered;                    EXTERNAL;
DOUBLE PROCEDURE standard_specs( frequency, class );
   VALUE   frequency, class;
   REAL    frequency;
   INTEGER class;                                       EXTERNAL;
```

```
SSTDS.WORK.PD8510          THU, DEC 22, 1983, 10:59 AM    PAGE  1


M88KL,P,"stdi"
BEGIN

&FILE factive.work;                          & for select_active_fcn &
&FILE factive2.work;                         & for select_active_off &
&FILE fcommand.work;                            & for command_token &
&FILE cstds.work;
&FILE cstds2.work;
&FILE ccal.work;                                  & for std_... types &
&FILE fcal.work;                                    & for acquire_data &
&FILE ccalwonu.work;       & for cmd_cal_type_netw and end_class_dmee &
&FILE cstdmeno.work;
&FILE cncmu.work;                                    & for menu names &
&FILE fmenu.work;                                & for change_softkey &
&FILE cmessagD.work;          & for command_not_implementas & & DEBUG &
&FILE cmsmesg1.work;
&FILE cmsgcal.work;
&FILE futil3.work;                                     & for tell, warn &
&FILE cchtable.work;
&FILE fchtable.work;                          & for set_metry_ch_integer &
&FILE fmbmgr.work;                           & for save_ and recall_data &
&FILE ctpngr.work;                                 & for cal_std_file &
&FILE cscreen2.work;                                & for ek_bracket_S &
&FILE fdispran.work;                               & for wrt_disp_byte &
&FILE fcontrol.work;                          & for measurement_restart &
&FILE ccontvar.work;                                  & for s21, etc. &
&FILE fparan.work;                                 & for new_parameter &
&FILE crins.work;                             & for active_function_rin &
&FILE fkernel.work;                              & for acquire, releans &


COMMENT  this array is new a fixed allocasion in the File smarkmen.;
EXTERNRL BYTE ARRRY cal_kit_array.L[0:cal_kit_array_size-1]; & markncm &
```

```
SSTDS.WORK.PD8510          THU, DEC 22, 1983, 10:55 AM    PAGE  2


REJECT;
INTEGER current_class;                                  & class   # (0-7) &
INTEGER current_elemsnt;                                & element # (1-7) &
GLOBRL IMIEGER last_class_element;
GLOBAL IMIEGER current_std_id;                          & standard number &

BYIE TRBLE class_param :=
   s11,  & port1_1st_std &
   s11,  & port1_2nd_std &
   s11,  & port1_3rd_std &
   s21,  & isoln_fwd_std &
   s11,  & match_fwd_std &
   s21,  & trano_fwd_std &
   s22,  & port2_1st_std &
   s22,  & port2_2nd_std &
   s22,  & port2_3rd_std &
   s12,  & isoln_rev_std &
   #22,  & mateh_rev_std &
   #12,  & trame_rev_std &
   0;    & freq_rsop_std &

INTEGER TABLE class_elements :=
   std_class_1 * port1_1st_std * class_list_size,
   #td_elasi_1 * port1_2nd_std * clase_iist_size,
   std_class_1 * port1_3rd_std * class_list_size,
   std_class_1 * isoln_fwd_std * class_list_size,
   std_class_1 * match_fwd_std * class_list_size,
   std_class_1 * trane_fwd_std * class_list_size,
   esd_class_1 * port2_1st_std * class_list_size,
   std_slass_1 * port2_2nd_std * class_list_size,
   std_class_1 * port2_3rd_utd * class_list_size,
   std_class_1 * isoln_rev_std * class_list_size,
   std_class_1 * match_rev_esd * class_list_size,
   esd_class_1 * trane_rev_std * class_list_size,
   esd_slass_1 * freq_rsep_std * class_list_size;

INTEGER TABLE end_element :=
              0,
   cnd_class_std1,
   cnd_class_std2,
   cnd_class_std3,
   cnd_class_std4,
   cnd_class_std5,
   cmd_class_std6,
   cnd_class_std7;

INTEGER TABLE std_class_label :=
   std_class_label1 * port1_1st_std * (label_size+2),
   std_class_label1 * port1_2nd_std * (label_size+2),
   std_class_label1 * port1_3rd_std * (label_size+2),
   std_class_label1 * isoln_fwd_std * (label_size+2),
   std_class_label1 * match_fwd_std * (label_size+2),
   std_class_label1 * trans_fwd_std * (label_size+2),
   std_class_label1 * port2_1st_std * (label_size+2),
   std_class_label1 * port2_2nd_std * (label_size+2),
   std_class_label1 * port2_3rd_std * (label_size+2),
```

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   std_slass_label1 * isoln_rev_std * (label_size+2),
   std_class_label1 * match_rev_std * (label_size+2),
   std_class_label1 * trans_rev_std * (label_size+2),
   std_class_label1 * freq_resp_std * (label_size+2);

INTEGER TRBLE cnd_class  :=
   cnd_sort1_std1,      & port1_1st_std &
   cnd_port1_std2,      & port1_2nd_std &
   cnd_port1_std3,      & port1_3rd_std &
   cnd_fwd_isolation,   & isoln_fwd_std &
   cnd_fwd_setch,       & match_fwd_std &
   end_fwd_transmissior,& trans_fwd_std &
   cnd_part2_std1,      & port2_1st_std &
   cnd_port2_etd2,      & port2_2nd_std &
   cnd_sort2_std3,      & port2_3rd_std &
   end_rev_ieolation,   & isoln_rev_std &
   cnd_rev_natch,       & match_rev_std &
   end_rev_traneniesion,& trans_rev_std &
   cnd_rseponee_type;   & freq_resp_std &

BYTE TRBLE gtd_class_line  :=
   2,    & port1_1st_std &
   1,    & port1_2nd_std &
   1,    & port1_3rd_std &
   2,    & isoln_fwd_std &
   2,    & natch_fwd_std &
   2,    & trans_fwd_std &
   2,    & port2_1st_std &
   1,    & port2_2nd_std &
   1,    & port2_3rd_std &
   2,    & isoln_rev_std &
   2,    & natch_rev_std &
   2,    & trans_rev_std &
   2;    & freq_resp_std &

INTEGER TABLE cnd_cal_kit :=
      0,              & 0 index is not used &
      end_cal_kit_1,
      cnd_cal_kit_2;

IKTEGER TRBLE cnd_modify_cal_kit :=
      0,              & 0 index is not used &
      cnd_modify_cal_kit_1,
      end_modify_cal_kit_2;

INTEGER TBBLE cnd_load_type :=
      cnd_fixed_load,
      cnd_sliding_load;

INTEGER TRBLE cnd_offset_type :=
      cnd_coax,
      end_waveguide;

INTEGER TABLE cnd_std_type :=
      cnd_define_open,
      cnd_define_short,
```

```
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      cnd_define_load,
      cnd_define_air_line,
      cnd_define_z;

INTEGER kit_number;                                  & cal kit number &
DOUBLE  cal_kit;                          & address of cal kit descriptor &
GLDBAL DOUBLE cal_std_addr;               & address of cal std descriptor &

INTEGER ARRAY nax_nseeured_etd[ port1_1st_etd:freq_resp_std ];
DOUBLE  RRRBY cal_std_addre[ port1_1st_std:freq_resp_etd,
                             1:class_size
                           ];
```

```
SSIDS.UORK.PDS51D              THU, DEC 22, 1983, 11:00 AM    PAGE  5


%EJECT;
COMMENT                                                  hilight_offset_type
*************************************************************************
*
*************************************************************************
;
PROCEDURE  hilight_offset_type;
   BEGIN & hilight_offset_type &
      BYTE POINTER type2;

      STPNTR( type2, cal_std_addr + type2_offset );
      hilight_key( cnd_offset_type[ type2 AND %O001 ],
                   cnd_coax,
                   cnd_waveguide
                 );
   END;  % hilight_offset_type &
```

```
SSTDS.UORK.PDS51D              THU, DEC 22, 1983, 11:00 AM    PAGE  6


%EJECT;
COMMENT                                                  hilight_load_type
*************************************************************************
*
*************************************************************************
;
PROCEDURE  hilight_load_type;
   BEGIN & hilight_load_type &
      BYTE POINTER type2;

      STPNTR( type2, cal_std_addr + type2_offset );
      hilight_key( cnd_load_type[ RRIGHT(type2,1) AND %O001 ],
                   cnd_fixed_load,
                   cnd_sliding_load
                 );
   END;  & hilight_load_type &
```

```
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%EJECT;
COMMENT                                                  hilight_std_type
*************************************************************************
*
*************************************************************************
;
PROCEDURE  hilight_std_type;
   BEGIN & hilight_std_type &
      BYTE POINTER std_type;

      STPNTR( std_type, cal_std_addr + type_offset );
      hilight_key( cnd_std_type[ std_type ],
                   cnd_define_open,
                   cnd_define_z
                 );
   END;  & hilight_std_type &
```

```
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%EJECT;
COMMENT                                                  hilight_last_class
*************************************************************************
*
*************************************************************************
;
SUBROUTINE hilight_last_class;                                      ENTRY;
   BEGIN % hilight_last_class &
      hilight_command( end_class[current_class] );
   END;  & hilight_last_class &
```

```
SSTDS.UORK.PD8510          THU, DEC 22, 1983, 11:00 AM    PAGE  9


%EJECT;
COMMENT                                                hilight_last_element
*************************************************************************
*
*************************************************************************
;
SUBROUTINE hilight_last_element;                                    ENTRY;
   BEGIN & hilight_last_element &
      hilight_command( end_element[current_element] );
   END;  & hilight_last_element &
```

```
SSTDS.WORK.PD9510          THU, DEC 22, 1983, 11:00 AM    PAGE  10


%EJECT;
COMMENT                                                update_kit_label
*************************************************************************
*
*************************************************************************
;
PROCEDURE update_kit_label(kit_number);
   VALUE kit_number;
   INTEGER kit_number;                                              ENTRY;
   BEGIN
     change_softkey( cal_kit + std_kit_label,
                     cmd_cal_kit_1-1+kit_number,
                     2
                   );
   END %update_kit_label;
```

```
SSTDS.UORK.PD9510          THU, DEC 22, 1983, 11:00 AM    PAGE  11


%EJECT;
COMMENT                                                 select_cal_kit
*************************************************************************
*
*  kit_number must be either 1 or 2 only -- guaranteed since generated
*  only by soft-keys or a recalled state previously set via soft-keys.
*
*************************************************************************
;
PROCEDURE  select_cal_kit( kit );
   VALUE   kit;
   INTEGER kit;                                                     ENTRY;
   BEGIN & select_cal_kit &

      hilight_key(cmd_cal_kit[kit],cmd_cal_kit_1,cmd_cal_kit_2);
      hilight_key(cmd_modify_cal_kit[kit],
                  cmd_modify_cal_kit_1,
                  cmd_modify_cal_kit_2
                 );
      kit_number :* kit;
      cal_kit := RORS( cal_kit_array );                             & DEBUG &
      recall_data( cal_kit, cal_std_file, kit );
      update_kit_label( kit );

   END;  & select_cal_kit &
```

```
SSTDS.WORK.PD8510          THU, DEC 22, 1983, 11:00 AM    PAGE  12


%EJECT;
COMMENT                                                      init_stds
*************************************************************************
*
*************************************************************************
;
PROCEDURE  init_stds;                                               ENTRY;
   BEGIN & init_stds &
      INTEGER i,
              j;

      current_std_id   :* std_undefined;
      cal_kit :* RORS( cal_kit_array );                             & DEBUG &

      IF recall_data( cal_kit, cal_std_file, 1 ) THEN
         update_kit_label( 1 );
      IF recall_data( cal_kit, cal_std_file, 2 ) THEN
         update_kit_label( 2 );

      current_std_id := 1;

   END;  & init_stds &
```

```
SSTDS.UORK.PDB510          THU, DEC 22, 1SS3, 11:00 RM    PAGE 13


$EJECT;
COMMENT                                                    set_std_addr
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  set_std_addr( std_no );
   VALUE   std_no;
   INTEGER std_no;
   BEGIN & set_std_addr &
      cal_std_addr := cal_kit +
                      std_def_1 +
                      (std_no - 1) * std_size;
   END;  & set_std_addr &
```

```
SS1DS.UORK.PDB510          THU, DEC 22, 1SS3, 11:00 RM    PAGE 14


$EJECT;
COMMENT                                                        std_id
*****************************************************************************
*
*  Selects the specified (id) standard for subsequent modification of
*  its values.
*
*****************************************************************************
;
PROCEDURE  std_id( id );
   VALUE   id;
   INTEGER id;                                                 ENTRY;
   BEGIN $ std_id &
      current_std_id := id;
      set_std_addr( current_std_id );
      hilight_std_type;
      gen_menu( MODIFY_STDS_MENU, 1 );

      release( active_function_rin );          & acquired in active &
      select_active_off( active_std_id );
      acquire( active_function_rin );            & restore access &
   END;  & std_id &
```

```
SS1DS.UORK.PDB510          THU, DEC 22, 1BS3, 11:00 AM    PAGE 15


$EJECT;
COMMENT                                                    define_std
*****************************************************************************
*
*  Specify standard type
*
*****************************************************************************
;
PROCEDURE  define_std( std_type );
   VALUE   std_type;
   BYTE    std_type;
   BEGIN & define_std &
      hilight_on( cnd_define_open, cnd_define_z );
      urt_disp_byte( cal_std_addr + type_offset,  etd_type );

      hilight_key( cnd_fixed_load, cnd_fixed_load, cnd_sliding_load );
      hilight_key( cnd_coax, cnd_coax, cnd_waveguide );
      urt_disp_byte( cal_std_addr + type2_offset, 0        );
   END;  & define_std &
```

```
SSTDS.UORK.PDS510          THU, DEC 22, 1983, 11:00 RM    PAGE 1G


$EJECT;
COMMENT                                                   define_type2
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  define_type2( type2 );
   VALUE   type2;
   BYTE    type2;
   BEGIN & define_type2 &
      BYTE POINTER type2_ptr;

      STPNTR( type2_ptr, cal_etd_addr + type2_offset );
      urt_disp_byte( ADRS(type2_ptr), (type2 OR type2_ptr) );
      hilight_load_type;                                      $ DEBUG &
      hilight_offset_type;                                    & DEBUG &
   END;  & define_type2 &
```

```
SSTDS.WORK.PDS510          THU, DEC 22, 1983, 11:00 AM    PAGE 17


#EJECT;
COMMENT                                                    std_class
*****************************************************************
*
*  Selects the specified class (id) for entering a list of standards.
*  Clears any existing list for the specified class.
*
*****************************************************************
;
PROCEDURE  std_class( id );
   VALUE   id;
   INTEGER id;
   BEGIN & std_class &

      current_class :* id;
      wrt_disp_byte( cal_kit + class_elements[current_class], 0 );
                                          & reset this std class &
      tell( specify_std_class );
      select_active_function( active_std_class );

   END;  & std_class &
```

```
SSTDS.WORK.PDS510          THU, DEC 22, 1983, 11:00 AM    PAGE 18


#EJECT;
COMMENT                                              std_class_element
*****************************************************************
*
*  Adds the specified standard (id) to the list of elements that make
*  up the current class.
*
*****************************************************************
;
PROCEDURE  std_class_element( id );
   VALUE   id;
   INTEGER id;                                                 ENTRY;
   BEGIN & std_class_element &
      INTEGER index;
      BYTE POINTER class_element;

      STPNTR( class_element,
              cal_kit + class_elsnents[current_class]
            );

      index := 1 + class_element[0];
      IF index <= class_size THEN
         BEGIN & if &
            wrt_disp_byte( RDR3(class_element[index]), id    );
            wrt_disp_byte( RDR5(class_element[0]),     index );
         END   & if &
      ELSE
         warn( exceeded_std_class_limit );

   END;  & std_class_element &
```

```
SSTDS.WORK.PDS510          THU, DEC 22, 1983, 11:00 AM    PAGE 19


#EJECT;
COMMENT                                              cal_kit_defined
*****************************************************************
*
*****************************************************************
;
SUBROUTINE cal_kit_defined;
   BEGIN & cal_kit_defined &
      save_data( cal_kit,
                 cal_kit_array_size,
                 cal_std_file,
                 kit_number
               );                                  & store in bubble &
      & this call can be moved to routine which modifies actual label &
      update_kit_label( kit_number );
      previous_menu;
      current_std_id  := std_undefined;
   END;  & cal_kit_defined &
```

```
SSTDS.WORK.PDS510          THU, DEC 22, 1983, 11:00 AM    PAGE 20


#EJECT;
COMMENT                                                  get_element
*****************************************************************
*
*  Select the element of a class (1-7) to be subsequently measured.
*  Look up the appropriate standard number.
*
*****************************************************************
;
PROCEDURE  get_element( element );
   VALUE   element;
   INTEGER element;                                            ENTRY;
   BEGIN & set_element &
      BYTE POINTER std_type,
                   class_element;

      current_element :* element;

      STPNTR( class_element,
              cal_kit + class_elements[current_class]
            );

      get_std_addr( class_element[element] );

      STPNTR( std_type, type_offset + cal_std_addr );

      IF (std_type[1] AND sliding) = 0 THEN              & not sliding &
         acquire_data
      ELSE                                                  & sliding &
         BEGIN
         gen_menu( SLIDING_LOAD_MENU, 1 );
         tell( slide_load );
         END;

   END;  & get_element &
```

```
SSTD3.WORK.PD8510          THU, DEC 22, 1983, 11:00 AM    PAGE 21


%EJECT;
COMMENT                                                annotate_std_classes
**************************************************************************
%
%  Annotate the classes.  Called From set_cal_type.
%
**************************************************************************
;
PROCEDURE  annotate_std_classes;                                    ENTRY;
   BEGIN % annotate_std_classes %
      INTEGER class;

      FOR class := portt_1st_etd UNTIL trans_rev_std DO
         change_softkey( std_class_label[class] + cal_kit,
                         cmd_class[class],
                         std_class_line[class]
                       );

   END;  % annotate_etd_classes %
```

```
SSTDS.WORK.PD8510          THU, DEC 22, 1983, 11:00 AM    PAGE 22


%EJECT;
COMMENT                                                    set_std_class
**************************************************************************
%
%  Specifies the class from which standards will be selected during cal.
%
**************************************************************************
;
PROCEDURE  set_etd_class( class );
   VALUE  class;
   INTEGER class;                                                   ENTRY;
   BEGIN % set_etd_class %
      BYTE POINTER class_element;
      INTEGER etd,
              index;
      REAL%A   etd_label;

      current_class := class;

      IF current_class <> freq_resp_std THEN
         new_parameter( class_param[current_class] );

      STPNTR( class_element,
              cal_kit + class_elements[current_class]
            );
      last_class_element := INTEGER( class_elemcnt[0] );

      max_measured_std[current_class] := 0;

      IF last_class_element > 1 THEN
         BEGIN % more than one std in this class %
            hilight_off( cmd_class_std1, cmd_class_etc7 );

            % All keys have to be changed or cleared in case the menu  %
            % displayed as the result of a "prior menu", or similar    %
            FOR std := 1 UNTIL class_size DO                  % 1 to 7 %
               BEGIN % for %
                  IF std > last_class_element THEN
                     std_label := " "
                  ELSE
                     std_label := cal_kit + std_def_1 + label_offset +
                                  (std_size * (class_element[std]-1));
                  change_softkey( std_label,
                                  cmd_element[std],
                                  1
                                );
               END;  % for %              % must be before gen_menu() %
            change_softkey( std_class_label[current_class] + cal_kit,
                            cmd_class_done,
                            1
                          );              % must be before gen_menu() %

            gen_menu( STD_CLASS_MENU, 1 );

            IF last_class_element < 7 THEN
               FOR std := last_class_element UNTIL 6 DO       % 0 to 7 %
```

```
SSTDS.WORK.PD8510          THU, DEC 22, 1983, 11:00 AM    PAGE 23


               blank_softkey( std );    % must be after gen_menu()  %

            tell( connect_std );
         END  % more than one std in this class %
      ELSE % single standard %
         set_element( 1 );                        % set-up and measure it %

   END;  % set_std_class %
```

```
SSTDS.WORK.PD8510          THU, DEC 22, 1983, 11:00 AM    PAGE 24


%EJECT;
COMMENT                                                    std_measured
**************************************************************************
%
%  Add the current standard to the list of standards measured.  Return
%  its f_min and f_max.
%
**************************************************************************
;
INTEGER PROCEDURE std_measured( f_min, f_max, class );
   % by reference %
   REAL    f_min, f_max;
   INTEGER class;                                                   ENTRY;
   BEGIN % std_measured %
      BOOLEAN move_stds;
      INTEGER i;
      REAL POINTER std;
      BYTE POINTER byte_ptr = std;

      % check if this std has already been measured %
      move_stds := FALSE;
      IF max_measured_etd[current_class] >= 1 THEN
         FOR i := 1 UNTIL max_measured_std[current_class] DO
            IF move_stds THEN
               cal_std_addrs[current_class,(i-1)] :=
                                        cal_std_addrs[current_class,i]
            ELSE IF cal_std_addrs[current_class,i] = cal_std_addr
                 THEN
               move_stdc := TRUE;
      IF NOT move_stds THEN
         max_measured_std[current_class] :=
                                    max_measured_std[current_class] + 1;

      % place this standard in the list of measured standards %
      cal_std_addrs[current_class,max_measured_std[current_class]] :=
                                                        cal_std_addr;

      % return the frequency limits of this standard %
      STPNTR( std, cal_std_addr );
      f_min := std[ f_min_index ];
      f_max := std[ f_max_index ];
      class := current_class;
      std_measured := INTEGER( byte_ptr[type2_offset] );

   END;  % std_measured %
```

```
SSTDS.WORK.PDS510          THU, DEC 22, 1983, 11:00 AM    PAGE 25


REJECT;
COMMENT                                                  frequency_covered
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
&
&  Returns TRUE if the current frequency range has been covered by
&  standards measured since the most recent set_std_class(), FALSE
&  otherwise.
&
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
;
BOOLEAN PROCEDURE frequency_covered;                              ENTRY;
   BEGIN & frequency_covertd &
      BYTE    used;
      BOOLEAN covered;                          & temporary result &
      INTEGER i,
              j;
      REAL    min,
              max,
              band_start,
              band_stop,
              temp_min,
              temp_max;
      QUAD    temp_quad;
      REAL POINTER std;

      covered := FALSE;
      used := 0;

      IF max_measured_std[current_class] > 0 THEN
         BEGIN & if &

            & compute stop frequency &
            band_stop := REAL( entry_ch_quad(ch_center_frequency) );
            band_stop := (2 * band_stop) -
                         REAL( entry_ch_quad(ch_start_frequency) );
            & and start frequency &
            band_start := REAL( entry_ch_quad(ch_start_frequency) );

            j := 0;
            min := 1.0E37;                          & a very big number &
            FOR i := 1 UNTIL max_measured_std[current_class] DO
               BEGIN & for &
                  STPNTR( std, cal_std_addrs[current_class,i] );
                  temp_min := std[f_min_index];
                  temp_max := std[f_max_index];
                  IF ( (temp_min < min)      AND
                       (temp_min < band_stop)  AND
                       (temp_max > band_start)
                     ) THEN     & part of standard is in current band &
                     BEGIN & if &
                        j := i;
                        min := temp_min;
                        max := temp_max;
                     END;  & if &
               END;  & for &
```

```
SSTDS.WORK.PDS510          THU, DEC 22, 1983, 11:00 AM    PAGE 26

            & check for coverage &
            IF min <= band_start THEN
               BEGIN & if &
                  used := SBIT( used, j );

                  & cumbersome, but smaller than a sort &
                  FOR i := 1 UNTIL max_measured_std[current_class] DO
                     FOR j := 1 UNTIL max_measured_std[current_class] DO
                        IF NOT TBIT(used,j) THEN
                           BEGIN & if &
                              STPNIR( std, cal_std_addrs[
                                                 current_class,
                                                 j
                                                 ]
                                    );
                              IF std[f_min_index] < max THEN
                                 BEGIN & if &
                                    temp_max := std[f_max_index];
                                    IF temp_max > max THEN
                                       max := temp_max;
                                    used := SBIT(used,j);
                                 END;  & if &
                           END;  & if &

                  IF max >= band_stop THEN
                     covered := TRUE;
               END;  & if &
         END;  & if &

      frequency_covered := covered;

   END;  & frequency_covered &
```

```
SSTDS.WORK.PDS510          THU, DEC 22, 1983, 11:00 AM    PAGE 27


REJECT;
COMMENT                                                  standard_specs
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
&
&  Returns the address of the REAL RRRRY containing the specifications
&  of the standard in the class for the specified frequency.
&  Individual specifications are indexed by the ..._index constants in
&  cstds.work.
&
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
;
DOUBLE PROCEDURE standard_specs( frequency, class );
   VALUE   frequency, class;
   REAL    frequency;
   INTEGER class;                                                 ENTRY;
   BEGIN & standard_specs &
      INTEGER i;
      BOOLEAN done;
      REAL POINTER std;

      done := FALSE;
      i := max_measured_std[class];
      UNTIL ( (i > 0) AND (NOT done) ) DO
         BEGIN & until &
            STPNTR( std, cal_std_addrs[class,i] );
                 & take_data must use the same banding rules &
            IF ( (std[f_min_index] <= frequency) AND
                 (std[f_max_index] >= frequency)
               ) THEN
               done := TRUE
            ELSE
               i := i - 1;
         END;  & until &

      standard_specs := cal_std_addrs[class,i];

   END;  & standard_specs &


#FILE fstdmenu.work;

EOF
```

```
CSTDS2.WORK.PDS510         THU, DEC 22, 1983, 11:00 AM    PAGE 1


INTEGER CONSTANT
      min_stds        := 1,
      max_stds        := 22,

      label_size      := 10,
      class_size      := 7,
      class_list_size := class_size + 1,

      std_kit_label   := 1,  & indexed as [-1:label_size] &
      std_class_1     := 12,
      std_class_label :=117,  & indexed as [-1:label_size] &
      std_def_1       :=272,
      f_min_offset    := 0,  & real &
      f_max_offset    := 4,  & real &
      z0_offset       := 8,  & real &
      delay_offset    := 12,  & real &
      loss_offset     := 16,  & real &
      c0_offset       := 20,  & real &
      c1_offset       := 24,  & real &
      c2_offset       := 28,  & real &
      z_offset        := 32,  & real &
      label_offset    := 37,  & indexed as [-1:label_size] &
      type_offset     := 48,  & byte &
      type2_offset    := 49,  & byte &

      std_size        := 50,

      cal_kit_size    := (std_def_1) +            & kit_label +     &
                         (std_size * max_stds),   & std descriptors &

      cal_kit_array_size := ((cal_kit_size - 1) OR %003F) + 1;
```

```
FSTDS2.WORK.PD8510          THU, DEC 22, 1983, 11:00 AM    PAGE  1

%FILE cetds2.work;

EXTERNAL INTEGER current_ttd_id;
EXTERNAL DOUBLE  cal_std_addr;

PROCEDURE update_kit_label(kit_number);
   VALUE kit_number;
   INTEGER kit_number;                                    EXTERNAL.L;
PROCEDURE  std_id( id );
   VALUE   id;
   INTEGER id;                                            EXTERNAL.L;
PROCEDURE  std_class_element( id );
   VALUE   id;
   INTEGER id;                                            EXTERNAL.L;
```

```
CSTIM.WORK.PD8510           THU, DEC 22, 1983, 11:00 AM    PAGE  1

INTEGER CONSTANT

cmd_power_menu := 60,
cmd_sweep_time := 61,
cmd_n_points_menu := 62,
cmd_cw := 63,
cmd_swept := 64,
cmd_stepped := 65,
cmd_51_points := 66,
cmd_101_points := 67,
cmd_201_points := 68,
cmd_401_points := 69,
cmd_source_power := 70,
cmd_power_slope := 71,
cmd_power_slope_off := 72,
cmd_atten_port1 := 73,
cmd_atten_port2 := 74,
cmd_bold := 75,
cmd_single := 76,
cmd_n_groups_kbd := 77,
cmd_continuous := 78,
cmd_couple_stimulus := 80,
cmd_uncouple_stimulus := 81,
cmd_group4 := 0;
```

```
FSTIM.WORK.PD8510           THU, DEC 22, 1983, 11:00 AM    PAGE  1

COMMENT
  This is a software generated file !!!
  Changes must be made in SKINFD.WORK
  Run GENSK.LANI to re-generate file;

SUBROUTINE proc4;  ENTRY;
BEGIN

CASE command_token-60 OF
BEGIN
& 60 &
BEGIN END;
& 61 &
select_active_function(active_sweep_time);
& 62 &
BEGIN END;
& 63 &
BEGIN
  hilight_on( cmd_cw, cmd_stepped);
  cw_mode;
END;
& 64 &
BEGIN
  hilight_on( cmd_cw, cmd_stepped);
  swept_mode;
END;
& 65 &
BEGIN
  hilight_on( cmd_cw, cmd_stepped);
  stepped_mode;
END;
& 66 &
new_step_size( 16 );
& 67 &
new_step_size( 8 );
& 68 &
new_step_size( 4 );
& 69 &
new_step_size( 2 );
& 70 &
select_active_function(active_source_power);
& 71 &
BEGIN
   hilight_on( cmd_power_slope, cmd_power_slope_off );
   set_entry_ch_integer( power_slope_on, ch_power_slope_mode );
   urt_priv_ib_source( sl1, newline);
   select_active_function( active_power_slope );
END;
& 72 &
BEGIN
   hilight_on( cmd_power_slope, cmd_power_slope_off );
   set_entry_ch_integer( power_slope_off, ch_power_slope_mode );
   select_active_off( active_power_slope );
   urt_priv_ib_source( sl0, "");
END;
```

```
FSTIM.WORK.POSS10           THU, DEC 22, 1983, 11:00 AM    PAGE  2

& 73 &
select_active_function(active_atten_port1);
& 74 &
select_active_function(active_atten_port2);
& 75 &
hold_sweep;
& 76 &
single_sweep;
& 77 &
select_active_function(active_n_groups_kbd);
& 78 &
continuous_sweep;
& 79 &
BEGIN                                                     & DEBUG &
warn(command_not_implemented );                           & DEBUG &
& select_active_function( active_stimulus_offset ); &
END;                                                      & DEBUG &
& 80 &
BEGIN
  hilight_on( cmd_couple_stimulus, cmd_uncouple_stimulus );
  set_coupled_stimulus_status( TRUE );
END;
& 81 &
BEGIN
  hilight_on( cmd_couple_stimulus, cmd_uncouple_stimulus );
  set_coupled_stimulus_status( FALSE );
END;
& 82 &
BEGIN
   previous_menu;
   device_reversed;
END;
END;
END proc4;
```

```
FSIIMUL2.UORK.POB510          THU, DEC 22, 1983, 11:00 PM    PAGE  1


EXTERNRL INTEGER source_pointt;

PROCEDURE  update_stinulus_step_size;                          EXTERNRL;
```

```
SSTIMUL2.WORK.PD&510          IHU, DEC 22, 1983, 11:00 Rn    PRGE  1


M68KL,P,"stin2"
$EGIN

#FILE fcommand.work;                                  & command_tsken &
#FILE fcontrol.work;
#FILE fchdats.work;
#FILE fstring.work;
#FILE fprsvib.work;
#FILE ffnt.work;
#FILE fbreok.work;
#FILE cchars.work;
#FILE cchtoble.work;
#FILE fchtoble.work;
#FILE fcstab2.work;                                     & for cb_quad &
#FILE fchtab3.work;
#FILE cstimiii.work;                                 & for pomor_slops_... &
#FILE fstimul3.work;                                & for onnotete_stinulus &
#FILE fcontver.work;                                   & for new_step_oize &
#FILE fsentv2.work;                                        & for rebuild &
PFILE fective.work;
#FILE factive2.work;                                & for octive_function &
#FILE fetoblee.work;                                   & for format_toble &
#FILE fmenu.work;                                       & for hilight_... &
#FILE futil.work;
#FILE fcouple.work;                                     & for oet_couplcd &
#FILE cotin.work;
#FILE ftestset.uark;                                & for devict_reversed &


GLOBRL INTEGER eource_poents; & Irst number of points $510 told oourct &

DOUBLE CONSTRNI   points_fnt        := %07000400;
```

```
SSTimUL2.UORK.PD8510          INU, OEC 22, 1983, 11:00 RM    PAGE  2


&EJECT;
COnnEMT                                          update_stinulus_ottp_size
*****************************************************************************
*
*****************************************************************************
;
PROCEDUKE  update_stinulus_step_size;                          ENTRY;
   BEGIN & update_stinulus_step_size &
      INTEGER CONSTRNT sn_string_oize := 6;
      IKTEGER number_of_points,
              prefix,
              postfix;
      BYTE    RRRRY    sn_string[-1 : sn_string_size];

      sn_string[ -1 ]:=sn_string_size;
      sn_string[ 0 ]  := 0;          & initialize to enpty (0 length) &

      number_ef_points := 800 / step_size;
      IF source_points <> nunber_of_pointe THEN
         BEGIN & if &
            $ourcs_points := number_of_points;
            sn_string := append_string( fomsat_double( source_points,
                                                       sn_string,
                                                       points_fnt
                                                     ),
                                        newline
                                      );
         END;  & if &
&     ELSE leave sn_string enpty &

      IF NOT coupled_eh( ch_start_frequency ) THEN   & all source fene &
         BEGIN & if &                                & are uncoupled   &
            break_entry_control( 3-current_entry_ch ); & and both eh's &
            ert_priv_ib_eource( sn, sn_string );       & need changing &
            break_entry_contrel( current_entry_ch );
         END;  & if &
      nrt_priv_ib_source( sn, sn_etring );
      urt_priv_ib_eource( clr_fun, "" );

   END;  & update_stinulus_step_size &
```

```
SSTIMUL2.UORK.PD3510          THU, DEC 22, 1983, 11:00 Rn    PAGE  3


#EJECT;
COMMENT                                                        suept_stinulus
*****************************************************************************
a
*****************************************************************************
;
SUBROUTINE suept_etinulus;
   $EGIN & suept_stinulus &
      IF sueep_node <> suept THEN
         $EGIN & if &
            select_active_off( active_cu );
            IF NOT coupled_ch(ch_stert_frequency) THEN &all source fcne&
               BEGIN & if &          & are uncoupled and need changing &
                  break_entry_control( 3 - current_entry_ch );
                  IF sueep_node = single_pt THEN
                     urt_priv_ib_source( fa, neuline );
                  urt_priv_ib_source( s1, neuline );
                  break_entry_control( current_entry_ch );
               END;  & if &
            IF sueep_node = single_pt THEN
               $EGIN & if &
                  urt_priv_ib_source( Fa, neuline );
                  rebuild := TRUE;          & remove array processing &
                  annotate_stinulus;
               END;  & if &
            wrt_priv_ib_source( st, neuline );
            urt_priv_ib_source( clr_fun, "" );
            sueep_node := suept;
         END;  & if &
   END;  & suept_stinulus &
```

```
SSTIMUL2.WORK.PDBS10          THU, DEC 22, 1983, 11:00 AM    PAGE  4


REJECT;
COMMENT                                                  stepped_stimulus
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE stepped_stimulus;
   BEGIN & stepped_stimulus &
      IF sweep_node <> stepped THEN
         BEGIN & if &
            select_active_off( active_cu );
            IF NOT coupled_ch(ch_start_frequency) THEN &all source fcns&
               BEGIN & if &          & are uncoupled and need changing &
                  break_entry_control( 3 - current_entry_ch );
                  IF sweep_node = single_pt THEN
                     urt_priv_ib_source( fa, neuline );
                  break_entry_control( current_entry_ch );
               END;  & if &
            IF sweep_node = single_pt THEN
               BEGIN & if &
                  urt_priv_ib_source( fa, neuline );
                  rebuild := TRUE;           & renove array processing &
                  annotate_stimulus;
               END;  & if &
            sweep_node := stepped;
            update_stimulus_step_size;  & puts source in stepped sweep &
         END;  & if &
   END;  & stepped_stimulus &
```

```
SSTIMUL2.UORK.PDBS10          THU, DEC 22, 1983, 11:00 AM    PAGE  5


NEJECT;
COMMENT                                                          cu_node
*****************************************************************************
*
* EXTERNRL SPECIFICATION FOR cu_node
*
* FUNCTION: Aborts any active "sweep", sets sweep node to cu, and
*           resunes activity.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*****************************************************************************
*
* LOGIC INFORMATION FOR cu_node
*
* INTIRL REFINERENT:
*
*    abort_sweep
*    IF source functions are uncoupled THEN
*       susp eource foreground and background
*       set stimulus to cu node
*       susp source foreground and background, returning to original
*    set stinulus to cu node
*    restart_sweep
*
*****************************************************************************
;
PROCEDURE  cu_node;
   BEGIN & cu_node &
      INTEGER CONSTANT cu_string_size := 32;
      BYTE ARRAY cu_array[-1:cu_string_size];
      ALPHA      cu_string;

      IF sweep_node <> single_pt THEN
         BEGIN & if &

            IF ( (active_function >= active_start) AND
                 (active_function <= active_epan)
               ) THEN
               select_active_function( active_cu );

            abort_sweep;

            cu_string := RDRS(cu_array);
            cu_string := init_string(cu_string, cu_string_size);

            sweep_node := single_pt;

            IF NOT coupled_ch(ch_start_frequency) THEN &all source fcns&
               BEGIN & if &          & are uncoupled and need changing &
                  break_entry_control( 3 - current_entry_ch );
                  urt_priv_ib_source(
```

```
SSTIMUL2.WORK.PDBS10          THU, DEC 22, 1983, 11:00 AM    PAGE  6


                           cu,
                           append_ch(
                                 fornat_quad(
                                       ch_quad( ch_center_frequency,
                                                3 - current_entry_ch
                                              ),
                                       cu_string,
                                       fornat_table[frequency_fornat]
                                             ),
                                 neuline
                                    )
                           );
                  break_entry_control( current_entry_ch );
               END;  & if &
            urt_priv_ib_source(
                     cu,
                     append_ch( fornat_quad(
                                       ch_quad( ch_center_frequency,
                                                current_entry_ch
                                              ),
                                       cu_string,
                                       fornat_table[frequency_fornat]
                                             ),
                                 neuline
                              )
                           );

            rebuild := TRUE;           & set up for array processing &
            annotate_stimulus;
            restart_sweep;

         END;  & if &

   END;  & cu_node &
```

```
SSTIMUL2.UORK.PDSS10          THU, DEC 22, 1983, 11:00 AM    PAGE  7


REJECT;
COMMENT                                                        suept_node
*****************************************************************************
*
* EXTERNRL SPECIFICATION FOR suept_node
*
* FUNCTION: Aborts any active sweep, sets sweep node to swept, and.
*           resunes sweep activity.
*
* PRRAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*****************************************************************************
*
* LOGIC INFORMRTION FOR suept_node
*
* IHTIRL REFIHEMENT:
*
*    abort_sweep
*    set stinulus to suept node
*    restart_sweep
*
*****************************************************************************
;
SUBROUTINE suept_node;
   BEGIN & suept_node &
      abort_sweep;
      suept_stinulus;
      restart_sweep;
   END;  & suept_node &
```

```
SSTIMUL2.WORK.PD8610          THU, DEC 22, 1983, 11:00 RR     PAGE  8


REJECT;
COMMENT                                                    stepped_node
*****************************************************************************
*
* EXTERNRL SPECIFICRIIDN FOR etepped_node
*
* FUNCTION: Rborts any active sweep, sets suoop mode to stappcd, end.
*           resumes sweep activity.
*
* PRRRMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: oont
*
*****************************************************************************
*
* LOGIC INFORMATIDN FOR stepped_mode
*
* INTIAL REFIKEMENT:
*
*    abort_sweep
*    set stimulus to stepped mode
*    restart_sweep
*
*****************************************************************************
;
SUBROUTINE stepped_mode;
   BEGIN & stepped_mode &
      abort_sweep;
      stepped_stimulus;
      restart_sweep;
   END;  & stepped_mode &
```



```
SSTIMUL2.WORK.PD8510          THU, DEC 22, 1983, 11:00 RR     PAGE  9


REJECT;
COMMENT                                              set_souplcd_stimulus_status
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  set_coupled_stimulus_status( state );
   VRLUE   state;
   BOOLERR state;
   BEGIN & set_couplod_stimulus_statuo &
      abort_owtep;

      set_coupled_status( state, couple_source );
      IF ( ch_integer(ch_domain,1) = ch_integer(ch_domain,2) ) THEN
         set_coupled_status( otatt, couple_stimulus );

      rebuild := TRUE;
      annotate_stimulus;
      restart_sweep;
   END;  & set_coupled_stimulus_status &


RFILE fstin.work;

END$
```

```
FSTIMUL3.WORK.PD8510          THU, DEC 22, 1983, 11:00 RR     PAGE  1


PROCEDURE  annotate_stimulus;                              EXTERNAL;
```

```
SSTIMUL3.WORK.PD8510          THU, DEC 22, 1983, 11:00 RR     PAGE  1


M6&KL,P,"stin3"
BEGIN

RFILE fstring.work;                              & for append_string &
RFILE fdisplay.work;
RFILE facreen.work;
RFILE cchtable.work;
RFILE fchtable.work;                          & for current_sotry_ch &
RFILE fchtab2.work;
RFILE fchtab3.work;                                & for coupled_ch &
RFILE fchdata.work;                                & for sweep_node &
RFILE ffnt.work;
RFILE cdatap.work;                                 & for ..._domain &
RFILE cstimuli.work;                          & for start_stop, etc. &
RFILE cscontvar.work;

DOUBLE CONSTRNT   freq_annot_fnt := X27300F09,
                  aux_annot_fnt  := X16000FF3,
                  time_annot_fnt := X16000FF8;
```

```
SSTINUL3.WORK.PDB510          THU, DEC 22, 1983, 11:00 RM     PAGE  2


$EJECT;
COMMENT                                                    annotate_stinulus
*************************************************************************
*
*************************************************************************
;
PROCEDURE  annotate_stinulus;                                        ENTRY;
   BEGIN & annotate_stinulus &
      BYTE    RRRRY    string[ -1 : stin_size ];
      DOUBLE  annot_fnt;
      INTEGER dg_addr;
      INTEGER start_node_display,
              stop_node_display,
              start_display,
              stop_display,
              stop_suffix_display;
      INTEGER ch,
              first_ch,
              last_ch,
              domain;

      string[-1] := stin_size;

      & make this table driven &                                & DEBUG &
      IF coupled_ch(ch_start_stinulus) THEN
         BEGIN & if &
            first_ch := last_ch := current_entry_ch;
            IF first_ch = 1 THEN
               BEGIN & if &
                  dg_addr :* novech2(start1_node_position,
                                     start_row,
                                     start_col
                                    );
                  dg_addr := novech2(stop1_node_position,
                                     stop_row,
                                     stop_col
                                    );
                  dg_addr := jnp(start2_node_position,
                                 etart2_suffix_display+stin_suffix_size
                                );
                  dg_addr := jnp(stop2_node_position,
                                 stop2_suffix_display+stin_suffix_size
                                );
               END  & if &
            ELSE
               BEGIN & else &
                  dg_addr :* novech2(start2_node_position,
                                     start_row,
                                     start_col
                                    );
                  dg_addr :* novech2(stop2_node_position,
                                     stop_row,
                                     stop_col
                                    );
                  dg_addr := jnp(start1_node_position,
                                 start1_suffix_display+stin_suffix_size
```

```
SSTINUL3.WORK.PDB510          THU, DEC 22, 1983, 11:00 RM     PAGE  3

                                );
                  dg_addr :* jnp(stop1_node_position,
                                 stop1_suffix_display+stin_suffix_size
                                );
               END;  & else &
         END   & if &
      ELSE
         BEGIN & else &
            first_ch := 1;
            last_ch := 2;
            dg_addr :* novech2(start1_node_position,
                               start_row,
                               start1_col
                              );
            dg_addr :* novech2(stop1_node_position,stop_row,stop1_col);
            dg_addr := novech2(start2_node_position,
                               start_row,
                               start2_col
                              );
            dg_addr := novech2(stop2_node_position,stop_row,stop2_col);
         END;  & else &

      FOR ch := first_ch TO last_ch DO
         BEGIN & for &
            domain := ch_integer(ch_domain, ch);
            IF domain = freq_domain THEN
               annot_fnt := freq_annot_fnt
            ELSE IF domain = aux_domain THEN
               annot_fnt := aux_annot_fnt
            ELSE & domain = time_domain or tdr_domain &
               annot_fnt := time_annot_fnt;

            IF ch = 1 THEN
               BEGIN & if &
                  start_node_display   := start1_node_display;
                  stop_node_display    := stop1_node_display;
                  start_display        := start1_display;
                  stop_display         := stop1_display;
                  stop_suffix_display  := stop1_suffix_display;
               END   & if &
            ELSE &  = 2 &
               BEGIN & else &
                  start_node_display   := start2_node_display;
                  stop_node_display    := stop2_node_display;
                  start_display        := start2_display;
                  stop_display         := stop2_display;
                  stop_suffix_display  := stop2_suffix_display;
               END;  & else &

            IF ( (sweep_mode = single_pt) AND
                 (domain <> time_domain)  AND
                 (domain <> tdr_domain)
               ) THEN
               BEGIN & if single_pt &
                  print_string( "  C.U.",
                                stin_node_size,
```

```
SSTINUL3.WORK.PDB510          THU, DEC 22, 1983, 11:00 RM     PAGE  4


                                start_node_display
                               );
                  jnp( stop_node_display,
                       stop_suffix_display + stin_suffix_size
                     );
                  print_string( format_quad( ch_quad(ch_center_stinulus,
                                                     ch
                                                    ),
                                             string,
                                             annot_fnt
                                            ),
                                stin_size,
                                start_display
                               );
                  print_string( "", stin_size, stop_display );
               END   & if single_pt &
            ELSE IF ch_integer( ch_stinulus_mode, ch ) = start_stop THEN
               BEGIN & else if start_stop &
                  print_string( "START ",
                                stin_mode_size,
                                start_node_display
                               );
                  print_string( "STOP  ",
                                stin_mode_size,
                                stop_mode_display
                               );
                  print_string( format_quad( ch_quad( ch_start_stinulus,
                                                      ch
                                                     ),
                                             string,
                                             annot_fnt
                                            ),
                                stin_size,
                                start_display
                               );
                  print_string( format_quad( ch_quad( ch_stop_stinulus,
                                                      ch
                                                     ),
                                             string,
                                             annot_fnt
                                            ),
                                stin_size,
                                stop_display
                               );
               END   & else if start_stop &
            ELSE & center/span node &
               BEGIN & else center_span &
                  print_string( "CENTER",
                                stin_node_size,
                                start_node_display
                               );
                  print_string( "SPAN  ",
                                stin_node_size,
                                stop_node_display
                               );
                  print_string( format_quad( ch_quad(ch_center_stinulus,
```

```
SSTINUL3.WORK.PDB510          THU, DEC 22, 1983, 11:00 RM     PAGE  5

                                                     ch
                                                    ),
                                             string,
                                             annot_fnt
                                            ),
                                stin_size,
                                start_display
                               );
                  print_string( format_quad( ch_quad( ch_span_stinulus,
                                                      ch
                                                     ),
                                             string,
                                             annot_fnt
                                            ),
                                stin_size,
                                stop_display
                               );
               END;  & else center_span &
         END;  & for &

   END;  & annotate_stinulus &

END$
```

```
CSTIMULI.WORK.PD8510          THU, DEC 22, 1983, 11:00 AM     PAGE  1


INTEGER CONSTANT  center_span      := 0,              & stinulus node &
                  start_stop       := 1,
                  no_stinulus_node := -1;
INTEGER CONSTANT  power_slope_off  := 0,          & power slope node &
                  power_slope_on   := 1;
```



```
F311NULI.WORK.PD8510          THU, DEC 22, 1983, 11:00 AM     PAGE  1


&FILE cstimuli.work;

PROCEDURE  set_stimulus_node( new_stimulus_node );
   VALUE   new_stimulus_node;
   INTEGER new_stimulus_node;                                  EXTERNAL;
PROCEDURE  update_start_stop_center_open;                      EXTERNAL;
PROCEDURE  update_start;                                       EXTERNAL;
PROCEDURE  update_center;                                      EXTERNAL;
BOOLEAN PROCEDURE enter_frequency_n_time( string, effective_now );
   VALUE   strang, effective_now;
   REPNR   string;
   BOOLEAN effective_now;                                      EXTERNAL;
QUAD PROCEDURE frequency_at_point(point_number);
   VALUE   point_number;
   INTEGER point_number;                                       EXTERNAL;
QUAD PROCEDURE entry_frequency_at_point(point_number);
   VALUE   point_number;
   INTEGER point_number;                                       EXTERNAL;
QUAD PROCEDURE entry_stimulus_at_point(point_number);
   VALUE   point_number;
   INTEGER point_number;                                       EXTERNAL;
INTEGER PROCEDURE point_at_ch_stimulus(stimulus_value, ch);
   VALUE   stimulus_value, ch;
   INTEGER ch;
   QUAD    stimulus_value;                                     EXTERNAL;
INTEGER PROCEDURE point_at_frequency(frequency_value);
   VALUE frequency_value;
   QUAD  frequency_value;                                      EXTERNAL;
BOOLEAN PROCEDURE  step_stimulus( stimulus_value );
   VALUE   stimulus_value;
   INTEGER stimulus_value;                                     EXTERNAL;
PROCEDURE  set_new_out;                                        EXTERNAL;
PROCEDURE  urt_priv_ib_source_freq(start_frequency, stop_frequency);
   VALUE   start_frequency, stop_frequency;
   QUAD    start_frequency, stop_frequency;                    EXTERNAL;
PROCEDURE  init_source;                                        EXTERNAL;
SUBROUTINE preset_source;                                      EXTERNAL;
```

```
SSTIMULI.WORK.PD3510          THU, DEC 22, 1983, 11:01 AM     PAGE  1


M68KL,P,"stimuli"
BEGIN

RFILE cdebug.work;                                  & for forced_step &
RFILE fiocnfig.work;
RFILE cchtable.work;
RFILE fchtable.work;
RFILE fchtab2.work;
RFILE fchtab3.work;
RFILE fprivib.work;
RFILE ffnt.work;
RFILE factive.work;
RFILE factive2.work;
RFILE facttbl.work;
RFILE fxadc.work;
RFILE fdatap1.work;
RFILE crims.work;                          & for active_function_rin &
RFILE fkernel.work;                                  & for release &
RFILE fkernel4.work;                       & for conditional_acquire &
RFILE cstimuli.work;
RFILE fstimul2.work;                            & for source_points &
RFILE fstimul3.work;                         & for annotate_stimulus &
RFILE fcnv9x.work;
RFILE fcontrol.work;                              & for group_number &
RFILE fcontvar.work;       & for partial_new_step_size and constants &
RFILE fbreak.work;                                & for step_source &
RFILE fstring.work;                                 & for append_ch &
RFILE cchars.work;                                   & for newline &
RFILE fchdata.work;                                & for step_size &
RFILE fdomain.work;                            & for update_domain_vars &


INTEGER aux_out_dac = bottom + X2E;

DOUBLE CONSTANT   power_fnt        := X0004000F,
                  frequency_fnt    := X0000000F;
DOUBLE &CONSTANT& sweep_time_fnt   =  power_fnt; & trick the compiler &
                                              & dont make 2 copies &

BOOLEAN source_initialized;
QUAD    temp;

BOOLEAN postponed_values;
INTEGER postponed_entry_ch,
        postponed_domain;
QUAD    postponed_start,
        postponed_center;
REAL    postponed_sweep_time;
```

```
SSTIMULI.WORK.PD8510          THU, DEC 22, 1983, 11:01 AM     PAGE  2


REJECT;
COMMENT                                                  set_stimulus_node
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  set_stimulus_node( new_stimulus_node );
   VALUE   new_stimulus_node;
   INTEGER new_stimulus_node;                                      ENTRY;
   BEGIN & set_stimulus_node &
      IF new_stimulus_node <> entry_ch_integer(ch_stimulus_node) THEN
         BEGIN & if &
            set_entry_ch_integer( new_stimulus_node, ch_stimulus_node );
            annotate_stimulus;
         END;  & if &
   END;  & set_stimulus_node &
```

```
SSTIMULI.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  3


$EJECT;
COMMENT                                        update_start_stop_center_span
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR update_start_stop_center_span
*
* FUNCTION:
*    To compute the stimulus stop and span values from the start and
* center values of the currently active domain, and store those values
* into the entry channel table along with the start and center as
* stimulus values -- e.g. ch_start_stimulus.
*
* DECLARATION INFORMATION:
*    INPUT:  none
*
*    OUTPUT:  none
*
* EXTERNAL EFFECTS:
*    none.
*
*****************************************************************************
*
* LOGIC INFORMATION FOR update_start_stop_center_span
*
* PROCEDURES CALLED:
*
* INITIAL REFINEMENT:
*
*    stop := center + center - start.
*    span := stop - start.
*
*****************************************************************************
;
PROCEDURE update_sscs_ch( ch, domain );
   VALUE   ch, domain;
   INTEGER ch, domain;
   SEGIN & update_sscs_ch &
      INTEGER ch_start,
              ch_center;
      QUAD    start,
              stop,
              center,
              span;

      CASE domain OF
         BEGIN & case &
& freq_domain &   BEGIN & freq_domain &
                     ch_start  := ch_start_frequency;
                     ch_center := ch_center_frequency;
                  END;  & freq_domain &
& time_domain &   BEGIN & band_pass time_domain &
& band_pass   &      ch_start  := ch_start_time;
                     ch_center := ch_center_time;
                     update_domain_vars;
                  END;  & band_pass time_domain &
& time_domain &   BEGIN & low_pass time_domain &
```

```
SSTIMULI.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  4


& low_pass    &      ch_start  := ch_start_time;
                     ch_center := ch_center_time;
                     update_domain_vars;
                  END;  & low_pass time_domain &
& aux_domain  &   BEGIN & aux_domain &
                     ch_start  := ch_start_aux_out;
                     ch_center := ch_center_aux_out;
                  END;  & aux_domain &
         END;  & case &

      start  := ch_quad( ch_start, ch );
      center := ch_quad( ch_center, ch );

      set_ch_quad( start,  ch_start_stimulus,  ch );
      set_ch_quad( center, ch_center_stimulus, ch );

      stop   := center + center - start;
      span   := stop - start;

      set_ch_quad( stop, ch_stop_stimulus, ch );
      set_ch_quad( span, ch_span_stimulus, ch );

      annotate_stimulus;

      set_active_limits( start, stop, active_marker1 ); & same all mkrs&

   END;  & update_sscs_ch &


SUBROUTINE update_start_stop_center_span;                          ENTRY;
   BEGIN & update_start_stop_center_span &
      update_sscs_ch( current_entry_ch, entry_ch_integer(ch_domain) );
   END;  & update_start_stop_center_span &
```

```
SSTIMULI.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  5


REJECT;
COMMENT                                                    update_start
*****************************************************************************
*
* Updates ch_start_<domain> based on ch_center_stimulus and
* ch_span_stimulus.  Useful for new center or span values.
*
* start, stop, center, and span ch_..._stimulus values are then
* updated from the ch_start_<domain> and ch_center_<domain> value, so
* the value of ch_center_<domain> must be valid before calling this
* routine.
*
*****************************************************************************
;
PROCEDURE update_start;                                            ENTRY;
   BEGIN & update_start &
      set_entry_ch_quad( ( entry_ch_quad(ch_center_stimulus) -
                           entry_ch_quad(ch_span_stimulus)/2
                         ),
                         get_active( get_chtable_index, active_start )
                       );
      update_start_stop_center_span;
   END;  & update_start &
```

```
SSTIMULI.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  6


REJECT;
COMMENT                                                    update_center
*****************************************************************************
*
* Updates ch_center_<domain> based on ch_start_stimulus and
* ch_stop_stimulus.  Useful for new start or stop values.
*
* start, stop, center, and span ch_..._stimulus values are then
* updated from the ch_start_<domain> and ch_center_<domain> value, so
* the value of ch_start_<domain> must be valid before calling this
* routine.
*
*****************************************************************************
;
PROCEDURE update_center;                                           ENTRY;
   BEGIN & update_center &
      set_entry_ch_quad( ( entry_ch_quad(ch_start_stimulus) +
                           entry_ch_quad(ch_stop_stimulus)
                         ) / 2,
                         get_active( get_chtable_index, active_center )
                       );
      update_start_stop_center_span;
   END;  & update_center &
```

```
SSTIMULI.UORK.PDS51D          THU, DEC 22, 1983, 11:01 AM     PAGE  7


REJECT;
COMMENT                                              enter_frequency_n_time
*****************************************************************************
*
* EXERWOL SPECIFICATION FOR enter_frequency_n_time
*
* FUNCTION:
*    To enter the values of start frequency, center frequency, and
* sweep time returned from the source as the result of a new entry
* for one of the three.  Processes the string received from a source
* in response to the "OC" request.
*
* DECLARATION INFORMATION:
*    INPUT:  string      The ASCII string returned from the source in
*                        the form NR "," NR "," NR <cr> <lf>, where
*                        NR refers to the generic data type defined in
*                        the HP-IB code and format conventions 9728, and
*                        <cr> and <lf> refer to the ASCII characters.
*
*    OUTPUT:  none
*
* EXTERNAL EFFECTS:
*    Changes the internal values maintained for the source for the
* entry channel.
*
*****************************************************************************
*
* LOGIC INFORMATION FOR enter_frequency_n_time
*
* PROCEDURES CALLED:
*    CNV9R
*    CNV92
*
* INITIAL REFINEMENT:
*
*    initialize temporary string.
*
*    copy first (start frequency) value into temporary string.
*    convert temporary string to a quad integer.
*    store the quad integer value into the entry channel's table.
*
*    copy second (stop frequency) value into temporary string.
*    convert temporary string to a quad integer.
*    store the quad integer value into the entry channel's table.
*
*    copy third (sweep time) value into temporary string.
*    convert temporary string to a integer.
*    store the integer value into the entry channel's table.
*
*    update the start, stop, center, and span values in the channel
*          table.
*
*****************************************************************************
;
BOOLEAN PROCEDURE enter_frequency_n_time( string, effective_now );
   VALUE   string, effective_now;
```

```
SSTIMULI.WORK.PDS51D          THU, DEC 22, 1983, 11:01 AM     PAGE  8

   ALPHA   string;
   BOOLEAN effective_now;                                          ENTRY;
   BEGIN & enter_frequency_n_time &
      INTEGER index;
      WORD    half_span;

      IF ( effective_now       RND
           postponed_values    RND
           (postponed_entry_ch <> current_entry_ch)
         ) THEN
         BEGIN & if &
            act_ch_quad( postponed_start,
                         ch_start_frequency,
                         postponed_entry_ch
                       );
            set_ch_quad( postponed_center,
                         ch_center_frequency,
                         postponed_entry_ch
                       );
            set_ch_real( postponed_sweep_time,
                         ch_sweep_time,
                         postponed_entry_ch
                       );
            update_secs_ch( postponed_entry_ch, postponed_domain );
            postponed_values := FALSE;
            enter_frequency_n_time := TRUE;
         END   & if &
      ELSE
         enter_frequency_n_time := FALSE;

      index := 1;
      postponed_start     := CNVDR( string, index );
      postponed_center    := CNV9R( string, index );
      postponed_sweep_time := CNV92( string, index );

      IF sweep_mode = single_pt THEN
         BEGIN & if &
            read_priv_ib( source, na_fun, "OPCU", string );
            index := 1;
            postponed_center := CNV9R( string, index );
         END;  & if &

      IF effective_now THEN
         BEGIN & if &
            set_entry_ch_quad( postponed_start,
                               ch_start_frequency
                             );
            set_entry_ch_quad( postponed_center,
                               ch_center_frequency
                             );
            set_entry_ch_real( postponed_sweep_time,
                               ch_sweep_time
                             );

            IF entry_ch_integer(ch_domain) = freq_domain THEN
               BEGIN & if &
```

```
SSTIMULI.WORK.PDS51D          THU, DEC 22, 1983, 11:01 AM     PAGE  9

                  update_start_stop_center_span;
                  IF conditional_acquire( active_function_rin ) THEN
                     BEGIN & if &   & making sure it's available first &
                        release( active_function_rin );
                        select_active_function(active_previous);
                     END;  & if &
                  control_data_proc_freq(1);          & temp until can  &
                  control_data_proc_freq(2);          & handle coupling &
               END;  & if &

            group_number := 0;      & used to restart averaging factor &
         END   & if &
      ELSE
         BEGIN & else &
            postponed_values   := TRUE;
            postponed_entry_ch := current_entry_ch;
            postponed_domain   := entry_ch_integer( ch_domain );
         END;  & else &

   END;  & enter_frequency_n_time &
```

```
SSTIMULI.WORK.PDS51D          THU, DEC 22, 1983, 11:01 AM     PAGE 10


REJECT;
COMMENT                                                 frequency_at_point
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR frequency_at_point
*
* FUNCTION
*    Computes and returns a quad stimulus value, given a point number,
* based on the acquisition channel and its stimulus range.  The function
* implemented is
* point_number < start,frequency_at_point(point_number)
*                          = start frequency
* point_number > stop, frequency_at_point(point_number)
*                          = stop frequency
* otherwise,           frequency_at_point(point_number) = start_stimulus
*                          + (frequency span)*(point_number/span)
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  point_number         start <= point_number <= stop
*
*    OUTPUT: frequency_at_point   the corresponding stimulus value
*
* USAGE:
*    stimulus := frequency_at_point(this_point)
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
*****************************************************************************
*
* LOGIC INFORMATION FOR frequency_at_point
*
* INTIAL REFINEMENT:
*
*****************************************************************************
;
QUAD PROCEDURE frequency_at_point(point_number);
   VALUE   point_number;
   INTEGER point_number;                                           ENTRY;
   BEGIN & frequency_at_point &
      QUAD start_frq,
           center_frq,
           half_span;

      IF sweep_mode = single_pt THEN
         frequency_at_point := acquisition_ch_quad(ch_center_frequency)
      ELSE
         BEGIN & sweep_mode <> single_pt &
            start_frq  := acquisition_ch_quad(ch_start_frequency);
            center_frq := acquisition_ch_quad(ch_center_frequency);

            IF point_number <= start THEN
               frequency_at_point := start_frq
            ELSE IF point_number >= stop THEN
```

```
$STIMULI.WORK.PD8S10          THU, DEC 22, 1983, 11:01 AM    PAGE 11


            BEGIN & else if &
               frequency_at_point :=
                              center_frq + center_frq - start_frq;
            END   & else if &
         ELSE
            BEGIN & else &
               half_span := center_frq - start_frq;
               frequency_at_point := start_frq +
                                     ( (half_span + half_span)
                                       * point_number
                                       + center
                                     ) / span;
                                       & "center" is for rounding &
            END;  & else &
      END;  & sweep_mode <> single_pt &

   END;  & frequency_at_point &


QUAD PROCEDURE entry_value_at_point(point_number, ch_start, ch_center);
   VALUE   point_number, ch_start, ch_center;
   INTEGER point_number, ch_start, ch_center;
   BEGIN & entry_value_at_point &
      QUAD start_value,
           center_value,
           half_span;

      start_value  := entry_ch_quad(ch_start);
      center_value := entry_ch_quad(ch_center);

      IF point_number <= start THEN
         entry_value_at_point := start_value
      ELSE IF point_number >= stop THEN
         BEGIN & else if &
            entry_value_at_point :=
                              center_value + center_value - start_value;
         END   & else if &
      ELSE
         BEGIN & else &
            half_span := center_value - start_value;
            entry_value_at_point := start_value +
                                    ( (half_span + half_span)
                                      * point_number
                                      + center
                                    ) / span;
                                      & "center" is for rounding &
         END;  & else &

   END;  & entry_value_at_point &


QUAD PROCEDURE entry_frequency_at_point(point_number);
   VALUE   point_number;
   INTEGER point_number;                                    ENTRY;
```

```
$STIMULI.WORK.PD8S10          THU, DEC 22, 1983, 11:01 AM    PAGE 12


   BEGIN & entry_frequency_at_point &

      IF sweep_mode = single_pt THEN
         point_number := center;

      entry_frequency_at_point := entry_value_at_point(
                                                point_number,
                                                ch_start_frequency,
                                                ch_center_frequency
                                                  );
   END;  & entry_frequency_at_point &


QUAD PROCEDURE entry_stimulus_at_point(point_number);
   VALUE   point_number;
   INTEGER point_number;                                    ENTRY;
   BEGIN & entry_stimulus_at_point &

      IF sweep_mode = single_pt THEN
         point_number := center;

      entry_stimulus_at_point := entry_value_at_point(
                                                point_number,
                                                ch_start_stimulus,
                                                ch_center_stimulus
                                                  );
   END;  & entry_stimulus_at_point &
```

```
$STIMULI.WORK.PD8S10          THU, DEC 22, 1983, 11:01 AM    PAGE 13


REJECT;
COMMENT                                              point_at_frequency
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR point_at_frequency
*
* FUNCTION
*    Computes and returns point number corresponding to the given
* frequency, based on the acquisition channel and its frequency range.
* The frequency is rounded to the nearest point number, not truncated.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  frequency            start <= frequency <= stop
*
*    OUTPUT: point_at_frequency   the corresponding point
*
* USAGE:
*    this_point := point_at_frequency(this_frequency_value)
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
*****************************************************************************
*
* LOGIC INFORMATION FOR point_at_frequency
*
* INTIAL REFINEMENT:
*
* get start and center frequencies.
* IF frequency_value <= start frequency THEN
*    return point number 0
* ELSE IF frequency_value >= stop frequency THEN
*    return point number 800
* ELSE
*             800*(frequency-start) + span/2(for rounding]
*    return   ---------------------------------------------
*                          span
*
*****************************************************************************
;
INTEGER PROCEDURE point_at_ch_value(value, ch, ch_start, ch_center);
   VALUE   value, ch, ch_start, ch_center;
   INTEGER ch, ch_start, ch_center;
   QUAD    value;
   BEGIN & point_at_ch_value &
      QUAD start_frq,
           center_frq,
           half_span;

      start_frq  := ch_quad(ch_start, ch);
      center_frq := ch_quad(ch_center, ch);

      IF start_frq = center_frq THEN        & single_pt is handled by &
         point_at_ch_value := stop          & pt_at_ch_stimulus below &
```

```
$STIMULI.WORK.PD8S10          THU, DEC 22, 1983, 11:01 AM    PAGE 14


      ELSE                                  & "stop" is next lock pt. &
         BEGIN & start_frq <> center_frq &

            IF value <= start_frq THEN
               point_at_ch_value := 0
            ELSE IF value >= (center_frq + center_frq - start_frq)
                 THEN
               point_at_ch_value := stop
            ELSE
               BEGIN & else &
                  half_span := center_frq - start_frq;
                  point_at_ch_value := ( 800*(value-start_frq) +
                                         half_span
                                       ) / (half_span + half_span);
               END;  & else &
         END;  & start_frq <> center_frq &

   END;  & point_at_ch_value &


INTEGER PROCEDURE point_at_ch_stimulus(stimulus_value, ch);
   VALUE   stimulus_value, ch;
   INTEGER ch;
   QUAD    stimulus_value;                                  ENTRY;
   BEGIN & point_at_ch_stimulus &

      IF sweep_mode = single_pt THEN
         point_at_ch_stimulus := center
      ELSE
         point_at_ch_stimulus := point_at_ch_value( stimulus_value,
                                                    ch,
                                                    ch_start_stimulus,
                                                    ch_center_stimulus
                                                  );

   END;  & point_at_ch_stimulus &


INTEGER PROCEDURE point_at_frequency(frequency_value);
   VALUE frequency_value;
   QUAD  frequency_value;                                   ENTRY;
   BEGIN & point_at_frequency &

      point_at_frequency := point_at_ch_value( frequency_value,
                                               current_acquisition_ch,
                                               ch_start_frequency,
                                               ch_center_frequency
                                             );

   END;  & point_at_frequency &
```

```
SSTIMULI.WORK.PDB510          THU, DEC 22, 1983, 11:01 AM    PAGE 15


%EJECT;
COMMENT                                                    step_stimulus
*******************************************************************************
*
*******************************************************************************
;
BOOLEAN PROCEDURE  step_stimulus( stimulus_value );
   VALUE   stimulus_value;
   INTEGER stimulus_value;                                          ENTRY;
   BEGIN & step_stimulus &

COMMENT
      IF stimulus is frequency THEN;
      step_stimulus := step_source( stimulus_value );

COMMENT
      if stimulus is other that frequency, must call break_fifo check
      routine and return the boolean success value;

   END; & step_stimulus &
```

```
SSIIMULI.WORK.PDB510          THU, DEC 22, 1983, 11:01 AM    PAGE 16


REJECT;
COMMENT                                                    set_aux_out
*******************************************************************************
*
*******************************************************************************
;
PROCEDURE  set_aux_out;                                             ENTRY;
   BEGIN & set_aux_out &
      INTEGER data;
      data := INTEGER( entry_ch_quad(ch_center_aux_out) );
      If data < -2048 THEN
         data := -2048
      ELSE IF data > 2047 THEN
         data := 2047;
      aux_out_dac := data;
   END;  & set_aux_out &
```

```
SSTIMULI.WORK.PDB510          THU, DEC 22, 1983, 11:01 AM    PAGE 17


REJECT;
COMMENT                                          urt_priv_ib_source_freq
*******************************************************************************
*
*
*******************************************************************************
;
PROCEDURE  urt_priv_ib_source_freq( start_frequency, step_frequency );
   VALUE  start_frequency, stop_frequency  ;
   QUAD   start_frequency, stop_frequency  ;                        ENTRY;
   BEGIN
      INTEGER CONSTANT string_size := 23;
      BYTE    ARRAY   string[ -1 : string_size ];

      string[-1] := string_size;
      urt_priv_ib_source(
                  fa,
                  append_ch( format_quad( start_frequency,
                                          string,
                                          frequency_fnt
                                        ),
                             newline
                           )
               );
      urt_priv_ib_source(
                  fb,
                  append_ch( format_quad( stop_frequency,
                                          string,
                                          frequency_fnt
                                        ),
                             newline
                           )
               );
   END;  & urt_priv_ib_source_freq &
```

```
SSTIMULI.WORK.PDS510          THU, DEC 22, 1983, 11:01 AM    PAGE 18


REJECT;
COMMENT                                                    init_source
*******************************************************************************
*
*  This routine used to talk to the source in start/stop or center/span,
*  depending upon the stimulus_mode.
*
*******************************************************************************
;
PROCEDURE  init_source;                                             ENTRY;
   BEGIN & init_source &
      QUAD start_frequency,
           stop_frequency,
           center_frequency;
      INTEGER CONSTANT string_size := 23;
      BYTE    ARRAY   string[ -1 : string_size ];

      string[-1] := string_size;

      start_frequency  := entry_ch_quad( ch_start_frequency );
      center_frequency := entry_ch_quad( ch_center_frequency );
      stop_frequency   := center_frequency + center_frequency
                                           - start_frequency;

      urt_priv_ib_source_freq( start_frequency, stop_frequency );

      urt_priv_ib_source(
                  at,
                  append_ch( format_ceel( entry_ch_real(ch_sweep_time),
                                          string,
                                          sweep_time_fnt
                                        ),
                             newline
                           )
               );
      urt_priv_ib_source(
                  pl,
                  append_ch(
                        format_real( entry_ch_real(ch_source_power),
                                     string,
                                     power_fnt
                                   ),
                        newline
                        )
               );
      IF entry_ch_integer(ch_power_slope_mode) = power_slope_off THEN
         urt_priv_ib_source(  sl0, newline )
      ELSE & power slope on &
         urt_priv_ib_source(
                     sl1,
                     append_ch( format_ceal(
                                          entry_ch_real(ch_power_slope),
                                          string,
                                          power_fnt
                                            ),
                                newline
```

```
SSTIMULI.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE 19


                    )
                );

  END;  & init_source &
```

```
SSTIMULI.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE 20


%EJECT;
COMMENT                                                    init_ch_stimuli
*************************************************************************
*
*************************************************************************
;
SUBROUTINE init_ch_stimuli;                                        ENTRY;
  BEGIN & init_ch_stimuli &

    IF NOT ( coupled_ch(ch_start_frequency) AND
           source_initialized
         ) THEN
      init_source;
&   ELSE coupled and initialized, so don't need to do it again.      &

    source_initialized := TRUE;

  END;  & init_ch_stimuli &
```

```
SSTIMULI.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE 21


%EJECT;
COMMENT                                                    preset_source
*************************************************************************
*
*************************************************************************
;
SUBROUTINE preset_source;                                          ENTRY;
  BEGIN & preset_source &
    clr_priv_ib(source);                    & selective device clear &
    source_points := 0;
    urt_priv_ib_source(  clr_fun, "IPWA1RM"+0+"CS" );
    urt_priv_ib_source(  display_off, " " );
  END;  & preset_source &
```

```
SSTIMULI.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE 22


%EJECT;
COMMENT                                                    init_stimuli
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR init_stimuli
*
* FUNCTION
*    To initialize the channel-independent source functions.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  None
*
*    OUTPUT: None
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
*************************************************************************
*
* LOGIC INFORMATION FOR init_stimuli
*
* INTIAL REFINEMENT:
*
*************************************************************************
;
SUBROUTINE init_stimuli;                                           ENTRY;
  BEGIN & init_stimuli &

    source_initialized := FALSE;
    postponed_values := FALSE;

    clr_priv_ib(source);                    & selective device clear &
    IF NOT                                                  & DEBUG &
    urt_priv_ib_source(clr_fun,"HA1RM"+0+"CSRM"+X28)
      THEN forced_step := 1;                                & DEBUG &

    source_points := 0;           & clear to force setting it below &
    partial_new_step_size( step_size );

  END;  & init_stimuli &

END$
```

```
RSTRING.WORK.P08510          THU, DEC 22, 1983, 11:01 AM    PAGE  1


RSMB,R
  MED string functions
  WAM string,"WEC     P08510  "
  EM1 clear_string
  CM1 init_string
  CM1 append_ch
  EM1 append_string
*
R0 REG 0   REGISTERS: M68KL - 4 FEB 1980
R1 REG 1
R2 REG 2
R3 REG 3
R4 REG 4
R5 REG 5
R6 REG 6
R7 REG 7
R8 REG 8
R9 REG 9
R10 REG 10
R11 REG 11
R12 REG 12
R13 REG 13
R14 REG 14
R15 REG 15
F REG 13
R REG 14
S REG 15
* The following string operators have been added instead of using those
* from MARK.UPSOFT.  These contain overflow checking, and use RLPHAs
* instead of BYTE ARRAYs for the parameters.  This allows the calling
* program to pass either an ALPHA or a BYTE ARRAY.  The R510 is using
* a BYTE ARRAY with dimension [-1:max_size] in order to include an
* array size value in addition to the string length.  One only needs
* to get the array size value once prior to any use.  It will not be
* modified by any of these routines.  It may be set by calling the
* "init_string" procedure, or by the statement
*           string[-1] := max_size;
* These R510 strings behave normally when passed to a procedure
* expecting a normal ALPHA parameter (such as John's USTR), but allow us
* to provide some additional protection in routines that write into the
* string or append characters or other strings to the string.
*
* It may be of interest to note that a literal "" does not result in a
* null (zero length) string, but rather is changed by the compiler into
* " ".  We will be defining a globally available null string that may
* be used if required, or an existing string may be set to a null string
* by the procedure "clear_string".
*
* These string operators utilize a "string" defined as follows:
*    BYTE ARRAY string[-1:max_size]
* where string[0] contains the lengths of the current string contained
* in the array, and string[-1] contains the maximum length of the array
* -- string[-1] := max_size.  This array is passed as an ALPHA to the
* procedures below.  The string operators return the ALPHA to allow
* them to be used as parameters for other procedures, but the string
```

```
RSTRING.WORK.P08510          THU, DEC 22, 1983, 11:01 AM    PAGE  2

* is modified in the original byte array regardless of whether the
* return value is used.
*
* RLPHA PROCEDURE clear_string(string);
*    VALUE string;
*    RLPHA string;                                          EXTERNAL;
*
* Clears the string, i.e. sets the length of the string to zero.
*
clear_string EQU *
  MOVE.L A0,A12
  CLR.B  (A12)        string[0] := 0;
  RTS
*
* RLPHA PROCEDURE init_string(string, max_length);
*    VALUE string, max_length;
*    ALPHA string;
*    BYTE  max_length;                                      EXTERNAL;
*
* Initializes the string array and clears the string, i.e. sets the
* size (string[-1]) of the array to max_length, and sets the length of
* the string to zero.
*
init_string EQU *
  MOVE.L A0,A12
  MOVE.B 5(S),-1(A12) string[-1] := max_size;  (second parameter)
  CLR.B  (A12)        string[0]  := 0;
  MOVE.L (S)+,A2      save return address temporarily
  ADDQ.L #02,S        delete parameter
  JMP    (A5)         return
*
* RLPHA PROCEDURE append_ch(otring,ch);
*    VALUE string, ch;
*    ALPHA string;
*    BYTE ch;                                               EXTERNAL;
*
* Appends the character, ch, onto the end of the string.  If the string
* completely fills the available space, the last character of the string
* is overwritten with the character.  If the character is a backspace,
* the string length is reduced by one unless it is already zero.
*
* CAUTION:  Due to the effect of appending a backspace described above
* append_ch is not normally suitable for appending BINARY data.  It may
* be appropriate to use append_string, which does not check for
* the backspace character, or to use a different approach for appending
* binary data.
*
append_ch EQU *
  MOVE.L A0,A12       A12 := otring (type ALPHA);
  MOVE.B 5(S),A7      A7  := ch;
  CMP.B  #08,A7       IF ch = backspace
  BNE    NOTBS
  TST.B  (A12)           IF string[0] <= 0
  BLE    END1               return;
  SUB.B  #01,(A12)       ELSE string[0] := string[0] - 1;
  BRA    END1               return;
```

```
RSTRING.WORK.P08510          THU, DEC 22, 1983, 11:01 AM    PAGE  3

NOTBS: ADD.B #01,(A12) ELSE etring[0] := string[0] + 1;
  MOVE.B (A12),A2        A7 := strine[0];
  CMP.B  -1(A12),A7      IF atring[0] > string[-1]
  BLE    MOVE
  SUB.B  #01,(A12)          string[0] := string[0] - 1;
  MOVE.B (A12),A7           A7 := string[0];
MOVE: EXTS   A7
  MOVE.B 5(S),0(A12,A7)  string[ string[0] ] := ch;
END1: MOVE.L (S)+,A5  save return address temporariiy
  ADDQ.L #02,S        delete parameter
  JMP    (A5)         return
*
* RLPHA PROCEDURE append_etring(string, string2);
*    VALUE string, string2;
*    ALPHA string, string2;                                 EXTERNAL;
*
* Appends string2 onto the end of string.  If the result would exceed
* the space available for string, the trailing characters of string2
* are lost.   Unlike append_ch, backspace characters in either string
* have no effect.
*
* In general, register assignments are as follows:
*   A0 -> value parameter string (ALPHA)
*   A0 -> return value (ALPHA)
*   A1 -> count = number of characters in string2 to add to string.
*   A7 -> temporary accumulator for computing count (A1) and end of
*         string (A9).
*   AA -> otring (ALPHA)
*   A5 -> end of string (ALPHA), the place to add the next character.
*   A12-> string2 (ALPHA)
*
append_string EQU *
  MOVE.L 4(S),A12     A12 := string2 (type ALPHA)
  MOVE.B (A12),A1     A1 := count;   ( string2[0] )
  MOVE.L A0,AA        IF count > (string[-1] - string[0])
  MOVE.B -1(AS),A7
  SUB.B  (AA),A7
  CMP.B  A7,A1
  BLE    SHORT
  MOVE.B A7,A1           count := string[-1) - string[0];
SHORT: TST.B A1       IF count <= 0
  BLE    END2              return
  MOVE.B (A8),A7      ELSE
  ADD.B  A1,(AS)         string[0] := string[0] + count;
  ADD.B  #01,A7          MOVE string[ string[0]+1 ] :=
  EXTS   A7                    string2[1], +(count);
  MOVE   A7,A9
  ADD.L  A0,A3
  LEA    1(A12),A12
  EXTS   A1
  BRA    SKIP
LOOP: MOVE.B (A12)+,(A9)+    ( the actual move )
SKIP: DBRA A1,LOOP
END2: MOVE.L (S)+,A5  save return address temporariiy
  ADDQ.L #04,S        delete parameter
  JMP    (A8)         return
```

```
RSTRING.WORK.P08510          THU, DEC 22, 1983, 11:01 AM    PAGE  4

*
  END
```

```
FSTRING.WORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  1


ALPHA PROCEDURE clear_string(string);
   VALUE   string;
   &LPHA   string;                                          EXTERNAL;
ALPHA PROCEDURE init_string(string, nax_length);
   VALUE   string, nax_length;
   ALPHA   etring;
   &YTE    nax_length;                                      EXIERNAL;
ALPKR PROCEDURE append_chfstring, eh);
   VALUE   etring, ch;
   ALPHA   string;
   8V1E    ch;                                              EX1ERNAL;
ALPHA PROCEDURE append_string(string1, string2);
   VALUE   string1, string2;
   ALPHA   string1, string2;                                EXTERNAL;
```

```
CSYSTEM.WORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  1


INIEGER CONSTANT

cnd_title := 310,
cnd_hpib_info := 311,
cnd_crt_off := 312,
cnd_service_nenu := 313,
cnd_erase_title := 317,
end_title_done := 318,
end_8510_addr := 319,
cnd_systen_bus_addr := 320,
end_source_addr := 321,
cnd_test_set_eddr := 322,
cmd_plotter_addr := 323,
cnd_printer_addr := 324,
cnd_aoto_cnd_addr := 325,
cmd_paeo_thru_addr := 326,
cnd_revision := 327,
cnd_privib_local := 328,
cnd_privib_renote := 323,
cnd_if_gain_nenu := 330,
cnd_peek_poke_addr := 331,
cnd_peek := 332,
cnd_pohe := 333,
cnd_test_nenu := 334,
cnd_groupt0 := 0;
```

```
F8YSTEM.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  1


COMMEKT
  This is a softuare generated file !!!
  Changes nust be nade in 8KINFO.WORK
  Run GENSK.LANI to re-generate file;

SUBROUTINE proc10;  ENTRY;
BEGIN

CASE connand_token-310 OF
BEGIN
& 310 &
select_active_function( active_title );
& 311 &
BEGIN END;
& 312 &
uarn(connand_not_inplenented);
& 313 &
BEGIN END;
& 314 &
enter_title_char( char_index );
& 315 &
enter_title_char( space_index );
& 316 &
enter_title_char( backspace_index );
& 317 &
erase_title;
& 318 &
BEGIN
   aelect_active_off( active_title );
   previous_nenu;
END;
& 319 &
select_active_function( active_8510_hpib_addr );
& 320 &
select_active_function( active_systen_bus_hpib_addr );
& 321 &
select_active_function( active_source_hpib_addr );
& 322 &
select_active_function( active_testset_hpib_addr );
& 323 &
seltct_active_function( active_plotter_hpib_addr );
& 324 &
select_active_function( octive_printer_hpib_addr );
& 325 &
select_active_function( active_ch_end_hpib_addr );
& 326 &
select_active_function( active_pass_thru_hpib_addr );
& 327 &
select_active_function( active_revision );
& 328 &
BEGIN
   hilight_on( cnd_privib_local, cnd_privib_renote );
   abort_sueep;
   clr_ren_priv_ib;
   urt_priv_ib_source(  display_on, " " );
```

```
F8YSTEM.UORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  2


END;
& 329 &
BEGIN
   hilight_on( cnd_privib_local, cnd_privib_renote );
   abort_sueep;
COMMENT
   set_ren_priv_ib;
COMMENT
   urt_priv_ib_eource(  display_off, " " );
   reset_priv_ib_act_funs;
   restart_eueep;
END;
& 330 &
BEGIN END;
& 331 &
select_active_function( active_address );
& 332 &
select_active_function( active_peek );
& 333 &
select_active_function( active_poke );
& 334 &
BEGIN
   trap_15_type := eervice_trap;
   TRAP(15);
END;
END;
END proc10;
```

```
33YSTEM.WORK.PD8510          THU, DEC 22, 1983, 11:01 AM    PAGE  1

M68KL,P,"system"

$ECIK

$FILE Futil.work;
$FILE csystem.work;
$FILE factive.work;                    & Fpr eelect_active_function $
$FILE factive2.work;                       & far select_active_off &
$FILE fprivib.work;
$FILE fprivib2.work;
$FILE fconnand.work;                     & for connand_token value &
$FILE fkernel.work;
$FILE crino.work;
&FILE fcentrol.work;           $ for abort_sweep and restart_sweep &
$FILE fmenu.work;
$FILE cdebug.work;                         & for trop_15_type, etc. &
$FILE ftitle.work;           & far enter_title_cher ond title_dene $

$FILE fsystem.work;

END$
```

```
FIABLE.WORK.PD8510           THU, DEC 22, 1983, 11:01 AM    PAGE  1

 GLOBAL INTEGER TASLE log_table:=-32765,-31311,-29899,-28525,
  -27198,-25902,-24642,-23414, -22217,-21050,-19911,-19799,
  -17712,-16649,-15611,-14594, -13599,-12624,-11669,-10733,
   -9815, -8914, -8031, -7163,  -6312, -5475, -4653, -3845,
   -3050, -2269, -1500,  -744,    1;

 GLOBAL INTEGER ATN TABLE atn_table:=-32768,-32107,-31424,-30719,
  -25992,-29242,-28469,-27671, -26849,-26002,-25130,-24232,
  -23307,-22357,-21379,-20376, -19346,-18290,-17208,-16101,
  -14970,-13815,-12638,-11440, -10222, -8936, -7734, -6467,
  -5189, -3900, -2605, -1304,  0;
```

```
FTACD.WORK.PD8510            THU, DEC 22, 1983, 11:02 AM    PAGE  1

 SUBROUTINE TPINI;                                    EXTERNAL;
 INTEGER PROCEDURE TPST;                              EXTERNAL;
 INTEGER SUBROUTINE TPErr;                            EXTERNAL;
 BOOLEAN SUBROUTINE REW;                              EXTERNAL;
 BOOLEAN PROCEDURE TPRED(Add,Len); VALUE Add; DOUBLE Add;
                          INTEGER Len;                EXTERNAL;
 BOOLEAN PROCEDURE TPWRT(Add,Len); VALUE Add,Len; DOUBLE Add;
                          INTEGER Len;                EXTERNAL;
 BOOLEAN SUBROUTINE IPmark;                           EXTERNAL;
 BOOLEAN SUBROUTINE TPready;                          EXTERNAL;
 BOOLEAN PROCEDURE IPseek(pos); VALUE pos; INTEGER pos; EXTERNAL;
 INTEGER SUBROUTINE TPrecord;                         EXTERNAL;
```

```
STBCO.WORK.PD8510            THU, DEC 22, 1983, 11:02 AM    PAGE  1

COMMENT
**********  FILE: IRCO.JT8.PD8510  **********
*
*              Cartridge Tape Drive (TRCO) Module
*
**********
*
*        Sept 25 1981                          VERSION R03.01.01
*        JOHN BARR
*
*              MODIFIED FOR M68K BOARD System
**********
*
*  ENTRY POINTS
*
*
*
*  The tape on the 8510 Front panel uses the DC-100 tape cardridge. The
*      cardridge can hold 105-140K words of information depending on
*      format and updatebility (of individual records). The tape will
*      be used to store internal program (probaby requiring 50% of a
*      tape), user stored calibration coefficients, and save/recall
*      states. In addition, it is intended to load service routines via
*      the tape.
*
*    SPECS
*      FORMAT:
*              SIF - Standard Interchege Format -- See Jan/10/78 Reno
*                    SIF is a file/record structure on the tape - It
*                    makes no mention of the data (type or structure).
*                    Data encoding is done on space seperation of flux
*                    reversal (a 'one' is 1.75 longer than a 'zero').
*                    A file consist of FILE MARK followed by 'n'
*                    RECORDS. There can be 2047 files of 4096 records,
*                    if tape capacity allows.
*                    A FILE MARK is a data record plus file gap. Its
*                    data record can contain information but may be
*                    null (sometimes it is called RECORD 0).
*                    RECORDS are a data record plus a record gap,
*                    numbered 1 to n for each file.
*                    A data record consist of a header plus max of
*                    128 words of data plus trailer. Each header
*                    contains the filed, recordN, # of bytes contain
*                    in the body, if updatable, and approxiate check-
*                    sums.
*                    Updatability means that a record may be reuritten
*                    independently of the other records, i.e. there
*                    was enought space allocated orginal for the worst
*                    case record.
*                    NOTE:End-of-file is signal by existence of end of
*                    tape or start of another file.
*
*
*                    SIF Tapes can be used with the 9845/35, S375
```

```
S1RCO.UORK.PD8510              IHU, DEC 22, 1983, 11:02 HM     PAGE  2


*                   Tape perpherial, Future terminals, Capricorn 85.
*                   CBKHOT by 9825 or 264X Terminals.
*                   Use with the above alleued syateno will require
*                   1 special program.  See Note on TPnerk.
*     Capacity (uords):
*        109K     9845/35 Format -Single File  850 Updatable Records
*        110K     Nax Updatable  -Single File  861 Updatable Records
*        143K     Ron-Updatable  -Single File 1120 * 128Uord Records
*
*                   Usable Tape 3360 inches
*                              12.5 inches for End OF Track
*                              2.50+-.375     File Cap
*                              1.0 +-.15      Record Gap
*                              2.75           Updatable @ec/File Header
*                              1.55           Average! 128Uord Nonupdate
*
*                 Capacity = K of uords stored in Records
*                      If packed 128 Words#/Records
*                    3360= # of File Headers * ( .25 + 2.50+-.375) +
*                            @ of Records in all files *
*                                    (1.0+-.15 + ( 2.75 OR 1.85))
*
*                  RO1E: If Files are packed in they can be read by
*                        any SIF systen, but not all SIF systens can
*                        pack data on ae tight, therefore if dupication
*                        or generation of tapes on another tape systen is
*                        desired the 9845 is the botton linit.
*     TRANSFER RATE:
*                 Typical multi-record            .7 Kuord/Sec
*                 Uorat Case Single record Burst 2.2 Kuord/Sec
*                 Single Track  50K Words         35 Sees
*                 Total Tape                     100 Sees
*                 BEWIND                          19 Secs
*                 Average Access                 ?T6 Sees
*
*****************************************************************
*
*   DATA STRUCTURES
*
*    NOTE:TRCO uses Inverted information (all but Checksuns are fised)
*
*  TRCObodych(ecksun)
*  TPbodych(ecksun)    (sun of uords in body)
*  TRCOheadch(eckeun)
*  TPheadch(eckeun)    (sun of File,record and length uords)
*  TPlenud -- lengnt uord in header
*        BII 0-7  Rctual bytes used - 1 ( FF=256 bytes)
*        SII 8-15 Rlocated @ytes -1  (Updatable if odd)
*  TPrecud -- Record uord in header
*        BIT 0-11 Record nunber
*        BIT 12-15 Field field (used uith reserved bit)
*  TPfileud -- File uord in header
*        BIT 0-10 File nunber
*        BIT 11-12 Type =00 ->Enpty,%00 -> not Enpty
*        BIT 13 Reaevred bit (Exchangability=1)
*        BIT 14 = 0
```

```
S1BCO.UORK.PD8510              THU, DEC 22, 1983, 11:02 AM     PAGE  3


*        BIT 15 File identifier record = 1
*  TRK1rec  -- record nunber of first record on Trk1
*  TPerrnon -- detail error information  ( not presently, if ever used )
*  TPrec    -- last record nunber read or uritten
*  TPfile   -- DELETED RLWAYS = 1 in neu format
*  TPstatus -- Tape status -- see belou
*
*
* TPstatus
*BIT                BIT                BIT                BIT
* 0 HOLE detected    4 in Gap           8                  12
* 1 Cartout          5 Trk 0 or 1       9                  13
* 2 ESTS Drive fault 6 BEndofValidData  10 Position knoun  14
* 3 WPR set          7 @BeginOFlape     11 Check(eun)err   15 RECenpty
*
*****************************************************************
*
*     I/O ADDRESS   + 10 BASE of %FE00
*    DEC MEX BINARY
*
*    0   0 000 %000     R:CHECKSUM        W:THRESHOLD     **
*    2   2 000 %010     R/U: TACH                           *   IRCO
*    4   4 000 %100     R:STATUS          U:IXSTRUCTION     *   TAPE
*    6   6 000 %110     R/U: DATA                           **CONTROLLER
*****************************************************************
end of conment;
GLOBRL INTEGER     TRCOdata=IO+%06,TRCOtach=IO+%02,
       TRCOchecksun=IO+%00,TRCOthres=IO+%00,
       TRCOstatus=IO+%04,TRCOcnd=IO+%04;
INTEGER  MiscStatus=IO+%R0;

GLOBRL INTEGER TPIns,TPCnd,Taeh;
GLOBRL BOOLERN Uait,TPError,Reed_body;
GLOBRL INTEGER TPstatus,
       TPrec,TPerrnun,
       TPFileud,TPrecud,IPlenud,
       TPheadck,TRCOheadck,
       TPbodyck,TRCObodyck;
INTEGER CONSTANT  rec_per_track := 426,
                  TRK1rec:=rec_per_track,     IRKOlast_rec:=TRK1rec - 1,
                  TRKOlast_rec1:=TRKOlast_rec -1, IRK1rec1:=1RK1rec + 1,
                  TRK1last_rec :=TRK1rec+TRK1rec-1,
                  TRK1last_rec1:=TRK1last_rec -1;
INTEGER CONSTANT &MiscStatus& TRCOirq:=2,TRCOerror:=0;
INTEGER CONSTANT &IPstatus bit positions&  HOLE:=0,Cartout:=1,Eats:=2,
       UPR:=3,Gap:=4,Trk:=5,EVD:=6,BOI:=7,
       Pos:=10,Checkerr:=11,RECenpty:=15,&13-14 not used&
        &Tape TPIns bit position& Mod:=6,FST:=7,Fgap:=8,FWD:=15;


BOOLERN PROCEDURE Rdnextrec(Add,Len); VRLUE Add; DOUBLE Add;
                                      INTEGER Len; FORURRD;


&TPCO URITE ROUTINES -- TEMP SHOR1HAND&
SUBROUTINE TPCMD;      TRCOcnd:=NOT(IPIns OR IPCnd) ;
```

```
STRCO.UOPK.PD8510              THU, DEC 22, 1983, 11:02 BH     PAGE  4


&TBCO REAO ROUTINES -- TEMP SHORTHAND&
SUBROUTINE TPrdstat;
   TPstatus:=TURN(TPs1atus,NOT (IRCOstatus),%3F);

SUBROUTINE CLRstatus;
   BEGIN TPCnd:=%034000; TPCMO; END;


&URIT FOR INTEPRUT RESPSONSE&
SUBROUTINE TPCnduait;
   BEGIN
      TPCMO;
      UMILE TBIT(MiscStatus,TRCOirq) OO:
      TPrdstat;
      TPError:= NOT 1BIT(MiscStatus,TRCOerror) ;
   END;

SUBROUTINE TPCnduaitclr;
      BEGIN   TPCnduait;
      IF TBIT(TPstatus,HOLE) THEM BEGIN CLRstatus; TPError:=FALSE: END;
         END;


SBASIC TAPE MOVEMEKT ROUTINES&
SUBROUTINE MovTilir;
   BEGIM  IRCOtach:=NOT 1ach; TPCnd:=%074000; TPCnduaitclr; END;

SUBROUTINE FastFudlr;
   BEGIN TPIns:=%100200: BovTilir; END;

SUBROUTINE SlouFudlr;
   BEGIN TPIns:=%100000; MovTilir; END;

SUBROUTINE FastRevlr;
   BEGIN TPIns:=%000200; MovTilir; EMO;

SUBROUTINE SlouRevIr;
   BEGIN TPIns:=%000000: MovTilir; END;

SUBROUTINE STOPTAPE;
   BEGIN TPCnd:=%011000; TPCnduait; END;

SUBROUTINE STOPNOU;
   BEGIN IPCnd:=%01D000; TPCMO; EMO;

SUBROUTINE StopRecGap;
   BEGIN TPIns:=RBIT(TPIns,Fgap); IPCnd:=%041000; &IR uent stop&
                          TPCnduaitclr; END;

SUBROUTINE SlouRevGap;
   BEGIN Tach:=-200; SlouRevIr; StopRecGap; END;

SUBROUTINE GapCount;
   BEGIN TACOtach:=NO1 1ach; TPCnd:=%060000; TPCnduaitclr; StopRecGap;
```

```
STRCO.UORK.PD8510              THU, DEC 22, 1983, 11:02 AM     PAGE  6


   END;

SUBROUTINE  FeatFudGipa;
  BEGIN TPIns:=%100200;   GapCount;    END;

SUBROUTINE  FastRevGace;
  BEGIM TPIns:=%X00200;   GapCount;    EMO;



SBBSIC TAPE REAO ROUTINES&
INTEGER SUBROUTINE REROCK;
  BEGIM TPCnd:=%076000; TPIns:=%100000; TPCnduait;
                  REROCK:= TRCOdata; EMO;
INTEGER SUBROUTINE RERO6;
  BEGIN TPCnd:=%072000; TPIns:=%100000; TPCnduait;
                  RERO6:= NO1 TRCOdata; EMO;


&BASIC TAPE URITE ROUTINES&
SUBROUTINE UrtGap;
   BEGIN  TACO1ach:=NOT Tach; TPCnd:=%054000;
          TPIns:=%100000;  TPCnduaitclr; END;
PROCEDURE Urtimmed(Osta); VRLUE Data; INTEGER Data;
   BEGIN    TRCOdata:=MO1 Data;
         TPCnd:=%X06X00; TPIns:=%100000;   TPCnduait;   EMO;
PROCEDURE Urtsyn6(Oata); VRLUE Data; INTEGER Data;
  BEGIM    1RCOdata:=ROT Data;
         TPCnd:=%062000; TPIns:=%100000;   TPCnduait;   END;
SUBROUTINE Urtcheck;
  BEGIN TPCnd:=%066000; TPIns:=%100000;   TPCnduait;   END;


&TRACK CONTROLS
SUBROUTINE IRACKO;
    BEGIN
          TPrec := -1;
          TPIne:=RBIT(TPIns,Mod); TPCnd:=%140XO; TPCMO; TPrdstat: END;
SUBROUTINE TRACK1;
    BEGIN
          IPrec := TRK1rec - 1;
          TPIns:=SBIT(TPIns,Mod); TPCnd:=%014000; TPCMO;
                                  IPIns:=RBIT(1PIns,Mod); TPrdstat; END;
```

```
STACO.UORK.PO8510          THU, DEC 22, 1983, 11:02 AM    PAGE  6

%EJECT; COMMENT
*****************************************************************************
*Position and Posunknown set and cleared the position flags in
*         the status word
*
*  Position is called to change a the position flag and it is passed
*     the new position point and anyother is cleared.
*   Pos -- the position flags are valid
*   BOT -- @ begining of tape (lead point) -- the normal rewind position
*              of either physical track
*   EVD -- @ logical end of tape -- no more data on tape
*
*  Posunknoun clears all position flags, and present and Trk1 file and
*       record information. Pos is set false.
*****************************************************************************
end of connent;
PROCEDURE Position(Pospoint); VALUE Poepoint; INTEGER Pospoint;
BEGIN
    TPstatus:=RBIT(TPstatus,BOT);
    TPstatus:=RBIT(TPstatus,EVD);
    TPstatus:=SBIT(TPstatus,Pospoint);
    TPstatus:=SBIT(TPstatus,Pos);
    IF TBIT(TPstatus,BOT) THEN TPrec:=-1;
END Position;

SUBROUTINE  Posunknoun;
BEGIN
   Position(Pos);
   TPstatus:=RBIT(TPstatus,Pos);
   TPrec:=-2;
END;
```

```
STACO.UORK.PO8510          THU, DEC 22, 1983, 11:02 AM    PAGE  7

%EJECT; COMMENT
*****************************************************************************
*Rewind is the basic rewind the tape to load point routine.
*
*    It has no parameters and returns TRUE if the rewind was done.
*         It will updated position flags.
*
* If presently at BOT just backups to the load point hole and the moves
*   forward past it.
* If not at BOT then go forward approx 1.5 inches or next hole, then
*   go in reverse looking for a double hole ( two holes within 1 inch)
*  When they are found, the tape will start forward till 14 inches
*   without a hole occur (double hole pairs are spaced 12 inches).
* The tape is slowed down and continuee till load point where it stops.
*
* If TPError has occured, the tape is stop ( it may be still searching)
*   the position flags are cleared and Rewind returns FALSE.
* If no TPError, the position is set to BOT and Rewind returns TRUE.
* Errors are drive faults or Cartout. Male detect is not an error here.
* Track 0 is selected.
*
* A routine FullRewind use to exist -- it would do a rewind and find out
*   what was the first file/record on track1 -- however this is fixed
*   for the ehosen tape format
*****************************************************************************
end of comment;

BOOLEAN SUBROUTINE Rewind;
BEGIN
 IF NOT TBIT(TPstatus,BOT) THEN
    BEGIN
    Tach:=-1500; FastFwdIr;
    DO
       BEGIN
          DO  BEGIN Tech:=1; FastRevIr; END
              UNTIL TBIT(TPstatus,HOLE) OR TPError;
          Tach:=-1000; FastRevIr;    END
       UNTIL TBIT(TPstatus,HOLE)  OR  TPError;
    DO BEGIN Tach:=-14000; FastFwdIr; END
       UNTIL NOT TBIT(TPstatus,HOLE)  OR  TPError;
    END ELSE &at BOT&
       BEGIN Taeh:=-5000; SlouRevIr; END;

    Tach:=-14000;  SlouFwdIr;
    TRACKO;
    IF  TPError THEN  BEGIN STOPNOW; Posunknoun;  EKO
        ELSE Position(BOT);
 Rewind:=NOT TPError;
 END  Rewind;

COMMENT
*****************************************************************************
*  INgap verifies that the tape in is valid point to start a read.
*
*   It has no input paraneters and will return true if OK to read.
*
```

```
STACO.UORK.PDS510          THU, DEC 22, 1983, 11:02 AM    PAGE  8

*   If at BOT then first record gap is found, and INgap is TRUE if
*         not TPError.
*   If at EVD , INgap is set FALSE.
*   If not at BOT or EVD, then must be in a record gap, INgap is TRUE.
*****************************************************************************
end of connent;
BOOLEAN SUBROUTINE INgap;
BEGIN
IF TBIT(TPstatus,BOT) THEN
    BEGIN
        Tach:=-1000; SlouFudIr;
        IF TBIT(TPstatus,Gap) THEN   STOPTAPE
             ELSE StopRecGap;
        Position(Pot);
    END  ;
IF TBIT(TPstatus,EVD) THEN TPError:=TRUE;

INgap:=KOT TPError;
END INgap;
```

```
STACO.UORK.PO8510          THU, DEC 22, 1983, 11:02 AM    PAGE  9

%EJECT;COMMENT
*****************************************************************************
*
*  TPINT is the poweron intialization routine.
*
*  It has no input or output paraneters.
*
*  It intializates variables and clears position and error flags.
*****************************************************************************
end of connent;
SUBROUTINE TPINT;                    ENTRY;
BEGIN
  TPIns:=0;
  TPError:=FALSE;
  CLRstatus;
  TPstatus:=0;
  Posunknoun;
  TPrdstat;              & nay not be neccessary&
END  TPINT ;
```

```
STRCO.UORK.POS510              Thu, DEC 22, 1983, 11:02 AM     PAGE  10


@EJECT; COMMENT
*****************************************************************************
*TPST is an integer function returning tape status.
*
*  TPST is an integer function call with no input parameters, returns
*          the full tape status word.
*
*  It reads the present tape status and clears position if needed.
*    It also saves if a drive fault has occured.
*  It then clears the tape status and rereads the status and adds
*    back in if a drivefault had occured.
*
*  In doing this double read of tape status, Cartout or ESTS it recorded
*    but the routinue returns present status (plus ESTS). A clrstatus
*    will remove these flags if the problen or state is no longer true.
*****************************************************************************
end of connent;
INTEGER PROCEDURE TPST;
BEGIN
 BOOLERN Drivefault;
    TPrdstat;
    IF (TBIT(TPstatus.Cartout) OR TBIT(TPstatus,Ests) ) THEN Posunknown;
    Drivefault:=TBIT(TPstatus,Ests);
    CLRstatus;
    TPrdstat;
    IF Drivefault THEN TPstatus:=SBIT(TPstatus,Ests);
    TPST:=TPstatus;
END TPST ;
```

```
STRCO.UORK.PD8510              THU, DEC 22, 1983, 11:02 AM     PAGE  11


@EJECT; COMMENT
*****************************************************************************
* TPErr reports the present status with reading TRCO.
*       Used for determining why a Tape failure occured.
*          or the status after a completed operation
*****************************************************************************
end of connent;
INTEGER SUBROUTINE TPErr;
      TPErr:=TPstatus;

COMMENT
*****************************************************************************
* IPrecord is used to report the record number of the last record (r/u)
*     NOTE: -1 neans tape position at BOT
*           -2 neans tape position unknown
*****************************************************************************
end of connent;
IKTEGER SUBROUTINE TPrecord;
      TPrecord:=TPrec;
```

```
STRCO.UORK.PD8510              THU, DEC 22, 1983, 11:02 AM     PAGE  12


@EJECT; COMMENT
*****************************************************************************
*TPready prepares the tape for use and checks if a tape is in.
*     Boolean function that returns if the tape position is still known
*
*   NOTE: use to do a rewind if position unknown/failed only if tape out
*****************************************************************************
end of connent;
BOOLERN SUBROUTINE TPready;            ENTRY;
BEGIN
    TPST;
    TPError:=NOT TBIT(TPstatus,Poe);
    TPready:=NOT TPError;
END TPready;

COMMENT
 IF Gap(-> gap in read error occured ??) at track EVD
 if no nore at tape EVD ELSE reuind and prepare to read next record
 Could be simplified nou due to fix record format -- EVD at Rec425, 851;
 BOOLERN SUBROUTINE EVDTEST;
  BEGIN
   IF TBIT(TPstatus,Gap) THEN BEGIN
       TPError:=FRLSE;
       CLRstatus;
       IF TBIT(TPstatus,Trk) THEN
            BEGIN TPError:=TRUE;  Position(EVD); END
         ELSE IF Reuind THEN BEGIN TRACK1; INgap; TPrec := TRK1rec;END;
       EVDTEST:= NOT TPError;
       END
     ELSE EVDTEST:=FRLSE;
  END EVDTEST;
```

```
STRCO.UORK.PD8510              THU, DEC 22, 1983, 11:02 AM     PAGE  13


NEJECT; COMMENT
*****************************************************************************
*Rdnextrec is the basic read next record routine.
*   No input paraneters, returns TRUE if read sucessful.
*   The Data read is stored at "Rdd", and all the file , record, and
*        and position flags are approiately updated.
*
*   Reasons for readfail : Cartout, ESTS (drive fail), EVD,
*                  or Check(sun)err.  (Check TPstatus)
*
*  The threshold reg is set for read and the checksun reg is cleared.
*  The tape is assuned to be in a gap . R read connand is given and if
*    it is not successful an TPError occurs. If the TPError is because
*    of an EVD of this track, if this is not trk1 and there is data on
*    Irk1, a reuind will occur and the read will try again. If the
*    failure was due to true EVD or Carout or ESTS--Error is left FRLSE.
*  The tape (if not error) will then read the three header words, and
*    the header chekcsun. The TRCO checksun will be read and clear to
*      check later.
*  If the body part of the record is not entpy the nunber of words as
*    calculated fron the Bytes Used in the length word will be read and
*      the tape and TRCO body checksun will be read and the record
*       status set not enpty.   (R Read_body flag is also checked)
*  If the body is enpty, the length and checksun are set to zero.
*  The checksun are checked and if they donot conpair and there had
*     been no other error, the record will be reread for three trys.
*  At this point if any error has occured the tape will be stopped
*     and if not EVD the position flags cleared.
*  Nouever if no TPErrors the tape will searched till gap and stop,
*     position, file, and record flags set.
*****************************************************************************
end of connent;
BOOLERN PROCEDURE Rdnextrec(Rdd,Len);VRLUE Rdd;       &forward declared$
                              DOUBLE Rdd;   INTEGER Len;&forward declared$
BEGIN
 INTEGER Pass,Bytelen,Index,Stratch;
 INTEGER POINTER henPtr;

 BOOLERN SUBROUTINE CheckOK;
  BEGIN
  CheckOK:=TRUE;
  IF NOT((TPheadck=TACOheadck) AND (TPbodyck=TACObodyck) OR TPError )
        THEN IF Pass>3 THEN BEGIN TPstatus:=SBIT(TPstatus,Checkerr);
                                  TPError:=TRUE; END
                       ELSE BEGIN SlouRevGap;;
                                  CheckOK:=FALSE; END;
  END CheckOK;

Rdnextrec:=FALSE;
IF TPready THEN IF INgap THEN
BEGIN
  STFNTR(henPtr,Rdd);
  TACOthres:= NOT @03060;
 Stratch:=TACOchecksun;
 Pass:=0;
```

```
STACO.WORK.PDS510              THU, DCC 22, 1983, 11:02 AM     PAGE  14


 OO BECIN
    TPtstus:=RBIT(TPstatus,Checksrr);
    TPstatus:=SBIT(TPstatus,RECempty);
    OO TPfilsed:=REBC6 UNTIL NOI EVOTESI;

    IF NOT TPError THEM BECIN
      TPrecud:=READ6;
      IPlenud:=READ6;
      TPheadck:=READCK;
      TACOheadck:=TACOchecksun;
      IF ((TPfileud AND Z1800)#0) BND Read_body IHEN BECIN
         Bytelen:=TPlenud RNO ZFF;
         FOR Index:=0 UNTIL RIGHT(Bytelen,1) DO hemPtr[Index]:=READ6;
         Sytelen:=Bytelen+1;
         TPstatuo:=RBIT(TPstatus,REComply);
         TPbodyck:=REROCK;
         TRCObodyck:=TRCOchocksum;     END
       ELSE BECIN Bytelen:=0;  TPbodyck:=TBCObodyck:=0;  END;
      Pass:=Pass+1;
    END;
  END UNTIL CheckOK;

  IF IPError THER BECIN STOPROU;
                  IF NOT TBIT(TPstatuo,EVO) THEN Poeunknoun; END
          ELSE BEGIN StopRecGap;
                     Posatson( Pes);
                     TPrec :=TPrecud  RNO ZFFF;
                     Len:=Bytelen;
               END;
  Rdnextree:=NOT TPError;
  END;

END Rdnextrec;
```

```
STACO.WORK.POS510              THU, DEC 22, 1983, 11:02 AM     PAGE  16


REJECT; COMMENT
*****************************************************************************
*TPRED is basic tape read
*
*****************************************************************************
end of connent;
BOOLERN PROCEDURE  TPRED(Rdd,Len); VRLUE Rdd; DOUBLE Rdd;
                                              INTEGER Len;  ENTRY;
BEGIN
   Read_body:=TRUE;
   TPRED:=Rdnextrec(Rdd,Len);
 END TPRED;

COMMENT
*****************************************************************************
* TPrd_header does a normal read without reading the body
*
*   Body buffer is in monitor ran BUT is not actually used
*****************************************************************************
end of comment;
BOOLERN SUBROUTINE TPrd_header;
BEGIN INTEGER Len;
      Read_body:=FRLSE;
      TPrd_header:=Rdnextrec(RDRS(Parn0),Len);
END IFrd_header;


BOOLERN SUBROUTINE REU;              ENTRY;
BEGIN
   TPST;
   IF TBIT(TPstatus,Cartout) THEN REU:=FRLSE
         ELSE  BEGIN IPError:=TRUE; REN:= Reuand;  END;
END REU;
```

```
STRCO.UORK.POB510              THU, DEC 22, 1953, 11:02 AM     PRCE  1C


REJECT; COMMENT
*****************************************************************************
*TPURT will write the next record. It xosume the file xtructure
*     is prenarked.
*  It will return TRUE if write occured.
*
*
$
*  The write protect is checked first and if not protsctcd
*      The file, record and length word and enpty bit are fixed
*      The threshold and checksum regs are initialized.
*      The file header and file body ( if length is nonzero ) is then
*      written. If there were no
*      errors then next gap is found and the tape stops, else the tape
*      stops in place.
*
*      NO test for Holes is done since this tape is prenarked!!!!!
*
*****************************************************************************
end oF connent;
COMMENT
*****************************************************************************
*   IPURT is the basic next record write routine
*****************************************************************************
end of comment;
BOOLERN PROCEDURE  TPURT(Rdd,Len); VRLUE Rdd,Len; DOUBLE Rdd;
                                          INTEGER Len;     ENTRY;
BEGIN
 INTEGER Index,Stretch,Length;
 INTEGER POINTER HemPtr;

TPURT:=FALSE;
IF TPready THEN IF INgap IHEN
BEGIN
   STPNTR(nemPtr,Rdd);
   IF IBIT(TPstatus,UPR) IHEN TPError:=TRUE
       ELSE BEGIN

          TPrecud:=TPrec:=TPrec+1;
          TPfileud:=(IF TPrec=0 THEN X8001 ELSE 1);
          Length:=RIGHT(Len+1,1);
          TPlenud:=((Len-1) RND ZFF) OR XFF00;
          TPfileud:= (IF Length=0 THEN (TPfileud RND XE7FF)
                                  ELSE (TPfileud OR  X1800));

          TACOthres:=NOT @63050;
          Stretch:=TRCOchecksun;

          DO Urtsyn6(TPFiltud) UNTIL NOT EVOTEST;
          IF NOT TPError THEN BEGIN
             Urtsyn6(TPrecud);
             Urtsyn6(TPlenud);
             Urtcheck;
             Stretch:=TACOchecksun;

             IF LengthM0 THEN
```

```
STRCO.UORK.PD8510              THU, DEC 22, 1953, 11:02 AM     PAGE  17


                FOR Index:=0 TO Length-1 DO Urtsyn6(HemPtr[Indtx]);
             Urtcheck;
             Urtcheck;  &POSTAMBLE&
             END;
          END;

    IF TPError THEN
          BEGIN STOPNOW;  Poeunknoun; END
     ELSE StopRecGap;

    TPURT:=NOT TPError;
 END;
END TFURI;
```

```
STACO.WORK.PO8510              THU, DEC 22, 1983, 11:02 AM     PAGE 18

$EJECT; COMMENT
*****************************************************************
*****************************************************************
end of comment;
PROCEDURE wrt_init_record;
BEGIN
INTEGER stratch;

IF IBIT( TPstatus, WPR ) THEN TPError := TRUE
 ELSE
   BEGIN
   TPrecud := TPrec := TPrec + 1;
   IF TPrec # 0 THEN TPfileud := 1 ELSE IPfileud := %8001;
   TPlenud := %FF00;

   TACOthree := NOT %63060;

   IF TPrec # 1 THEN lach := -1000 ELSE lach := -2500;
   WrtGap;
   stretch   := TACOchecksun;

   Wrtinned( TPfileud );
   Wrtsyn6(  TPrecud );
   Wrtsyn6(  TPlenud );
   Wrtcheck;
   stretch   := TACOchecksun;

   REPEAT 151 OO Wrtsyn6( %FFFF );

   END;

END wrt_init_record;
```

```
STACO.WORK.PO8510              THU, DEC 22, 1983, 11:02 AM     PAGE 19

$EJECT; COMMENT
*****************************************************************
* TPmark will mark the tape with the needed file structure, erasing an
*  previous information. This file structure is one file, 852 records.
*
*****
== NOTE
*   This format is readable by the 9845/35 , and 9875A. It fails on the
*   HP85 for lack of a File Zero -- which is not required for SIF!!!!!
*   If a file Zero existed the 9845/35 cannot read it but will skip it.
*
*
*  Do twice the following : Rewind the tape, back up 1/2 inch, and
*     do 42E times: Write a record gap ( unless Rec=1 then a File gap)
*     then write a empty file with a data block of 256 bytes of FF's
*     with the proper header. EXIT if a tape error occurs.
*     After the 426 records write an EVD gap.
*  Rewind and report success or failure.
*****************************************************************
end of comment;
BOOLEAN PROCEDURE TPmark;
BEGIN
INTEGER track_count,
        rec_count;

   track_count:=-1;

   WHILE ( track_count := track_count + 1 ) <= 1
         AND NOT TPError OO
     BEGIN
     IF REW THEN
        BEGIN
        IF track_count # 0 THER TRACK1;
        Tach := -700; SlowFudlr;

        rec_count := 0;
        WHILE ( rec_count := rec_count + 1) <= rec_per_track
              AND NOT TPError
          DO
             wrt_init_record ;
        IF NOT TPError THEN
           BEGIN Tach := -13000;  WrtGap; END;
        END;
     STOPNOW;
     Peeunknown;
     END track loop;

      TPmark := NOT TPError;;

      REW;

END TPmark;
```

```
STACO.WORK.PO8510              THU, DEC 22, 1983, 11:02 AM     PAGE 20

$EJECT; COMMENT
*****************************************************************
* IPseek(pos) will seek (find) and position the tape prior to the rec
*             number selected.
*
* TPseek will use a combination of trk switching, fast rev/fud , and
*        slow reading of record headers to position the tape.
*
* First a check of special conditions are made : first or last records
*       on a track, or the tape is already at requested position.
* Using the present position and track, and the new position and track
*       a rec_offset(minus=rev,plus=forward of present position) will
*       be computed. A high speed gap counting routine will be called
*      to position the tape approx 1-2 records away. A record read will
* A read of record header will verify position, if not correct yet the
*      will either back up or continue forward till in position or TPErr
*****************************************************************
end of comment;
BOOLEAN PROCEDURE TPseek(new_pos); VALUE new_pos; INTEGER new_pos;
BEGIN
  INTEGER  rec_offset,chenge_Flg,TPrec_tenp;

  TPrec_tenp := TPrec;
  IF new_pos >= TRK1rec   THEM  TRACK1 ELSE IRRCKO;   & destorys TPrec &
  TPrec      := TPrec_tenp;
  IF TPrec # IRKOlact_rec THEN TPrec := IPrec + 1;

  IF TPready AND new_pos<=TRK1last_rec AND new_pos>=0 IHEM
     BEGIN
     IF (new_pos <= 1)  OR
          ( (new_pos >= IRK1rec) AND (new_pos <= IRK1recl ) )  THEM
        BEGIN    &want near beginning of a track &
        Rewind; & sets trackO,TPrec = -1 &
        IF new_pos>=TRK1rec THEN  1RACK1 ;
        END
     ELSE
     If new_pos = TPrec THEM  &cannot do for first recs on track&
        SlouKavGap            &want record just done &
     ELSE
     IF  (new_pos >= TRK1last_rec1) OR
       ( (new_pos >= TRKOlast_rec1) AND (new_pos <= TRKOlast_rec) ) THEM
       BEGIN          & want the end of a track &
       Tach := -1000; & large &    Fas1FudGaps;   & will stop at EVO &
       Tach := -5000;  SlouRevIr;
       REPERT 4 DO
          BEGIN
          SlouRevGap; CLRstatus;
          END back up fron EVD loop;
       END
     ELSE
        BEGIH       & want record not at present, or near end/beginning&
        rec_offset := new_pos  - TPrec ;
        change_fig := 0;
        IF TPrec  >=TRK1rec IHEM
           BEGIN   change_flg := change_flg + 1;
                   rec_offset:=rec_offset + rec_per_track;  END;
```

```
STACO.WORK.PO8510              THU, DEC 22, 1983, 11:02 AM     PAGE 21

        IF new_pos>=1RK1rec THEN
           BEGIN   change_flg := change_flg + 1;
                   rec_offset:=rec_offeet - rec_per_track;  END;

        IF rec_offset>=3 THEN
           BEGIN     change_fig  := change_fig OR %1;
                     Tach:=2-rec_offset; FastFudGaps; END
        ELSE IF rec_offeet<=-3 THEN
           BEGIN     change_fig  := change_flg OR %1;
                     Tach:=rec_offset+2; FastRevGaps; END;

        IF TBII(change_Flg,0) THEN
           BEGIN  &INgap if tracks change or major move&
           Tach:=-200; SlowFudlr;
           IF TBIT(TPstatus,Gap) THEN   STOPTAPE
              ELSE StopRecGap;
           END;
        END;

     WHILE TPrd_header AND (TPrec # new_pos) AND (NOT TPError) DO
        IF TPrec>new_pos THEN
           REPEAT (TPrec - new_pos + 1) DO SlouRevGap;
     SlouRevGap;

     END
  ELSE TPError := TRUE;

STOPNOW;

IPseek:= (NOT TPError) AND ( TPrec = new_pos );

TPrec := TPrec - 1;
END IPseek;
```

```
STRCO.UORK.PDS510              THU, DEC 22, 1983, 11:02 AM     PAGE  22

REJECT;COMMENT ********** END OF TRCO SUBROUTINES  **************;


COMMENT
**************************************************************************
* TAPEntry is a fudge routine that except to find a value on the stack
*          that selects one of N TRCO routines.
*
* TAPEntry DOESNOT !!!! use the normal calling conventions.
*
*  Stock Parm        ROUTINE
*     0          SUBROUTINE TPINT
*     1          INTEGER PROCEDURE TPST/
*     2          INTEGER SUBROUTINE TPErr/
*     3          BOOLEAN SUBROUTINE REU/
*     4          BOOLEAN PROCEDURE TPRED(Add,Len)/ VALUE Add/
*                                          DOUBLE Add/ INTEGER Len/
*     5          BOOLEAN PROCEDURE TPUR1(Add,Len)/ VALUE Add,Len/
*                                          DOUBLE Add/ INTEGER Len/
*     6          BOOLEAN SUBROUTINE INgap/
*     7          BOOLEAN SUBROUTINE TPready/
*     8          BOOLEAN PROCEDURE TPmark/
*    10          BOOLEAN PROCEDURE TPeeek(pee)/VALUE pee/INTEGER pee/
*    11          INTEGER SUBROUTINE TPrecord/
**************************************************************************
end of comment;
SUBROUTINE TAPEntry;
BEGIN
     BSSEMBLE(  MOVE (S)+,R1;
                MOVE.L 6RR#5.L,G;
                CMPI #D11,R1;
                BEQ  TPrecord;
                CMPI #D10,R1;
                BEQ  IPseek;
                CMPI #D9,R1;
                BEQ  TPmark;
                CMPI #D7,R1;
                BEQ  TPready;
                CMPI #D6,R1;
                BEQ  INgap;
                CMPI #D5,R1;
                BEQ  TPURT;
                CMPI #D4,R1;
                BEQ  TPRED;
                CMPI #D3,R1;
                BEQ  REU;
                CMPI #D2,R1;
                BEQ  TPErr;
                CMPI #D1,R1;
                BEQ  TPST;
                BRA  TPINT );
END TAPEntry;
```

```
ATEMA.UORK.PDSS10              THU, DEC 22, 1983, 11:02 AM     PAGE  1

RSMB,R
        MED     ten times quad
        MAM     TEMA,"UCC PD8510"
        ENT     TERR
R0      REG     0
R1      REG     1
S       REG     15
TEMA    EQU     *
        RSL.L   #1,     R1
        ROXL.L  #1,     R0      times 2
FIVER   EQU     *
        MOVE.L  R0,     -(S)
        MOVE.L  R1,     -(S)
        RSL.L   #1,     R1
        ROXL.L  #1,     R0      times 2
        RSL.L   #1,     R1
        ROXL.L  #1,     R0      times 2
        ADD.L   (S)+,   R1
        BCC     CC
        ADDQ.L  R1,     R0      no ROOX.L memory to register
CC:     ADD.L   (S)+,   R0      plus the savad value
        RTS
        END
```

```
FTERM.UORK.PDS510              THU, DEC 22, 1983, 11:02 AM     PAGE  1

  SUBROUTINE CRLF; EXTERNAL;
  PROCEDURE USTR(STR); VALUE STR; ALPHA STR; EXTERNAL;
  PROCEDURE UNEX(NUM); VALUE NUM; INTEGER NUM; EXTERNAL;
  PROCEDURE UHex(Num,Uidth); VALUE Num,Uidth;
                             OURD Num; INTEGER Uidth; EXTERNAL;
```

```
STERM.UORK.PD8510              THU, DEC 22, 1983, 11:02 AM     PAGE  1

M68KL,P,"TERM"
BEGIN

BYTE ARRAY BR(-1:16);
BYTE RCIRSC=XFFFFFE3B,RCIRD=XFFFFFE39;
BYTE CONSTANT byte_zero:=0, baud_clk_mode:= X8E;
BYTE timer_cnd = XFFFFFE67, baud_clk = XFFFFFE65;
INTEGER CONSTANT Ix:=0,Rx:=1;

RFILE cide.work;
WFILE ffnt.work;

PROCEDURE UCHAR(C);VALUE C;BYTE C; ENTRY;
BEGIN DO BEGIN END UNTIL TBIT(RCIRSC,Ix); RCIRD:=C; END;


SUBROUTINE  set_up_output;
BEGIN BR[-1]:=16; UCHAR[ X20 );    END;


PROCEDURE U3TR(SR);VALUE SR;ALPHA SR;  ENTRY;
BEGIN
LABEL LOOP,LOOP_CHECK;
ASSEMBLE(
            MOVE.L   R0,  R8     ;
            MOVE.B  (R5)+,   B1  ;
            EXIS.U   R1          ;
            BRA      LOOP_CHECK  ;
   LOOP:    MOVE.B  (R5)+,   R0  ;
            BSR      UCHAR       ;
 LOOP_CHECK: DBRA R1, LOOP        );
END;


SUBROUTINE CRLF;                                          ENTRY;
BEGIN
   LABEL LOOP;
   UCHAR(13); UCHAR(10);
   ASSEMBLE( MOVE.U   #D2500,R0;
      LOOP:  TRAP  1            ;
             DBRA     R0, LOOP    ) ;
             @ 2.5nS   delay for 9500 baud@
 END;


PROCEDURE UNUM(NUM);   VALUE NUM;   DOUBLE NUM; ENTRY;
BEGIN
      set_up_output;
      USTR(format_double(NUM,BORS(BR),X01000C00));
      END;

PROCEDURE UOURD(x); VALUE x; QURD x;                    ENTRY;
BEGIN
      set_up_output;
      WSTR(format_quad(x,RORS(BR),X01000D00));
```

```
STERM.WORK.PD8510          THU, DEC 22, 1983, 11:02 AM    PAGE  2


END;

PROCEDURE WREAL(NUM); VALUE NUM;    REAL NUM; ENTRY;
BEGIN
      set_up_output;
      WSTR(format_real(NUM,ADRS(8R),Z30000D06));
      END;

PROCEDURE WCPX(NUM); VALUE NUM; COMPLEX NUM; ENTRY;
BEGIN REAL X=NUM,Y=NUM+4;
      WREAL(X); WSTR(","); WREAL(Y);
      END;


PROCEDURE Whex(NUM,WIDTH); VALUE NUM,WIDTH; QWRD NUM; INTEGER WIDTH;
                                                    ENTRY;
BEGIN
      set_up_output;
      WSTR(format_quad(NUM,ADRS(8R),
                Z60000000+LEFT(DOUBLE(WIDTH),8)+DOUBLE(WIDTH)) );
END;

PROCEDURE WHEX(NUM); VALUE NUM; INTEGER NUM; ENTRY;
  Whex(NUM,4);

BYTE SUBROUTINE RCHRR; ENTRY;
  BEGIN DO BEGIN END UNTIL IBII(RCIASC,Rx); WCHRR(RCHAR:=RCIAD); END;


END$

INTEGER PROCEDURE RHEX; ENTRY;
  BEGIN
  BYTE Char;
  INTEGER Temp;

  Temp:=0;
  WCHRR('?);
  WHILE ( (Char:=RCHRR) # 13 AND Char # Z20 AND Char # ', ) DO
    BEGIN
       IF Char=8 THEN Temp:=RIGHT(Temp,4)
       ELSE IF Char>='0 AND Char<='9 THEN
                    Temp:=LEFT(Temp,4)+( Char AND ZF)
       ELSE IF Char>='A AND Char<='F THEN
                    Temp:=LEFT(Temp,4)+(Char AND Z7)+9
       ELSE IF Char>='a AND Char<='f THEN
                    Temp:=LEFT(Temp,4)+(Char AND Z7)+8
       ELSE BEGIN Temp:=0; WCHAR(7); END;
    END;
   RHEX:=Temp;  CRLF;
   END;

PROCEDURE acia_speed(count); VALUE count;   BYTE  count;       ENTRY;
BEGIN   timer_end:=baud_clk_mode;
        baud_clk:=count;
```

```
STERM.WORK.PD8510          THU, DEC 22, 1983, 11:02 AM    PAGE  3


        baud_clk:=byte_zero;
END acia_speed;
```

```
FIERM2.WORK.PD8510         THU, DEC 22, 1983, 11:02 AM    PAGE  1


  PROCEDURE WCHRR(C); VALUE C: BYTE C; EXTERNAL;
  PROCEDURE WOURD(NUM);  VALUE NUM; QUAD NUM; EXTERNAL;
```

```
FTERM3.WORK.PD8510         THU, DEC 22, 1983, 11:02 AM    PAGE  1


  PROCEDURE WNUM(NUM); VALUE NUM; DOUBLE NUM; EXTERNAL;
  PROCEDURE WREAL(NUM); VALUE NUM; REAL NUM; EXTERNAL;
  PROCEDURE WCPX(NUM); VALUE NUM; COMPLEX NUM; EXTERNAL;
  &INTEGER PROCEDURE RHEX; EXTERNAL; 8
```

```
F1ESTSET.UORX.POS510          IHU, DEC 22, 19&3, 11:02 RM    PAGE  1


BOOLERH SUBROUTINE slow_test_set;                EXTERNRL.L; & DEBUG &
SUBROUTINE device_roversed;                                  EXTERNAL.L;
BOOLERH PROCEDURE  oet_teot_set( nau_parms, lock_required );
   VALUE   neu_paran;
   IHIEGER neu_paran;
   BOOLERH lock_roouired;                                    EXTERNAL.L;
PROCEDURE  build_test_set;                                   EXTERNAL.L;
SUBROUTINE redefine_test_set;                                EXTERNAL.L;
PROCEDURE  preset_test_set;                                  EXTERNAL.L;
```

```
STESTSET.WORK.PD8510          THU, DEC 22, 1SS3, 11:02 AH    PAGE  1


A68KL,P,"testset"
BECIN

@FILE ftern.work;                                            & DEBUG &
@FILE cdebugc0.work;                                         & DEBUG &
@FILE cyadc.work;
@FILE cehiable.work;
NFILE fchtable.work;                                & for eet_ch_oued &
@FILE fchtab2.work;                                   & for eh_nused &
@FILE fchdata2.work;                                    & for old_id &
@FILE fcontvar.work;                                & for nax_aaraneter &
@FILE cdatap.work;          & for freq_domain, nax_domain, Hax_format &
@FILE fchpfr.work;
@FILE fprivib.work;
@FILE fprivib2.work;                                & for trig_griv_ib &
@FILE fstring.work;
@FILE frnv9x.work;
@FILE fkernel.work;                                       & for uait() &
@FILE fkernel4.work;                                 & for signal_init() &
@FILE crina.work;                                  & for eontinue_signal &
@FILE cneesagl.work;          & for reveree_device end foruerd_device &
@FILE futil2.work;                                  & for clear_message &
@FILE futil3.work;                                  & for tell end users &
@FILE cnewline.work;                                      & far Rewline &
&FILE ffmt.work;                                  & for format_integer &
@FILE facetbi.work;                             & for oet_active_linit &
@FILE cactive.work;                                 & for active_start &
@FILE fdiepran.work;                                & for wrt_disp_byte &
@FILE frecall.work;                                   & for recall_type &
@FILE cnwnu.work;                               & for QEVICE_READY_RENU &
@FILE fnenu.work;                                         & for gen_menu &
&FILE fbresk.werk;                                  & for break_nouaed &
@FILE fcoHtrnl.work;                                & for reatart_aweep &
```

```
STESTSET.WORK.PD8510          THU, DEC X2, 1983, 11:02 AH    PAGE  2


@EJECT;
INTEGER CONSTRNT id_eize        :=   127,  & test-aet id string size  &
                 old_id_size    :=    20,
                 reverse_dev_bit := X0040,  & reverse device flag bit  &
                 phase_lock_bit  := X0010,  & lock bit in speed uord   &
                 speed_nask     := X0003,
                 rebuilt        := nax_acquisition_paran + 1,
                 etring_aize    :=     6;

INTEGER CONSTANT non_functional  :=    -1,  & non functional function  &
                 reverse_dev    :=     0,  & nanually reverse device  &
                 slou           :=     1,  & autonatic; wait for srq  &
                 faet           :=     2;  & Autonatic; faet          &

INTEGER CONSTANT no_oper__      :=     0,  & port configure bits      &
                 a1             :=     1,  & for IC connand.          &
                 b1             :=     2,
                 a2             :=     4,
                 b2             :=     8;

DOUBLE  CONSTANT test_aet_format := X07000500;

BOOLERN test_set_present,
        waiting_for_device_rdy;
INTEGER old_paran,          & the last paraneter eet up by the testset &
        old_paran_index;    & the last parameter's acq paran tbl index &
```

```
STESTSET.UORK.PD8S10          THU, DEC 22, 1983, 11:02 RM    PAGE  3


@EJECt;
CORNENT                                  switching_speed and test_set_speed
*****************************************************************************
*
*   "switching_speed" RRRRY:
*   ewitching_speed contains the test-set switching speed for a given
*   switchable port (driven, phase-lock, numerator, or denominator).
*
*   "test_set_speed" RRRRY:
*   test_set_speed is a symnetric square natrix containing the switching
*   speed fron one paraneter to another with the tuo paraneters as
*   indices into the array.  It could be a lower- or upper-triangular
*   natrix, but computing the index would take nore space and be slower
*   than the additional array locations.  The diagonal (fron_uaran =
*   to_paran) is reserved for switching tinne fron the paraneter in
*   effect prior to a build_teet_eet to the first one after -- otherwise
*   the diagonal elenente are not used.
*
*   TEST SET SWItChiNG TIMING:
*   test_set is stable about 300 nicroseconds after a
*   trigger.  It is not ready to accept another trigger for
*   about 3 nilliseconds.  It takes about &.29 nilliseconds to
*   stabilize after an "RCO," (fron the tine the "RCO" has been
*   accepted by the test set software and the "," is loaded
*   into the HP-IB I.C. until ail ie processed and stable).
*   It takes about 5.44 nillieeconds to stabilize after the
*   test-set software reads the "," fron the HP-IB I.C..
*   [ as ef 22 Nov &3 ]
*
*****************************************************************************
;
bYTE    RRRAY ewitching_speed[ numerator_port:attenuator ],
              test_set_speed [ 1:nax_aaraneter, 1:nax_aaraneter ];
                                        & could be lower-triangular, &
                                        & but indexing is too slou.  &
INTEGER RRRRY configuration  [ 1:nax_aaraneter],
              port_0hable    [ 1:Nax_peraneter];
```

```
STESTSET.UORK.POB510          THU, DEC 22, 1983, 11:02 AM    PAGE  4


REJECT;
BYTE TABLE port_map :=                & indexed by 3*port_type + port &
      0, 0, 0,                        & port_type = 0 is illegal.     &
      nun_no_ratio,    & numerator_port,   0 &
      non_b1,          & numerator_port,   1 &
      nun_b2,          & numerator_port,   2 &
      denon_no_ratio,  & denominator_port, 0 &
      denon_a1,        & denominator_port, 1 &
      denon_a2,        & denominator_port, 2 &
      driven_none,     & driven_port,      0 &
      driven_a1,       & driven_port,      1 &
      driven_a2,       & driven_port,      2 &
      lock_donot_care, & phase_lock_port,  0 &
      lock_to_a1,      & phase_lock_port,  1 &
      lock_to_a2;      & phase_lock_port,  2 &

BYTE TABLE numerator_control_bits :=  & indexed by numerator port type &
      b1,              & nun_b1 &     & MUST coincide with constants   &
      b2,              & nun_b2 &     & from cyadc.work.               &
      a2,              & nun_a2 &
      a1,              & nun_a1 &
      oo_ports,        & nun_100kHz_cal and nun_no_ratio &
      no_ports,        & nun_detector_gnd   &
      oo_ports,        & nun_ref_100kHz_cal &
      no_ports,        & nun_adc_gnd        &
      no_ports,        & nun_vcal           &
      no_ports,        & nun_vref           &
      no_ports,        & nun_temp1          &
      no_ports,        & nun_temp2          &
      no_ports;        & nun_analog_in      &
BYTE TABLE denominator_control_bits :=& indexed by denon'tor port type &
      b1,              & denon_b1 &
      a1,              & denon_a1 &
      a2,              & denon_a2 &
      no_ports,        & denon_100khz_cal &
      no_ports;        & denon_detector_gnd and denon_no_ratio &
BYTE TABLE lock_control_bits :=       & indexed by phase-lock port type &
       a1,             & lock_to_a1 &
       a2;             & lock_to_a2 &
                       & and lock_donot_care &
ALPHA TABLE number_string :=
      "0"&newline,
      "1"&newline,
      "2"&newline,
      "3"&newline,
      "4"&newline,
      "5"&newline,
      "6"&newline,
      "7"&newline,
      "8"&newline,
      "9"&newline,
      "10"&newline,
      "11"&newline,
      "12"&newline,
      "13"&newline,
      "14"&newline,
```

```
STESTSET.UORK.PO8510          THU, DEC 22, 1983, 11:02 AM    PAGE  5


      "15"&newline;
                                                          & DEBUG &
                                                          & DEBUG &
                                                          & DEBUG &
BOOLEAN SUBROUTINE slow_test_set;                    ENTRY; & DEBUG &
   BEGIN & slow_test_set &                                 & DEBUG &
      slow_test_set := (switching_speed[driven_port] = non_functional);
   END;  & slow_test_set &                                 & DEBUG &
```

```
STESTSET.UORK.PDS510          THU, DEC 22, 1983, 11:02 AM    PAGE  6


REJECT;
COMMENT                                                device_reversed
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR device_reversed
*
* FUNCTION: Resumes a measurement after the user indicates that the
*           device direction has been changed and the device is ready.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
*****************************************************************************
*
* LOGIC INFORMATION FOR device_reversed
*
* INTIAL REFINEMENT:
*
*    restart_sweep.
*
*****************************************************************************
;
SUBROUTINE device_reversed;                                        ENTRY;
   BEGIN & device_reversed &
      IF waiting_for_device_rdy THEN
         restart_sweep;
      & otherwise, it is just a spurious input &
   END;  & device_reversed &
```

```
STESTSET.UORK.PD8S10          THU, DEC 22, 1983, 11:02 RD    PAGE  7


REJECT;
COMMENT                                                   tell_reverse
*****************************************************************************
*
*****************************************************************************
;
INTEGER PROCEDURE tell_reverse( parameter );
   VALUE  parameter;
   INTEGER parameter;
   BEGIN & tell_reverse &
      INTEGER device_message;

      IF ( parameter_descriptor[ param[parameter), driven_port ] AND
           reverse_dev_bit
         ) <> 0 THEN
         device_message := reverse_device
      ELSE
         device_message := forward_device;

      tell( device_message );
      tell_reverse := device_message;

   END;  & tell_reverse &
```

```
STESTSET.UORK.PDB510          THU, DEC 22, 1983, 11:02 RR     PAGE  8


%EJECT;
COMMENT                                                    set_test_set
*****************************************************************
*
*   Set up test set for the specified param based on the parameter
*   descriptor.  If the new acquisition parameter (new_param_index) is
*   the same as the prior one, no operation is performed.  For this
*   reason the diagonal elements of the test_set_speed matrix are
*   saved for remembering the previous parameter's switching speeds --
*   see the description above for the test_set_speed array.
*
*   lock_required = TRUE if either the driven or the phase-lock port
*   have changed, indicating a need to phase-lock.
*
*   Returns FAILSE if the pause for device reversal was aborted.
*
*****************************************************************
;
BOOLEAN PROCEDURE  set_test_set( new_param_index, lock_required );
   VALUE   new_param_index;
   INTEGER new_param_index;
   BOOLEAN lock_required;                                    ENTRY;
   BEGIN % act_test_set %
      BYTE    speed,
              lock;
      BOOLEAN success_status;
      INTEGER device_message;
      LABEL   exit;

      lock_required := FALSE;
      success_status := TRUE;

      IF test_set_present AND (new_param_index <> old_param_index) THEN
         BEGIN % if %
            IF old_param_index = rebuilt THEN
               BEGIN % if %
                  old_param_index := new_param_index;
                  old_param := param[old_param_index];
               END;  % if %

            IF new_param_index = (old_param_index + 1) THEN
               trig_priv_ib( test_set )
            ELSE
               wrt_priv_ib( test_set,
                            rc,
                            number_string[new_param_index-1]
                          );

            lock := test_set_speed[ param[new_param_index], old_param ];
            speed := lock AND speed_mask;

            % WAIT IF NECESSARY %
            IF speed <> fast THEN
               IF speed = slow THEN
                  wait( test_set_ready )                % wait for srq %
               ELSE IF speed = reverse_dev THEN
```

```
STESTSET.UORK.PDB510          THU, DEC 22, 1983, 11:02 RR     PAGE  9


               BEGIN % else if %
                  device_message := tell_reverse( new_param_index );
                  gen_menu( DEVICE_READY_MENU, 1 );
                  waiting_for_device_rdy := TRUE;
                  release(control_variables);
                  success_status := break_paused;       % wait %
                  acquire(control_variables);
                  waiting_for_device_rdy := FALSE;
                  clear_message( device_message );
               END   % else if %
            ELSE % speed = non_functional %
               warn( illegal_test_set_operation );

            old_param_index := new_param_index;
            old_param := param[old_param_index];
            IF (lock AND phase_lock_bit) <> 0 THEN
               lock_required := TRUE;
         END;  % if %

exit: set_test_set := success_status;

   END;  % set_test_set %
```

```
STESTSET.UORK.PDB510          THU, DEC 22, 1983, 11:02 RR     PAGE 10


%EJECT;
COMMENT                                                  build_test_set
*****************************************************************
*
* EXTERNAL SPECIFICATION FOR build_test_set
*
* FUNCTION
*    Set up test-set(s)'s save/recall registers for the parameters
*    described by the parameter descriptor.  Tables for test-set
*    switching speed and whether re-phase-lock is required are built for
*    use by set_test_set.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS: Tables are built for use by set_test_set.
*
* COMMENTS:
*
*****************************************************************
*
* LOGIC INFORMATION FOR build_test_set
*
* INTIBL REFINEMENT:
*
*****************************************************************
;
PROCEDURE  build_test_set;                                   ENTRY
   BEGIN % build_test_set %
      BYTE    speed,
              parameter;
      INTEGER from_param,
              to_param;

      % clear test set %
COMMENT something of this sort may be necessary for dual test-set oper'n
      IF test_set_present THEN
         wrt_priv_ib( test_set,
                      clr_fun,
                      "PEG,ICO,SWO,1,2,3,4,5,6,7,RXO"+newline
                    );

      IF ( (test_set_present) AND
           (last_acquisition_param >= first_acquisition_param)
         ) THEN
         BEGIN % if test_set_present %

            speed := fast OR phase_lock_bit;

            FOR to_param := first_acquisition_param UNTIL
                                          last_acquisition_param DO
               BEGIN % to param %
                  parameter := param[ to_param ];
```

```
STESTSET.UORK.PDB510          THU, DEC 22, 1983, 11:02 RR     PAGE 11


                  wrt_priv_ib( test_set,
                               ic,
                               number_string[configuration[parameter]]
                             );
                  IF port_enable[parameter] <> non_functional THEN
                     wrt_priv_ib( test_set,
                                  pe,
                                  number_string[port_enable[parameter]]
                                );
                  wrt_priv_ib( test_set,
                               sv,
                               number_string[to_preset-1]
                             );
                  IF to_param > first_acquisition_param THEN
                     FOR from_param := first_acquisition_param UNTIL
                                                   (to_param - 1) DO
                        IF ( ( speed_mask AND
                               test_set_speed[ parameter,
                                               param[from_param]
                                             ]
                             ) = reverse_dev
                           ) THEN
                           speed := reverse_dev OR phase_lock_bit;
               END;  % to param %

            FOR parameter := 1 UNTIL max_parameter DO
               test_set_speed[ parameter, parameter ] := speed;

            wrt_priv_ib( test_set,
                         mx,
                         number_string[ last_acquisition_param - 1 ]
                       );

         END;  % if test_set_present %

      old_param_index := rebuilt;  % assures no match with a parameter %

   END;  % build_test_set %
```

```
STESTSET.UORK.PDS510          THU, OEC 22, 1983, 11:02 AM     PAGE  12


REJECT;
COMMENT                                              compute_speed_matrix
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  compute_speed_matrix;
   BEGIN & compute_speed_matrix &
      BYTE    epeed,
              temp,
              fron_nun_port,
              fron_denon_port,
              fron_driven_port,
              fron_lock_port,
              to_non_port,
              to_denon_port,
              to_driven_port,
              to_lock_port;
      INTEGER to_paran,
              fron_paran,
              port_control_bits;

      INTEGER PROCEDURE get_port( parameter, port );& this saves epace &
         VALUE parameter, port;                      & for indexing.    &
         BYTE  parameter, port;
         BEGIN & get_port &
            get_port := parameter_descriptor[ parameter, port ];
         END;  & get_port &

      FOR to_paran := 1 UNTIL nax_parameter DO
         BEGIN & For to_paran &

            to_nun_port   := get_port(to_paran, nunerator_port);
            to_denon_port := get_port(to_paran, denominator_port);
            to_driven_port:= get_port(to_paran, driven_port);
            to_lock_port  := get_port(to_paran, phase_lock_port);

            port_control_bits :=
                           nunerator_control_bits[   to_nun_port   ] OR
                           denominator_control_bits[ to_denon_port ] OR
                           lock_control_bits[        to_lock_port  ];

            configuration[ to_paran ] := port_control_bite AND %000F;

            IF euitching_speed(driven_port] <> non_functional THEN
               port_enable[ to_paran ] := to_driven_port AND %003F
            ELSE
               port_enable[ to_paran ] := non_functional;


            IF to_paran > 1 THEN
               FOR fron_paran := 1 UNTIL (to_paran - 1) DO
                  BEGIN & for fron_paran &
                     speed := fast;

                     fron_nun_port    := get_port(fron_paran,
```

```
STESTSET.UORK.PD8510          THU, OEC 22, 1983, 11:03 AM     PAGE  13

                                          nunerator_port
                                         );
                  fron_denon_port  := get_port(fron_paran,
                                          denominator_port
                                         );
                  fron_driven_port := get_port(fron_paran,
                                          driven_port
                                         );
                  fron_leck_port   := get_port(fron_paran,
                                          phase_lock_port
                                         );

                  & NUMERATOR PORT SUITCHING SPEED &
                  IF ( (to_nun_port <> aron_nun_port) AND
                       (to_nun_port <= nun_a1)        AND
                       (fron_nun_port <= nun_a1)
                     ) THEN
                     BEGIN & if &
                        temp := suitching_speed[ nunerator_port ];
                        IF temp < speed THEN & get slouest speed &
                           speed := temp;
                     END;  & if &

                  & DENOMINATOR PORT SUITCHING SPEED &
                  IF ( (to_denon_port <> fron_denon_port) AND
                       (to_denon_port <= denon_a2)       AND
                       (from_denon_port <= denon_a2)
                     ) THEN
                     BEGIN & if &
                        temp := ewitching_speed[denominator_port];
                        IF temp < speed THEN & get slouest speed &
                           speed := temp;
                     END;  & if &

                  & DRIVEN PORT SWITCHING SPEED &
                  IF to_driven_port <> fron_driven_port THEN
                     BEGIN & if &
                        IF ( (to_driven_port XOR fron_driven_port)
                             AND reverse_dev_bit
                           ) <> 0 THEN          & reverse device &
                           temp := reverse_dev
                        ELSE
                           temp := euitching_speed[ driven_port ];
                        IF temp < speed THEN & get slouest speed &
                           speed := temp;
                     END;  & if &

                  & PHASE-LOCK PORT SWITCHING SPEED &
                  IF ( (to_lock_port <> fron_lock_port) AND
                       (to_lock_port <= lock_to_a2)     AND
                       (fron_lock_port <= lock_to_a2]
                     ) THEN
                     BEGIN & if &
                        temp := suitching_speed[phase_lock_port];
                        IF temp < speed THEN & get slouest speed &
                           speed := temp;
```

```
STESTSET.UORK.PD8510          THU, DEC 22, 1983, 11:03 AM     PAGE  14

                     END;  & if &

                  & CHECK IF NEED TO PHASE-LOCK &
                  IF ( (fron_lock_port   <> to_lock_port) OR
                       (fron_driven_port <> to_driven_port)
                     ) THEN
                     speed := speed OR phase_lock_bit;

                  test_set_speed[ fron_paran, to_paran ] := speed;
                  test_set_speed[ to_paran, fron_paran ] := speed;

               END;  & for fron_paran &

            test_set_speed[ to_paran, to_paran ] := fast;

         END;  & for to_paran &

   END;  & compute_speed_matrix &
```

```
STESTSET.UORK.PD8510          THU, DEC 22, 1983, 11:03 AM     PAGE  15


REJECT;
COMMENT                                              redefine_test_set
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE redefine_test_set;                                        ENTRY;
   BEGIN & redefine_test_set &
      compute_speed_matrix;
      old_paran := all;       & Hell, you have to start with something &
      old_paran_index := rebuilt;
   END;  & redefine_test_set &
```

```
STESTSET.WORK.PD&510          THU, DEC 22, 1983, 11:03 RR    PAGE 16

REJECT;
COMMENT                                                    preset_test_set
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR preset_test_set
*
* FUNCTION
*    To initialize the test-set.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  none
*
*    OUTPUT: none
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
*****************************************************************************
*
* LOGIC INFORMATION FOR preset_test_set
*
* INTIAL REFINEMENT:
*
*****************************************************************************
;
PROCEDURE  preset_test_set;                                        ENTRY;
   BEGIN & preset_test_set &
      BYTE ARRAY id_array[-1:id_size];
      BYTE    parm,
              temp,
              atten_nmbr,
              ch_atten_port;
      BOOLEAN test_set_changed;
      INTEGER chan,
              parameter,
              domain,
              port_type,
              index;
      ALPHA   id_string;
      QUAD    min,
              mid,
              max;

      SUBROUTINE set_atten;
         BEGIN & set_atten &
            urt_priv_ib(test_set,
                        atten_nmbr,
                        append_ch(format_real(
                                     ch_real( ch_atten_port, chan ),
                                     id_string,
                                     format_table[test_set_atten_format]
                                                 ),
                                  neuline
                                 )
```

```
STESTSET.WORK.PD&510          THU, DEC 22, 1983, 11:03 RR    PAGE 17

                        );
         END;  & set_atten &

      & initialize string &
      id_string := ADRS(id_array);
      id_string := init_string( id_string, id_size );

      clr_priv_ib(test_set);
      test_set_present := urt_priv_ib( test_set,
                                       clr_fun,
                                       "IPRM255CS" + neuline
                                     );
      IF test_set_present THEN
         read_priv_ib(test_set, oi, "", id_string)
      ELSE
         id_string := append_string( id_string,
                        ";5.0E08,1.8E10;4.5E07,9.99E11;" +
                        "1,1,1,1;2,1,1,1;1,2,2,2;2,2,2,2;2,2,2,2,0;"
                              );
      IF test_set_debug THEN                                    & DEBUG &
         BEGIN & if &                                           & DEBUG &
            CRLF; USTR(id_string); CRLF;                        & DEBUG &
         END;  & if &                                           & DEBUG &

COMMENT   this code allows the &510 to avoid overwriting user modified
          parameter definitions as long as the physical test set has not
          changed.  It must be modified to assure that the proper data
          is build into the parameter definitions for power-on, preset,
          recall, etc.          ;
      test_set_changed := FALSE;
      index := 1;
      UNTIL id_array[index] <> '; DO
         BEGIN & while &
            IF index <= old_id_size THEN
               BEGIN & if &
                  IF old_id[index] <> id_array[index] THEN
                     test_set_changed := TRUE;
                  urt_disp_byte( RORS(old_id[index]), id_array[index] );
               END;  & if &
            index := index + 1;
         END;  & while &
      test_set_changed := TRUE;   & override the above result && DEBUG &

      IF test_set_changed THEN
         BEGIN & if &
            index := index + 1;                 & skip over semi-colon &

            & test-set specification frequency limits &
            min := CNV9A( id_string, index );
            max := CNV9A( id_string, index );
            IF ( (recall_type = preset_rtcall) OR
                 (recall_type = test_recall)
               ) THEN
               BEGIN & if &
                  mid := (max + min)/2;
```

```
STESTSET.WORK.PD8510          THU, DEC 22, 1983, 11:03 AM    PAGE 18

               FOR chan := 1 UNTIL 2 DO
                  BEGIN & for &
                     set_ch_quad( min, ch_start_frequency,  chan);
                     set_ch_quad( mid, ch_center_frequency, chan);
                  END;  & for &
            END;  & if &

         & hard (absolute] test-set frequency limits &
         min := CNV9A( id_string, index );
         max := CNV9A( id_string, index );

         & changing domains is a kludge, but nice solution ie pain. &
         FOR chan := 1 UNTIL 2 DO
            BEGIN & for &
               domain := ch_integer( ch_domain, chan );
               set_ch_integer( free_domain, ch_domain, chan );
               ch_set_active_limits( min, max, active_start, chan );
               set_ch_integer( domain, ch_domain, chan );
            END;  & for &

         & GET PARAMETER DESCRIPTIONS &
         FOR parameter := s11 UNTIL s22 DO
            FOR port_type := numerator_port UNTIL phase_lock_port DO
               BEGIN & for &

                  temp := CNV9A(id_string,index);

                  IF temp = 0 THEN
                     BEGIN & if &
                        CASE parameter-1 OF & get param, other port &
                           BEGIN & case &
                        & s11 &     poem := s22;
                        & s21 &     parm := s12;
                        & s12 &     parm := s21;
                        & s22 &     parm := s11;
                           END;  & case &
                        temp := parameter_descriptor( parm,
                                                      port_type
                                                    );
                        IF port_type = driven_port THEN
                           temp := temp OR reverse_dev_bit;
                     END   & if &
                  ELSE
                     temp := port_map[ 3*port_type + temp ];

                  parameter_descriptor[parameter, port_type] := temp;

               END;  & for &

         & GET SWITCHING SPEEDS &
         FOR port_type := numerator_port UNTIL attenuator DO
            BEGIN & for &
               temp := CNV9A(id_string, index);
               IF temp = 0 THEN
                  temp := non_functional;
               switching_speed[port_type] := temp;
```

```
STESTSET.WORK.PD8510          THU, DEC 22, 1983, 11:03 AM    PAGE 19

            END;  & for &

         IF switching_speed[attenuator] <> non_functional THEN
            BEGIN & if attenuator present &
               chan := 1;  & until two test-set capability is added &
               atten_nmbr := atten1;
               ch_atten_port := ch_atten_port1;
               set_atten;

               atten_nmbr := atten2;
               ch_atten_port := ch_atten_port2;
               set_atten;
            END;  & if attenuator present &

         compute_speed_matrix;

      END;  & if &

   old_param := s11;       & Well, you have to start with something &
   old_param_index := rebuilt;

END;  & preset_test_set &

END$                                                        & DEBUG &
         IF test_set_debug THEN                             & DEBUG &
            BEGIN & if debug &                              & DEBUG &
               USTR("test-set(f/t): ");                     & DEBUG &
               UNEX(old_param_index);                       & DEBUG &
               NNEX(new_param_index);                       & DEBUG &
               CRLF;                                        & DEBUG &
            END;  & if debug &                              & DEBUG &


   IF test_set_debug THEN                                   & DEBUG &
      BEGIN & if debug &                                    & DEBUG &
         CRLF;                                              & DEBUG &
         USTR("compute test_set_speed: ");                  & DEBUG &
         CRLF;                                              & DEBUG &
         FOR fro_param := 1 UNTIL max_parameter DO          & DEBUG &
            BEGIN & for fro_param &                         & DEBUG &
               UNEX( fro_param ); USTR("  ");               & DEBUG &
               FOR to_param := 1 UNTIL max_piramoter DO      & DEBUG &
                  BEGIN & for to_param &                    & DEBUG &
                     WHEX(test_set_tpeed[ fro_param,        & DEBUG &
                                          to_param          & DEBUG &
                                        ]                   & DEBUG &
                         );                                 & DEBUG &
                  END;  & for to_param &                    & DEBUG &
               CRLF;                                        & DEBUG &
            END;  & for fro_param &                         & DEBUG &
         CRLF;                                              & DEBUG &
      END;  & if debug &                                    & DEBUG &
```

```
FTIME.UORK.PD8510               INU, DEC 22, 1983, 11:03 BM     PAGE   1

PROCEDURE  control_data_proc_tine( channel );
   VRLUE channol; INTEGER channel;                              EXTERNRL.L;
PROCEDURE  array_datap( ch ) ;   VALUE ch;    INTEGER ch;       EXTERNRL.L;
PROCEDURE tdr_check;                                            EXTERNRL.L;.
```

```
STIME.UORK.PDBS10               INU, DEC 22, 1983, 11:03 AM     PAGE   1

N68KL,P,"tine"
BEGIN
COMMENT
*************************************************************************
* This nodule contains the code For the TIME DOMAIN and GATING functions
*
*
* things to do
*     conbine and place in subroutine the NPYE and save in nenory ??
*     replace preenpt in npy_array, fftun, etc uith preenpt and read
*                                          array fifo
*************************************************************************
;

#FILE cdebug.uork;                                              &DEBUG&
NFILE ftern.uork;                                               &DEBUG&
#FILE ftern2.uork;                                              &DEBUG&
#FILE ftern3.uork;                                              &DEBUG&
#FILE fdatap.uork;
#FILE futil.uork;
#FILE futil2.uark;
#FILE fkernel.uork;
#FILE fkernelR.uork;                                          &preenpt&
#FILE fchdata.uork;
#FILE cchtable.uork;
#FILE fchtablc.uork;                                  &current_entry_ch&
#FILE fchtab2.uork;                                   &ch_quad, ch_real&
#FILE fnenngr.uork;
#FILE fsize.uork;
#FILE fstinuli.uork;

PROCEDURE copy_user3( fron_addr, to_addr, size );
                       VRLUE fron_addr, to_addr, size;
                      DOUBLE fron_addr, to_addr; INTEGER size; EXTERNAL;
PROCEDURE ifft(adr);     VALUE adr;      DOUBLE adr;          EXTERNAL.L;
PROCEDURE  fft(adr);     VALUE adr;      DOUBLE adr;          EXTERNAL.L;
PROCEDURE fftun(adr);    VALUE adr;      DOUBLE adr;          EXTERNAL.L;
RERL PROCEDURE BESI(x);  VALUE x;        REAL x;              EXTERKAL;
REAL PROCEDURE SORT(x);  VALUE x;        RERL x;              EXTERNAL;
REAL PROCEDUKE  SIN(x);  VALUE x;        REAL x;              EXTERNAL;
REAL PROCEDURE  COS(x);  VRLUE x;        REAL x;              EXTERNAL;
SUBROUTINE MPYE_ptrs;                                         EXTERNAL;
SUBROUTINE MPYE_ptr;                                          EXTERNAL;
SUBROUTINE MPYE;                                              EXTERNAL;
SUBROUTINE DIVE_ptr;                                          EXTERNAL;
SUBROUTINE fetch_CMVE1;                                       EXTERNAL;
REAL PROCEDURE CMV2E(x); VALUE x;        REAL x;              EXTERNAL;
SUBROUTINE nagE;                                              EXTERNAL.L;
SUBROUTINE angE;                                              EXTERNAL.L;
SUBROUTINE DVP2;                                              EXTERNAL;
SUBROUTINE fst_trig_long;                                     EXTERNAL.L;
SUBROUTINE fst_trig;                                          EXTERNAL.L;
SUBROUTINE array_correct;                                     EXTERNAL.L;
SUBROUTINE array_elec_length;                                 EXTERNAL.L;
EXTERNAL REAL TuoPi, Pi;
```

```
SIIME.UOAK.PD8510               THU, DEC 22, 1983, 11:03 AM     PAGE   2


DOUBLE dp_scr_array_tine,
       dp_scr_array_freq,
       ehirp_array,
       #tln_array,
       gate_array,
       pre_gate_array,
       post_gate_array,
       old_FeTs;
INTEGER nun_pts,
        chan,
        donain,
        gate_donain,
        stin,
        flag;
REAL   Fo,  Fs,
       gate_cen_Fs,
       x0;                                &conputed dc values&
INTEGER CONSTRNT inpulse := inpulse_tdr,
        nop :* 0,    npy  := 1,   sun := 2;

GLOBAL                                                    Sdebug&
INTEGER TRBLE tine_uind := 0,   6,   13;
INTEGER TABLE  pre_uind :* 4;
INTEGER TABLE gate_uind :* 2,   5,  5,   8;
INTEGER TABLE gate_size :* 2,   2,  5,  10;
```

```
STIME.WORK.POS510               THU, DEC 22, 1983, 11:03 AM     PAGE   3

#EJECT;COMMENT                                               tdr_check
*************************************************************************
*
*************************************************************************
;
PROCEDURE tdr_check;                                            ENTRY;
BEGIN
 OUAD step ,
      pts ;
   pts := OUAD(nunber_of_points);
   step:=(( 2 * ch_quad( eh_center_frequency ,current_entry_eh ) )
              - ch_quad( ch_start_frequency , current_entry_ch ) )/ pts;
   IF step < 45000000 THEN step := 45000000;
   urt_priv_ib_source_freq( step, pts * step );
   tell( tdr_freq_change );

   COMMENT  -- beuare of 8350 reounding problens
            conpute and conpare old and neu start/centers ;

END  tdr_check;
```

```
STINE.WORK.PD8510              THU, DEC 22, 1583, 11:03 AM     PAGE   4

#EJECT;COMMENT                                        control_data_proc_time
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  control_data_proc_time( channel );
   VALUE   channel;
   INTEGER channel;                                               ENTRY;
   BEGIN & control_data_proc_time &
      flag := 0;
   END;  & control_data_proc_time &
```

```
STINE.WORK.PDS510              THU, DEC 22, 1983, 11:03 AM     PAGE   5

#EJECT;COMMENT
*****************************************************************************
*
* results in a fracitional part x 2^^32
*****************************************************************************
;
DOUBLE PROCEDURE eyc_frac(x);     VALUE x;      REAL x;             ENTRY;
BEGIN
BYTE xexp=x+3, exp;
DOUBLE xd=x;

  exp := xexp+1;
  xd  := xd AND %FFFFFF00;
  eyc_frac := IF  exp<0  THEN  ARIGHT(xd,-exp)  ELSE  ALEFT(xd,exp);

END cyc_frac;
```

```
STIME.WORK.PD8510              THU, DEC 22, 1983, 11:03 AM     PAGE   6

#EJECT; COMMENT
*****************************************************************************
*  compute_dc_value is a copy of Dave's routine From his report
*
*  Averaging the pt-1, pt_2 values would provide more dc stability, and
*    improve baseline stability also.
*  Probaby a fix value exp averaging that is reset on any control_time
*    changes and on measurment restart, and ??????????
*****************************************************************************
end of comment;
PROCEDURE   compute_dc_value;
BEGIN
REAL x1, y1,
     x2, y2,
     x_delta,   x_temp,
     raduis,    x_center;

ASSEABLE( MOVE.L dp_scr_array_freq, R8;
          JSR    fetch_CMVE1;   ROVE.L R0,x1;   MOVE.L R1,y1;
          ADD.W  86,R8;
          ISR    fetch_GMVE1;   BOVE.L R0,x2;   MOVE.L R1,y2);

 If ABS( (x_delta := x2 - x1 ) ) >.001 THEN
     BEGIN     & x seperation enought to aviod noise or DIV by Zero &
     x_center := .5 *( x2 + x1 + ( y2 + y1 )*( y2 - y1 ) / ( x_delta ));
                              & DANGER   x2 = x1 problems &
     x_temp   :=   x1 - x_center;
     raduis   :=   SORT(  ( x_temp*x_temp ) + ( y1*y1 )  ) ;
     x0       :=   x_center  +  ( IF y1<0 THEN raduis ELSE -(raduis) ) ;
     END
   ELSE  & signal too small or too close &
     x0 := x1;
 CMV2E( x0 );
 ASSEMBLE( MOVE.L  dp_scr_array_time, R8;      MOVE.W =M0, (R8)+;
           MOP;                                MOVE.W  R0, (R8)+;
           MOP;                                MOVE.W  R1, (R8)+   );
END;


REAL PROCEDURE   compute_tg0_value;
BEGIN
REAL delta_ang ;
   ASSEMSLE( MOVE.L dp_scr_array_time, R8;
             MOVE.L (R8)+,     R0;              MOVE.W (R8)+,    R1;
             JSR    DIVE_ptr;
             JSR    angE;
             ROVE.L  R0, delta_ang   );
   compute_tg0_value := delta_ang / ( 360. * Fs );
END compute_tg0_value;
```

```
STIME.WORK.PD8S10              THU, DEC 22, 1983, 11:03 AM     PAGE   7

#EJECT;COMMENT
*****************************************************************************
*
*   sum in ramp portion of steo response
*     see Dave's report pg6.7, this ie presently only the linear portion
*****************************************************************************
;
PROCEDURE td_ramp(adr, FsTo, FsTs, pts);
               VALUE adr, FsTo, FsTs, pts;
               DOUBLE adr;  REAL FsTo, FsTs;  INTEGER pts;
 BEGIN
   DOUBLE ptr12 = REGISTER 12;                        & freese use Of R12 &
   REAL t, correction;

   t  := FsTo;
   ptr12 := adr;

   REPEAT pts DO                  &do the H(D) * Fs * T ramp correction &
      BEGIN
      correction  :=   ( x0 * t ) ;
      ASSEMSLE (  MOVE.W  =M0,   (R12)+;     & clear imag part &
                  ROVE.L  correction, R0;
                  MOVE.L  (R12),  R1;        JSRK  ADD2;
                  SWAP    R0;                MOVE.W   R0,(R12)+;
                  SWAP    R0;                MOVE.W   R0,(R12)+   );
     t        :=  t + FsTs;                                &becomes Fsl &
      END pts loop;

 END td_ramp;
```

```
STIME.WORK.PDBS10              THU, DEC 22, 1983, 11:03 AM     PAGE  8


#EJECT;COMMENT
*****************************************************************************
*
*   two array multiply
*****************************************************************************
;

PROCEDURE array_mpy( adr1, adr2, pts);
          VALUE adr1,adr2,     & input1, input2 ( output )&
                pts: INTEGER pts;    & array size &
          DOUBLE adr1,adr2;
BEGIN
INTEGER loopctr = REGISTER 7;
LABEL loop, test;
   RSSEMBLE(
               MOVE.L  adr1,  R8;
               MOVE.L  adr2,  R10;
               MOVE.L   R10,  R13;
               MOVE.W  pts,   loopctr;
               BRR     test;
         loop: JSR     MPYE_ptr;
               SWAP    R0;              MOVE.W  R0,  (R13)+;
               SWAP    R0;              MOVE.W  R0,  (R13)+;
               NOP;                     MOVE.W  R1,  (R13)+;
         test: DBRR    loopctr, loop                          );

   preempt;
 END array_mpy
```

```
STIME.WORK.PDBS10              THU, DEC 22, 1983, 11:03 AM     PAGE  9

#EJECT;COMMENT
*****************************************************************************
          zero out imag part ( only real )
*****************************************************************************
;
 PROCEDURE array_zero_imag(adr, pts ); VALUE adr ,pts ;
                                       DOUBLE adr;     INTEGER pts ;
 BEGIN
  INTEGER loopctr=REGISTER 7;
  LABEL loop, test;
  RSSEMBLE(
            MOVE.L   adr,  R8;
            MOVE.W   pts,  loopctr;
            BRR      test;
       loop: MOVE.W  #0,(R8);
            ADDQ     #6,  R8;
      test: DBRR     loopctr, loop              );
 END array_zero_imag;

COMMENT
*****************************************************************************
          zero out array  R11 has ptr,  R4 has repeat count
*****************************************************************************
;
SUBROUTINE  array_zero;
BEGIN
LABEL loop, test;
RSSEMBLE(
               BRA     test;
         loop: MOVE.W  #0,(R11)+;   NOP;
               MOVE.W  #0,(R11)+;   NOP;
               MOVE.W  #0,   (R11)+;
         test: DBRA    R4,   loop          );
END array_zero;

PROCEDURE user3_zero( addr, numb);
                VALUE addr, numb; DOUBLE addr; INTEGER numb;      ENTRY;
BEGIN
    RSSEMBLE(   MOVE numb, R4;  MOVE.L addr, R11;  BSR array_zero );
END user3_zero;
```

```
STIME.WORK.PDBS10              THU, DEC 22, 1983, 11:03 AM     PAGE 10

#EJECT; COMMENT
*****************************************************************************
* builds the chirp array -- builds it in three stages
*       stage 1 the zero pt
*       stage 2 the first and last segments which are mirror images
*               and are pts - 1 long
*       stage 3 the middle segment is zeroed out -- this is size+1-2*pts
*****************************************************************************
end of comment;
PROCEDURE build_chrip( adr, pts, FsTs );  VALUE adr, pts, FsTs;
                                DOUBLE adr, FsTs;  INTEGER pts;
BEGIN
INTEGER POINTER ptr11=REGISTER 11, ptr12=REGISTER 12;
DOUBLE ang_delta=REGISTEK 5, ang_inc=REGISTER 6, ang=REGISTER 7;
INTEGER loopctr =REGISTER 4;
LABEL loop, teat;

     STPNTR(ptr11, adr); STPNTR(ptr12, adr+6144);
     RSSEMBLE(MOVE.W #0,(R11)+;      MOVE #4000, (R11)+   ;
              MOVE.W #1,(R11)+          );  & set first val = 1.0&

     ang_delta :=  -FsTs;
     ang_inc   := ang := RRIGHT(ang_delta,1);
      RSSEMBLE(                              & R11 is first segment &
              MOVE.W pts, loopctr;           & R12 is last  segment &
              SUB    #1, loopctr;
              BRA    test;
        loop: MOVE.L ang, R0;          JSR  fst_trig_long;
              SWAP   R0;               MOVE.W   R0, (R11)+;   &imag&
              SWAP   R0;               MOVE.W   R0, (R11)+;   &real&
              ROO.L  ang_delta,ang_inc; MOVE.W  #0, (R11)+;   &exp &
              RDD.L  ang_inc,ang;      MOVE.W   #0, -(R12);   &exp &
              NOP    R0;               MOVE.W   R0, -(R12);   &real&
              SWAP   R0;               MOVE.W   R0, -(R12);   &imag&
        test: OBRA   loopctr, loop              );


      RSSEMBLE(
              MOVE.W #01024, loopctr;     ADD.W  #1,    loopctr;
              SUB.W  pts,    loopctr;     SUB.W  pts,   loopctr;
              BSR    array_zero      );     &  R11 is adr, R4 count &


     ifft(adr); fftun (adr);                 & includes a preenpt &

END build_chirp;
```

```
STIME.WORK.PDSS10              THU, DEC 22, 1983, 11:03 AM     PAGE 11

#EJECT;COMMENT
*****************************************************************************
* special routine for use by the run time chirp
*****************************************************************************
end of comment;
SUBROUTINE npy_chirp;
    BEGIN
    LABEL loop, test;
    INTEGER loopctr=REGISTER 4;
    DOUBLE ang_delta=REDISTER 6, ang_inc=REGISTER 6, ang=REGISTER 7;
    RSSEMBLE(
               BRA     test;
          loop: MOVE.L  ang, R0;  JSR fst_trig_long;  CLR.W R1;
               MOVE.L  R11,  R8;
               JSR     RPYE_ptr;
               SWAP    R0;              MOVE.W   R0, (R11)+;
               SWAP    R0;              MOVE.W   R0, (R11)+;
               ROO.L   ang_inc, ang;    MOVE.W   R1, (R11)+;
               RDD.L   ang_delta, ang_inc;
         test: DBRA    loopctr, loop                        );
END npy_chirp;
```

```
SIIRE.WORK.PDB510          THU, DEC 22, 1983, 11:03 AM    PAGE 12

$EJECT;COMMENT
*****************************************************************
*****************************************************************
end of comment;
PROCEDURE chirpxfn(adr1,adr2,pta,FoIe,FsIo,FoIe,FoIo);
   VALUE adr1,adr2,  & asr ptr to acr and chirp arrays &
         pts,      & # of freq pts available , # of time points &
         fsIa,FsIo,    & FreqStepTimeStep, FreqStepTimeInit  products &
         FoIs,FoIo;    & FreqInitTimeStep, FreqInitTimeInit  products &
   DOUBLE adr1,adr2;
   INTEGER pts; DOUBLE FsIs,FsIe,FoIs,FoIo;
BEGIN
   DOUBLE ang_delta=REGISTER 5, ang_inc=REGISTER 6, ang=REGISTER 7;
   INTEGER POINTER ptr11=REGISTER 11, ptr12=REGISTER 12;
   INTEGER loopctr=REGISTER 4;

     & the actual chirp-Z code &
     & oec DRVE'S paper       &

   ang_delta := FsIs;
   ang_inc   := ang := FoIo * RRIGHT(ang_delta,1);
   ang_inc   := ang_inc  * ang_delta;
   loopctr:=pts-1;
   STPNTR(ptr11,adr1+6);          & skip first npy -- it is by one &
   npy_chirp;

   RSSEMBLE(  MOVE.U   #01024, loopctr;    SUB.U  pts, loopctr;
              BSR      array_zero              );



   ifft(adr1); fftun(adr1);                & includes a preenpt &

   &NOIC: UNSCRAMBLING NOT REQUIRED IN CHIRPXFN IF A SECOND
          FFT IS WRITTEN THAT ACCEPTS SCRAMBLED INPUTS.&


   array_npy( adr2, adr1, 1024 );                    & CONVOLUTION &

   fft(adr1); fftun(adr1);                & includes a preenpt &



   STPNTR(ptr11, adr1);
   ang_delta := FsIs;
   ang_inc   := FoIs * RRIGHT(ang_delta,1);     ang := FoIo;
   loopctr:=pts;                                  &npy by  down chirp &
   npy_chirp;

  END chirpxfn;
```

```
SIIRE.WORK.PDSSIO          THU, DEC 22, 1983, 11:03 AM    PAGE 13

$EJECT; COMMENT
*****************************************************************
*generate a window array -- with various parameters
*****************************************************************
;
REAL PROCEDURE td_windou(adr, wind_parm, node, pts, opt);
    VALUE  adr,wind_parm,node, & array adr,  window parm, node&
           pts,opt;            & number of data pts,&
    DOUBLE adr; INTEGER wind_parm, node, pts, opt;
BEGIN
 REAL parm,X,G,FN,SUM,norm;  INTEGER N;  BOOLEAN rect;
 DOUBLE POINTER ptr12=REGISTER 12;
 COMMENT                                    node
                                             0 BASEBAND
                                            2,3 PASS BAND    RF,RF-ENV ;

  IF node = tdr_domain THEN   N:= 0  ELSE N:= -#DIGIT(pts-1, 1) ;
  SUM:=0.;

  FN := 2.0/REAL(pts -1);                                    &rf nodes&
  IF node = tdr_domain THEN FN := .5 * FN;                   &baseband&

  rect := ( wind_parm = 0 );
  parm := REAL( wind_parm );

  norm:=1./BESI(parm);


  STPNTR(ptr12,adr);              &besi and Sqrt do not use reg12&
 REPEAT pts DO                              &compute/store window loop&
  BEGIN
  X:=REAL(N)*FN;

  IF (N=0) OR rect THEN G:=1.0 ELSE
   G:=BESI( parm * SQRT( 1- X*X ) ) * norm ;          &bess&


  IF opt = sun THEN BEGIN                                     &sun&
     IF N>0 AND node=tdr_domain THEN G:=2.*G;&double for non dc terms&
     SUM:=SUM+G; END;                            & MOVE ???? &

  GMV2E( G );

  IF opt = npy THEN RSSEMBLE(   MOVE.L R12,RS; JSR BPYE_ptr   );

  RSSEMBLE( SUAP RO;     ROVE.U RO,(R12)+; SUAP RO;  ROVE.U RO,(R12)+;
                ADD.U &1,N;  ROVE.U R1,(R12)+    );
 END pts loop ;

 preenpt;
 td_windou:=SUM;
 END td_windou;
```

```
STIRE.WORK.PDSSIO          IHU, DEC 22, 1983, 11:03 AM    PAGE 14

$EJECT;COMMENT
*****************************************************************
*
*****************************************************************
;
PROCEDURE td_stin(adr,stin,parm,node,pts);
   VALUE adr,stin,parm, & array adr, stin,  windouparm &
               node,pts ;& window node, & of freq pts, int pt pooit&
         DOUBLE adr; INTEGER parm,stin,nodc,pts;
 bEGIN
  COMMENT STIN 0  IMPULSE
               1  STEP
               2  SQUARE WAVE       END;
  REAL G1,GO,G,GS;
  INTEGER POINTER ptr12=REGISTER 12;
  INTEGER  N;
  BOOLEAN RERLG;

  G1:=td_windou(adr,parm,node,pts, sun);          &create windou first&
                                                   &remember area &
        &COMPENSATE FOR LACK OF 1/N IF ifft&
  GO:= 1.0/(G1*1024.);      &Normalize to height,&
  GS:=-1.0/(1024.*TwoPi);  &for etep \ area is 1, no normalizing needed&

  STPNTR(ptr12,adr); N:=0;
  REPEAT pts DO BEGIN
  REALG := TRUE;
  IF stin = impulse THEN  G := SO
   ELSE  BEGIN IF N<>0 THEN BEGIN &:=GS/REAL(N);  REALG := FALSE; END
               ELSE  G:=X40DDOOF& &1/204&&;                END else ;

  GMV2E( G );
  IF NOT RERLG THEN                &renove &       &zero real ie 1/j&
               ASSEMBLE(SUAP RO); & poor man's 1/j  swap real/imag &

  RSSEMBLE( MOVE.L R12,R8;  JSR  BPYE_ptr;
            SUAP RO;     ROVE.U AO,(R12)+;  SUAP RO;  ROVE.U RO,(R12)+;
            ADD.U 41,N;  ROVE.U R1,(R12)+   );     &create windou/stin&
  END loop;                                        & ovcratore window &

  END td_stin ;
```

```
SIIRE.WORK.PDB510          THU, DEC 22, 1983, 11:03 AM    PAGE 15

REJECT; COMMENT
*****************************************************************
*****************************************************************
end of comment;
PROCEDURE do_time_domain;
BEGIN
REAL To, Is, tgO;

DOUBLE FoIo, FoTs, FsTo, FsTs, phase ;
INTEGER wind ;

   To  :=  RERL( ch_quad( ch_start_time , chan ) );
   Ts  :=  RERL( ch_quad( ch_center_time, chan ) )  - To ;
   To  := To * T@-15;      Ts  := Ts * 2B-15 / REAL( num_pts - 1 );

   FoTo := cyc_frac( Fo * To );          &Fo has special val in Env &
   FoTs := cyc_frac( Fo * Ts );
   FeTo := cyc_frac( Fa * To );
   FsTs := eyc_frac( Fs * Ts );


       & add freq / time  / window / stin  change test &
       &   here    or in calling routine  -- for gating use &
   IF FsTs N old_FeTs THEN BEGIN  old_FsIs := FsTs;   flag := 0;  END;
```

```
STIME.WORK.POS510              THU, DEC 22, 1983, 11:03 AM     PAGE 16


%EJECT;
   IF (menory_stolen(chirp_array, td_chirp_arrays_id, (6144*array_size))
         OR ( flag = 0) ) AND (chirp_array # 0) THEN
      BEGIN
      tell( comp_time_coeff );
      build_chrip( chirp_array , non_pts,  fsIs );
      IF donain = tdr_donain THEN
          BEGIN
          stin := ch_integer( ch_tdr_stinulus_type , chan );
          END
       ELSE  &time_donain denain&
          SEGIN
          stin :=  inpulse;
          END;
      uind      := time_uind(  ch_integer( ch_time_windou, chan ) );
      atin_array :=  chirp_array  + 6144;
      td_atin(  stin_array , stin, uind,  donain, nun_pts );
      clear_neesage( comp_time_coeff );
      END;

   IF chirp_array # 0 THEN
      BECIN

      IF donain = tdr_donain THEN
         BEGIN
           & correct dc phase for phase offset &
         phase := DOUBLE(ch_real(ch_phase_offset, chan) * -728.17778 );
         RSSEMBLE(  MOVE.L  phaae,  R0;                  &2**15 / 360 &
                    JSR     fst_trig;            CLR.W  R1;
                    MOVE.L  dp_scr_array_time, R5;
                    JSR     RPYE_ptr;
                    MOVE.L  dp_scr_array_time, R&;
                    SWRP    R0;      MOVE.W  R0, (R8)+;
                    SWAP    R0;      MOVE.W  R0, (R5)+;
                    SWRP    R0;      MOVE.W  R1, (R5) ;
                    MOVE.W  R1,R0;   MOVE.L  R0, a0      );
         tg0 :=  compute_tg0_value ;
         END;

      array_npy( otin_array, dp_scr_array_time, nun_pts );
                                                 &uindow / stin &
      chirpxfn(  dp_ecr_array_time, chirp_array,  nun_pts,
                 FsIs, fsIo, FoIs, FoIo  );

      IF donain = tdr_donain THEN
         BECIN
         IF stin = inpuise_tdr THEN
               array_zero_insg(dp_scr_array_time, nun_pts )
          ELSE td_ramp( dp_scr_array_time, Fs*(To-tg0),Fs*Is, nun_pts);
         END tdr_donain cleanup ;

      release_auxiliary_nenory( chirp_array ,td_chirp_arraya_id  ) ;
      END
   ELSE
      warm( exceeded_available_nenory );
```

```
STIRE.WORK.P08510              THU, DEC 22, 1983, 11:03 AM     PACE 17

END do_time_donain;
```

```
STIME.WORK.P08510              THU, DEC 22, 1983, 11:03 AM     PAGE 18


REJECT; COMMENT
*****************************************************************************
*****************************************************************************
end of conment;
PROCEDURE build_gate( gate_adr, pts, gate_parm, real_only_flg );
                    VALUE gate_adr, gate_parm, pts, real_only_fig;
          DOUBLE gate_adr; INTEGER gate_parm, pts; BOOLEAN real_only_fig;
BEGIN
  INTEGER loopctr=REGISTER 4;
  DOUBLE   tenp12=REGISTER 12;      & prevents local use of R12  &
  DOUBLE   exp_etep,
           exp_parm,
           tenp = exp_parm;
  REAL Go, GoFs, GnFs, GspanFs,
       p1_0,
       sin_step, sin_den,
       sin_real,
       n_real;
  INTEGER  n, loop,
       nant_pt_0 = pt_0,  exp_pt_0 = pt_0 * 2;

    pts := ( (pts-1)/gate_size[gate_parm]) + 1 ;  &MAX GATE -TOR node??&

    GoFs:= Fs * ( Go := REAL(ch_quad(ch_gate_start, chan))*10-15 );
    GnFs:= Fa * ( 2.0 * REAL(ch_puad(ch_gate_center,chen))*10-15 - Go );
    IF (GspanFs := GnFs - GoFs ) > 1.0 THEN  GspanFe:= 1.0;

    pt_0  :=  GspanFs / 1024.;          &scaling fft ???????&
    sin_step := Pi * GspanFs ;
    sin_den  := Pi * 512. ;            &acaling fft ???????&

    IF real_only_fig THEN
       BEGIN    pt_0 := pt_0 * 2.0 ;  sin_den :=  sin_den / 2.;   END;

    gate_cen_Fs := ( GoFe + GnFs ) / 2. ;
    exp_atep := exp_parn := cyc_frac( -gate_cen_Fs );

    ASBEMBLE(    MOVE.L  gate_adr, R12;       MOVE.W  pts,   loop;
                 MOVE.W  =H0,      (R12)+;    SUB.W   #1,    loop;
                 MOVE.W  nant_pt_0,(R12)+;    MOVE.W  #1,    n;
                 MOVE.W  exp_pt_0, (R12)+          );
```

```
S1IME.WORK.P08510              THU, DEC 22, 1583, 11:03 AM     PAGE 19


REJECT;
    REPEAT loop 00
       BEGIN
       n_real:= REAL( n );
       sin_real := SIN( ain_step * n_real ) / (sin_den * M_real) ;
                          & SIN  does not use R12 --- reurite this ness  &
       RSSEMBLE(    MOVE.L  exp_parn, R0;    JSR fst_trig_long;
                    CLR.W   -(S);            MOVE.L  R0, -(S);
                    MOVE.L  sin_real, R0;    JSR CMV2E;
                    MOVE.L  S,   R&;         JSR MPYE_ptr;
                    SWAP    R0;              MOVE.W  R0,    (R12)+;
                    SWAP    R0;              MOVE.W  R0,    (R12)+;
                    ADD.W   #6, S;           MOVE.W  R1,    (R12)+   );
       n := n + 1;
       exp_parm  := exp_parm  +  exp_atep;
       END loop;

    RSSEMSLE(    MOVE.L  R12, R11;                        & zero fill &
                 ROVE.W =D1024, loopctr;     SWB.W  pts,   loopctr;
                 BSR     array_zero      );     &  R11 is adr, R4 count &

    td_windou( gale_adr, gate_uind[ gate_parm ], tdr_donain,
                       pts,  npy );

    fft( gate_adr );    fftun( gate_adr );    &only the real part used&
                                              & perhapa shorter array &
                                              & includes a preenpt &
END build_gate;
```

```
STIME.WORK.PD8510          THU, DEC 22, 1983, 11:03 AM    PAGE 20

#EJECT; COMMENT
*************************************************************************
*************************************************************************
end of comment;
PROCEDURE gate( data_adr, gate_adr, pta, real_only_flg);
        VALUE  data_adr, gate_adr, pta, real_only_fig ;
        DOUBLE data_adr, gate_adr; INTEGER pta; BOOLEAN real_only_fig;
BECIN
  LABEL exp_taat,loop, ttat;
  INTEGER offset;
  INTEGER loopctr=REGISIER 4;

      offset := 6 * pta;
      RSSEMBLE(                          & zero fill data array&
              MOVE.L data_adr,  R11;      ROO.W  offaet,  R11;
              MOVE.W =01024, loopctr;     SUB.W  pta,     loopctr;
              BSR     array_zero      );     &  R11 so adr, R4 count &

      IF real_only_fig IMEN
          RSSEmBLE(                                    &half lst pt??&
              MOVE.L  data_adr,   R11;      ROO.W   #4,  R11;
              MOVE.W  (R11),      &O;       SUb.b   #1,  RO;
              BVC     txp_teat;             ROO.b   #1,  RO;
      txp_test:MOVE.W   RO,       (R11)    );

      fft( data_adr );    fftun( data_adr );& includes a preenpt &


     RSSEmBLE(
              MOVE.L  gate_adr, R10;   &BVE.l  data_adr,  R8;
              MOVE.W  =01024,loopctr;  MOVE.l   &&,       R13;
              MOVE.L  #-1,       R5;
              BTST    =00,  real_only_fig;
              BEQ     ttat;            &if fig falee (0) branch &
              MOVE.L  =NOFFFF,  R5;    &real data only naoh&
              BRR     taet;
          loop: MOVE.L   (R8)+,  RO;    MOVE.W  (R8)+,  R1;
              RNO.L    R5,     RO;
              CLR.L    R2;              ADDO    #2,     &10;
              MOVE.W   (R10)+, R2;      ROVE.W  (R10)+, R3;
              JSR      NPYE;
              SWAP     RO;              ROVE.W  RO,  (R13)+;
              SWAP     RO;              MOVE.W  RO,  (R13)+;
              NOP;                      BOVE.W  R1,  (R13)+;
          test: OBRA    loopctr, loop                          );

      ifft( data_adr );   fftun( data_adr );& includes a preenpt &

END gate;
```

```
STIME.WORK.PD8510          THU, DEC 22, 1983, 11:03 AM    PAGE 21

#EJECT; COMMENT
*************************************************************************
*
*uill at firat uat a fft tize array ( adr ) but afttr  gating only
* the frtq eizt array elnenta will be uaed
aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
end of comment;
PROCEDURE build_gate_conp( adr, pta, gate_parn, real_value_only);
                VALUE adr, pta, gete_parn, real_value_only;
        DOUBLE adr;  INTEGER gate_parn, pte;  BOOLEAN real_value_only;
BECIN
DOUBLE tenp,
       ang_delta=REGISIER 5, ang=RECISTER 6;
INTEGER loopctr = REGISTER 7;
LABEL loop1, loop2, teat1, teat2;

   tenp      := - eyc_frac( gate_cen_Fa * Fo / Fa );
   ang_delta := - cyc_frac( gate_cen_Fo );
   ang       := tenp;
   RSSEmBLE(
                MOVE.L  adr,  R13;
                ROVE.W  pta,   loopctr;
                BRA     teat1;
         loop1: ROVE.L  ang, RO;  JSR fat_trig_long;
                SWAP    NO;              MOVE.W   RO, (R13)+;
                SWAP    BO;              MOVE.W   RO, (R13)+;
                ROO.L   ang_delta, ang;  ROVE.W  =NO, (R13)+;
         teot1: DBRA    loopctr, loop1                          );

   id_windou( adr, pre_winn& gatt_parn &, donain,  pta, apy );

   gatc( adr, gate_array, pta, reai_value_only );


   RSSEmBLE(
                MOVE.l  adr,  &10;
                ROVE.L  R10,  R13;
                ROVE.W  pta,   loopctr;
                bRR     test2;
         loop2: mOVE.l  (R10)+, RO;      MOVE.W  (R10)+,  R1;
                JSR     nagE;
                ROVE.l  =f1.0,  R1;      JSR     DVR2;
                                         ROVE.W  =NO, (R13)+;
                SWAP    RO;              ROVE.W  RO,  (R13)+;
                SWAP    RO;              MOVE.w  RO,  (R13)+;
         test2: DbRR    loopctr, loop2                          );


   pre_gate_array :* adr + array_size;
   td_windou( pre_gate_array, pre_winn&gate_parn&, donain, pta, nop );
END build_gate_conp;
```

```
STIME.WORK.PD8510          THU, DEC 22, 1983, 11:03 AM    PAGE 22

#EJECT; CONNENT
*************************************************************************
*************************************************************************
end of comment;
PROCEDURE do_gating;
BEGIN
INTEGER gate_parn;

   IF ( nenory_stolen(gate_array, td_gate_arraye_id, 2*6144)  OR
        (flag = 0) OR (gate_donain N donain) )  AND (gate_array # 0) THEN
        BEGIN
        tcll( conp_gate_coeff );
        gate_parn :=  ch_integer( ch_gate_windou , chan ) ;
        build_gate( gate_array,  nun_pts, gate_parn, donain=tdr_donain );

        post_gate_array := gate_array + 6144;
        build_gate_conp( poet_gate_array, nun_pte,
                         gate_parn, dsnain=tdr_donain );

        gate_donain :* donain;
        clear_neeeage( conp_gatt_coeff );
        END;

   IF gate_array # 0 THEN
      BEGIN

      &Pre_conp&
      array_npy( pre_gate_array, dp_ecr_array_tine, nun_ptt );

      gate( dp_scr_array_tine, gate_array,
                           nun_pts, donain=tdr_donain);

      &Poet Conp &                                        &real npy&
      array_npy( poet_gate_array, dp_ecr_array_tine, nun_pts );

      rtleaee_auxiliary_nenory( gate_array ,td_gete_arrays_id  ) ;
      END
   ELSE
      uarn( exceeded_availahle_nenory );

END de_gating;
```

```
STIME.WORK.PD8510          THU, DEC 22, 1983, 11:03 AM    PAGE 23

#EJECT; COMMENT
*************************************************************************
*
* NISTORY
* &/9/83 -- error in conputing Fe fixed
*************************************************************************
end of comment;
PROCEDURE array_datap( ch );    VALUE ch;    INTEGER  ch;          ENTRY;
BEGIN
DOUBLE ptre_base = REGISTER 11;
DOUBLE vars_base = REGISTER 12;
DOUBLE POINTER dp_ptre = ptrs_pase;
INTEGER point, nun_pts_freq;
DOUBLE  dp_d;
```

```
STIME.WORK.PD8510          THU, DEC 22, 1983, 11:03 AM    PAGE  24


%EJECT;
  IF ( dp_scr_array_time := request_memory( 6144 ) ) # 0  THEN
       BEGIN
       chan := ch;
       domain := ch_integer( ch_domain, chan );

       num_pts := num_pts_freq  := number_of_points;
       dp_scr_array_freq := dp_scr_array_time;
       Fo   := REAL( ch_quad( ch_start_frequency , chan ) );
       Fa   :=  frequency_step( chan );

       IF domain = tdr_domain THEN
          BEGIN
          num_pts := num_pts + 1;
          dp_scr_array_freq := dp_scr_array_freq + 6;
          Fo      := 0.0 ;
          END  tdr_domain domain ;


       %et_vars_ptrs_base( 0 );                          &restore&
       dp_d     := dp_ptrs[ dp_d_ptr   ];

       %SSEMBLE( MOVE num_pts_freq, R7; MOVE.L dp_scr_array_freq, R13 );
       array_correct;

       IF domain = tdr_domain THEN compute_pc_value;
            & debug for testing gate shapes &              & DEBUG &
 IF gate_debug THEN %SSEMBLE( MOVE.W num_pts_freq,      R0;    & DEBUG &
                              JSRX   CRV42;                    & DEBUG &
                              MOVE.L dp_scr_array_time, R11;   & DEBUG &
                              MOVE.W  #00000,(R11)+;SWAP R0;   & DEBUG &
                              MOVE.W  R0,    (R11)+;SWAP R0;   & DEBUG &
                              MOVE.W  R0,    (R11)+;           & DEBUG &
                              MOVE.W  num_pts_freq,      R4;   & DEBUG &
                              BSR     array_zero             ); & DEBUG &

       IF ch_integer( ch_gating , chan )  # gate_on THEN
          do_gating;

          & skip if elec_length/phase offset / para conv OFF &
       set_vars_ptrs_base( 0 );                          &restort&
       %SSEMBLE( MOVE num_pts_freq, R7; MOVE.L dp_scr_arrey_freq, R13 );
       array_elec_length;

       IF ( domain = tdr_domain ) OR ( domain = tune_domain ) THEN
          do_tune_domain;     & will need to make # pts same for output&

       copy_user3( dp_scr_array_freq, dp_d       , num_pts_freq );

       set_vars_ptrs_base( 0 );                          &restore&
       REPEAT num_pts_freq  DO
              %SSEMBLE(  JSRX     update_d_loop.L    );

       flag := 1;
       release_memory( dp_scr_array_time );
       END
```

```
STIME.WORK.PD8510          THU, DEC 22, 1983, 11:03 AM    PAGE  25


    ELSE
       uarn( exceeded_available_memory );

END array_datap;
ENDS
%*********************************************************


PROCEDURE dump( adr, nun );  VALUE adr, nun; DOUBLE adr; INTEGER nun;
BEGIN
INTEGER loop;
REAL x,y;
FOR loop := 0 TO nun DO
   BEGIN
   WNUM( loop );
   %SSEMBLE (   MOVE.L adr,  R&;     JSR fetch_CMVE1;
                MOVE.L  R1, y;       JSR WREAL;          ADD.L &6, adr );
                WREAL( y );      CRLF;
   END loop;
END dump;

MOVEM.l R0-R13,-(S); AND.W =MOFF,R1;MOVE.L R0,R2; MOVE.W R1,R2; SWAP R0;
MOVE.W R1,R0; MOVE.L R0,-(S); MOVE.L R2,-(S); MOVE loopctr,R0;
EXTS.L  R0;
JSR WNUM;MOVE.L (S)+,M0;JSR WREAL;MOVE.L (S)+,B0;JSR WREAL;JSR CRLF;
MOVEM.L (S)+,R0-R13;

%SSEMBLE(  MOVE.L   gate_adr,  temp );
IF time_debug THEN
FOR n:# 0 TO 300  DO
  BEGIN  WREAL(n);
  %SSEMBLE( ROVE.L temp, R12;    MOVE.W (R12)+,R1;    MOVE.l (R12)+, R0;
            MOVE.L  R12,temp;    AND.L  =HFFFF00FF,R0;   JSR WREAL );
  CRLF;     REPEAT  4000 DO TRAP( 1);                        END;
```

```
FTIME2.WORK.PD8510         THU, DEC 22, 1983, 11:03 AM    PAGE   1


PROCEDURE user3_zero( addr, nunb);
              VALUE addr, nunb; DOUBLE addr; INTEGER nunb; EXTERNAL.L;
```

```
CTITLE.WORK.PD8510         THU, DEC 22, 1983, 11:03 AM    PAGE   1


INTEGER CONSTANT space_index     := -1,
                 backspace_index := -2;
```

```
FTITLE.UORK.PDBS10              INU, DEC 22, 1983, 11:03 RM     PAGE  1


#FILE ctitle.work;

EXTERNAL INTEGER char_index;

SUBROUTINE erait_title;                                         EXTERNAL;
PROCEDURE  select_title_char( index );
   VALUE   index;
   INTEGER index;                                               EXTERNAL;
PROCEDURE  write_title;                                         EXTERNAL;
PROCEDURE  enter_title_char( index );
   VALUE   index;
   INTEGER index;                                               EXTERNAL;
```

```
STITLE.UORK.PDS510              INU, DEC 22, 1983, 11:03 RM     PAGE  1


NGSKL,P,"title"
BEGIN

#FILE fdisplay.wark;
#FILE fscreen.work;
#FILE fstring.work;                                  & for append_ch &
#FILE futil.work;                                          & for toll &
#FILE cactive.wark;                                & for octive_title &
#FILE factive2.work;          & for active_function and active_title &
#FILE fchdata2.work;                                 & for title_line &
#FILE ctitle.worh;                & for space_ and backspacc_index &
#FILE fdiapram.wark;                                 & for wrt_diap_str &


RLPNR CONSTANT title_set := "ABCDEFGHIIKLMNOPQRSTUVWXY2. 0123456789"
                          + "()+-" + wpy_char + "/*" + 225
                          + 225 + gamma_char + 177 + 175;

DOUBLE  title_set_addr = title_set;
GLOBAL INTEGER char_index;
```

```
STIILE.UORK.PDBS10              INU, DEC 22, 19E3, 11:03 RM     PAGE  2


#EJECT;
COMMENT                                                 select_title_char
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  select_title_char( index );
   VALUE   index;
   INIEGER index;                                               ENTRY;
   BEGIN & select_title_char &
      INTEGER addr;

      char_index := index;

      addr :* lb( entry_aux_display, title_set );
      addr := novech( addr,
                      entry_aux_row + 1,
                      titlt_col - 1 + index
                    );
      addr :* printch( addr, up_arrow );
      addr :* jnp(addr, entry_aux_display + entry_aux_size);

   END;  & atlect_title_char &
```

```
SIITLE.UORK.PDS510              INU, DEC 22, 1983, 11:03 RM     PAGE  3


#EJECT;
COMMENT                                                     write_title
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  write_title;                                         ENTRY;
   BEGIN & write_title &
      print_etring( title, title_size, title_display );
      wrt_disp_str( RDRS(title_line),
                    title
                  );
   END;  & write_title &
```

```
STITLE.UORK.PD8510          TNU, DEC 22, 1983, 11:03 AM    PAGE  4


REJECT;
COMMENT                                                enter_title_char
*****************************************************************
*
*****************************************************************
;
PROCEDURE  enter_title_char( index );
   VALUE   index;
   INTEGER index;                                              ENTRY;
   BEGIN % enter_title_char %
      BYTE POINTER ch;

      IF active_function <> active_title THEN
         tell( title_function_not_active )
      ELSE
         BEGIN % else %
            IF index = backspace_index THEN % backspace %
               append_ch( title, bs )
            ELSE IF index = space_index THEN % space %
               append_ch( title, ' ' )
            ELSE % not backspace or space %
               BEGIN % else %
                  SIPNTR( ch, title_set_addr );
                  append_ch( title, ch[char_index] );
               END;  % else %
            write_title;
         END;  % else %

   END;  % enter_title_char %
```

```
STITLE.WORK.PD8510          TKU, DEC 22, 1983, 11:03 RM    PAGE  5


REJECT;
COMMENT                                                erase_title
*****************************************************************
*
*****************************************************************
;
SUBROUTINE erase_title;                                        ENTRY;
   BEGIN % erase_title %
      clear_string( title );
      write_title;
   END;  % erase_title %

END$
```

```
FTOPKBD.1WORK.PD8510        TNU, DEC 22, 1983, 11:03 AM    PAGE  1

EXTERNAL INTEGER key_token;
```

```
STOPKBD.UORK.PD8510         TNU, DEC 22, 1983, 11:03 AM    PAGE  1


M68KL,P,"topkbd"
BEGIN

RFILE cids.work;
RFILE fioconfig.work;
RFILE fkernel.work;
NFILE fkernel2.work;
RFILE fkernel3.work;
RFILE fintrpt.work;
NFILE erims.work;
NFILE ffifo.work;
NFILE ffifos.work;
#FILE fpubib.work;
NFILE cpubib.work;
NFILE fconnand.work;                              % for abort_connand %
RFILE cnessag2.work;                               % for all_nestages %
NFILE futil2.work;                                % for clear_nessage %
RFILE fnunber.work;                                 % for get_number %
RFILE fkeys.work;                        % for top_key_table and cnd_... %

BYTE CONSTANT key_clk := %23,        % clock prescaler := 3          %
              key_nod := %02,        % n-key rollover, encoded scan %
              key_erf := %ED,        % clear error flag             %
              key_out := %40,        % set output fifo node         %
              key_clr := %C1;        % clear key fifo               %
INTEGER CONSTANT key_nax       :=  35,
                 key_etat_naek := %DF;

BYTE key_data = io + %81,
     key_stat = io + %83,
     key_end  = io + &83;
INTEGER key_code;
GLOBAL INTEGER key_token;


SUBROUTINE init_keyboard_fifo;                                 ENTRY;
   BEGIN
      init_fifo( keyboard_fifo,
                 keyboard_fifo_size,
                 keybd_fifo,
                 keybd_fifo_not_full,
                 keybd_fifo_nat_enpty );
   END;


SUBROUTINE init_top_keyboard;
   BEGIN % init_top_keyboard %
      key_cnd := key_nod;
      key_cnd := key_clk;
      key_cnd := key_erf;
      key_end := key_cut;
      key_cnd := key_clr;
   END;  % init_top_keyboard %
```

```
STOPKBD.WORK.POSS1O            THU, OEC 22, 1983, 11:04 RM    PAGE  2




& a process &
PROCEDURE  top_key;                                              ENTRY;
   &EGIN & top_key &

      init_tep_keyboard;
      iradr( ADRS(intrpt_top_key), top_key_vctr );

loop: IF (key_stat RND key_etet_nask) = 0 THER
         waitio(top_key_vctr);  & wait for next keyboard interrupt. &
      abort_command := TRUC;
      IF TBIT(key_stat,6) THEM
         SEGIM
            May_end := key_clr;
            IF NOT remote THEN
               write_fifo( keyboard_fifo, end_illegal );
         EMO if tbit
      ELSE
         BEGIN
            key_code := INIEGER1key_data] RMD X003F;
            IF kay_coda > kay_nax THEM
               BEGIN & if &
                  IF NOT remote THEM
                     write_fifo( keyboard_fifo, end_illegal );
               END   & if &
            ELSE
               BEGIN & alae &
                  key_token := top_key_table[key_code];
                  eet_aerial_poll( key_preaeed_orq );
                  IF NOT remote THEK
                     write_fifo(keyboard_fifo, key_token);
               EMO;  & else &
         END elae not tbit;

      HO TO loop;

   EMO; & top_key &



& a process &
PROCEDURE keyboard;                                              EMTRY;
   BEGIN  & keyboard &
      INTEGER token;

loop: token := read_fifo( keyboard_fifo );

      IF token < 0 THEN     & thaac keya require parsing (0-9,., etc.) &
         BEGIN & if &
            acquire( entry_string );
            token := get_number(token);   & rtne tern'r or non-numeric &
                                          & that aborted the entry.     &
            clear_neaeege( all_neaaages );     & clear warning naaaages &
            write_fifo( token_fifo, token );
```

```
STOPKBD.UORK.PDBS1O            TNU, BEC 22, 1983, 11:04 RM    PAGE  3

            IF ((token <= end_u4) RNO (token >+ end_enter)) TNEN
               BEGIN & if &
                  wait( entry_atring_ready );
                  set_aerial_poll( entry_complete_arq );
               EMD;  & if &
            raleaae( entry_etring );
         END   & if &
      ELSE IF NOT ((token <= cnd_u4) NND (token >= cnd_enter)) TNEK
         & ignore extraneous terminetars &
         BEGIN & elae if &
            clear_neaeage( all_neaaanea );    & clear warning neeaagea &
            xrite_fifo( token_fifo, token );
         EMO;  & else if &

      GO TO loop;

   EMO;  & keyboard &

EMO$
```

```
FTOPKEYS.WORK.PD&S1O           INU, DEC 22, 1983, 11:04 RM    PAGE  1

NFILE ccnddecl.work;

   INTEGER CONSTANT offset          := -64,        & negative values &
                    zero_token      := offset + 0, & keep these      &
                    one_token       := offset + 1, & separate from   &
                    two_token       := offset + 2, & command token   &
                    three_token     := offset + 3, & values.         &
                    four_token      := offset + 4,
                    five_token      := offset + 5,
                    six_token       := offset + 6,
                    eeven_toktn     := offset + 7,
                    eight_token     := offset + &,
                    nine_token      := offset + 9,
                    decimal_token   := offset + 10,
                    ninus_token     := offset + 11,
                    backspice_token := offset + 13;

   INTEGER TABLE key_table:=
            cnd_u4,             &  0 &
            nine_token,         &  1 &
            sight_token,        &  2 &
            seven_token,        &  3 &
            cnd_illegal,        &  4 &
            cnd_iliegal,        &  5 &
            cnd_key_1,          &  & &
            cnd_key_5,          &  7 &
            end_u3,             &  S &
            six_token,          &  9 &
            five_token,         & 10 &
            feur_token,         & 11 &
            end_entry_off,      & 12 &
            cnd_illegal,        & 13 &
            end_key_2,          & 14 &
            cnd_key_6,          & 15 &
            cnd_u2,             & 1E &
            three_token,        & 17 &
            tuo_token,          & 1& &
            one_token,          & 19 &
            cnd_doun,           & 20 &
            cnd_illegal,        & 21 &
            cnd_key_3,          & 22 &
            cnd_key_7,          & 23 &
            cnd_enter,          & 24 &
            minus_token,        & 25 &
            decinal_token,      & 26 &
            eero_token,         & 27 &
            cnd_up,             & 2& &
            cnd_prior_menu,     & 29 &
            cnd_key_4,          & 30 &
            cnd_key_8,          & 31 &
            cnd_illegal,        & 32 &
            cnd_nkrval,         & 33 &
            backspace_token,    & 34 &
            cnd_illegal;        & 35 &
```

```
CTOPMISC.WORK.PD851o           THO, BEC 22, 1983, 11:04 &M    PAGE  1

INTEGER CONSTANT done_tone  := 0,
                 tone_1     := 1,
                 tone_2     := 2,
                 error_tone    3;
```

```
FTOPMISC.WORK.POSS10          THU, DEC 22, 1983, 11:04 RM     PAGE  1


%FILE ctopmisc.work;

EXTERNAL BYTE flag1_save.L, & memory image of flag registers          &
              flag2_save.L; & required only for proto2.               &
                            &    proto3 is a read/write location.     &
PROCEDURE beep(tone);
   VALUE tone;
   INTEGER tone;                                          EXTERNAL.L;
```

```
STOPMISC.WORK.POSS10          THU, DEC 22, 1983, 11:04 RM     PAGE  1


M68NL,P,"topmisc"
BEGIN

%FILE fiocnfig.work;
%FILE fkernel3.unrk;
%FILE cdebug.work;                                              & DEBUG &

BYTE flag1_addr = io + %RB, & HPIB B1 ifc,ren,atn; beeper; crt disable &
     flag2_addr = io + %B1; & leds                                      &

GLOBAL BYTE flag1_save,     & memory image of flag registers           &
            flag2_save;     & required only for proto2.                &
                            &    proto3 is a read/write location.      &

byte CONSTANT zero := 0;


PROCEDURE beep(tone);
   VALUE tone;
   INTEGER tone;                                                 ENTRY;
   BEGIN  & beep &
      BYTE CONSTANT tone_mask := %18;

      IF NOT beeper_off THEN                                    & DEBUG &
         BEGIN & if &                                           & DEBUG &
            flag1_save := ( (LEFT(tone,3) AND tone_mask) OR
                            (flag1_save AND NOT tone_mask) );   & set tone &
            flag1_save := SBIT(flag1_save,5);                   & beep on  &
            flag1_addr := flag1_save;
            REPEAT 30000 OO;                                    & DEBUG &
COMMENT                                                         & DEBUG &
            pause(4);                                & pauee 500 milliseconds &
            flag1_save := RBIT(flag1_save,5);                   & beep off &
            flag1_addr := flag1_save;
         END;  & if &                                           & DEBUG &

   END beep;


SUBROUTINE init_top_misc;                                       ENTRY;
   BEGIN
      flag1_save := zero;          & beeper off, crt on, hpib asserted &
      flag1_addr := flag1_save;
      flag2_save := %FF;           & all leds off                     &
      flag2_addr := flag2_save;
   END init_top_misc;

END$
```

```
STPDUMP.WORK.P08S10           THU, DEC 22, 1983, 11:04 RM     PAGE  1


M88KL,"tpdump"
BEGIN
%FILE ftern.work;
&
%FILE ftaco.work;
&
COMMENT  use if tape code is to be in RAM , not ROM ;
INTEGER 10=%FFFFFE00;DOUBLE ARRAY parm[0:63]; INTEGER Parm0=parm[0];
%FILE staco.work;

BYTE PRRRY      tape_data[0:2S5];

ALPHA TABLE menu:="0       Rewind              1      Find Record",
                  "2       Read Record         3      Read Continous",
                  "4       Initialize",
& need to add tape copy routines ??, and ??? &
                                               7      Return to Monitor";

PROCEDURE  display_menu;
  BEGIN
  INTEGER index;

  WSTR(""+27+"n"+27+"H"+27+"J");                & home and clear screen&
  FOR index:=0 TO 3 DO BEGIN WSTR( menu[index] ); CRLF; END;
  CRLF;
  WSTR(""+27+"1");                      &menory lock&
  END display_menu;


INTEGER SUBROUTINE request_item;
  BEGIN
        request_item:=RHEX;
        WSTR(""+27+"&a5y1C"+27+"J")     &cursor position&
  END request_item;


PROCEDURE urt_err(nEa); VALUE nes;   ALPHA nes;
  BEGIN
  REPEAT 5 DO CRLF;
  BSIR("     ******");  WSIR(nes);  WSTR("****** ");
  REPEAT 2 OO CRLF;
  WSTR("          Tape Status ="); WHEX(TPErr);
  CRLF;
  END;


PROCEDURE  dump_line(byte_ptr,count) ;
           VALUE byte_ptr,count;  BYTE POINTER byte_ptr; INTEGER count;
  BEGIN
  INTEGER POINTER int_ptr = byte_ptr;
  INTEGER index;

  IF count>16 THEN count:=16;
```

```
STPDUMP.WORK.P08S10           THU, DEC 22, 1983, 11:04 RM     PAGE  2


  FOR index:=0 ID ( (count+1) /2)-1 DO WHEX( int_ptr[index] );
  WSTR(""+27+"&e48C"+27+"y");               &monitor functions on&
  FOR index:=0 TO count-1  DO IF (byte_ptr[index] AND %7F) = 13 THEN
                              WCHRR(%7F)
                              ELSE WCHRR( byte_ptr[index] );
  WSTR(""+27+"Z"+8+8+"  ");                         &display functions off&
  CRLF;
  END dump_line;


BOOLEAN PROCEDURE  dump_record;
  BEGIN
  INTEGER index,length;

  dump_record:=TRUE;
  CRLF;

  IF TPRED( RDRS(tape_data), length ) THEN
     BEGIN
     WSTR(  "  Tape Record # = "); WNUM(TPrecord);
     WSIR(  "  Record Length = "); WNUM(length); WS1R(" bytes");
     CRLF;
     IF length = 0 THEN
           urt_err(" EMPTY RECORD ")
     ELSE FOR index:=0 STEP 16 WHILE index < length
              DO  dump_line( RDRS(tape_data[index]), length - index  );
     END
  ELSE
     BEGIN
        urt_err("Tape read error");
        dump_record:=FRLSE;
     END;
  END dump_record;


display_menu;
TPINT;
REW;

WHILE TRUE DO
  BEGIN
  CASE request_item
  BEGIN
&0&   IF NOT REW THEN urt_err("Rewind Error");
&1&   BEGIN
         WSIR("Enter record # ");
         IF NOI IPseek(RHEX) THEN
                     urt_err("Tape seek error");
      END;
&2&   IF dump_record THEN;
&3&   WHILE dump_record DO;
&4&   IF NOT TPmark THEN
                     urt_err("Tape marking error");
```

```
STPDUMP.UORK.PD8510          THU, DEC 22, 1983, 11:04 AM    PAGE  3


&5&   ;
&6&   ;
&7&   TRAP(15);
  END case;

END infinite loop;

ENDS
```

```
CTPMGR.UORK.PD8510           THU, DEC 22, 1983, 11:04 AM    PAGE  1

INTEGER CONSTANT

   pur_on_state := 5,    & bubble register for power up state &
   preset_state := 6,    & bubble index for preset state info. &
   prior_state  := 7,    & bubble index for last state info. &

   tape_device  := 1,
   mbn_device   := 2,
   HPIB_device  := 3,

   module       := 1,

   max_file_appends := 5,

   & state_file thru cal_set must always be contiguous !!! &
   state_file   := 1,    & must occur before cal_file &
   memory_file  := 2,    & memory data   = M &
   cal_std_file := 3,
   cal_file     := 4,    & must occur after state_file&
   state_set    := 5,
   memory_set   := 6,
   cal_std_set  := 7,
   cal_set      := 8,
   e_param_file := 9,    & ram data = RAM_BASE &
   display_file := 10,   & display memory &
   format_file  := 11,   & formatted data = F &
   data_file    := 12,   & data = D &
   Machine_file := 15;
```

```
FTPMGR.WORK.PD8510           THU, DEC 22, 1983, 11:04 AM    PAGE  1


RFILE ctpmgr.work;

& Saves a tape file from RAM data block &
PROCEDURE record_file (ram_addr, byte_lgth, file_id, mbn_pg);
  VALUE ram_addr,byte_lgth,file_id,mbn_pg;  DOUBLE ram_addr,byte_lgth;
  INTEGER file_id, mbn_pg;                                  EXTERNAL;

& Restores a file from tape to bubble or RAM &
PROCEDURE restore_file (ram_addr, file_id, dest);
  VALUE ram_addr, file_id, dest;  DOUBLE ram_addr;
  INTEGER file_id, dest;                                    EXTERNAL;

INTEGER PROCEDURE scan_directory (dir_ptr, file_id);
  VALUE dir_ptr,file_id;  INTEGER dir_ptr,file_id;          EXTERNAL;

PROCEDURE delete_file (file_type,file_id);
  VALUE file_type,file_id; INTEGER file_type,file_id;       EXTERNAL;

PROCEDURE undelete_file;                                    EXTERNAL;
PROCEDURE list_directory;                                   EXTERNAL;
BOOLEAN SUBROUTINE valid_directory;                         EXTERNAL;
PROCEDURE init;   & init tapes &                            EXTERNAL;
SUBROUTINE init_tape_mgr;                                   EXTERNAL;

EXTERNAL              & byte counts for appended tape file data   &
INTEGER ARRAY file_byte_cnt [0:max_file_appends];

EXTERNAL              & addresses of appended tape file data      &
DOUBLE ARRAY file_address [0:max_file_appends];

EXTERNAL
ALPHA TABLE file_type;
```

```
STPMGR.UORK.PD8510           THU, DEC 22, 1983, 11:04 AM    PAGE  1

%SBKL,P,"TPBGR"

BEGIN

COMMENT------------8510 TAPE MANAGER--------------------------------+
|                                                                    |
|  This illustrious "can of worms" contain what some may refer to as |
|  the basic I/O routines for the 8510 data tape files which transfer|
|  data to tape from bubble or RAM, and from tape to bubble or RAM.  |
|                                                                    |
|    record_file(file_id, byte_lgth, dest, pg)     (RAM/mbn to tape) |
|    restore_file (file_id, ram_ptr, reg_num)      (tape to RAM/mbn) |
|                                                                    |
|  The following tape information and utility routines are included: |
|                                                                    |
|    delete_file  (data_type, file_number)                           |
|    undelete_file                                                   |
|    list_directory                                                  |
|    scan_directory (blk_num, file_id)    {looks for a tape file  }  |
|    valid_directory (validates tape format and loads unloaded tape) |
|    load_tape       {reads in tape directory and duplicate}         |
|    init            {initialises and formats tapes}                 |
|    tape_error      {displays error message regarding tape status}  |
|                                                                    |
+--------------------------------------------------------------------;

%FILE ftaco.work;
%FILE fmbn.work;
%FILE fmbngr.work;
%FILE fmemgr.work;
%FILE fmenu.work;
%FILE emsgtape.work;
%FILE cmessag2.work;
%FILE futil4.work;
%FILE Futil3.work;
%FILE futil2.work;
%FILE cactvl.work;                                  & for active_off &
%FILE factvl.work;                  & for select_active_function &
%FILE cdisplay.work;                & for directory listing       &
RFILE fdisplay.work;
%FILE fcommand.work;                & for command_token           &
%FILE cscreen.work;                 & screen info for directory   &
%FILE ctpmgr.work;                  & tape file constants         &
%FILE cdtmgr.work;                  & command_token values        &
%FILE cdebugc1.work;                & DEBUG                       &
%FILE Fterm.work;                   & DEBUG                       &
%FILE frecall.work;                 & recall machine state/dump   &
%FILE fcontrol.work;                & abort/restart sweeps        &
%FILE Fdatamgr.work;                & for machine dump info       &

INTEGER CONSTANT
  max_blk:= 84,          & maximum block number on tape              &
  first_blk:= 0,         & first block number on tape                &
  first_blk_avail:= 170, & byte index in directory to 1st empty block&
  blks_avail:= 171,      & directory byte index to no. avail blocks  &
```

```
STPMGR.WORK.PD8510          THU, DEC 22, 1983, 11:04 AM    PAGE  2


  empty_file:= 0,       & unused file type                          &
  tape_id:= 28510,      & 8510 tape identifier for tape validation  &
  id_word:= 56,         & directory word index for 8510 tape id     &
  dir_lgth:= 176;       & number of bytes used by tape directories  &

GLOBAL &for debug purposes&
INTEGER ARRAY directory_wordbuf [0:127];  &indexes directory by words&
BYTE POINTER  directory_bytebuf;          &indexes directory by bytes&
DOUBLE directory_bufptr=directory_bytebuf;&pointer to file directory &

GLOBAL &for debug purposes&
INTEGER ARRAY tape_wordbuf [0:127];       &all-purpose tape buffers  &
BYTE POINTER  tape_bytebuf;               &via word or byte index    &
DOUBLE  tape_bufptr=tape_bytebuf;         &Pointer to tape buffers   &
DOUBLE POINTER tape_double;

GLOBAL                  & byte counts for appended tape file data    &
INTEGER ARRAY file_byte_cnt [0:max_file_appends];

GLOBAL                  & addresses of appended tape file data       &
DOUBLE ARRAY file_address [0:max_file_appends];

& DO NOT put this table in display memory !!! &
GLOBAL
ALPHA TABLE file_type :=
  "",
  "INST STATE",
  "MEMORY",
  "CRL KIT",
  "CRL SET",
  "STATES 1-3",
  "MEMORY 1-4",
  "KITS 1-2",
  "CAL 1-8",
  "RAW DATA",
  "DISPLAY",
  "FORMATTED",
  "DATA",
  "       ",
  "       ",
  "MACH. DUMP";

INTEGER dir_blk,        & pointer thru directory for listing to crt &
        deleted_blk,    & last block to be deleted, (-1 if none)    &
        deleted_file;   & last tape file to be deleted              &

BOOLEAN directory_ok,   & flag to determine valid tape directory    &
        backup_ok,      & flag to determine valid dup. directory    &
        tape_ok,        & flag to determine valid tape in drive     &
        abort_tape_fn;  & flag to abort current tape function       &

GLOBAL
BOOLEAN directory_on;
```

```
STPMGR.WORK.PD8510          THU, DEC 22, 1983, 11:04 AM    PAGE  3


REJECT;
COMMENT
$DOC+

NAME--
  tape_error
*****************************************************************
*
* SHORT DESCRIPTION--
*   displays an error message describing a tape malfunction
*
* EXTENDED DESCRIPTION--
*   Checks the tape status word to determint the tape malfunction and
*   displays the appropriate message describing it.
*
* INPUTS--
*   none
*
* OUTPUTS--
*   error message to display gen
*
* ROUTINES CALLED--
*   TPErr
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   This routine will only be called if the tape/tape drive is really
*   in trouble (i.e. screwy tape or malfunctioning drive).
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   check current tape status word
*   display appropriate message depending on bit(s) set in status word
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE tape_error;
&
$DOC-&

BEGIN
  INTEGER tape_status, msg;
  tape_status := TPErr;
  IF TBIT(tape_status,1) THEN warn (no_tape)            ELSE
    BEGIN
      IF TBIT(tape_status,3) THEN msg:= write_protect_macro ELSE
```

```
STPMGR.WORK.PD8510          THU, DEC 22, 1983, 11:04 AM    PAGE  4


     IF TBIT(tape_status,2) THEN msg:= tape_drive_macro    ELSE
     IF TBIT(tape_status,6) THEN msg:= format_macro        ELSE
     IF TBIT(tape_status,11) THEN msg:= checksum_macro     ELSE
       msg:= unknown_macro;
     macro_warn (tape_errors, msg);
   END;
END tape_error;
```

```
STPMGR.WORK.PD8510          THU, DEC 22, 1983, 11:04 AM    PAGE  5


REJECT;
COMMENT
$DOC+

NAME--
  directory_off
*****************************************************************
*
* SHORT DESCRIPTION--
*   replaces tape directory display with regular trace data display
*
* EXTENDED DESCRIPTION--
*   This routine eliminates the tape directory display, restores the
*   the regular display, and returns to the previous softkey menu which
*   displayed the various tape functions.
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   get_attribute
*   jmp
*   previous_menu
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   clear directory flag
*   restore data/annotation display
*   reset tape directory file pointer
*   generate previous menu (tape menu)
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
SUBROUTINE directory_off;                                  ENTRY;
&
$DOC-&

BEGIN
  #FILE fdisptbl.work;
  #FILE ccndcase.work;
  #FILE cplot.work;
  INTEGER TABLE screen_info :=
```

```
STPMGR.UORK.PD8510              THU, OCC 22, 1983, 11:04 RR     PAGE  6


     & text display &
     dq_jnp_neu_adr,function_display,function_display+function_size,
     & entry &
     dq_novech2_neu_adr,entry_position,entry_row,entry_col,
     dq_jnp_neu_adr,entry_display,entry_display+entry_size,
     dq_novech2_neu_adr,entry2_position,entry_row,entry_col,
     dq_jnp_neu_adr,entry2_display,entry2_display+entry_size,
     dq_stop;

  IF (connand_token <> cnd_next_page)     RNO
     (connand_tokcn <> cnd_prev_page)     RND
     (connand_teken <> cnd_firet_page)    RND
     (connand_token <> cnd_last_page)     AND
     (connand_token <> end_print_parane)  RNO
     (connend_token <> cnd_plot_parans)   AND
     (cannand_token <> end_next_op_paran) THEN
  &EGIN
    4irectory_on := FRLSE;
    IF connand_token <> cnd_prior_nenu THEN
      previous_nenu;
    & restore regular display &
    eetattribute (junp_all, nop);
    & reset values in text display overlay area &
    dir_blk :* display_fron_table (dir_blk, ADRS(scrcen_info));
    dir_blk := 0;
    reetart_sweep;
  END;
END directory_off;
```

```
S1FMGR.UORK.PD8510              THU, DEC 22, 1983, 11:04 RM     PAGE  7


REJECT;
CONNENT
&DOC+

NAME--
  init_tape_vars
*****************************************************************************
*
* SHORT DESCRIPTION--
*   initializes tape function variables
x
* EXTENDED DESCRIPTION--
*   This routine initializes all tape function variables and turns off
*   any directory displayed.  It is primarily used uhen loading a neu
*   tape or initializing one.
*
* INPUTS--  aone
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   4irectory_off
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*
* RUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*   If directory is displayed then
*     turn off directory and put up regular display
*   clear all tape function flags
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE init_tape_vars;
&
&DOC-&

BEGIN
  IF directory_on THEN
    directory_off;
  tape_ok :* directory_ok := backup_ok :* abort_tape_fn := FALSE;
  dir_blk := deleted_file := 0;
  deleted_blk :* -1;
END init_tape_vars;
```

```
STPMGR.UORK.P08510              THU, DEC 22, 1983, 11:04 RM     PAGE  8


REJECT;
CONNENT
&DOC+

NAME--
  lead_tape
*****************************************************************************
*
* SHORT DESCRIPTION--
*   loads a copy of the tape directory in RRM
*
* EXTENDED DESCRIPTION--
*   Loads and initializes tape directory in RRM and sets a flag to
*   all user function tape operations if a valid tape is in the drive
*
* INPUTS--  none
*
* OUTPUTS-- none
*
* ROUTINES CALLED--
*   tell
*   uarn
*   TPRED
*   REU
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
OECLARRATION--
;
PROCEDURE load_tape;
&
&DOC-&

BEGIN
  INTEGER rec_lgth;
  BOOLEAN format_ok;

  BOOLEAN SUBROUTINE dir_ok;
    dir_ok := directory_ok := TPRED(directory_bufptr,rec_lgth);

  TPINT;
  init_tape_vars;
  tell (loading_tape);
```

```
STPMGR.UORK.P08510              THU, DEC 22, 1983, 11:04 RM     PAGE  9


  & verifying directories &
  IF NOT REU THEN
    tape_error
  ELSE
  IF NOT abort_comand THEN
    BEGIN

      CONNENT
        check directory and backup directory
        check directory format
      ;
      format_ok := FRLSE;
      IF dir_ok THEN
        format_ek :* rec_lgth = dir_lgth;
      IF (backup_ok:=TPREO(directory_bufptr,rec_lgth)) THEN
        format_ok := rec_lgth * dir_lgth
      ELSE
        IF (directory_ok:=REU) THEN          & recover fron bad backup &
          dir_ok;

      IF NOT directory_ok AND NOT backup_ok THEN
        tape_error
      ELSE
      IF NOT
        (format_ok:*tape_ok:= directory_uordbuf[id_uord]=tape_id) THEN
        nacro_uarn (tape_errors,format_nacro); &check for valid tape id&
    END;
  tape_ok :* tape_ok AND NOT (abort_tape_fn:*abort_command);
END load_tape;
```

```
STPMGR.WORK.PDS510          THU, DEC 22, 1983, 11:04 AM    PAGE 10

&EJECT;
COMMENT
@DOC+

NAME--
  valid_directory
*****************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
BOOLEAN SUBROUTINE valid_directory;                          ENTRY;
&
&DOC-&

BEGIN
  IF NOT TPready OR NOT tape_ok OR abort_tape_fn THEN
    load_tape;
  IF tape_ok THEN
  IF (NOT directory_ok AND backup_ok)  OR
     (directory_ok AND NOT backup_ok)  THEN
    warn (using_backup);
  valid_directory := tape_ok AND (directory_ok OR backup_ok);
END valid_directory;
```

```
STPMGR.WORK.PDS510          THU, DEC 22, 1983, 11:04 AM    PAGE 11

@EJECT;
COMMENT
@DOC+

NAME--
  list_directory
*****************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE list_directory;                                    ENTRY;
&
SDOC-&

BEGIN
  INTEGER list, dir_blk_cnt, i;

  SUBROUTINE print_num;
  BEGIN
    list := printch (list,(i/10)+48);
    list := printch (list,(i MOD 10)+48);
  END print_num;

  SUBROUTINE new_line;
    list := crlf (list);

  IF valid_directory THEN
    BEGIN
      INTEGER n,cnt;
      INTEGER ARRAY dir_copy [0:max_blk];
```

```
STPMGR.WORK.PDS510          THU, DEC 22, 1983, 11:04 AM    PAGE 12

      i := n := 0;
      cnt := -1;

      & count number of files on tape &
      FOR i := first_blk TO max_blk DO
        IF directory_bytebuf[LEFT(i,1)+1] > 0 THEN
          dir_copy(cnt:=cnt+1) := directory_wordbuf[i];

      & determine directory listing choice &
      IF (command_token = cmd_directory) OR
        (command_token = end_first_page) THEN
        dir_blk := 0
      ELSE
      IF (command_token = cmd_prev_page) THEN
        BEGIN
          IF dir_blk <= 10 THEN
            cnt := 0                        & can't previous from 1st  &
          ELSE
          IF dir_blk > cnt THEN             & page previous to last pg &
            dir_blk := cnt - (10+(cnt MOD 10))
          ELSE                              & all other previous pages &
            dir_blk := (IF dir_blk > 21 THEN dir_blk-21 ELSE 0)
        END
      ELSE
      IF (command_token = end_last_page) THEN
        IF cnt > 10 THEN                    & check for more than 1 pg &
          IF (dir_blk := cnt MOD 10) > 0 THEN
            dir_blk := cnt - dir_blk        & partial last page &
          ELSE
            dir_blk := cnt - 10;            & full last page &

      IF (dir_blk <= cnt) OR (cnt < 0) THEN
        BEGIN
          IF NOT directory_on THEN
            BEGIN
              directory_on := TRUE;
              abort_sweep;    & restart sweep in directory off routine &
              select_active_function (active_off);  & clear active fn. &
              jmp (jump_all, end_position);         & turn off display &
            END;
          & directory headings &
          list := lb(text_display,"     TAPE DIRECTORY");
          new_line; new_line;
          list := lb(list," FILE       NO.   BLOCK SIZE");
          IF cnt >= 0 THEN
            DO BEGIN  & list tape directory &
              dir_blk_cnt := dir_copy [dir_blk];
              list := novech (list, n+12, T);
              list := lb(list,file_type[RIGHT(dir_blk_cnt,12)]);
              list := novech (list, n+12, 14);
              list := printch(list,RIGHT((dir_blk_cnt AND %OFOO),5)+48);
              list := lb(list,"      ");
              i := (dir_blk_cnt AND %OFF);
              print_num;
            END UNTIL ((dir_blk:=dir_blk+1)>cnt) OR ((n:=n+1)=10);
          & brief tape directory summary &
```

```
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            i := cnt+1;
            new_line; new_line;
            print_num;
            list := lb(list," FILES ON TAPE");
            new_line;
            i := (directory_bytebuf[blks_avail]);
            print_num;
            list := lb(list," BLOCKS LEFT ON TAPE");
            list := jmp (list, entry_aux_position);
          END directory display;
      END if valid_directory;
END list_directory;
```

```
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$EJECT;
COMMENT
$UUC+

NAME--
  update_directory
*****************************************************************************
*
* SHORT DESCRIPTION--
*   updates directory and duplicate directory on tape
*
* EXTENDED DESCRIPTION--
*   This function writes the current tape (and duplicate) directory on
*   on tape from a current copy kept in RAM.  The RAM copy is used to
*   do file searches, file deletions, and file writes without having to
*   access the tape each time.  The tape's primary directory is written
*   into record 0, and its duplicate is written into record 1.
*
*   Global flags (BACKUP_OK, DIRECTORY_OK) are set accordingly depending
*   on whether or not each directory was written successfully to tape.
*   This function will return a TRUE value if either or both directories
*   were successfully written, and a FALSE value if neither directory
*   was successfully written.
*
* INPUTS--  none
*
* OUTPUTS--
*   TRUE  * either primary or backup directory written to tape w/o fail
*   FALSE * both attempts to write primary or backup directories failed
*
* ROUTINES CALLED--
*   REW
*   TPWRT
*   TPseek
*   tape_error
*
* ERROR CONDITIONS AND RECOVERY--
*   Tape failure --> displays warning message, FALSE value returned
*
* NOTES--
*   A tape is still valid as long as either primary or duplicate
*   directory is valid.
*
* AUTHOR--
*
*****************************************************************************
!
* INITIAL REFINEMENT--
*   Clear flags which indicate valid directories
*   If tape does not rewind successfully then
*     display error message
*   else
*     If RAM copy of directory is written successfully on tape then
*       set flags indicating valid tape directories
*     else
*       if RAM copy of directory is written successfully to backup then
```

```
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*         set valid backup directory flag
*       else
*         display error message
*   return TRUE if either primary or duplicate directory flag is set
*   return FALSE if neither primary or dupliate directory flag is set
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
BOOLEAN SUBROUTINE update_directory;
&
$DOC-&

BEGIN

  BOOLEAN SUBROUTINE dir_ok;
    dir_ok := backup_ok := TPWRT (directory_bufptr,dir_lgth);

  update_directory :* directory_ok := backup_ok := FALSE;
  IF NOT REW THEN                  & get records 0,1 for directory updates &
    tape_error
  ELSE
  IF NOT (abort_tape_fn:=abort_command) THEN
    BEGIN
      IF (directory_ok :* TPURT (directory_bufptr,dir_lgth)) THEN
        dir_ok
      ELSE  & rely on backup directory &
      IF NOT (&backup_ok :*TPseek(1)) THEN
        tape_error
      ELSE
      IF NOT dir_ok THEN
        tape_error;
      update_directory := directory_ok OR backup_ok;
    END;
END update_directory;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  init
*****************************************************************************
*
* SHORT DESCRIPTION--
*   initializes tape format and directory
*
* EXTENDED DESCRIPTION--
*   This routine corresponds to the softkey [INITIALIZE TAPE] whose
*   function is to mark and format a tape and its directory.
*
* INPUTS--  none
*
* OUTPUTS--  none
*
* ROUTINES CALLED--
*   TPmark
*   warn
*   tell
*   tape_error
*
* ERROR CONDITIONS AND RECOVERY--
*   none
*
* NOTES--
*   When the tape is being marked and formatted, a lower level tape
*   intrinsic is used.  This low-level routine DOES NOT check for
*   front panel keyboard interrupts which will automatically abort the
*   tape initialization.  (Could be a problem)
*
* AUTHOR--
*
*****************************************************************************
!
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
PROCEDURE init;                                          ENTRY;
&
$DOC-&

BEGIN
  INTEGER i;
  tell (initializing_tape);
  IF NOT REW THEN
    tape_error
```

```
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  ELSE
  IF abort_command THEN
    warn (init_aborted)
  ELSE
  IF TPmark THEN
    BEGIN
      init_tape_vars;
      FOR i:= 0 TO 127 DO directory_wordbuf[i]:=0;
      directory_wordbuf[id_word] := tape_id;
      directory_wordbuf[max_blk+1]:= %0055;  &list avail and &avail blks&
      IF (tape_ok := update_directory) THEN
        acknowledge (tape_init)
      ELSE
      IF abort_tape_fn THEN
        warn (init_aborted);
    END
  ELSE
    tape_error;
  previous_menu;
END init;
```

```
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REJECT;
COMMENT
SDOC+

NAME--
  scan_directory
*****************************************************************
*
* SHORT DESCRIPTION--
*   does a tape file search
*
* EXTENDED DESCRIPTION--
*   This routine scans the tape directory (copy of directory in RAM)
*   for a particular file (FILE_ID) starting at a given directory entry
*   (DIR_PTR).  It returns the directory entry (0..84) if the file is
*   found, otherwise it returns a -1 indicating that the file does not
*   exist on tape.
*
*   This function is also used to search for additional file extensions
*   if a tape file occupies more than one block which corresponds to a
*   directory entry.
*
* INPUTS--
*   FILE_ID = tape file identified by a byte wide value containing the
*             data type (0..15 = upper 4 bits)  and
*             file number (1..S = lower 4 bits).
*   DIR_PTR = which directory entry (corresponds to tape blocks 0..84)
*             to start scanning from
*
* OUTPUTS--
*   directory entry (0..84) if file is found
*   -1 if file is not found
*
* ROUTINES CALLED--  none
*
* ERROR CONDITIONS AND RECOVERY--
*   range checks file ids and directory entry pointers
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*   If starting directory entry pointer is within range then
*     check each directory entry for requested tape file (file_id)
*   If tape file found then
*     return directory entry
*   else
*     return -1
*
*****************************************************************
*
* REVISION LOG--
*
```

```
STPMGR.UORK.PDS510              THU, DEC 22, 1983, 11:04 AM     PAGE  19

*****************************************************************
DECLARATION--
;
INTEGER PROCEDURE scan_directory (dir_ptr, file_id);
  VALUE dir_ptr, file_id;  INTEGER dir_ptr;  BYTE file_id;      ENTRY;
&
$DOC-&

BEGIN
  BOOLEAN found;
  found:=FALSE;
  IF (dir_ptr <= max_blk) AND (dir_ptr >= first_blk) THEN
  UNTIL NOT (found := (directory_bytebuf[LEFT(dir_ptr,1)) = file_id))
        AND (dir_ptr < max_blk)   DO  dir_ptr := dir_ptr+1;
  scan_directory := (IF found THEN dir_ptr ELSE -1);
END scan_directory;
```

```
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REJECT;
COMMENT
SDOC+

NAME--
  delete_file
*****************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*   Scans directory for FILE_TYPE and FILE_ID and deletes that file
*   by marking directory block(s) with empty file types and updating
*   the bytes which contain the first available block and number of
*   total available blocks.
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************
*
* REVISION LOG--
*
*****************************************************************
DECLARATION--
;
PROCEDURE delete_file (file_type, file_id);
VALUE file_type, file_id;  INTEGER file_type, file_id;          ENTRY;
&
$DOC-&

BEGIN
  INTEGER blk_no;
  BYTE file;
  IF valid_directory THEN
  IF (blk_no:=scan_directory(first_blk,
     (file := LEFT(file_type,4) OR file_id))) < 0 THEN
    warn (no_file_found)
  ELSE
    BEGIN
      tell(deleting_file);
      deleted_blk := blk_no;
      deleted_file := directory_wordbuf[blk_no];
```

```
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      IF directory_bytebuf[first_blk_avail] > blk_no THEN
        directory_bytebuf [first_blk_avail] := blk_no;
      DO BEGIN
        directory_bytebuf[blks_avail]:=directory_bytebuf[blks_avail]+1;
        directory_wordbuf[blk_no] := empty_file;
      END UNTIL (blk_no:=scan_directory (blk_no+1,file)) < 0;
      IF update_directory THEN
        acknowledge (file_deleted)
      ELSE
        deleted_blk := -1;              & file not deleted successfully &
    END;
  IF abort_tape_fn THEN
    macro_warn (file_aborted, delete_macro);
END delete_file;
```

```
$EJECT;
COMMENT
$DOC+

NAME--
  undelete_file
*********************************************************************
*
* SHORT DESCRIPTION--
*   recovers a file that has just been deleted
*
* EXTENDED DESCRIPTION--
*   "Undeletes" the last file deleted provided a file has not been
*   saved after the last deletion (indicated by DELETED_BLK = -1).
*   Scans directory for FILE_TYPE and FILE_ID and deletes that file
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*********************************************************************
*
* INITIAL REFINEMENT--
*
*********************************************************************
*
* REVISION LOG--
*
*********************************************************************
DECLARATION--
;
PROCEDURE undelete_file;                                   ENTRY;
&
$DOC-&

BEGIN
  IF valid_directory THEN   & first check if tape is ok &
  IF deleted_blk >= 0 THEN
  BEGIN
    INTEGER blks_rescued;
    tell (undeleting_file);
    directory_bytebuf[blks_avail] := directory_bytebuf[blks_avail] -
                            (blks_rescued:=deleted_file AND %OF);
    directory_wordbuf[deleted_blk] := deleted_file;
    deleted_file := deleted_file AND %FF00;     & mask out file length &
    WHILE ((blks_rescued:=blks_rescued-1)>0) AND
      ((deleted_blk:=scan_directory(deleted_blk+1,
      RIGHT(deleted_file,8)))> 0)  DO
```



```
      directory_wordbuf[deleted_blk] := deleted_file;
      directory_bytebuf[first_blk_avail] :=
        scan_directory (deleted_blk+1, empty_file);
      IF update_directory THEN
        BEGIN
          acknowledge (file_undeleted);
          deleted_blk := -1;
        END;
    END
    ELSE
  macro_warn (file_error, undelete_macro);
  IF abort_tape_fn THEN
    macro_warn (file_aborted, undelete_macro);
END undelete_file;
```



```
$EJECT;
COMMENT
$DOC+

NAME--
  record_file
*********************************************************************
*
* SHORT DESCRIPTION--
*
* EXTENDED DESCRIPTION--
*   Saves the file, FILE_ID, through FILE_WRITE.  FILE_LENGTH computes
*   and returns the number of blocks (BLK_SIZE) in the file.
*   FILE_WRITE buffers the file information to be written to tape one
*   record (128 words at a time using DATA_PTR as an offset relative
*   to the information (accessed via ram_addr).
*   FROM_MBM indicates whether the data being recorded is from
*   bubble memory (TRUE) or from RAM (FALSE).
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*   For writing machine dumps, the following order of recording is done:
*     - data bubble (module 1)
*     - formatted data
*     - data
*     - raw
*
* AUTHOR--
*
*********************************************************************
*
* INITIAL REFINEMENT--
*
*********************************************************************
*
* REVISION LOG--
*
*********************************************************************
DECLARATION--
;
PROCEDURE record_file (ram_addr, byte_lgth, file_id, mbm_pg);
  VALUE ram_addr,byte_lgth,file_id,mbm_pg;  DOUBLE ram_addr, byte_lgth;
  INTEGER file_id, mbm_pg;                                   ENTRY;
&
$DOC-&

BEGIN
  INTEGER POINTER info_ptr=ram_addr;
  DOUBLE  lgth, blk_sz;
```



```
  INTEGER blk_size=blk_sz+2, & number of tape blocks to needed for file&
          blk_ptr,           & current tape block being written to     &
          blk_buf,           & record counter for each tape block write&
          data_type;
  INTEGER
    data_ptr,                & data buffer pointer                     &
    appends;                 & appending data info. in file to write   &
  BOOLEAN wrote_ok,          & redundancy checking during tape writes  &
          purged_file;       & attempt to write over existing file     &
&*******************************************************************&

  SUBROUTINE file_append;
  BEGIN
    INTEGER app_reg = REGISTER 6;
    app_reg := appends;
    IF (app_reg:=app_reg+1) <= max_file_appends  THEN
      IF (byte_lgth := file_byte_cnt [app_reg]) > 0 THEN
        BEGIN                       & append another data block to file &
          STPMTR( info_ptr, (ram_addr:=file_address[app_reg]) );
          data_ptr := -128;         & reset to beginning of buffer &
        END;
    appends := app_reg;
  END file_append;

&*******************************************************************&

  SUBROUTINE get_next_block;
  BEGIN
    blk_ptr := scan_directory (blk_ptr+1,empty_file);
    blk_buf := 0;               & reset record count for next tape block &
    IF (wrote_ok := IPseek (blk_ptr*10+2)) THEN
      IF (mbm_pg >= 0)  THEN  & buffer next data block if from bubble &
        BEGIN
          wrote_ok := read_mbm(ram_addr, set_add_mbm(mbm_pg,0,
                      (IF byte_lgth>=2560 THEN 2559 ELSE byte_lgth-1)));
          data_ptr := -128;            & reset to beginning of buffer &
        END;
  END get_next_block;

&*******************************************************************&

  SUBROUTINE tape_write;
  BEGIN
    IF (wrote_ok := ram_addr <> 0) THEN
    DO BEGIN    & write to file &
      IF dump_debug THEN
        BEGIN
          IF mbm_pg >= 0 THEN
            BEGIN USTR("pg"); UHEX(mbm_pg); END
          ELSE
            BEGIN UHex(ram_addr,8); UHex(byte_lgth,5); END;
          USTR(" --> blk");
          UHEX(blk_ptr); IF NOT wrote_ok THEN UHEX(status_mbm);
          CRLF;
        END;
```

```
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      WHILE blk_buf:=blk_buf+1  UNTIL                    & write a block &
        NOT (wrote_ok:=IPWRT(ADRS(info_ptr[data_ptr:=data_ptr+128]),
        (IF byte_lgth>256 THEN 256 ELSE byte_lgth))) OR
        (abort_tape_fn := abort_command)               OR
        ((byte_lgth := byte_lgth - 255) <= 0)          OR
        (blk_buf = 10);
      & mark tape block in directory with file ID &
      directory_bytebuf[LEFT(blk_ptr,1)] := file_id;
      IF nbn_pg < 0 THEN                  & no file appends from bubble data &
        IF (byte_lgth <= 0) THEN
          file_append;
      IF (byte_lgth > 0) AND (blk_buf = 10) THEN
        get_next_block;
    END UNTIL NOT wrote_ok      OR
              abort_tape_fn     OR
              (byte_lgth <= 0);
  END tape_write;

!*************************************************************************!

  SUBROUTINE copy_bubble_1;
  BEGIN
    IF bubble_ok THEN
    IF (ran_addr := request_memory (2560) ) = 0 THEN
      fatal (exceeded_available_memory)
    ELSE
      BEGIN
        STPNTR (info_ptr, ran_addr);
        nbn_pg := 0;
        byte_lgth := 131072;              & 2048 nbn pages * 64 bytes &
        & 1 tape block (2560 bytes) - 256 bytes of file header = 2303 &
        wrote_ok := read_nbn(ran_addr, set_add_nbn(nbn_pg,0,2303));
        IF wrote_ok THEN
          tape_write;
        release_memory (ran_addr);
        nbn_pg := -1;                     & reset to load RAM data from tape &
        data_ptr := -128;
        get_next_block;
      END;
  END copy_bubble_1;

!*************************************************************************!

  BOOLEAN SUBROUTINE file_write;
  BEGIN
    tell(recording_file);
    directory_bytebuf[(blk_ptr:=directory_bytebuf    & file hdr block: &
    [first_blk_avail])*2+1] := blk_size;           & file size       &
    directory_bytebuf[blks_avail] :=
    & update N avail blks &   directory_bytebuf[blks_avail]-blk_size;
    IF NOT (wrote_ok:= IPeek(blk_ptr*10+2)) THEN
      tape_error
    ELSE
      BEGIN  & 1st record contains file info &
        deleted_blk := -1;
        tape_double&0& := byte_lgth;
```

```
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      IF data_type = memory_set THEN
        & copy memory trace directory from bubble &
        MOVE tape_wordbuf[2] := nbn_dir[men_dir_offset), *(5)
      ELSE
      IF data_type = cal_set THEN
        & copy cal data directory from bubble &
        MOVE tape_wordbuf[2] := nbn_dir&0&, *(men_dir_offset)
      ELSE
        & copy appending file byte lgths into file info. record &
        MOVE tape_wordbuf[2]:=file_byte_cnt&0&,*(max_file_appended-1);
      IF (wrote_ok := IPWRT(tape_bufptr,256)) THEN
        BEGIN
          IF (data_type=machine_file) THEN
            copy_bubble_1;
          IF wrote_ok AND NOT abort_tape_fn THEN
            BEGIN
              IF file_byte_cnt(1)>0 THEN  & check for appending file &
              BEGIN
                byte_lgth:=file_byte_cnt&0&; & byte lgth to 1st file &
                STPNTR(info_ptr,(ran_addr:=file_address&0&));
              END;
              tape_write;
            END;
        END;
      IF NOT abort_tape_fn THEN
      IF wrote_ok THEN                    & update 1st avail blk &
        directory_bytebuf(first_blk_avail) :=
        scan_directory (blk_ptr+1, empty_file)
      ELSE
        BEGIN
          load_tape;                      & retrieve old directory&
          macro_warn (file_error, record_macro);
        END;
    END;
  file_write := wrote_ok AND NOT abort_tape_fn;
END file_write;

!*************************************************************************!

  BOOLEAN SUBROUTINE room_on_tape;
  BEGIN
    blk_sz := (IF ((lgth:=byte_lgth+256) MOD 2560) > 0 THEN
              (lgth/2560)+1  ELSE
              (lgth/2560));
    IF directory_bytebuf[blks_avail) < blk_size THEN
      BEGIN
        IF purged_file THEN
          undelete_file;
        room_on_tape := FALSE;
        warn(no_tape_room);
      END
    ELSE
      room_on_tape := TRUE;
  END file_length;

!*************************************************************************!
```

```
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  IF TEST(TPErr,3) THEN
    macro_warn (tape_errors, write_protect_macro)
  ELSE
  IF valid_directory THEN
    BEGIN
      blk_buf := 1;           & record counter for each tape block write&
      appends := 0;           & appending data info. in file to write  &
      data_ptr:= -128;        & data buffer pointer                     &
      data_type := RIGHT(file_id,4);
      IF dump_debug THEN
        BEGIN
          USTR("RECORDING"); UHex(byte_lgth,8); USTR(" bytes from ");
          IF nbn_pg<0 THEN UHex(ran_addr,8)
          ELSE UHEX(nbn_pg); UHEX(file_id); CRLF;
        END;
      IF (purged_file:=(scan_directory(first_blk,file_id)>=0)) THEN
        delete_file (data_type, file_id AND 00FF);
      IF room_on_tape THEN
        IF file_write AND update_directory THEN
          acknowledge (File_recorded);
      IF abort_tape_fn THEN
        macro_warn (file_aborted, record_macro);
    END;
END record_file;
```

```
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REJECT;
COMMENT
$DOC+

NAME--
  restore_file
!*************************************************************************!
!
! SHORT DESCRIPTION--
!
! EXTENDED DESCRIPTION--
!   Restores file contents of FILE_ID into RAM via INFO_PTR, or into
!   bubble buffered through INFO_PTR.  This is determined by DEST,
!   in which a value of 0 indicates restoration to RAM, and a non-zero
!   (positive) value indicates a page number in bubble to start
!   restoring to.
!
! INPUTS--
!
! OUTPUTS--
!
! ROUTINES CALLED--
!
! ERROR CONDITIONS AND RECOVERY--
!
! NOTES--
!   For reading machine dumps, the following order of restoring is done:
!     - data bubble (module 1)
!     - formatted data
!     - data
!     - raw
!
! RUMOR--
!
!*************************************************************************!
!
! INITIAL REFINEMENT--
!
!*************************************************************************!
!
! REVISION LOG--
!
!*************************************************************************!
DECLARATION--
;
PROCEDURE restore_file (ran_addr, file_id, dest);
  VALUE ran_addr, file_id, dest;  DOUBLE ran_addr;
  INTEGER file_id, dest;                                          ENTRY;
&
$DOC-&

BEGIN
  %FILE ftrace.work;
  RFILE cdatap.work;
  INTEGER POINTER info_ptr=ran_addr;
  INTEGER blk_no,                          & tape block number      &
```

```
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        rec_lgth,                           & # bytes/tape record     &
        i,                                  & temporary debug variable&
        data_type,                          & type of data on file    &
        src_pts,                            & # points being restored &
        msg,                                & error message number    &
        blk_buf,                            & records/block counter   &
        nbn_block_cnt,                      & tape block counter      &
        cnt;                                & tape records/bubble data&
  INTEGER data,                             & data buffer/ram pointer &
        appends;                            & appending file data cntr&
  DOUBLE  lgtb;                             & # bytes/data file       &
  INTEGER ARRAY restore_file_cnt [0:max_file_appends];
  BOOLEAN read_ok;

!*************************************************************************!

  BOOLEAN SUBROUTINE ok_to_restore_file;
  BEGIN
    IF NOT (read_ok:=TPRED(tape_bufptr,rec_lgtb]) THEN  &tape file info&
      tape_error
    ELSE
    IF dest >= 0 THEN                               & read from bubble &
      BEGIN
        lgth := tape_double&0&;
        IF data_type = memory_file THEN
          & men_dir_offset index contains reg mem to restore to &
          nbn_dir[men_dir_offset=nbn_dir[men_dir_offset]] := lgth
        ELSE
        IF data_type = memory_set THEN      & restore nbn memory info &
          MOVE mem_dir[men_dir_offset] := tape_wordbuf[2],*(5)
        ELSE
        IF data_type = cal_file THEN
          BEGIN
            & cal_dir_effset index contains reg num to restore to &
            cnt := nbn_dir[cal_dir_offset];
            IF (read_ok := ok_to_save_cal (cnt, lgth)) THEN
              dest := get_start_pg (cal_file, cnt);
          END
        ELSE
        IF data_type = cal_set THEN         & restore nbn cal info &
          MOVE nbn_dir&0& := tape_wordbuf[2], *(men_dir_offset);
      END
    ELSE
      BEGIN
        MOVE restore_file_cnt&0&:=tape_wordbuf[2],*(max_file_appends+1);
        lgth:=(IF restore_file_cnt[1]>0 THEN restore_file_cnt&0& ELSE
                                            tape_double&0&);
        IF data_type=machine_file THEN
          BEGIN
            dest := cnt := 0;
            lgth := 131072      & 2048 nbn pages * 64 bytes &
          END
        ELSE
        IF dest < 0 THEN        & range check # points for RRM data &
        IF NOT (read_ok := restore_file_cnt&0&=file_byte_cnt&0&) THEN
          BEGIN
```

```
SIPMGR.UBRM.PD8510              THU, DEC 22, 1983, 11:05 AM     PAGE  31

          src_pts := restore_file_cnt&0&/300;    & 50 pts * 6 bytes &
          IF (src_pts=5) THEN
            msg := restore_401_macro     ELSE
          IF (src_pts=4) THEN
            msg := restore_201_macro     ELSE
          IF (src_pts=2) THEN
            msg := restore_101_macro     ELSE
            msg := restore_51_macro;
          macro_warn (restore_pts_error, msg);
        END;
    END;
  ok_to_restore_file := read_ok;
END ok_to_restore_file;

!*************************************************************************!

  SUBROUTINE get_next_block;
  BEGIN
    blk_buf := 0;                & reset block buffer count for tape  &
    blk_no := scan_directory (blk_no+1, file_id);
    read_ok := TPseek (blk_no*10+2);                 & get Next block &
  END get_next_block;

!*************************************************************************!

  SUBROUTINE write_next_block;
  BEGIN
    IF lgth > 0 THEN
    DO BEGIN                                         & read in 1 block &
      cnt     := cnt + 1;                            & records for mem &
      lgth    := lgth - 256;                         & read a record   &
      blk_buf := blk_buf + 1;                        & # records read  &
    END UNTIL
      (abort_tape_fn := abort_command) OR
      NOT (read_ok:=TPRED(ADR$(info_ptr[data:=data+12$]),rec_lgth)) OR
      (lgth <= 0) OR (blk_buf = 10);
  END write_next_block;

!*************************************************************************!

  SUBROUTINE append_data_info;
  BEGIN
    INTEGER app_reg = REGISTER 6;
    app_reg := appends;
    IF (app_reg:=app_reg+1) <= max_file_appends THEN
      IF (lgth:=restore_file_cnt[app_reg]) > 0 THEN
        BEGIN
          data := -128;
          STPNTR(info_ptr,(ram_addr:=file_address[app_reg]));
        END;
    appends := app_reg;
  END append_data_info;

!*************************************************************************!

  BOOLEAN SUBROUTINE read_aborted;
```

```
STPMGR.WORK.PD8510              THU, DEC 22, 1983, 11:05 AM     PAGE  32

    read_aborted := NOT read_ok OR abort_tape_fn;

!*************************************************************************!

  SUBROUTINE read_debug;
  BEGIN
    IF dump_debug THEN
      BEGIN
        WSTR("blk"); WHEX(blk_no); WSTR(" -->");
        IF dest < 0 THEN
          BEGIN UHex(ram_addr,3); UHex(lgth,&); END
        ELSE
          BEGIN WSIR("pg"); WHEX(dest); END;
        CRLF;
      END;
  END read_debug;

!*************************************************************************!

  SUBROUTINE read_tape;
  BEGIN
    IF (read_ok := ram_addr <> 0) THEN
    IF NOT read_aborted THEN
    DO BEGIN                                  & read and restore the file &
      read_debug;
      write_next_block;
      IF NOT read_aborted THEN
        IF dest >= 0 THEN          & write to bubble starting @ pg dest &
          BEGIN
            data := -128;          & reset nbn buffer ptr for next blk  &
            COMMENT
            read_ok := wrt_nbn (ram_addr, set_add_nbn(dest,0,
                       (cnt-1)*256&rec_lgth-1));
            read_ok := wrt_nbn_ok (ram_addr, dest,
                                   (cnt-1)*25&+rec_lgtb-1);
            cnt := 0;
          END
        ELSE
          IF lgth <= 0 THEN        & check for appending data files     &
            append_data_info;
      IF (blk_buf=10) AND (lgth > 0) THEN
        get_next_block;
    END UNTIL read_aborted OR (lgth<=0);
  END read_tape;

!*************************************************************************!

COMMENT  >>>> POTENTIAL PROBLEM <<<<
  could be a problem here if user decides to abort
  machine dump restore from tape !!!!
;
  SUBROUTINE restore_the_world;
  BEGIN
    IF bubble_ok THEN                  & get a buffer to restore bubble&
      IF (ram_addr:=request_memory(2560)) = 0 THEN
        fatal (exceeded_available_memory)
```

```
STPMGR.WORK.PD8510              THU, DEC 22, 1983, 11:05 AM     PAGE  33

      ELSE
        BEGIN
          SIPNIR (info_ptr,ram_addr);
          read_tape;                   & restore data bubble (module 1)&
          release_memory (ram_addr);
          IF NOT read_aborted THEN
            BEGIN
              dest := appends := -1;       & reset to restore RRM data &
              append_data_info;
              DO BEGIN
                get_next_block;
                read_debug;
                write_next_block;      & should be inst. state portion &
              END UNTIL read_aborted OR (lgth <= 0);
              do_recall;               & set up memory for d,f, and rau&
              abort_sweep;
              new_data(machine_file);  & get memory addr for d,f,rau   &
              append_data_info;        & get next appending file &
              IF blk_buf=10 THEN
                get_next_block;
              read_tape;               & read the rest of machine state&
            END;
        END
  END restore_the_world;

!*************************************************************************!

  data_type := RIGHT(file_id,4);
  IF (blk_no:= scan_directory (first_blk,file_id))<0 THEN
    warn (no_file_found)
  ELSE
  IF NOT IPseek (blk_no*10+2) THEN
    tape_error
  ELSE
  IF valid_directory THEN
  IF ok_to_restore_file THEN
    BEGIN
      IF dump_debug THEN
        BEGIN
          USTR("RESTORING"); UHex(lgth,3); USTR(" bytes from tape to ");
          IF dest<0 THEN Whex(ram_addr,3)
          ELSE UHEX(dest); WHEX(file_id); CRLF;
        END;

      blk_buf := 1;                        & records/block counter   &
      nbn_block_cnt :=                     & tape block counter      &
      cnt :=                               & tape records/bubble data&
      appends := 0;                        & appending file data cntr&
      data := -128;                        & data buffer/ram pointer &
      tell (restoring_file);
      abort_sweep;
      IF (data_type = machine_file) THEN
        restore_the_world                  & restore machine dump &
      ELSE
        BEGIN
          read_tape;
```

```
STPMGR.WORK.PD8510              THU, DEC 22, 1983, 11:05 AM     PAGE  34


        IF dest < 0 THEN                & tape to RAM restore &
          BEGIN
            IF (data_type = data_file) THEN
              partial (update_d)
            ELSE
            IF data_type = format_file THEN
              partial (update_F);
          END
        ELSE                            & tape to nbm restore &
          IF read_ok THEN               & update bubble directory  &
            read_ok := update_nbm_dir
          ELSE
            bubble_ok;                  & get old bubble directory &
      END;

    restart_sweep;
    IF abort_tape_fn THEN
      compute_warn (data_type_otr, abort_restore)
    ELSE
    IF read_ok THEN
      acknowledge (file_restored)
    ELSE
      macro_warn (file_error, restore_macro);
  END; &IF read_ok, ok to restore file&
END restore_file;
```

```
STPMGR.WORK.PD8510              THU, DEC 22, 1983, 11:05 AM     PAGE  35


%EJECT;
COMMENT
$DOC+

NAME--
  init_tape_mgr
*****************************************************************************
*
* SHORT DESCRIPTION--
*   initializes variables for tpmgr
*
* EXTENDED DESCRIPTION--
*
* INPUTS--
*
* OUTPUTS--
*
* ROUTINES CALLED--
*
* ERROR CONDITIONS AND RECOVERY--
*
* NOTES--
*
* AUTHOR--
*
*****************************************************************************
*
* INITIAL REFINEMENT--
*
*****************************************************************************
*
* REVISION LOG--
*
*****************************************************************************
DECLARATION--
;
SUBROUTINE init_tape_mgr;                                       ENTRY;
&
$DOC-&

BEGIN
  STPNTR(directory_bytebuf, ADRS(directory_wordbuf));
  STPNTR(tape_bytebuf, ADRS(tape_wordbuf));
  STPNTR(tape_double, ADRS(tape_wordbuf));
  FOR dir_blk := 0 TO 127 DO
    directory_wordbuf[dir_blk] := 0;
  directory_on := FALSE;
  init_tape_vars;
END init_tape_mgr;

END$
```

```
FTPMGR2.WORK.PD8510             THU, DEC 22, 1983, 11:05 AM     PAGE  1


SUBROUTINE directory_off;                                       EXTERNAL;
EXTERNAL BOOLEAN directory_on;
```

```
CTRACE.WORK.PD8510              THU, DEC 22, 1983, 11:05 AM     PAGE  1


BYTE CONSTANT ch1_ref_line_mark := '>,
              ch2_ref_line_mark := '<,
              ch1_trace_mark    := 159,             & right arrow &
              ch2_trace_mark    := 168;             & left  arrow &

INTEGER CONSTANT  m_off      := 0,          & state of memory trace &
                  m_on       := 1,
                  d_off      := 0,          & state of data trace   &
                  d_on       := 1;

INTEGER CONSTANT  trace_all_off       := 0,          & trace_type &
                  trace_data          := 1,
                  trace_data_into_mem := 2,

                  trace_mem_limit     := 3,   & first mode using mem &
                  trace_mem           := 3,
                  trace_data_and_mem  := 4,

                  trace_math_limit    := 5,   & first mode using math &
                  trace_data_plus_mem := 5,
                  trace_data_minus_mem := 6,
                  trace_data_times_mem := 7,
                  trace_data_div_mem  := 8;

INTEGER CONSTANT  no_mem   := 0,
                  mem1     := 1,
                  mem2     := 2,
                  mem3     := 3,
                  mem4     := 4,
                  data1    := 5,
                  data2    := 5,
                  cal1     := 7,
                  cal2     := 8,
                  cal3     := 9,
                  cal4     := 10,
                  cal5     := 11,
                  cal6     := 12,
                  cal7     := 13,
                  cal8     := 14;
```

```
F1RRCE.UORK.PD&510          THU, DEC 22, 1983, 11:05 AM    PAGE  1


#FILE ctrace.work;
#FILE FtraceO.work;                                    & for partial &
PROCEDURE  ch_partial( update_block, ch );
   VALUE   update_block, ch;
   IKTEGER update_block, eh;                           EXTERNAL.L;
PROCEDURE  annotate_nath_and_nen( trace_type );
   VALUE   trace_type;
   INTEGER trace_type;                                 EXTERNRL.L;
PROCEDURE  annotate_ref_poaition;                      EXTERNAL.L;
```

```
STRRCE.UORK.PD&510          THU, DEC 22, 1983, 11:05 AM    PAGE  2


REJECT;
COMMENT                                                          partial
**********************************************************************
*
* See alao init_group_control_vars.
*
**********************************************************************
;
PROCEDURE  ch_partial( update_block, ch );
   VALUE   update_block, ch;
   INTEGER update_block, cn;                           ENTRY;
   BEGIN & eh_partial &
      INTEGER fifo_word;
      BYTE    fifo_word_upper = fifo_word,
              fifo_word_lower = fifo_word+1;

      fifo_word_upper := ( BYIE(ch) AND array_ch_naek ) OR
                         array_update_nask;

      IF ch_integer(ch_n_etate,ch) = n_on THEK
         BEGIN & if &
            fifo_word_lower := update_n;
            urite_fifo( array_update_fifo, fifo_word );
         EKO;  & if &

      IF ( (ch_integer(ch_d_state,ch) = d_on) AND
           (update_block <> update_n )
         ) THEN
         BEGIN & if &
            fifo_word_lower := update_block;
            urite_fifo( array_update_fifo, fifo_word );
         END;  & if &

   END;  & ch_partial &


PROCEDURE  partial( update_block );
   VALUE   update_block;
   INTEGER update_block;                               ENTRY;
   BEGIN & partial S
      ch_partial( update_block, current_entry_ch );
   END;  & partial &
```

```
STRACE.UORK.PDS510          THU, DEC 22, 1953, 11:05 AM    PRGE  3


#EJECT;
COMMENT                                                annotate_ref_position
**********************************************************************
*
*
;
PROCEDURE  annotate_ref_position;                                  ENTRY;
   BEGIN & annotate_ref_position &
      INTEGER POINTER epeca;
      INTEGER ref_line_poeition,
              ref_line_dieplay,
              x_ref_line,
              y_ref_line,
              addr,              & current display generator address &
              ch;
      REAL ref_poaition;

      FOR ch := 1 UNTIL nax_ch DO
         BEGIN & for &
            IF ch = 1 THEN
               BEGIN & if &
                  STPN1R( apses, AORS(grat1_apecs) );
                  ref_line_position := ref_line1_position;
                  ref_line_display  := ref_line1_diaplay;
               END   & if &
            ELSE
               BEGIN & elae &
                  STPNTR( specs, AABS(grat2_specs) );
                  ref_line_poaition := ref_line2_poeition;
                  ref_line_diaplay  := ref_line2_diaplay;
               END;  & elec &

            addr := ref_line_pesition;
            IF apece[grat_type] = rectangular THEN
               BEGIN & if &
                  ref_poaition := ch_real( eh_ref_yosition, ch );
                  IF ( (ref_position < 0.0) OR
                       (ref_position > 10.0)
                     ) THEN
                     addr := jnp( addr, ref_line_display+ref_line_size )
                  ELSE
                     BEGIN & else &
                        x_ref_line := opeca[grat_x];
                        y_ref_line := specs[grat_y] + INTEGER(
                                          ref_position * REAL(specs[div_y])
                                                             );
                        addr := nove2(addr,x_ref_line,y_ref_line);
                        addr := setattribute[ref_linc_display, incr);
                        IF ch = 1 THEN
                           BEGIN & if &
                              addr := nove(addr, -45, -80);
                              addr := printch(addr, ch1_ref_line_nark);
                              addr := nove(addr, -1G,  80);
                              addr := plot(addr,
                                           10*specs[div_x],
                                           0,
```

```
STRACE.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  4


                                    normal,
                                    slow
                                    );          & reference line &
                        END   & if &
                     ELSE
                        BEGIN & else &
                           addr := plot(addr,
                                    10*speee[div_x],
                                    0,
                                    normal,
                                    slow
                                    );          & reference line &
                           addr := move(addr,   0, -80);
                           addr := printch(addr, ehz_ref_line_mark);
                           addr := move(addr, -64,  80);
                        END;  & else &
                     addr := setattribute(addr, incroff);
                  END;  & else &
               END;  & if &

            addr := jmp(addr, ref_line_diaplay + ref_line_size);

         END;  & for &

      END;  & annotate_ref_position &
```

```
STRACE.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  5


%EJECT;
COMMENT                                                annotate_nath_and_nen
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  annotate_nath_and_nen( trace_type );
   VALUE   trace_type;
   INTEGER trace_type;                                                 ENTRY;
   BEGIN & annotate_nath_and_nen &

      annotate_parameter;        & turn on/off paran for n-only off/on &
      print_string( nath_annotation[ trace_type ],
                    nath_size, nath_n_display[current_entry_ch - 1]);

   END;  & annotate_nath_and_nen &

END$
```

```
ETRACED.WORK.PD8510         THU, DEC 22, 1983, 11:05 AM    PAGE  1


& update starting points          &
INTEGER CONSTANT update_proc_virs  :=0,
                 update_rau_array  :=1,
                 update_rau        :=2,      & later inc these by one &
                 update_d          :=3,
                 update_n          :=4,
                 update_f &rect&   :=5,
                 update_f_polar    :=6;       &not used in call&
```

```
FTRACED.WORK.PD8510         THU, DEC 22, 1983, 11:05 AM    PAGE  1


PROCEDURE  partial( update_block );
   VALUE   update_block;
   INTEGER update_block;                                  EXTERNAL;
```

```
FTRACE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 RH     PAGE  1


SUBROUTINE annotate_math_op;                              EXTERNAL.L;
PROCEDURE  repaint_traces;                                EXTERNAL.L;
PROCEDURE  release_mem;                                   EXTERNAL.L;
```

```
STRACE2.UORX.PD8510          THU, DEC 22, 1983, 11:05 RH     PAGE  1


MGSKL,P,"trac2"
BEGIN

TYPELENGTH USER3:S;

RFILE ftrace.uork;
@FILE cmenu.work;
RFILE fmenu.work;
RFILE fcontv2.uork;                                    & for rebuild &
RFILE fsize.work;
@FILE fcontrol.work;
@FILE cchtable.uork;
@FILE fchtable.uork;
@FILE Fchtab2.work;
@FILE Fchdata.work;
@FILE fgratic.uork;
@FILE cdiap.uork;
MFILE cmeseeg2.work;
@FILE futiL3.work;                                          & for uarn &
@FILE fmbmgr.uork;                  & for eave_data() and recall_data() &
@FILE ctpmgr.uork;                                        & for menary_file &
@FILE fcommand.uork;                                  & for command_token &
@FILE fmemmgr.uork;                   & for request_ and release_array &
@FILE fdisplay.uork;
@FILE fscreen.mark;
@FILE Fdatap.uork;

PROCEDURE copy_user3( From_addr, to_addr, size );
                      VRLUE fron_addr, to_addr, size;
                     DOUBLE fren_addr, to_eddr; IKTEGER size: EXTERNAL;


IKTEGER CONSTANT last_array := 2;
DOUBLE ARRAY menory_addr[1:last_array];      & address of menory array &
BYTE   ARRAY menory_numb[1:last_array],       & menory # in this array &
             menory_user[1:iast_array);      & ch'e bit set uhen using &

RLPHR TABLE nath_annotation :=
   &  0  neth_d_piua_n       & "( + )",
   &  1  nath_d_minus_n      & "( - )",
   &  2  nath_d_times_n      & "( *mpy_char* )",
   &  3  nath_d_divided_by_n & "( / )";
```

```
STRACE2.UDRK.PD3510          THU, DEC 22, 1983, 11:05 Rh     PAGE  2


@EJECT;
COMMENT                                                    release_nen
*****************************************************************I***
*
*****************************************************************
;
PROCEDURE  release_nen;                                          ENTRY;
   BEGIN & release_nen &
      INTEGER array_nun;

      FOR array_nun := 1 UNTIL last_array DO
         BEGIN & for &
            nenory_user[array_nun] :=
                  RBIT(~nemory_user[array_nun], current_entry_ch );
            IF ( (nenory_numb[array_nun] <> 0) BND
                 (nenory_user[array_nun] = 0)
               ) THEN  & it uas allocated RND other ch isn't using it &
               BEGIN & if &
                  releate_array( nenory_addr[array_nun] );
                  nenory_numb[array_nun] := 0;
               END;  & if &
         END;  & for &

   END;  & release_nen &
```

```
STRRCE2.UORK.PD8510          THU, DEC 22, 1983, 11:05 RM     PAGE  3


@EJECT;
COnnENT                                                        get_nen
*****************************************************************
*
*   Releases any currently held nenory for the current entry channel,
*   checks to see if the requested data nenory is already in nenory
*   else allocates space for it and reads it in from bubble.
*   If successful, Fills the data nenory tables, sets the channel table
*   value for ch_n_base, and returns TRUE. Else it releases the nenory,
*   clears the data nenory tables, sets the ehannel table value for
*   ch_n_base to 0, and returns FALSE.
*
*****************************************************************
;
BOOLEAN PROCEDURE get_nen( nen_id );
   VRLUE   nen_id;
   INTEGER nen_id;
   BEGIN & get_nen &
      BOOLERN success;
      INTEGER array_nun ,
              use_this_array,
              an_open_array;

      success :* TRUE;
      release_ncn; & release array(s) currently in use by this channel &

      & see if the desired nenory nunber is already in ran &
      use_this_array := 0;
      an_open_array  := 0;     & at least one is aluays open & & DEBUG &
      FOR array_nun  := 1 UNTIL last_array DO
         BEGIN & for &
            IF nenory_numb[array_nun ] = nen_id THEN
               use_thie_array := array_nun
            ELSE IF nenory_numb[array_nun ] = 0 THEN
               an_open_array := array_nun ;
         END;  & for &

      IF use_thie_arrey = 0 THEN
         BEGIN & if not already in ran &
            use_this_array :* an_cpen_array;
            IF ( nenory_addr[use_this_array]
                    :* request_array( block_size )
               ) <> 0 THEN
               BEGIN & if ran allocation successful &
                  nenory_user[use_this_array] :*
                                 SBIT( nenory_user[use_this_array],
                                       current_entry_ch
                                     );
                  nenory_numb[ute_this_arrey] := nen_id;
                  set_entry_ch_double( nenory_addr[use_this_array],
                                       ch_n_base
                                     );
                  success := recall_data( entry_ch_double( ch_n_base )
                                                    - header_size,
                                          nemory_fiie,
                                          nen_id
```

```
STRACE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  4

                                        );
            END   & if ran allocation successful &
         ELSE
            BEGIN & if ran allocation not successful &
               success := FALSE;
               warn( exceeded_available_menory );
            END;  & if ran allocation not successful &
      END   & if not already in ran &
   ELSE & desired menory was already in ran &
      menory_user[use_this_array] :=
            SBIT( menory_user[use_this_array], current_entry_ch );

   IF NOT success THEN
      BEGIN & if &
         release_men;
         set_entry_ch_double( 0, ch_n_base);
      END;  & if &

   get_men := success;

END;  & get_men &
```

```
SIRACE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  5


%EJECT;
COMMENT                                                        data_on
*****************************************************************
*
*****************************************************************
;
SUBROUTINE data_on;
   BEGIN & data_on &
      set_entry_ch_integer( d_ch, ch_d_state );
      IF current_entry_ch = 1 THEN
         move(trace1_position, trace1_x, trace1_y)
      ELSE & entry ch = 2 &
         nave(trace2_position, trace2_x, trace2_y);
   END;  & data_on &
```

```
STRACE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  6


%EJECT;
COMMENT                                                       data_off
*****************************************************************
*
*****************************************************************
;
SUBROUTINE data_off;
   BEGIN & data_off &
      IF current_entry_ch = 1 THEN
         jnp( trace1_position, end_trace1 )          & ch 1 data trace &
      ELSE & entry ch = 2 &
         jnp( trace2_position, end_trace2 );         & ch 2 data trace &
      set_entry_ch_integer( d_off, eh_d_state );
      abort_sweep;
   END;  & data_off &
```

```
STRACE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  7


%EJECT;
COMMENT                                                       men_off
*****************************************************************
*
*****************************************************************
;
SUBROUTINE men_off;
   BEGIN & men_off &
      IF current_entry_ch = 1 THEN
         jnp( tracein_position,                      & ch 1 menory trace &
              tracein_display + trace_size
            )
      ELSE & entry ch = 2 &
         jnp( trace2n_position,                      & ch 2 menory trace &
              trace2n_display + trace_size
            );
      set_entry_ch_integer( n_off, ch_n_state );
   END;  & men_off &
```

```
STRACE2.UORK.PDS510          THU, DEC 22, 1923, 11:05 AM    PAGE  8

%EJECT;
COMMENT                                                          men_on
*****************************************************************************
*
*   Sets the channel table value for ch_n_state to n_on, turns on the
*   CRT memory trace, and updates the positioning vecotr to avoid a line
*   to the first point.
*
*****************************************************************************
;
PROCEDURE  men_on;
   BEGIN & men_on &
      INTEGER position,
              display,
              x,
              y,
              dg_addr;

      get_entry_ch_integer( n_on, ch_n_state );

      & turn on CRT memory trace &
      IF current_entry_ch = 1 THEN
         BEGIN & if &
            position := trace1n_position;
            display  := trace1n_display;
         END   & if &
      ELSE & entry_ch = 2 &
         BEGIN & else &
            position := trace2n_position;
            display  := trace2n_display;
         END   & else &

      & update first position vector (to avoid a line) &
      dg_addr := dg_read_xy( display, x, y );
      dg_addr := move2( position, x, y );

   END;  & men_on &
```

```
31RRCE2.UORK.PDB510          THU, DEC 22, 1983, 11:05 AM    PAGE  5

%EJECT;
COMMENT                                                      data_into_men
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  data_into_men( men_id );
   VALUE   men_id;
   INTEGER men_id;
   BEGIN & data_into_men &
      INTEGER array_num,
              other_ch;

      save_data( entry_ch_double(ch_d_base) - header_size,
                 block_size,
                 memory_file,
                 men_id
               );

      & see if any channel it looking at this memory number &
      FOR array_num  := 1 UNTIL last_array DO
         IF memory_numb[array_num ] = men_id THEN
            copy_user3( entry_ch_double(ch_d_base),
                        memory_addr[array_num ],
                        number_of_points
                      );

      IF entry_ch_integer(ch_trace_math) <> math_off THEN
         partial( update_d )             & will also update men if on &
      ELSE IF entry_ch_integer(ch_n_state) = n_on THEN
         partial( update_n );

      IF trace_mode <> simple_ch THEN
         BEGIN & if &
            other_ch := 3 - current_entry_ch;
            IF ch_integer( ch_trace_math, other_ch ) <> math_off THEN
               ch_partial( update_d, other_ch )
            ELSE IF ch_integer( ch_n_state, other_ch ) = n_on THEN
               ch_partial( update_n, other_ch );
         END;  & if &

   END;  & data_into_men &
```

```
STRACE2.UORK.PD8S10          THU, DEC 22, 1983, 11:05 AM    PAGE  10

%EJECT;
COMMENT                                                      select_men
*****************************************************************************
*
*  Allocates memory if necessary (true memory array, not data or cal),
*  and sets the channel table value for ch_n_base.  Returns TRUE if
*  successful, FALSE otherwise.
*
*****************************************************************************
;
BOOLEAN PROCEDURE select_men( men_id );
   VALUE   men_id;
   INTEGER men_id;
   BEGIN & select_men &
      BOOLEAN result;

      IF ( (men_id <= mem4) AND (men_id >= men1) )THEN
         result := get_men( men_id )
      ELSE IF men_id <= data2 THEN  & measured data &
         BEGIN & else measured data &
            set_entry_ch_double( ch_double( ch_d_base,
                                            1 - data1 + men_id
                                          ),
                                 ch_n_base
                               );
            result := TRUE;
         END   & else measured data &
      ELSE
         result := FALSE;                          & bad men_id number &

      select_men := result;
   END;  & select_men &
```

```
STRRCE2.UORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  11

%EJECT;
COMMENT                                              partial_set_trace_type
*****************************************************************************
a
*   NOTE:  Must leave memory allocated and in ram even for data_and_men
*   in order to be able to update scale/div, etc., quickly.
*
*****************************************************************************
;
PROCEDURE  partial_set_trace_type( trace_type );
   VALUE   trace_type;
   INTEGER trace_type;
   BEGIN & partial_set_trace_type &
      BOOLEAN old_men,
              old_data,
              new_men,
              new_data;


      old_men  := new_men  := entry_ch_integer( ch_n_state ) = n_on;
      old_data := new_data := entry_ch_integer( ch_d_state ) = d_on;

      IF trace_type <> trace_data_into_men THEN
         BEGIN & if not d->m &

            & MEMORY &
            IF trace_type >= trace_men_limit THEN      & will need ram &
               BEGIN & if &
                  IF NOT select_men(entry_ch_integer(ch_men_nmbr)) THEN
                     BEGIN & if unsuccessful &
                        trace_type := trace_data;
                        hilight_key( cmd_data, end_data, end_meth );
                     END;  & if unsuccessful &
               END   & if &
            ELSE                                       & will not need ram &
               release_men;

            & MATH &
            IF trace_type >= trace_math_limit THEN   & common for math &
               BEGIN & if &
                  new_data := TRUE;
                  new_men := FALSE;
               END   & if &
            ELSE                                           & turn off math &
               BEGIN & else &
                  set_entry_ch_integer( math_off, ch_trace_math );
               END;  & else &

         END;  & if not d->m &


      CASE trace_type OF
         BEGIN & case &

& off &     BEGIN & off &
               new_data := FALSE;
```

```
STRACE2.WORK.PDS510          THU, DEC 22, 1983, 11:05 AM    PAGE  12


                    new_men := FALSE;
                 END;  & off &
& data &         BEGIN & data &
                    new_data := TRUE;
                    new_men := FALSE;
                 END;  & data &
& data -> men &  data_into_men( entry_ch_integer(ch_men_nmbr) );
& memory &       BEGIN & memory &
                    new_data := FALSE;
                    new_men := TRUE;
                 END;  & memory &
& data and men & BEGIN & data and memory &
                    new_data := TRUE;
                    new_men := TRUE;
                 END;  & data and memory &
& data + men &   set_entry_ch_integer( math_d_plus_n,  ch_trace_math );
& data - men &   set_entry_ch_integer( math_d_minus_n, ch_trace_math );
& data * men &   set_entry_ch_integer( meth_d_times_n, ch_trace_math );
& data / men &   set_entry_ch_integer( math_d_divided_oy_n,
                                       ch_trace_math
                                     );

      END  & case &
   ELSE
      BEGIN & else case &                        & same as data only &
         release_men;
         new_data := TRUE;
         new_men := FALSE;
      END;  & else case &


   IF new_men XOR old_men THEN     & memory trace state has changed &
      IF new_men THEN
         men_on
      ELSE
         men_off;

   IF new_data XOR old_data THEN  & data trace state has changed &
      BEGIN & if &
         IF new_data THEN
            data_on
         ELSE
            data_off;
         rebuild := TRUE;
      END;  & if &

   IF trace_type <> trace_data_into_men THEN
      BEGIN & if &
         annotate_math_and_men(trace_type);
         partial( update_d );  & else done by data_into_men routine &
      END;  & if &

   IF rebuild THEN
      restart_sweep;     & no operation unless "control" is in idle &

END;  & partial_set_trace_type &
```

```
STRACE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  13
```

```
STRACE2.WORK.PDS510          THU, DEC 22, 1983, 11:05 AM    PAGE  14

REJECT;
COMMENT                                                    set_trace_type
*************************************************************************
*
*************************************************************************
;
PROCEDURE  set_trace_type( trace_type );
   VALUE   trace_type;
   INTEGER trace_type;
   BEGIN & set_trace_type &
      IF trace_type <> trace_data_into_men THEN
         hilight_on( cmd_data, cmd_math );
      partial_set_trace_type( trace_type );
   END;  & set_trace_type &
```

```
STRACE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE  15

REJECT;
COMMENT                                                  select_trace_node
*************************************************************************
*
*************************************************************************
;
PROCEDURE  select_trace_node( node );
   VALUE   node;
   BYTE    node;
   BEGIN & select_trace_node &
      IF node <> trace_node THEN
         BEGIN & if &
            abort_sweep;
            IF node = single_ch THEN
               BEGIN & single channel &
                  hilight_on( cmd_single_ch, cmd_dual_ch );
                  hilight_pff( cmd_overlay, cmd_split );
               END   & single channel &
            ELSE
               BEGIN & dual channel &
                  hilight_on( cmd_overlay, cmd_split );
                  hilight_kty(tmd_dual_ch, end_single_ch, end_dual_ch);
               END;  & dual channel &
            pop_menu( DISPLAY_MENU );
            trace_node := node;
            rebuild := TRUE;
            trace_and_graticule;
            partial( update_d );
            IF trace_node <> single_ch THEN
               BEGIN & if &
                  ch_partial( update_d, 3-current_entry_ch );
               END;  & if &
            restart_sweep;
         END;  & if &
   END;  & select_trace_node &
```

```
STRRCE2.WORK.POS510          THU, DEC 22, 1983, 11:05 RM    PAGE  16


REJECT;
COMMENT                                                    select_menory
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  select_menory( menory );
   VALUE   menory;
   INTEGER menory;
   BEGIN & select_menory &
      hilight_on( end_menory1, end_menery_ehZ );
      pop_menu( DISPLAY_MENU );
      set_entry_ch_integer( menory, ch_men_nnbr );
   END;  & eelect_menory &
```

```
STRRCE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 RM    PAGE  17


#EJECT;
COMMENT                                                    annotate_math_op
*****************************************************************************
*
*****************************************************************************
;
SUBROUTINE annotate_math_op;                                        ENTRY;
   BEGIN & annotate_math_op &
      change_softkey( math_annotation[ entry_ch_integer(ch_math_op) -
                                       trace_math_limit
                                     ],
                      end_math,
                      2
                    );
   END;  & annotate_math_op &
```

```
STRRCE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 RR    PAGE  18


REJECT;
COMMENT                                                    select_math_op
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  eelect_math_op( op );
   VRLUE   op;
   INTEGER op;
   BEGIN & eelect_math_op &
      hilight_on( cnd_d_plus_n, cnd_d_div_n );
      eet_entry_ch_integer( op, ch_math_op );
      annotate_math_op;
      pop_menu( DISPLAY_MENU );
   END;  & eeleet_math_op &
```

```
STRRCE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 RM    PAGE  19


#EJECT;
COMMENT                                                    repaint_traces
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  repaint_traces;                                          ENTRY;
   BEGIN & repaint_traces &
      INTEGER trace_type;

      IF entry_ch_integer( ch_n_state ) = n_on THEN
         IF entry_ch_integer( ch_d_state ) = d_on THEN
            trace_type := trace_data_and_nen
         ELSE
            trace_type :* trace_nen
      ELSE & n_off and d_on (can't have both n_off and d_off) &
         IF entry_ch_integer( ch_traee_nath ) = nath_off THEN
            trace_type := trace_data
         ELSE
            traee_type := entry_ch_integer( ch_nath_op );

      partial_eet_trace_type( trace_type );

   END;  & repaint_traces &
```

```
STRACE2.WORK.PD8510          THU, DEC 22, 1983, 11:05 AM    PAGE 20


@EJECT;
COMMENT                                                    init_trace
*****************************************************************
@
*****************************************************************
;
PROCEDURE  init_trace;                                        ENTRY;
   BEGIN & init_trace &
      INTEGER array_num,
              trace_type;

      nan_off;
      data_off;

      FOR array_num  := 1 UNTIL last_array DO
         BEGIN & for &
            memory_addr[array_num ] := 0;                  & DEBUG &
            memory_numb[array_num ] := 0;
            memory_user[array_num ] := 0;
         END;  & for &

      annotate_math_op;
      repaint_trace@;

   END;  & init_trace &

@FILE fdiap.Work;

END$
```

```
STRIGTBL.UORK.PD8510         IHU, DEC 22, 1983, 11:05 AM    PAGE  1


M68KL,P,"trigtbl"  BEGIN

 EXTERNAL  DOUBLE ARRAY sine_cos.L[0:1024];   &uord access in diap ran&
 EXTERNAL INTEGER BDDFR;

 DOUBLE SINTH=REGISTER 1, COSTH=REGISTER 2, SINDTH, COSDTH;
 INTEGER ILOOP;
 INTEGER MPTR=REGISTER 9;

 PROCEDURE save_sin_cos( val , adr );
                          VALUE val, adr; DOUBLE val; INTEGER adr;
       ASSEMBLE( MOVE.W adr, R5;       RDD.U  R5, R5;     RDD.W R5,R5;
            LEA sine_cos.L,R11;     RDD.U  R5,R11;
            SURP R0;                MOVE.W R0,(R11)+        ;
            SURP R0;                MOVE.U R0,(R11)        );

 SUBROUTINE sin_cos_iter;
  BEGIN
  FOR ILOOP:=1 TO 255 DO
     BEGIN ASSEMBLE(
       LEA MODFR, MPTR;
       MOVE.L COSDTH, (R9)+;
       ROVE.L SINTH,  (R9)+;
       MOVE.L COSIH,  (R9)+;
       MOVE.L COSTH,  (R9)+;
       MOVE.L SINTH,  (M9)+);
     SINTH:*SINTH+Z08000; IF OVERFLOU THEM SINTH:=Z7FFF0000;
     COSIH:=CUSTH+Z08000; IF OVERFLOU THEM COSTH:=Z7FFF0000;
     RSSEMBLE(
       SURP COSTH;
       ROVE COSTH, SINTH);
     save_sin_cos( SINTH , ILOOP );
     RSSERBLE(
       MOVE.L (R9)+, SINTH;
       MOVE.L (R9)+; COSIH;
       ROVE.L SINDTH, (R9)+;
       ADD.L  (R9)+, SINTH;
       SUB.L  (R9)+, COSIH);
     END;
  END sin_cos_iter;

 SUBROUTINE init_trig; ENTRY;
 BEGIN
  SINTH:=SINDTH:=13176712;
  COSIH:=COSDTH:=214744322S;
  sin_cos_iter;
  FOR ILOOP:=1 STEP 1 UNTIL 255 DO
      BEGIN
      COSIH:=sine_cos[ILOOP];
      RSSEMBLE(SURP COSTH; NEG COSTH);
      save_sin_cos( COSTH , ILOOP + 256 );
      BSSEMBLE(SURP COSIH; NEG COSTH);
      save_sin_cos( COSTH , ILOOP + 512 );
      RSSEMBLE(SURP COSIH; NEG COSIH);
      save_sin_cos( COSTH , ILOOP + 768 );
```

```
STRIGTBL.WORK.PD8510         THU, DEC 22, 1983, 11:05 AM    PAGE  2


      END;
   save_sin_cos( Z00007FFF ,    0 );
   save_sin_cos( Z00007FFF , 1024 );
   save_sin_cos( Z7FFF0000 ,  256 );
   save_sin_cos( Z00008000 ,  512 );
   save_sin_cos( Z80000000 ,  768 );
  END build_trig;
END$
```

```
FUNRT.UORK.PD8510            THU, DEC 22, 1983, 11:05 AM    PAGE  1
```

SUMM1.WORK.PD8510 THU, DEC 22, 1983, 11:05 AM PAGE 1

SUMM1.WORK.PD8510 THU, DEC 22, 1983, 11:05 AM PAGE 2

CUTIL.WORK.PD8510 THU, DEC 22, 1983, 11:06 PM PAGE 1

```
BYTE CONSTANT
  macro_char :=  '?;
```

FUTIL.WORK.PD8510 THU, DEC 22, 1983, 11:06 AM PAGE 1

```
$FILE cmessage.work;
$FILE futil3.work;
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 AM     PAGE  1


A68KL,P,"util"
BEGIN

%FILE cutil.work;
%FILE cids.work;
%FILE fscreen.work;
%FILE ftopnisc.work;
%FILE fpubib.work;
%FILE cpubib.work;
%FILE foutib.work;                          & for urt_pubib_string &
%FILE cmsgnbn.work;                      & for bubble failure messages &
%FILE cmessag2.work;
%FILE cdebug.work;                                        & DESUG &
%FILE ftcrm.work;                                         & DESUG &
%FILE falphas.work;
%FILE fstring.work;
%FILE ffnt.work;



INTEGER CONSTANT tell_severity  := 0,
                 warn_severity  := 1,
                 fatal_severity := 2,
                 null_severity  := -1,
                 macro_mode     := -1,
                 string_size    := 60;
DOUBLE  CONSTANT error_format   := Z27000500;

INTEGER  prior_severity,
         held_severity,
         held_message;

RLPHR macro_msg;
BYTE ARRAY macro_str [0:string_size];

%LPHA TABLE prefix :=
   " ",
   "CBUTION: ",
   "ERROR: ";
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 AM     PAGE  2

%EJECT;
COMMENT                                                              util
.....................................................................
.
. This module defines the following utility procedures.
.    tell
.    warn
.    fatal
.
.....................................................................
;
PROCEDURE  print_message( message_number, severity );
  VALUE   message_number, severity;
  INTEGER message_number, severity;
  BEGIN & print_message &
     IF ( (severity > prior_severity) OR
          (message_number = null_message)
        ) THEN
        BEGIN & if &
           IF severity > tell_severity THEN
              prior_severity := severity
           ELSE
              prior_severity := null_severity;
           held_severity := severity;
           clear_string(error);
           append_string(error, prefix[severity]);
           IF message_number <> macro_mode THEN
              BEGIN
                 held_message := message_number;
                 macro_msg := ADRS(byte_list) + message_number;
              END;
           append_string(error, macro_msg);
           print_string( error, error_size, error_display );
        END;  & if &
     IF message_debug THEN                                    & DEBUG &
        BEGIN & if &                                          & DEBUG &
           UNEX( message_number );                            & DEBUG &
           clear_string(error);                               & DEBUG &
           append_string(error, prefix[severity]);            & DEBUG &
           IF message_number <> macro_mode THEN               & DEBUG &
             macro_msg := ADRS(byte_list) + message_number;   & DEBUG &
           append_string(error, macro_msg);                   & DEBUG &
           USTR( error );                                     & DEBUG &
           CRLF;                                              & DEBUG &
        END;  & if &                                          & DEBUG &
  END;  & print_message &
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 AM     PAGE  3


%EJECT;
PROCEDURE get_macro(macro_insert, message_number, severity);
  VALUE   macro_insert, message_number, severity;
  RLPHA   macro_insert;
  INTEGER message_number, severity;
  BEGIN & get_macro &
     INTEGER lgth, lgth2,
             i = REGISTER 6;
     BYTE POINTER str1,
                  str2 = macro_insert;

     IF severity > prior_severity THEN   & update message number held &
        held_message := message_number;
     macro_msg := ADRS(macro_str);
     STPNTR(str1, ADRS(byte_list) + message_number);
     & check for string overflows in original and macro strings &
     lgth := (IF str1 > string_size THEN string_size ELSE str1);
     lgth2:= (IF (lgth+str2) > string_size THEN (string_size-lgth)
                                           ELSE str2);
     i := 0;
     DO i:=i+1 UNTIL ((str1[i] = macro_char) OR (i = lgth))
        ;
     MOVE macro_str := str1, +(i+1); & copy to macro char or str1 end &
     IF (str1[i] = macro_char) AND (lgth2 > 0) THEN
        BEGIN
           MOVE macro_str[i] := str2[1], +(lgth2);
                                          & insert macro string &
           MOVE macro_str[i+str2]:= str1[i+1],+(lgth-i);
                                          & copy rest of string &
           macro_str := lgth + lgth2 - 1;  & set new string lgth &
        END;                            & -1 accounts for macro char &
     print_message (macro_mode, severity);
     IF severity = warn_severity THEN
        BEGIN
          beep(error_tone);
          set_serial_poll( problem_srq );
        END;
  END;  & get_macro &
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 AM     PAGE  4


%EJECT;
COMMENT                                                              tell
**********************************************************************
*
* EXTERNAL SPECIFICATION FOR tell
*
* FUNCTION: To print a message to the user.  The message displayed
*           is specified by the message parameter declared in file
*           "cmessage".
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  message      the message to be displayed (index from file
*                         "cmessage").
*
*    OUTPUT: none
*
* USAGE:
*    %FILE cmessage.
*    tell( calibration_prompt ).
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
**********************************************************************
*
* LOGIC INFORMATION FOR tell
*
* INITIAL REFINEMENT:
*    print message
*
**********************************************************************
;
PROCEDURE tell( message_number );
  VALUE   message_number;
  INTEGER message_number;                                      ENTRY;
  BEGIN & tell &
     print_message( message_number, tell_severity );
  END; & tell &


PROCEDURE  macro_tell( message_number, macro_number);
  VALUE   message_number, macro_number;
  INTEGER message_number, macro_number;                        ENTRY;
     BEGIN & macro_tell &
        get_macro( ADRS(byte_list) + macro_number,
                   message_number,
                   tell_severity);
     END;  & macro_tell &


PROCEDURE  compute_tell( string, message_number );
  VALUE   string, message_number;
  ALPHA   string;
  INTEGER message_number;                                      ENTRY;
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 RM    PAGE  5

   BEGIN & compute_tell &
      get_nacro(string, message_number, tell_severity);
   END;  & compute_tell &


PROCEDURE  acknowledge(message_number);
   VALUE   message_number;
   INTEGER message_number;                                    ENTRY
   BEGIN
      tell(message_number);
      beep(done_tone);
   END aknouledge;
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 RM    PAGE  6

REJECT;
COMMENT                                                              warn
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR warn
*
* FUNCTION
*    Identical to "tell" except "WARNING: " is prefixed to the selected
* message. The maximum message length is reduced by 9 characters since
* the "WARNING: " has to fit in the same space.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  message      the message to be displayed.
*
*    OUTPUT: none
*
* USAGE:
*    RFILE cmessage.
*    warn( no_tape_in_drive ).
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
*************************************************************************
*
* LOGIC INFORMATION FOR warn
*
* INTIAL REFINEMENT:
*    prefix "WARNING: " to the message
*    display message
*
*************************************************************************
;
PROCEDURE warn(message_number);
   VALUE   message_number;
   INTEGER message_number;                                    ENTRY;
      BEGIN & warn &
         beep(error_tone);
         print_message(message_number, warn_severity);
         set_serial_poll( problem_srq );
      END;  & warn &


PROCEDURE  macro_warn(message_number, macro_number);
   VALUE   message_number, macro_number;
   INTEGER message_number, macro_number;                      ENTRY;
   BEGIN & macro_warn &
      get_macro( ADRS(byte_list)+macro_number,
                 message_number,
                 warn_severity);
   END;  & macro_warn &


PROCEDURE  compute_warn(string, message_number);
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 RM    PAGE  7

   VALUE   string, message_number;
   ALPHA   string;
   INTEGER message_number;                                    ENTRY;
   BEGIN & compute_warn &
      get_nacro (string, message_number, warn_severity);
   END;  & compute_warn &
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 RM    PAGE  8

REJECT;
COMMENT                                                              fatal
*************************************************************************
*
* EXTERNAL SPECIFICATION FOR fatal
*
* FUNCTION
*    Identical to "tell" except "ERROR: " is prefixed to the selected
* message. The maximum message length is reduced by 7 characters since
* the "ERROR: " has to fit in the same space.  The "fatal" function
* also prints the address for the calling routine and causes the
* processor to hang.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  message      the message to be displayed.
*
*    OUTPUT: none
*
* USAGE:
*    RFILE cmessage.
*    fatal( phase_lock_error ).
*
* EXTERNAL EFFECTS:
*
* COMMENTS:
*
*************************************************************************
*
* LOGIC INFORMATION FOR fatal
*
* INTIAL REFINEMENT:
*    prefix "ERROR: " to the message
*    display message
*    display calling routine's address
*    cause the processor to hang (repeating memory refreshes)
*
*************************************************************************
;
PROCEDURE fatal( message_number );
   VALUE   message_number;
   INTEGER message_number;                                    ENTRY;
   BEGIN & fatal &

      COMMENT
        Check for error message numbers that could occur on power up
        prior to loading message strings from bubble to RAM since bubble
        may be trashed by them;
      IF (message_number = un_init_nbr) OR
         (message_number = bubble_init_error) THEN
        BEGIN
          IF (held_message := message_number) = un_init_nbr THEN
            macro_msg := "UNINITIALIZED DATA"
          ELSE
            macro_msg := "UNABLE TO SAVE/RECALL DATA";
          message_number := macro_mode;
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 RM     PAGE  9


        END;

      beep(error_tone);
      print_message( message_number, fatal_severity );
      set_serial_poll( problem_srq );
hang: TRAP(refresh_vctr);              & refresh in case interrupts off&
      GO TO hang;                      & so nothing happens to message &
                                       &   until it can be read.       &
   END; & fatal &
```

```
SUTIL.UORK.PD8510              THU, DEC 22, 1983, 11:06 RM     PAGE  10


NEJECT;
COMMENT                                                        clear_message
*****************************************************************************
*
* EXTERNRL SPECIFICATION FOR clear_message
*
* FUNCTION: To clear a message from the screen.  The message currently
*           displayed will be cleared if it is the same as the specified
*           message.
*
* PRRAMETER DESCRIPTION:
*
*    INPUT:  message      the message to be cleared (index from file
*                         "cmessage").
*
*    OUTPUT: none
*
* USAGE:
*    #FILE cmessage.
*    clear_message( calibration_prompt ).
*
* EXTERNRL EFFECTS:
*
* COMMENTS:
*
*****************************************************************************
*
* LOGIC INFORMATION FOR clear_message
*
* INITIAL REFINEMENT:
*    IF message_number = held_message THEN
*       tell( null_message ).
*
*****************************************************************************
;
PROCEDURE clear_message( message_number );
   VRLUE   message_number;
   INTEGER message_number;                                      ENTRY;
   BEGIN & clear_message &
      IF ( (message_number = held_message) OR
           (message_number = all_messages)
         ) THEN
         tell( null_message );
   END; & clear_message &
```

```
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NEJECT;
COMMENT                                                        output_error
*****************************************************************************
*
*****************************************************************************
;
PROCEDURE  output_error;                                       ENTRY;
   BEGIN & output_error &
      BYTE ARRAY output_array[-1:string_size];
      RLPNR      output_string;
      BYTE       fmt;
      & initialize string &
      output_string := RDRS( output_array );
      output_string := init_string( output_string, string_size );
      append_ch( format_integer( held_message,
                                 output_string,
                                 error_format
                               ),
                 ',
               );
      append_ch( output_string, '" );
      append_string( output_string, prefix[held_severity] );
      append_string( output_string, macro_msg );
      append_ch( output_string, '" );
      append_ch( output_string, newline );
      wrt_pubib_string( output_string );
      tell( null_message );         & clear message and "held_" values &
   END;  & output_error &


SUBROUTINE init_message;                                       ENTRY;
   BEGIN
      prior_severity := null_severity;
      held_severity := tell_severity;
      held_message := null_message;
      macro_msg := RDRS(byte_list)+null_message;
   END;

END$
```

```
FUTIL2.UORK.PD8510             THU, DEC 22, 1983, 11:06 AM     PAGE  1


COMMENT  must be used with either cmessage or futil for message_number;

PROCEDURE  fatal( message_number );
   VRLUE   message_number;
   INTEGER message_number;                                     EXTERNRL;
PROCEDURE clear_message( message_number );
   VRLUE   message_number;
   INTEGER message_number;                                     EXTERNAL;
PROCEDURE  output_error;                                       EXTERNAL;
```

```
FUTIL3.UORK.PDS510          THU, DEC 22, 1983, 11:06 BM     PAGE  1


PROCEDURE  tell( message_number );
   VALUE   message_number;
   INTEGER message_number;                                  EXTERNAL;
PROCEDURE  warn( message_number );
   VALUE   message_number;
   INTEGER message_number;                                  EXTERNAL;
PROCEDURE  acknowledge(message_number);
  VALUE    message_number;
  INTEGER  message_number;                                  EXTERNAL;
```

```
FUTIL4.UORK.PD8510          THU, DEC 22, 1983, 11:06 AM     PAGE  1

$FILE cutil.work;

PROCEDURE macro_tell ( message_number, macro_number);
   VALUE message_number, macro_number;
   INTEGER message_number, macro_number;                    EXTERNAL;

PROCEDURE compute_tell ( string, message_number );
   VALUE   string, message_number;
   ALPHA   string;
   INTEGER message_number;                                  EXTERNAL;

PROCEDURE macro_warn (message_number, macro_number);
  VALUE    message_number, macro_number;
  INTEGER message_number, macro_number;                     EXTERNAL;

PROCEDURE compute_warn (string, message_number);
  VALUE    string, message_number;
  ALPHA    string;
  INTEGER message_number;                                   EXTERNAL;
```

```
OUTPUT0.UORK.PDS510         THU, DEC 22, 1983, 11:06 AM     PAGE  1


$RAM$       000100
sup_an      000108
TwoPi       000112
Pi          000116
Pi2         00011A
Pi4         00011E
Pi8         000122
Sqrt2       000126
deg_to_rads 00012A
speed_of_lig00012E
speed_of_lig000132
$DRIES      00032A
ch_dp_ptrs  000456
type_of_crat0004AS
e_coeff     00066A
cpx_1       000692
time_wind   000786
cnd_if_gain 0008EC
cnd_if_port 000SF2
File_type   000920
title_size2 000BES
entry_size2 000BEA
function_siz000AEC
entry_aux_si000BEE
title_displs000BF0
entry_displa000AF2
entry2_dispi000AF4
Function_dis000AF6
entry_aux_di000AFS
1EMI        000EBE
TUDX        000FF6
EXP         0010C2
SIN         001006
COS         00117E
RTAN        00121A
BESI        00129C
exp_cmplx   001316
LOG2        00137C
NEG1        001430
RNEG1       00143A
RDD1A       00144C
RDD1G       001452
RDD1M       001458
RDD1T       00145E
RDD1        001462
SUB1A       001474
SUB1G       00147E
SUB1M       001480
SUS1T       001486
S6R1A       00148C
SBR1G       001492
SBR1M       C01498
S6R1T       00149E
SSR1        0014A6
SUB1        0014AA
```

```
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MPY1A       0014BC
BPY1G       0014C2
MPY1M       0014CS
MPY1T       0014CE
MPY1        0014D2
exp_overflou00150A
DIV1A       001518
DIV1G       00151E
DIV1M       001524
DIV1T       00152B
DVR1B       001530
DVR1G       001536
DVR1M       00153C
DVR1T       001542
DVR1        001546
DIV1        00154B
CNV2E       00158C
CNV1E_ssve  0015BM
CNV1E       0015C6
fetch_CNVE1 001642
CNVE1       001646
CNVe1       001648
CNVE20_1    001E56
copy_user3  001670
BPYE_ptrs   00169E
MPYE        001680
BPYE_ptr    0016BE
RODE        0016DE
RODE_ptr    0016EE
SBRE        00171C
SBRE_ptr    001722
SUSE        001728
SUBE_ptr    001736
DVRE        001744
DVRE_ptr    00174E
DIVE        001788
DIVE_ptr    001792
RBS2        0017A0
NEG2        0017B4
RRBS2       0017BC
RNEG2       0017C0
BPY2I       0017C8
BPY2M       0017CE
MPY2G       0017D4
BPY2R       0017DR
hPY2        0017DE
RDD21       0018OR
RDD2M       001810
RDD2G       001816
RDD2R       00181C
BDD2        001820
SUB2T       001662
SUB2M       001868
SUB2G       00186E
SUS2B       001874
S8R21       00187R
```

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```
SBR2M       001880
88R2G       001866
SBR2M       00188C
8AR2        001890
8UB2        001892
CMP2T       001898
CMP2M       00189E
CMP2G       0018A4
CMP2A       0018AA
CPR2T       0018A0
CPR2M       0018A6
CPR2G       0018AC
CPR2A       0018C2
CPR2        0018C6
CMP2        0018C8
MOD2G       001800
MOD2M       001806
MOD2        0018DE
DIV2T       0018F4
DIV2M       0018FA
DIV2G       001900
DIV2A       001906
DVR2T       00190C
DVR2M       001912
DVR2G       001918
DVR2A       00191E
DVR2        001922
DIV2        001924
CMV13       0019CE
CMV15       0019CE
CMV23       0019CE
CMV25       0019CE
CRV52       001R02
CMV42       001R04
CRV51       001R08
CRV41       001R0A
CMV31       001R0C
CMV32       001R0E
CRV14       001R20
CMV24       001R20
MPY3T       001R40
MPY3M       001R46
MPY3G       001R4C
MPY3A       001R62
MPY3        001R66
RPY3L       001R64
MBSA        001RAA
MEGA        001RAE
CMPAA       001RB4
EMPAG       001RB8
CMPAM       001RBC
CMPAT       001RC0
CPRAA       001RC4
CPRAG       001RC8
CPRAM       001RCC
CPRAT       001RD0
```

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```
CPRA        001RD2
CMPA        001RD6
LDRAT       001REC
LDRAA       001E00
LDRAG       001b14
LDRAM       001R28
MPY9        001R3E
DIV9        001RC8
MPYAA       001054
MPYAG       00105R
MPYAM       001060
MPYAT       001066
MPYA        001D6A
OIVMM       001D74
DIVAG       001D7A
OIVAM       001D80
OIVAT       001D86
DIVA        001D8A
DVRAA       001D8E
DVRAG       001D94
DVRAM       001D9A
DVRAI       001DA0
DVRA        001DA4
CMV5A       001DAC
CMV4A       001DAE
CMV3A       001DA0
CMVA3       001DA8
CMVAA       001DB8
CMVA5       001DB8
CMV2A       001DAC
CMVA2       001E10
MOO3G       001E38
MOO3M       001E3E
MOO3        001E40
LDR2T       001E48
LDR2M       001E5A
LDR2G       001E6E
LDR2A       001E80
OIV3T       001E92
OTV3M       001E96
OIV3G       001E9A
DIV3A       001E9E
DVR3T       001ER2
DVR3M       001ER6
DVR3G       001EAA
DVR3A       001EAE
DVR3        001EB0
DIV3        001ER2
DIV3L       001EF0
DIV3A       001F1A
8DRT        001F30
CASE        001F90
urt_disp_qua001FP8
urt_disp_db1001FA8
urt_disp_rea001FA8
urt_disp_int001FAE
```

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```
urt_disp_byt001FC4
urt_disp_str001FEC
preenpt     0020A0
send        0020AE
welt        0020EE
auaited     002130
pending     002148
uaitio      002160
acquire     002194
conditionsl_002216e
release     00224C
delay       00228E
pause       0022F6
terminate   0023A4
abort       0023C0
run         0023E0
create      00245E
signal_init 00251E
resource_ini002540
intrpt_botto00255E
intrpt_rpg  002594
intrpt_top_k002ECA
intrpt_uart 002600
intrpt_priv_002636
intrpt_delay00265C
intrpt_tick 0026AE
init_kernel 002712
snapshot    00284A
init_fifo   0029DC
urite_fifo  002A2E
read_fifo   002AAC
enpty_fifo  002A3E
drau        002A72
xdrau       0029A0
ydrau       002A0B
nove        002C00
nove2       002C40
novech      002CE6
novech2     002CRE
plot        002C04
printch     002D26
crlf        002D54
lb          002D80
setattribute002DD8
jnp         002E04
jsr         002E2C
rts         002E54
dg_urite    002E84
dg_read     002EA6
dg_read_xy  002ECA
print_hex   002EFE
dg_hex      002F2A
init_display002F74
clear_displa002FE2
irint       002FFC
iradr       00308A
```

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```
irrdy       0030E4
iren        0030EC
irdis       0030F4
irclr       0030FC
irset       003104
irack       00310C
irirr       003120
clear_string003130
init_string 003136
append_ch   003146
append_strin003176
CMV92       0031A2
CMV9A       003414
format_integ0036EC
format_doubl0036EE
format_quad 003736
format_real 00376A
format_3_cnp00378C
bad_of_int  003b70
UCMAR       003E28
U8TR        003E4E
CRLF        003E68
UMUM        003E80
MOUAD       003EA2
UREAL       003EC8
UCPh        003EEE
UMex        003F10
UMEX        003F52
RCMAR       003F6E
lrmit_quad  003F86
select_activ00420C
aelect_activ004706
enter_active0047EC
rpg_entry   00541A
step_entry  005732
keypad_entry0059F2
narker_value005AF4
narker_to   005988
auto_scale  005C02
output_activ005EAA
output_ident005F1A
init_active 005F68
ch_integer  005FFC
ch_real     006062
ch_quad     00E0EA
ch_double   006164
acquisition_0061DA
acquisition_0061EC1
acquisition_0061FEd
acquisition_006210b
entry_ch_int006222
entry_ch_rea006234
entry_ch_qua006246
entry_ch_dou006258
set_ch_integ006206
set_ch_doubl00634E
```

```
aet_eh_real 006302
eat_entry_ch0063F0e
aet_entry_ch0064Ore
eet_ch_quae 006424
eet_entry_eh0064R8
aet_entry_ch0064C4
aelect_coupl0064E2
coupled_ch  0065A0
partial_sele0065BRr
reiect_entry0065CC
select_acqui006674_
init_eh_tebi$066BC
aet_etinulue0067DC
update_etart00691C
ucdate_atart006930
update_cente00696C
enter_freque0069PAt
frequency_at0068KH
entry_freque006C8E
enlry_etinul006CB8p
goint_at_ch_006DC8
gcint_at_fre006DF8
atep_etimulu006E14
aet_aux_out 006E24
art_priv_ib_006E58_
init_eource 006EB4
inil_ch_atin006F8R
preset_eourc006FRH
init_stiauli006FCR
reset_acquia0070MOd
partial_aau_007566
aeu_stsp_aie007720
eet_up_paraw007744
aet_dp_ptre 007888
idit_group_c00799E_
init_control007R38b
init_nbn    007888
test_nbn    007876
parma_nbn   007N7E
sct_edd_nbn 007886
etatue_nbn  00788E
read_nbn    007P96
urt_nbn     007P9E
read_boot_nb007885
urt_boot_nbw007AAE
TP1NT       007888
TP8T        0078C0
TPErr       0078C6
AEU         0078CC
TPMED       D078D2
TPUAT       0078D8
1Ngap       007ADE
TPready     007AE4
TPnark      007AEB
TPaeek      007AF0
TPrecord    007AF6
```



```
update_dawa1007908
partial_act_007838
procll      007CD6
nark0       007E5C
eet_vere_atr00806E
frequency_et008084
data_proc_ch008DC8
data_proc_ch008106
ruset_4ata_p008172
control_data00817Cf
eontrol_deta008358
update_data_008586
log_iin_ang 008688
nin_nax     008718
beep        0087E2
init_top_nie00882E
uart_proceee00885C
init_keyeear008886
top_key     0088C0
keyboard    00896E
got_nunber  0089FH
init_botton_008C1A
botton_key  008C30
reset_rpg   008CE0
rpg         008002
botton_box  008946
init_output 008E3E
pub_ib_outpu008F8Rc
pub_ib_farma008FA4c
pub_ib_outpu008FB2
pub_ib_input0081FEt
pub_ib_input009212
proc0       00836C
abort_sweep 009A42
restart_swee009AAA
measurement_009BB8t
hold_sweep  009ARE
single_sweep009ACA
centinuous_e009ADA
n_eweep     009AEA
control     009F74
init_public_00A0A5o
paroer      00A30C
print_etring00A8A4
print_big_et00A81E
blank_displ a00ABBA
onable_displ00ABCE
init_ecreen 00A602
update_hpib_00A036
set_najor_ed00AD84
eet_ninor_ad00A072
eet_serial_p00A084
clear_aerial00AE5C
request_naek00AE82
input_block 00833C
pass_thru_co00845E
```



```
local_bey   00B882
hpib_lietene00B918
list_op_pira00C188
liat_op_para00C22A
next_op_para00C23E
liat_aya_par00C246
liat_trace_v00C2F6
string_out_e00C4CE
urt_pubib_et00C57C
next_xfer_re00C5F6
output_block00CAA8
output_statu00CBA8
output_tapc 00CCCE
hpib_talker 00CCE8
releaae_nen 00CDE6
annotate_nat00D412
repaint_trae00D45C
init_trace  00D4BC
proc8       0004FE
graticule_ty00D67A
partial_trac000FB8g
trace_and_gr00C270
init_gratic 00E298
get_freguenc00E324
disable_phae00E380_
check_abort 00E3FA
break_entry_00E8041
break_acq_co00EB46
coupled_bree00E85E
init_break  00E330
maintain_aae00E970
etep_eource 00E082
phaae_lock  00EE42
trigger_yadc00EE4E
break_idle  00EE78
break_gaueed00EE8B
intrpt_yadc 00EF02
init_yadc   00F128
control_yadc00F164
aet_if_gain 00F238
init_auto_ra00F244
check_everlo00F266
auto_ranging00F280
control_rece00F326
ealib_yadc  00F0E0
correct_tabl00FEBA
conv_table  00FE8E
nath_table  00FECE
fnt_Table   00FEE2
update_table00FF12
conv_to_z   00FF8E
conv_to_y   00FFC4
conv_to_reci00FFC6
logE        00FFD6
engE        010048
nagE        010150
```



```
array_corree01018E
array_elec_l0101F0
eonpute_data01022E
update_d_loo0102AA
dec_snoothin01030A
one_port_cor0104B2
two_port_cor0104CE
nachine_dunp010612
neu_data    010604
gen_cal_info010A12
gen_eave_nen010BBA
gen_laet_reg010D32
eave_laet_et010D3C
eave        010086
recall      010084
recall_preee010DB4e
recall_power010E02a
proc1       010E58
cal_eize    01104E
restore_pare011090
deallocate_c01109C
partial_allo01112Ca
init_correct01118B
cal_acquisit011FAAn
acquire_data011FDA
proc7       012082
clear_paran_0123A2
correction_p012406
correction_p012616
paran_corree012654h
eave_cal    012680
init_cal0   01278E
rocall_gfr  0127EE
configure   012920
glow_teet_ee0129CC
device_rever0129DC
eet_teet_eet012A32
build_test_p012B64
preset_teet_012F16
tdr_check   013204
control_deta01335A
eyc_frac    013368
user3_zero  013590
array_datap 013FAA
eet_ceupled_01412E
init_coupled014182e
init_user_gr01421E
perae_user_g01453E
annotate_par0146CA
annotate_pkr014724
annotate_ref014A5E
annotate_sca014B0A
update_scale014B04
update_ref_v014BF8
annotate_enh014C1Cn
set_xadc_ate01408A
```

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force_trig_y014DC4
reset_xadc 014OF8
init_xadc 014E10
array_update014E68
init_array_u014F74
packed_sin_c014F98
intersect_an014FEA
arc 01509C
r_circle 015252
w_circle 01538A
do_recall 0155F6
Hilight_last0157DC
hilight_last0157ECn
select_cal_k0157FC
update_kit_101584E
init_stds 01586E
std_id 0158E0
etd_class_e10159C6
set_elenent 015A4A
annotate_std015AB2
eet_std_cla015AF0
etd_neaeured015C0E
freqoency_co015CEC
standard_spe015E8B
proc12 015F06
fet_trig_lon01b0CC
fet_trig 0160D0
fet_eqrt 016106
proc3 016170
init_token_f016246
command 01627A
mou_if_gain 01647E
meu_if_gain_0164EA
meu_paranete016556E
proc5 016654
total_delay 016876
if_average_o01698A
if_average_o0169B2
display_wnoo0169D4
display_wnoo0169F8o
init_retract016A1E
retrace 016A34
nark1 016A4A
select_titlef08004
urite_title F08050
enter_title_F0807A
proc10 F08118
reset_firnt_F08270
put_update_nf0836E
select_plot_F08EFE
output_plot F08F8C
documentatiof09020
proc2 F09056
display_fronF09264
ch_partial F093DE
partial F09448

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annotate_refF09458i
annotate_natF0960An
nark_dg_baseF09800
nark_dg_top F0E15C
nark_stack F0F544
nentop F0F544
nenbotton F1EA7A
sine_cos F1EA7C
cal_kit_arraF1FA80
tracel_base F21276
tracel_n_basF218EC
trace2_base F23188
trace2_n_basF237F6
nbn_prgn_etaF9FC00
directory_ofFF807B
valid_dirnctFFB1FE
list_directoFF825C
init FF85A2
scan_directoFF8640
delete_file FF86A0
undelete_FilFF876C
record_file FF8840
restore_fileFF884C
init_tape_ngFF9286
reset_nenoryFF9544
requcst_nenoFF970C
request_arraFF987G
release_nenoFF98EA
release_arraFF99F8
release_auxiFF9A2An
nenory_etoleFF9A9A
urt_nbn_ok FF9BEC
bubble_ok FF9C46
get_start_pgFF9CFE
update_nbn_dFF9E8A
clear_cal FFA1CA
cal_seg_sizeFFA2A2
cal_oeg_avaiFFA2EA
ok_to_save_cFFA316
save_data FFA436
record_data FFA62A
read_data_heFFA844
recail_data FFA87A
restore_dataFFA9CE
load_dg_dataFFAA74
recall_lunplFFAB7A
save_lunplusFFABDE
init_save_reFFABFA
highlignt_neFFAE2E
blank_softkeFFAF2B
kill_softkeyFFAF7B
init_softkeyFFAFA4
change_softkFFAFC2
hilight_off FFB03A
hilight_connFF915A
hilight_connFFB236k

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hilight_on FFB240
hilight_key FFB258
gen_nenu FFB27A
processi_softFFB54A
previcus_nenFFB588
pop_nenu FF85EC
get_priv_ib_FFB81C
set_priv_ib_FF8832
reset_priv_iFFB85Cf
clr_priv_ib FFB880
trig_priv_ibFFB89E
eet_ren_privFFB8BC
clr_ren_privFFB8DC
poll_priv_ibFFB984
intrpt_priv_FFBA7A
init_priv_ibFFBB34
urt_priv_ib FFBCA4
urt_priv_ib_FFBD02
read_priv_ibFFBD1A
syntax_checkFFBD98i
priv_ib_srq FF9E04
init_sup_brkFFBED8
update_stinuFFBF82e
proc4 FFC274
annotate_stiFFC3F6
tell FFC966
nacro_tell FFC978
conpute_tellFFC99E
acknouleoge FFC9B8
uarn FFC9CC
nacro_uarn FFC9F4
compute_uarnFFCA1A
fatal FFCA34
clear_nessagFFCA8E
output_errorFFCAAA
init_nessageFFCB36
ifft FFCB9E
fft FFCBAE
fftun FFCCE6
get_active FFCE86
ch_active_suFFCERO
active_suffiFFCEC8
ch_active_foFFCED8
active_fornaFFCF2C
active_limitFFCF3C
set_active_1FFCF9E
init_trig FFDOA6
annotate_forFFD170
neu_fornat_pFF01C8
neu_fornat FFD1F2
proc6 FFD248
nunber_of_poFFD2CE
array_size FFD2DC
block_size FFD2EA
select_narkeFFD342
select_ref_nFFD3BC

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narker_pointFFD4F4
ch_narker_vaFFD54E
narker_valueFFD592
ch_nkr_valueFFD5A2
nkr_value FFD606
nkr_stinuiusFFD614
nkr_etinulusFFD654
put_narker FFD686
partial_updaFFD850
update_narksFFD888
init_narkersFFD898
proc9 FFD8FC
nark3 FF09FC
plot_to_hpibFF0A96
char_index FFDAC.
active_narkeFFDACP
source_pointFFDB20
valid_priv_1FFDB24
fifo_sup_brkFFDB82
nenu_level FFDB8E
level_info FFDB90
nbn_dir FFDC1A
directory_woFFDE96
tape_uordbufFFDF5A
file_byte_cnFFE0A2
file_addressFFE0AE
directory_onFFE0D4
command_tokeFFE0D8
command_pendFFE0DA
abort_connanFFE0DC
last_class_aFFE0E2
current_etd_FFE0E4
cal_etd_addrFFE0EC
recall_type FFE276
display_on FFE27C
default_cal_FFE3F6
cal_type FFE406
cal_in_progrFFE408
cal_coeffs_aFFE40A
neasuring_stFFE40C
tape_nbn_fn FFE42C
file_nun FFE434
reg_nun FFE436
data_type FFE438
data_addr FFE43A
data_byte_cnFFE43E
data_type_stFFE442
xctrl_save FFE4B4
yadc_avg_facFFE4C6
yadc_avg_facFFE4C8
yadc_rau_nasFFE4CA
ref_overloadFFE4CC
tst_overloadFFE4CE
yadc_rau_ptrFFE4D0
yadc_rau_sigFFE404
adc_correctiFFE6D41

OUIPUIO.UORX.P08510 THU, DEC 22, 1983, 11:06 AM PAGE 15

```
test_tablee FFE3E0
ref_tablee  FFE944
trig_flag   FFE9A0
npl_fig     FFE9B1
grat1_epeca FFEA7E
grat2_epece FFEA82
outbuf_ptr  FFEA98
block_out_lgFFEA9A
outbuf      FFEA9C
byte_avail  FFEAA0
device_clearFFEAA2
aerial_poll_FFEB68
serial_poll_FFEB6A
connand_paesFFEB80
renote      FFEB82
titla_array FFEB91
title       FTEBC4
error_array FFEBC9
error       FFEBFA
function_arrFFEBFF
function    FFEC1A
entry_array FFEC1F
entry       FFEC3A
entry_flip_FFFEC3E
entry_aux_arFFEC41
entry_aux   FFEC78
block_bufferFFEC7C
group_nunberFFECA6
key_token   FFECB4
flag1_aave  FFECB6
flag2_aave  FFECB7
ch_dp_scr__OFFECB8
ch_dp_scr__1FFEEA0
ch_dp_acr__2FFF0B8
ch_dp_ptrs_OFFF270
ch_dp_ptrs_1FFF294
ch_dp_ptra_2FFF2B8
ch_dp_vara_OFFF2DC
ch_dp_vars_1FFF340
ch_dp_vare_2FFF3A4
eyeten_z0   FFF403
current_acquFFF40Cn
last_paran_aFFF40E
last_paran_aFFF410
laat_acquieiFFF41Aa
paran       FFF41B
ch          FFF423
rau_baae    FFF428
rau_pu1     FFF448
dp_rau_base FFF468
array_proceeFFF49C
rebuild     FFF49E
dunp_size   FFF4D8
aave_size   FFF4DC
laat_state_aFFF4EC
current_acquFFF4E2n
```

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```
current_entrFFF4E4
acaled      FFF4E6
log_acale_faFFF4E8i
active_functFFF4EA
active_fcn_vFFF4EC
peek_n_poke FFF4FC
rpg_algorithFFF500
atep_algoritFFF501
nkr_algorithFFF502
keypad_algorFFF503
display_formFFF504
token_fifo  FFF53E
keyboard_fiFFFF55C
public_ib_fiFFF57A
array_updateFFF598
running     FFF5AA
ready       FFF5AE
link        FFF5B0
counter     FFF526
atack_top   FFF7FC
RODCP       FFF80E
Multlnit1   FFF816
Multlnit2   FFFB1C
SUBCP       FFF81E
MPYFP       FFF82E
RODFP       FFF836
SUBFP       FFFB40
MOFA        FFFB4A
MOOFA       FFF86C
MDBFA       FFF894
XFM2P       FFF8A4
MPLDO       FFF8C8
MIMTP       FFFBD0
XFM2O       fFF8DA
MPYOI       FFF8FA
LLDRO       FFF906
LLDR2       FFF90A
LLDMY       FFF90E
RDEXP       FFF912
MPYLF       FFF514
RODLF       FFF918
SUBLF       FFF91A
DIVFP       FFF91E
MYMAM       FFF922
MDBDG       FFF926
MRLDG       FFF930
MPLDG       FFF942
MBMFT       FFF950
IFCAM       FFF976
BCPDIV      FFF992
MPYAV       FFF9A4
CPXMA       FFF9BA
MCPMP       FFF9BE
CPIMV       FFF9CC
DADLF       FFF9E0
Mbn_nisc_staFFFC00g
```

OUIPUID.UDAK.P08510 THU, DEC 22, 1983, 11:06 AM PAGE 17

```
nbn_aub_prgnFFFC00
```

FXROC.UORK.P08510 THU, DEC 22, 1983, 11:06 AM PAGE 1

```
PROCEDURE  set_xadc_etep_size(atep_size);
   VALUE   atep_size;
   IMIEGEA atep_size;                                  EXTERNAL.L;
SUBROUTINE force_trig_yadc;                            EXTERNAL.L;
```

```
SXADC.UORK.PD8510              THU, DEC 22, 1983, 11:06 AM     PAGE  1


%68KL,P,"xadc"
BEGIN

@FILE fkernel3.uork;
@FILE fbreak.uork;
@FILE fiocnfig.uork;


INTEGER CONSTANT normal_201  := %04,       & 201 points/sweep.        &
                 stop_sweep  := %10;       & Track analog sweep; Reset &
                                           & staircase and auto-zero.  &
INTEGER CONSTANT delay_1_nSec := 31,       & 32 uSec increments        &
                 min_delay    :=  0;

INTEGER CONSTANT zero       := 0;

INTEGER xnode = botton + %38,
        xadc_gn = botton + %30,
        xcnd1 = botton + %32,
        xposctr = botton + %36,
        xctr0   = botton + %3A,
        xctr1   = botton + %3C,
        xcnd2 = botton + %3E,
        pictl = botton + %7C;

EXTERNAL INTEGER sup_gn;
COMMENT
   refer to BBDOC.JT8 for more detailed definitions.
;

COMMENT
   local storage for S5102 registers with multiple functions per word.
;
INTEGER CONSTANT &for set_bb_xnode&
        force_trigger := %80, clr_trigger  := %00, trigger_mask  := %80,
        load_xctr_lwS_res := %24, clr_load_xctr := %00,
        load_xctr_with_resolution_mask := %27,   load_xctr_mask := %20,
        set_init_yadc := %00, clr_init_yadc:= %08, intt_yadc_mask:= %08;



PROCEDURE  set_xadc_step_size(new_step_size);
   VALUE   new_step_size;
   INTEGER new_step_size;                                        ENTRY;
   BEGIN & set_xadc_step_size &

      xcnd2 := ( new_step_size - 1 )  OR %10;

   END;  & set_xadc_step_size &
```



```
SXBOC.UORK.PD8510              THU, DEC 22, 1983, 11:06 AM     PAGE  2


#EJECT;

COMMENT                                                        set_bb_xnode
*****************************************************************************
*
* EXTERNAL SPECIFICATION FOR set_bb_xnode
*
* FUNCTION: Changes only the requested bits of the botton box register
*           xnode. This register (see botton boc documentation) controls
*           force trigger modes,polarity of pulse output,loading of
*           timing counters. initializing state machine,and resolution
*           of timing counters.
*           Because of the nature of the harduare, past xnode values
*           have to ORed into the new new value sent.
*
* PARAMETER DESCRIPTION:
*
*    INPUT:  xnode_value       Desired bit values to be set
*
*            xnode_mask        Bit pattern of bits to be effected
*                               1 = effect      0 = no effect
*
* USAGE:
*
*         set_bb_xnode(forced_trigger,trigger_mask)
*
* EXTERNAL EFFECTS:
*     The OUN variable uill be updated uith the lastest bit pattern.
*     The use of urong bit patterns could cause BAD effects.
*
* COMMENTS:
*
*****************************************************************************
*
* LOGIC INFORMATION FOR set_bb_xnode
*
* INTIAL REFINEMENT:
*
*
* NOTE -- for some uses it is expected that this routine takes alcast
*         11 uSecs.    ( ie setting force processor trigger )
*
*****************************************************************************
;
PROCEDURE set_bb_xnode(xnode_value,xnode_mask);
   VALUE xnode_value,xnode_mask;  INTEGER xnode_value,xnode_mask;
BEGIN
   OUN INTEGER xnode_save;

   xnode_save := TURN( xnode_save, xnode_value, xnode_mask );
   xnode := xnode_save;

END set_bb_xnode;
```

```
SXADC.UORK.PD8510              THU, DEC 22, 1983, 11:06 AM     PAGE  3


REJECT;
COMMENT
*****************************************************************************
*
* NOTE: trigger_node is set true here, it must be set false by
*       the calling routine.
*****************************************************************************
;
SUBROUTINE force_trig_yadc;                                    ENTRY;
BEGIN
   last_trigger := 0;
   trigger_node := 1;
   first_trigger:= 1;

   ASSEMBLE( MOVE SR,-(S);  ORI =H0700,SR );
   set_bb_xnode(force_trigger,trigger_mask);

    & the force trig must be cleared before the second conversion
      of a multiple trigger measure starts -- thereofore interrupts
      uill be disable to prevent a process swap / long interrupt &

   set_bb_xnode(clr_trigger,trigger_mask); &watch min pulse uidth 11u&
   ASSEMBLE(  MOVE (S)+, SR  );

END force_trig_yadc;
```

```
SXADC.UORK.PD8510              THU, DEC 22, 1983, 11:06 AM     PAGE  4


#EJECT;
SUBROUTINE reset_xadc;                                         ENTRY;
   BEGIN
      set_bb_xnode( set_init_yadc, init_yadc_mask );
      set_bb_xnode( clr_init_yadc, init_yadc_mask );
      delay( delay_1_nSec );       & allow time for YADC trig &
   END;
```

```
SXADC.WORK.PDS510              INU, DEC 22, 1983, 11:06 AM     PAGE  5


%EJECT;

PROCEDURE  init_xadc;                                          ENTRY;
   BEGIN % init_xadc %
      INTEGER xstat;

      xadc_gn:=sep_gn;

      set_bb_xnode( X04, XFF );

      reset_xadc;
      xctr0 := 200;
      xctrl := zero;

      set_bb_xnode( load_xctr_1uS_rae, load_xctr_with_raeolution_mask );
      set_bb_xnode( clr_load_xctr,     hoed_xctr_week );
      set_xadc_step_size(inormal_201);

      xstat := xpoectr;            % clear iorq by reading xposctr %
      xcndl := stop_susap;
      pictl := zero;               % 8620 interface turned off %

   END;  % init_xadc %
END$
```

```
SXMBN.WORK.PDBS10              THU, DEC 22, 1983, 11:06 AM     PAGE  1


M68KL,P,"xmbn" BEGIN USE REGISTER 0-11;

GLOBAL LABEL    parmo_mbn,eet_add_nbn, etatus_nbn  ,read_nbn, urt_nbn;
GLOBAL LABEL    test_nbn ,rmad_boot_mbn,urt_boot_nbn;
LABEL           mbn_code_entry_pt;
GLOBAL
INTEGER  nbm_sub_prgm_eel     =XFFFFFC00,
         nbn_niac_statue_reg  =&FFFFFC00,
         nbn_prgm_start_add   =&FFF9FC00;
INTEGER CONSTANT Zero:=0;

BOOLEAN SUBROUTINE init_mbn ;                                  ENTRY;
BEGIN
          & is the improper parmeter call  mismatch a problem
               or is the fact that the first parmeter is in RO OK!!!&
                    & Floating base ie tricky to tect&
                    & Caule Toggle a bit and test ???&
   IF (XC RNO mbn_niac_status_reg RNO nbm_niac_status_reg)=XC THEN
       BEGIM mbn_aub_prgm_eal:=X&2; GO TO nbm_code_entry_pt; END;
  init_nbn :=FRLSE;
END init_mbn ;

teet_nbn :    mbm_eub_prgm_eel:=X&0;  SO TO nbm_cede_entry_pt;
parme_nbn:    mbn_sub_prgm_eel:=X&3;  GO TO nbm_cede_entry_pt;
eet_add_nbn:  mbn_sub_prgm_sel;=X&4;  GO TO mbm_code_entry_pt;
atatue_nbn:   nbm_eub_prgm_oel:=X&5;  GO TO mbn_code_entry_pt;
read_nbn:     mbn_sub_prgm_sel:=X&6;  GO TO nbn_code_entry_pt;
urt_nbn:      nbm_sub_prgm_eel:=X&8;  GO TO nbn_code_entry_pt;
read_boot_nbn: nbm_eub_prgm_eal:=XSR;  GO TO mbn_code_entry_pt;
urt_boot_nbn:  nbm_eub_prgm_eel:=&8C;

nbn_cebe_entry_pt:   ASSEMBLE(JMP $nbm_prgm_start_add.L);

END$
```

```
SXT@CO.UORK.PDS510             INU, DEC 22, 1983, 11:06 AM     PAGE  1


M68KL,P,"XTACO"
BEGIN
DOUBLE TAPEVector=XG4; &Containta location of TAPEEntry&
COMMENT
##############M THE FOLLOWING IS IN THE MONITOR ##########################
**************************************************************************
* TAPEntry is a fudge routine that except to find a value on the atack
*          that aclecta one of M TACO routinea.
*
* TAPEntry DOESNOT !!!!! use the normal calling conventiona.
*
*  Stack Parm        ROUTINE
*     0          SUBROUTINE TPINT
*     1          INTEGER PROCEDURE TPST/
*     2          INTEGER SU6ROUIINE TPErr/
*     3          BOOLEAN SUBROUTINE REU/
*     a          BOOLEAN PROCEDURE 1PRED(Rdd,Len)/ VRLUE Rdd/
*                                          DOUbLE Rdd/ INIEGER Len/
*     5          bOOLEAn PROCEDURE TPURT(Rdd,Len)/ VRLUE Rdd,Len/
*                                          DOUBLE Rdd/ INTEGER Len/
*     6          bOOLEAn SUBROU(inE INgap/
*     7          BOOLEAN SUBROUTINE TPready/
*     9          BOOLEAN SUBROUTINE TPnark/
*    10          BOOLEAN PROCEDURE TFeeek(poa)/VRLUC pos/INTEGER pos/
*    11          INTEGER SUBROUTINE TPrecord/
**************************************************************************
end of conment;

GLOBAL LABEL TPINT,TPST,TPErr,REW,TPRED,TPURT;
GLOBAL LABEL INgap,TPready;
GLOBAL LABEL TPaaek,TPrecord,IPnark;
LABEL TAPEntry;

TPINT:      RSSEMBLE(   BOVE =D0,-(S);   BRA TAPEntry  );
TPST:       RSSEMBLE(   MOVE =D1,-(S);   &RR TAPEntry  );
IPErr:      RSSEMRLE(   MOVE =D2,-(S);   BRA TAPEntry  );
REW:        RSSEMBLE(   nOVE =D3,-(S);   BRA TAPEntry  );
TPRED:      RSSEMBLE(   NOVE =O4,-(S);   BRA TAPEntry  );
TPURT:      RSSEMBLE(   BOVE =D5,-(S);   BRA TAPEntry  );
INgap:      RSSEnBLE(   BOVE =D6,-(S);   BRA TAPEntry  );
TPready:    RSSERBLE(   NOVE =D7,-(S);   BRA TAPEntry  );
TPnerk:     RSSEnBLE(   BOVE =O9,-(S);   BRA TAPEntry  );
IPseek:     RSSEMBLE(   NOVE =O10,-(S);   BRA TAPEntry  );
TPrecord:   RSSEnBLE(   ROVE =D11,-(S);   bRR TAPEntry  );

1APEntry:RSSEMBLE( MOVE.L BTAPEVector,-(S);  RTS );

END$
```

```
CYADC.UORK.PD8510              THU, OEC 22, 1983, 11:06 AM     PAGE  1


NFILE caverage.work;                              & for avg_on, etc. &

COMMENT Tbeac are the valuea for the data acquisition control variables.
        The nane in brackets is the channel table index value.  Ihe
        channel table pointer ueed nuot be conaistent with the data
        type.
;
& numerator  port for ncaaurs &        & changes affect STESTSET.UORK &
INTEGER CONSTRNT   nun_b1              := 0,          & and JOELAY.UORK &
                   nun_b2              := 1,
                   nun_a2              := 2,
             &followuing are non-ratio nodes&
                   nun_e1              := 3,
                   nun_100kbz_cal      := 4,
                   num_detector_gnd    := 5,
                   nun_no_ratio        := nun_detector_gnd,
                   nun_ref_100khz_cal  := 6,
                   nun_adc_gnd         := 7,
                   nun_vcal            := &,
                   nun_vref            := 5,
                   nun_tenp1           :=10,
                   nun_tenp2           :=11,
                   nun_analog_in       :=12;

& denoninator port -- if a ratio node selected in nuneratorB
                                        & changes affect STESTSET.UORK &
INTEGER CONSTRNT   denon_b1            := 0,          & and SOELAY.WORK &
                   denon_a1            := 1,
                   denon_a2            := 2,          & 3 skipped &
                   denon_100khz_cal    := nun_100khz_cal,
                   denon_detector_gnd  := nan_detector_gnd,
                   denon_no_ratio      := denon_detector_gnd;

& driven port &
INTEGER CONSTRNT   driven_none         := 0,
                   driven_a1           := 1,
                   driven_a2           := 2;

& phaae lock port &                     & changea affect STESTSET.UORK &
INTEGER CONSTRNT   lock_to_a1          := 0,
                   lock_to_a2          := 1,
                   lock_donot_care     := 2,   & effectively a1 &
                   caling              :=-1;

& i.f. gain      &
INTEGER CONSTRNT   auto_range          := 0,
                   if_no_gain          := 1,
                   if_12db_gain        := 2,
                   if_24db_gain        := 3,
                   if_36db_gain        := 4,
                   if_45db_gain        := 5,
       & only for caling &
                   if_all_off          := 6,
                   if_1st_on           := 7,
                   if_2nd_on           := 8,
```

```
CYBDC.UORK.PDSS10              THU, DEC 22, 1983, 11:06 RM     PRGE  2


                 if_3th_on          := 9,
                 if_4th_on          :=10;
& if gain port   &
INTEGER CONSTRNT  tset_port         := 0,
                  ref_port          := 1;

INTEGER CONSTRNT  adc_cal_only      := 0,
                  adc_if_offset_cal := 1,
                  full_if_cal       := 2,
                  force_cal         := -1;
```

```
FYADC.WORK.P08510              THU, DEC 22, 1983, 11:06 AM     PRGE  1


PROCEDURE control_yadc(rau_out,average_mode,average_factor,
                       rau_ready_count,rau_ready_mask);
  VALUE  rau_out,average_mode,average_factor,rau_ready_count,
         rau_ready_mask;
  DOUBLE  rau_put,raw_ready_count;
  BYTE    average_mode;
  INTEGER average_factor,raw_ready_mask;
                                                        EXTERNAL.L;
PROCEDURE control_receiver(numerator,deneninator,phase_look_port,
                           nun_gain_range,denon_gain_range );
                  VALUE    numerator,denominator,phase_lock_port,
                           nun_gain_range,denon_gain_range ;
                  BYTE     numerator,deoominator,phase_lock_port,
                           nun_gain_range,denon_gain_range ;
                                                        EXTERNAL.L;
PROCEDURE calib_yadc(cal_level); VALUE cal_level; INTEGER cal_level;
                                                        EXTERNAL.L;
PROCEDURE init_auto_range;                              EXTERNAL.L;
PROCEDURE auto_raoging(acq_paran); VALUE acq_paran; INTEGER acq_paran;
                                                        EXTERNAL.L;
SUBROUTINE set_if_gain;                                 EXTERNAL.L;
SUBROUTINE check_overload;                              EXTERNAL.L;
#FILE cyadc.work;
```

```
SYRDC.UDRK.POS510              THU, DEC 22, 1983, 11:06 AM     PRGE  1


MG&KL,P,"yadc"
BEGIN
COMMENT
*****************************************************************************
* This file is to contain
*      1) intrpt_yadc
*      2) init_yadc
*      3) control_yadc
*      4) control_reciever
*      5) set_if_gain
*      6) calib_yadc
*
*
*  Major items to do
*      2) nake use of overlapp tines available after nultipier  GO's
*      5) computed gotos in critical paths
*      7) document !!!!!
*
*   flake the triggered node 20 bits for CU and if cal nodes --
*      includes 20 N natrix ( nay be there ) , 20 bit  averaging (done),
*       20 bit ratio , and 20 bit  store ( done ).
*   Uill probaby have to work on if cal to use 20 bits
*****************************************************************************
end of connent;

#FILE cdebug.work;                                      % DEBUG &
#FILE ftern.work;                                       & DEBUG &
#FILE ftern2.work;                                      & OEBUG &
#FILE ftern3.work;                                      & OEBUG &
#FILE futil.work;                       & for warn and several nessages &
#FILE cids.work;
#FILE crins.work;
#FILE fiocnfig.work;
#FILE fkernel3.work;
#FILE fintrpt.work;
#FILE fxadc.work;
NFILE fbreak.work;

#FILE ccontvar.work;
#FILE cyadc.work;

TYPELENGTN USER3: 6;
EXTERNAL INTEGER IFCAN, MPYAW, NYNRN, RDEXP;
EXTERNAL INTEGER ready;
COMPLEX PROCEDURE CNVE1( val); VALUE val; USER3 val;          EXTERNAL;
```

```
SYRDC.UORX.P08510              THU, DEC 22, 1983, 11:06 AM     PAGE  2


#EJECT;
BYTE CONSTRNT    set_botton_box_irq := %5S + botton_vctr;
INTEGER CONSTRNT cal_avg := 16, cal_avg_bit := 4;
DOUBLE CONSTRNT  adc_in_range := (-100 ) * cal_avg;
BYTE TABLE       phase_step :=37   ,27    ,17    ,7    ;&3 deg step&
INTEGER CONSTRNT nin_delay := 0,delay_30uS  := 1,
                 delay_60uS  := 2,   delay_100uS  := 3,
                 delay_150uS  := 5,  delay_200uS  := 6,
                 delay_250uS  := &,  delay_1_msec := 31,
                 phase_0 := 0,  phase_90 := 1,  phase_270 := 3,
                 lsb_ydac := 4,
                 cal_ctr_linit := 50, eel_ctr_linit_nax:= 200 ;

BYTE CONSTRNT byte_zero := 0,
             enable_ext_ref  :=%80, cal_sig_on  :=  34+ enable_ext_ref,
             lo_normal_phase :=20 , cal_sig_off := %40+ enable_ext_ref;
INTEGER CONSTRNT   zero := 0;

INTEGER adcY1L = botton  + %00     , adcY3L = botton  + %08,
        adcY4N = botton  + %0E,
        ydac   = botton  + %10     , adcctl = botton  + %12,
        caldac = botton  + %14     ,
        xctr0  = botton  + %3A     , xctr1  = botton  + %3C,
        tstgn  = botton  + %50     , refgn  = botton  + %5E,
        status = botton  + %7E;
BYTE    botton_byte = botton + 1 ;
BYTE    ehsel  = botton_byte  + %2C,
        tstpha = botton_byte  + %54, calpha = botton_byte  + %56,
        refpha = botton_byte  + %5A,
        tstctl = botton_byte  + %52,
        refctl = kotton_byte  + %5C;

BYTE ircnd1 = io + 1 + %92;
BYTE ARRAY tst_nen,ref_nen
                  [ first_acquisition_naran : nax_acquisition_paran ];
DOUBLE ARRAY yadc_scr[0:3];
DOUBLE  yadc_eal_ptr;
INTEGER eignal_bit_bueket;
USER3   yedc_scr_cnplx = yadc_scr;

GLOBAL  INTEGER xctrl_save;
BOOLERN cal_valid  , detector_cal_valid;
INTEGER cal_ctr,          eal_ctr_rate,       oid_cal_levei;
BYTE    yadc_ratio_mode,
        ref_nux, tst_nux ,
        ref_ctl, tst_ctl;
GLOBAL INTEGER yadc_avg_factor1, yadc_avg_factar2, yadc_rau_nask,
        ref_overload, tst_overload ;
GLOBRL OOUBLE  yadc_rau_etr, yadc_rau_signal;
```

```
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#EJECT;COMMENT
**************************yadc data structure**************************
*  adc_correction_table
*       This table provides the correction for the & bit ade readings.
*       The 2SE possible 8-bit adc values are then added to the 12bit
*       adc to provide the 19 bit result. ( the 12 bit adc is filling
*       in the gaps between the &bit adc.) The table ie 256 19 bit
*       values ( using 32_bit data type ). The 8 bit dac values range
*      fron -255 to 0.
*
*  teet_tables/ref_tables
*      These tables contain the Quad Cain Correction ( If detector )
*      The first 32 bits are the offset correction for the inag detector
*      The next  32 bite are the offeet correction for the ref  detector
*      There are then 5 block of h-natrix correction each containing
*                 16 bits    ( 1 - h11 )
*                 16 bits       h12
*                 16 bits       h21
*                 16 bits    ( 1 - h22 )          ie used negatived
*                 16 bits       exp / gain correct ( steps ef 12 db )
*          The 0 block io for no  gain stages on
*          The 1 block io for one gain stage  an   ( the first stage )
*                            ( and the individual stages while caling )
*          The 2 block io for tuo gain stages on   ( the firet tuo    )
*          The 3 block is for three gain stages on ( the first three )
*          The 4 block ie for four  gain stages on ( all stages       )
*          The 5 block is no quad correct -- none If iten ie tenperature
*
*  test_index, ref_index
*          These tables contain the indes to use in the h-natrix. The
*            orginal index cones fron the If Rnp boards telling uhat
*            gain is aet. Thie is a 4 hit pattern ( one bit for each )
*            gain stage. Thie leads to 16 possible values, but only
*            five valid and uill index into the blocks 0 - 4 of the
*            h-natrix tables.
*               Table gn_index is the vaules noved into teet/ref_index.
*          If an non If iten ( ie tenperature ) ie selected then block
*            5 uill be elected for all poeiible inputs -- no correction
*               Table null_correction is than noved into teet/ref_index.
*
*  cal_val
*         A calibration dac exists to set a test level for the 8-bit
*           adc calibration. Its exact value ie not inprotant. The
*           preeet values uill be nodified during run tine eo to speed
*           up the search the next calibration.
*           There is a setting for each bit 0 - 7
***********************************************************************
end of connent;
```

```
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#EJECT;
CLOBAL DOUBLE ARRAY adc_correction_table[-255:0);
DOUBLE adc_table * adc_correction_table + 1;

INTEGER CONSTANT h_blk_site:=5;
CLOBAL INTEGER ARRAY test_tables[-4: (6*h_blk_size)-1 );
DOUBLE  teot_inag_offeet = teet_tablea[-4],
        teet_real_offeet * teot_tebles[-2];
INIECER ARRAY taot_index(0:15);
GLOBAL INIEGER ARRAY  ref_1ablea[-4: (6*h_blk_aiza)-1 ];
DOUBLE   ref_inag_offeet =  ref_tablee[-4],
         raf_real_offazt =  ref_tebles[-2];
INTEGER ARRAY  ref_index(0:15);
INTEGER TABLE gn_index :=
          0           ,  2*h_blk_eize,  2*h_blk_eize,  0,&special cases&
          2*h_blk_aiza,  0           ,  0           ,  0,&for caling&
          2*h_blk_aizt,  2*h_blk_eize,  2*h_blk_eire,  2*h_blk_aiza,
          4*h_blk_aize,  4*h_blk_oize,
          6*h_blh_size,
          8*h_blk_eiza;
INTEGER TABLE null_correction :=
         10*h_blk_eire, 10*h_blk_eize, 10*h_blk_eize, 10*h_blk_aiza,
         10*h_blk_siat, 10*h_blk_aize, 10*h_blk_eize, 10*h_blk_aizt,
         10*h_blk_size, 10*h_blk_siza, 10*h_blk_eize, 10*h_blk_aiza,
         10*h_blk_eize, 10*h_blk_eire, 10*h_blk_eize, 10*h_blk_eize;


INTEGER TABLE cal_val := 445,  470,  505,  505,
                         805, 1200, 1985, 3565;
```

```
3YROC.WORK.PDS510                THU, DEC 22, 1383, 11:07 AM     PAGE  5

#EJECT;COMMENT
***********************************************************************
* intrpt_yadc
*       handles the yadc interrupt and converte the adc readinge to
*   needed data fornat and atores the results in rau nenmory.
*         Muat be the highest Ievei interruptand fast !!! 180uSac
*
* Data out
*     Conplex/floating data                 fixed point data ( cal )
*        INAG                                  TEST IMAG
*        REAL                                  TEST TEST
*        EXP                                   REF  IMAG
*                                              REF  TEST
*      3-uord results                       4-double reaults
*
* NOTE: No general oobroutinea nay be called by intrpt_yadc because
*       the subroutines nay use registers that uere not saved in the
*       interrupt handling !!
***********************************************************************
end of connent;
SUBROUTINE intrpt_yadc;                                          ENTRY;
BEGIN
LABEL correct_teet, correct_ref,
      store_in_rau,
      ratio_tsst, ratio_1, ratio_2 ,
      elr_inag,sup_avg, evg_1,   avg_2,   avg_3,
      intrpt_exit, intrpt_eignal_exit, ine_ptr_exit ,
      over_1, over_2, over_3;
   INTEGER bug_nark = %0CC;  &DEBUG&

   bug_nark := %9S76;
```

```
SYROC.UORK.PD8510                THU, DEC 22, 1983, 11:07 AM     PAGE  6

#EJECT;COMMENT
***********************************************************************
* The start of the interrupt docs the data read and quad gain correction
*
* The teet data ie read first and adc gain and offset corrected.
* If in CAL node the refrence data ia then read and corrected
* Else the test data is quad corrected, and then the reference data ia
*      read, adc and quad corrected.
* Then  the decision to ratio or to use only Ref or Test is nade.
*
* ADC Correction
*     18 bit result * Lou uord \12 bits\
*                      + adc_tables( index by high uord \8 bits\ )
*                      - offset \atore in teet_tables\
* QUAD Correction
*      Data  * Data + 1/4 * Data * M
*              Data ia Real and Inag of a given converted
*              M ia a 2x2 natrix -- noninally all zeros
*                it corrects for the gain and quaduarate errore of Data
***********************************************************************
end of connent;
ASSEMBLE(
   MOVEM.L  R0/R1/R2/R3/R8/R9, -(S);
   MOVEm.U  adcY1L,R0/R1/RS/R9;             & load test channel data &
   ADD.L    adc_table(R8),R0;               & correcting adc         &
   LER      teat_inag_offset,RS;
   SUB.L    (R&)+,          R0;
   ADD.L    adc_teble(R9),R1;
   SUB.L    (RS)+,          R1    );

   If NOT trigger_node THEN GO TO correct_teet;

 ASSEMBLE(
   MOVEm.U  adcY3L,R2/R3/R8;                & load ref  channel data &
   MOVE.U   adcY4M,R9;                      & avoid MOVEm affecting YDAG&
   ADD.L    adc_table(R8),R2;               & correcting adc         &
   LER      ref_insg_offaet, R8;
   SUB.L    (RS)+,          R2;
   ADD.L    adc_table(R9),R3;
   SUB.L    (B8)+,          R3    );

   If first_trigger THEN
      BEGIN
      firet_trigger := 0;
      ASSEmBLE (
            MOVEm.L  R0/R1/R2/R3,  yadc_ecr ); & save valuee in nenory &

      END
    ELSE ASSEMBLE (
            LER       yadc_scr, R8;
            ADD.L     R0,(RS)+;                Badd neu value and acculnate&
            ADD.L     R1,(RS)+;
            ADD.L     R2,(R8)+;
            ADD.L     R3,(R8)+     );
```

```
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      IF  TBI1( status, end_of_trigger ) THEN
         GO TO intrpt_exit  & still more triggers&
       ELSE
          &EGIN &last trigger&
          last_trigger := 1;
          ircnd1 := eet_botton_box_irq;
          ASSERBLE(
            BTST    #7, yadc_ratio_node;    &E0(0) fit pt&
            SHE     intrpt_signal_exit ;    &HE(1) cal data&

            MOVE.W  yadc_avg_factor1,R3;    &get scaling factor&
            MOVEM.L yadc_ecr,    R0-R1;     & restore teat valuea &
            ASR.L   R3,          R0;
            RSR.L   R3,          R1;        & handle in exp ???????&

            LER     teat_inag_offaet+8,R&;
            MOVE.B  tetgn,       &2;        &ifgain range for index&
            RS&.W   &3,          R2;
            BCS     over_1;
            CMP.8   =HFO,        R2;        &overloed - all gains off&
            BNE     ovar_1;
            RDo.W   B1,tat_overload ;
  over_1:   &OO.W   R2,          R2;        &convert to word index   &
            MOVE.W  R2,          R9;
            RDD.W   teat_index+32(R9),R8;   &aelect start of coeff'a &

            LER     IFCRM+6,     R9;        &aet multiply if correct &
            MOVE.1  (R8)+,       (R9)+;     &H11, H12   LDR2; LDH1;  &
            hOVE.1  (RS)+,       (R9)+;     &H21, H22   LDR3; LDM0;  &
            hOVE.L  R0,          (R9)+;     &YH         LOR0; LDA1;  &
            MOVE.1  R1,          (R9)+;     &XM; LDR2;LDR3;DUAL;SUMPR&
            MOVE.W  (R8)+,        R1;       &EXP of correction coeff &

            MOVEM.L yadc_ecr+&,   R2-R3;    & restore ref valuea &
            MOVE.W  yadc_avg_factor1,R0;    &get sealing factor&
            RSR.L   R0,          R2;
            RSR.L   R0,          R3;
            LER     ref_inag_offaet+8,R8;
            BRR     correct_ref  );
          END;
```

```
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#EJECT;
correct_test:HSSEMBLE(
   BOVE.W   tstgn,       R2;             &ifgain range for index&
   RSR.W    #3,          R2;
   BCS      over_2;
   CMP.8    xHFO,        R2;             &overload - all gaina off&
   BNE      over_2;
   RDD.W    #1,     tst_overload ;
over_2:RDD.W R2,         R2;             &convert to word index   &
   HOVE.W   R2,          R9;
   RDD.W    test_index+32(R9),R8;        &aelect etart of coeff'a &
   LER      IFCRM+6,     R9;             &aet multiply if correct &
   MOVE.L   (R8)+,       (R9)+;          &H11, H12   LDM2; LDM1;  &
   HOVE.L   (R8)+,       (R9)+;          &H21, H22   LDM3; LDM0;  &
   hOVE.1   RO,          (R9)+;          &YM         LOAO; LDA1;  &
   MOVE.L   R1,          (R9)+;          &XM; LDR2;LDR3;DUAL;SUMPR&
   MOVE.W   (R8)+,        R1;            &EXP of correction caeff &


   MOVEM.W  adcY3L,R2/R3/R8/R9;          &loed ref  channel data &
   ROO.L    adc_table(R8),R2;            &correcting adc         &
   LER      ref_inag_offset,R8;
   SUB.L    (R8)+,       R2;
   ROO.L    adc_table(R9),R3;
   SUB.L    (R8)+,        R3 );

correct_ref:RSSEMALE(
   MOVE.W   refgn,       RO;
   RSR.W    #3,          RO;
   BCS      over_3;
   CBP.B    =HFO,        R2;             &overload - all gaine off&
   BNE      over_3;
   ROD.W    #1,    ref_overload;
over_3:RDD.W RO,         RO;             &convert to word index   &
   MOVE.W   RO,          R9;
   ROD.W    ref_index+32(R9),R8;         &aelect etart of coeff'e &
   LER      IFCRM,       R9;             &get teat data if correct &
   ROVE.L   (R9)+,       RO;             &real/inag &
   RDD      (R9)+,       R1;             & add exp to H exp &


   MOVE.1   (R8)+,       (R9)+;          &H11, H12   LDM2; LDM1;  &
   hOVE.1   (R8)+,       (R9)+;          &H21, H22   LDM3; LDM0;  &
   MOVE.1   R2,          (R3)+;          &YM         LOAO; LDA1;  &
   MOVE.1   R3,          (R3)+;          &XM; LDR2;LDR3;DUAL;SUMPR&
   MOVE.W   (R8)+,        R3  );         &EXP of correction coeff &

& test for sweeping to faat &

& use computed goto'e to replace bit teat (bit test=computed goto time)&
& also handle inversion  ie 1/S11                                       &
RSSEMBLE(
   BTS1     #1,   yadc_ratio_node;       & E0(0) continue &
   BEO      ratio_teat;                  & HE(1) uee only ref&
   MOVE     R3,           R1;
   MOVE.L   (R9)+,        RO;           & get real/inag&
```

```
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   RDD      (R9),         R1;           & add exp to H exp and TERM&
suap_data:BTS1 N2, yadc_ratio_node;     & EO(0) not complex data &
   BNE      aup_avg;                     & NE(1)  complex data &
   B1ST &3, yadc_ratio_node;            & E0(0) donot auap &
   BEQ      clr_inag;                    & NE(1) suap real/inag y1/y2&
   SWAP     RO;
clr_inag:RHO.L =HOFFFF,RO;              & zero inag data          &
   BRA      aup_avg;
ratio_test: MOVE.L   (R9)+, R2;         & get real/inag &
   BOD      (R9)+,        R3;           & add exp to H exp and TERM &
   BTST     #O, yadc_ratio_node;         & EQ(0) ratioing off &
   BEO      ewap_data );                 & HE(1) ratio on &
```

```
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#EJECT;COMMENT
*************************************************************************
* ratioing here !!!       test in r0/r1, ref in r2/r3, result :0/r1
*    see complex div documentation -- for ratioing is that without
*    overflou testing and format change
*    (A+iB)/(C+iD) = [(AC+BO)+i(BC-BD)]/(CC+DD)
*
*    First to to find /C+iD/ by loading A1,MO with C and A3,M3 with D
*     Then C is load into M1,R2 and D into MO,R2
*     Then A is loaded into A3, and b into A1
*       Result is (BC-AD) in R2, and (AC+BD1 in AO
*     But tnat reeult is Multiplied by 1/(CC+DD) loaded into MO,M2
*     And the final reeult ie in R2,AO
*************************************************************************
end of  conment;
ASSEMBLE(
   BOVE.L   R2,           (R9)+;        &LDA1,LDM0;LDR3,LDM3,SUMPR;GO&
   SUB.b    R3,            R1;          & eubtract exponente        &
   AOD.B    #1,            R1;          & account for squaring      &
   MOVE.L   =H20000000,    R3;          & R3 = 1.0000000            &
   hOVE.1   R2,           (R9)+;        & LDM1,LDR3;  LDM0,LDM2;    &
   MOVE.W   (R9)+,         R2;          & Get CC+DD fron LDRO       &
   MOVE.W    R2,           &3;          & Hake R3 a little > 1.00000&
   BNE      ratio_1;                    & Check if R2=0 (CC+DD)     &
   MOVE.W   =H4000,        R2;          & USE TRAP DIV O instead ?? &
ratio_1: SUB.W (R9)+,      B1;          & RDEXP of CC+DD             &
   HOVE.L   RO,           (R9)+;        & LDR3,LOR1;  loading A,8   &
   RSR.W    #1,           R3;
   DIVS     R2,           R3;          & Get 1/(CC+DD)             &
   bVC      ratio_2;                    & check for overflou ???    &
   MOVE.W   =H4000,        R3;
   ROD.b    #1,            R1;          & bump exp for overflou     &
ratio_2: HOVE.W R3,       (R9)+;        & LOMO,M2 with 1/(CC+DO);GO &
   HOVE.L   (R9)+,         RO;          & Result fron RDA2,AO       &
   ADD.W    (R9)+,         R1);         & RDEXP; TERM               &
```

```
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$EJECT;
          &auept mode &
 aup_avg:ASSEMBLE(
   MOVE.L   yadc_rau_ptr,R9;
   MOVE.L   (M9),R8;
   BOVE.L   yadc_avg_factor1, R2;        & MSW = M, LSW = 1-M     &
   TST.W    R2;                          & test avg_factor2       &
   BEQ      atore_in_rau;                & CQ(0) K=1, no avgering &
   CMP.B    5(R8),   M1;                 & ME(1) KRO, average     &
   BEO      avg_2;                       & EO(0) old,new exp equal&
   BM1      avg_1;                       & MI    expo <> normalize&
   MOVE.B   R1,      R3;
   SUB.B    5(R8),   R3;
   RSR.W    &3,      R2;                 & adjUst 1-K for exp delta&
   BRR      avg_2;
avg_1: MOVE.B 5(R8), R3;
   SUB.B    R1,      R3;
   ADD.B    R3,      R1;
   SURP     R2;
   RSR.W    R3,      R2;                 & adjust K for exp delta &
   SURP     R2;
avg_2:LEA   MPYAV+6, R9;
   MOVE.L   RO,      (R8)+;              &&RR3,2 -- New value     &
   MOVE.L   (R8),    (R9)+;              &LDMO,1 -- Old value     &
   MOVE.L   R2,      (R9)+;              &LMM3,1;GO -- avg factor&
   MOVE.L   (R9)+,   RO;                 &RORO,2 -- (1-K)*OLD + K*MEW&
   ADD.B    ROEXP+1, R1;                 &MAEXP,IERM              &
   BVC      avg_3;
   MOVE     =H80,    R1;                 &assumed only underflow &
avg_3: MOVE.L   yadc_rau_ptr,R9;
store_in_rau: EQU *;
   SURP     RO     ;
   MOVE.W   RO,(R8)+;                    &save IMAG  &
   SURP     RO     ;
   MOVE.W   RO,(R8)+;                    &save REAL  &
   NOP             ;
   MOVE.W   R1,(R5)+;                    & save EXP               &
inc_ptr_exit: MOVE.L   R5,(R9);          &save modified rau pointer&

intrpt_signal_exit: MOVE.L   yadc_rau_signal,R8; &inline kernel "send" &
   ADDQ.W   #1,(R5);                     & inc rau_signal &
   BGT      intrpt_exit;                 & if not waiting for signal  &
   MOVE.W   yadc_rau_nask,RO;            & ready the waiting proccas  &
   OR.W     RO,ready;                    & "idle" will preenpt/eched  &
 intrpt_exit: GLR bug_nark;
   MOVEM.L (S)+, RO/R1/R2/R3/R5/R9;
   RTE    );
END intrpt_yadc;
```

```
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$EJECT;COMMENT                                                  init_yadc
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR init_yadc                                      *
*                                                                           *
* FUNCTION:                                                                 *
*                                                                           *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:                                                                 *
*                                                                           *
*    OUTPUT:                                                                *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR init_yadc                                           *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
*                                                                           *
* NOTE: Initailization of the YADC state machine is in init_xadc            *
*****************************************************************************
end of comment;
SUBROUTINE init_yadc_irq;
BEGIN
   iradr(  MARS( intrpt_yadc ), y_adc_vctr );
   trigger_smde := 0;
END init_yadc_irq;

PROCEDURE  init_yadc;                                           ENTRY;
BEGIN
INTEGER index;

   cal_ctr := 0;
   cal_ctr_rate := cal_ctr_linit ;
   old_cal_level := -1;                  & never cal'ed &
   MOVE test_index := gn_index,*(1&);
   MOVE  ref_index := gn_index,*(16);

END init_yadc;
```

```
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$EJECT;COMMENT                                                control_yadc
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR control_yadc                                   *
*                                                                           *
* FUNCTION:                                                                 *
*                                                                           *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:                                                                 *
*                                                                           *
*    OUTPUT:                                                                *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR control_yade                                        *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT:                                                       *
*                                                                           *
*                                                                           *
*****************************************************************************
end of comment;
PROCEDURE control_yadc(rau_out,average_mode,avg_factor,
                       rau_ready_count,rau_ready_nask);
  VALUE   rau_out,average_mode,avg_factor,rau_ready_count
          ,rau_ready_nask;
  DOUBLE  rau_out,rau_ready_count ;
  BYTE    average_mode;
  INTEGER avg_factor,rau_ready_nask;                            ENTRY;
BEGIN

   yadc_rau_ptr    := rau_out;
   yadc_avg_factor1 :=  0 ;
   yadc_avg_factor2 :=  0 ;
   xctrl_save       :=  0 ;
   xctrl            := zero;
   xctr0            := 200;          &should this be here ????  &&debug&
   IF NOT( average_mode = avg_off) AND avg_factor > 1 THEN
      BEGIN
      IF average_mode = avg_point_to_point  THEN
         BEGIN
        ASSEMBLE( MOVE.W avg_factor, RO;      &convert to power of 2 &
                  EXTS.L RO;
                  MOVE.L RO,MYMAM;
                  MOVE.W =030,RO;
                  ADD.B  RDEXP+1,RO;
                  EXTS.W RO;
                  MOVE.W RO,yadc_avg_factor1;
                  CLR.W  R1;
                  BSET   RO,R1;
                  SUB.W  =D1,R1;
```

```
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                  MOVE.W R1,xctrl_save );
         END  & at single point averaging&
       ELSE
         BEGIN &aup_to_aup avg  &
         yadc_avg_factor1 := 32768 / avg_factor;
         yadc_avg_factor1 := RBIT(   yadc_avg_factor1, 0 );
         yadc_avg_factor2 := 32768 - yadc_avg_factor1;
         END;
       END; &set averaging parameters&

   yadc_rau_signal     := rau_ready_count ;
   yadc_rau_nask       := rau_ready_nask ;
END control_yadc;
```

```
SYADC.UORK.POS910              THU, DEC 22, 1983, 11:07 AM     PAGE  15


$EJECT;COMMENT                                                  set_if_gain
###############################################################################
###############################################################################
end of comment;
SUBROUTINE set_if_goin_subl;
BEGIN
   tatctl   := tst_mux ;   & no gain / no autorange &
   refctl   := ref_nux ;   & no gain / no autorange &
   delay( delay_250uS );
END set_iF_gain_subt;

SUBROUTINE set_if_gain_sub2;
BEGIN
   REPEAT 4 DO
      BEGIN
      delay( delay_60uS ) ;
      tatctl   :* tst_ctl;
      refctl   :* ref_ctl;
      END;
END;
SUBROUTINE set_if_gain;                                         ENTRY;
BEGIN
   set_if_gain_sub1;
   set_if_gain_sub2;
   delay( delay_150uS );
END set_if_gain;
```

```
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REJECT;COMMENT
###############################################################################
###############################################################################
end of comment;
PROCEDURE init_auto_range;                                      ENTRY;
BEGIN
INTEGER index;
FOR index :=  first_acquisition_paran TO  max_acquisition_paran
   DO tst_men[ index ] := -1;
END init_auto_range;



SUBROUTINE check_overload;                                      ENTRY;
IF      ( NOT TBIT( refgn, 2 ) )
   OR    ( NOT IBIT( tetgn, 2 ) ) THEN uarn( if_overload );
```

```
SYADC.UORK.POS910              THU, DEC 22, 1983, 11:07 AM     PAGE  17


$EJECT;COMMENT                                                  auto_ranging
###############################################################################
###############################################################################
end of comment;
PROCEDURE auto_ranging( acq_paran );
            VALUE   acq_param ;          INTEGER acq_paran;     ENTRY;
BEGIN
BYTE POINTER tat_old, ref_old;
 STPNTR( tet_old, ADRS( tst_nen[ acq_paran ] ) );
 STPNTR( ref_old, RDRS( ref_nen[ acq_paran ] ) );

   IF tat_old < 0 THEN
     BEGIN   & Firat tine init&
     IF TBIT(tat_ctl, 7 ) THEN tst_old:=0 ELSE tst_old:=tst_ctl AND X78;
     IF TBIT(ref_ctl, 7 ) THEN ref_old:=0 ELSE ref_old:=ref_ctl AND X78;
     END first tine init;

   set_if_gain_subl;

   tatctl  :* tet_nux OR tet_old;    refctl := ref_nux OR ref_old;

   set_if_gain_sub2;

   check_overload;
   tatctl := tat_nux OR ( tet_old := tstgn AND X78 );
   refctl :* ref_nux OR ( ref_old := refgn AND X78 );
   delay( delay_150uS );
END  auto_ranging ;
```

```
SYADC.UORN.FDS910              THU, DEC 22, 1983, 11:07 AM     PAGE  18


$EJECT;COMMENT                                                  control_receiver
###############################################################################
*                                                                             *
* ENTERNRL SPECIFICATION FOR control_receiver                                 *
*                                                                             *
* FUNCTION:                                                                   *
*                                                                             *
*                                                                             *
* DECLARATION INFORMATION:                                                    *
*                                                                             *
*    INPUT:                                                                   *
*                                                                             *
*    OUTPUT:                                                                  *
*                                                                             *
* EXTERNAL EFFECTS:                                                           *
*                                                                             *
###############################################################################
*                                                                             *
* LOGIC INFORMATION FOR control_receiver                                      *
*                                                                             *
* MODULES CALLED:                                                             *
*                                                                             *
* INITIAL REFINEMENT:                                                         *
*                                                                             *
*                                                                             *
* COMMENT: Could perphas create a single table with n entry reus              *
*          and 3 columns -- if_nux, adc_nux, ratio_node --                    *
*          This would tie the items related to a selection numerator          *
*          closer by being on one line.                                       *
###############################################################################
end of comment;
BYTE TABLE if_gain :* X50, &auto range&
                      X00, &no gain  &
                      X40, &last gain stage on&
                      X60,
                      X70,
                      X78, &all gain stages on&
                      X00, &no gain  &
                      X40, & let etage &
                      X20,
                      X10,
                      X08; & 4th stage &
BYTE TABLE if_nux  :* X4 &b1&         , X3 &b2 or a1& ,
                      X2 &a2&         , X0 &gnd&,
                      X1 &100khz&     , X0 &gnd&,
                      X0 Bgnd&        ,
                      X0 &gnd&        , X0 &gnd&,
                      X0 &gnd&        , X0 &gnd&,
                      X0 &gnd&        , X0 &gnd&;
BYTE TABLE adc_nux  :=X8 &IF inputs&  , X8 SIF inputs&,
                      X8 &IF inputs&  , X8 SIF inputs&,
                      X8 &IF inputs&  , X8 &IF inputs&,
                      X8 &IF inputs&  ,
                      X9 & adc gnd &  , X41& vcal -- sets cal node&,
                      XD & volt &     , X5 & tenp &,
                      X5 & tenp &     , XD & volt &;
```

```
SYBDC.WORK.PDS510              THU, DEC 22, 1983, 11:07 AM     PAGE  19


BYTE CONSTANT         ratio :^ 1      ,use_ref_not_test   := 2 ,
                complex_data :^ 4     ,not_complex_use_y2 := & ,
           net_complex_use_y1 := 0;
INTEGER CONSTANT      ratio_bit:= 0   ,complex_bit := 2;
BYTE CONSTANT         cal_mode_double_output := 1&0;

BYTE TABLE ratio_mode:=ratio+complex_data,ratio+complex_data,
                       ratio+complex_data,complex_data+use_ref_not_test,
                       complex_data      ,complex_data,
                       complex_data+use_ref_not_test,
                       not_complex_use_y1,not_complex_use_y1    ,
                       not_complex_use_y2,not_complex_use_y1    ,
                       not_complex_use_y2,not_complex_use_y1    ;

PROCEDURE control_receiver(numerator,denominator,phase_lock_port,
                           num_gain_range,denom_gain_range );
                  VALUE    numerator,denominator,phase_lock_port,
                           num_gain_range,denom_gain_range ;
                  BYTE     numerator,denominator,phase_lock_port,
                           num_gain_range,denom_gain_range ;
                                                          ENTRY;
BEGIN
INTEGER index;  .

   ref_mux  := if_mux[ denominator ];
   tst_mux  := if_mux[ numerator   ];

   adcctl   := adc_mux[ numerator ];

   yadc_ratio_mode := ratio_mode[ numerator ];
   IF denominator >+ denom_no_ratio THEN
                yadc_ratio_mode := RBIT(yadc_ratio_mode,ratio_bit);

   IF numerator ^ num_al THEN  ref_mux  := if_mux[ denom_al ];
   calpha := cal_sig_off;
   IF numerator = num_ref_100khz_cal THEN
                               BEGIN
                               ref_mux  := if_mux[ denom_100khz_cal );
                               calpha := cal_sig_on;
                               END
    ELSE IF numerator = num_100khz_cal THEN   calpha := cal_sig_on;

   IF phase_lock_port % caling THEN
      chsel  :^ phase_lock_port
    ELSE
      yadc_ratio_mode := cal_mode_double_output; &double output&

   tst_ctl   := tst_mux    OR  if_gain[   num_gain_range ] ;
   rtf_ctl   := ref_mux    OR  if_gain[ denom_gain_range ] ;

             & tine coneuning change if only changed ??&
   IF NOT TBIT( yadc_ratio_mode, 7) THEN  & not used in cal mode &
      IF TBIT( yadc_ratio_mode, complex_bit) THEN
         MOVE test_index :^ gn_index,+(T6)
       ELSE
```

```
SYADC.BORK.PDS510              THU, DEC 22, 1983, 11:07 AM     PAGE  20

         MOVE test_index := null_correction,^(16);&turn auto range offT&
END control_receiver;
```

```
3YADC.UORK.PDS510              THU, BEC 22, 1983, 11:07 AM     PAGE  21


REJECT;COMMENT
*******************************************************************************
end of connent;
PROCEDURE check_h( iten ,  value );
VRLUE value;
INTEGER iten;   REAL value;
BEGIN
   IF BBS( value ) > .24999 THEN
      BEGIN
      cal_valid := FALSE;
      value := 0.0;
      END;
   iten := INTEGER ( 131072.0 ^ value );
END check_h;
CORMENT
*******************************************************************************
end of connent;
PROCEDURE ttore_h(tables, h_d=ta, real_gn, inag_gn);
    VALUE tablet, h_data, real_gn, inag_gn;
    INTEGER POINTER tablee; REAL POINTER h_data; REAL real_gn, inag_gn;
BEGIN
      check_h( tables[ 0 ] ,
               ((real_gn ^ h_data[ 0 ]) - (inag_gn ^ h_data[ A ])
                 - 1 ));
      check_h( tablet[ 1 ] ,
               ((inag_gn ^ h_data( 6 ]) - (real_gn ^ h_data[ 2 ]) ) );
      check_h( tables[ 2 ] ,
               ((real_gn ^ h_data[ 4 ]) + (inag_gn ^ h_data[ 0 ]) ) );
      check_h( tables[ 3 ) ,
               ((real_gn ^ h_data[ 6 ]) + (inag_gn ^ h_data[ 2 ])
                 - 1 ));
END ttore_h;
```

```
3YADC.UORK.PDS510              THU, BEC 22, 1983, 11:07 AM     PAGE  22

REJECT;COMMENT                                                  cal_adc
*******************************************************************************
* cal_adc calibrates the adc -- ie it createt the table that changes    *
*    the 8 bit adc and 12 bit adc into a single 19 bit adc.             *
*    The adc consists of an 8 bit and 12 bit ades ( both successive     *
*    approxianation ) overlapped by 2 bits. The 8 bit result is the     *
*    "nost significant half" and the 12 bit fills in the gaps.          *
*    This is done by calibrating the step of the 8bit dac ( adc ) with  *
*    the 12 bit adc. It aasunes that each 8bit dac bit is independent of*
*    any other -- to atleast 20 bits.                                   *
*                                                                       *
* cal_dac set the adc to read the cal dac instead of the usual if_inputs*
*    The adc_correction_teble is zeroed so that the readings of the     *
*       12bit dac uill cane straight thur at 12 bit readings.           *
*    The 8 bit dac is set to 2^(bit) ( note: the dac                    *
*       is bits 2 to 9 -- bit 0,1 are donot cares ).                    *
*    The 12 cal dac is nove to get the reading in the 12 bit adc range.*
*    Once this is done the 8 bit dac is noved doun to 2^(bit) - 1       *
*       and then back to 2^(bit) and the difference is measured.        *
*    This difference is added to previous bit differences to get a      *
*       bit weighting.                                                  *
*    After all 8 bit weightings are found, they are added to together to*
*       to form the adc correction table for all possible 256 values.  *
*******************************************************************************
end_of_connent;
BOOLEAN PROCEDURE cal_adc;
BEGIN
INTEGER index,                          & index for DO loops &
        bit,                            & index of bit number 0=lsb&
        direction,
        ypouer,                         & ydac value approx 2^bit &
        temp=ypouer;
DOUBLE ARRRY bit_weight[0:7];           & bit values of 8bit ADC  &
DOUBLE double_tcnp;

SUBROUTINE setup_trigger_yadc ;
BEGIN
    index       := index - 1;
    cal_val[bit] := cal_val[bit) + direction;
    caldac      :^ cal_val[bit);
    IF ( cal_val[bit] <= 0 ) OR ( cal_vei[bit] >= 4095 )
       OR ( index     <= 0 )
       THEN cal_valid := FALSE;
    trigger_yadc;
END setup_trigger_yadc ;


   control_receiver[ num_vcal, denen_detector_gnd,
                     caling, if_no_gain, if_no_gain );
   set_if_gain;
```

```
SYRDC.WORK.PD8510              THU, DEC 22, 1983, 11:07 AM     PAGE 23


%EJECT;
   FOR bit := 0 TO 7 DO
      BEGIN
      ypower := LEFT( 2, bit + 1);
      ydac   := ypower;

      index     := 100;
      direction := -1;
      DO  setup_trigger_ydac
          UNTIL ( (ydac_scr  > adc_in_range) OR NOT cal_valid );

      index     := 100;
      direction :=  1;
      DO  setup_trigger_ydac
          UNTIL ( (ydac_scr <= adc_in_range) OR NOT cal_valid );


      ydac := ypower - lsb_ydac;
      trigger_ydac;
      double_temp := ydac_scr ;   & 1st data point -- average !!!&

      ydac := ypower ;
      trigger_ydac;
      double_temp := double_temp - ydac_scr ;


      temp := INTEGER( BRIGHT( double_temp ,  cal_avg_bit ) ) AND %FFF;
     &IF ydac_cal_debug THEN BEGIN                                    debug&
     &    WNUM( cal_val[bit] ); WHEX(temp); CRLF;END;                 debug&
          & perphal save a copy of the bit weights ???  &
          & an error in production was not found-- due to 12 bit test?&
      IF (temp>=%800) OR (temp<=%500) OR (NOT cal_valid) THEN
         BEGIN
         cal_valid := FALSE;
         double_temp := RLEFT( %FFFFF800 , cal_avg_bit );
         END error test;
      IF bit # 0 THEN FOR index := 0 TO (bit - 1) DO
                      double_temp := double_temp + bit_weight[index);
      bit_weight[bit] := double_temp;
      END bit cal loop;

   FOR index := -255 TO 0 DO
      BEGIN
      ydac_scr := 0;
      FOR bit := 0 TO 7 DO
          IF TBIT( index + 255, bit) THEN      & ydac is inverted data &
             ydac_scr := ydac_scr + bit_weight[ bit ];
      adc_correction_table[ index ) := RRIGHT(ydac_scr,cal_avg_bit);
      END build full table;

   IF NOT cal_valid THEN warn(adc_cal_failed);
   cal_adc := cal_valid;
END cal_adc;
```

```
SYRDC.WORK.PD8510              THU, DEC 22, 1983, 11:07 AM     PAGE 24

%EJECT;COMMENT                                                  cal_offset
*****************************************************************
* cal_offset                                                    *
*     The offset of the IF system ( with the sync detectors connected) *
* by grounding the input of the sync detectors, reducing the IF gain  *
* to minimum ( does this matter ? ), and rotating the LO phase to the *
* test and reference detectors 0, 90, 180 and 270 degrees ( 0%,25%,50%,*
* and 75% of 2 PI ). These four values are averaged together to find a *
* center and this result is the offet. Test real and imag, and Ref    *
* real and imag are all done at the same time.                        *
*  There is averaging of the raw data as set be the calib_ydac routine.*
*  NOTE: The offset cal of the ydac is in this offset and there is no  *
*    seperate ydac offset -- however the value is approximately the same
*
* Since (??) the offset is independent of IF gain, there is one only set
*****************************************************************
end of comment;
PROCEDURE cal_offset;
BEGIN
  INTEGER step,                              & lo_phase setting index&
          index;                             & general DO loop index&
  DOUBLE ARRAY partial_offset[0:3];

 control_receiver( num_detector_gnd, denom_detector_gnd,
                   caling, if_no_gain, if_no_gain );
   set_if_gain;

   partial_offset[ 0 ] := 0;   partial_offset[ 1 ] := 0;
   partial_offset[ 2 ] := 0;   partial_offset[ 3 ] := 0;
```

```
SYRDC.WORK.PD8510              THU, DEC 22, 1983, 11:07 AM     PAGE 25


&EJECT;
   FOR step := phase_0 STEP phase_90 TO phase_270 DO
      BEGIN
      refpha := phase_step[ step ];
      tstpha := phase_step[ step ];
      delay( delay_200uS ); &??&
      trigger_ydac;
      FOR index := 0 TO 3 DO  partial_offset[ index ] :=
                     partial_offset[ index ] + ydac_scr[ index ];
      END rotating lo_phase;


   test_imag_offset  := BRIGHT( partial_offset[ 0 ], cal_avg_bit +2 );
   test_real_offset  := ARIGHT( partial_offset[ 1 ], cal_avg_bit +2 );
    ref_imag_offset  := ARIGHT( partial_offset[ 2 ], cal_avg_bit +2 );
    ref_real_offset  := ARIGHT( partial_offset[ 3 ], cal_avg_bit +2 );

 SIP ydac_cal_debug THEN BEGIN                                       debug&
 &   WHex( test_imag_offset , 6 );                                   debug&
 &   WHex( test_real_offset , 6 );                                   debug&
 &   WHex(  ref_imag_offset , 6 );                                   debug&
 &   WHex(  ref_real_offset , 6 );                                   debug&
 &   CRLF;   END;                                                    debug&

END cal_offset;
```

```
SYRDC.WORK.PD8510              THU, DEC 22, 1983, 11:07 AM     PAGE 26

%EJECT;COMMENT                                              cal_sync_detector
*****************************************************************
* cal_sync_detector does the quadrature gain correctinon of the       *
*   synchronous detectors -- is correct the phase and anplitude of the *
*   measured data to proper quadrature ( 90 deg ) and gain relationship*
*                                                                     *
*   It measures the real and imaginary components ( x, y respectively )*
*   of four known signals - provided by the clock as an 100khz calib  *
*   signal with shifted phase. Using these values, their squares, and *
*   crossproducts ( computed as x, y are measured ), a least squares  *
*   fit on the correction coefficients need to correct measured data  *
*   is done. These coefficiecnts are then offset and scaled to minimize*
*   storage.                                                          *
*                                                                     *
*                                                                     *
*                                                                     *
*                                                                     *
*   CHANGES:                                                          *
*   6/20  -- change to rotating LO not SIGNAL -- Signal path has low BW*
*****************************************************************
end of comment;
PROCEDURE  cal_sync_detector;
BEGIN
REAL RRRRY x, y,
           h[0:7],
           x_square, y_square,
           x_times_y[0:1];
 & WARNING: Compiler bug occurs if last array > 128 bytes from first &
COMPLEX RRRRY mess[0:4];
COMPLEX data;
REAL det;
REAL POINTER xp,yp,hp;
INTEGER chan,                          & chan select 0=test, 1=ref&
        index,                         & general do index   &
        step,                          & phase index of cal signal &
        step_index,                    & 2*step index  &
        range,
        range_offset;

   control_receiver( num_100khz_cal, denom_100khz_cal,
                     caling, if_1st_on, if_1st_on );
   set_if_gain;

    x_square[ 0 ] := 0;        x_square[ 1 ] := 0;
    y_square[ 0 ] := 0;        y_square[ 1 ] := 0;
   x_times_y[ 0 ] := 0;       x_times_y[ 1 ] := 0;
```

```
SYADC.WORK.PDS510              THU, DEC 22, 1983, 11:07 AM     PAGE  27

REJECT;
   FOR step := phase_0 STEP phaec_90 TO phaec_270 DO
      BEGIN                          & appears to be 150,90,0,-90 rotation&
      refpha :* phase_step[ step ];
      tstpha :* phase_step[ step ];
      delay( delay_1_msec );
      trigger_yadc;

      step_index := 2 & num of channels & * step;
      FOR chan:=0 TO 1 DO
         BEGIN
         y_square[ chan ] := y_square[ chan ] +
                ( y[ chan + step_index ]
                     := REAL( yadc_scr[ 2*chan ] ) )
                * y[ chan + step_index ] ;
         x_square[ chan ] := x_square[ chan ] +
                ( x[ chan + step_index ]
                     := REAL( yadc_scr[ 2*chan + 1 ] ) )
                * x[ chan + step_index ] ;
         x_times_y[ chan ] := x_times_y[ chan ] -    & negative sum &
                ( x[ chan + step_index ] * y[ chan + step_index ] );
         END chan storing measurements;

      END phase stepping cal signal;

   FOR chan:=0 TO 1 DO
      BEGIN
      det := 2.0E6  /          & 1 / cal_signal_normalizing_factor &
                &cal_avg * 125,000 nominal cal sig level == -10dbm&
             (    x_square[ chan ] *  y_square[ chan ]
               - x_times_y[ chan ] * x_times_y[ chan ] );

      STPNTR( yp, ADRS( y[ chan ] ) );
      STPNTR( xp, ADRS( x[ chan ] ) );
      STPNTR( hp, ADRS( h[ chan ] ) );

      hp[ 0 ] := (   ( xp[ 4 ] - xp[ 0 ] ) * y_square[  chan ]
                   + ( yp[ 4 ] - yp[ 0 ] ) * x_times_y[ chan ] ) * det;

      hp[ 2 ] := (   ( xp[ 4 ] - xp[ 0 ] ) * x_times_y[ chan ]
                   + ( yp[ 4 ] - yp[ 0 ] ) * x_square[  chan ] ) * det;

      hp[ 4 ] := (   ( xp[ 2 ] - xp[ 6 ] ) * y_square[  chan ]
                   + ( yp[ 2 ] - yp[ 6 ] ) * x_times_y[ chan ] ) * det;

      hp[ 6 ] := (   ( xp[ 2 ] - xp[ 6 ] ) * x_times_y[ chan ]
                   + ( yp[ 2 ] - yp[ 6 ] ) * x_square[  chan ] ) * det;

     &IF yadc_cal_debug THEN BEGIN                                  debug&
     &FOR index := 0 TO 3 DO WREAL( hp[ 2 * index ] ); CRLF; END; debug&

      END compute correction for each detector channel;
```

```
SYADC.WORK.PDS510              THU, DEC 22, 1983, 11:07 AM     PAGE  28

REJECT;
   range_offset :* 0;
   FOR range := 0 TO 4 DO
      BEGIN
      store_h( ADRS( test_table[ range_offset] ), ADRS( h[ 0 ] ),
                     1.0,  0.0 );
      store_h( ADRS(  ref_table[ range_offset] ), ADRS( h[ 1 ] ),
                     1.0,  0.0 );
      range_offset := range_offset + h_blk_size;
      END store h matrix;

   detector_cal_valid := cal_valid;
```

```
SYADC.WORK.PDS510              THU, DEC 22, 1983, 11:07 AM     PAGE  29

REJECT;
   FOR chan := 0 TO 1 DO
      BEGIN
   FOR range := if_all_off TO if_4th_on DO
      BEGIN

      IF chan=0 THEN
            control_receiver( num_100khz_cal, denom_detector_gnd,
                  lock_donot_care, range, if_all_off )
       ELSE   control_receiver( num_ref_100khz_cal, denom_detector_gnd,
                  lock_donot_care, if_all_off, range );
      set_if_gain;

      x_square      := 0;
      y_square      := 0;
      FOR step := phase_0 STEP phase_90 TO phase_270  DO
         BEGIN                       & appears to be 150,90,0,-90 &
         refpha := phase_step[ step ];
         tstpha := phasc_step[ step ];

         yadc_cal_str := ADRS( yadc_scr );
         delay( delay_200uS );
         trigger_yadc;

         data         := CMVE1( yadc_scr_emplx );   & change to 20 bit &
                                                    & when 20 bit ie done&
         y_square := y_square + y[ step  ] *
                        ( y[ step  ] := IMAG( data ) );
         x_square := x_square + x[ step  ] *
                        ( x[ step  ] := REAL( data ) );
         END phase stepping cal signal;

      det := .0b/(y_square + x_square ) ; &removing nominally cal level&
                                         & approx -24 dbm signal &
      neas[ range - if_all_off ] := COMPLEX(
           ( ( x[ 2 ] - x[ 0 ] ) * ( y[ 1 ] - y[ 3 ] )  ) * det  ,
           ( ( x[ 1 ] - x[ 3 ] ) * ( y[ 0 ] - y[ 2 ] )  ) * det    );
      END range steps;
```

```
SYADC.WORK.PDS510              THU, DEC 22, 1983, 11:07 AM     PAGE  30

REJECT;
      range_offset := 0;
      FOR range := 0 TO ( if_4th_on - if_all_off ) DO
         BEGIN

         data  := meas[ range ] / meas[ 1 ] ;  &normalize measurements&
         IF range R ( if_1st_on - if_all_off ) THEN
            BEGIN
            IF range >= ( if_2nd_on - if_all_off )      & correct for  &
               THEN  data := data  / meas[ 0 ];  &first stage abs error&

           &IF yadc_cal_debug THEN BEGIN WCPN(data); CRLF; END;   debug&

            IF range >= ( if_3th_on - if_all_off ) THEN
                              data := ( data * meas[ range - 1] );
            meas[ range ] := data ;

            If chan = 0 THEN
               store_h(  ADRS( test_table[ range_offset ] ),
               ADRS( h[ 0 ] ),REAL( data ),IMAG( data ))
             ELSE
               store_h(  ADRS( ref_table[ range_offset ] ),
               ADRS( h[ 1 ] ),REAL( data ),IMAG( data ));
            END skip 1st stage on case;

         range_offset := range_offset + h_blk_size;
         END range loop -- now h correction for IF gains;
      END chan loop for gain calibration;

   IF  NOT cal_valid  THEN
         IF  detector_cal_valid  THEN warn[autorange_cal_failed)
                                 ELSE warn[if_cal_failed];
   refpha :* lo_normal_phase;
   tstpha := lo_normal_phase;
END cal_sync_detector;
```

```
SYADC.UORK.PDS510              THU, DEC 22, 1983, 11:07 AM    PAGE  31


REJECT;COMMENT                                          reset_yadc_tables
*****************************************************************************
*****************************************************************************
end of comment;
PROCEDURE reset_yadc_tables;
BEGIN
INTEGER index, range, range_offset, range_exp;
     FOR index := -255 TO 0 DO adc_correction_table[ index ] := 0;
     test_imag_offset  := 0;        test_real_offset  := 0;
      ref_imag_offset  := 0;         ref_real_offset  := 0;
     FOR index := 0 TO  (( 6*h_blk_size) - 1)  DO
        BEGIN
        test_tables[index] := 0;
         ref_tables[index] := 0;
        END clear h  matrix;
     range_offset := 4;
     range_exp    := -1;
     FOR range := 0 TO 4 DO
        BEGIN
        test_tables[ range_offset ] := range_exp;
         ref_tables[ range_offset ] := range_exp;
        range_offset := range_offset +  h_blk_size;
        range_exp    := range_exp - 2 ;
        END set up range exp;

END reset_yadc_tables;
```

```
SYADC.UORK.PD8510              THU, DEC 22, 1983, 11:07 AM    PAGE  32


REJECT;COMMENT                                          test_yadc_responding
*****************************************************************************
*****************************************************************************
end of comment;
BOOLEAN SUBROUTINE test_yadc_responding;
BEGIN
   irdis( y_adc_vctr );
   irclr( y_adc_vctr );
   xctr1 := 1;
   force_trig_yadc;
   delay( delay_1_msec );
   IF TBIT( irirr , y_adc_vctr ) AND  NOT TBIT( status, end_of_trigger )
      THEN BEGIN  & yadc responding &
      control_yadc( RORS( yadc_cal_ptr ), avg_point_to_point,
                    cal_avg,              RORS( signal_bit_bucket ),
                  SBIT( 0, idle_process )   );
      init_yadc_irq;
      END   & yadc responding  &
    ELSE
      BEGIN & yadc not responding &
      cal_valid := FALSE;
      uarn( adc_not_responding  );
      END   & yadc not responsing&;
  test_yadc_responding := cal_valid;
END test_yadc_responding;
```

```
SYADC.UORK.PDS510              THU, DEC 22, 1983, 11:07 AM    PAGE  33


REJECT;COMMENT                                          calib_yadc
*****************************************************************************
*                                                                           *
* EXTERNAL SPECIFICATION FOR calib_yadc                                     *
*                                                                           *
* FUNCTION:                                                                 *
*                                                                           *
*                                                                           *
*       calib_yadc will by some algorithm determine if it is needed         *
*            ie based on time or temperature                                *
*                                                                           *
* DECLARATION INFORMATION:                                                  *
*                                                                           *
*    INPUT:   cal_level    the degree of fullness of the IF cal             *
*                                                                           *
*    OUTPUT:                                                                *
*                                                                           *
* EXTERNAL EFFECTS:                                                         *
*                                                                           *
*****************************************************************************
*                                                                           *
* LOGIC INFORMATION FOR calib_yadc                                          *
*                                                                           *
* MODULES CALLED:                                                           *
*                                                                           *
* INITIAL REFINEMENT;                                                       *
*                                                                           *
*                                                                           *
*****************************************************************************
end of comment;
PROCEDURE calib_yadc(cal_level); VALUE cal_level; INTEGER cal_level;
                                                                    ENTRY;
BEGIN

   IF cal_level = force_cal THEN
      BEGIN
      cal_ctr := 0;
      IF old_cal_level < 0 THEN cal_level := full_if_cal
       ELSE  cal_level := old_cal_level;
      END;

   IF (
      ( ( cal_ctr := cal_ctr - 1 ) <= 0 ) AND ( NOT yadc_cal_inhibit ) )
                                          OR
        (  cal_level # old_cal_level )    OR
        yadc_cal_force                    THEN
      BEGIN
      old_cal_level := cal_level;
      cal_ctr       := cal_ctr_rate ;
      IF cal_ctr_rate < cal_ctr_limit_max THEN
                     cal_ctr_rate := cal_ctr_rate + 1;


      reset_yadc_tables;
      cal_valid := TRUE;
```

```
SYADC.UORK.PD8510              THU, DEC 22, 1983, 11:07 AM    PAGE  34


    IF test_yadc_responding AND cal_adc THEN
          BEGIN
          IF cal_level > adc_cal_only THEN
             BEGIN
             cal_offset;
             IF cal_level > adc_if_offset_cal THEN
                 cal_sync_detector;
             END;
          END
     ELSE
          BEGIN
             test_imag_offset :=  test_real_offset  :=
             ref_imag_offset  :=  ref_real_offset   :=
                 adc_correction_table[-128] ;
          END adc_cal failed;

    check_abort;

    END cal loop;

END calib_yadc;
END$
```

APPENDIX C

MICROCODE SOFTWARE ROUTINES FOR THE VECTOR MATH PROCESSOR

MPYDOC.LANI.PD8510

******** a510 COMPLEX MULTIPLIER DOCUMENTATION *********

BRIEF DEFINITION OF TERMS
==========

ACC: Accumulator, represented as 2 16-bit shift registers;
2 accumulator pairs: ACC(0) & ACC(1), ACC(3) & ACC(4)
Shifts are done simultaneously to both ACC pairs.
When doing real math, operands are loaded into either
ACC(0) or ACC(1) for 16-bit values
ACC(0) and ACC(1) for 32-bit values (ACC(1)=lower word)
ACC(0) and ACC(1) for 24-bit values (ACC(1)=lower 8 bits)
When doing complex math, operands are loaded as such:
ACC(0) or ACC(1) for imaginary part
ACC(2) or ACC(3) for real part
Results are read from
ACC(0) or ACC(1) for 16-bit floating point
or for imag part of complex result
ACC(0) & ACC(1) for 32-bit floating point math
ACC(2) & ACC(3) for 32-bit floating point math
ACC(2) or ACC(3) for real part of complex result

MPY: Multiplier, represented as 2 16-bit parallel load serial
shift multipliers;
4 multipliers: MPY(0), MPY(1), MPY(2), MPY(3)
For complex math, 2 copies of multiplicand are loaded into
MPY pair 0&1 and MPY pair 2&3
MPY(0) & MPY(2) contain real part
MPY(1) & MPY(3) contain imag pert
For non-complex math, operands are loaded into
MPY(0) for 16-bit values
MPY(0) & MPY(1) for 32-bit values (MPY(0)=lower word)
Shifts are done simultaneously to both MPY pairs.

EXP: Exponent counter, used for aligning or normalizing values
in ACC. Can also be used as overflow flag.
Values usually loaded into EXP are:
exponent sums of multiplier & multiplicand
exponent differences of divisor & dividend
delta exponents between adder and addend

Normalization:
while ACC (MSB <> MSB-1) --> decrement EXP and shift ACC left

Complex Normalization: (DUAL)
Normalization flag set to check normalized result in either
real accumulator pair (ACC(0) & ACC(1)) or imaginary
accumulator pair (ACC(2) & ACC(3)), whichever gets normalized
first; otherwise only real ACC pair is checked for
normalization.

Complex Values:
represented as 16-bit imag part, 16-bit real part, 8-bit exp.

Complex Math: (SUMPR)
Enables complex values to be computed, particulary for multiplication; cannot have 32-bit MPYs in this mode.

Complex adder/subtractor: (LMPYADD)
Adds/subtracts complex conjugates.
Defaults to subtract mode; LMPYADD sets it to add mode.

Adder/Subtractor: (SSUB)
Adds/subtracts parameters prior to shifting into accumulators.
Defaults to add mode; SSUB set it to subtract mode.

MPY extension: (MEXT)
Cascade MPY pairs to 32 bits,
Cannot do complex matn (SUMPR) in tnis mode.

MICRO-ROUTINES

UADDFPR — 16-bit add or subtract

APPLICATION: floating point/complex numbers

PRECISION: 16-bit mantissa, 8-bit exponent

INPUT: 16-bit addend, 16-bit adder, (mantissa only)
8-bit "delta" exponent (difference between exponents of addeno and adder)

OUTPUT: 16-bit sum (mantissa only)
8-bit exponent (normalized result to be edded to larger value exponent between addend and adder)

SPEED: 3.875 usec (min)
11.375 usec (max)

SPACE: 16 words

DESCRIPTION: (ACC = adder/subtractor; MPY = addend/subtrahend)
Multiply MPY by 1 so that MPY acts like a shift reg.
Align ACC while EXP counter < 0
Align MPY while EXP counter > 0
Aod/subtract mantissas (ACC <-- ACC +/- MPY)
Normalize result in ACC
Set ADD latch in adder/subtractor for rounoing purposes
Rouno up result by 1 bit

MACRO-ROUTINES: ADDCP, SUBCP, MRLDG

UADDFP — Same as UADDFPR except w/o rounding

SPEED: 2.4375 usec (min)
6.0625 usec (max)

SPACE: 12 words

MACRO-ROUTINES: XPM2P

UADDLFP — 24-bit add or subract

APPLICATION: floating point numbers

PRECISION: 24-bit mantissa, 8-bit exponent

INPUT: 24-bit addend, 24-bit adder, (mantissa only)
8-bit "delta" exponent (difference between exponents of addend and adder)

OUTPUT: 24-bit sum (mantissa only)
8-bit exponent (normalized result to be added to larger value exponent between addend and adder)

SPEED: 4.375 usec (min)
15.625 usec (max)

SPACE: 21 words

DESCRIPTION: (ACC = adder/subtractor; MPY = addend/subtrahend)
Clear MPY & ACC adders
Since operands are loaded into ACC & MPY left-justified (MSB=bit 31, LSB=bit 8), right justify operands:
Sign extend ACC and shift out lower 8 bits
Multiply MPY by 1 (turn into shift register) while shifting out lower 8 bits
Align ACC while EXP counter < 0
Align MPY while EXP counter > 0
Add/subtract ACC and MPY, result left justified in ACC
Shift out lower ACC bits (0-7) that are not part of result
Left justify result in ACC with leading 0's in bits 0-7
Normalize result

MACRO-ROUTINES: ADDLF, DADLF

UMPYFP — 16-bit multiply

APPLICATION: floating point/complex numbers

PRECISION: 16-bit mantissa, 8-bit exponent

INPUT: 16-bit multiplicand, 16-bit multiplier (mantissa only)

OUTPUT: 16-bit product (mantissa only)
8-bit exponent (to be added to sum exponent of inputs)

SPEED: 4.3125 usec (min)
8.0625 usec (max)

SPACE: 11 words

DESCRIPTION: (ACC = multiplier, product; MPY = mulitplicand)
Initialize product exponent
Multiply ACC (lo bits) by MPY (16 bits) --> 32-bit product upper lo bits in MPY, lower lo bits in ACC
Shift upper lo bits from MPY to ACC(0) (result register)
Shift out 2 additional bits (lose 2 bits of precision to make room for possible double overflow of result)
Increment exponent to account the 2 LSBs shifted out
Normalize result.
ignore bits 0-14 of result and round up bit 15 into bits 16-31 of result.
Normalize result.

MACRO-ROUTINES: MPLDG, IFCAM, MPYAV, MCPMF, MPCPX, MPYCP, CPINV

UMPYFPNR — Same as UMPYFP except no rounding of result

SPEED: 3.000 usec (min)
4.875 usec (max)

SPACE: 8 words

MACRO-ROUTINES: IFCAM

UMPYFPRR — 16-bit multiply (reverse rounding)

APPLICATION: floating point/complex numbers

PRECISION: 16-bit mantissa, 8-bit exponent

INPUT: 16-bit multiplicand, 16-bit multiplier (mantissa only)

OUTPUT: 16-bit prooduct (mantissa only)
8-bit exponent (to be added tc sum exponent of inputs)

SPEED: 4.625 usec (min)
6.375 usec (max)

SPACE: 14 woros

DESCRIPTION: (ACC = multiplier, product; MPY = mulitplicand)
Same as UMPYFP except before rounding section, bit 15 of ACC Is inverted so that instead of rounding up it rounds down and vice-versa
NOTE: Useo to create noise in signals every n points

MACRO-ROUTINES: CPXMR

ULMPYFP — 16 by 32-bit multiply

APPLICATION: floating point/complex numbers

PRECISION: 16-bit mantissa, 8-bit exponent

INPUT: 16-bit multiplicand, 32-bit multiplier (mantissa only)

OUTPUT: 16-bit product (mantissa only)
8-bit exponent (to be added to sum exponent of inputs)

SPEED: 5.3125 usec (min)
9.0625 usec (max)

SPACE: 11 words

DESCRIPTION: (ACC = multiplier; MPY = mulitplicand)
Same as UMPYFP except
Multiply 16-bit MPY by 32-bit ACC = 48-bit result
upper 16 bits in MPY, lower 32 bits in ACC

MACRO-ROUTINES: XFM2P, MPYDV, IFCAM

MPYLFRC 32-bit multiply

APPLICATION: floating point numbers

PRECISION: 32-bit mantissa, no exponent

INPUT: 32-bit multiplicand, 32-bit multiplier (mantissa only)

OUTPUT: 32-bit product (mantissa only)
exponent = 1 for mantissa overflow, 0 for no overflow

SPEED: 4.8125 usec (min)
6.6875 usec (max)

SPACE: 8 words

DESCRIPTION: (ACC = multiplier; MPY = mulitplicand)
Set exponent to 0
Multiply 32-bit MPY by 32-bit ACC = 64-bit result
upper 32 bits in MPY, lower 32 bits in ACC
Shift upper 32 bits from MPY to ACC (result register)
Set exponent to 1 in case of overflow
Check for difference in actual sign bit and ACC sign bit through normalization check
Decrement exponent counter back to 0 if signs are same, no overflow

MACRO-ROUTINES: MDDFR

UMPYLFRC2 32-bit multiply --> result * 2

APPLICATION: floating point numbers

PRECISION: 32-bit mantissa, no exponent

INPUT: 32-bit multiplicand, 32-bit multiplier (mantissa only)

OUTPUT: 32-bit product multiplied by 2 (mantissa only)

SPEED: 4.5 usec

SPACE: 6 words

DESCRIPTION: (ACC = multiplier; MPY = mulitplicand)
Multiply 32-bit MPY by 32-bit ACC = 64-bit result
upper 32 bits in MPY, lower 32 bits in ACC
Shift bits 0-30 (31 bits, ignore MSB) from MPY to ACC (in lieu of shifting significant 32 bits of result into ACC and then shifting left once to multiply by 2)
NOTE: similar to MPYLFRC except for overflow checking

MACRO-ROUTINES: DIVFP

UMPYDB 32-bit multiply

APPLICATION: 32-bit integers

PRECISION: 32-bit integers

INPUT: 32-bit multiplicand, 32-bit multiplier

OUTPUT: 32-bit product (lower 32 bits of actual 64-bit result)

SPEED: 2.625 usec

SPACE: 5 words

DESCRIPTION: (ACC = multiplier; MPY = mulitplicand)
Set exponent to 0
Multiply 32-bit MPY by 32-bit ACC = 64-bit result
upper 32 bits in MPY, lower 32 bits in ACC

MACRO-ROUTINES: MPYD1

MPYFRC 16-bit multiply

APPLICATION: floating point/complex numbers

PRECISION: 16-bit mantissa, no exponent

INPUT: 16-bit multiplicand, 16-bit multiplier (mantissa only)

OUTPUT: 16-bit product (mantissa only)
exponent = 1 or 2 for mantissa overflow, 0 for no overflow

SPEED: 4.1875 usec (min)
7.9375 usec (max)

SPACE: 11 words

DESCRIPTION: (ACC = multiplier; MPY = mulitplicand)
Multiply 16-bit MPY by 16-bit ACC = 32-bit result
upper 16 bits in MPY, lower 16 bits in ACC(0)
Shift upper 16 bits from MPY to ACC (result register)
Clear exponent counter
Increment exponent in case of overflow
Check for difference in actual sign bit and ACC sign bit through normalization check
Decrement exponent counter back to 0 if signs are same, no overflow
Ignore lower bits 0-14 and round up bit 15 into resulting bits 16-31
Increment exponent in case of overflow in result
Check for difference in actual sign bit and ACC sign bit through normalization check
Decrement exponent if signs are the same, indicating no overflow

MACRO-ROUTINES: MDSFR, MINIP, MRLDG, MPLDG

UMPYLFP 24 by 32-bit multiply

APPLICATION: floating point

PRECISION: 32-bit mantissa, 8-bit exponent

INPUT: 32-bit multiplicand, 24-bit multiplier (mantissa only)

OUTPUT: 32-bit product (mantissa only)
8-bit exponent to be added to exponent sum of multiplicand and mulitplier

SPEED: 5.000 usec (min)
6.875 usec (max)

SPACE: 10 words

DESCRIPTION: (ACC = multiplier; MPY = mulitplicand)
Set exponent to zero
Shift out lower 8 bits of ACC to get 24 significant bits
Multiply 24-bit ACC by 32-bit MPY = 56-bit result
upper 32 bits in MPY, lower 24 bits in ACC
Shift significant 32 bits of result into ACC
Normalize result

MACRO-ROUTINES: XFM2P, MPYLF

UMPYDBG 32-bit by 16-bit multiply

APPLICATION: display formatting (from complex to display scale)

PRECISION: 32-bit value

INPUT: 32-bit multiplier, 16-bit multiplicand, 8-bit exponent

OUTPUT: 32-bit product

SPEED: 4.600 usec (min)
12.125 usec (max)

SPACE: 13 words

DESCRIPTION: (ACC = multiplier; MPY = multiplicand; EXP = exponent)
Converts ACC to floating point via normalization
Multiplies 16-bit MPY by 32-bit ACC = 48-bit product
16 bits in MPY, 32 bits in ACC
Shift most significant 16 bits from MPY to ACC
Convert final result in ACC to 32-bit integer value
by shifting ACC right ABS(EXP) times provided that
EXP is negative

MACRO-ROUTINES: MDBDG

UIFCAL IF calibration

APPLICATION: ???

PRECISION:

INPUT:

OUTPUT:

SPEED: 5.6857 usec (min)
9.4375 usec (max)

SPACE: 14 words

DESCRIPTION: ???

UNORMALIZE Normalize ACC contents

APPLICATION: floating point/complex/integers

PRECISION: 32-bits

INPUT: 32-bit value in ACC

OUTPUT: Normalized 32-bit value in ACC

SPEED: .875 usec (min)
4.625 usec (max)

SPACE: 7 words

DESCRIPTION: Clear adders
Sign extend ACC by 1 bit (use ACC adder)
Shift out ACC MSB from left side & decrement exponent
a maximum of 32 bits or until normalized
(ACC MSB <> ACC adder bit)
Shift in extended sign bit from ACC adder to ACC MSb
and increment exponent

MACRO-ROUTINES: MYNRM

ACCSHIFT Shifts 32-bit register 16 bits to the right

APPLICATION: floating point/complex/integers

PRECISION: 32-bits

INPUT: 32-bit value in ACC
OUTPUT: ACC arithmetically shifted right 16 bits

SPEED: 1.50 usec

SPACE: 5 words

DESCRIPTION: Sign extend ACC in ACC adder and shift ACC right 16 bits
NOTE: Especially used for chaining multiply operations

MACRO-ROUTINES: MPLDG

USHIFT Shifts 32-bit register to the right by EXP bits
(EXP = absolute value of negative exponent value)

APPLICATION: floating point/complex/integers

PRECISION: 32-bits

INPUT: 32-bit value in ACC, 8-bit negative exponent

OUTPUT: ACC arithmetically shifted right EXP bits

SPEED: .75 usec (min)
4.5 usec (max)

SPACE: 6 words

DESCRIPTION: Sign extend ACC in ACC adder
while exponent < 0:
shift ACC right 1 bit and increment exponent

MACRO-ROUTINES: MRLDG, MSHFT

MACRO-ROUTINES

The following macros are arranged in alphabetical order, however, some of them are arranged in a specific order in the multiplier source and may need to be regarded in that order due to the current 68K math/data processing routines' implementation.

Macros which may depend on other macros before or ahead of them are indicated as follows:

```
<macro label>: description of macro
               (after <prior macro label>)
               .
               .
               detail description of each word
               .
               .
               (followed by <next macro label>)
```

NOTE: when ACC's and MPY's are loaded or read, the real or imag parts claimed to be loaded or read may not be correct.

```
ADDCP:    Add 32-bit complex numbers  (mantissa only)
          16-bit real, 16-bit imag

          0) Load imag part of addend in MPY(0)
          1) Load real part of addend in MPY(2)
          3) Load imag part of augend in ACC(0)
          3) Load real part of augend in ACC(2)
          4) Load delta EXP, enable complex normalization,
             *** Execute UADDFPR ***
          5) Read imag part of result in ACC(0)
          6) Read real part of result in ACC(2)
          7) Read exponent from normalization, terminate.


ADDFP:    Add 16-bit floating point (mantissa only)

          0) Load addend in MPY(0)
          1) Load augend in ACC(0)
          2) Load delta exponent of 2 operands
             *** Execute UADDFPR ***
          3) Read result from ACC(0)
          4) Read exponent from normalization, terminate.


ADDLF:    Add 24-bit floating point (mantissa)

          0) Load EXP,
             Extend MPY to 32 bits,
             *** Execute UADDLFP ***


CPINV:    0-3:  a+bi --> a**2+b**2
          4-9:  (a+bi)(c+oi) --> (a+bi)(c-di)

          0) Load ACC(1) & MPY(0) with 16-bit imag part of operand
          1) Load ACC(3) & MPY(3) with 16-bit real part of operand,
             Enable complex multiply,
             *** Execute UMPYFP ***
          2) Read real part of result in ACC(0)
          3) Read normalization exponent, terminate.
          4) Load ACC(3) with 16-bit imag part of operand
          5) Load ACC(1) with 16-bit real part of operand
          6) Load MPY(0) & MPY(2) with 16-bit real operand,
             Enable complex normalization,
             *** Execute UMPYFP ***
          7) Read 16-bit imag part of result from ACC(2)
          8) Read 16-bit real part of result from ACC(0)
          9) Read EXP for exponent, terminate
```

```
CPXMR:    Complex multiply with reverse rounding
          (after MPYAV)

          0) Load ACC(3) with 16-bit imag part
          1) Load ACC(1) with 16-bit real part,
             enable complex normalization,
             enable complex multiply,
             set ADD latch in complex adder,
             *** Execute UMPYFPRR ***

DADLF:    Add 24-bit floating pt. (mantissa) - 2 simultaneous adds

          0) Load upper 16 bits of 1st multiplicand in MPY(1)
          1) Load lower 16 bits of 1st multiplicand in MPY(0)
          2) Load upper 16 bits of 2nd multiplicand in MPY(3)
          3) Load lower 16 bits of 2nd multiplicand in MPY(2)
          4) Load upper 16 bits of 1st multiplier in ACC(0)
          5) Load lower 16 bits of 1st multiplier in ACC(1)
          6) Load upper 16 bits of 2nd multiplier in ACC(2)
          7) Load lower 16 bits of 2nd multiplier in ACC(3)
          8) Load exponent (common to both sets of operands),
             Extend MPY pairs to 32 bits,
             Enable complex normalization,
             *** Execute UADDLFF ***
          9) Read upper 16 bits of 1st result
          10)Read lower 16 bits of 1st result
          11)Read upper 16 bits of 2nd result
          12)Read lower 16 bits of 2nd result
          13)Read resulting exponent, terminate


DIVFF:    32-bit floating point divide (???)
          (after SUBLF)

          0) Load upper 16 bits of operand in MPY(1) & MPY(3)
          1) Load lower 16 bits of operand in MPY(0) & MPY(2),
             extend MPY pairs to 32 bits,
             *** Execute UMPYLFRC2 ***

          (followed by MYNRM)


IFCAL:    IF calibration (???)
          (after MFDVR)

          0) Load MPY(2) with 16-bit imag part of operand
          1) Load MPY(1) with 16-bit real part of operand
          2) Load MPY(3) with 16-bit imag part of operand
          3) Load MPY(0) with 16-bit real part of operand
          4) load ACC(0) with upper 16 bits of operand
          5) Load ACC(1) with lower 16 bits of operand
          6) Load ACC(2) with upper 16 bits of operand
          7) Load ACC(3) with lower 16 bits of operand
             Enable complex normalization,
             Enable complex multiply,
             *** Execute UIFCAL ***
          (followed by IFCAM)


IFCAM:    (???)

          0) Read 16-bit result in ACC(0)
          1) Read 16-bit result in ACC(3)
          2) Read exponent
          3) Load MPY(2) with 16-bit imag part of operand
          4) Load MPY(1) with 16-bit real part of operand
          5) Load MPY(3) with 16-bit imag part of operand
```

```
6) Load MPY(0) with 16-bit real part of operand
7) Load ACC(0) with upper 16 bits of operand
8) Load ACC(1) with lower 16 bits of operand
9) Load ACC(2) with upper 16 bits of operand
10)Load ACC(3) with lower 16 tits of operand
   Enable complex normalization,
   Enable complex multiply,
   *** Execute U1FCAL ***
11)Read 16-bit imag part of result in ACC(0)
12)Read 16-bit real part of result in ACC(2)
13)Read exponent, terminate.

14)Load ACC(1) & MPY(0) with 16-bit imag part of operand
15)Load ACC(3) & MPY(3) with 16-bit real part of operand
   Enable compelx multiply,
   *** Execute UMPYFP ***
16)Load MPY(1) & MPY(3) with 16-bit imag part of operand
17)Load MPY(0) & MPY(2) with 16-bit real part of operand
18)Read 16-bit real part of result in ACC(0)
19)Read exponent result from EXP
20)Load ACC(3) with 16-bit imag part of operand
21)Load ACC(1) with 16-bit real part of operand,
   enable compelx normalization,
   *** Execute UMPYFPNR ***
22)Load MPY(0) & MPY(2) with 16-bit real part of operand,
   Enable complex normalization,
   *** Execute LLMPYFP ***

(followed by MPYAV)


LLDA0:  Loads ACC pairs, or reads ACC(0)

        0) Load ACC(0) with upper 16 bits of operand or
           Read 16-bit result from ACC(0)
        1) Load ACC(1) with lower 16 bits of operand

        (followed by LLDA2)


LLDA2:  Loeos ACC pair, or reads ACC(2)
        (after LLDA0)

        0) Load ACC(2) with upper 16 bits of operand or
           Read 16-bit result from ACC(2)
        1) Load ACC(3) with lower 16 bits of operand

        (followed by LLDMY)

LLDMY:  Loads MPY(0) and MPY(1)
        (after LLDA2)

        0) Load MPY(1) with upper 16 bits of operand
        1) Load MPY(0) with lower 16 bits of operand

        (followed by RDEXP)


MCPMP:  (???)
        (after CPXMR)

        0) Load MPY(1) & MPY(3) with 16-bit imag part of operand
        1) Load MPY(0) & MPY(2) with 16-bit real part of operand
        2) Load ACC(1) with imag part of operand
        3) Load ACC(3) with real part of operand,
           Enable complex normalization,
           Enable complex multiply,
           *** Execute UMPYFP ***
```

4) Read resulting exponent from EXP
5) Read 16-bit imag part of result from ACC(0)
6) Read 16-bit real part of result from ACC(2), terminate.

(followed by CPINV)

MDBDG: 32-bit integer by 16-bit fraction multiply
(after MPINRM)

0) Load ACC(0) with upper 16 bits of operand 1
1) Load ACC(1) with lower 16 bits of operand 1
2) Load MPY(0) with 16-bit fraction of operand 2
3) Load exponent of operand 2
*** Execute UMPYDBDG ***
4) Read upper 16 bits of result

(followed by MRLDG)

MDDFR: 32-bit fractional multiply, OP1*OP2 and OP1*OP3

0) Load MPY(1) & MPY(3) with upper 16 bits of operand 1
1) Load MPY(0) & MPY(2) with lower 16 bits of operand 1
2) Load ACC(0) with upper 16 bits of operand 2
3) Load ACC(1) with lower 16 bits of operand 2
4) Load ACC(2) with upper 16 bits of operand 3
5) Load ACC(3) with lower 16 bits of operand 3
Enable complex normalization,
Extend MPY pairs to 32 bits,
*** Execute MPYLFRC ***
6) Read upper 16 bits of result 1 in ACC(0)
7) Read lower 16 bits of result 1 in ACC(1)
8) Read upper 16 bits of result 2 in ACC(2)
9) Read lower 16 bits of result 2 in ACC(3)
terminate.

MDSFR: (???) OP1*OP3 and OP2*OP3

0) Load MPY(0) with 16-bit imag part of operand 1
1) Load MPY(1) with 16-bit real part of operand 1
2) Load MPY(2) with 16-bit imag part of operand 2
3) Load MPY(3) with 16-bit real part of operand 2
4) Load ACC(3) with 16-bit imag part of operand 3
5) Load ACC(1) with 16-bit real part of operand 3
Enable complex normalization,
Set ADD latch to complex adder,
Enable complex multiply,
*** Execute MPYFRC ***
6) Read 16-bit imag part of result from ACC(0)
7) Read 16-bit real part of reault from ACC(2), terminate.

MINIP: (???)
(after MPLOG)

0) Load MPY(1) with 16-bit imag part of operand
1) Load MPY(2) with 16-bit real part of operand
set ADD latch in complex adder
2) Load ACC(3) with 16-bit imag part of operand
3) Load ACC(1) with 16-bit real part of operand
Enable complex multiply,
*** Execute MPYFRC ***
4) Real 16-bit real part of result from ACC(2)
terminate.

```
MPCPX:   Multiply 2 complex numbers (16-bit imag, 16-bit real)
         (after MPYDV)

         0) Load imag part ot multiplicand in MPY(1) & MPY(3)
         1) Load real part of multiplicand in MPY(0) & MPY(2)
         2) Load imag part of multiplier in ACC(1)
         3) Load real part of multiplier in ACC(3),
            enable complex normalization,
            enable complex multiply,
            *** Execute UMPYFF ***

         (followed by MPDVR)


MPDVR:   Read complex result from ACC
         (after MPCPX)

         0) Read 16-bit imag result from ACC(2)
         1) Read 16-bit real result from ACC(0)
         (followd by IFCAL)


MPLDG:   (???)
         (after MRLDG)

         0) Load MPY(0) & MPY(2) with 16-bit imag part of operand 1
         1) Load MPY(1) & MPY(3) with 16-bit real part of operand 1
         2) Load ACC(3) with 16-bit imag part of operand 2
         3) Load ACC(1) with 16-bit real part of operand 2
            Enable complex normalization,
            Enable complex multiply,
            *** Execute UMPYFP ***
         4) Read resulting exponent from EXP
         5) Load MPY(0) with 16-bit operand,
            *** Execute ACCSHIFT ***
         6) Load MPY(2) with 16-bit operand,
            *** Execute MPYFRC ***

         (followed by MSHFT)


MPLOG:   R**2 - 1**2 = take magnitude of complex value

         0) Load ACC(1) & MPY(0) with 16-bit imag part of operand
         1) Load ACC(3) & MPY(3) with 16-bit real part of operand
            enable complex multiply
            *** Execute UMPYFP ***
         2) Read 16-bit real part of result from ACC(0)
         3) Read resulting exponent from EXP, terminate.

         (followed by MINIP)


MPYAV:   (???)
         (after IFCAM)

         0) Read ACC(2) wh/ contains 16-bit imag part
         1) Read ACC(0) wh/ contains 16-bit real part
         2) Read exponent from EXP, terminate.

         3) Load MPY(3) with 16-bit imag part of operand 1
         4) Load MPY(2) with 16-bit real part of operand 1
         5) Load MPY(0) with 16-bit imag part of operand 2
         6) Load MPY(1) with 16-bit real part of operand 2
         7) Load ACC(3) with 16-bit imag part of operand 3
         8) Load ACC(1) with 16-bit real part of operand 3,
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```
   Enable complex normalization,
   Enable complex multiply,
   Set add latch in complex adder,
   *** Execute Execute UMPYFP ***
9) Read 16-tit imag part of result from ACC(0)
10)Reao 16-bit real part of result from ACC(2)

(followed by CPXMR)


MPYCP:    Multiply 2 complex numbers (16-bit imag, 16-bit real)

          0) Loao imag part of multiplicand in MPY(0) & MPY(2)
          1) Load real part of multiplicand in MPY(1) & MPY(3)
          2) Load imag part of multiplier in ACC(3), Clear EXP
          3) Load real part of multiplier in ACC(1),
             Enable complex normalization, enable complex math
             *** Execute UMPYFP ***
          4) Read 16-bit imag part of result from ACC(0)
          5) Read 16-bit real part of result from ACC(2)
          6) Read resulting exponent in EXP counter, terminate.

MPYD1:    Multiply 2 32-bit integers

          0) Load MPY(3) with upper 16 bits of operand 1
          1) Load MPY(2) with lower 16 bits of operand 1,
             set add latch to complex aoder
          2) Load ACC(2) with upper 16 bits of operand 2
          3) Load ACC(3) with lower 16 bits of operand 2
             Extend MPY pairs to 32 bits
             *** Execute UMPYDB ***
          4) Read upper 16 bits of result from ACC(2)
          5) Reao lower 16 bits of result from ACC(3)
             terminate.


MPYDV:    Useo by complex divide to multiply real & imag part by const.
          (after MSHFT)

          0) Loao 16-bit values into MPY(0) & MPY(2),
             enable complex normalization
             *** Execute ULMPYFP ***
          1) Read exponent counter

          (followed by MPCPX)


MPYLF:    Multiply long floating point
          (after RDEXP)

          0) Load MPY(1) with upper 16-bits of operand
          1) Load MPY(0) with lower 16 bits of operand,
             Extend MPY pairs to 32 bits,
             *** Execute UMPYLFP ***

          (followed by ADDLF)


MRLDG:    (???)
          (after MDBDG)

          0) Loao ACC(0) with 16-bit operand
          1) Loao EXP with exponent
          2) Loao MPY(0) with 16-bit operano,
             *** Execute UADDFPR ***
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            3) Read 16-bit result in ACC(0)
            4) Read resulting exponent from EXP
               terminate.

            5) Load MPY(2) with 16-bit operand
            6) Load ACC(3) with 16-bit operand,
               *** Execute UMPFRC ***
            7) Load EXP with exponent,
               *** Execute USHIFT ***
            8) Read 16-bit result in ACC(2), terminate.

            (followed by MPLDG)


MSHFT:      Shift 32-bit value ABS(EXP) bits (EXP<0)
            (after MPLDG)

            0) Load EXP,
               *** Execute USHIFT ***
            1) Read ACC(0)
            2) Read ACC(2), terminate.

            (followed by MPYDV)


MYNRM:      Normalize 32-bit value in ACC(0) & ACC(1)
            (after DIVFP)

            0) Load ACC(0) with upper 16 bits of value
            1) Load ACC(1) with lower 16 bits of value,
               *** Execute UNORMALIZE ***

            (followed by MDELG)


RDEXP:      Reads exponent
            (after LLDMY)

            0) Read exponent from EXP

            (followed by MPYLF)


SUBCP:      Subtract 16-bit complex numbers  (mantissa only)

            0) Load MPY(0) with 16-bit imag part of operand 1
               Set subtract line in adder hardware
            1) Load MPY(2) with 16-bit real part of operand 1
            2) Load ACC(0) with 16-bit imag part of operand 2
            3) Load ACC(2) with 16-bit real part of operand 2
            4) Load delta exponent into EXP,
               Enable complex normalization,
               *** Execute UADDFPR ***
            5) Read 16-bit imag part of result from ACC(0)
            6) Read 16-bit real part of result from ACC(2)
            7) Read resulting exponent from EXP, terminate.
SUBLF:      Loads subtrahend for subtract operation
            (after ADDLF)

            0) Load MPY(1) with upper 16 bits or imag part
            1) Load MPY(0) with lower 16 bits or real part,
               Set subtract line to adder/subtractor hardware

            (followed by DIVFP)


XFM2P:      2-point transformation
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0) Load imag part of augend in ACC(0)
1) Load real part of augend in ACC(2)
2) Load imag part of addend in MPY(0)
3) Load real part of addend in MPY(2)
4) Load delta EXP, enable complex normalization,
   *** Execute UADDFPK ***
5) Read resulting exponent in EXP counter
6) Read imag part of result in ACC(0)
7) Read real part of result in ACC(2), terminate.

8) Load ACC(0) with 16-bit imag part of operand 1
9) Load ACC(2) with 16-bit real part of operand 1
10)Load MPY(0) with 16-bit imag part of operand 2,
   set suctract line in adder/subtractor
11)Load MPY(2) with 16-bit real part of operand 2
12)Load delta exponent,
   enable complex normalization,
   *** Execute UADDFP ***
13)Load MPY(1) & MPY(3) with imag part of operand
14)Load MPY(0) & MPY(2) with real part of operand,
   enable complex normalization,
   enable comlex multiply,
   *** Execute ULMPYFP ***
15)Read 16-bit imag part of result from ACC(0)
16)Read 16-bit real part of result from ACC(2)
17)Read resulting exponent from EXP, terminate.

XFM2Q:   (???)

         Similar to above....
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We claim:

1. An RF network analyzer system for analyzing a device under test (DUT), comprising:

an RF signal source having

an RF signal output;

first control means for controlling operation of the RF signal source, said first control means including means for controlling the frequency changes and retrace of the RF signal output of the RF signal source, and

first handshake means coupled to the first control means for communicating with the RF signal source;

a test set coupled to the RF signal source and the DUT, said test set having

an analog signal output,

second control means for controlling operation of the test set, and

second handshake means coupled to the second control means for communicating with the test set; and

a main analyzer having

an analog signal input coupled to the analog signal output of the test set,

an analog to digital converter for digitizing the analog signal input, said analog to digital converter having a digitized output signal,

third handshake means coupled to the first and second handshake means, and

a processor coupled to the third handshake means and the analog to digital converter for selecting the frequency changes of the RF signal source, and for processing the digitized measurement output signal during the frequency changes and retrace of the RF signal output.

2. An RF network analyzer system as in claim 1 wherein the first, second and third handshake means each comprise a digital interface circuit coupled to a common digital communications bus.

3. An RF network analyzer system as in claim 1 further comprising:

a single front panel;

a third control means for controlling internal operation of the single front panel; and

a fourth handshake means coupled to the single front panel and to the processor via the third handshake means so that a user can operate the RF signal source, the test set and the main analyzer from the single front panel.

4. An RF network analyzer system as in claim 3 wherein the first, second, third and fourth handshake means each comprise a digital interface circuit coupled to a common digital communications bus.

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