LeCroy 9320

Digital Storage Oscilloscope

SERVICE MANUAL

LeCroy

Innovators in Instrumentation

LeCroy 9320

Digital Storage Oscilloscope

SERVICE MANUAL

Version 1.0

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LeCroy
Corporate Headquarters

700 Chestnut Ridge Road
Chestnut Ridge, NY 10977-6499

Tel : (914) 425-2000
Fax : (914) 425-8967

LeCroy
European Headquarters

2, rue du pré-de-la-Fontaine
1217 Meyrin 1 / Geneva, Switzerland

Tel : 41 (022) 719.21.11
Fax : 41 (022) 782.39.15

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SECTION 1 GENERAL INFORMATION

1.1 Initial Inspection

It is recommended that the shipment be thoroughly inspected immediately upon delivery to the purchaser. All material in the container should be checked against the enclosed Packing List. LeCroy cannot accept responsibility for shortages in comparison with the Packing List unless notified promptly. If the shipment is damaged in any way, please contact the Customer Service Department or local field office immediately.

1.2 Warranty

LeCroy warrants its oscilloscope products to operate within specifications under normal use for a period of two years from date of shipment. Spares, replacement parts and repairs are warranted for 90 days. The instrument's firmware is thoroughly tested and thought to be functional, but is supplied "as is" with no warranty of any kind covering detailed performance. Products not manufactured by LeCroy are covered solely by the warranty of the original equipment manufacturer.

In exercising this warranty, LeCroy will repair or, at its option, replace any product returned to the Customer Service Department or an authorized service facility within the warranty period, provided that the warrantor's examination discloses that the product is defective due to workmanship or materials and that the defect has not been caused by misuse, neglect, accident or abnormal conditions or operation.

LeCroy will return all in-warranty products with transportation prepaid.

This warranty is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness, or adequacy for any particular purpose or use. LeCroy shall not be liable for any special, incidental, or consequential damages, whether in contract or otherwise.

1.3 Product Assistance

Answers to questions concerning installation, calibration, and use of LeCroy equipment are available from the Customer Service Department, 700 Chestnut Ridge Road, Chestnut Ridge, New York 10977-6499, U.S.A., tel: (914) 578-6060, or 6061, and 2 rue du Pré-de-la-Fontaine, 1217 Meyrin 1, Geneva, Switzerland, tel : (41) 22.719.21.11, or your local field engineering office.

1.4 Addresses

Corporate Headquarters

LECROY CORPORATION
700 CHESTNUT RIDGE ROAD
CHESTNUT RIDGE, NY 10977-6499

USA

TEL: (914) 425-2000
FAX: (914) 425-8967

European Headquarters

LECROY SA
2, CHEMIN PRE-DE-LAFONTAINE
P.O. BOX 341
CH-1217 MEYRIN 1 GENEVA
SWITZERLAND

TEL: 41 (22) 719-21-11
FAX: 41 (22) 782-39-15

USA

LECROY CORPORATION
700 CHESTNUT RIDGE RD
CHESTNUT RIDGE
NY 10977-6499

TEL: (914) 578-6060 or 6061
FAX: (914) 425-8967

LECROY CORPORATION
5912 STONERIDGE MALL RD 150
PLEASANTON CA 94588

TEL: (510) 463-2600
FAX: (510) 463-9179

Europe

LECROY GMBH
MANNHEIMERSTRASSE 177
POSTFACH 103767
D-6900 HEIDELBERG
GERMANY

TEL: 49.6221.831001
FAX: 49.6221.834655

LECROY BV
WAALRESEWEG 17
NL-5554 HA VALKENSWAARD
THE NETHERLANDS

TEL: 31.4902.8.9285
FAX: 31.4902.42628

LECROY LTD
28 BLACKLANDS WAY
ABINGDON BUSINESS PARK
ABINGDON, OXON OX14 1DY
GREAT BRITAIN

TEL: 44.23.553.31.14
FAX: 44.23.552.87.96

LECROY SARL
B.P. 214
AVENUE DU PARANA
F-91941 LES ULIS CEDEX
FRANCE

TEL: 33.1.69.18.83.20
FAX: 33.1.69.07.40.42

LECORY SRL
VIA CONCESIO 325
I-00188 ROMA
ITALY

TEL: 39.6.300.97.00
FAX: 39.6.300.96.00

LECROY SA
BAHNOFSTRASSE 18
5600 LENZBURG
SWITZERLAND

TEL: 4164.519.181
FAX: 4164.519.192

ESSA
EUIPOS Y SISTEMAS SA
APOLONIO MORALES 13-B
E-28036 MADRID

TEL: 34.1.359.0088
FAX: 34.1.359.0298

M.T. BRANDAO, LDA
RUA DO QUANZA, 150
4000 PORTO
PORTUGAL

TEL: 351.2.815.680
FAX: 351.2.815.630

DEWETRON ELEKTRONISCHE
MESSGERAETE Ges.M.B.H.
FOELLINGERSTRASSE 9E
8044 GRAZ

AUSTRIA

TEL: 43.316.391.804
FAX: 43.316.391.052

LUTRONIC APS
VIBEHOLMS ALLE 11-15
2600 GLOSTRUP

DENMARK

TEL: 45.4245.9764
FAX: 45.4363.0720

ORBIS OY
VANHA KAARELANTIE 9
01610 VANTAA
FINLAND

TEL: 358.0.566.4066
FAX: 358.0.531.604

HELLENIC SCIENTIFIC REP., LTD
11 VRASSIDA STREET
115 28 ATHENS
GREECE

TEL: 30.1.721.1140 or 721.3154
FAX: 30.1.724.1374

AVANTEC
TVETENVEIEN 6
0661 OSLO
NORWAY

TEL: 472.63.05.20
FAX: 472.65.84.14

ABB NERA A/S
P.O BOX 10
KOKSTADVEGEN 23
KOKSTAD BERGEN
NORWAY

TEL: 351.2.815.680
FAX: 351.2.815.630

MEASUREMENT SYSTEMS
SCANDINAVIA AB
P.O. BOX 393
FORETAGSALLEN 12, HUS 5 BV
184 24 AKERSBERGA
SWEDEN

TEL: 46.8.540.68100
FAX: 46.8.540.66536

Eastern Europe

ELSINCO GMBH
ROTENMUHLGASSE 11
1120 VIENNA
AUSTRIA

TEL: 43.222.812.1751
FAX: 43.222.812.2329

Mideast

AMMO
60 PINKAS STREET
P.O BOX 21384, 61213 TEL AVIV
ISRAEL

TEL: 972.3.453.157
FAX: 972.3.544.146

Asia

LECROY JAPAN CORPORATION
ESAKA SANSHO BLDG - 3RD FLOOR
16-3, 3-CHOME
TARUMICHO, SUITA CITY
OSAKA 564 JAPAN

TEL: 816.330.0961
FAX: 816.330.8096

LECROY JAPAN CORPORATION
ZAIKEN BLDG 6TH FLOOR
19-3, 2-CHOME
SASAZUKA, SHIBUYA-KU
TOKYO 151 JAPAN

TEL: 813.3376-9400
FAX: 813.3376.9587

SCIENTIFIC DEVICES AUSTRALIA
2 JACKS ROAD
SOUTH OAKLEIGH, VICTORIA
AUSTRALIA

TEL: 61.3579.3622
FAX: 61.3579.0971

TATA-HONEYWELL
55-A/8 & 9 HADAPSPAR
INDUSTRIAL ESTATE
PUNE 411 013 INDIA

TEL: 91.212.670445
FAX: 91.212.672205

E.C. GOUGH, LTD
245 ST.ASAPH STREET
P.O. BOX 22073
CHRISTCHURCH
NEW ZEALAND

TEL: 64.3.3798.740
FAX: 64.3.3796.776

ELECTRO TECH CORPORATION
1ST FLOOR, 16 KAZI CHAMBERS
BAHADURSHAH ZAFAR ROAD
KARACHI-74800
PAKISTAN

TEL: 92.21.493-8087 (dial slowly)
FAX: 92.21.493-7749

SINGAPORE ELECTRONICS
AND ENGINEERING, LTD
24 ANG MO KIO STREET, 65
SINGAPORE 2056

TEL: 65.480.7783
FAX: 65.481.4272

ABEX ENGINEERING PTE. LTD.
126 JOO SENG ROAD # 09-05
GOLD PINE INDUSTRIAL BLDG.
SINGAPORE 1336

TEL: 65.283.6288
FAX: 65.283.6628

LECOLN TECHNOLOGY CO.,LTD.
12F, NO 216, SEC 1,
HO PING E ROAD
TAIPEI TAIWAN R.O.C.

TEL: 886.2.365,0612
FAX: 886.2.367.1792

MEASURETRONIX
2102/31 RAMKAMHANG ROAD
BANGKOK 10240
THAILAND

TEL: 66.2.375.2733-4
FAX: 66.2.374.9965

EURO TECH (FAR EAST), LTD.
18 F, GEE CHANG HONG CENTER
65 WONG CHUCK HAND RD
HONG KONG

TEL: 8.52.814.0311
FAX: 8.52.873.5974

WOOJOO HI-TECH CORP.
DONGHYUN BLDG.
102-4 MOONJUNG-DONG,
SONGPA-KU
SEOUL 138-200 KOREA

TEL: 82.2.449.5472
FAX: 82.2.449.5475

P.T. DWI TUNGGAL JAYA SAKTI
WISMA RAJAWALI, 14TH FLOOR
JL JENDRAL SUDIRMAN
34 JAKARTA 10220 INDONESIA

TEL: 62.21.570.4563
FAX: 62.21.583.218

North America

ROHDE & SCHWARZ CANADA
555 MARCH ROAD
KANATA, ONTARIO K2K 2M5
CANADA

TEL: 613.592.8000
FAX: 613.592.8009

South America

SEARCH SA
VIAMONTE 1716 - PISO 7
1055 CAPITAL FEDERAL
ARGENTINA

TEL: 54.1.46.6156
FAX: 54.1.394.8374

ATP-HI-TEK
ALAMEDA AMAZONAS
422 ALPHAVILLE 06454-030
BARUEI, SP BRAZIL

TEL: 55.11.421.5477
FAX: 55.11.421.5032

Central America

NUCLEOELECTRONICA, SA
CALZ. LAS AGUILAS 101
DELEGATCION ALVARO OBREGON
01710 MEXICO, 20, d.f.
MEXICO

TEL: 52.5593.604
FAX: 52.5593.6021

South Africa

WESTPLEX LTD
TUSCANY HOUSE
376 OAK AVENUE
RANDBURG 2194
REPUBLIC OF SOUTH AFRICA

TEL: 27.11.787.0473
FAX: 27.11.787.0237

1.5 Maintenance Agreements

LeCroy offers a selection of customer support services. Maintenance agreements provide extended warranty and allow the customer to budget maintenance costs after the initial two year warranty has expired. Other services such as installation, training, enhancements and on-site repair are available through specific Supplemental Support Agreements.

1.6 Documentation Discrepancies

LeCroy is committed to providing state-of-the-art instrumentation and is continually refining and improving the performance of its products. While physical modifications can be implemented quite rapidly, the corrected documentation frequently requires more time to produce. Consequently, this manual may not agree in every detail with the accompanying product. There may be small discrepancies in the values of components for the purposes of pulse shape, timing, offset, etc., and, occasionally, minor logic changes. Where any such inconsistencies exist, please be assured that the unit is correct and incorporates the most up-to-date circuitry. In a similar way the firmware may undergo revision when the instrument is serviced. Should this be the case, manual updates will be made available as necessary.

1.7 Service Procedure

Products requiring maintenance should be returned to the Customer Service Department or authorized service facility. LeCroy will repair or replace any product under warranty at no charge. The purchaser is only responsible for one way transportation charges.

For all LeCroy products in need of repair after the warranty period, the customer must provide a Purchase Order Number before repairs can be initiated. The customer will be billed for parts and labor for the repair, as well as for shipping.

1.8 Return Procedure

To determine your nearest authorized service facility, contact the Customer Service Department or your field office. All products returned for repair should be identified by the model and serial numbers and include a description of the defect or failure, name and phone number of the user, and, in the case of products returned to the factory, a Return Authorization Number (RAN). The RAN may be obtained by contacting the customer service department in New York, tel: (914)578-6060, or 6061 ; in Geneva, tel: (41)22/719.21.11, or your nearest sales office.

Return shipment should be made prepaid. LeCroy will not accept C.O.D. or Collect Return Shipments. Air-freight is generally recommended. Wherever possible, the original shipping carton should be used. If a substitute carton is used, it should be rigid and be packed such that the product is surrounded with a minimum of four inches of excelsior or similar shock-absorbing material. In addressing the shipment, it is important that the Return Authorization Number be displayed on the outside of the container to ensure its prompt routing to the proper department within LeCroy.

1.9 Safety Precautions

The following servicing instructions are for use by qualified personnel only. Do not perform any servicing other than contained in service instructions. Refer to procedures prior to performing any service.

Exercise extreme safety when testing high energy power circuits. Always turn the power OFF, disconnect the power cord, discharge the cathode ray tube and all capacitors before disassembling the instrument.

The **W A R N I N G** symbol used in this manual indicates dangers that could result in personal injury.

The **C A U T I O N** symbol used in this manual identify conditions or practices that could damage the instrument.

1.10 Antistatic Precautions

CAUTION

Any static charge that builds on your person or clothing may be sufficient to destroy CMOS components, integrated circuits.
In order to avoid possible damage, the usual precautions against static electricity are required.

- Handle the boards in antistatic boxes or containers with foam specially designed to prevent static build-up.
- Ground yourself with a suitable wrist strap.
- Disassembly the instrument at a properly grounded work station equipped with antistatic mat.
- When handling the boards, do not touch the pins.
- Stock the boards in antistatic bags.

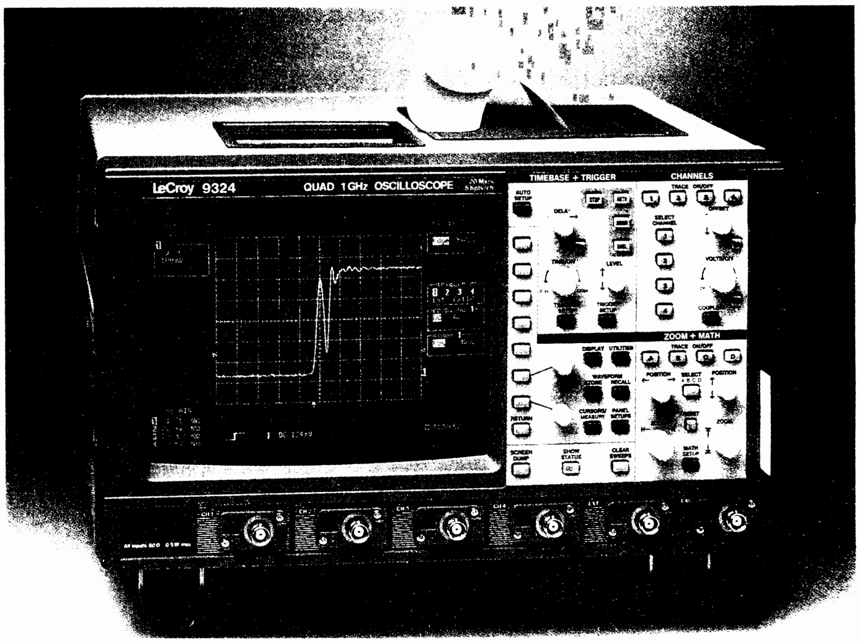
SECTION 2 SPECIFICATIONS

9320 Digital Oscilloscope

9320/24 PORTABLE DIGITAL OSCILLOSCOPES
1GHz Bandwidth

Main Features

- Two/Four Channels
- Main and Two Delayed Timebases for Accurate Time Measurement
- LeCroy ProBus™ Probe System
- Glitch, Pattern, State and Edge Qualified Triggers
- Automatic PASS/FAIL Testing
- Optional Built-in Printer
- DOS-Compatible Floppy Disk and Memory Card Options
- Persistence and XY Modes
- Fully Programmable via GPIB and RS-232



The 9320/24 is a general purpose instrument extending the power of digital oscilloscopes up to 1 GHz bandwidth. The oscilloscope is primarily intended for repetitive waveforms, which are sampled with an equivalent sampling rate of up to 20 GS/s. Single shot events up to a few MHz may also be acquired, with a single shot sampling rate of up to 20 MS/s.
The digital technology used provides standard DSO features like pre-trigger view, hardcopy, full programmability, etc. The proven user interface of the 9300 oscilloscope family ensures ease of use and user efficiency.

The LeCroy ProBus™ intelligent probe system allows automatic sensing of the probe type. For LeCroy's active FET probes it also provides variable offset at the probe tip; offset and coupling are controlled from the scope front panel.

Up to two delayed timebases can be positioned on the main trace and displayed giving unrivaled resolution and precision and very low jitter in time measurements. Advanced triggering capabilities, which include glitch, pattern and state/edge qualified triggers, drastically simplify the testing and debugging of electronics systems.

DOS compatible floppy disk and memory card options store waveforms and test setups, and make transferring data to a PC easier than ever before. Hardcopies may be made on GPIB, RS-232 or Centronics printers or plotters. An optional built-in printer is also available.
Additional firmware packages extend the oscilloscope's processing capabilities in both time and frequency domains.

Features and Benefits

TIME MEASUREMENT MADE EASY AND ACCURATE

Common applications in fields like digital electronics, computers, data communications, etc require precise time interval measurements. In order to make the measurements easier and more accurate, the 9320/24 features a main timebase and two delayed timebases which can be located almost anywhere on the main trace. The delayed timebases allow the selected portions of the waveform to be digitized at faster rates, thus providing higher horizontal resolution and more accurate measurements.

LECROY PROBUS™ INTELLIGENT PROBE SYSTEM

The ProBus™ system provides a complete measurement solution from probe tip to oscilloscope display. ProBus™ is an intelligent interconnection between LeCroy oscilloscopes and a growing range of innovative probes. ProBus™ provides automatic sensing of the probe type. For LeCroy's FET probes, it also allows offset at the probe tip and coupling to be controlled from the scope front panel.

A TRIGGER FOR EVERY APPLICATION

Two levels of trigger make catching difficult signals an easy task for the 9320/24. The standard trigger functions such as pre- and post- trigger, level, slope, mode and coupling are all accessed with simple and direct controls. Icon trigger graphics show the current setup at a glance. The touch of a button accesses further powerful trigger features (SMART trigger). SMART trigger modes allow the acquisition of complex phenomena. Trigger techniques include FAST-GLITCH mode for triggering on glitches down to 1 nsec, PATTERN trigger on the four input channels, STATE and EDGE QUALIFIED modes for tracking time violations.

AUTOMATIC MEASUREMENTS

In addition to cursor measurements, the 9320/24 performs fully automatic measurements. PASS/FAIL testing allows waveforms to be continually compared with a tolerance mask. (Masks may either be generated inside the instrument, or supplied on memory cards.) In addition, the 9320/24 can calculate any 5 waveform parameters from a list of 32, and compare them with user-defined limits. Any failure will cause preprogrammed actions such as Hardcopy, Save or GPIB SRQ. Basic statistics (low, high, average, standard deviation) may also be calculated on these parameters.

DOS COMPATIBLE MASS STORAGE

The 9320/24 offers two options (available together or separately) for built-in Mass Storage. Option FD01 provides a 3.5" 1.44 MB floppy disk drive, which stores waveforms and setups as DOS files. This may be used as a convenient way of transferring data to a PC. Option MC01 provides high-speed storage to Industry-Standard memory cards, which are also DOS compatible. Up to 8 MB of data (waveforms or setups) may be stored on a single card.

Mass Storage simplifies archiving, and can also be used to ensure that measurements are always made in the same way. Golden Waveforms (or tolerance masks) may also be stored, so that signals are compared with a known reference. Waveform processing is possible on live or stored waveforms.

BUILT-IN PRINTER

As well as driving most printers and plotters via GPIB (IEEE-488.2), RS-232 and optional Centronics interfaces, the 9320/24 also offers an optional internal printer. This thermal printer produces full size screen dumps in approximately 10 seconds.

FLEXIBLE INTERFACING

Both GPIB and RS-232 interfaces may be used for full remote control of the instrument. All front-panel controls and internal processing functions can be controlled.

POWERFUL DISPLAY MODES

The 9320/24's high-resolution raster display shows from one to four independent waveform grids. Persistence display mode allows easy viewing of signal changes over time, and XY mode plots any two sources against one another. Cursors are usable in all display modes.

MULTIPLE-WAVEFORM ZOOM

In addition to the two delayed timebases the 9320/24 has four Zoom/Math traces which may be used for signal processing or zooming waveforms. Up to four traces (e.g. a waveform and three different expansions) may be viewed simultaneously. Alternatively, four different expansions of the same waveform may be viewed.
The area to be expanded is selected by moving an intensified portion of the waveform. Cursor measurements may be made from one expanded portion to another, providing the most accurate time measurements possible.

EXTENSIVE WAVEFORM MATH

The 9320/24's built-in processing includes mathematics (Add, Subtract, Multiply and Divide, Negation and Identity) and Summation Averaging (up to 1000 sweeps). Option WP01 provides Averaging (Summed and Continuous) and Mathematics (including ABS, Differentiation, Identity, Integration, Log or Exp (base or base 10), Negation, Reciprocal, Rescale, Sin(x)/x, Square and Square root). Also included is Enhanced Resolution mode (up to 11 bits) and Extrema mode for storage of peak positive and negative values. More information is available in the 9300 WP01 datasheet.

OPTIONAL FFT PACKAGE

Option WP02 provides comprehensive Spectral Analysis capabilities. These permit the system designer to identify characteristics which may not be apparent in the time domain. WP02 provides a wide selection of displayed projections (magnitude, phase, real, imaginary, power spectrum, power density) and windowing functions, as well as averaging in the frequency domain. For more information, see the 9300 WP02 datasheet.

9320/24 Specifications

ACQUISITION SYSTEM
No. of Channels: 2 (9320) and 4 (9324).
Bandwidth (-3dB): DC to 1 GHz.
Rise-time: tr < 0,38/BW
Input Impedance (working conditions): 50 Ω ± 1%.
Input Impedance (power off and calibration): 50 Ω ± 10%
Maximum Input Voltage: ± 5 V DC (500mW) or 5 V RMS, fuse protected.
Max Operating Input Voltage: Same as Max input voltage.
Voltage Standing Wave Ratio (VSWR): ≤ 1,25 from 5 mV/div to 2 V/div, DC to 1 GHz.
Sensitivity Range: 5 mV/div to 2 V/div in 1-2-5 sequence and continuously variable.
Random Noise: < 300µV RMS,
220µV typical at 5mV/div;
0,025 div typ. at 10, 50, 200 mV/div, 1 V/div;
0,016 div typ. at 20, 100, 500 mV/div, 2 V/div.
Probe Calibrator: BNC connector, 250 mV into 50 Ω, generate rectangular pulses with 50% duty cycle; rise time < 750 psec; fall time <500 psec; non-flatness <1%; zero offset; programmable frequency. The calibrator output can also alternatively provide, under menu control, a trigger output or a PASS/FAIL output.
No. of Digitizers: 2 or 4, one per channel.
Vertical Resolution: 8 bits, all on screen (up to 12 bit with processing).
Conversion Rate: Up to 20 MS/s for transients, up to 20 GS/s for repetitive signals, simultaneously on all channels.
DC Accuracy: ≤ ± 2% full scale, at 0 V offset.
Vertical Expansion: up to 5x normally, up to 50x with averaging.
Cross Talk: >100: 1 DC to 1 GHz at any sensitivity and for any two channels having equal V/div setting.
> 300: 1 DC to 300 MHz, same conditions.
Interchannel Skew: < 50 psec for channels having equal setting.
Offset: Maximum allowed offsets depend on the sensitivity as shown in the following table.

Sensitivity:	Offset range:	Overdrive Limit:
5 - 24,5 mV/div	± 0,8 V	0,4 V
25,0 - 124 mV/div	± 4,0 V	2,0 V
126 mV/div - 2 V/div	± 10,0 V	5,0 V

Overdrive Recovery Time: The acquisition system tracks signals to within ± 2% full scale 35 ns (typical) after overloads that do not differ from the signal by more than the Overdrive Limit shown in the table above.

TIMEBASE SYSTEM
Timebases: Three, main and two delayed.
Main Timebase Range: 100 psec/div to 200 msec/div in 1-2-5 sequence.
Delayed Timebase Range: 100 psec/div to main timebase setting.
Clock Accuracy: ≤ 0.005%.
Time Digitizer Resolution: 10 psec.
Max Record Length: 5000 samples per channel.
Acquisition Modes: Random Interleaved Sampling from 100 psec/div to 10 µsec/div. Single shot from 20 µsec/div to 200 msec/div.

TRIGGER SYSTEM
Pre-Trigger Time: Adjustable in 0.1div increments up to 10 div full scale (grid width).
Post-Trigger Delay: Adjustable in 0.1 division increments up to 10,000 divisions.
Timing: Trigger date and time stored with each waveform.
External Trigger Input: 50 Ω ± 1%.
External Trigger Voltage Range: ± 0.5 V in EXT, ± 5 V in EXT/10.
Trigger Rate: Up to 1.5 GHz on one channel only, (CH2 in 9320, CH4 in 9324) when HF coupling selected; 750 MHz for all other channels.
Total Jitter: < 8 psec RMS.
Trigger Holdoff Range: By time 50 nsec to 20 sec with minimum steps of 12.5 nsec, by events 1 to 10^9, 75 MHz max rate.

STANDARD TRIGGER
Trigger Sources: CHAN1, CHAN2, (CHAN1 to CHAN4 in 9324), Ext, Ext/10. CH1 to CH4 and EXT have independent trigger circuits allowing individual setting of slope, level and coupling.
Slope: Positive, negative.
Coupling: DC, AC-AUTOLEVEL, and HF (for one channel only).
Modes: Stop, Auto, Normal, Single.

SMART TRIGGER
Single Source on any of CH1 to CH4 and EXT.
Pulse or Pattern Width<: 1 nsec to 1 µsec in steps varying from 500 psec to 20 nsec.
Pulse or Pattern Width>: Same ranges and steps as above.
Pattern: Trigger on the logic AND of the input channels (CH1 to CH4 in 9324, CH1 and CH2 in 9320), where each source can be defined as high (H), low (L) or don't care (X). The trigger can be selected at the beginning (entered) or at the end (exited) of the specified pattern. The pattern width or holdoff can also be specified as above.
State/Edge Qualified: Triggers on any source (CH1 to CH4 + EXT) after the entering of a qualifying condition- edge or state- that can be defined on a single source or on a pattern of the input channels. The trigger can take place after (or within) a programmable delay ranging from tmin to 1000 nsec in steps varying from 500 psec to 20 nsec,
where tmin = 2,0 nsec for State Qualified
tmin = 7 nsec for Edge Qualified.

The state qualified trigger requires the continuing presence of the enabling pattern to trigger, while the Edge Qualified trigger doesn't.

DISPLAY
CRT: 12.5 X 17.5 cm (5 X 7 inches); magnetic deflection; raster scan.
Resolution: 810 X 696 pixels.
Graticules: Internally generated, separate intensity control for graticule and waveforms; single, dual and quad graticules.
Display modes: Normal, infinite persistence, XY, dot join ON/OFF.

MEASUREMENT SYSTEM
Automatic Measurements determine:

Amplitude	Frequency	Period
Area	Maximum	Peak to Peak
Base	Mean	Risetime
Cycles	Median	RMS
Delay	Minimum	Std dev
Duty Cycle	Overshoot +	Top
Falltime	Overshoot -	Width
Δdelay	Δt at level	

As defined by ANSI/IEEE Std 181-1977 "Standard on Pulse Measurement and

Analysis by Objective Techniques".
In addition, Rise and Fall times may be measured at 10% and 90% levels, or 20% and 80% levels, or any other user-specified levels.

Δdelay provides time between midpoint transition of two sources, for making propagation delay measurements.

Δt at level allows the same measurement to be made at any specified level.

Two cross-hair cursors are used to define the region over which these parameters are calculated. The following statistical calculations are also available for each measurement: Average, High, Low, Std. Deviation.

Cursor Measurements: Absolute and relative for voltage, time and frequency.
Cursor Types: Horizontal bars for voltages, cursors riding on waveforms for times.

WAVEFORM PROCESSING
Waveform processing routines, up to four simultaneously, are called and set up via menus. These include arithmetic functions (Add, Subtract, Multiply, Divide, Negate, Identity), and Summation Averaging (up to 1000 signals).
Function Memories: 4 x 5000 points, 16 bit.
Automatic Testing: Up to five waveform parameters may be tested against selectable thresholds. Waveforms may also be tested against tolerance templates which can be generated inside the instrument.
Optional Processing: Extra processing power can be added by installing LeCroy's waveform processing options.
Option WP01 provides Averaging, Summation and Continuous, Extended Mathematics including Integration, Differentiation, Log, Exp, ABS, Square, etc; High Resolution mode, up to 11 bits; Extrema mode for storage of extreme positive and negative values.
Option WP02 provides FFT spectral analysis with a wide selection of displayed parameters.

AUTOSETUP
Front panel button. Automatically scales timebase, trigger and sensitivity settings to correctly display repetitive signals with amplitudes between 10 mV and 5 V.
Autosetup Time: Approximately 2 sec, frequency above 50Hz; duty cycle greater than 0.1%.

Vertical Find: Individual per channel, automatically scales sensitivity and offset.

INTERFACING
Remote Control: Of all front-panel controls, as well as all internal functions is possible by GPIB and RS-232.
RS-232 Port: Asynchronous up to 19200 baud for computer/terminal control or printer/plotter connection.
GPIB Port: (IEEE-488.1) Configurable as talker/listener for computer control and fast data transfer. Command language complies with requirements of IEEE-488.2.
Centronics: Optional parallel interface.
Hardcopy: Screen dumps are activated by a front-panel button or via remote control. TIFF format is available for importing to DTP programs. The following printers and plotters can be used to make hardcopies: HP ThinkJet, QuietJet, LaserJet, PaintJet and EPSON compatible printers. HP 7400 and 7500 series, or HPGL compatible plotters.

STORAGE
Reference Memories: 4x5000 points, 16 bits, usable to store acquired and processed waveforms.
Setups: Up to four stored in battery backed-up memories. Front-panel settings are maintained for two years.
Two DOS Compatible Mass Storage Options: 1.44 MB, 3.5" floppy disk and/or up to 8 MB fast storage memory card, provide non-volatile mass storage of waveforms and/or front-panel setups.

SELF TESTS
Auto-Calibration ensures specified DC and timing accuracy.

GENERAL
Temperature: 5° to 40° C (41° to 104° F) rated, 0° to 50° C (32° to 122° F) operating.
Humidity: < 80%.
Shock & Vibration: Meets MIl-STD-810C modified to LeCroy design specifications and MIL-T-28800C.
Power: 90-250 V AC, 45-66 Hz, 150 W.
Battery Backup: Front-panel settings maintained for two years.
Dimensions: (HWD) 8.5" x 14.5" x 16.25", 210 mm x 370 mm x 410 mm.
Weight: 10 Kg (22 lbs) net, 15.5 Kg (34 lbs) shipping.
Warranty: Two years.

Ordering Information

Oscilloscope and Options

9320	2 Channel Digital Oscilloscope
9324	4 Channel Digital Oscilloscope
9320WP01	Waveform Math
9320WP02	FFT Processing
9320-MC01/04	Card Reader + 512K Memory Card
9320-FD01	3.5" Floppy Disk Drive + Centronics Interface
9320-GP01	Internal Printer + Centronics Interface
9320-W5	5 Year Extended Warranty

Oscilloscope Accessories
Supplied with Instrument:

9320-OM	Operator's Manual
9320-RCM	Remote Control Manual
9320-FC	Front Cover
PP062	1 GHz, 500 Ω, 10:1 passive probe (two with Model 9320, four with Model 9324)

Ordered Separately:

AP020	1 GHz, 10:1 FET input ProBus™ probe
AP021	800 MHz, 5:1 FET input ProBus™ probe
PP090	75 Ω to 50Ω, 2:1 ProBus™ adapter
9320-CC	Calibration Certificate
9320-SM	Service Manual
9320-MC02	128K Memory Card
9320-MC04	512K Memory Card
DC/GPIB-2	2 Meter GPIB Cable
OC9001	Oscilloscope Cart
93XX-RM01	Rackmount
93XX-TC1	Transit Case
93XX-TC2	Carrying Bag

USA Direct Sales: 1 (800) 5LE-CROY

LeCroy Worldwide Sales Offices

ASIA/PACIFIC	LeCroy Pty Ltd	61.38.90.7358
BENELUX	LeCroy BV	04902.8.9285
CANADA	LeCroy Canada	514.928.4707
FRANCE	LeCroy SARL	(1).69.07.38.97
GERMANY	LeCroy GmbH	06221 83.10.01
ITALY Roma	LeCroy SRL	06.336.797.00
ITALY Milano	LeCroy SRL	02.204.70.82
JAPAN Osaka	LeCroy Japan	0816.330.0961
JAPAN Tokyo	LeCroy Japan	0813.3376.9400
SWITZERLAND	Geneva	022.719.21.11
SWITZERLAND	Lenzburg	064.51.91.81
United Kingdom	LeCroy Ltd	023.553.31.14

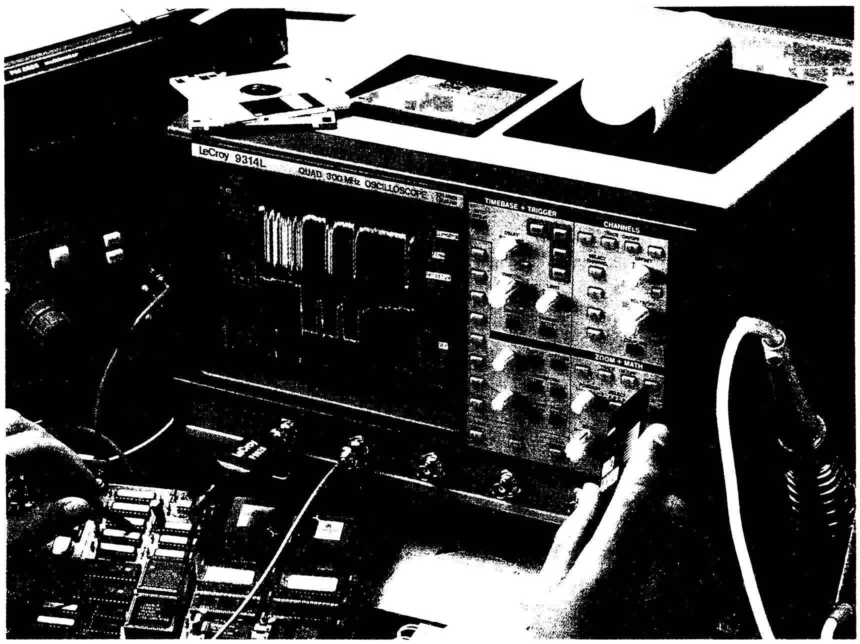
Other sales and service representatives throughout the world.

LeCroy
The Digital Scope Specialists

9300 series internal
3.5" Floppy, RAM card, Printer

Main Features

- 3.5" Floppy drive, DOS format, affordable and convenient
- Ultra-fast RAM card, DOS format, ideal for PASS/FAIL testing
- High-resolution Printer, ideal for fast, on-the-spot documentation
- Convenient Hardcopy storage to card/disk



3.5" Floppy

The floppy drive is a convenient storage medium, not only for saving and retrieving waveforms or instrument settings, but also for storing hardcopies that can be printed from a PC when desired. The floppy supports both 720K and 1.44M DOS formats so that it can be read back on any PC with a 3.5" drive, avoiding the need to interface the oscilloscope to your PC. As with the RAM-card option, the floppy system capabilities include automatic storage of data under pre-programmed conditions.

RAM Card

The RAM card is a fast and compact storage medium for saving and retrieving waveforms or instrument settings. It complies fully with the PC industry's PCMCIA/JEIDA standard. With the special Autostore feature, waveforms can be automatically stored to the card after every acquisition, and "played back" when desired. And with the scope's powerful PASS/FAIL feature, failure data can also be saved automatically to the RAM card.

Printer

The internal printer is an invaluable tool for instant, on-the-spot documentation. It generates a clear, crisp hardcopy of the screen in just a few seconds. The printout's large size combined with its high-resolution provide you with an excellent document that matches the screen's superior quality even to the finest details. And because it frees you from the trouble of carrying and interfacing a bulky printer, it's the ideal solution for field measurements.

Mass-storage Features and Benefits

LeCroy's mass storage capabilities provide a range of benefits:
- Easy data transfers to PCs
- Waveform logging
- Waveform archiving for future use
- Faster troubleshooting
- Faster, more reproducible testing
- Shared oscilloscope resources

EASY DATA TRANSFERS TO PCs
Because the 9300 series oscilloscope uses DOS-formatted floppy disks and memory cards, transferring waveform data to a PC is a breeze. The removable storage allows transfers without cables, programming, or any knowledge of GPIB, RS-232, or other interfaces. And what's more, LeCroy provides, free of charge, a binary-to-ASCII format conversion program for the PC since some PC-based analysis packages (such as spreadsheets), require ASCII format.

WAVEFORM LOGGING
By using Glitch or Dropout triggering in combination with the powerful AUTO-STORE mode, LeCroy oscilloscopes can monitor and log intermittent problems automatically. To store a waveform, the oscilloscope opens and names a DOS-compatible file and then stores the waveform data into the file. This logging feature requires no operator intervention and maintains data and the operational setup through power line failures. Logged waveforms can be selectively played back by trigger time/ date or by sequence number, or can be scrolled through sequentially.

WAVEFORM ARCHIVING FOR FUTURE USE
- Recallable proof of performance
- Additional data analysis as needed
- Accurate trend or drift monitoring
- Calibration procedure verification

When storing waveforms, LeCroy DSOs also archive a header of setup information and the acquisition time/date. After recalling an archived waveform, the several hundred byte header ensures correct time and voltage scaling. When recalled into the oscilloscope, the waveform can be zoom expanded, compared, or analyzed just like a live waveform. The time/date offers proof of measurement authenticity and trend sequence.
All LeCroy DSOs store raw waveform data using one byte per sample point. Signal averaged, Enhanced Resolution (ERES) filtered, and other processed data use two bytes per point, to take advantage of the added resolution.

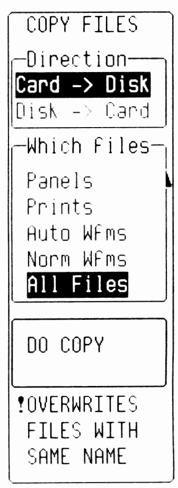
HARDCOPY ARCHIVING
Hardcopies of the screen can also be stored for future use. For instance, a screen saved in TIFF format can eventually be imported into a Word Processor to illustrate a report. As another example, field-measurement screens could be saved in LaserJet format on the memory card or floppy disk, and then printed from a PC back in the lab.

FASTER FIELD MEASUREMENTS
Recallable reference waveforms and oscilloscope setups for each test point on a Device Under Test (DUT) can make fault troubleshooting faster and more accurate. A dedicated memory card or floppy disk can hold all of the correct test point waveforms and associated DSO setups for a particular DUT.
The technician can recall stored setups quickly and consistently, thereby avoiding incorrect measurement conditions. He can then compare actual waveforms to recalled reference waveforms taken from a known working system. So the technician needs less knowledge and skill to quickly probe a large number of test points and verify that the correct waveforms exist.
If a problem is found, the aberrant waveform may be saved. It can later be shown to laboratory-based engineers, for example, for problem-solving guidance or for improvement of DUT design.
Memory cards, being rugged and shirt-pocket sized, are ideal for this application.

FASTER, MORE REPRODUCIBLE TESTING
LeCroy oscilloscopes can compare measured waveforms against upper and lower waveshape tolerances or against parameter limits, such as risetime, overshoot, or peak voltage, and make PASS/FAIL decisions. This PASS/FAIL testing decreases test times in GPIB-based ATE systems by reducing data transfers. It increases reproducibility and accuracy in manual tests by eliminating human errors.
Once defined, these tests may be saved by storing instrument setups which include the specified tolerances and/or reference waveforms. Different test personnel can easily share a common test library via PC network.
Waveshape test limits can be generated by capturing a "golden" waveform and by then selecting amplitude and timing limits (in fractions of screen graticule divisions). Or a user can create standard waveform limit templates on a computer (e.g. ANSI/CCITT telecommunication templates)
On LeCroy 9300 series DSOs, specific parameter tolerance test procedures are created by selecting limits for any five out of twenty pulse parameters with Boolean AND or OR conditions between them. During testing , FAIL responses can include an audible beep, GPIB SRQ, hardcopy output, or store to memory card.

SHARED OSCILLOSCOPE RESOURCES
Tired of spending hours to recover your precious setup after someone else used your instrument? Just plug-in your *personal* RAM card or floppy and restore your setup in just seconds. Each individual user can keep his own preferred setups on his own floppy disk or RAM card.

A selection of files can be copied from the memory card to the disk and vice-versa.



Hardcopy Features and Benefits

The internal printer adds a whole range of benefits to the LeCroy 9300 series:
- Ultra fast printouts
- High resolution printing
- No-trouble interfacing
- No-trouble carrying

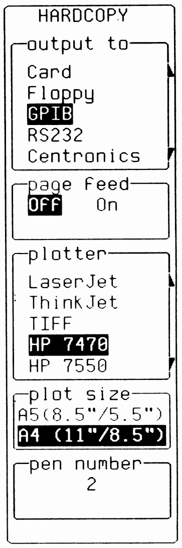
ULTRA-FAST PRINTOUTS
Measurement documentation is made easier - and faster - than ever since the internal printer produces a hardcopy in less than 10 seconds. What's more the document is date- and time-stamped: a real bonus for archiving those test results.

HIGH RESOLUTION PRINTING
With a resolution of 190 dots-per-inch, the internal printer matches the screen's superior quality, to document the captured traces down to their finest details. And the size of the printout is impressive for an internal printer: a full 7" diagonal!

TROUBLE-FREE INTERFACING
Tired of struggling with cable schematics, baud rates, gender-changers, and dip switches? The internal printer frees your mind for more productive tasks. Just select the internal printer in the scope's utilities menu, hit the SCREEN DUMP button, and you're in business!

TROUBLE-FREE TRANSPORTING
Having a printer totally integrated in the instrument makes life much easier for field-measurement applications. Imagine carrying a scope, a printer (and perhaps a floppy drive) in one hand!

The 9300 series oscilloscope supports a whole range of popular printers and plotters. Hardcopies of the screen can be either sent directly to the device or to the card/ floppy for future use.



OTHER HARDCOPY SOLUTIONS
High quality project reports, presentation materials, technical manuals, and troubleshooting instructions often require integration of text and graphics on the same page. Advanced PC desktop publishing - and more and more word processors - Such as Word-for-Windows, WordPerfect, or AMI Pro can directly import graphic files, size them, and position them anywhere on the page. Written text can then wrap around or be positioned within the graphics. LeCroy 9300 oscilloscopes can save screens in TIFF (Tagged Image Format File). After transferring the file to a PC, the DTP software can import and manipulate the document like any other graphic object.
The LeCroy 9300 series also offers a wide range of interfacing capabilities with external hardcopy devices:
- Plotters. HPGL, HP 7400 and 7500 compatible
- Printers. HP LaserJet, ThinkJet, Paintjet (including color), DeskJet (including color) and Epson
- Interfacing. RS-232, GPIB, or even Centronics (optional)

Floppy drive, RAM card and Printer Specifications

3.5" FLOPPY DRIVE
Type: 3.5 inch floppy drive, DOS format.
Supported disk formats: 720KB, 1.44MB
Maximum transfer rate: 15 kB/sec
Typical Waveform Transfer Speed:

Length	Store	Recall
1000	2.2 s	0.4 s
10000	2.7 s	1.0 s
50000	5.5 s	3.4 s

Waveform File Size: A channel-trace will use 1 byte per sample plus approximatively 359 bytes of waveform descriptor. A processed trace will use 2 bytes per sample.
Template Size: Approximatively 21K bytes.
Panel Setup Size: Approximatively 3K bytes.

RAM CARD
Type: PCMCIA 1.0 JEIDA 3.0 & 4.0.
Supported card formats: SRAM for reading and writing, ROM, OTP, and FLASH for reading, the driver software supports card sizes up to 8MB.
Maximum transfer rate: 170 kB/sec
Typical Waveform Transfer Speed:

Length	Store	Recall
1000	25 ms	20 ms
10000	100 ms	80 ms
50000	400 ms	300 ms

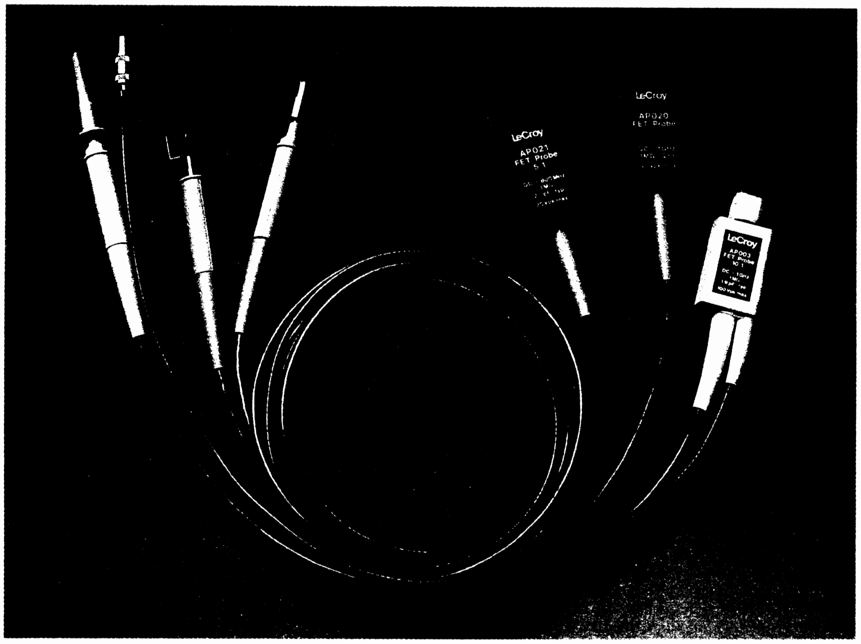
Waveform File Size: Same as for the floppy.
Template Size: Approximately 21K bytes.
Panel Setup Size: Approximately 3K bytes.

PRINTER
Type: Raster printer, thermal.
Resolution: 190 DPI.
Printout Size: 126 mm x 90 mm
Paper: Thermal printer paper, 30 meter roll, 110 mm width, type Seiko or similar.
Printing speed: 6 seconds approx. for one screen.

AP003, AP020 and AP021 Active FET Probes

Main Features

- Bandwidths to 1 GHz
- LeCroy ProBus™ interface for the AP020 and the AP021
- 1 MΩ input Impedance
- Low capacitance at probe tip
- Rugged mechanical construction
- Automatic sensing and control on scopes equipped with ProBus™



FET Probes provide the oscilloscope user with a higher level of measurement capability. Compared with passive probes, they offer low circuit loading, low capacitance and high bandwidth. This combination makes them the ideal tools for working on sensititve or high-speed electronics.

This performance is achieved by the integration of a high-impedance Field Effect Transistor (FET) amplifier into the probe tip. The circuit under test sees only the amplifier's input impedance - it is effectively buffered from the scope's input impedance and the probe cable.

LeCroy's AP series of FET probes are mechanically rugged in design, while their miniature construction allows them to be used in hand-held PCB probing applications. Their detachable tips are designed for simple replacement, and they are supplied with a full set of accessories.

Models AP020 and AP021 offer 1 GHz and 800 MHz Bandwidth respectively. AP020 features X10 signal attenuation and is especially recommended for LeCroy's 9320 and 9324 1 GHz oscilloscopes. The AP021 offers X5 attenuation when used with the new 9360.

As an active device, the FET probe requires a stabilized power supply. LeCroy provides an elegant solution to this with the ProBus™ probe interface.

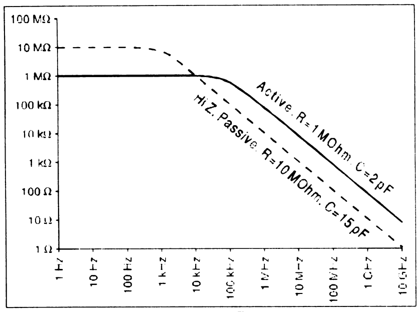
ProBus™ provides probe power and signal connection in one integrated package. It also allows the scope to control other probe functions, such as input coupling and DC offset. The ProBus™ interface is now available on a growing range of LeCroy oscilloscopes and probes. AP003 has an external power connector for use with scopes which are not ProBus™ compatible. All other models use the ProBus™ interface.

Features and Benefits

Connecting a probe to a circuit can significantly distort its signals by adding undesired loading - mostly capacitive and resistive. FET probes offer high resistance and low capacitance therefore they present minimal loading to the circuit under test, and protect from making erroneous measurements.

HIGH RESISTANCE
Low resistance probes have significant DC effects when used in high impedance circuits. They can greatly affect the behaviour of the device under test by changing the swing and the DC offset of the probed signal. A 1 MΩ impedance FET probe will not affect gain or offset in virtually all the cases.

LOW CAPACITANCE
Although not important in DC measurements, capacitive loading is very disruptive at high signal frequencies. The capacitive loading effects can be drastic. When probed with a 10 MΩ, 15 pF passive probe, a 100 MHz signal "sees" a 100 Ω load as illustrated on the picture below.



Probe Impedance versus Frequency

With only 2 pF of capacitance at the probe tip, LeCroy's FET probes reduce circuit loading at high frequencies by a factor of 10. Minimizing tip capacitance can also push the probe's resonant frequency beyond the system bandwidth. Sensitivity to ground lead inductance is also minimized.

PROBUS
The ProBus™ system is a complete measurement solution from probe tip to oscilloscope display. It supplies power to active probes, while automatically sensing probe attenuation. ProBus™ enables direct control of the probe offset and input coupling from the scope's front panel, extending the instrument's accuracy up to the probe tip. In addition, ProBus™ automatically optimizes scope and probe offset adjustments, calibrates the gain at the probe tip and compensates for non-linearities, providing most accurate measurements.

Specifications

MODEL	AP003	AP020	AP021
Bandwidth (MHz)	DC-1000	DC-1000	DC-800
Risetime (psec)	< 350	< 350	< 437
Attenuation	10:1 ±2%	10:1±2%	5:1±2%
Input R (MΩ)	1 ±5%	1±2%	1±2%
Input C (pF)	1.9 ±0.3	1.8 ±0.2	2.7 ±0.2
Max Input Voltage	±100 V	±40 V	±20 V

MODEL	AP003	AP020	AP021
Dynamic Range	±7 V	±5 V	±2.5 V
DC Offset Range	N/A	±20 V	±10 V
Input Coupling	DC	DC/AC	DC/AC
Total length (m)	1.5	1.5	1.5
Power requirement	±12 V	±12 V	±12 V
Interface	N/A	ProBus™	ProBus™

Recommended Matching

LeCroy Model	AP-003	AP-020	AP-021
9304-10-14	XX		
9360-61			X
9320-24		X	
94XX	X		
7200	XX		
7200A	X		
ScopeStation	X		

X: External Power Supply not required
XX: External Power Supply required

Ordering Information

AP003	1 GHz active FET probe
AP020	1 GHz active FET probe
AP021	800 MHz active FET probe with ProBus™ interface. All probes are shipped with the following accessories: 1x Retractable hook 1x Ground Lead 1x BNC Adaptor 1x IC Tip 3x Ground Bayonets 1x Mini pincher with Lead Adaptor
AP501	Power Supply for the AP003

USA Direct Sales: 1 (800) 5LE-CROY

LeCroy Worldwide Sales Offices

ASIA/PACIFIC	LeCroy Pty Ltd	61.38.90.7358
BENELUX	LeCroy BV	04902.8.9285
CANADA	LeCroy Cnd	514.928.4707
FRANCE	LeCroy SARL	(1).69.18.83.20
GERMANY	LeCroy GmbH	06221 83.10.01
ITALY Milano	LeCroy SRL	02.204.70.82
ITALY Rome	LeCroy SRL	06.336.797.00
JAPAN Osaka	LeCroy Japan	0816.330.0961
JAPAN Tokyo	LeCroy Japan	0813.3376.9400
SWITZERLAND	Geneva	022.719.21.11
SWITZERLAND	Lenzburg	064.51.91.81
United Kingdom	LeCroy Ltd	0235-533114

Other sales and service representatives throughout the world.

Features and Benefits

EXTENSIVE SIGNAL AVERAGING
Two operation modes:
Summation averaging up to 1,000,000 waveforms.
Continuous averaging with weighting factors up to 1023.
Average speed up to 200,000 points/s in summation averaging mode.

EXTREMA MODE
Keeps track of time and amplitude drift by storing extreme positive and negative values, such as glitches, over a programmable number of sweeps.

POWERFUL ARITHMETIC
Processes addition, subtraction, multiplication or division on any pair of waveforms.

MATHEMATICAL FUNCTIONS
Computes identity, negation, reciprocal, integration, differentiation, square, square root, absolute value, sin x/x, exponential and log on any waveform.

ENHANCED RESOLUTION
Allows filtering of the digitized signals, whether they are single-shot or repetitive, in order to increase the resolution of the displayed trace from 8 bits to 11 bits in steps of 0.5 bits.

VERTICAL EXPANSION
Provides vertical scale expansion by a factor of up to 50.

CHAINING OF OPERATIONS
Automatically chains up to four operations. An indefinite number of operations can be performed sequentially, either manually or via remote control.

REMOTE CONTROL
Controls remotely all front-panel settings, as well as all waveform processing options via either GPIB or RS-232-C interfaces.

Functional Description

The WP01 waveform processing package can be implemented in any of the models of the 9300 family of digital oscilloscopes. This firmware is optimized for processing signals in real time. A powerful 68020 microprocessor and a 68881 co-processor enable very rapid representation of results such as averages, integrations, exponentials and multiplications.

Waveform operations can be performed on live, stored, processed or expanded waveforms. They are selected through simple menus that allow functions to be chained together allowing more complex computations. For example, it is possible to perform the integration of an averaged waveform or the multiplication of a differentiated waveform.

All processing occurs in function memories A, B, C and D which may be displayed on the screen by simply pressing the appropriate function button. All the necessary processing is automatically performed for all the functions selected.

The number of points used in the calculations is selectable and goes from 50 to 10,000 points for models with 10,000 data points of memory per channel. It goes up to 50,000 points for all other models.

SIGNAL AVERAGING
WP01 offers two powerful, high-speed averaging modes that can be used to reduce noise and improve the signal-to-noise ratio. Vertical resolution can be extended by several bits to improve dynamic range and increase the overall input sensitivity to as much as 50 mV/division.

Summed Averaging consists of the repeated addition (with equal weight) of recurrences of the selected source waveform. The number of acquisitions averaged can be selected up to 1,000,000 sweeps with the accumulation automatically stopping when the number is reached.

Continuous Averaging, sometimes called exponential averaging, is the repeated weighted average of the source waveform with the previous average. Averaging goes on indefinitely with each new acquisition and the effect of previous waveforms gradually tends to zero. Relative weighting factors can be chosen from 1:1 to 1:1023. The method is particularly useful for monitoring noisy signals which may change slowly over a period of time.

ENHANCED RESOLUTION
The WP01 package provides a selective filtering technique that improves vertical resolution for reduced bandwidth applications. By effectively removing high-frequency noise, with digital smoothing functions, waveforms can be analyzed with resolution from 8 to 11 bits. The technique can be used with both single-shot and repetitive signals and provides an ideal method for smoothing transient phenomena.

EXTREMA MODE
Tracking rare glitches or monitoring signals drifting in time and amplitude is made easy with EXTREMA *mode*. EXTREMA waveforms are produced by repeatedly comparing acquisitions of a source waveform with a stored waveform that contains previous maximum and/or minimum excursions. Whenever a given data point of a new acquisition exceeds the existing data point of the stored waveform, the old data point is replaced by the new. In this way the envelope of all waveforms is accumulated for up to a maximum of 1,000,000 sweeps.

ARITHMETIC
The 9300 family offers basic arithmetic operations such as addition, subtraction, division, multiplication and negation, even on the standard models. These arithmetic functions can be performed on any source waveform on a point-by-point basis. Different vertical gains and offsets of the source waveforms are automatically taken into account in the computed result.

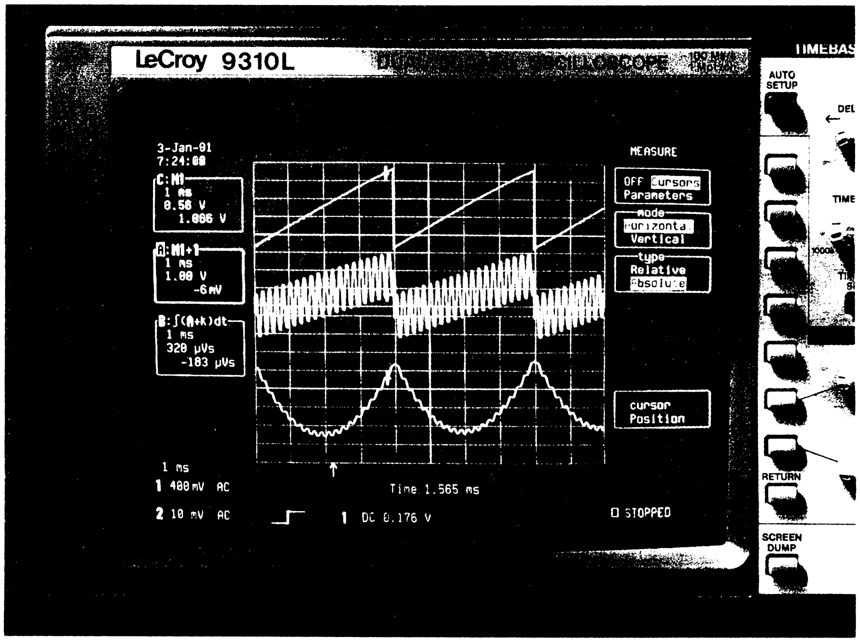
MATHEMATICAL FUNCTIONS
Functions including differentiation, integration, absolute value, square, square root, logarithm (base 10 and e), exponential, reciprocal, and sin x/x interpolation may be performed on any source waveform. Arithmetical and mathematical functions can also be chained together to construct more complex processing routines.

9300 WP01

WP01 Waveform Processing Firmware for the 9300 Family of Digital Oscilloscopes

Main Features

- Averaging - summation and continuous
- Arithmetic - including addition, subtraction, ratio and multiplication
- Functions - including integration, differentiation, log, expansion, ABS, square root and more
- Extrema mode - storage of extreme positive and negative values



Added as a factory option or retrofitted in the field, the WP01 Waveform Processing Package adds high-speed averaging, filtering and mathematical capabilities to the 9300 family of digital oscilloscopes.

General

The LeCroy WP01 Waveform Processing package offers powerful routines that extend the processing capabilities of the 9300 family of Digital Oscilloscopes.

All processing is built in to eliminate the need for external computers and controllers. High-speed microprocessors are used to ensure that computed waveforms are displayed instantly on the screen.

The package is fully programmable over GPIB or RS-232-C interface and hard copies can be directly made onto a wide range of printers.

WP01 Specifications

SUMMATION AVERAGING
Number of Sweeps: 1 to 1,000,000.
Number of Input Points: 50 to 50,000 (50 to 10,000 for models with 10,000 data points per channel).
Vertical Expansion: 50 x maximum.
Maximum Sensitivity: 50 mV/div after vertical expansion.
Speed: up to 200,000 points/s.

CONTINUOUS AVERAGING
Possible Weighting Factors: 1:1, 1:3, 1:7, 1:15, 1:31, 1:63, 1:127, 1:255, 1:511 and 1:1023.
Number of Input Points: 50 to 50,000 (50 to 10,000 for models with 10,000 data points per channel).
Vertical Expansion: 50 x maximum.
Maximum Sensitivity: 50 mV/div after vertical expansion.

ARITHMETIC
Addition, subtraction, multiplication, and ratio on any two waveforms.
Number of Input Points: 50 to 50,000 (50 to 10,000 for models with 10,000 data points per channel).
Vertical Expansion: 5 x to 50 x depending on the source waveforms.

FUNCTIONS
Identity, negation, integration, differentiation, square, square root, logarithm and exponential (base e and 10), sin x/x, reciprocal and absolute value of any source waveforms.

Number of Input points: 50 to 50,000 (50 to 10,000 for models with 10,000 data points per channel).
Vertical Expansion: 5 x to 50 x depending on the source waveforms.

ENHANCED RESOLUTION
Choice of five low-pass filters for vertical resolution improvement from 8 to 11 bits at reduced bandwidth.

Vertical Expansion: 50 x maximum.
Maximum Sensitivity: 50 mV/div after vertical expansion.

EXTREMA
Logs all extreme values of a waveform over a programmable number of sweeps. Maxima and minima can be displayed together, or separately by choosing ROOF or FLOOR traces.

Number of Sweeps: 1 to 1,000,000.
Number of Input Points: 50 to 50,000 (50 to 10,000 for models with 10,000 data points per channel).

Glitches as short as 0.002% of the time base down to 10 ns are displayed.
Vertical Expansion: 5 x maximum.

CHAINING OF OPERATIONS
Up to four functions can be automatically chained using Functions A, B, C and D. Using memories M1 to M4 for intermediate results, any number of operations can be chained manually or via remote control.

REMOTE CONTROL
All controls and waveform processing functions are fully programmable using the oscilloscope's GPIB or RS-232-C interfaces. Simple English-like commands are used.

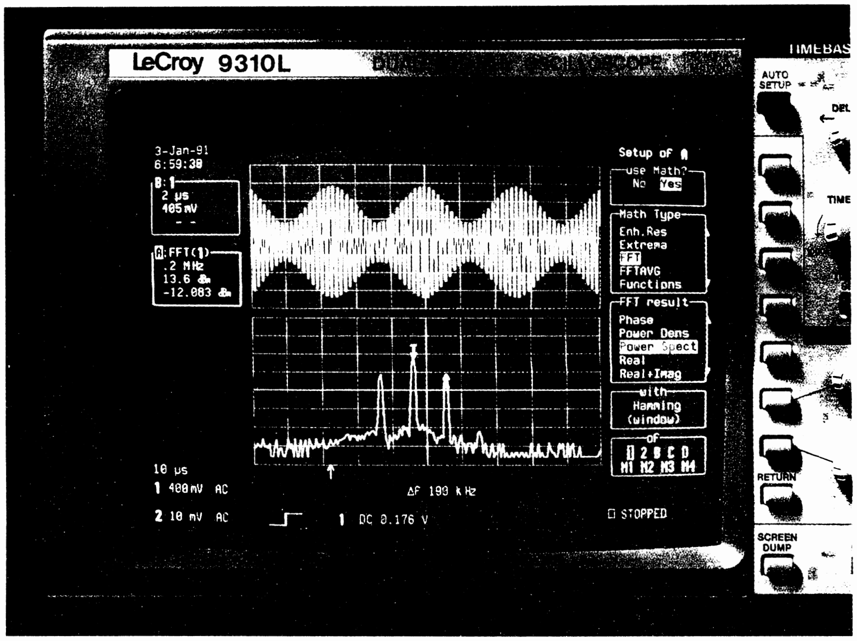
STORED FRONT PANELS
Up to four front-panel setups, including WP01 settings, can be stored in resident non-volatile memory and recalled using the menu buttons or via remote control.

9300 WP02

WP02 Spectrum Analysis Firmware for the 9300 Family of Digital Oscilloscopes

Main Features

- Up to 50,000-point FFTs over two or four channels simultaneously
- Frequency range from DC to up to 300 MHz
- Frequency resolution down to 20 μHz
- Up to 10 Gs/s sampling rates
- Frequency domain averaging
- Wide selection of display formats and window functions
- 1,000-point FFTs in less than 0.5 s



Adding the WP02 Spectrum Analysis Package to the 9300 family of digital oscilloscopes provides a fast and economical solution to frequency domain applications.

General

The WP02 Spectrum Analysis Package extends the range of measurement capabilities of the 9300 series of Digital Oscilloscopes. The package is fully programmable over GPIB and RS-232-C interfaces.

Fast Fourier Transforms (FFTs) rapidly convert time domain waveforms into frequency domain records to reveal valuable spectral information such as phase, magnitude and power.

Hardcopies can be directly made on a wide range of printers. As the package is a firmware option which is installed inside the oscilloscope, it eliminates the need for any external controller and is easy to retrofit.

Features and Benefits

LONG RECORD TRANSFORMS
Long record FFTs (up to 10,000 points or up to 50,000 points, depending on the model) provide significant signal-to-noise ratio improvement.

WIDE-BAND FREQUENCY ANALYSIS
DC to up to 300 MHz bandwidth with high resolution.

HIGH SAMPLING RATES
Up to 10 gigasamples/s effectively eliminates aliasing errors.

BROAD SPECTRUM COVERAGE
Up to 25,000 spectral components (5,000 for 10,000-point memory).

MULTI-CHANNEL ANALYSIS
All input channels can be analyzed simultaneously to allow comparison of independent signals for common frequency-domain characteristics.

VERSATILE DISPLAY FORMATS
Frequency-domain data may be presented as magnitude, phase, real, imaginary, complex, log-power and log-PSD (Power Spectral Density). These display formats can all be selected via menu options.

STANDARD WINDOW FUNCTIONS
Rectangular for transient signals; von Hann (Hanning) and Hamming for continuous waveform data; Flattop for accurate amplitude measurements; Blackman-Harris for maximum frequency resolution.

CALIBRATED VERTICAL SCALING
Flattop truncation window provides precisely calibrated vertical scaling for all spectral components.

FREQUENCY DOMAIN AVERAGING
Up to 50,00 FFT results may be averaged to reduce base-line noise and enable analysis of phase-incoherent signals or signals which cannot be triggered on.

TIME-DOMAIN AVERAGING
Averaging real-time signals prior to FFT execution can increase the dynamic range up to 70 dB.

FREQUENCY CURSORS
Cursors give up to 0.004% frequency resolution (up to 0.002% for 10,000 point memory) and measure power or voltage differences to 0.2% of full scale.

CHAINING OF OPERATIONS
Up to four operations can be automatically chained, e.g., Function D=FFT of (CH1 X CH2). Any number of operations can be performed sequentially, either manually or via remote control.

FULL REMOTE CONTROL
All front-panel settings and waveform processing functions are programmable via GPIB or RS-232-C interfaces. Acquired and processed waveforms can be down-loaded to a computer and can later be retrieved and displayed on the oscilloscope.

HARD COPIES
Provides hard copies of the screen using a wide range of printers.

PROCESSING OF EXPANSIONS
Up to four regions of the same waveform, or of different waveforms, can be expanded and processed simultaneously.

FFT ON SEGMENTED WAVEFORMS
Individual waveform segments can be expanded and then analyzed using FFT. Time and date information is automatically recorded for each segment.

FOURIER PROCESSING
Fourier processing is a mathematical technique which enables a time-domain waveform to be described in terms of frequency-domain magnitude and phase, or real and imaginary spectra. It is used, for example, in spectral analysis where a waveform is sampled and digitized, then transformed by a Discrete Fourier Transform (DFT). Fast Fourier Transforms (FFT) are a set of algorithms used to reduce the computation time (by better than a factor of 100 for a 1000 point FFT) needed to evaluate a DFT. The principal advantage of FFT is the speed with which it can analyze large quantities of waveform samples. Using standard measurement techniques, FFT converts a time-domain measurement instrument into a digital spectrum analyzer.

The Spectrum Analysis package enhances the outstanding features of the LeCroy 9300 family. It provides high resolution and wide-band spectrum analysis together with sophisticated window functions and fast processing.

FFT AND LeCROY OSCILLOSCOPES
In FFT mode, LeCroy oscilloscopes provide measurement capabilities superior to those of common swept spectrum analyzers. It is now possible to perform spectral analysis on repetitive and single events at an attractive price. Users can obtain time and frequency values simultaneously and compare phases of the various frequency components with each other.
Rather than the commonly used "power of two" record lengths, the routines used in the WP02 package feature decimal record lengths which can be selected in a 1, 2.5, 5 sequence. Resulting spectra are also calibrated in convenient decimal Hertz values.
The WP02 package is supported by the exceptional acquisition characteristics which are the hallmark of LeCroy oscilloscopes (+2% DC accuracy, high effective bits, improved resolution through averaging). Computations are made using 16-bit processing that allows high accuracy, stability and repeatability.
With LeCroy oscilloscopes, signals may be acquired from up to four acquisition channels and processed simultaneously using up to four functions. This is particularly useful for network characterization or when looking for common frequency-domain characteristics on multiple signals.

IMPROVED RESOLUTION
Fast Fourier Transform calculates equally-spaced frequency components from DC to the full instrument bandwidth. By lowering the sampling rate, it is possible to make measurements with 20 µHz resolution up to 0.5 Hz (Nyquist). By increasing the sampling mode, the widest resolution becomes 100 MHz and the Nyquist frequency 5.0 GHz. This is comfortably above the highest frequency components recordable by the oscilloscope, thus virtually eliminates aliasing effects.

WP02 Specifications

MEMORIES

	9304/10/14	9310M/L and 9314M/L
Acquisition memory/ch (8-bit)	10K points	50K points
Reference memories (16-bit)	4 x 10K points	4 x 50K points
Function memories (16-bit)	4 x 10K points	4 x 50K points

FREQUENCY

		9304/10/14	9310M/L and 9314M/L
Frequency resolution		0.1 mHz to 50 MHz	20 µHz to 100 MHz
Horizontal expansion		100 X	1000 X
Transform size	in	40 to 10000 points	40 to 50000 points
	out	20 to 5000 points	20 to 25000 points

Frequency Range: DC to instrument bandwidth.
Nyquist Frequency Range: 0.5 Hz to 5 GHz.
Frequency Scale Factors: 0.05 Hz/div to 0.2 GHz/div in a 1-2-5 sequence.
Frequency Accuracy: 0.01%.
Selection of the Transform Size: The number of points can be selected in a 1, 2.5, 5 sequence. The transform size defines the decimation applied to the signal after acquisition. It can be adjusted and optimized after signal acquisition and prior to FFT execution.

AMPLITUDE AND PHASE
Amplitude Accuracy: Better than 2%. Amplitude accuracy may be modified by the window function (see the window functions table).
Signal Overflow: A warning is provided at the top of the display when the input signal exceeds the ADC range.
Number of Traces: Time domain and frequency domain data can be displayed simultaneously (up to 4 waveforms).
Phase Range: -180° to +180° .
Phase Accuracy: ±5 (for amplitude > 1.4 div).
Phase Scale Factor: 50° /division.
Zero Baseline: 0 div (center of screen).

SPECTRUM DISPLAY FORMATS AND SCALING
Frequency Scale: Linear, real, imaginary or complex spectrum, in V/div, zero base line at 0 div (center of screen).
Power Spectrum in dBm (1 mW into 50 Ω).
Power Spectral Density (PSD) in dBm.
Phase Display: Linear.
Magnitude Display: Linear. Power and PSD spectra displays have 160 dB range (20 dB/div), continuously expandable up to 0.5 dBm/div.

FREQUENCY DOMAIN POWER AVERAGING
Summation averaging of power, PSD or magnitude for up to 50,000 spectra.

VERTICAL EXPANSION
All spectral formats, up to 50 times, continuously.

DEFINITIONS
Filter Bandwidth at -6 dB characterizes the frequency resolution of the filter.
Highest Side Lobe indicates the reduction in leakage of signal components into neighboring frequency bins.
Scallop Loss is the maximum loss of an equivalent rectangular filter.

WINDOW FUNCTIONS
Rectangular, von Hann (Hanning), Hamming, Flattop and Blackman-Harris. The table below indicates the filter pass-band shape and the resolution.

CURSORS
Absolute (crosshair) and relative (arrow) cursors provide frequency and amplitude (phase, power, power density) measurements. Horizontal bars provide absolute and relative amplitude, (phase, power and power density) measurements.

FFT EXECUTION TIME
100 points in less than 0.05 s.
1000 points in less than 0.5 s.
10000 points in less than 5 s.

REMOTE CONTROL
All WP02 processing functions are fully programmable via the GPIB and RS-232-C interfaces. Simple English-like commands are used.

REMOTE READ AND WRITE
All waveform formats including complex can be read by computer for storage or further processing. Externally generated waveforms can be written into Memories M1 to M4 for FFT or other processing.

STORED FRONT PANELS
Up to 4 front-panel setups, including WP02 menu settings can be stored in non-volatile memory and recalled by the menu buttons at the right side of the screen.

WP02 INSTALLATION
A WP02 package may be retrofitted at any time.

FILTER PASS BAND AND RESOLUTION

Window type	Filter bandwidth at -6 dB [freq. bins]	Highest side lobe [dB]	Scallop loss [dB]	Noise bandwidth [freq. bins]
Rectangular	1.21	-13	3.92	1.0
von Hann	2.00	-32	1.42	1.5
Hamming	1.81	-43	1.78	1.36
Flattop	1.78	-44	0.01	2.96
Blackman-Harris	1.81	-67	1.13	1.71

LeCalsoft–Calibration Software for LeCroy Digital Oscilloscopes

Main Features

- Traceability to reference standards
- Computer check of key specifications
- Computer–aided readjustment
- Fully automated configurations available
- Supports all 93XX and 94XX models
- IBM® PC–AT compatible

The LeCalsoft package enables a fast and thorough verification of all key specifications.

General

The LeCroy LeCalsoft (94XXCS05) test and calibration package provides a convenient, unambiguous check of LeCroy oscilloscopes. Designed for users who require traceability to reference standards (NIST, etc.), this package is ideally suited for use in calibration laboratories where the oscilloscopes are checked at fixed intervals.

Results of the calibration check are fully documented on hard copy, or they can be archived on hard disk or diskette.

LeCalsoft works on any PC compatible with the IBM®–AT standard. It controls the oscilloscope and the calibration sources through a National Instruments® GPIB interface.

Features

Calibration Check

All the essential specifications of the Digital Oscilloscope, such as bandwidth, linearity, noise, trigger, timebase and effective–bit count are tested. Deviations from nominal values are calculated and displayed on the screen, printed, or archived on hard disk or diskette.

Comprehensive Documentation of the Test Results

At the end of each calibration check, two types of documentation are available: a long form printout which gives details of the results of all the tests executed, and states whether or not the results are within the specifications, and a short form printout which gives a summary of the test results.

Calibration Traceable to National Standards (NIST, etc.)

By using signal sources traceable to a standard, the calibration will be traceable to the same standard, provided the relevant documentation is maintained.

Manual and Automated Calibration Check

Both manual operation with computer assistance, and automated operation are possible. Automated operation requires programmable multiplexer and signal sources. See the list of supported devices below.

Assisted Adjustment of the Oscilloscope

A computer–aided adjustment procedure is also provided. By following instructions on the screen, the trained technician is guided through the adjustments required to correct the settings of the oscilloscope so that it is within the specifications.

Calibration Certificate

On request, LeCroy will perform calibration traceable to National Standard Organizations. Calibration certificates are provided as part of this service.

Functional Description

Calibration Practice

LeCroy oscilloscopes are auto–calibrating digital oscilloscopes and therefore do not require regular calibration like analog oscilloscopes. However, for users who require traceability to reference standards (such as those provided by the National Institutes of Standards and Technology), and for calibration laboratories which must inspect incoming instruments and perform recalibration at prescribed intervals, the LeCalsoft computer–aided test and calibration packages provide an easy solution.

Under guidance of the LeCalsoft program, some adjustments to the oscilloscope can be made by an electronics technician. However major deviations from specifications usually require repair by a trained service engineer. LeCroy regularly schedules training classes. If no in–house trained person is available, the nearest LeCroy service center can carry out repairs and calibration, and provide traceability to reference standards.

Using the LeCroy LeCalsoft Packages

For calibration checking, digital oscilloscopes have a great advantage over analog oscilloscopes because waveforms can be transferred to a host computer. This simplifies the calibration procedure enormously, makes it potentially faster and allows an extensive range of tests with unambiguous interpretation of the results.

LeCalsoft performs an extensive series of tests which verify the specifications of the oscilloscope. It includes many tests relevant to analog scopes such as Noise and Linearity tests. Although these tests are difficult and time consuming on an analog oscilloscope, they can be computer controlled and are quickly and easily performed on a digital oscilloscope. Tests which are specific to digital oscilloscopes, such as Sinefit tests are also included.

The various test options in LeCalsoft are presented to the operator in the form of a simple menu system. The user has the choice of performing an automated calibration check of the oscilloscope, or individually testing any of the specifications. Some of the tests require the use of high–quality external signal generators. The user receives instructions on the screen when it is necessary to change the cable connections, but apart from this minor intervention, the tests are fully computer controlled when supported GPIB–programmable instruments are used.

Supported Instrumentation

LeCalsoft software works on any AT–compatible equipped with a math coprocessor and a National Instruments GPIB interface. Automated calibration checking is possible using a set of instruments from the following list. (For an automated calibration check, either the LeCroy or Keithley programmable multiplexer is required to feed the calibration signals to the oscilloscope input.)

RF sinewave generators:
- Marconi 2019A, 2022C, 2030, 2031
- Fluke 6060B, 6061A
- Hewlett–Packard 8642A, 8642B
- Rohde & Schwarz SMX

AF sinewave generators:
- Marconi 2019A, 2022C, 2030, 2031
- Hewlett–Packard 8642A, 8642B
- Rohde & Schwarz SMX
- Tektronix FG5010
- LeCroy AFG 9100

DC Precision Power Supply:
- Tektronix PS5004
- Datron 4708 Autocal Multifunction Standard

Fast Pulse Generator:
- Tektronix CG5001/CG551AP

Power Meters:
- Hewlett–Packard HP436A, HP437B

Multiplexers:
- Keithley 199 SYSTEM DMM/ SCANNER with LeCroy interface board.
- LeCroy 4951, 4973–1, 4973–2 Multiplexers.

Frequency standard:
- WWV or HBG1500

Recommended Accessories

A full kit of calibration connectors and interfaces is available from LeCroy. It includes all the necessary cables, adapters, splitters and filters, as well as the Programmable Multiplexer. Also available is a repair package including special tools, board extenders, etc., for computer–aided adjustment.

Use of Other Instruments

It is possible to perform the calibration check with some other unsupported signal sources. However, the user is then required to set up these instruments manually and to perform one measurement at a time. The LeCalsoft package guides the user step by step, and controls the oscilloscope data acquisition and the computation of the results.

LeCalsoft compares the signal measured by the oscilloscope with the signal it would expect to receive from the generator. Warning messages are displayed whenever tolerances are exceeded. Some of the adjustments may be carried out by the user when the test sequence is finished. In this case, the software will guide the user through the correct adjustment procedure. At the end of the calibration check, a printout can be generated to list the results.

Specifications

Computer Required: Any PC compatible with the IBM–AT standard, and equipped with a mathematical coprocessor and a National Instrument Inc. GPIB interface.

Operating System: DOS 3.0 upward

Medium: $3^1/_2$" 1.44 Mb
$5^1/_4$" 1.2 Mb diskette

Major Tests Supported by LeCalsoft

Internal

To ensure proper calibration of the oscilloscope, internal auto–calibration tests are automatically executed during normal operation. This standard sequence of internal auto calibration tests is initiated by the software and the results are transferred to the PC for analysis.

The tests are:

- Calibration of the resolution of the time–to–digital converter with respect to the system clock
- Determination of the gain constants of the input amplifiers
- Offset compensation versus gain variation
- Global internal non–linearity
- General functionality check

Bandwidth

To calculate the bandwidth, the amplitudes of sine waves of increasing frequencies are measured. The sine wave generator is first set to 500 kHz with an amplitude 75% of full screen, i.e. ±3 vertical divisions. The frequency is then swept up to the point where an amplitude drop of 3 dB is observed. This indicates the bandwidth.

This test is executed on all channels for 1 MΩ and 50 Ω input impedance and for all vertical sensitivities. It requires a sine wave generator with good flatness.

Generators supported under program control are listed on page 2.

Linearity

15 different known voltages, varying from 5% to 95% of full screen, are applied by the external voltage reference source. For each voltage value, a full waveform is acquired, and the mean value is compared to the known input voltage. The linearity is determined through a linear regression fit to the 15 measurements.The slope, the offset and the chi–square of the fit are computed.

With the linearity test, many other related tests are performed: response time of the overload protection of the 50 Ω input, linearity of the variable gain calibration, range and linearity of the offset setting, and quality of the input coupling.

This procedure is executed on all channels for both 1 MΩ and 50 Ω input impedance. The test requires a DC source with a precision and time stability of 0.1%, a voltage range of 0 V to 20 V adjustable in steps of 5 mV, and an output current capability of 300 mA.

Power supplies supported under program control are listed on page 2.

Noise

The noise tests are executed on all channels for both 1MΩ and 50 Ω input impedance, with AC and DC coupling, five different time–base settings, and open inputs. Full waveforms are acquired with different offset values. The peak–to–peak as well as the RMS values of each measurement are computed, and the maximum values are recorded. The program also indicates the occurrence of any "flyers", i.e. short noise peaks generated by the ADC's.

The noise tests also include:

- checking the linearity of the variable offsets of all channels between 2.5% and 97.5% of full screen.
- checking the stability of the ground line when switching the inputs between GROUND and DC coupling modes.

Rise time/Overshoot

Executed on all channels for both 1MΩ and 50 Ω input impedance, these tests measure the rise time of the oscilloscope response to the input voltage step, as well as the amount of pre–shoot and overshoot. They require a voltage step generator with calibrated fast rise–time amplitude.

The Voltage Step Generator supported under program control is the Tektronix CG5001.

Sinefit

The performance of the analog–to–digital converter is evaluated in terms of the number of effective bits (a measure of the signal–to–noise ratio). It is measured on all channels, at a sensitivity of 50 mV/div., by applying a pure sine wave at varying frequencies and timebase settings

This test is a measurement of dynamic linearity. It shows the effect of such errors as noise, non–linearities and aperture jitter.

Timebase

The timebase test compares the internal clock with a very precise and stable external timebase reference (clock generator) such as the WWV standard or HBG 1500.

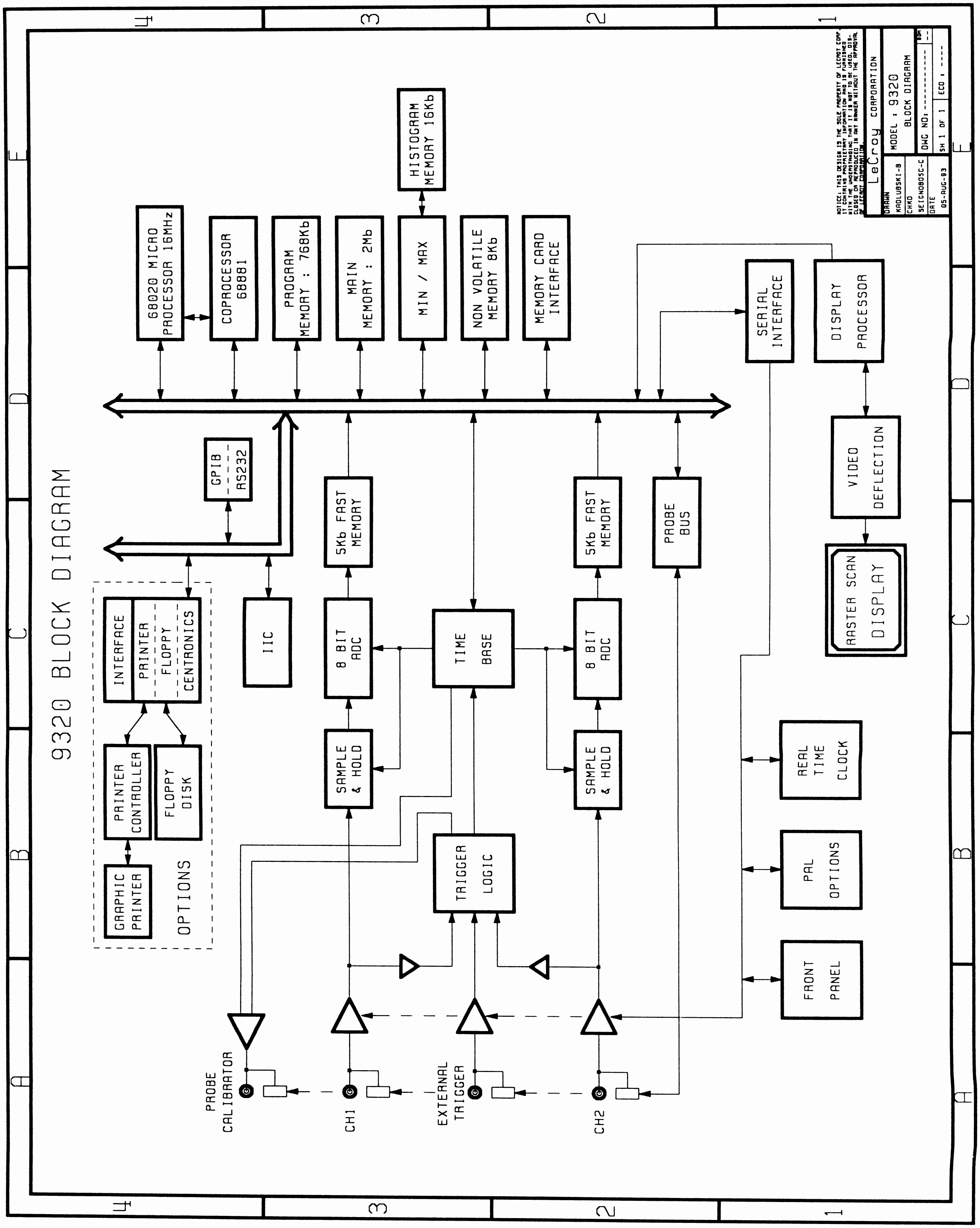
Trigger

The trigger capabilities are tested for all possible configurations. These include:

- Internal and external trigger sources
- DC, AC, HF–reject, and LF–reject couplings
- Trigger level settings in all slope modes.

SECTION 3 BLOCK DIAGRAM and SUB-ASSEMBLIES

9320 Digital Oscilloscope


9320 BLOCK DIAGRAM
68020 MICRO PROCESSOR 16MHz
COPROCESSOR 68881
PROGRAM MEMORY : 768Kb
MAIN MEMORY : 2Mb
MIN / MAX
HISTOGRAM MEMORY 16Kb
NON VOLATILE MEMORY 8Kb
MEMORY CARD INTERFACE
SERIAL INTERFACE
DISPLAY PROCESSOR
VIDEO DEFLECTION
RASTER SCAN DISPLAY
GPIB RS232
5Kb FAST MEMORY
5Kb FAST MEMORY
PROBE BUS
IIC
8 BIT ADC
TIME BASE
8 BIT ADC
SAMPLE & HOLD
SAMPLE & HOLD
TRIGGER LOGIC
INTERFACE
PRINTER
FLOPPY
CENTRONICS
PRINTER CONTROLLER
FLOPPY DISK
GRAPHIC PRINTER
OPTIONS
REAL TIME CLOCK
PAL OPTIONS
FRONT PANEL
PROBE CALIBRATOR
CH1
EXTERNAL TRIGGER
CH2
LeCroy CORPORATION
MODEL : 9320
BLOCK DIAGRAM
DRAWN
KAOLUBSKI-B
CHKD
SEIGNOBOSC-C
DATE
05-AUG-93
DWG NO:
SH 1 OF 1
ECO :

3.2 9320 Sub-Assemblies

F9314M-1	Processor with 2 Mbyte RAM
F9320-3	Main card, dual channel, 20Ms/s, 5 Kbytes memory
F9300-4	GPIB + RS232 interface
F9320-5	Dual channel front panel 9320
93XX-PS1715	Power supply +/- 5V, +/- 15V.
93XX-Display	Video, deflection, CRT, yoke
M93XX	Mechanical for 93XX series

3.3 9320 Hardware Options

9320-FDGP	Graphic Printer & Floppy Disk
	F9300-6 : Centronics, Floppy, Printer interface
	F9300-7 : Printer controller
9320-GP01	Graphic Printer
	F9300-6 : Centronics, Floppy, Printer interface
	F9300-7 : Printer controller
9320-FD01	Floppy Disk
	F9300-6 : Centronics, Floppy, Printer interface

SECTION 4 THEORY of OPERATION

4.1 F9314M-1 Processor Board

The processor board is based on to the 68020 and 68881 coprocessor, with a clock frequency of 16 MHz, and 2 Mbytes memory
The internal Data Bus is 32 bits wide, the peripheral Data Bus set 8 or 16 bits, and the Address Bus has 27 bits (A0-A25 and A31).

The board contains the following sections:

Program memory (EPROM)

768 Kbytes	:	2 x 2 Mbit Eproms and 2 x 1 Mbit Eproms
Data Bus	:	16 bits.
Address	:	0000 0000 to 000D FFFE.

Working memory (PS RAM)

2 Mbytes memory	:	4 Pseudo static RAM of 4 Mbit.
Data Bus	:	16 Bits.
Address	:	0040 0000 to 004F FFFE or 005F FFFE.

Memory card

An interface is implemented to support an external memory card, whose size can range from 16 Kbytes to 4Mbytes.
Data bus : 8 bits.

Non volatile memory

A static RAM of 8 Kbytes contains the parameters used at power on to initialize the scope and the stored parameters (panels). This memory is battery backed up.
Data bus : 8 bits.

Min/Max calculation

A gate array MNX401 makes a histogram in its associated 16 Kbytes memory and remembers the minimum and maximum data values it sees.
Data bus: 16 bits.

Graphic processor

The graphic processor of the raster scan display is a gate array designated MDS410.

Clock frequency	:	48 MHz.
Trace and characters memory	:	32 Kbytes (CTRAM).
Bitmap memory	:	40 Kbytes (BMRAM).
Character font EPROM	:	32 Kbytes (FCRAM).
Data bus	:	8 bits.

DAC command of the display intensity

The control of the display intensity is done by a 8 bits RAMDAC.

Status and command registers

Status (read) and command (write) registers control the memory card and front panel interface during the boot or after a RESET.

External interfaces

Serial RS232 interface
Parallel GPIB interface
See F9300-4 Description Section 4.3

Optional interfaces

Graphic Printer	:	F9300-6 interface and F9300-7 controller Floppy
Disk Drive	:	F9300-6 interface
Centronics	:	F9300-6 interface

Serial peripherals

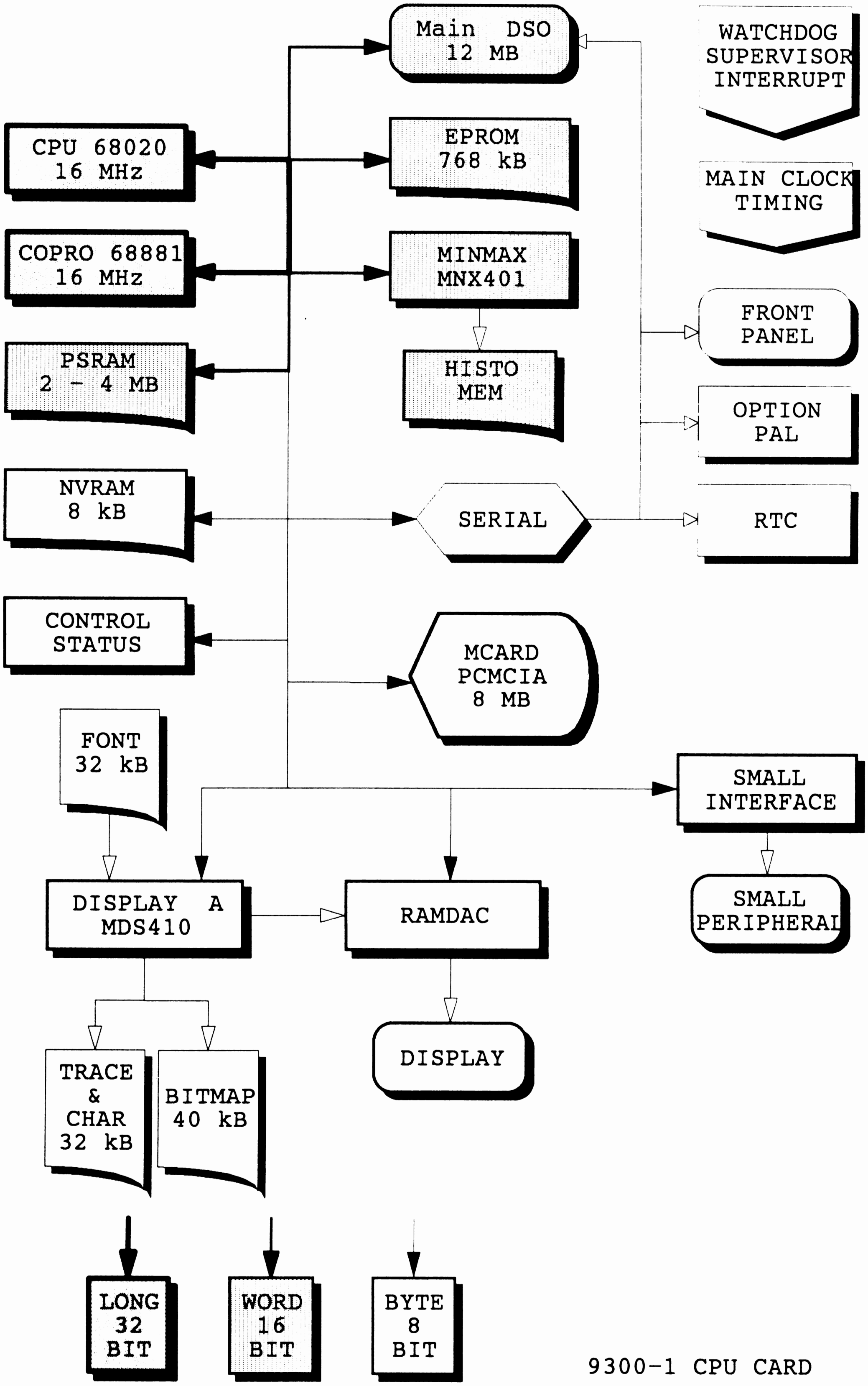
The processor controls the digital and analog section with a double serial controller.

DAC's registers (read/write).
Front panel registers (68HC05C4).
RTC registers (68HC68T1).
Probe detection.
Software options (GAL).
Front end control.
Trigger control (MTR408).

Real time clock

Integrated circuit 68HC68T1 (Motorola or RCA).

Resolution	:	1 sec to 99 years.
Clock frequency	:	32.768 KHz.
Non volatile memory	:	32 Kbytes.
Data & Address bus	:	8 bits.
Interrupt level	:	5.



9300-1 CPU CARD

4.2 F9320-3 Main Board

4.2.1 Introduction

The board is divided in five parts :

- Front end control
- Channel 1 and Channel 2 front end's
- Channel 1 and Channel 2 ADC's
- Trigger control
- Time base

4.2.2 Front End Control, Channel front end's, and ADC's

Serial commands of Gain and Coupling

Address : 0141 0000

Three bytes are sent by the processor board to set :
- the attenuators
- the input signal ot the VCAL
- the AC/DC trigger coupling

Control of the Trigger coupling : byte 2

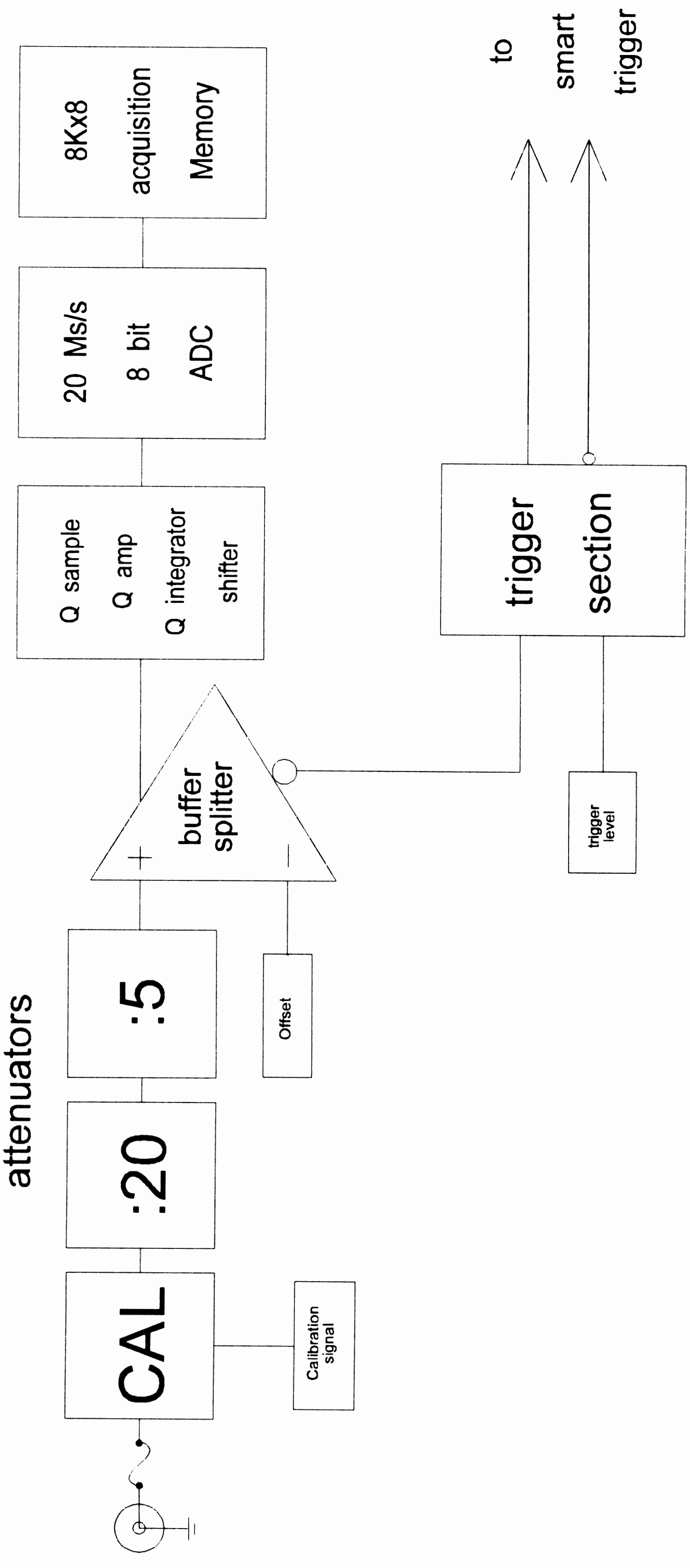
D7	D6	D5	D4	D3	D2	D1	D0
-------	-------	-------	-------	-------	-------	-------	-------
nu	: 10 Ext	HF Ch2	AC Ext	AC Ch2	AC Ch1	nu	nu

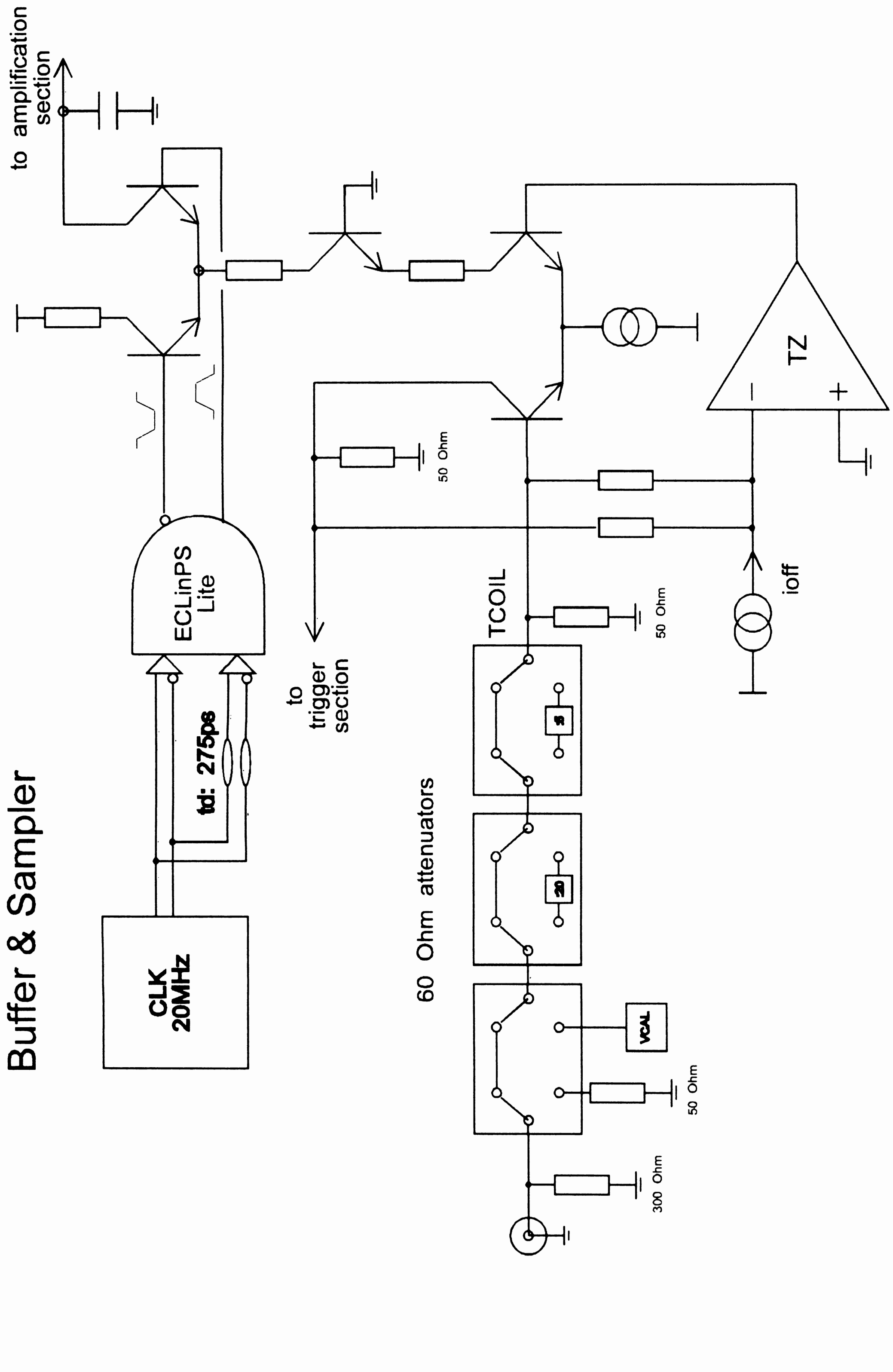
Control of Channel 1 and Channel 2 : byte 3 (lower byte)

D7	D6	D5	D4	D3	D2	D1	D0
-------	-------	-------	-------	-------	-------	-------	-------
nu	: 5 Ch2	: 20 Ch2	VCAL Ch2	nu	: 5 Ch1	: 20 Ch1	VCAL Ch1

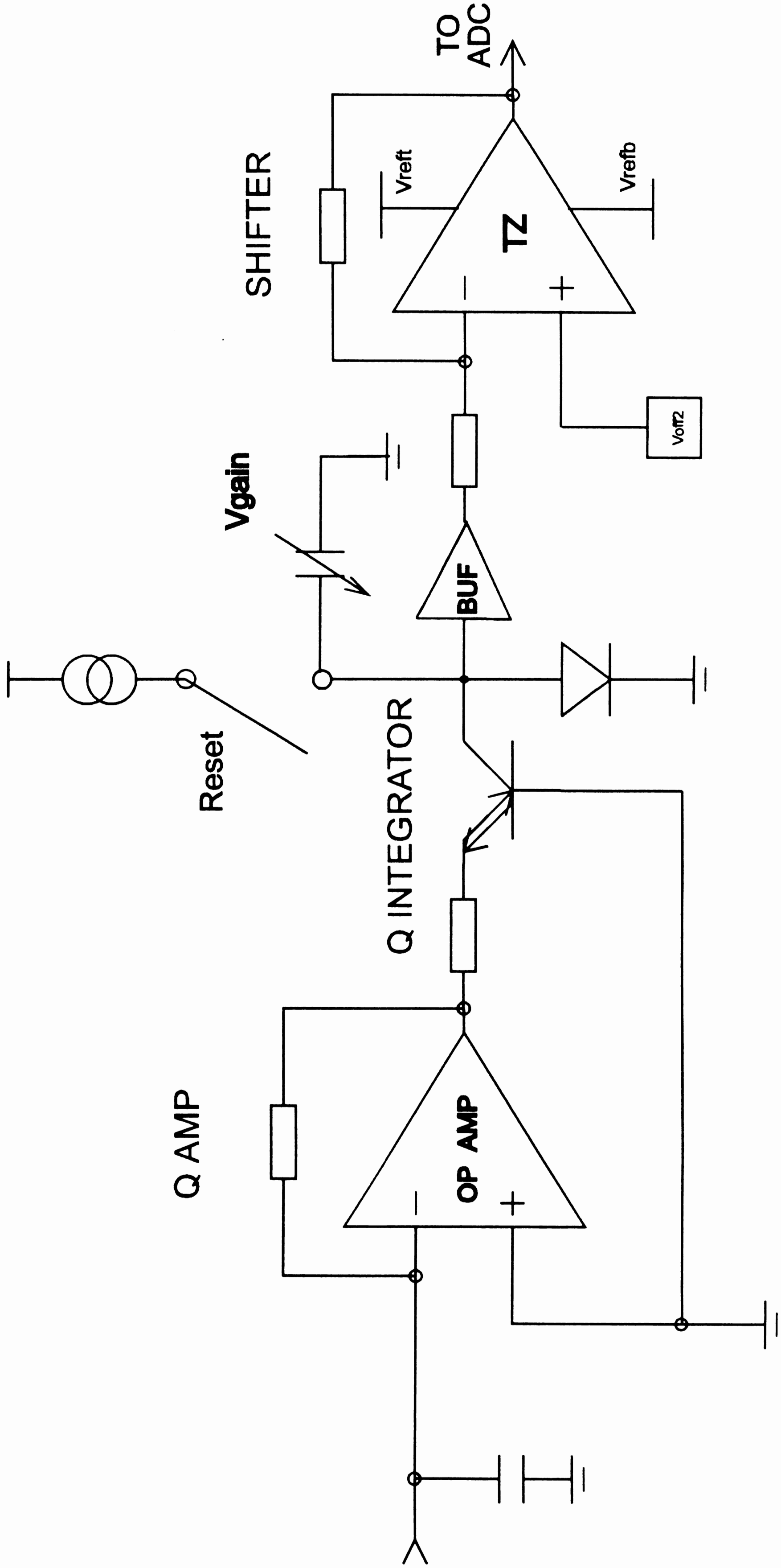
VCAL	= 1	Calibration signal is sent to the input Channel
: 20	= 0	: 20 attenuator is set
: 5	= 0	: 5 attenuator is set
AC	= 0	Trigger AC coupling is set
HF	= 0	Enable the : 4 divider for Channel 2 HF trigger used with TRSEL1/3 (byte 2 of trigger control)
:10	= 0	External Trigger / 10 is set
nu	=	not used

Front end, Sample & Hold, ADC Block Diagram




Buffer & Sampler
CLK 20MHz
td: 275ps
ECLinPS Lite
to amplification section
to trigger section
50 Ohm
TCOIL
50 Ohm
ioff
TZ
60 Ohm attenuators
VCAL
50 Ohm
300 Ohm

Front End Amplfier



4.2.3 Trigger Control

Address : 0141 1000

Three bytes are sent by the processor board to select :

- Trigger source
- Trigger patern
- Edge qualifier pattern
- Slope of the trigger edge
- Polarity and range of the pulse width
- < and > of the pulse width
- TDC and trigger calibration
- Holdoff by event or by time

Holdoff, Pattern, and Calibration control : byte 0

D7	D6	D5	D4	D3	D2	D1	D0
NOPAT	X Ch2	X Ch1	nu	nu	STATQ	TIM HLD	EVT HLD

NOPAT : select the negative output of the trigger

X (Ch) : Trigger patern (when high the channel is not used for the pattern)

STATQ : validate the state qualifier pattern

TIMHLD : holdoff by time

EVTHLD : holdoff by event

note : bit active low

Holdoff, Pattern control and selection of the trigger validation : byte 1

D7	D6	D5	D4	D3	D2	D1	D0
nu	nu	HLDEN	ST Ch2	ST Ch1	nu	EDGEQ	VALID

ST (Ch) : Trigger pattern, state of the channel to validate the pattern
ST ChX = 0 pattern true if ChX is high
ST ChX = 1 pattern true if Ch X is low

HOLDEN : enable holdoff by time or by event

EDGEQ : validate the edge qualifier pattern

VALID : trigger validation
low = single source
high = multi source

Trigger source, slope and polarity : byte 2

D7	D6	D5	D4	D3	D2	D1	D0
-------	-------	-------	-------	-------	-------	-------	-------
TRSEL2	TRSEL1	NU	TRSEL3	PAT Ch	PW RANGE	SLOPE	PULSE <,>

TRSEL 3,2,1 : Trigger source

TRSEL 3	2	1	
0	0	x	EX Trigger
0	1	x	HF Ch2, HF must be low (byte 2 of front-end control)
1	0	0	nu
1	0	1	Ch_2
1	1	0	Ch_1
1	1	1	nu

PAT Ch X : PAT or Ch 1, Ch 2 select pattern if bit high

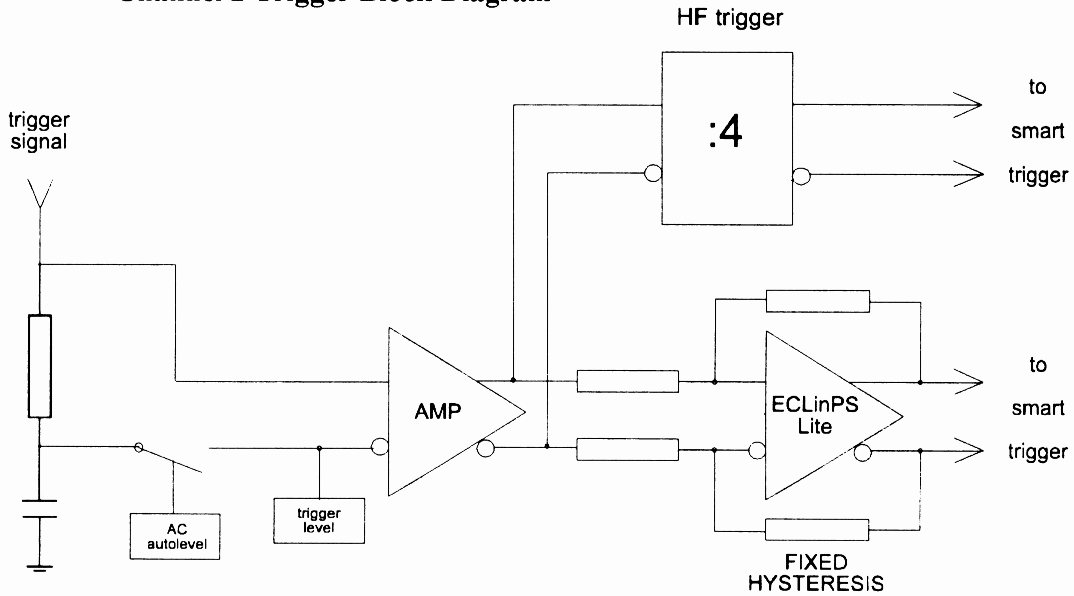
PWRANGE : Pulse width range high => fastglitch (500ps to 50ns)
low => pulse width(50ns to 1Us)

SLOPE : slope edge , slope positive if bit high

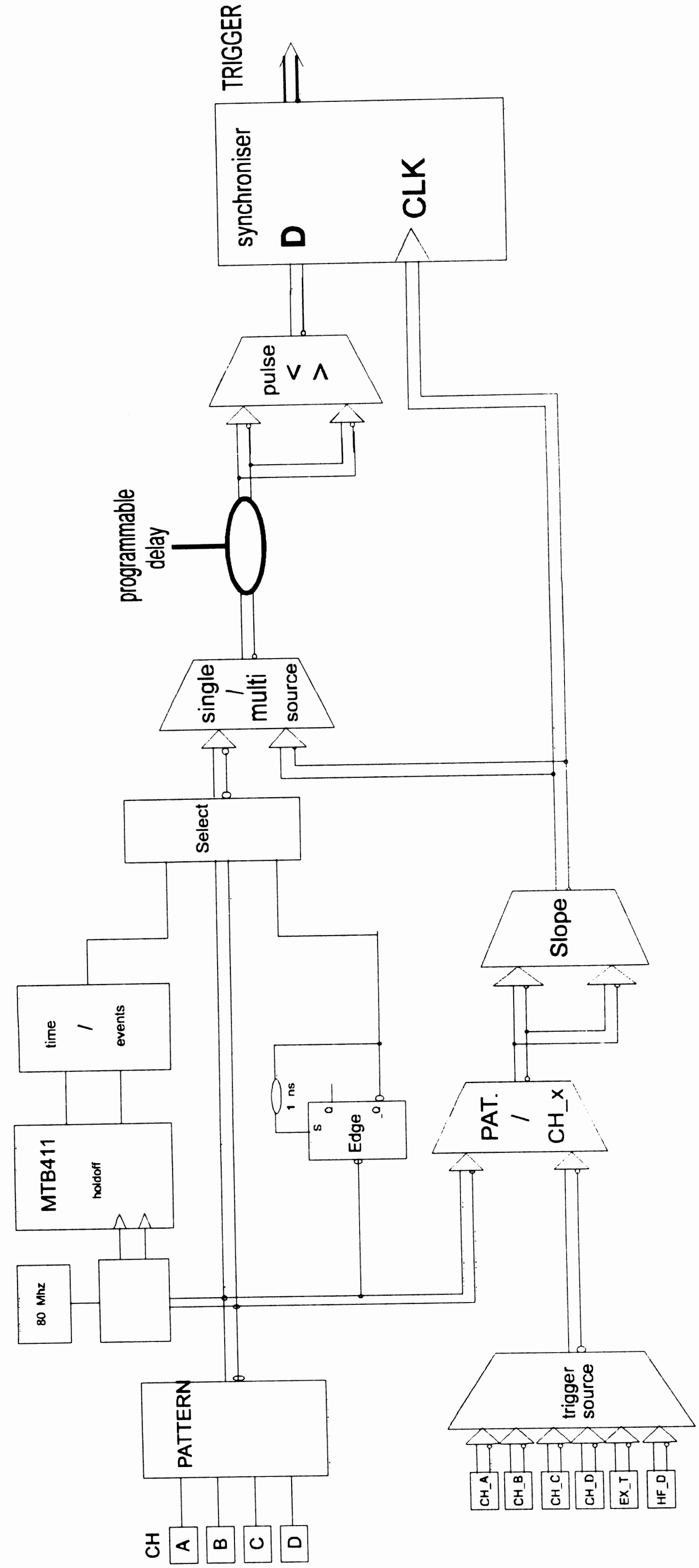
PULSE <, > : pulse width condition, smaller than (<) if bit low

note : bits HLDEN, EDGEQ, STATQ: only one must be low.

Channel 2 Trigger Block Diagram

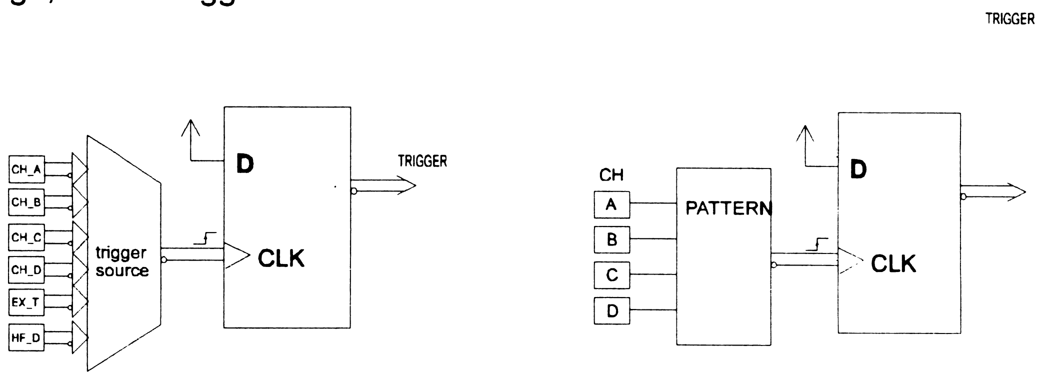


SMART TRIGGER

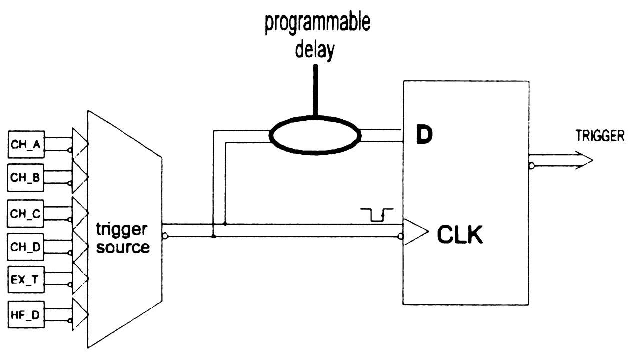


Smart trigger description

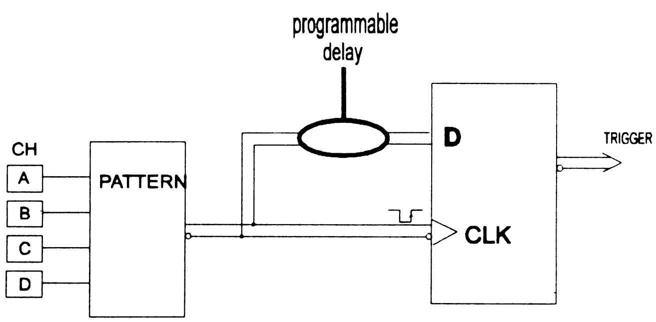
Edge,Pattern trigger



Edge pulse width trigger

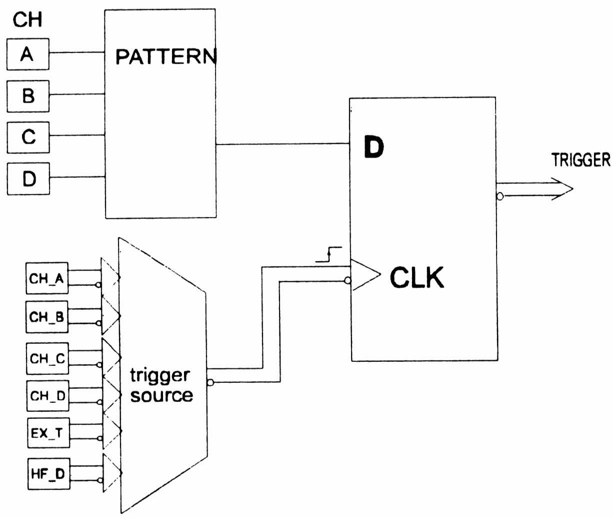


Pattern width trigger

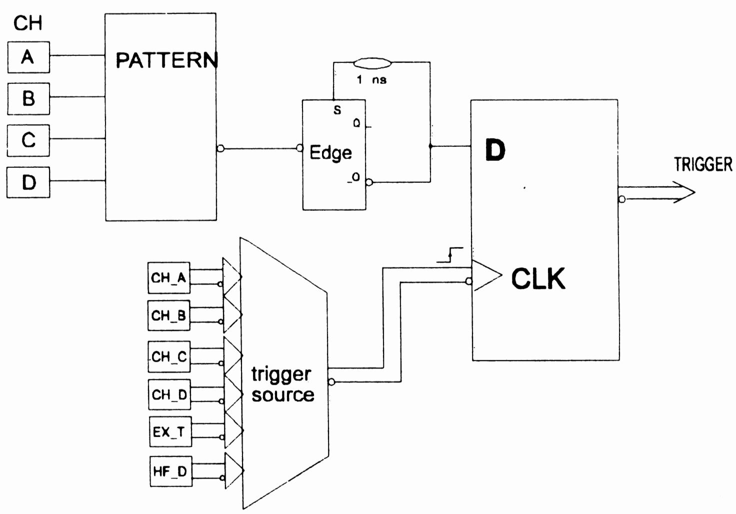


Smart trigger description

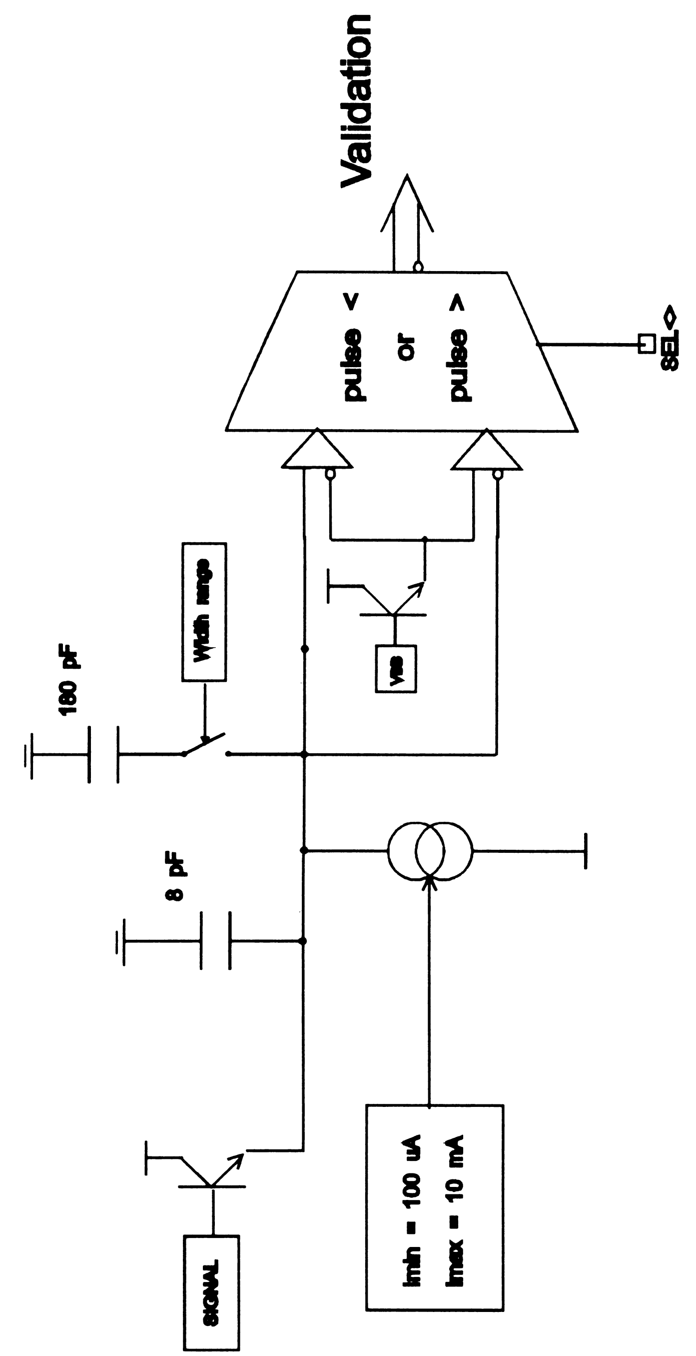
State qualified trigger



Edge qualified trigger



FASTGLITCH DETECT



4.2.4 Time Base Control

Address : 0141 2000

One byte is sent by the processor board to select :

- Time base
- Probe calibrator output

D7	D6	D5	D4	D3	D2	D1	D0
-------	-------	-------	-------	-------	-------	-------	-------
PRB CAL2	PRB CAL1	PRB CAL0	X	TB3	Buzzer	STQ TB1	X

STQ (TB1) : control for STATE or EDGE QUALIFIER

BUZZER : buzzer

TB3 : reset for HOLDOFF by TIME or EVENTS

PRBCAL0 : demux, select bit S0

PRBCAL1 : demux, select bit S1

PRBCAL2 : demux, select bit S2

S2	S1	S0	
0	0	0	16 MHz output
0	0	1	pattern or state Q output
0	1	0	trigger output
0	1	1	state '0' for pass fail
1	0	0	state '1' for pass fail
1	0	1	CLK 40 MHz (FDCK, MTB411)
1	1	0	CLK memory, (TBCK, MTB411)
1	1	1	not used

X : not used

4.3 F9300-4 GPIB and RS 232 Interface

This board is connected to the processor F9314M-1 through a flat cable. Data bus is 8 bits, address bus: 12 bits.
Address 0180 000 to 0180 00FF.

4.3.1 RS 232 Serial Interface

Based on the 2661A IC from Signetics or Philips.
- Clock frequency 4.9152 MHz.
- 4 internal registers of 8 bits.
- Interrupt level 2.
- Connector type DB9 with 9 male pins.

4.3.2 GPIB Interface

Based on the circuit 7210 IC from NEC.
- Clock frequency 5 MHz.
- 8 internal registers of 8 bits.
- Tri-state external GPIB drivers. - Low level output.
- Interrupt level 3.

The GPIB address is set by software and stored in non-volatile memory.

4.4 F9320-5 Front Panel

The front panel is connected to the processor board with a flat cable. Power supply and control signals are supplied from the processor. The front panel is divided in two sections:
- One board with Motorola 68HC05C4 processor, coders, and serial data interface.
- One matrix Keyboard with push buttons.

4.5 F9300-6 Centronics, Floppy, Printer interface option

4.5.1 Centronics interface option

This Centronics interface makes direct connection possible to external parallel printer.
- Address 0130 0180 to 0130 01A0
- Interrupt level 2

4.5.2 Floppy Disk drive interface option

Based on the circuit MCS3201 from Motorola.
- Address 0130 01C0 to 0130 01C7
- Interrupt level 4

Address	Read	Write
0130 01C0	Input register	-----
0130 01C2	-----	Digital output register
0130 01C4	Main status register	-----
0130 01C5	Data register	Data register
0130 01C7	Data input register	Disk control register

4.5.3 Printer Interface option

Internal graphic printer : Seiko LPT5446
- Address 0130 0140 to 0130 0160
- Interrupt level 2

4.6 F9300-7 Printer Controller option

Based on the LPT5000 series control chip set from Seiko instrument Inc

- PT501P01 CPU
- PT500GA1 Gate array
- Technical reference 39019-2234-01
- Address 0130 0100

4.7 93XX-Display

4.7.1 General Description

The raster scan display module is divided into five sections:
- Graphic processor
- Deflection
- Video
- Yoke
- Cathode ray tube

4.7.2 Basic Characteristics

- Nine inches diagonal monochrome, yellowish, orange.
- CRT anti-glare treated
- Non interlaced resolution of (X)810 x (Y)696 pixels at 60 Hz or 50 Hz frequency.
- Landscape vertical raster
- Electromagnetic deflection.
- Intensity control rise and fall time > 12 ns.
- Analog intensity input
- TTL synchronization input.
- Horizontal nominal size: 165 mm for X-on = 15.39 Ms.
- Horizontal size adjustment: > +/- 5 mm.
- Horizontal offset adjustment: +/- 5 mm.
- Vertical nominal size: 120 mm for Y-on = 14.5µs.
- Vertical size adjustment: > +/- 5 mm.
- Vertical offset adjustment: +/- 5 mm.
- X and Y differential non linearity: 10%.

The line deflection is vertical, from bottom to top. The field deflection is horizontal, from left to right and is resynchronized to the power line frequency.

4.7.3 Horizontal Deflection

The horizontal deflection is synchronized to the 50 or 60 Hertz power line frequency. The on time display is the same for both frequencies, therefore the deflection is calculated for 60 Hz. The horizontal deflection is controlled by the HSYNC signal.

The trailing edge of HSYNC resets the horizontal spot position to a hardware predefined position at the left side of the screen: MAX_left. When ever HSYNC is high, the spot stays at this position.
The falling edge of HSYNC starts the horizontal deflection ramp. The ramp has the same rate for either 50 or 60 Hertz frequency.
When ever HSYNC is low, the horizontal deflection will rise left to right, until HSYNC becomes high, or the system has reached the maximum right position (MAX_RIGHT).

4.7.4 Vertical Synchronization

The timing of both VSYNC and HSYNC is synchronized to the pixel clock (PCLK).

The pixel rate is 48 MHz.

4.7.5 Horizontal and Vertical Resolution

	# of vertical line	Time in ms
HSYNC_T	842	15.998
HSYNC_W	22	0.418
HSYNC_E	4	0.076
HSYNC_S	6	0.114
X-ON	810	15.390
X-OFF	32	0.608

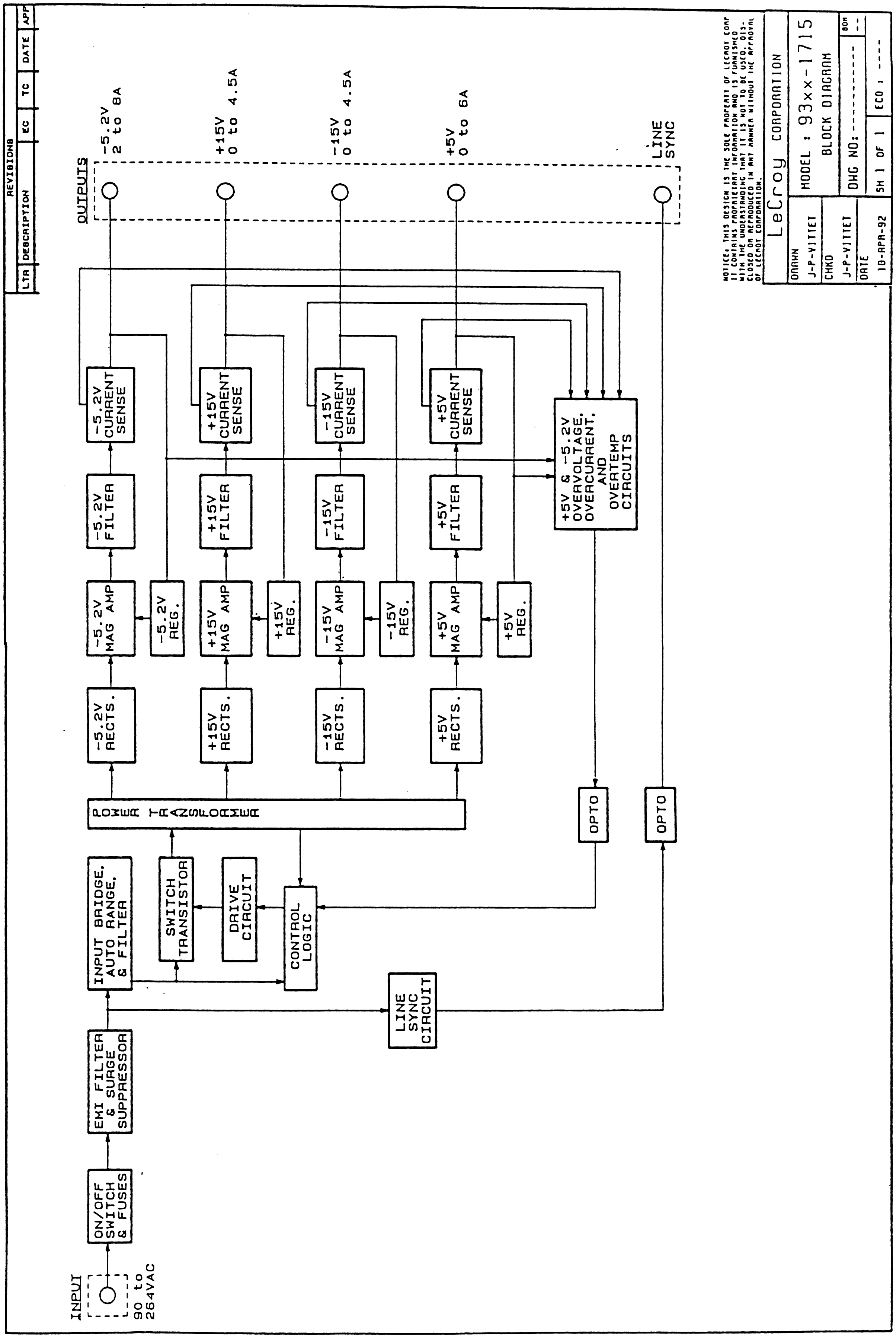
Values for the horizontal timing for the maximum field refresh frequency.

Vertical timing.

	# of Pixels	Time in μs
VSYNC_T	912	19.000
VSYNC_W	136	2.833
VSYINC_E	0	0.000
VSYNC_S	80	1.666
Y-ON	696	14.500
Y-OFF	216	4.500

4.8 93XX-PS1715 Power Supply Specifications

Input voltage	: 90 to 132 V or 180 to 250 V. Auto ranging line voltage.
Input frequency	: 45 Hz to 66 Hz.
Input rush current	: Max 40 A peak at start up.
Environmental	: Operating temperature range 0 °C to 55 °C Storage temperature range -20 °Cto 85 °C Relative humidity from 5% to 95%.
Shock vibration	: MIL-STD-810D MIL-T-28000C, para 4.5.5.4.2
Output voltages	: - 5.2 Vdc, 8 amp Max. + 5.2 Vdc, 4.5 amp Max. -15.1 Vdc, 4.5 amp Max +15.1 Vdc, 4.5 amp Max.
Output adjustment	: +/- 5%.
Regulation	: +/- 1%.
Transient response	: -5.2 V < 400 mV. +5.2 V < 250 mV. +/- 15.1 V < 1.5 V. Maximum recovery time 1.5 msec.
Ripple and noise	: Peak to peak value < 1%. Line frequency rejection < 5 mV.
Overshoot	: < 5% at start up.
Hold up time	: 20 msec.
Output short circuit protection	: Yes.
Output overvoltage protection	: No.
Input protection	: 5 amp fuses.
Thermal protection	: Yes.
Safety	: VDE 0806, IEC 380, UL478, CSAC22.2#154
EMI	: VDE 0871 class B, FCC 20780 part 15j, class B.
MTBF	: 80.000 hours.


REVISIONS
LTR
DESCRIPTION
EC
TC
DATE
APP
INPUT
90 to 264VAC
ON/OFF SWITCH & FUSES
EMI FILTER & SURGE SUPPRESSOR
INPUT BRIDGE, AUTO RANGE, & FILTER
SWITCH TRANSISTOR
DRIVE CIRCUIT
CONTROL LOGIC
LINE SYNC CIRCUIT
POWER TRANSFORMER
-5.2V RECTS.
+15V RECTS.
-15V RECTS.
+5V RECTS.
-5.2V MAG AMP
-5.2V REG.
+15V MAG AMP
+15V REG.
-15V MAG AMP
-15V REG.
+5V MAG AMP
+5V REG.
-5.2V FILTER
+15V FILTER
-15V FILTER
+5V FILTER
-5.2V CURRENT SENSE
+15V CURRENT SENSE
-15V CURRENT SENSE
+5V CURRENT SENSE
+5V & -5.2V OVERVOLTAGE, OVERCURRENT, AND OVERTEMP CIRCUITS
OPTO
OPTO
OUTPUTS
-5.2V 2 to 8A
+15V 0 to 4.5A
-15V 0 to 4.5A
+5V 0 to 6A
LINE SYNC
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.
LeCroy CORPORATION
DRAWN J-P-VITTET
CHKD J-P-VITTET
DATE 10-APR-92
MODEL : 93xx-1715
BLOCK DIAGRAM
DWG NO: -----------
SH 1 OF 1
ECO : ----
BOM --

SECTION 5 PERFORMANCE VERIFICATION

5.1 Introduction

This procedure can be used to verify the main operating specifications of the LeCroy 9320 digital storage oscilloscope, it is useful as a calibration verification procedure as well as an incoming inspection checkout.

5.2 Test Equipment needed

Instrument	Qty	Specifications	Recommended	Where used
Signal Generator (sine wave)	1	Frequency : 500 KHz to 1 GHz Accuracy : 0.001 % Amplitude : 1 V peak to peak	Marconi 2030	5.7 5.10 5.11
Signal Generator (sine wave)	1	Frequency : 5 KHz Amplitude : 6 V peak to peak	Topward TFG-8101	5.9
DC precision Power Supply	1	Amplitude : 10 V, DC Accuracy : < 0.1 %	Tektronix PS5004	5.5 5.8
Digital Multimeter	1	5 digits	Keithley 199	5.6
Power meter	1	dBm mode	HP 436A	5.7
Cable	1	BNC, 50 Ω, length 20 cm (7.87 inches)	Suhner	5.10
Cable	1	BNC, 50 Ω, length 100 cm (39.37 inches)	Suhner	
BNC T adapter	1	BNC, 50 Ω, T adapter	Suhner	5.10
SMA power splitter	1	50 Ω, 6 dB, 0.5 W	Suhner 4901.19A	5.7
SMA adapter	1	50 Ω,	Suhner SMA 50-1	5.7
Cable	2	BNC to SMA, 50 Ω length 100 cm (39.37 inches)	Suhner RG 58 C/U	5.7

Table 5-1 : Test Equipment

5.3 Turn On

Switch On the power using the power switch on the rear panel and check :

- that the display turns on after about 10 seconds
- that the display is stable
- that the range of intensity and grid intensity is reasonable

Wait for about 10 minutes for the scope to reach a stable operating temperature.

5.4 Average noise level : DC 50Ω

Specification

< 300 µV RMS at 5 mV/div
< 3.6 mV Peak to Peak at 5 mV/div

Description

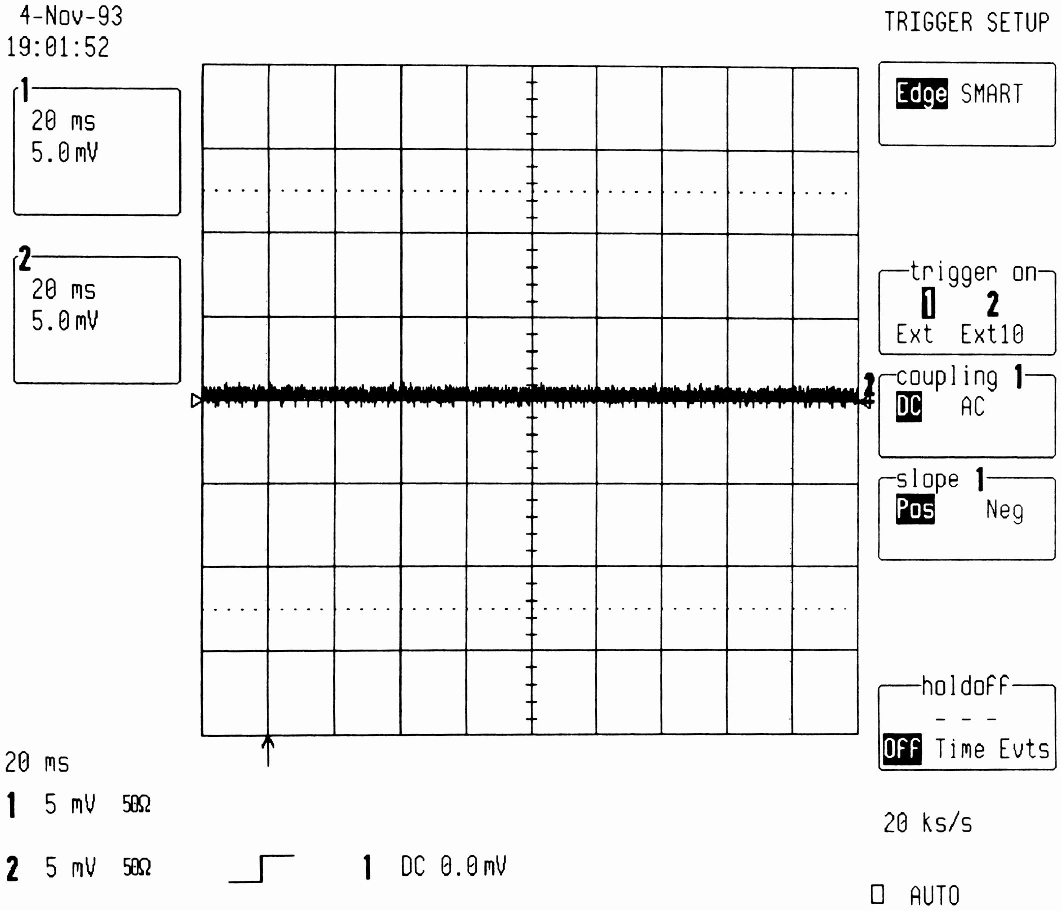
The average noise level is tested at 5 mV/div, this is to verify the proper operation of the main board, front-end and ADC's.
The scope parameters functions are used to measure the RMS and Peak amplitude of the noise.

5.4.1 Peak to Peak noise

Procedure

With no signal connected to the inputs, set 9320 DSO settings as follows :

- Turn on traces	: Ch1 and Ch2
- Display setup	: Standard, Dot Join on, Persistence off, Single grid
- Input coupling	: Ch1and Ch2 : DC 50 Ω
- V/div. offset	: Normal
- Probe atten	: X1
- Input gain	: 5 mV/div
- Trigger setup	: Edge
- Trigger on	: 1
- Coupling 1	: DC
- Slope 1	: Pos
- Holdoff	: Off
- Trigger Mode	: Auto
- Timebase	: 20 msec/div.



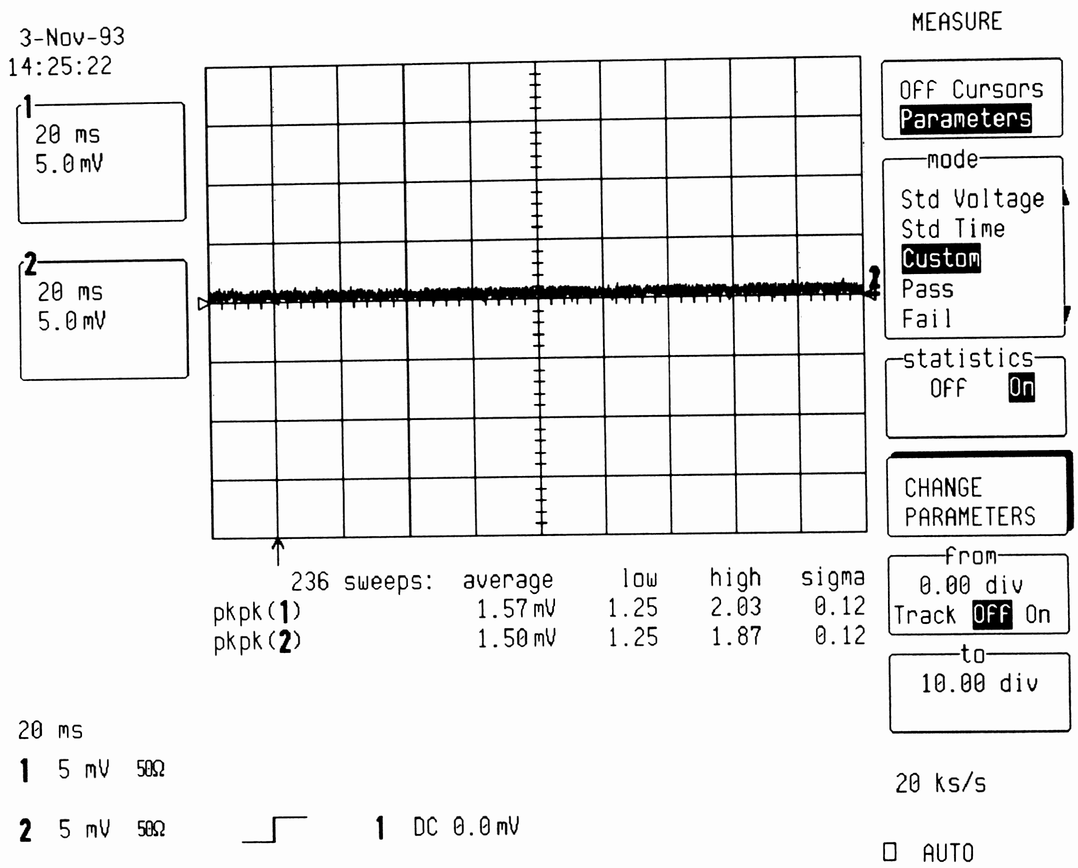
- Press	: Cursors/Measure
- Measure	: Parameters
- Mode	: Custom
- Statistics	: On

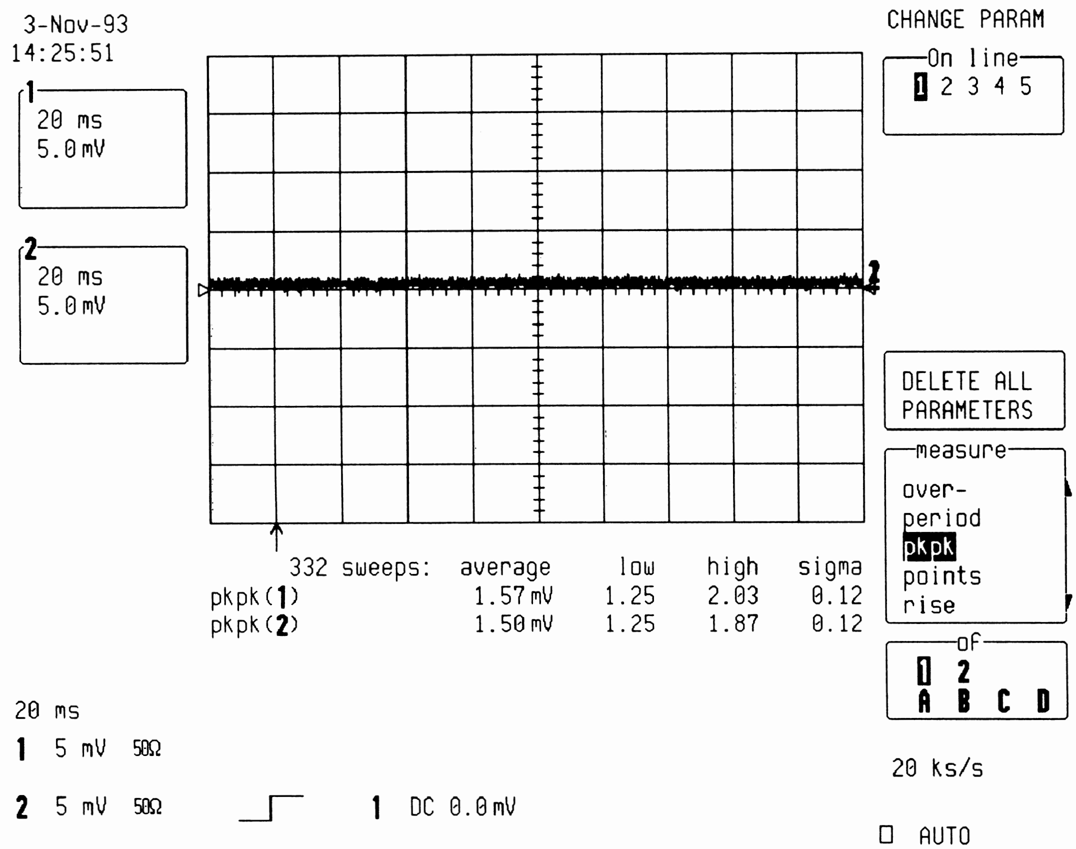
- Change parameters

- On line 1	: Measure pkpk of Ch1
- On line 2	: Measure pkpk of Ch2

Check after at least 100 sweeps that the high pkpk readout is less than 3.6 mV, corresponding to 9% of full scale.

Repeat the tests for Timebase : 10 msec/div, 2 msec/div, .2 msec/div, and .02 msec/div, and check as above.


3-Nov-93
14:25:22
1
20 ms
5.0 mV
2
20 ms
5.0 mV
MEASURE
Off Cursors
Parameters
mode
Std Voltage
Std Time
Custom
Pass
Fail
statistics
Off On
CHANGE PARAMETERS
from
0.00 div
Track Off On
to
10.00 div
236 sweeps: average low high sigma
pkpk(1) 1.57 mV 1.25 2.03 0.12
pkpk(2) 1.50 mV 1.25 1.87 0.12
20 ms
1 5 mV 50Ω
2 5 mV 50Ω
1 DC 0.0 mV
20 kS/s
AUTO


3-Nov-93
14:25:51
1
20 ms
5.0 mV
2
20 ms
5.0 mV
CHANGE PARAM
On line
1 2 3 4 5
DELETE ALL PARAMETERS
measure
over-
period
pkpk
points
rise
of
1 2
A B C D
332 sweeps: average low high sigma
pkpk(1) 1.57 mV 1.25 2.03 0.12
pkpk(2) 1.50 mV 1.25 1.87 0.12
20 ms
1 5 mV 50Ω
2 5 mV 50Ω
1 DC 0.0 mV
20 kS/s
AUTO

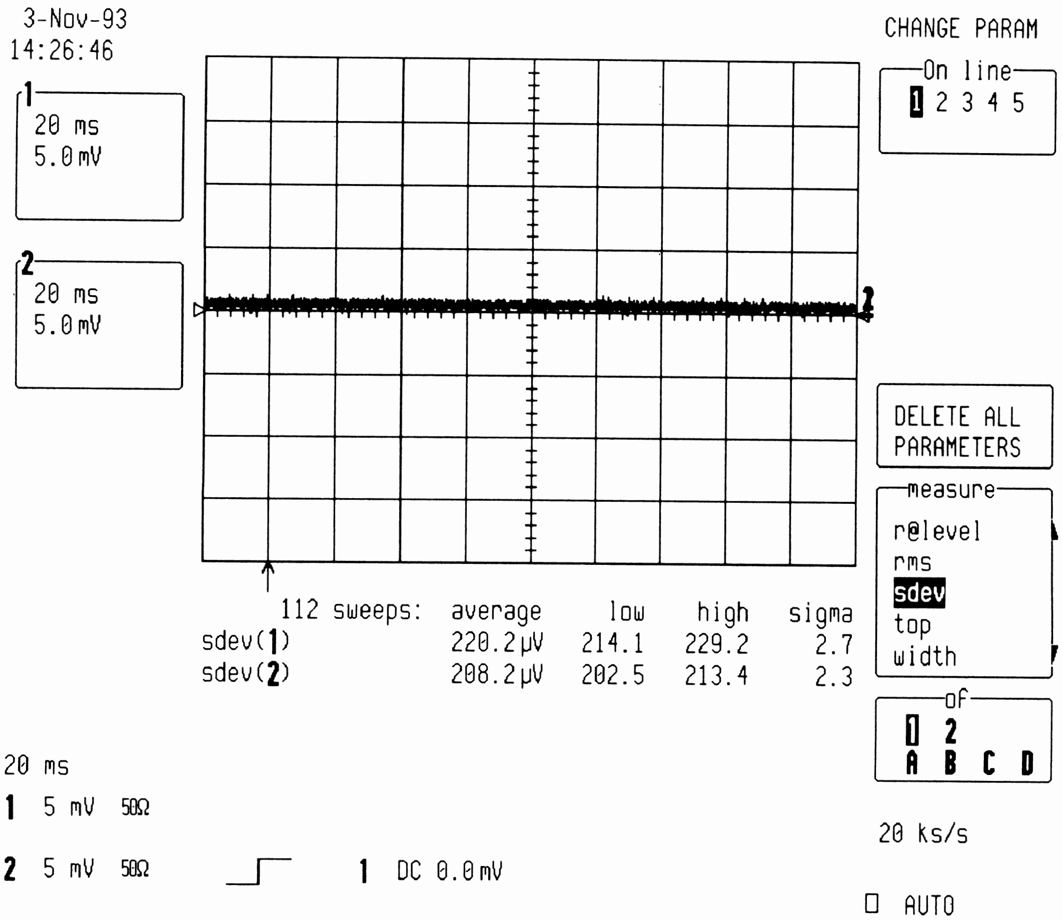
5.4.2 RMS noise

- Change Parameters

- On line 1 : Measure sdev of Ch1
- On line 2 : Measure sdev of Ch2

Check after at least 100 sweeps that high sdev readout is less than 300 μV, corresponding to 0.75% of the full scale.

Repeat the tests for Timebase : 10 msec/div, 2 msec/div, .2 msec/div, and .02 msec/div, and check as above.



5.5 Offset control

Specification

± .8 V for the ranges : 5 mV/div, 10 mV/div, 20 mV/div.
± 4 V for the ranges : 50 mV/div, 100 mV/div.
± 10 V for the ranges : 200 mV/div, 500 mV/div, 1 V/div, 2 V/div.

Description

The maximum allowed offsets depend on the sensitivity as shown in table 5-2 and 5-3, and is tested over the full 5 mV to 2 V range.

5.5.1 Negative Offset control Procedure

Set the DSO as follows :

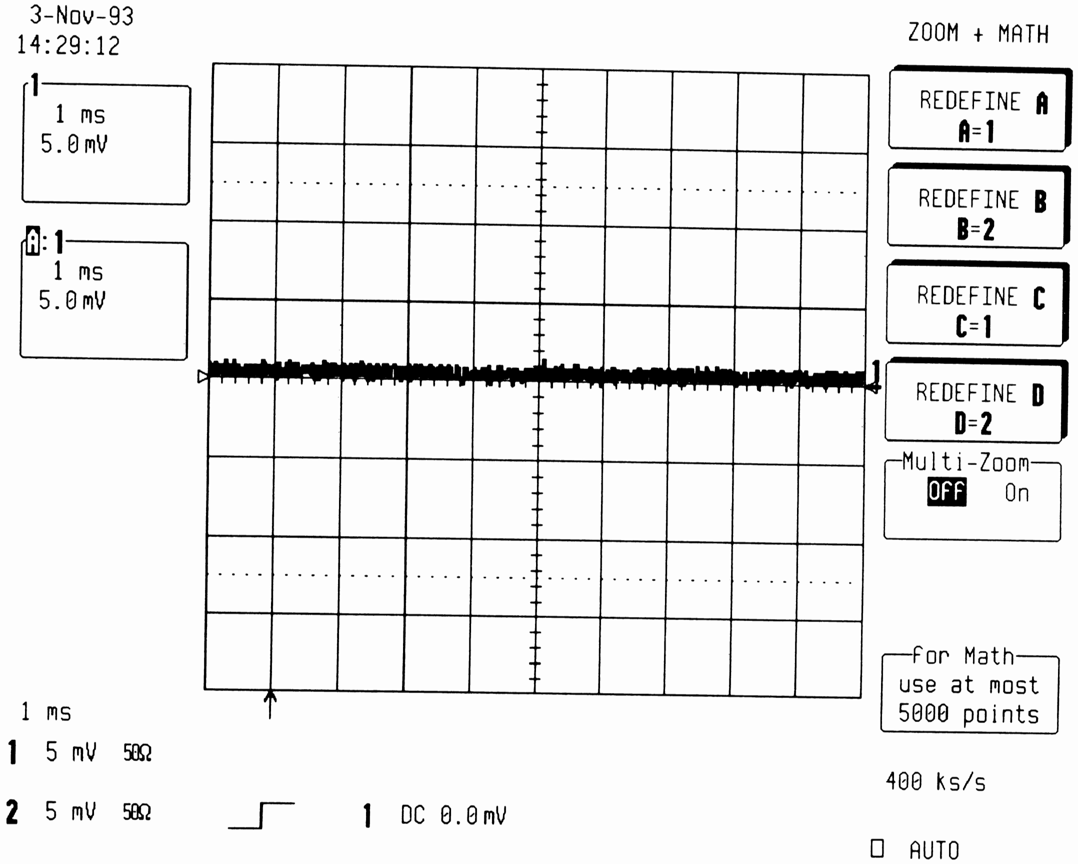
- Turn on trace : Ch1
- Display setup : Standard, Persistence off, Dot join on, Single grid
- Input coupling : Ch1 DC 50 Ω
- V/div. offset : Normal
- Probe atten : X1
- Input gain : 5 mV

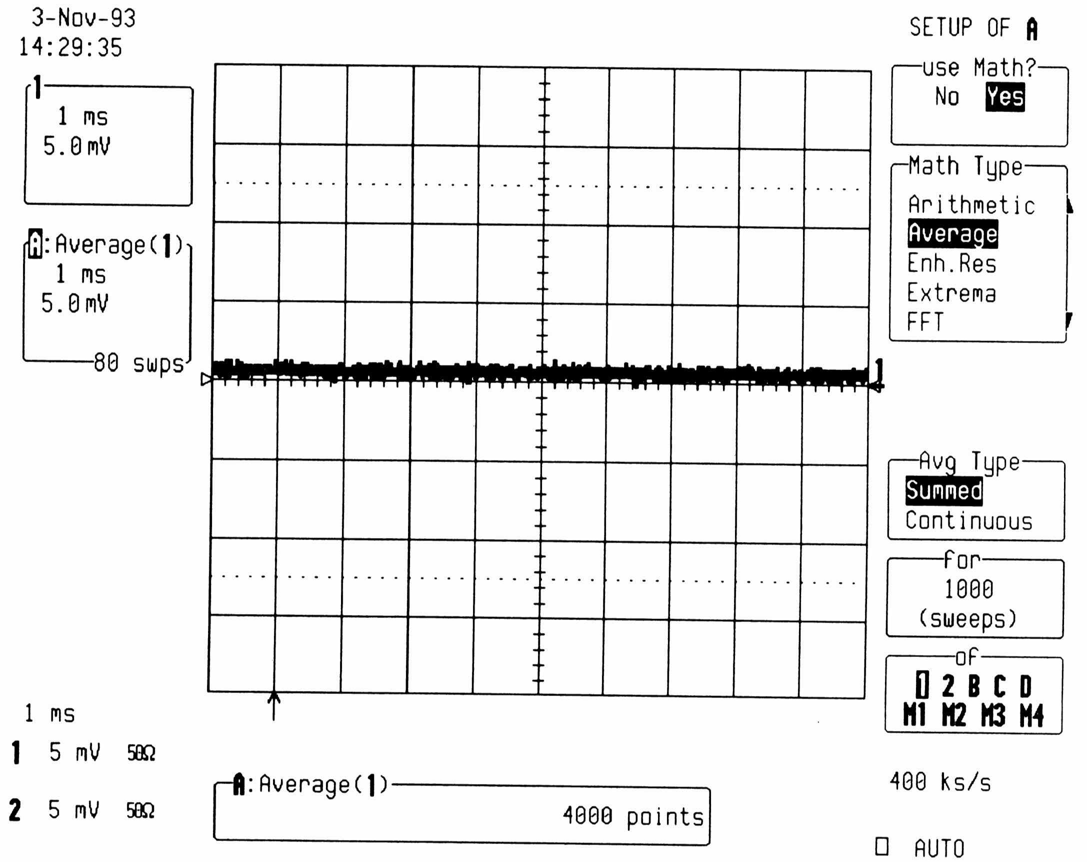
- Trigger setup : Edge
- Trigger on : 1
- Coupling 1 : DC
- Slope 1 : Pos
- Mode : Auto
- Holdoff : Off
- Timebase : 1 msec/div.

- Turn on trace : A
- Select Math Setup
- For Math : Use at most 5000 points
- Redefine A
- Use Math ? : Yes
- Math Type : Average
- Avg Type : Summed
- Of : Channel 1

- Turn off trace : Channel 1

- Cursors/Measure : Parameters
- Mode : Std Voltage
- Statistics : on
- on displayed trace : A

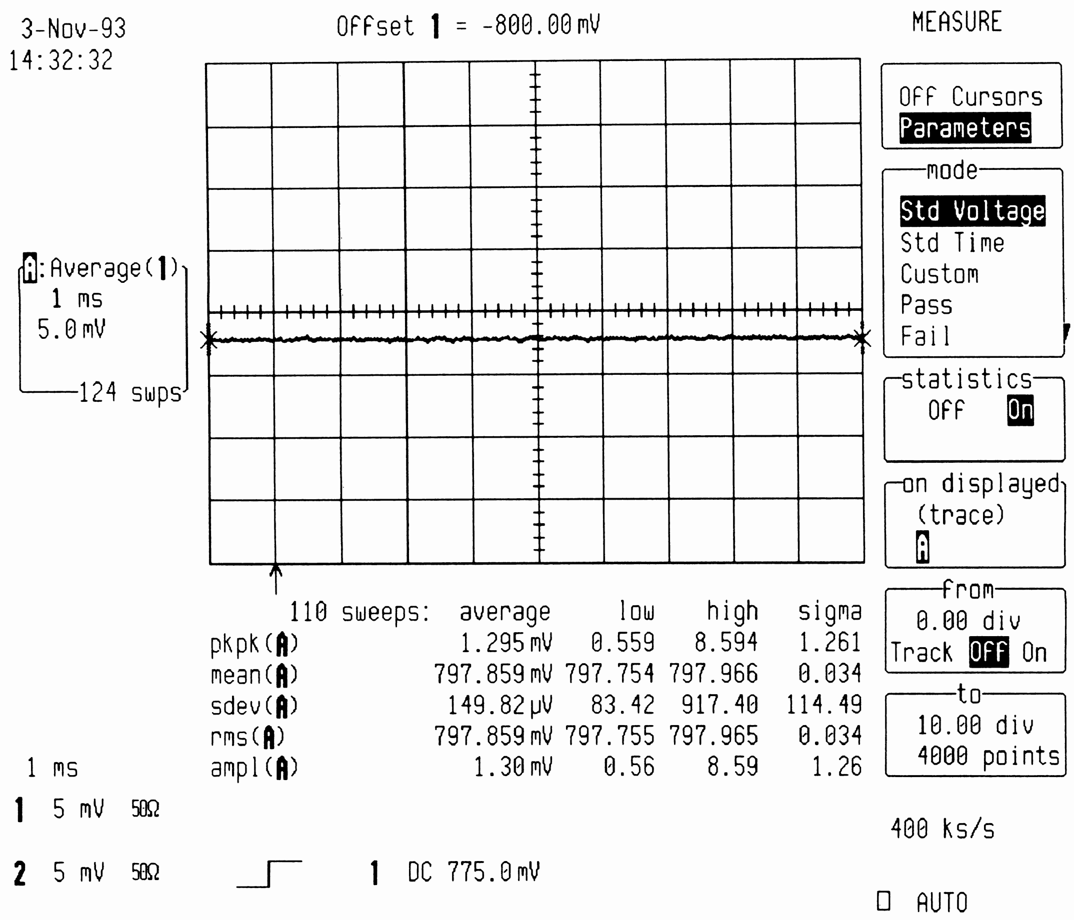

3-Nov-93
14:29:12
ZOOM + MATH
1
1 ms
5.0 mV
A: 1
1 ms
5.0 mV
REDEFINE A
A=1
REDEFINE B
B=2
REDEFINE C
C=1
REDEFINE D
D=2
Multi-Zoom
Off On
For Math
use at most
5000 points
1 ms
1 5 mV 50Ω
2 5 mV 50Ω
1 DC 0.0 mV
400 kS/s
AUTO


3-Nov-93
14:29:35
SETUP OF A
1
1 ms
5.0 mV
use Math?
No Yes
Math Type
Arithmetic
Average
Enh.Res
Extrema
FFT
A: Average(1)
1 ms
5.0 mV
80 swps
Avg Type
Summed
Continuous
for
1000
(sweeps)
of
1 2 B C D
M1 M2 M3 M4
1 ms
1 5 mV 50Ω
2 5 mV 50Ω
A: Average(1)
4000 points
400 kS/s
AUTO

From the high precision voltage source PS5004, apply to Channel 1 the following voltage value : + .8 V.
Using the offset control, move the Ch1 trace through the entire range until the following offset value is reached : - .8 V.
Verify that the displayed trace A : Average (1) is in the screen (near to the center horizontal graticule line) .

- Press clear sweeps

Check after at least 100 sweeps that the average mean (A) parameter readout is :
+ 800 mV ± 2 %.



Range	Conditions of Test		Offset Control	Average Mean Parameter Reading		
Volts/div Control	PS Output	9320 Input	9320 Offset	Minimum Value, -X %	Maximum Value, +X %	± X %
5 mV	+ 800 mV	+ 800 mV	- 800 mV	+ 784 mV	+ 816 mV	2 %
50 mV	+ 4 V	+ 4 V	- 4 V	+ 3.9 V	+ 4.1 V	2.5 %
.2 V	+ 5 V	Max + 5 V	- 5 V	+ 4.85 V	+ 5.15 V	3 %
2 V	+ 5 V	Max + 5 V	- 10 V	+ 4.5 V	+ 5.5 V	10 %

Table 5-2 : Negative offset control

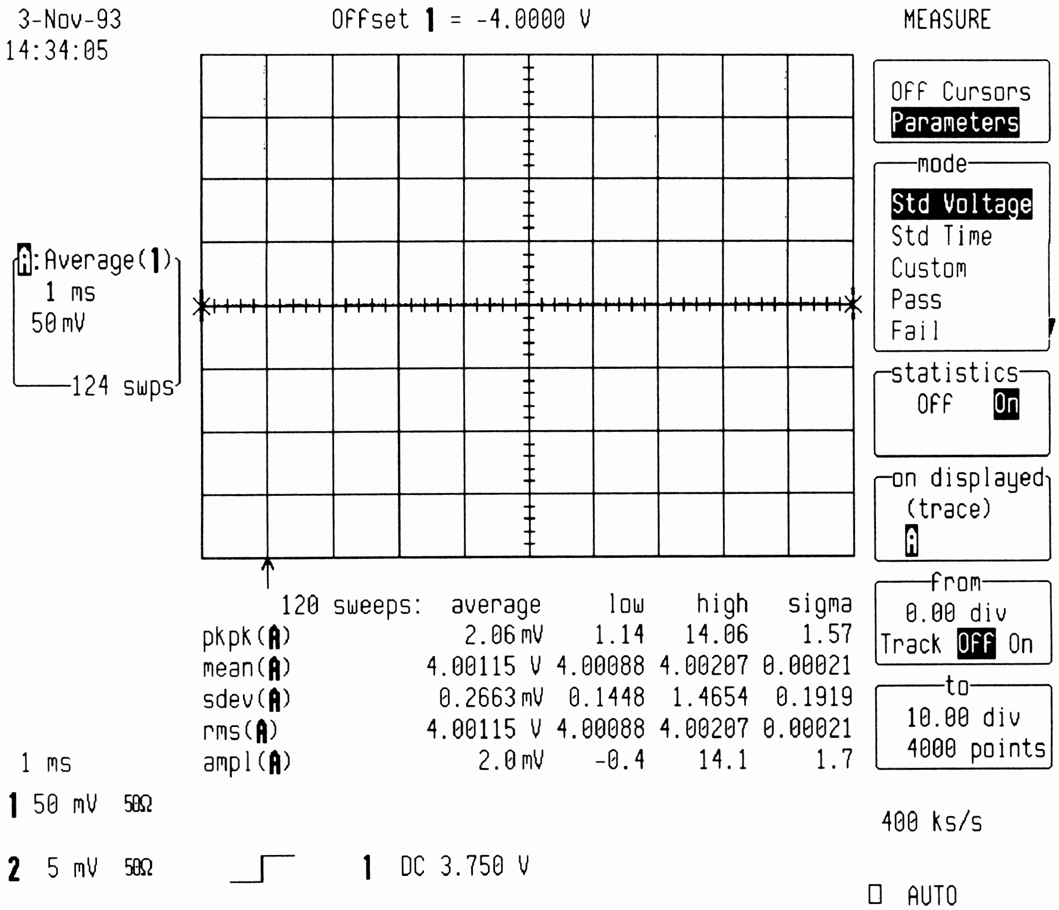
Set input gain to 50 mV/div, from the high precision voltage source, apply to Channel 1 the following voltage value : + 4 V.

Using the offset control, move the Ch1 trace through the entire range until the following offset value is reached : - 4 V.

Verify that the displayed trace A : Average (1) is in the screen (near to the center horizontal graticule line) .

- Press clear sweeps

Check after at least 100 sweeps that the average mean (A) parameter readout is : + 4 V ± 2.5 %.



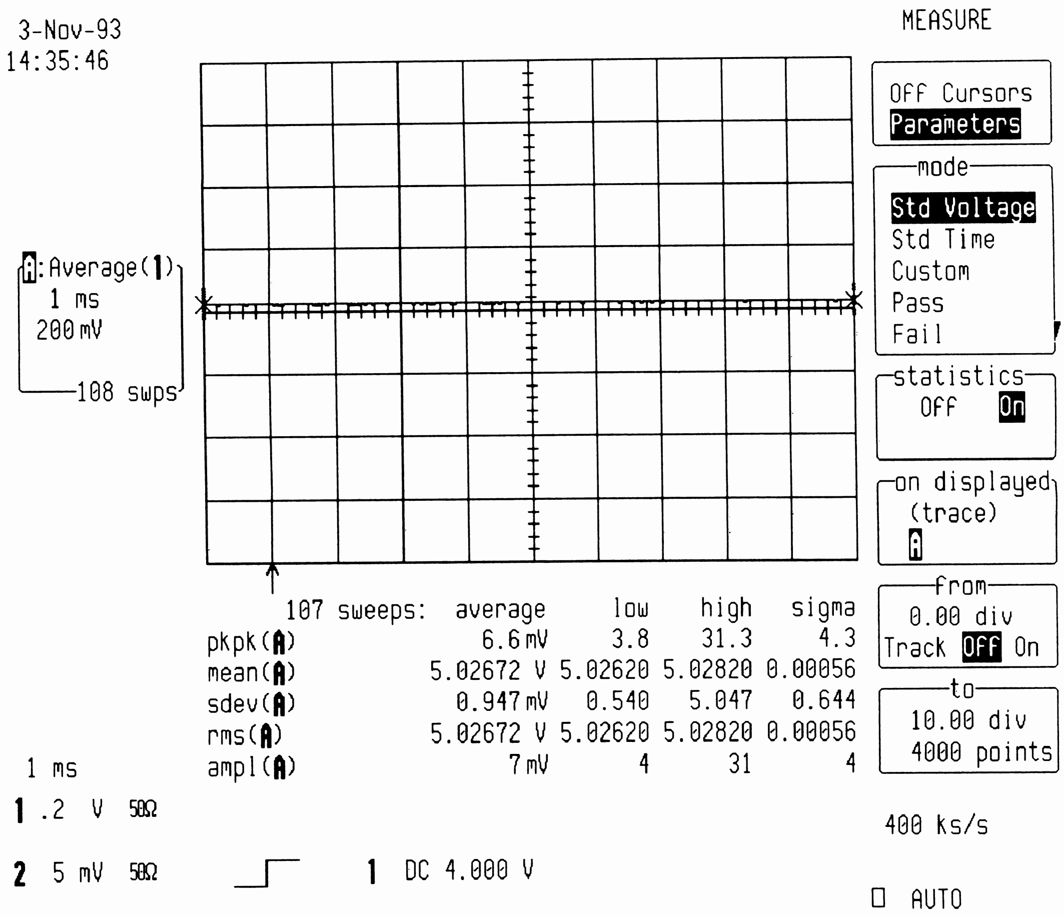
Set input gain to 200 mV/div, from the high precision voltage source, apply to Channel 1 the following voltage value : + 5 V.

Using the offset control, move the Ch1 trace through the entire range until the following offset value is reached : - 5 V.

Verify that the displayed trace A : Average (1) is in the screen (near to the center horizontal graticule line) .

- Press clear sweeps

Check after at least 100 sweeps that the average mean (A) parameter readout is : + 5 V ± 3 %.



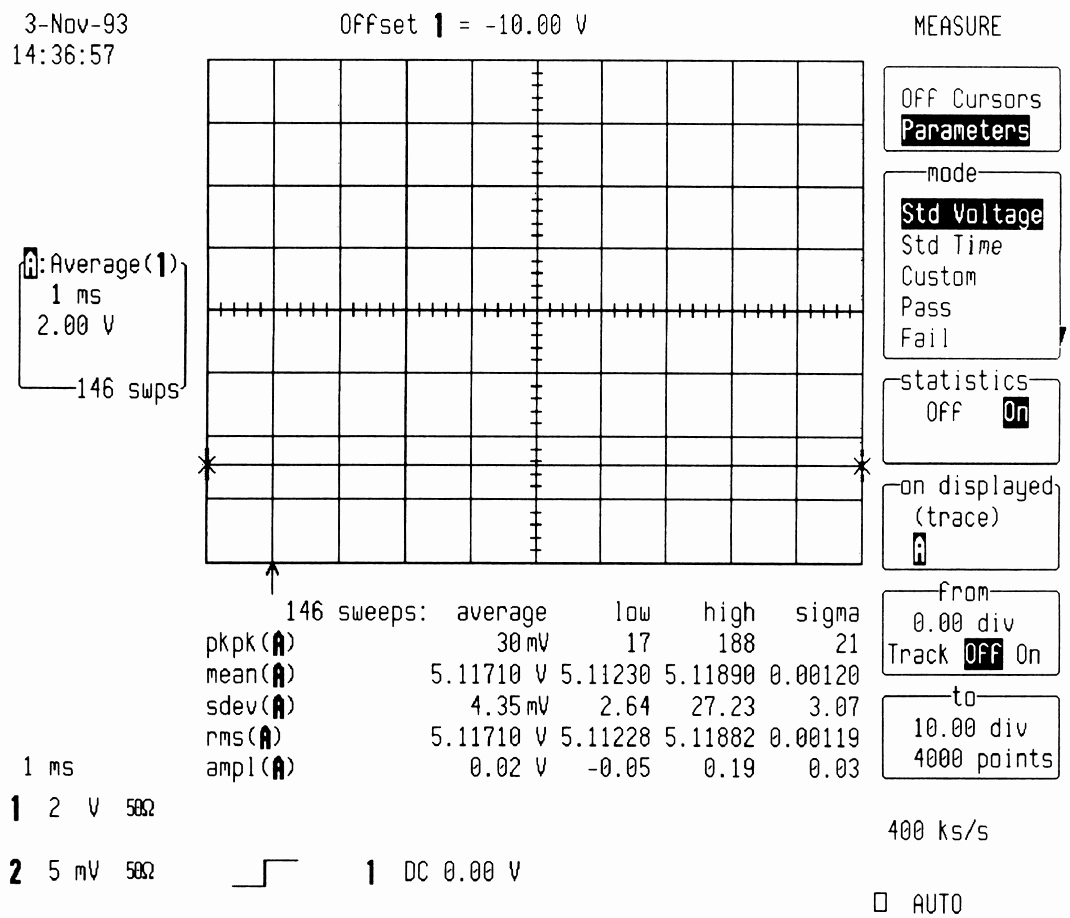
Set input gain to 2 V/div, from the high precision voltage source, apply to Channel 1 the following voltage value : + 5 V.

Using the offset control, move the Ch1 trace through the entire range until the following offset value is reached : - 10 V.

Verify that the displayed trace A : Average (1) is in the screen.

- Press clear sweeps

Check after at least 100 sweeps that the average mean (A) parameter readout is : + 5 V ± 10 %.



- Repeat all the tests for Channel 2 substituting channel controls and input connector.

5.5.2 Positive Offset control Procedure

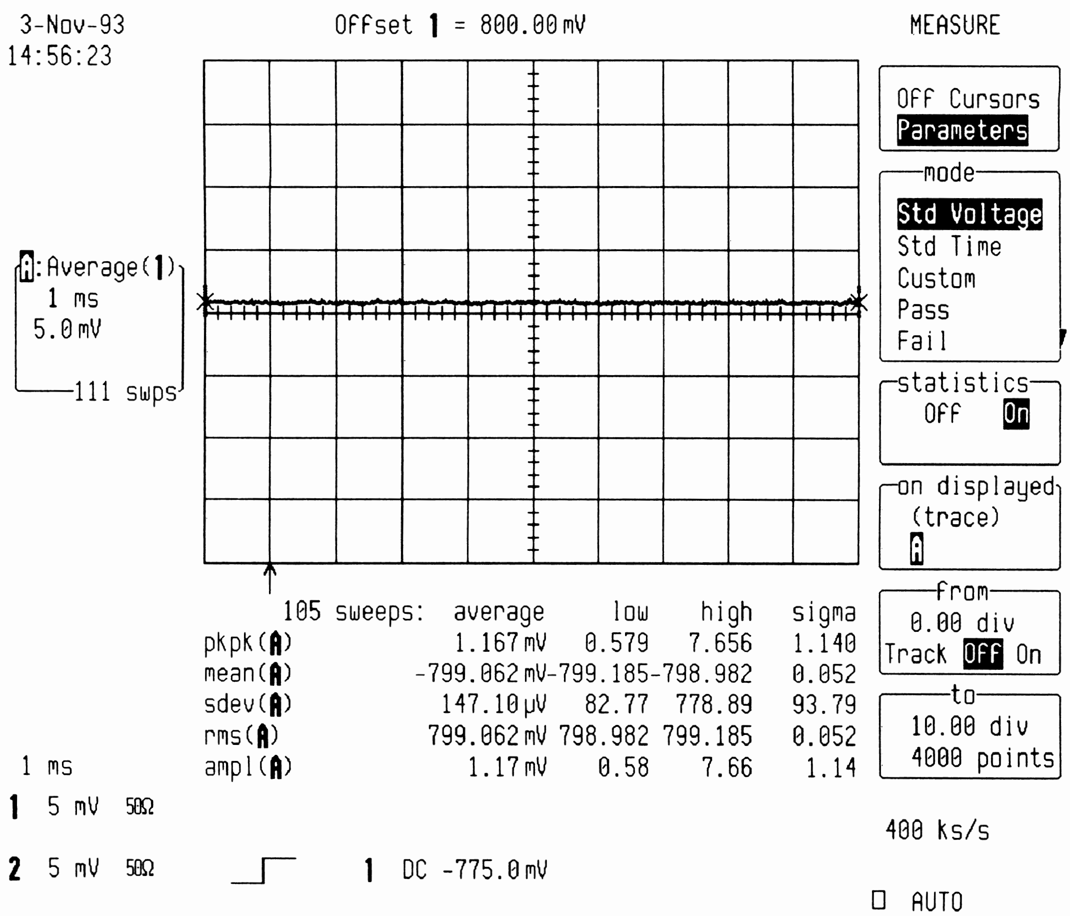
Set Channel 1 input gain to 5 mV/div. From the high precision voltage source PS5004, apply to Channel 1 the following voltage value : - .8 V. Using the offset control, move the Ch1 trace through the entire range until the following offset value is reached + .8 V. Verify that the displayed trace A : Average (1) is in the screen (near to the center horizontal graticule line) .

- Press clear sweeps

Check after at least 100 sweeps that the average mean (A) parameter readout is : - 800 mV ± 2%.

Range	Conditions of Test		Offset Control	Average Mean Parameter Reading		
Volts/div Control	PS Output	9320 Input	9320 Offset	Minimum Value, -X %	Maximum Value, +X %	± X %
5 mV	- 800 mV	- 800 mV	+ 800 mV	- 784 mV	- 816 mV	2 %
50 mV	- 4 V	- 4 V	+ 4 V	- 3.9 V	- 4.1 V	2.5 %
.2 V	- 5 V	Max - 5 V	+ 5 V	- 4.85 V	- 5.15 V	3 %
2 V	- 5 V	Max - 5 V	+ 10 V	- 4.5 V	- 5.5 V	10 %

Table 5-3 : Positive offset control



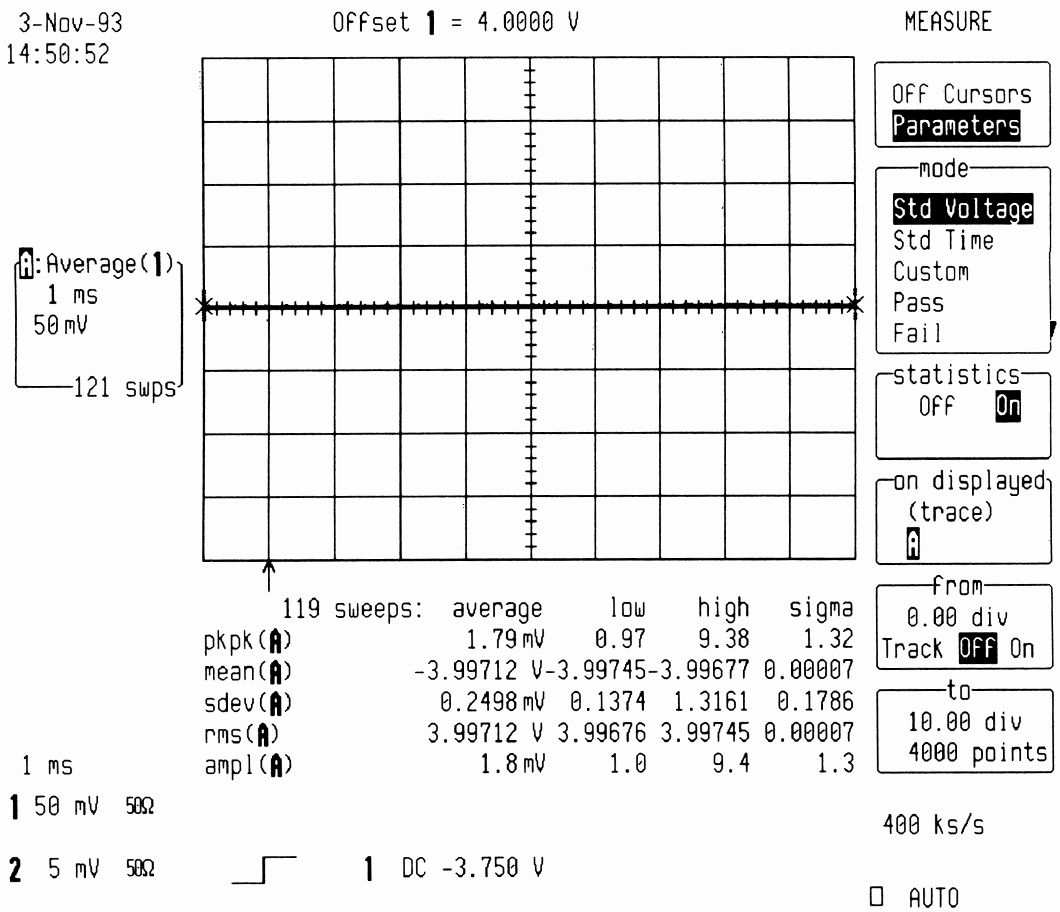
Set input gain to 50 mV/div, from the high precision voltage source, apply to Channel 1 the following voltage value : - 4 V.

Using the offset control, move the Ch1 trace through the entire range until the following offset value is reached : + 4 V.

Verify that the displayed trace A : Average (1) is in the screen (near to the center horizontal graticule line) .

- Press clear sweeps

Check after at least 100 sweeps that the average mean (A) parameter readout is :
- 4 V ± 2.5 %.



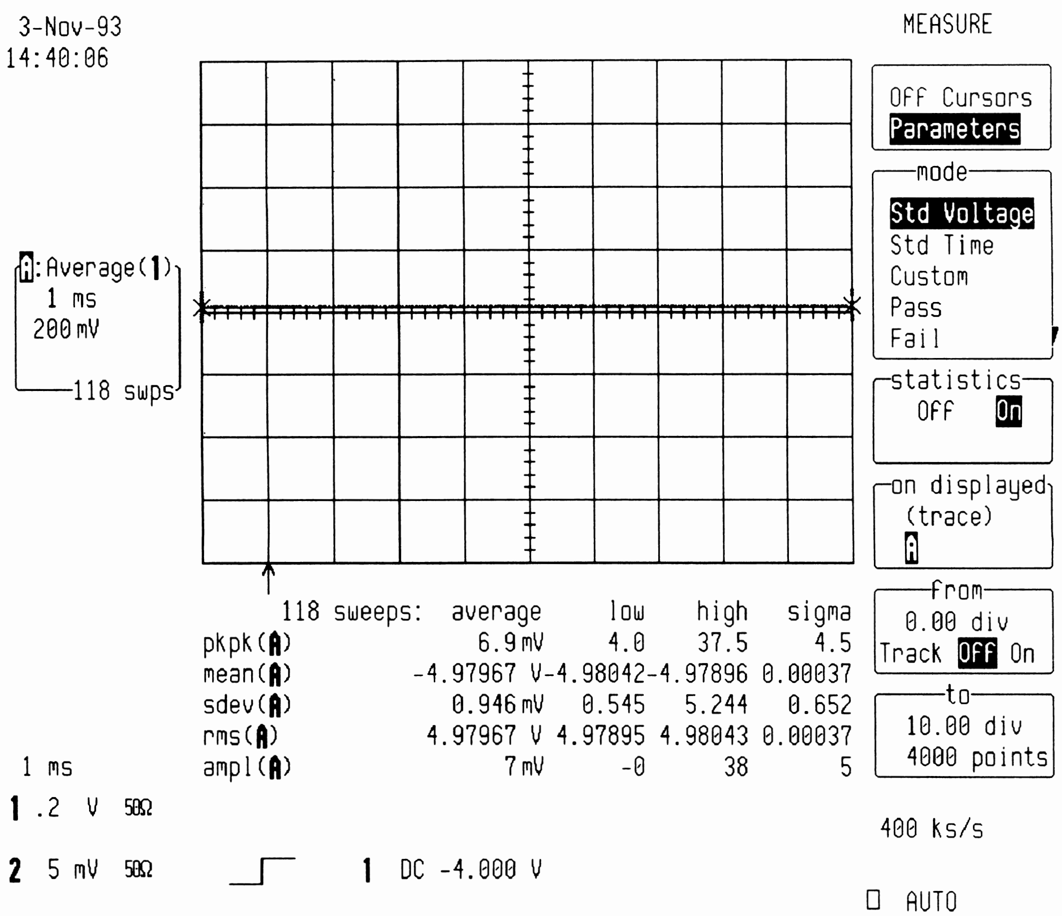
Set input gain to 200 mV/div, from the high precision voltage source, apply to Channel 1 the following voltage value : - 5 V.

Using the offset control, move the Ch1 trace until the following offset value is reached : + 5 V.

Verify that the displayed trace A : Average (1) is in the screen (near to the center horizontal graticule line) .

- Press clear sweeps

Check after at least 100 sweeps that the average mean (A) parameter readout is : - 5 V ± 3 %.



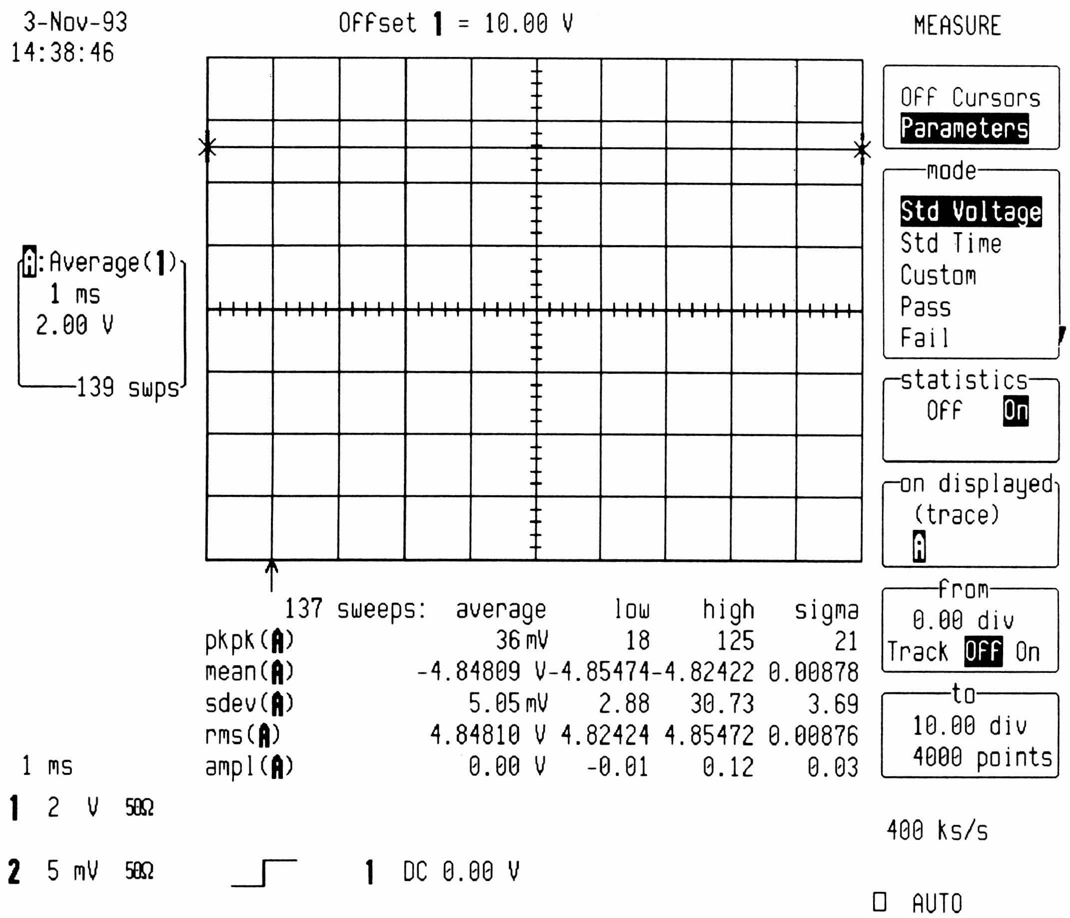
Set input gain to 2 V/div, from the high precision voltage source, apply to Channel 1 the following voltage value : - 5 V.

Using the offset control, move the Ch1 trace through the entire range until the following offset value is reached : + 10 V.

Verify that the displayed trace A : Average (1) is in the screen.

- Press clear sweeps

Check after at least 100 sweeps that the average mean (A) parameter readout is : - 5 V ± 10 %.



- Repeat all the tests for Channel 2, substituting channel controls and input connector.

5.5.3 Input Grounded Verification

With no cable plugged into scope.

Set the DSO as follows :

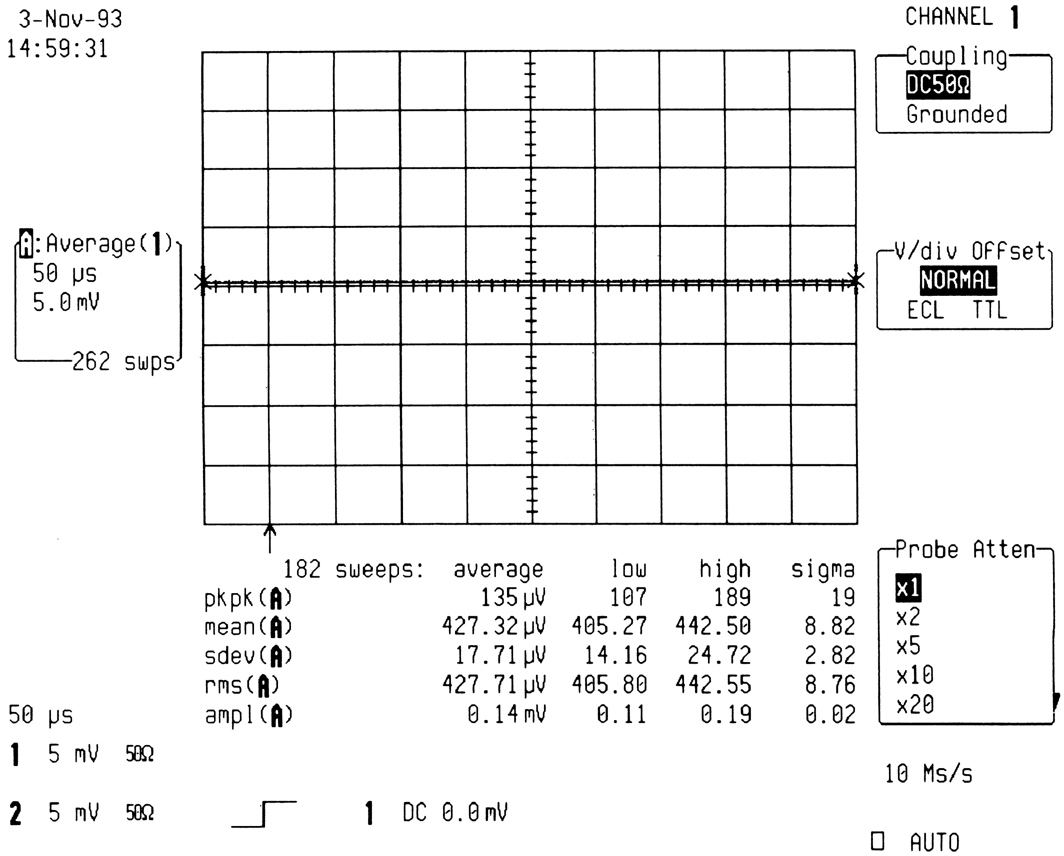
- Turn on trace	: Channel 1
- Input gain	: 5 mV/div
- Offset	: Zero
- Timebase	: 50 µsec/div
- Turn on trace	: A
- Select Math Setup	
- For Math	: Use at most 5000 points
- Redefine A	
- Use Math ?	: Yes
- Math Type	: Average
- Avg Type	: Summed
- Of	: Channel 1
- Turn off trace	: Channel 1
- Cursors/Measure	: Parameters
- Mode	: Std Voltage
- Statistics	: on
- on displayed trace	: A
- Coupling	: DC 50Ω

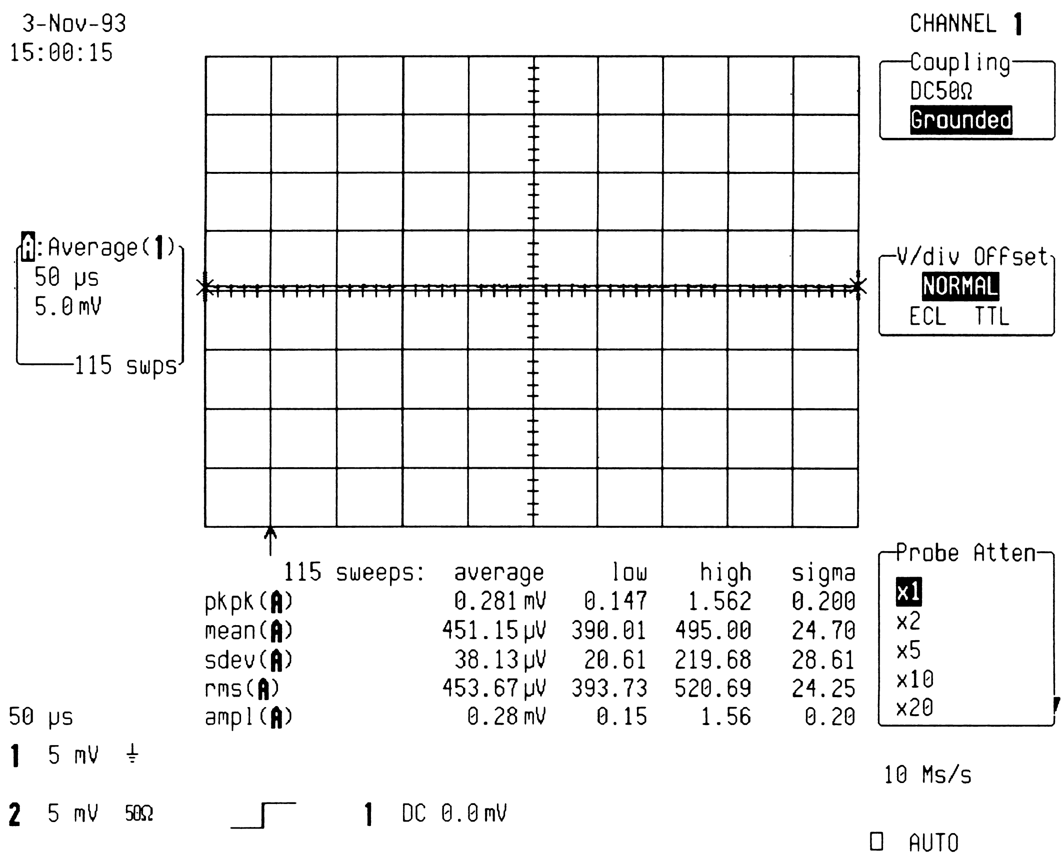
After at least 100 sweeps readout the mean(A) : Average.

- Switch between coupling 50 Ω and Grounded,

Check that the mean(A) : Average is not changing by more than 800 µV.

- Repeat the test for Channel 2.


3-Nov-93
14:59:31
CHANNEL 1
Coupling
DC50Ω
Grounded
A: Average(1)
50 µs
5.0 mV
262 swps
V/div Offset
NORMAL
ECL TTL
182 sweeps: average low high sigma
pkpk(A) 135 µV 107 189 19
mean(A) 427.32 µV 405.27 442.50 8.82
sdev(A) 17.71 µV 14.16 24.72 2.82
rms(A) 427.71 µV 405.80 442.55 8.76
ampl(A) 0.14 mV 0.11 0.19 0.02
Probe Atten
x1
x2
x5
x10
x20
50 µs
1 5 mV 50Ω
2 5 mV 50Ω
1 DC 0.0 mV
10 Ms/s
AUTO


3-Nov-93
15:00:15
CHANNEL 1
Coupling
DC50Ω
Grounded
A: Average(1)
50 µs
5.0 mV
115 swps
V/div Offset
NORMAL
ECL TTL
115 sweeps: average low high sigma
pkpk(A) 0.281 mV 0.147 1.562 0.200
mean(A) 451.15 µV 390.01 495.00 24.70
sdev(A) 38.13 µV 20.61 219.68 28.61
rms(A) 453.67 µV 393.73 520.69 24.25
ampl(A) 0.28 mV 0.15 1.56 0.20
Probe Atten
x1
x2
x5
x10
x20
50 µs
1 5 mV
2 5 mV 50Ω
1 DC 0.0 mV
10 Ms/s
AUTO

5.6 50 Ω input Impedance

Specification

50 Ω ± 1 %

Description

The 50 Ω input impedance is tested in working conditions, with a high precision digital multimeter.

Procedure

- Set DSO Ch1 : On
- Input coupling : DC 50 Ω
- Input gain : 20 mV/div
- Time base : 50 µsec/div

Check with a high precision DMM : input impedance must be 50 Ω ± 1 %.

- Repeat the test for Input gain : 100 mV/div and .5 V/div, the input impedance must be 50 Ω ± 1 %.

Repeat impedance checks for Channel 2, External Trigger and External / 10.

5.7 Bandwidth

Specification

- 3dB : DC to at least 1 GHz

Description

The purpose of this test is to ensure that the entire 9320 system has a bandwidth of at least 1 GHz at 100 mV/div. An external source is used as the reference to provide a signal where amplitude and frequency are well controlled.

Procedure

Setup a leveled sine wave generator.

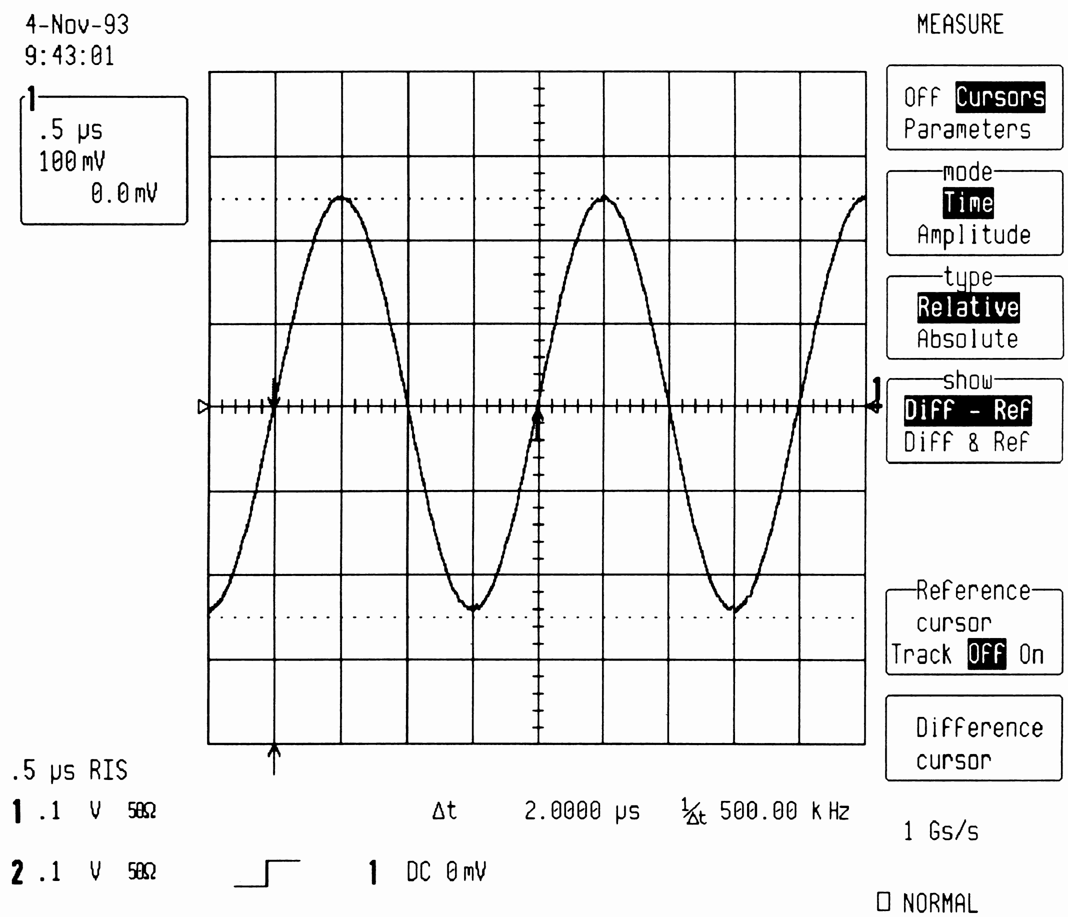
- Frequency : 500 KHz

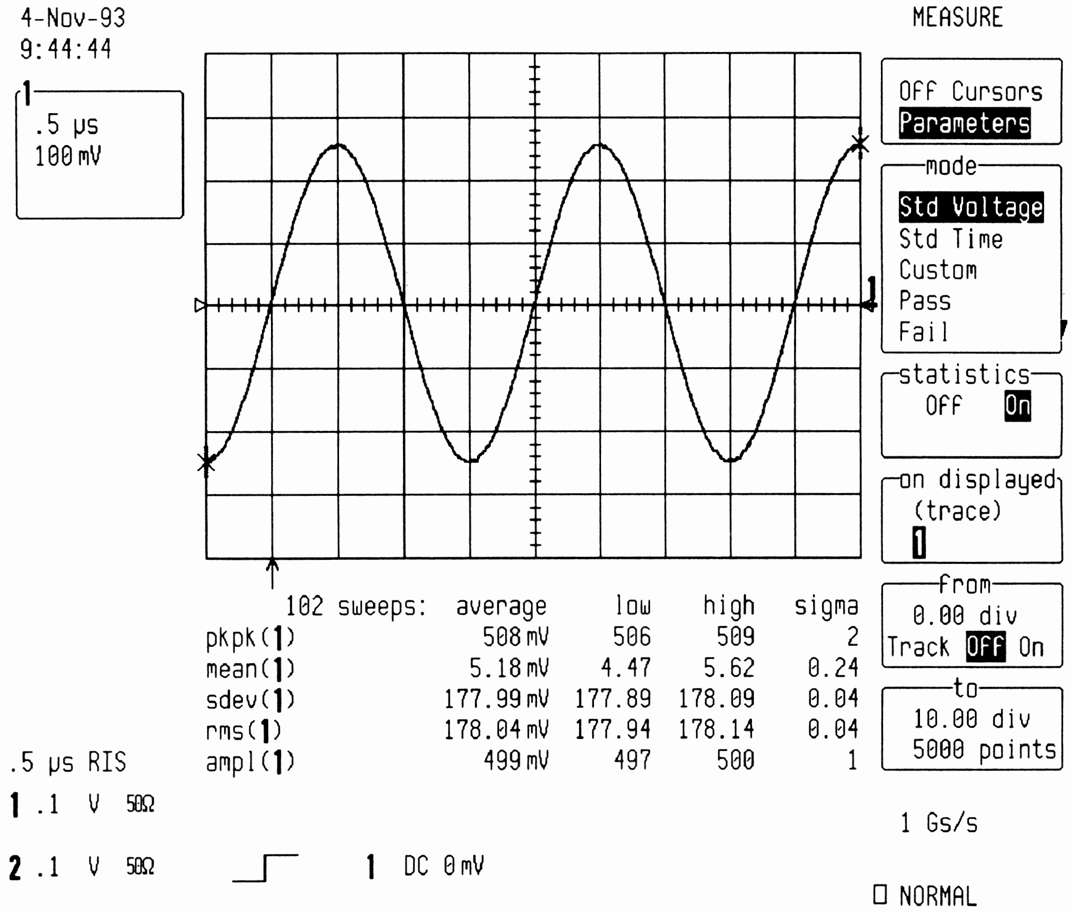
Connect the generator output to Channel 1 and Channel 2 via a SMA power splitter 50 Ω, 6 dB, 0.5 W type 4901.19A of Suhner, and two SMA / BNC cables 50 Ω ± 2 Ω of 5 ns (1 meter or 39.37 inches).

- Turn on trace : Ch1
- Display setup : Standard, Persistence off, Dot join on, Single grid
- Input coupling : Ch1 : DC 50 Ω
- V/div. offset : Normal
- Probe atten : X1
- Input gain : 100 mV/div

- Offset	: 0 mV
- Trigger setup	: Edge
- Trigger on	: 1
- Trigger level	: 0 mV
- Coupling 1	: DC
- Slope 1	: Pos
- Mode	: Norm
- Holdoff	: Off
- Timebase	: .5 µsec/div
- Cursors/Measure	: Parameters
- Mode	: Std Voltage
- Statistics	: On
- On displayed trace	: 1

Adjust the generator output amplitude to get a 500 mV amplitude sine wave (5 divisions), and check amplitude of the signal with parameter ampl(1).





- Disconnect the SMA power splitter with cables from the generator, and connect a power meter (HP436A or equivalent) with power sensor (HP 8482A) to the generator output.
- Record the power meter readout. i.e : $V1$ at 500 KHz = 4.05 dBm

- Set the generator frequency to 1 GHz
- Record the power meter readout. i.e : $V2$ at 1 GHz = 3.89 dBm

- Calculate the attenuator factor of the generator : Δ1= V1 -V2 in mV

$$dBm = 20\log_{10}\left(\frac{V}{Vref}\right)$$

Where Vref = 0.224 V Rms or 0.316 V peak (that is, 0 dBm is defined as a sine wave of 0.224 V Rms, giving 1.0 mW into 50 Ω).

i.e : 4.05 $dBm = 20\log_{10}\left(\frac{V1}{Vref}\right) \Rightarrow V1 = 504$ mV peak

i.e : 3.89 $dBm = 20\log_{10}\left(\frac{V2}{Vref}\right) \Rightarrow V2 = 494$ mV peak

i.e : Δ1= 10 mV

At 1 GHz, the amplitude of the source is also typically decreased by ≈ 0.55 dBm, due to the 50 Ω cable.

Attenuator factor of the cable : $\Delta 2 = 10^{\left(\frac{0.55}{20}\right)} = 1.065 \Rightarrow 6.5\ \%$ of 500 mV ≈ 32 mV

- Reconnect the SMA power splitter with cables to the 9320 DSO.

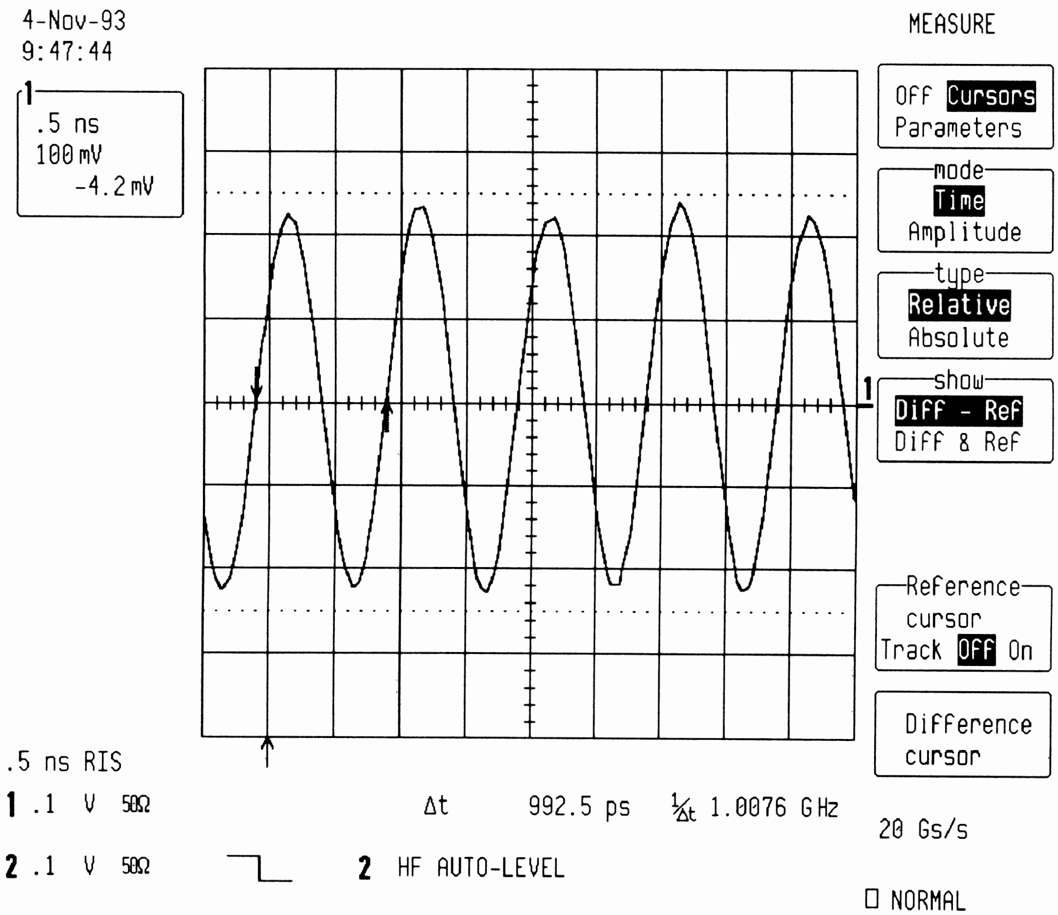
Set DSO settings as follows :

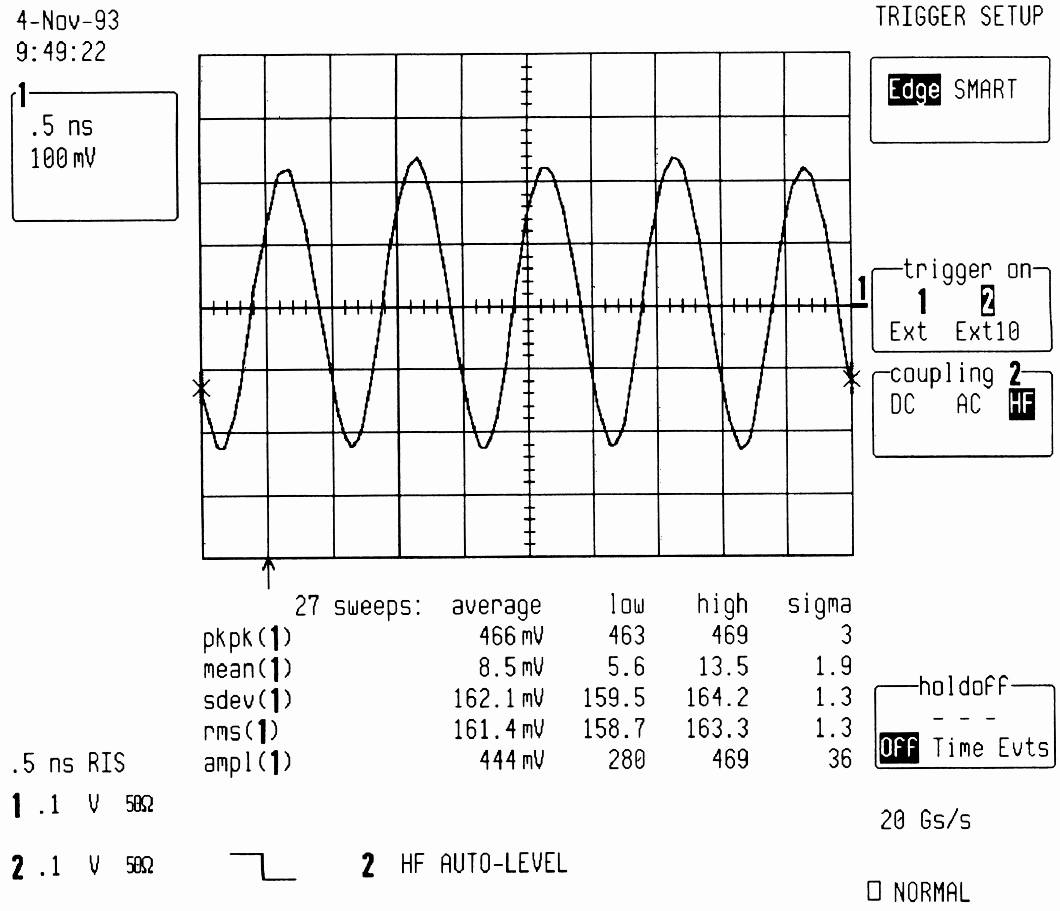
- Trigger on : Ch2
- Coupling 2 : HF
- Time/div : .5 ns

Check on the 9320, that the sine wave amplitude is :

$\text{ampl}(1) + \Delta 1 + \Delta 2 \geq 350$ mV

corresponding to 70 % of the initial amplitude at .5 MHz (.7 X 500 mV = 350 mV, 3dB point) or greater, minus the attenuator factor of generator with 50 Ω cable :





Repeat the tests to check Channel 2 bandwidth, substituting channel controls and input connector.

5.8 Manual linearity test using an external high precision voltage source (NIST traceable)

Specification

≤ ± 2 % of full scale at 0 mv offset

Description

This test measures the DC Accuracy within the gain range specified.
The parameters Std voltage are used to measure the amplitude of the DC input signal.

In the absence of the computer automated calibration system based on LeCroy Calibration Software (LeCalsoft) for the 9320 model oscilloscope, the manual performance test procedure can be followed to establish a NIST traceable calibration, provided the measurement instruments used are NIST traceable calibrated.

For a NIST calibration, follow the manual linearity test procedure using a calibrated and certified high precision (better than 0.1 %) voltage source, for example TEK PS5004 or equivalent.

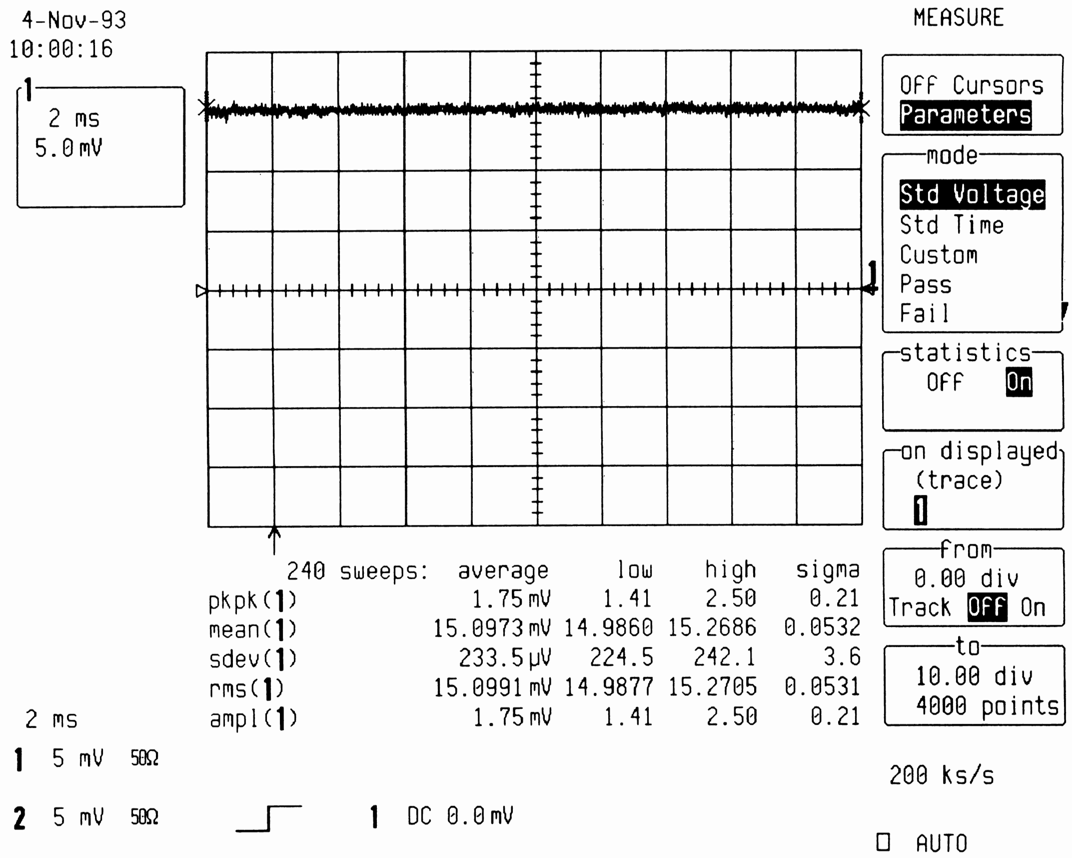
Procedure

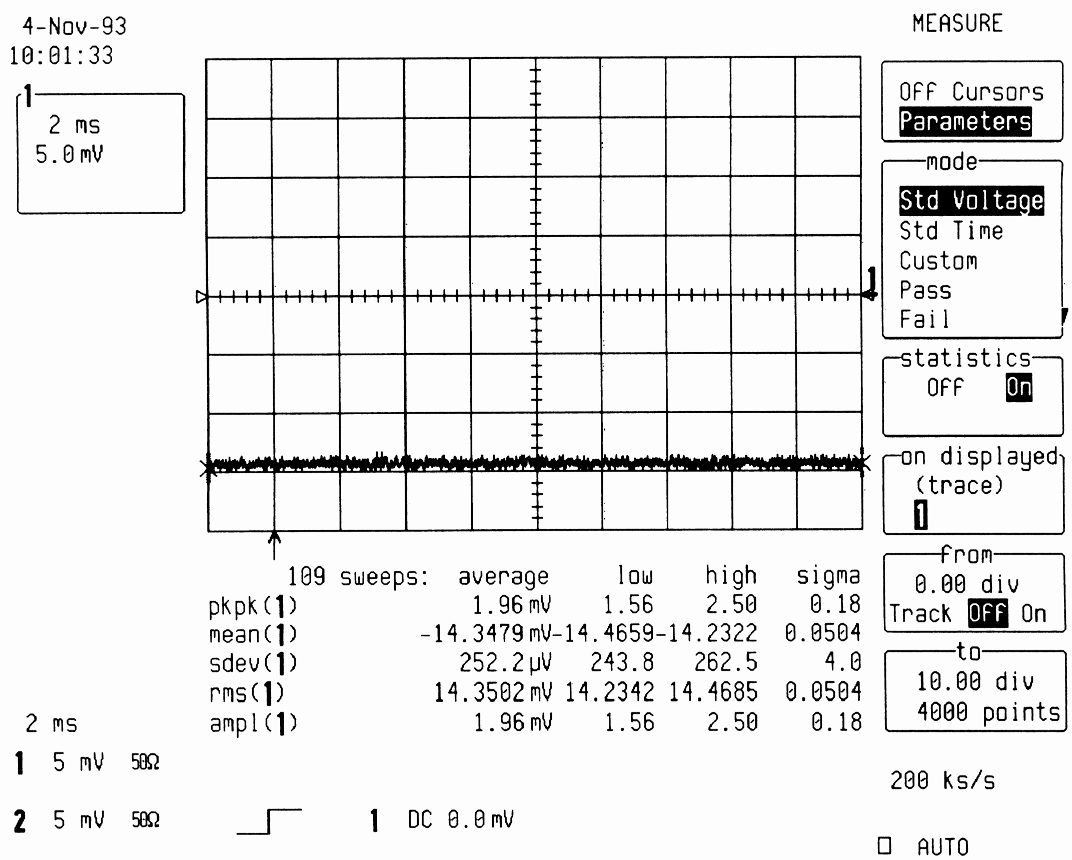
- Turn on trace	: Ch1
- Display setup	: Standard, Persistence off, Dot join on, Single grid
- Input coupling	: Ch1 : DC 50 Ω
- V/div. offset	: Normal
- Probe atten	: X1
- Input offset	: 0.0 mV
- Input gain	: from 5mV/div to 2 V/div (see table 5-4)
- Trigger setup	: Edge
- Trigger on	: 1
- Coupling 1	: DC
- Slope 1	: Pos
- Mode	: Auto
- Holdoff	: Off
- Timebase	: 2 msec/div.
- Cursors/Measure	: Parameters
- Mode	: Std Voltage
- Statistics	: On
- On displayed trace	: 1

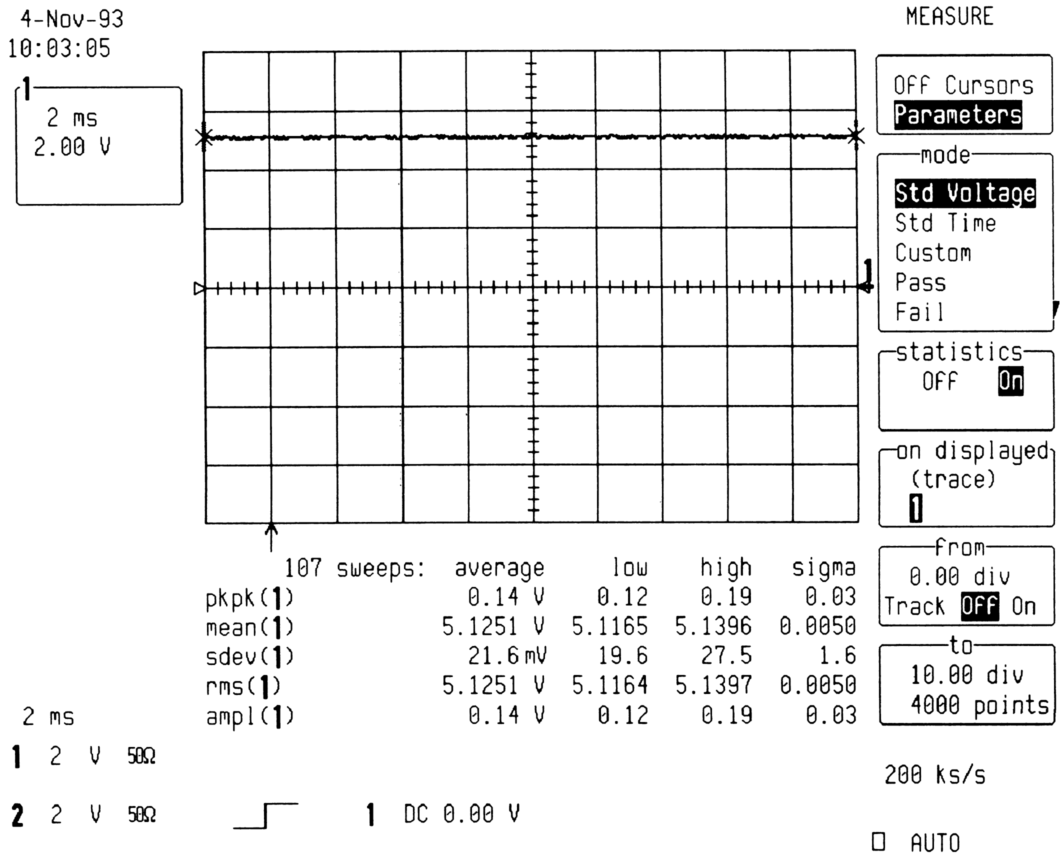
For the ranges 5 mV/div to 1 V/div, from the high precision voltage source, apply the following 2 voltage values, one after another : + 3 major screen divisions, - 3 major screen divisions.

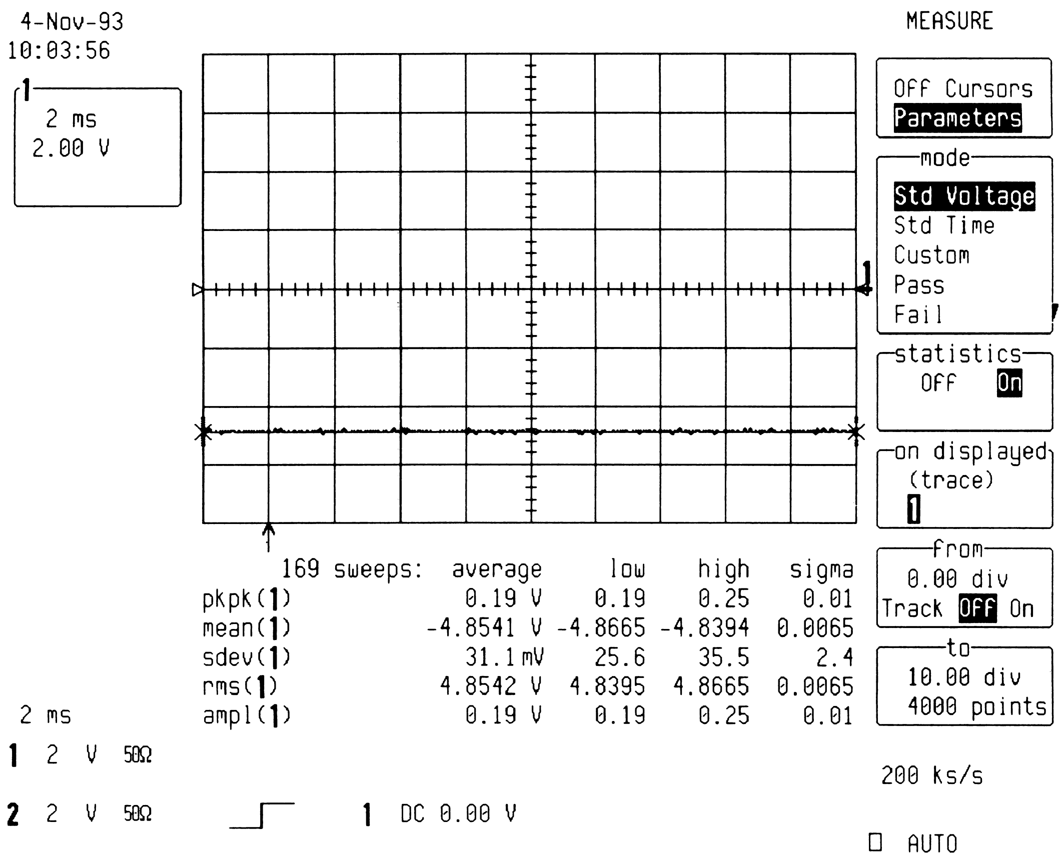
For the low sensitivities : 5 mV, 10 mV, 20 mV and 50 mV/div, use a 50 Ohm 20 dB attenuator.

For the range 2V/div, the maximum input voltage is ± 5 V (± 2.5 major divisions).


4-Nov-93
10:00:16
MEASURE
1
2 ms
5.0 mV
Off Cursors
Parameters
mode
Std Voltage
Std Time
Custom
Pass
Fail
statistics
Off On
on displayed
(trace)
1
from
0.00 div
Track Off On
to
10.00 div
4000 points
240 sweeps: average low high sigma
pkpk(1) 1.75 mV 1.41 2.50 0.21
mean(1) 15.0973 mV 14.9860 15.2686 0.0532
sdev(1) 233.5 µV 224.5 242.1 3.6
rms(1) 15.0991 mV 14.9877 15.2705 0.0531
ampl(1) 1.75 mV 1.41 2.50 0.21
2 ms
1 5 mV 50Ω
2 5 mV 50Ω
1 DC 0.0 mV
200 ks/s
AUTO


4-Nov-93
10:01:33
MEASURE
1
2 ms
5.0 mV
Off Cursors
Parameters
mode
Std Voltage
Std Time
Custom
Pass
Fail
statistics
Off On
on displayed
(trace)
1
from
0.00 div
Track Off On
to
10.00 div
4000 points
109 sweeps: average low high sigma
pkpk(1) 1.96 mV 1.56 2.50 0.18
mean(1) -14.3479 mV -14.4659 -14.2322 0.0504
sdev(1) 252.2 µV 243.8 262.5 4.0
rms(1) 14.3502 mV 14.2342 14.4685 0.0504
ampl(1) 1.96 mV 1.56 2.50 0.18
2 ms
1 5 mV 50Ω
2 5 mV 50Ω
1 DC 0.0 mV
200 ks/s
AUTO


4-Nov-93
10:03:05
1
2 ms
2.00 V
MEASURE
Off Cursors
Parameters
mode
Std Voltage
Std Time
Custom
Pass
Fail
statistics
Off On
on displayed
(trace)
1
from
0.00 div
Track Off On
to
10.00 div
4000 points
107 sweeps: average low high sigma
pkpk(1) 0.14 V 0.12 0.19 0.03
mean(1) 5.1251 V 5.1165 5.1396 0.0050
sdev(1) 21.6 mV 19.6 27.5 1.6
rms(1) 5.1251 V 5.1164 5.1397 0.0050
ampl(1) 0.14 V 0.12 0.19 0.03
2 ms
1 2 V 50Ω
2 2 V 50Ω
1 DC 0.00 V
200 ks/s
AUTO


4-Nov-93
10:03:56
1
2 ms
2.00 V
MEASURE
Off Cursors
Parameters
mode
Std Voltage
Std Time
Custom
Pass
Fail
statistics
Off On
on displayed
(trace)
1
from
0.00 div
Track Off On
to
10.00 div
4000 points
169 sweeps: average low high sigma
pkpk(1) 0.19 V 0.19 0.25 0.01
mean(1) -4.8541 V -4.8665 -4.8394 0.0065
sdev(1) 31.1 mV 25.6 35.5 2.4
rms(1) 4.8542 V 4.8395 4.8665 0.0065
ampl(1) 0.19 V 0.19 0.25 0.01
2 ms
1 2 V 50Ω
2 2 V 50Ω
1 DC 0.00 V
200 ks/s
AUTO

Range	Attenuator	Conditions of Test			Average Mean Parameter Reading	
Volts/div Control	20 dB	PS Output	9320 Input	9320 Full scale	Min Value -2 % of FS	Max Value +2 % of FS
5 mV	Yes	+ 150 mV	+ 15 mV	40 mV	+ 14.2 mV	+ 15.8 mV
10 mV	Yes	+ 300 mV	+ 30 mV	80 mV	+ 28.4 mv	+ 31.6 mV
20 mV	Yes	+ 600 mV	+ 60 mV	160 mV	+ 56.8 mV	+ 63.2 mV
50 mV	Yes	+ 1.5 V	+150 mV	400 mV	+ 142 mV	+ 158 mV
.1 V	No	+ 300 mV	+ 300 mV	800 mV	+ 284 mV	+ 316 mV
.2 V	No	+ 600 mV	+ 600 mv	1.6 v	+ 568 mV	+ 632 mV
.5 V	No	+ 1.5 V	+ 1.5 V	4 V	+ 1.42 V	+ 1.58 V
1 V	No	+ 3 V	+ 3 V	8 V	+ 2.84 V	+ 3.16 V
2 V	No	Max +5 V	Max +5 V	16 V	+ 4.68 V	+ 5.32 V
5 mV	Yes	- 150 mV	- 15 mV	40 mV	- 14.2 mV	- 15.8 mV
10 mV	Yes	- 300 mV	- 30 mV	80 mV	- 28.4 mv	- 31.6 mV
20 mV	Yes	- 600 mV	- 60 mV	160 mV	- 56.8 mV	- 63.2 mV
50 mV	Yes	- 1.5 V	- 150 mV	400 mV	- 142 mV	- 158 mV
.1 V	No	- 300 mV	- 300 mV	800 mV	- 284 mV	- 316 mV
.2 V	No	- 600 mV	- 600 mv	1.6 v	- 568 mV	- 632 mV
.5 V	No	- 1.5 V	- 1.5 V	4 V	- 1.42 V	- 1.58 V
1 V	No	- 3 V	- 3 V	8 V	- 2.84 V	- 3.16 V
2 V	No	Max -5 V	Max -5 V	16 V	- 4.68 V	- 5.32 V

Table 5-4 : DC Linearity Readout Accuracy

For each point, read off the average " Mean " parameter voltage, and compare to the digital readout of the voltage reference.

The difference of the two values in mV, should be within ± 2% of full scale of the scope.

The average mean parameter reading should be within the limits shown in table 5-4.

Repeat the tests for Channel 2, substituting channel controls and input connector.

5.9 Trigger Level

Specification

Channel 1, Channel 2, External trigger and External/10 have independent trigger circuits allowing individual setting of slope, level and coupling.
External trigger voltage range : DC ± .5 V
External /10 voltage range : DC ± 5 V

Description

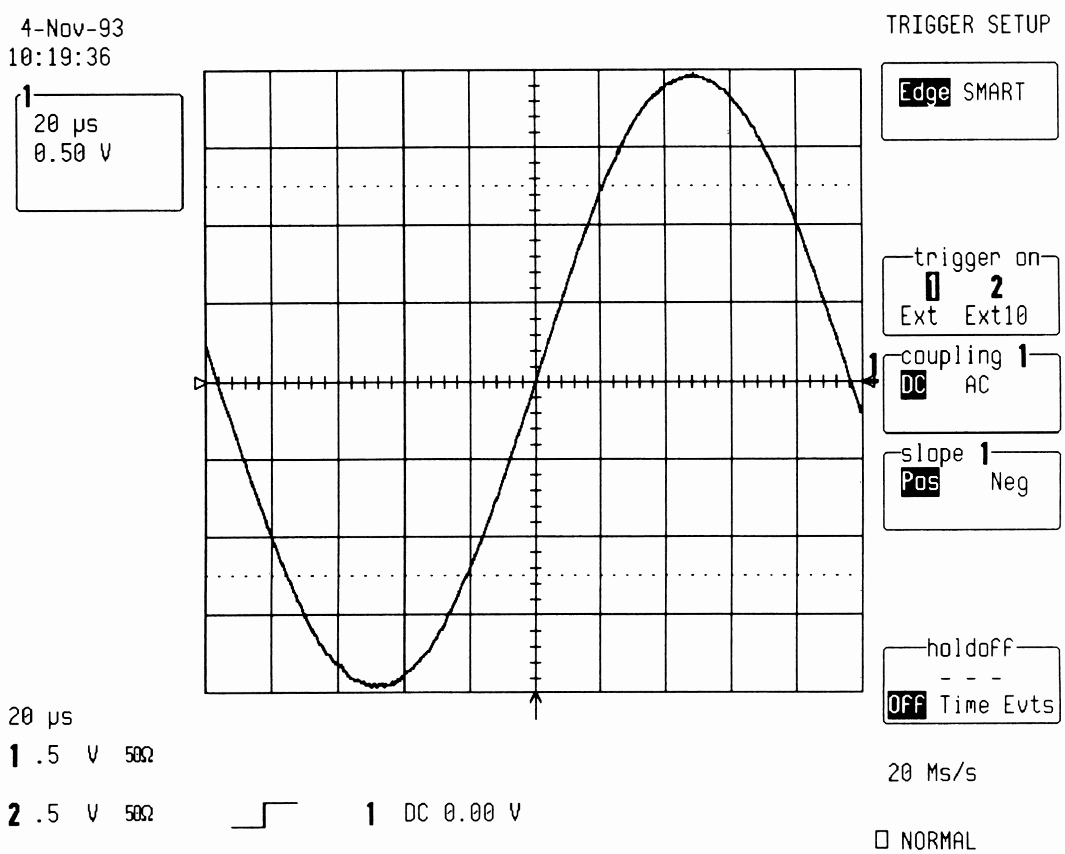
The trigger level accuracy is tested at different DC levels : + 3, 0, - 3 major screen divisions.

5.9.1 Channel 1

Setup any sine wave generator capable of generating sine waves of 5 KHz. Connect the generator output to Channel 1.

- Turn on trace	: Ch1
- Display setup	: Standard, Persistence off, Dot join on, Single grid
- Input coupling	: Ch1 : DC 50 Ω
- V/div. offset	: Normal
- Probe atten	: X1
- Input gain	: .5 V/div
- Input offset	: 0 mV
- Trigger setup	: Edge
- Trigger on	: 1
- Coupling 1	: DC
- Slope 1	: Pos
- Mode	: Auto or Norm
- Holdoff	: Off
- Pre-Trigger Delay	: 50 %
- Timebase	: 20 µsec/div
- Cursors/Measure	: Off
- Set Trigger level	: DC 0.0 mV

Adjust the sine wave generator's output amplitude to get 8 divisions peak to peak, corresponding to a 2 V amplitude. It is important that the offset of the input is set to zero mV, use show status and acquisition status to verify.

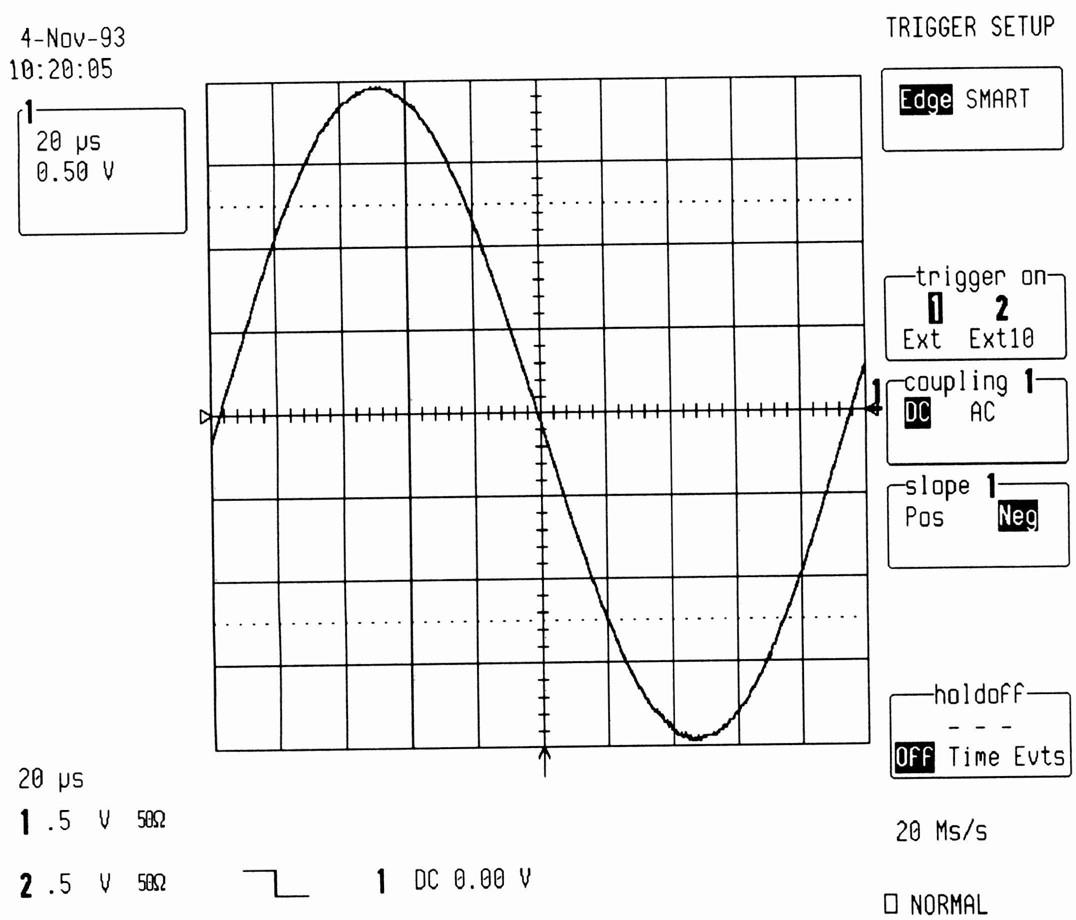


check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 2 minor divisions.

- Repeat the test for the following conditions :

- Slope 1 : Neg

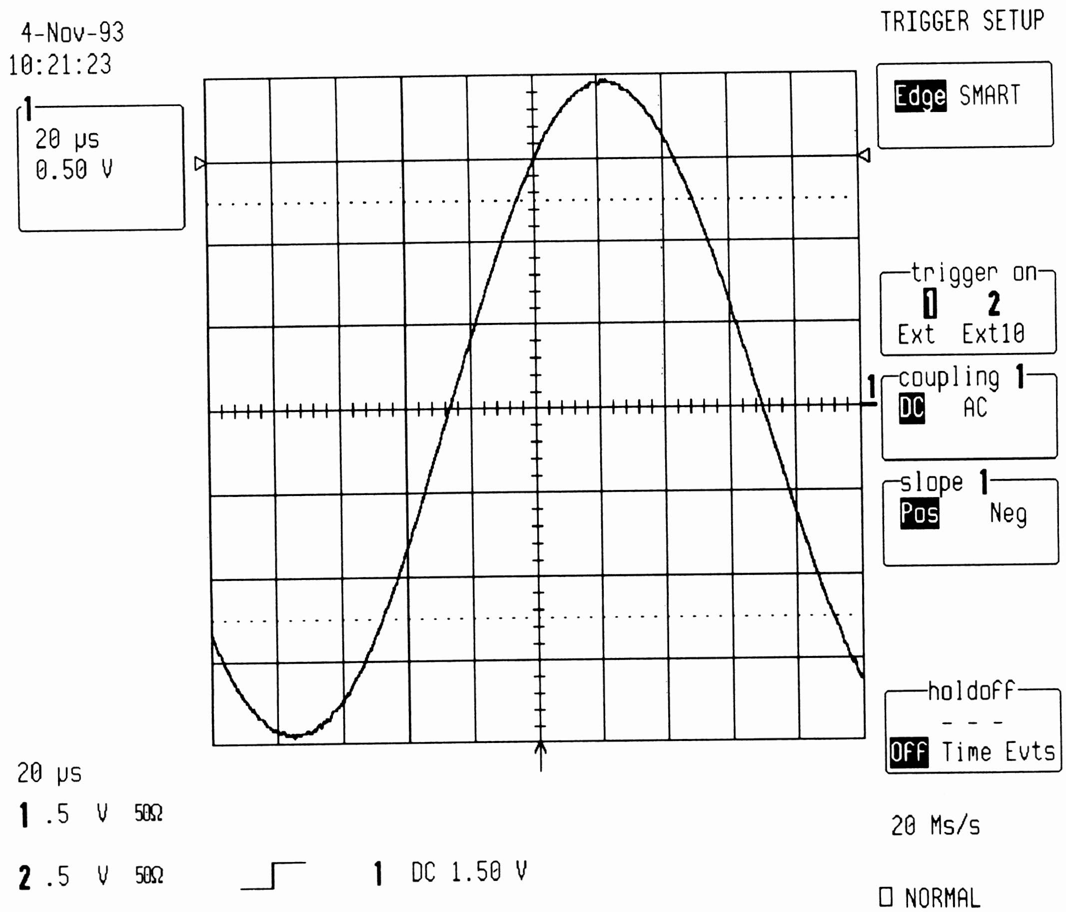
check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 2 minor divisions.



- Set Trigger level : DC + 1.5 V

- Slope 1 : Pos

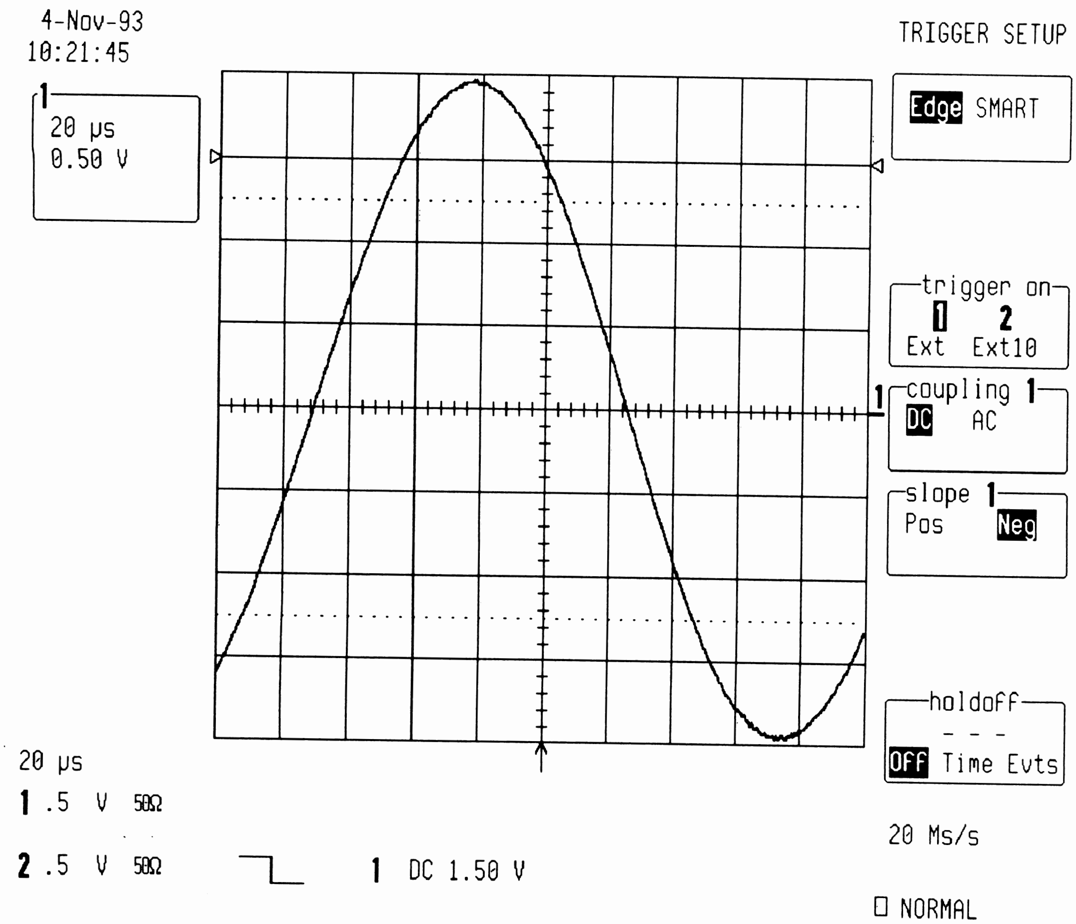
check : The sine wave must pass the horizontal center at + 3 divisions within ± 2 minor divisions.



- Repeat the test for the following conditions :

- Slope 1 : Neg

check : The sine wave must pass the horizontal center at + 3 divisions within ± 2 minor divisions.

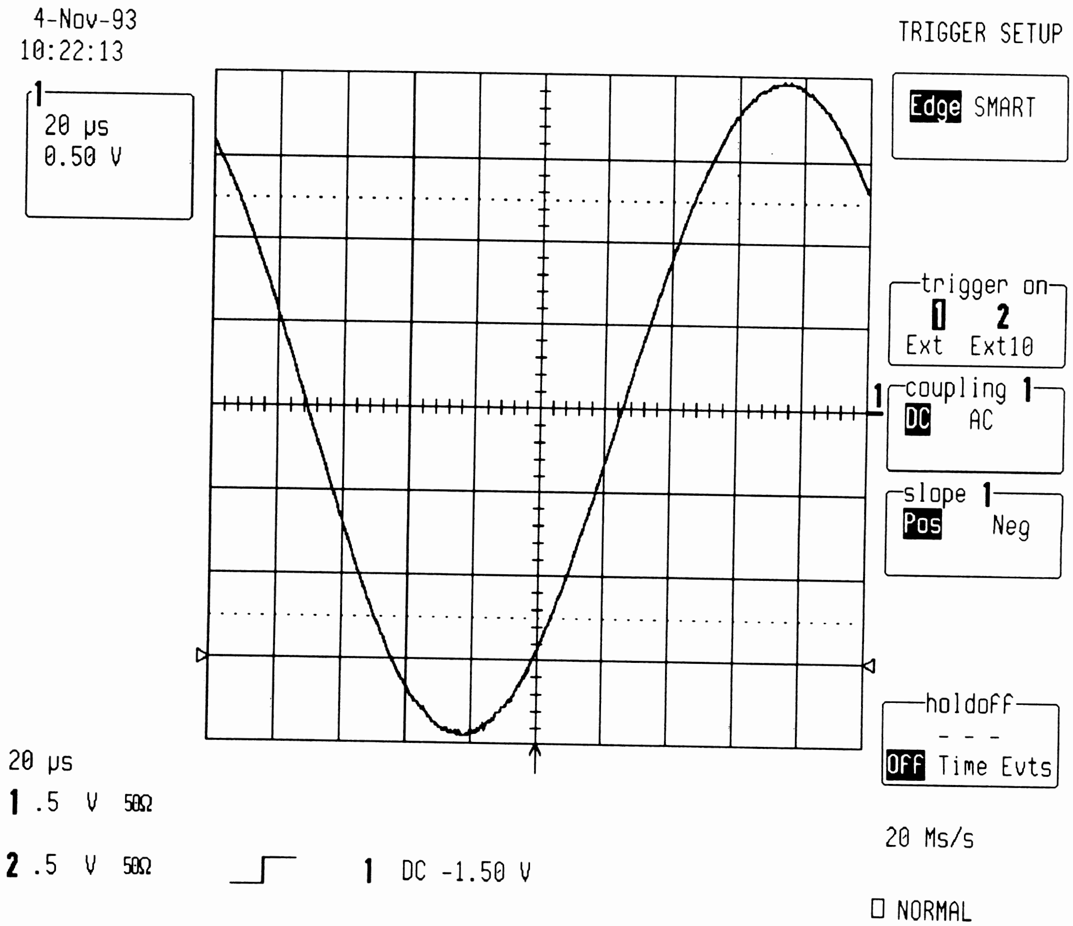


- Repeat the test for the following conditions :

- Trigger level : DC - 1.5 V

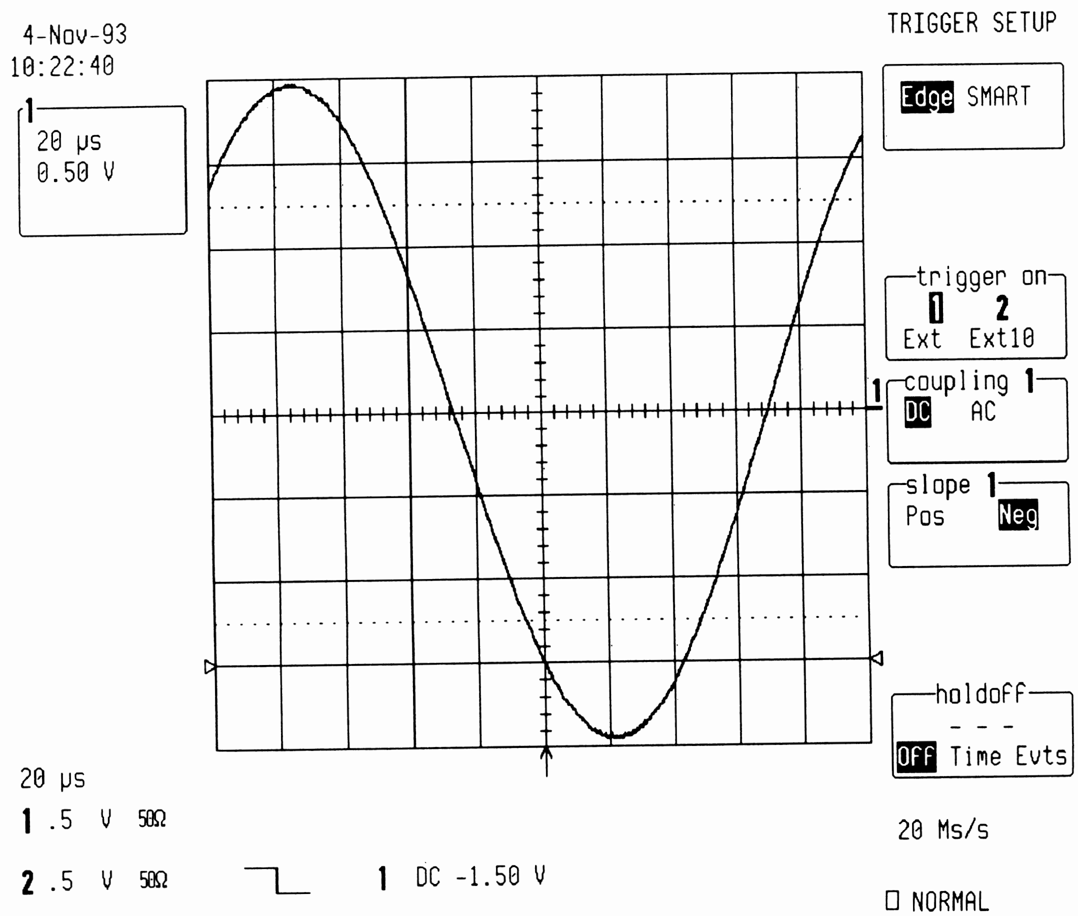
- Slope 1 : Pos

check : The sine wave must pass the horizontal center at - 3 divisions within ± 2 minor divisions.



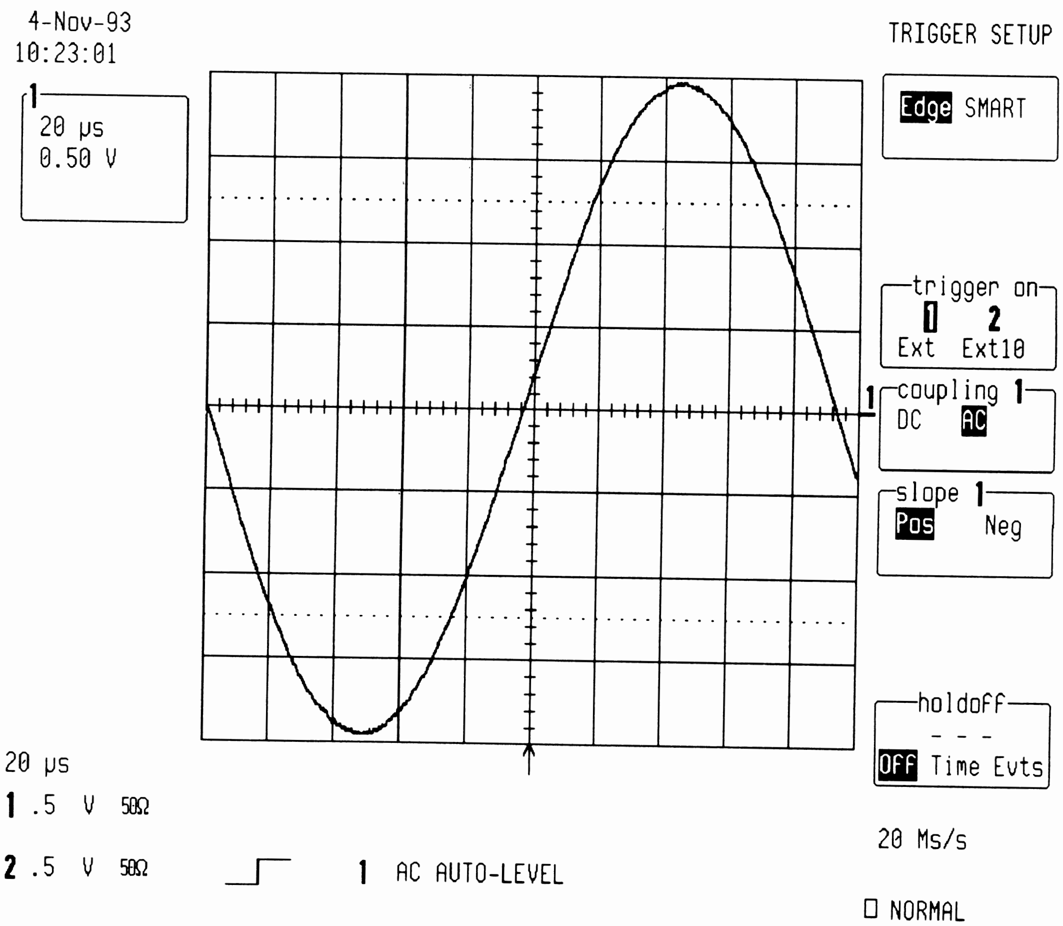
- Select Slope 1 : Neg

check : The sine wave must pass the horizontal center at - 3 divisions within ± 2 minor divisions.



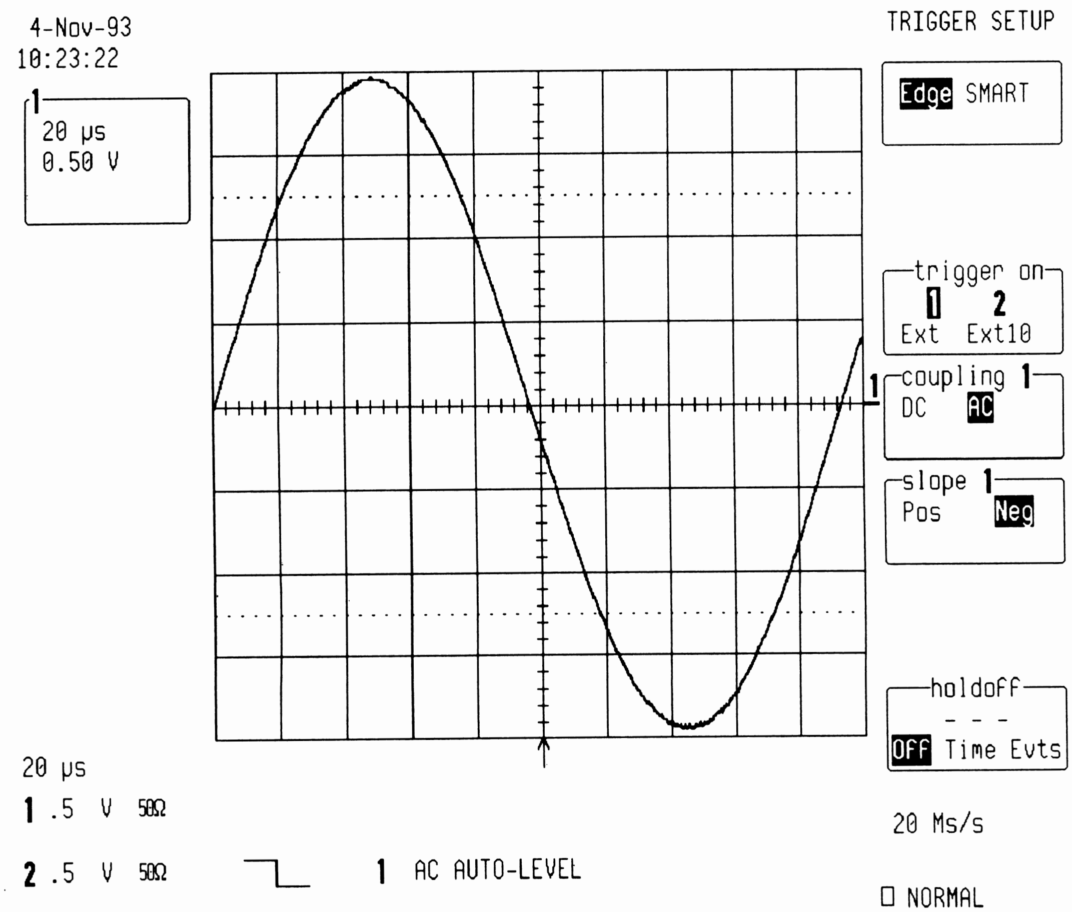
- Coupling 1 : AC Auto-Level
- Slope 1 : Pos

check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.



- Set Slope 1 : Neg

check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.



5.9.2 Channel 2

Disconnect the input from Channel 1 and connect it to Channel 2.

- Turn on trace	: Ch2
- Input coupling	: Ch2 : DC 50 Ω
- V/div. offset	: Normal
- Probe atten	: X1
- Input gain	: .5 V/div
- Input offset	: 0 mV
- Trigger setup	: Edge
- Trigger on	: 2
- Coupling 2	: DC
- Slope 2	: Pos

- Repeat the above check procedure for Channel 2, trigger slope positive and negative, trigger coupling DC and AC Auto-Level.

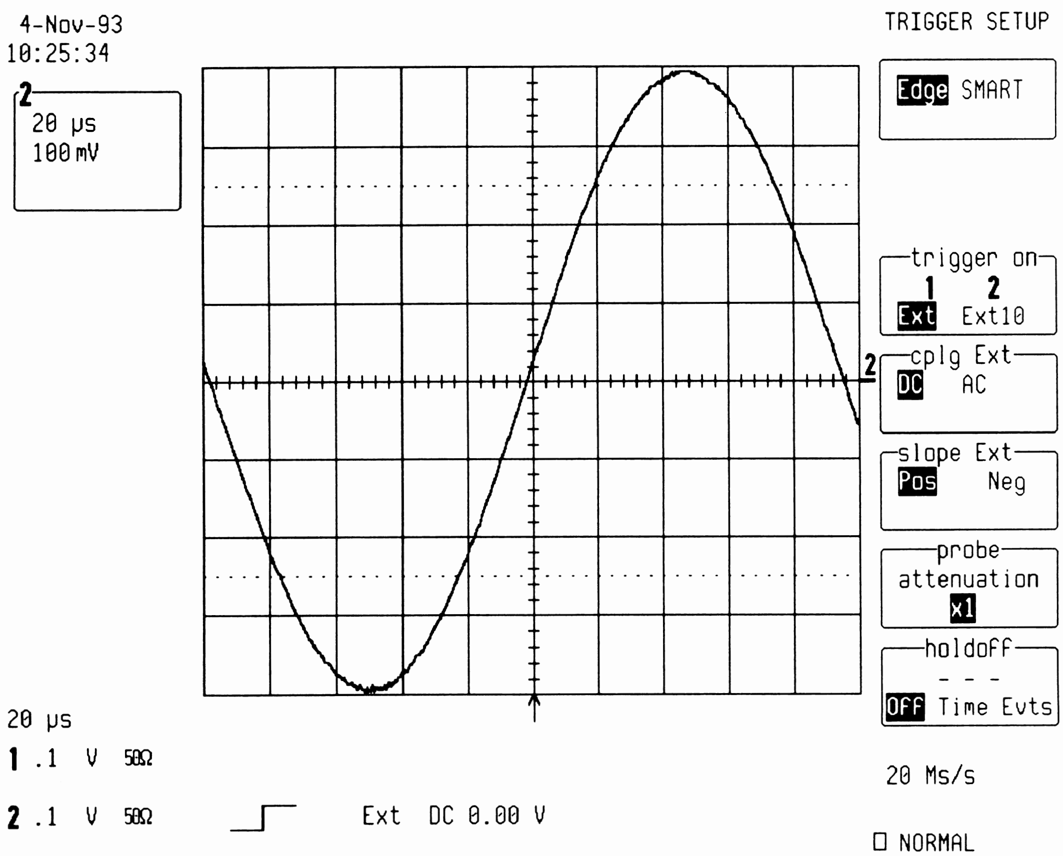
5.9.3 External Trigger

- Connect the output of the generator to External input and to Channel 2 via a coaxial T-connector. The cable length from External to Channel 2 must be short, at most 2 nsec.

- Set DSO as follows :

- Turn on trace	: Ch2
- Input coupling	: Ch2 : DC 50 Ω
- V/div. offset	: Normal
- Probe atten	: X1
- Input gain	: .1 V/div
- Input offset	: 0 mV
- Trigger setup	: Edge
- Trigger on	: Ext
- Coupling Ext	: DC
- Slope Ext	: Pos
- Set Trigger level	: DC 0.0 mV

- Adjust the sine wave generator's output amplitude to get 8 divisions peak to peak, corresponding to a .4 V amplitude. It is important that the offset of the input is set to zero mV, use show status and acquisition status to verify.



check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.

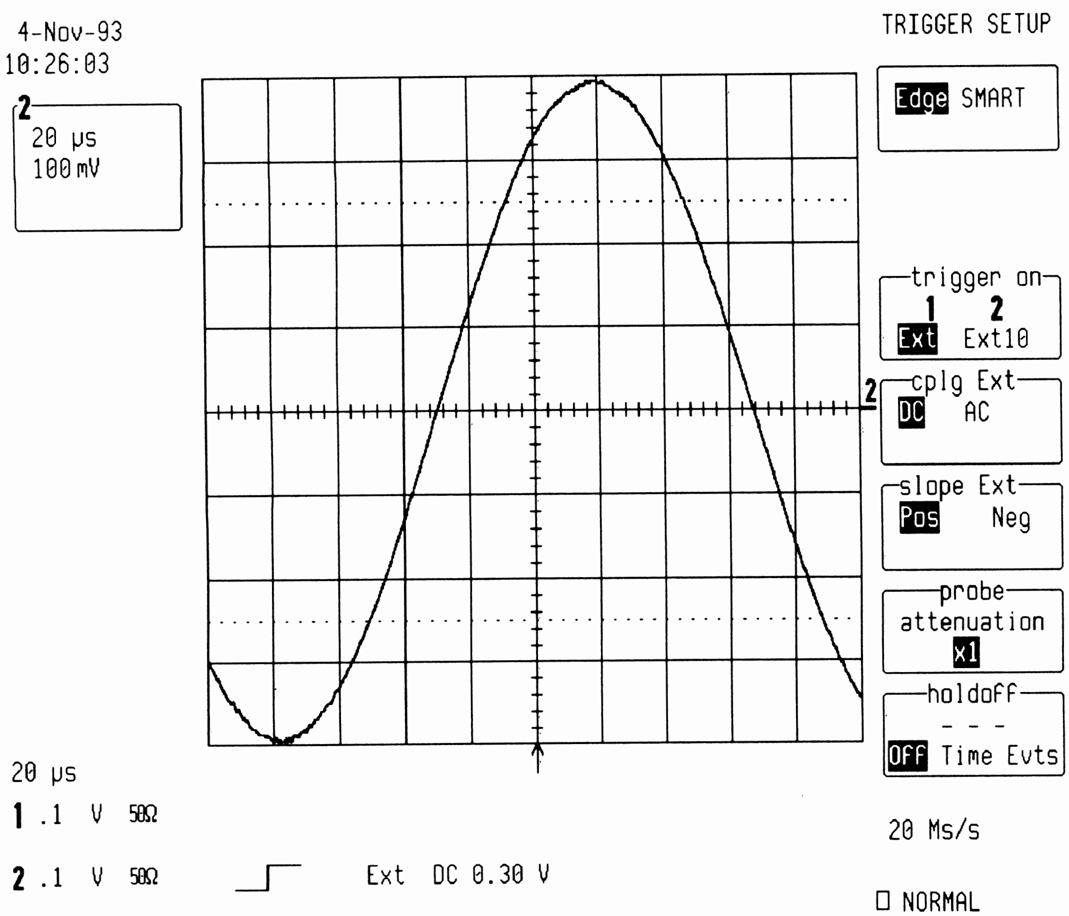
- Set Slope Ext : Neg

check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.

- Repeat the test for the following conditions :

- Trigger level : DC + 0.3 V
- Slope Ext : Pos

check : The sine wave must pass the horizontal center at + 3 divisions within ± 3 minor divisions.



- Set Slope Ext : Neg

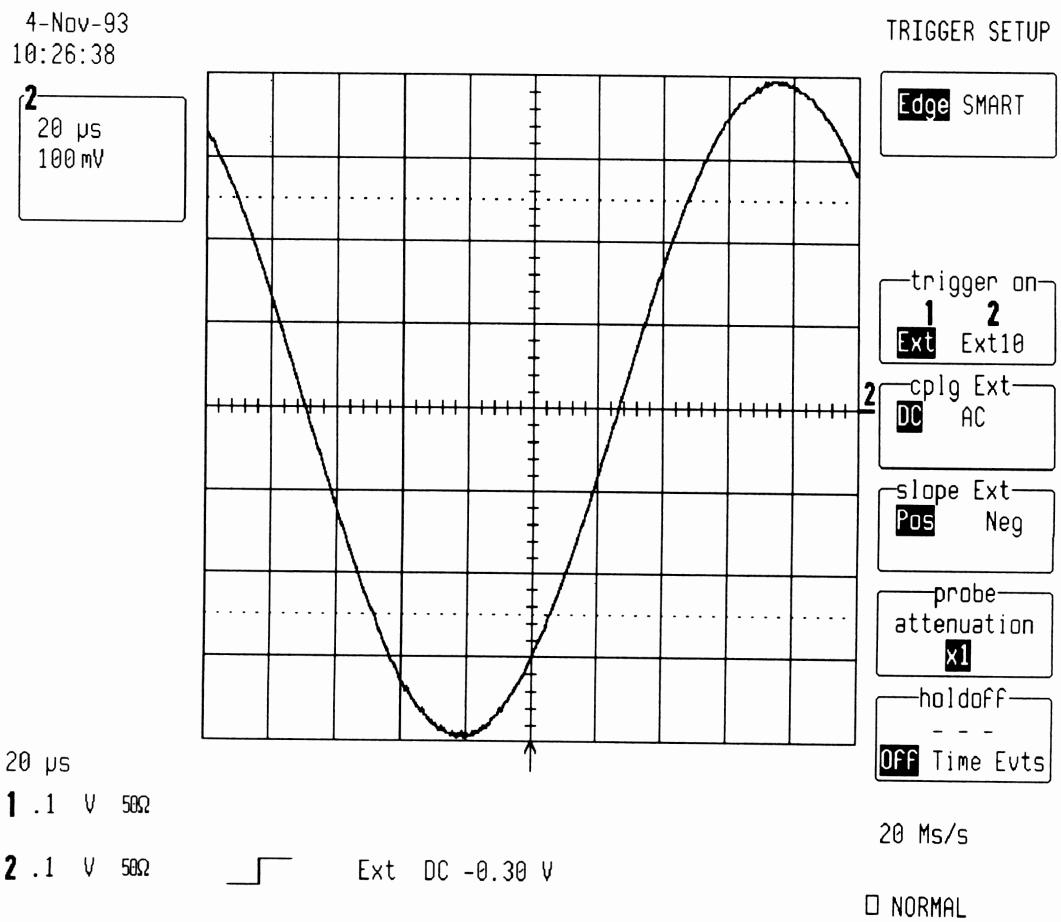
check : The sine wave must pass the horizontal center at + 3 divisions within ± 3 minor divisions.

- Repeat the test for the following conditions :

- Trigger level : DC - .3 V

- Slope Ext : Pos

check : The sine wave must pass the horizontal center at - 3 divisions within ± 3 minor divisions.

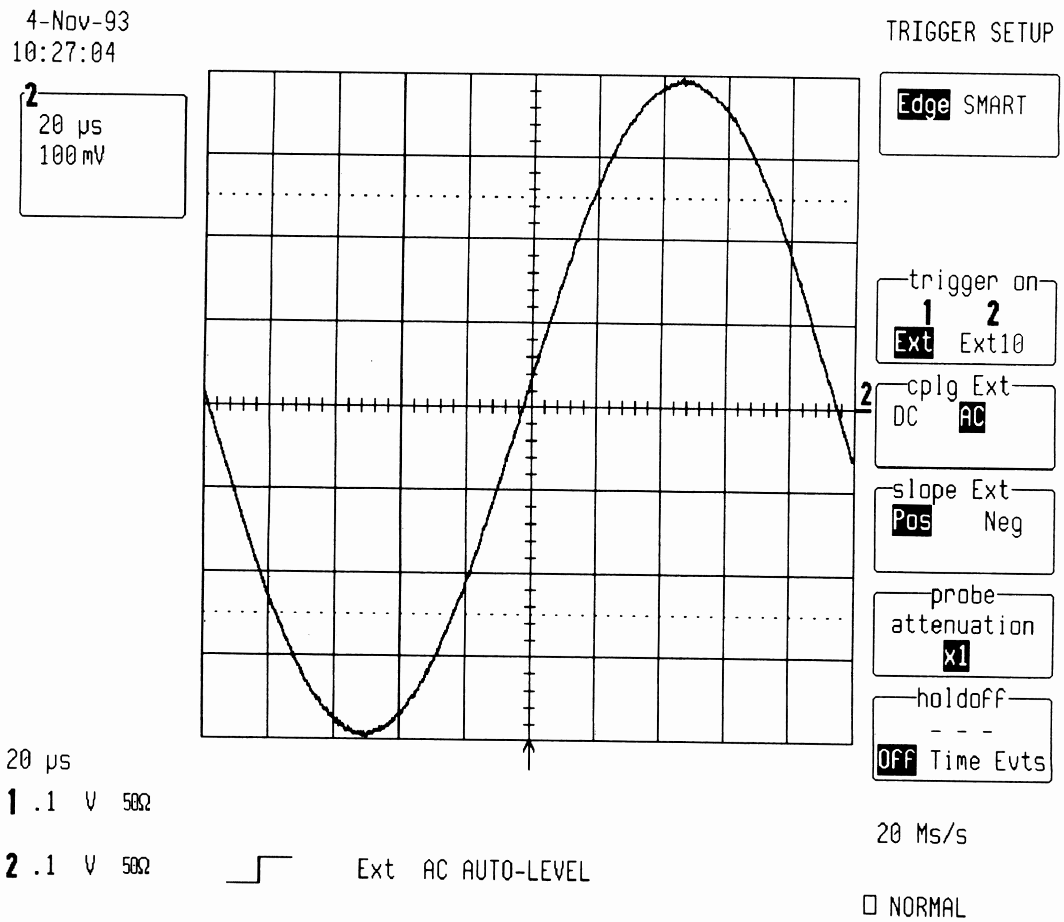


- Set Slope Ext : Neg

check : The sine wave must pass the horizontal center at - 3 divisions within ± 3 minor divisions.

- Select Coupling Ext : AC Auto Level

check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.



- Set Slope Ext : Neg

check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.

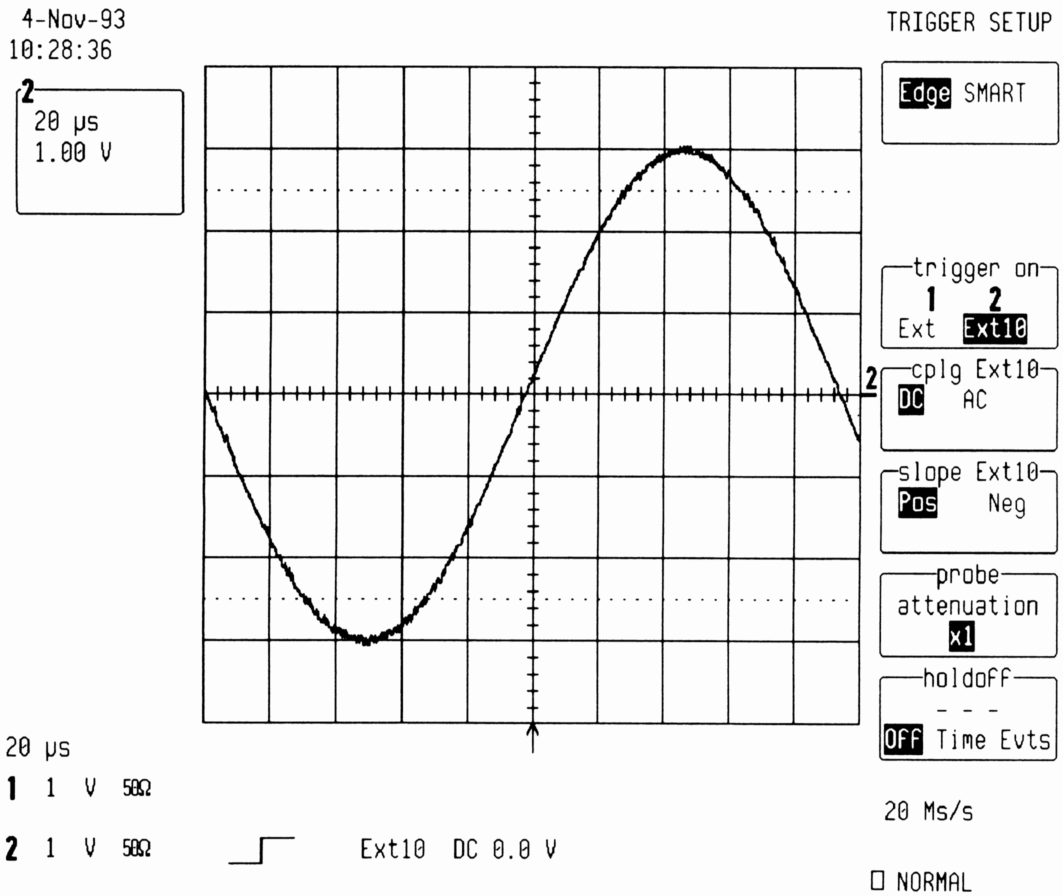
5.9.4 External /10 Trigger

- Set DSO as follows :

- Input gain	: 1 V/div
- Input offset	: 0 mV
- Trigger setup	: Edge
- Trigger on	: Ext/10
- Coupling Ext/10	: DC
- Slope Ext/10	: Pos
- Ext/10 Trigger level	: DC 0.0 mV

- Adjust the sine wave generator's output amplitude to get 6 divisions peak to peak, corresponding to a 3 V amplitude. It is important that the offset of the input is set to zero mV, use show status and acquisition status to verify.

check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.



- Set Slope Ext/10 : Neg

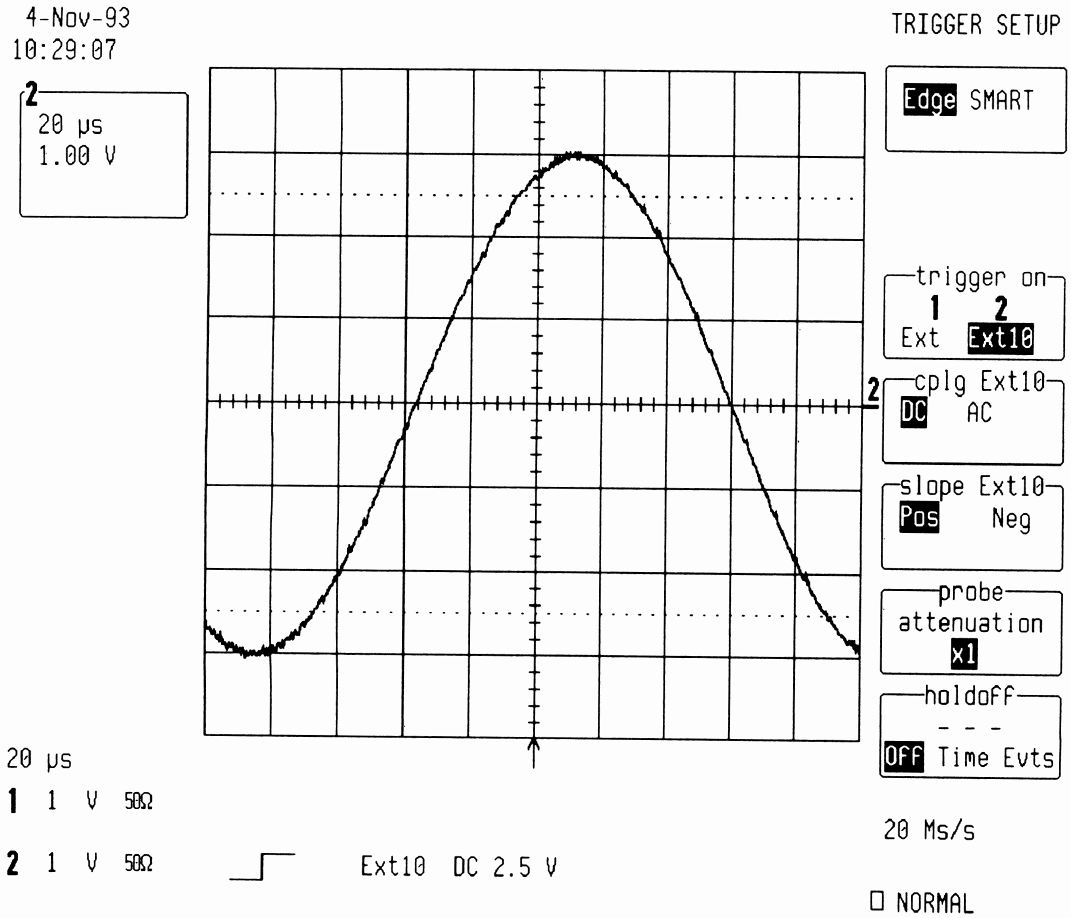
check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.

- Repeat the test for the following conditions :

- Ext/10 Trigger level : DC + 2.5 V

- Slope Ext/10 : Pos

check : The sine wave must pass the horizontal center at + 2.5 divisions within ± 3 minor divisions.



- Set Slope Ext/10 : Neg

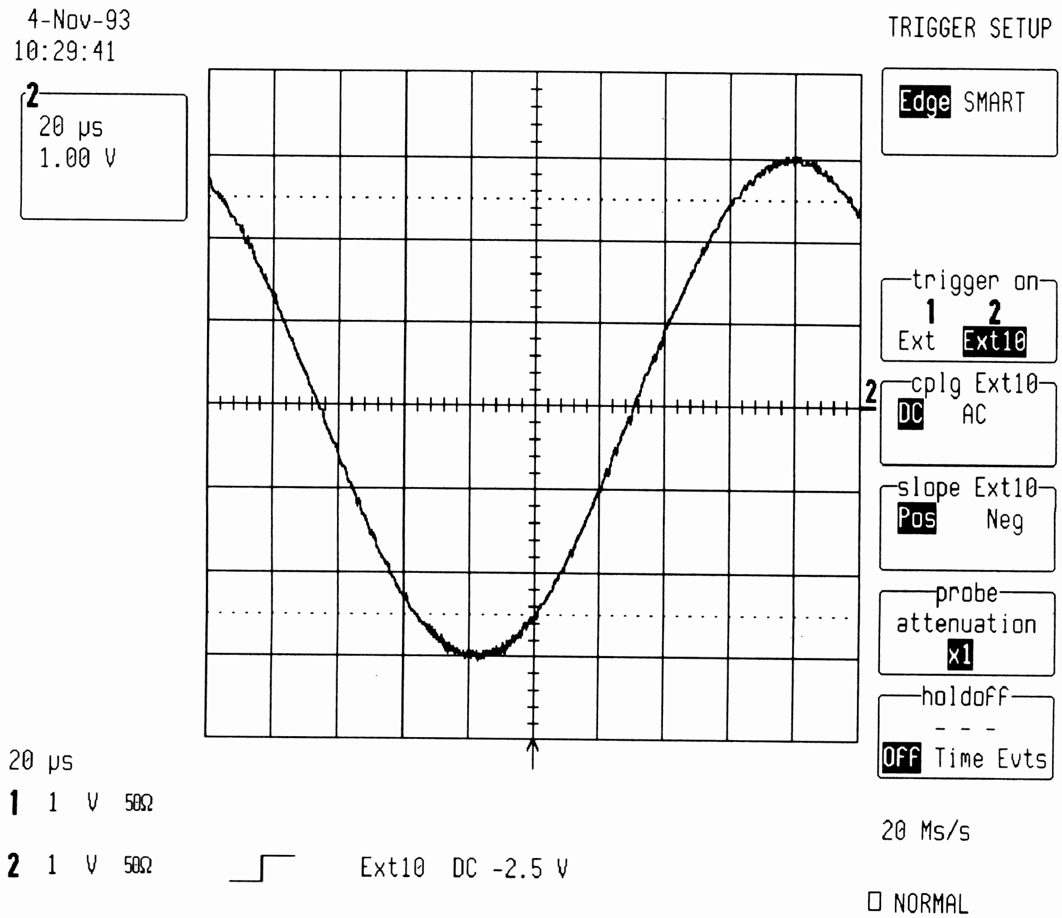
check : The sine wave must pass the horizontal center at + 2.5 divisions within ± 3 minor divisions.

- Repeat the test for the following conditions :

- Ext/10 Trigger level : DC - 2.5 V

- Slope Ext/10 : Pos

check : The sine wave must pass the horizontal center at - 2.5 divisions within ± 3 minor divisions.



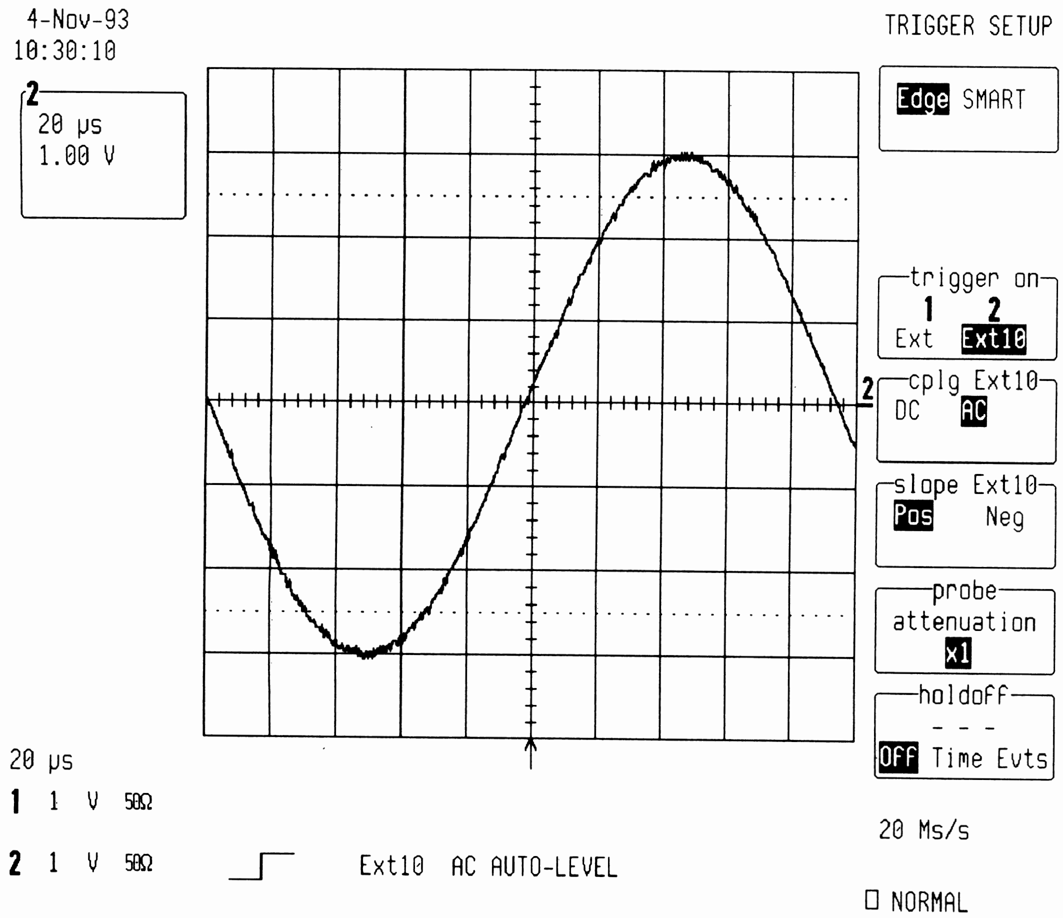
- Set Slope Ext/10 : Neg

check : The sine wave must pass the horizontal center at - 2.5 divisions within ± 3 minor divisions.

- Select Coupling Ext/10 : AC Auto Level

- Slope Ext/10 : Pos

check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.



- Set Slope Ext/10 : Neg

check : The sine wave must pass through the horizontal center of the screen (50 % pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions.

5.10 Trigger Rate

Specification

Up to 750 MHz on Channel 1, Channel 2, and External Trigger
Up to 1.5 GHz on Channel 2, only when HF coupling selected

Description

The purpose of this test is to ensure that the Trigger rate is at least 750 MHz on all Channels and 1 GHz on Channel 2 HF.

5.10.1 Channel 1 Trigger Rate

Procedure

Setup a leveled sine wave generator.

- Frequency	: 750 MHz

- Set DSO as follows :

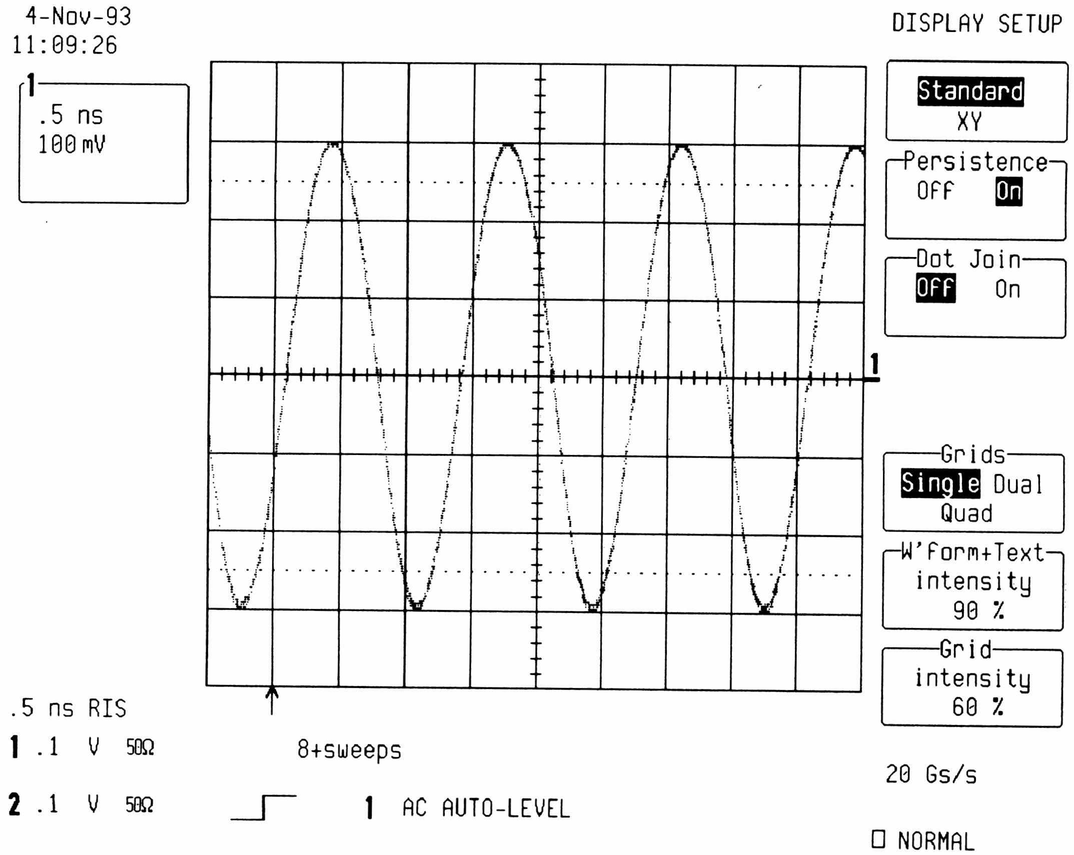
- Turn on trace	: Ch1
- Display setup	: Standard, Persistence On, Dot join Off, Single grid
- Input coupling	: Ch1 : DC 50 Ω
- V/div. offset	: Normal
- Probe atten	: X1
- Input gain	: .1 V/div
- Input offset	: 0 mV
- Time/div	: .5 ns
- Trigger setup	: Edge
- Trigger on	: 1
- Coupling 1	: AC Auto-Level
- Slope 1	: Pos
- Holdoff	: Off

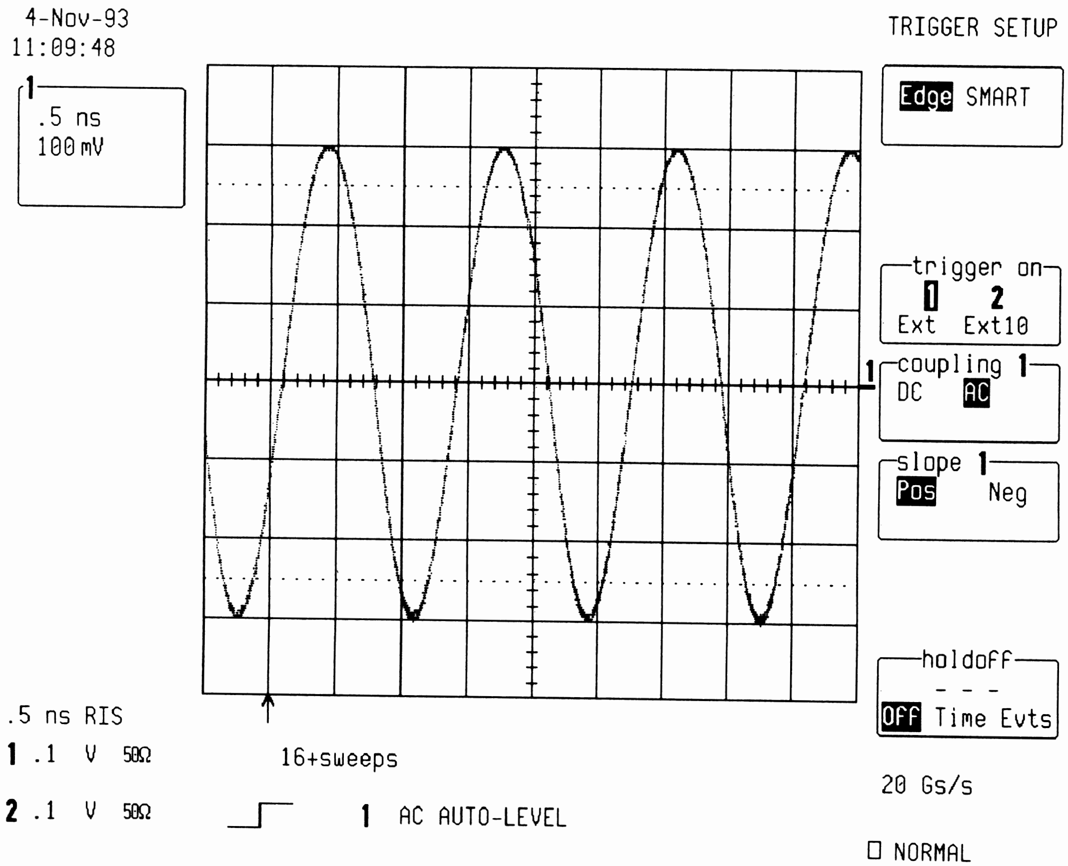
- Adjust the sine wave generator's output amplitude to get 6 divisions peak to peak, corresponding to a .3 V amplitude.

Check : The scope must keep triggering in a stable way, a smooth 750 MHz sine wave must be visible on the screen.

5.10.2 Channel 2 Trigger Rate

- Repeat the test for Channel 2, substituting channel controls and input connector and check as above.


4-Nov-93
11:09:26
1
.5 ns
100 mV
DISPLAY SETUP
Standard
XY
Persistence
Off On
Dot Join
Off On
Grids
Single Dual
Quad
W'form+Text
intensity
90 %
Grid
intensity
60 %
.5 ns RIS
1 .1 V 50Ω
2 .1 V 50Ω
8+sweeps
1 AC AUTO-LEVEL
20 Gs/s
NORMAL


4-Nov-93
11:09:48
1
.5 ns
100 mV
TRIGGER SETUP
Edge SMART
trigger on
1 2
Ext Ext10
coupling 1
DC AC
slope 1
Pos Neg
holdoff
- - -
Off Time Evts
.5 ns RIS
1 .1 V 50Ω
2 .1 V 50Ω
16+sweeps
1 AC AUTO-LEVEL
20 Gs/s
NORMAL

5.10.3 External Trigger Rate

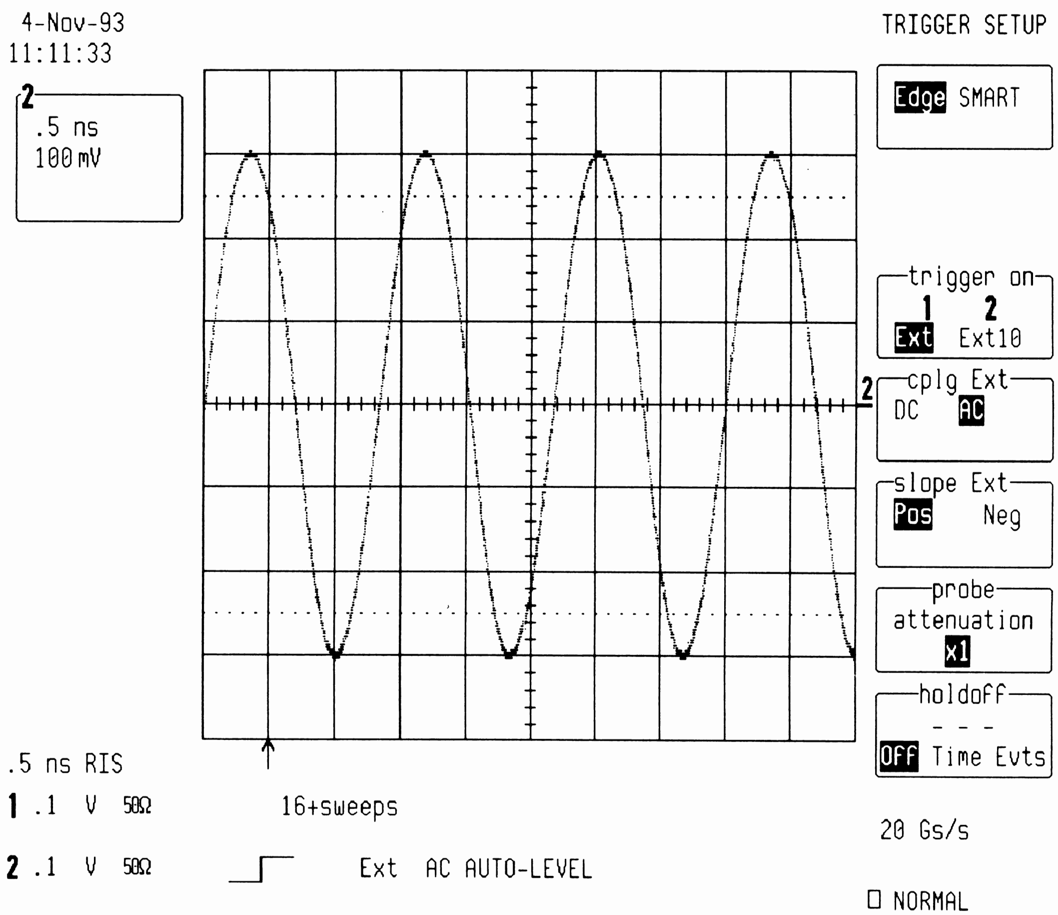
Set DSO as follows :

- Turn on trace : Ch2
- Input coupling : Ch2 : DC 50 Ω
- Input gain : .1 V/div
- Input offset : 0 mV
- Time/div : .5 ns
- Trigger setup : Edge
- Trigger on : Ext
- Coupling Ext : AC Auto-Level
- Slope Ext : Pos

- Connect the output of the generator to External input and to Channel 2 via a coaxial T-connector. The cable length from External to Channel 2 must be short, at most 2 nsec.

Adjust the sine wave generator's output amplitude to get 6 divisions peak to peak, corresponding to a .3 V amplitude.

Check : The scope must keep triggering in a stable way, a smooth 750 MHz sine wave must be visible on the screen.



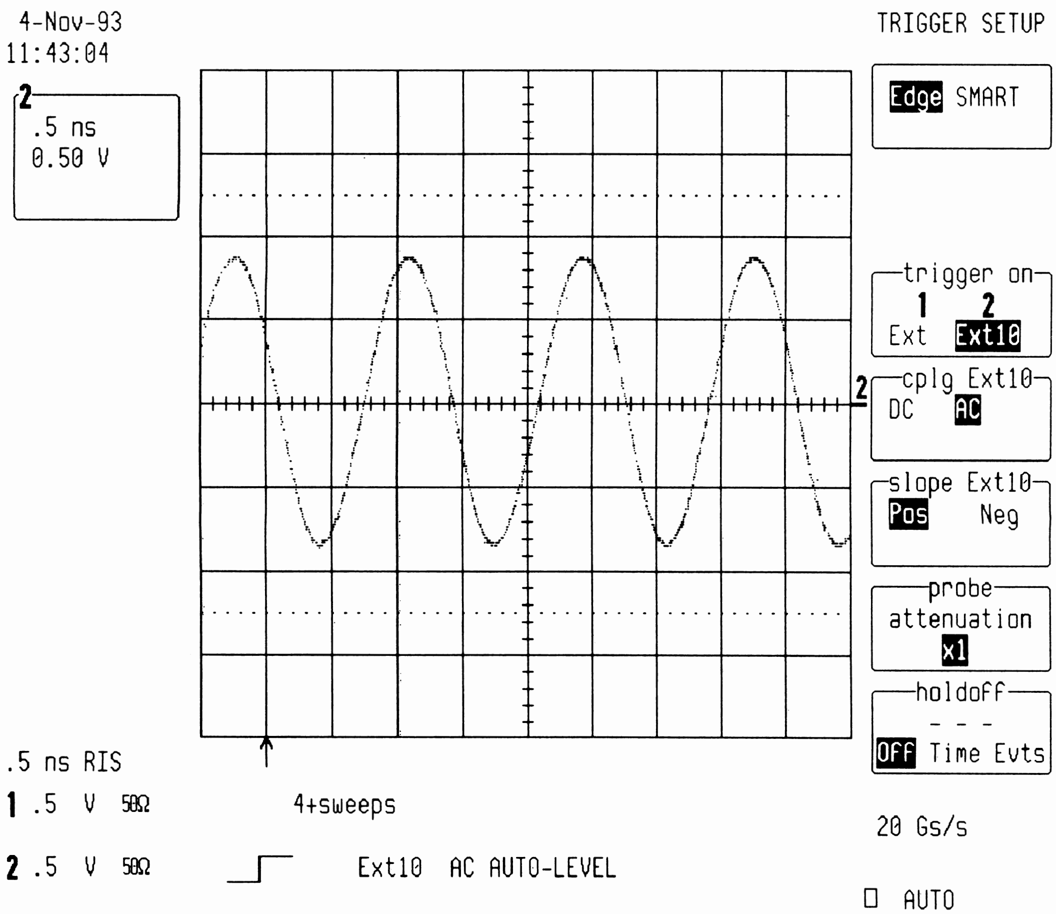
5.10.4 External/10 Trigger Rate

- Repeat the test for External /10, set the DSO and generator's output as follows :

- Input gain Ch2	: .5 V/div
- Trigger on	: Ext/10
- Coupling Ext	: AC Auto-Level
- Slope Ext	: Pos

- Adjust the sine wave generator's output amplitude to get 4 divisions peak to peak, corresponding to a 1 V amplitude.

Check : The scope must keep triggering in a stable way, a smooth 750 MHz sine wave must be visible on the screen.



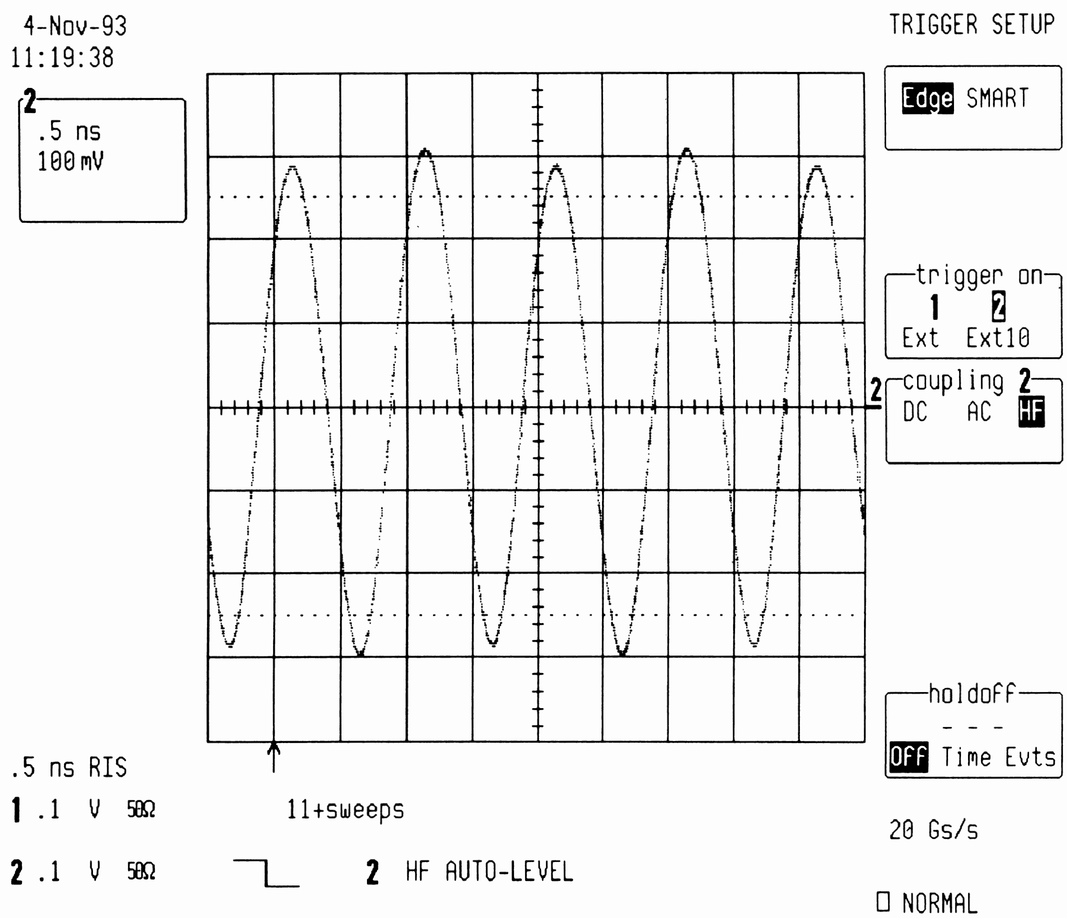
5.10.5 Channel 2 HF Trigger Rate

- Set DSO as follows :

- Turn on trace	: Ch2
- Input gain	: .1 V/div
- Input offset	: 0 mV
- Time/div	: .5 ns
- Trigger setup	: Edge
- Trigger on	: 2
- Coupling 2	: HF
- Set Frequency	: 1 GHz

- Adjust the sine wave generator's output amplitude to get 6 divisions peak to peak, corresponding to a 0.3 V amplitude.

Check : The scope must keep triggering in a stable way, a smooth 1 GHz sine wave must be visible on the screen.



5.11 Smart Trigger

Specification

Pulse width < or > 1 nsec to 1 µsec in steps varying from 500 psec to 20 nsec.

5.11.1 Trigger on Pulse Width < 10 nsec

Procedure

Setup a leveled sine wave generator.

- Frequency : 100 MHz

Connect the generator output to Channel 1

- Turn on trace : Ch1
- Display setup : Standard, Persistence off, Dot join on, Single grid
- Input coupling : Ch1 : DC 50 Ω
- V/div. offset : Normal
- Probe atten : X1
- Input gain : .5 V/div

- Trigger setup : Smart
- Setup Smart Trigger : Glitch
- Trigger on : 1
- Coupling 1 : DC
- At end of : Neg
- Width : < 10 nsec
- Mode : Norm
- Timebase : 5 nsec/div

- Adjust the generator output amplitude to get a five divisions amplitude sine wave.

Check that the scope triggers

- Switch to Width : > 10 nsec

Check that the scope doesn't trigger : slow trigger and no flashes in box next to normal.

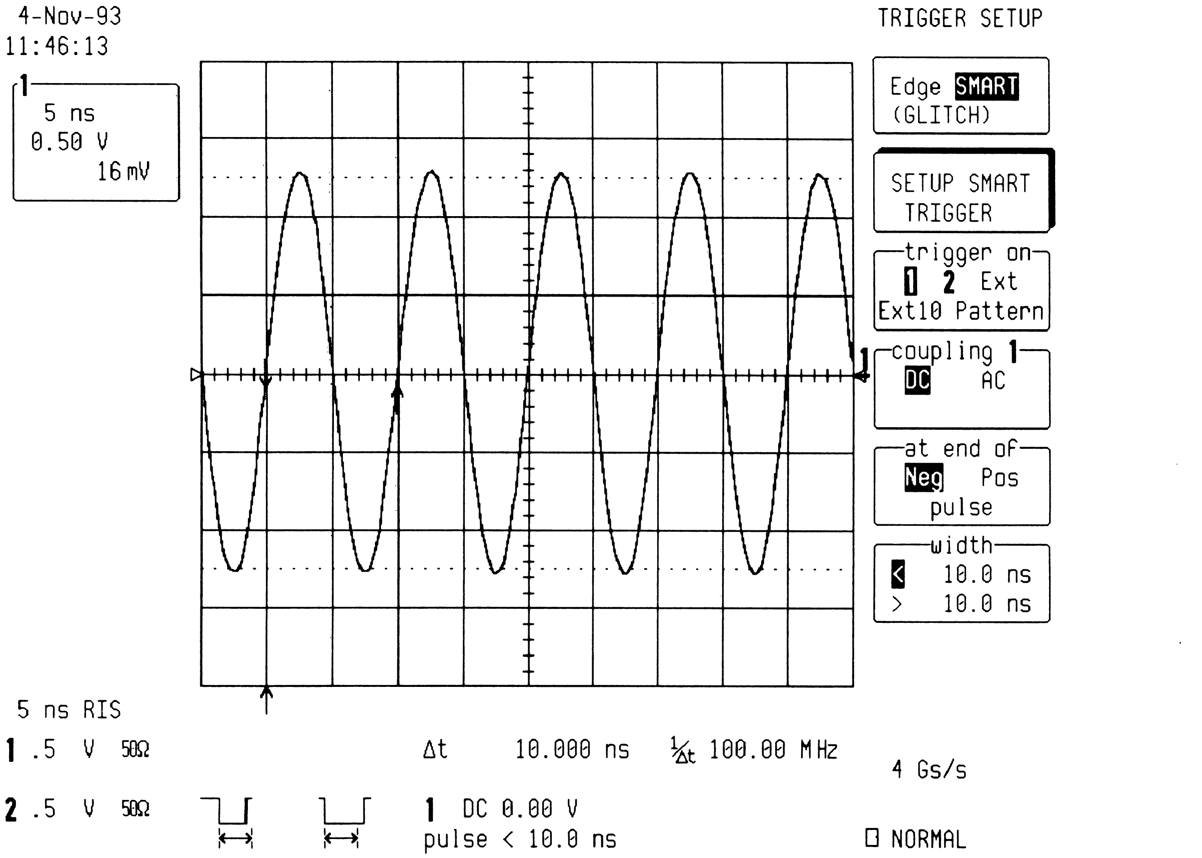
5.11.2 Trigger on Pulse Width > 10 nsec

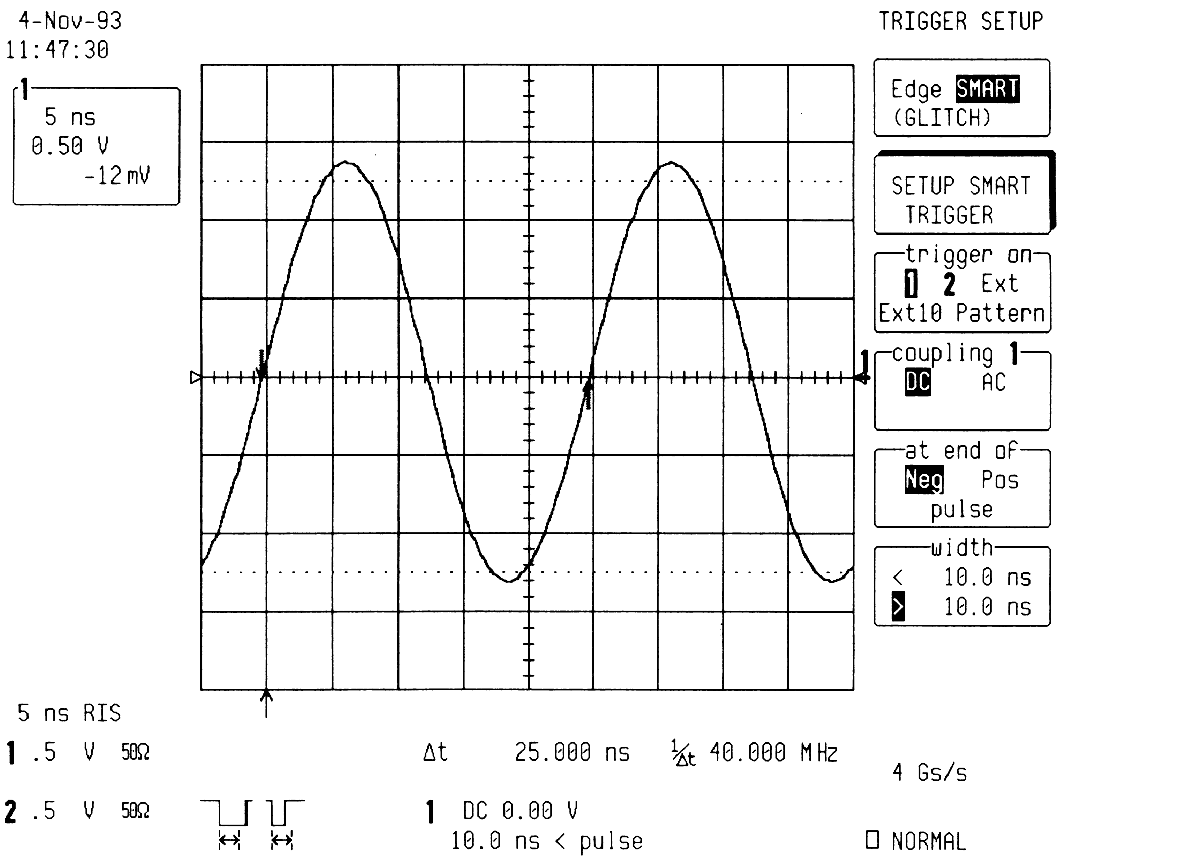
- Adjust the generator frequency to 40 MHz

Check that the scope triggers

- Switch to Width : < 10 nsec

Check that the scope doesn't trigger : slow trigger and no flashes in box next to normal.


4-Nov-93
11:46:13
1
5 ns
0.50 V
16 mV
TRIGGER SETUP
Edge SMART
(GLITCH)
SETUP SMART
TRIGGER
trigger on
1 2 Ext
Ext10 Pattern
coupling 1
DC AC
at end of
Neg Pos
pulse
width
< 10.0 ns
> 10.0 ns
5 ns RIS
1 .5 V 50Ω
2 .5 V 50Ω
Δt 10.000 ns
1/Δt 100.00 MHz
4 Gs/s
1 DC 0.00 V
pulse < 10.0 ns
NORMAL


4-Nov-93
11:47:30
1
5 ns
0.50 V
-12 mV
TRIGGER SETUP
Edge SMART
(GLITCH)
SETUP SMART
TRIGGER
trigger on
1 2 Ext
Ext10 Pattern
coupling 1
DC AC
at end of
Neg Pos
pulse
width
< 10.0 ns
> 10.0 ns
5 ns RIS
1 .5 V 50Ω
2 .5 V 50Ω
Δt 25.000 ns
1/Δt 40.000 MHz
4 Gs/s
1 DC 0.00 V
10.0 ns < pulse
NORMAL

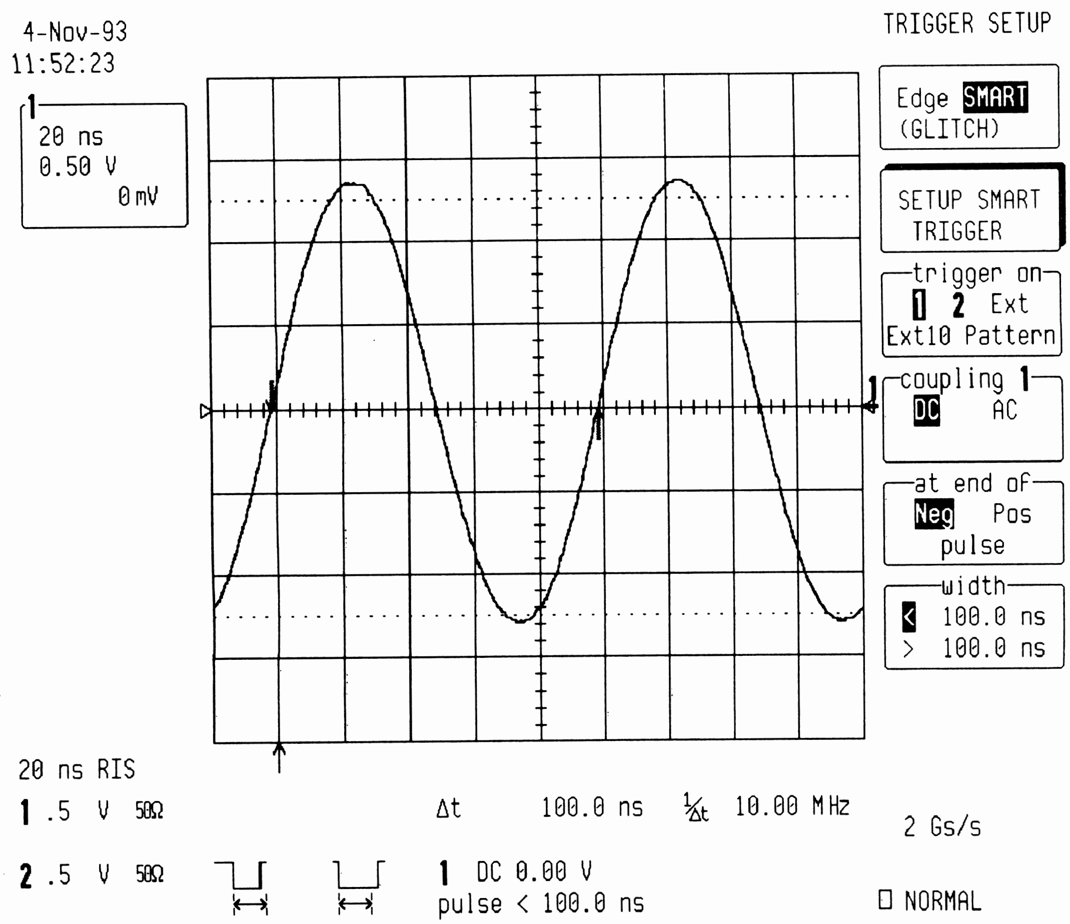
5.11.3 Trigger on Pulse Width < 100 nsec

- Set the generator frequency to 10 MHz

- Pulse width : < 100 nsec

- Timebase : 20 nsec/div

Check that the scope triggers.



- Switch to Width : > 100 nsec

Check that the scope doesn't trigger : slow trigger and no flashes in box next to normal.

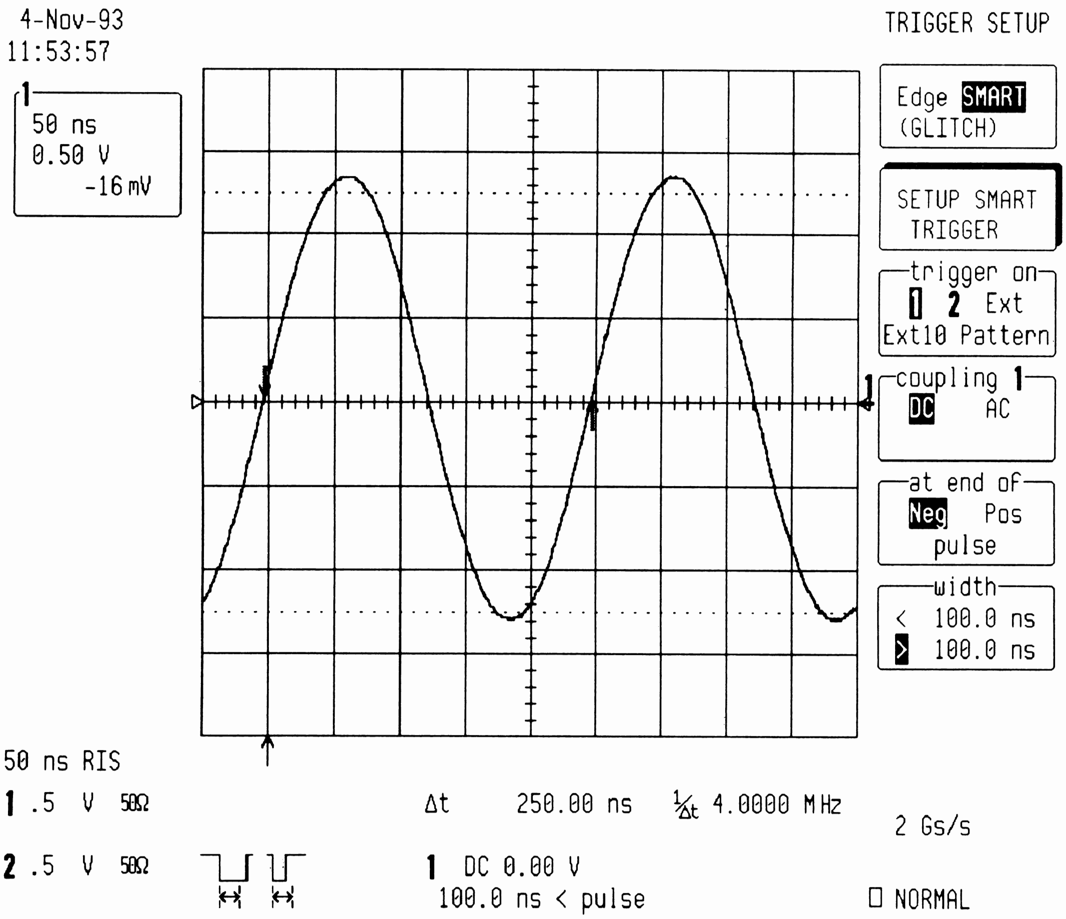
5.11.4 Trigger on Pulse Width > 100 nsec

- Adjust the generator frequency to 4 MHz

- Pulse width : > 100 nsec

- Set Timebase : 50 nsec/div

Check that the scope triggers.



- Switch to Width : < 100 nsec

Check that the scope doesn't trigger : slow trigger and no flashes in box next to normal.

- Repeat all the above tests for Channel 2, substituting channel controls and input connector, and check as above.

5.12 Time Base Accuracy

Specification

Clock accuracy : ≤ ± 0.0050 % or ≤ ± 50 ppm

Description

This test measures the accuracy of the internal 80 MHz clock.
An external sine wave generator of 1 MHz with a frequency accuracy better than ± 0.001 % is used.

Manual Time Base Verification Procedure

Setup a leveled sine wave generator.

- Frequency : 1 MHz

Connect the generator output to Channel 1

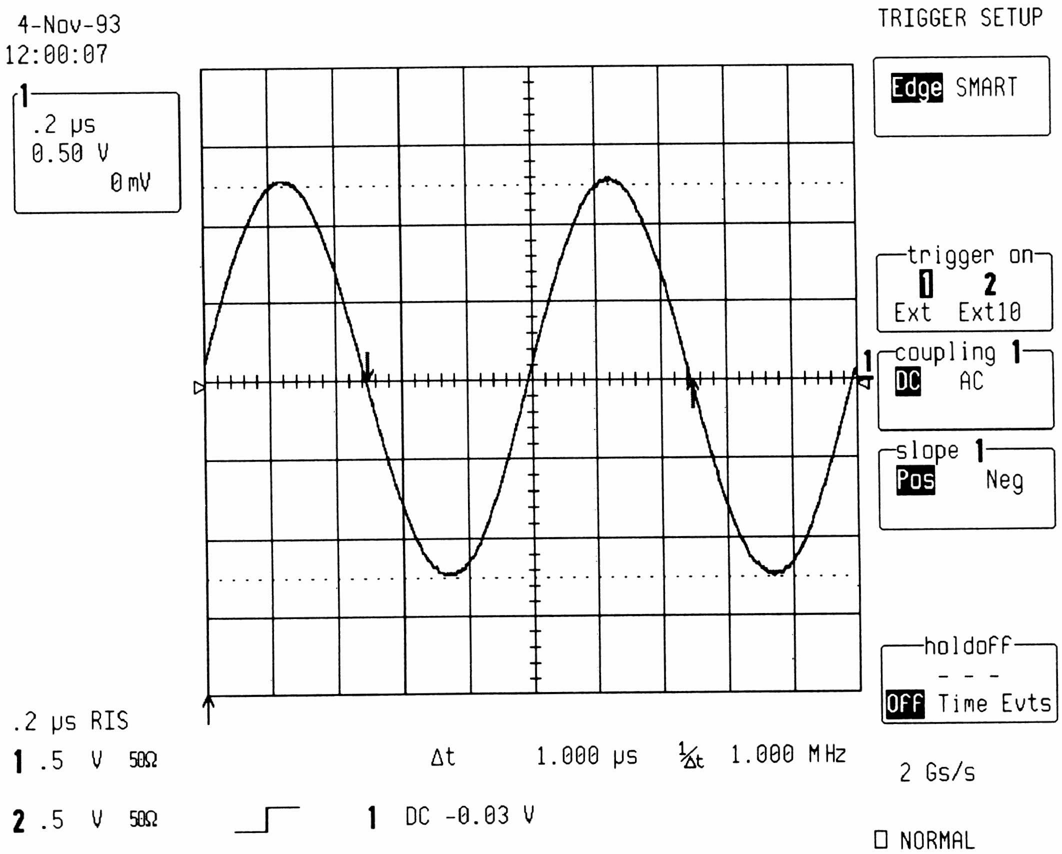
- Turn on trace : Ch1
- Display setup : Standard, Persistence off, Dot join on, Single grid
- Input coupling : Ch1 : DC 50 Ω
- V/div. offset : Normal
- Probe atten : X1
- Input gain : .5 V/div

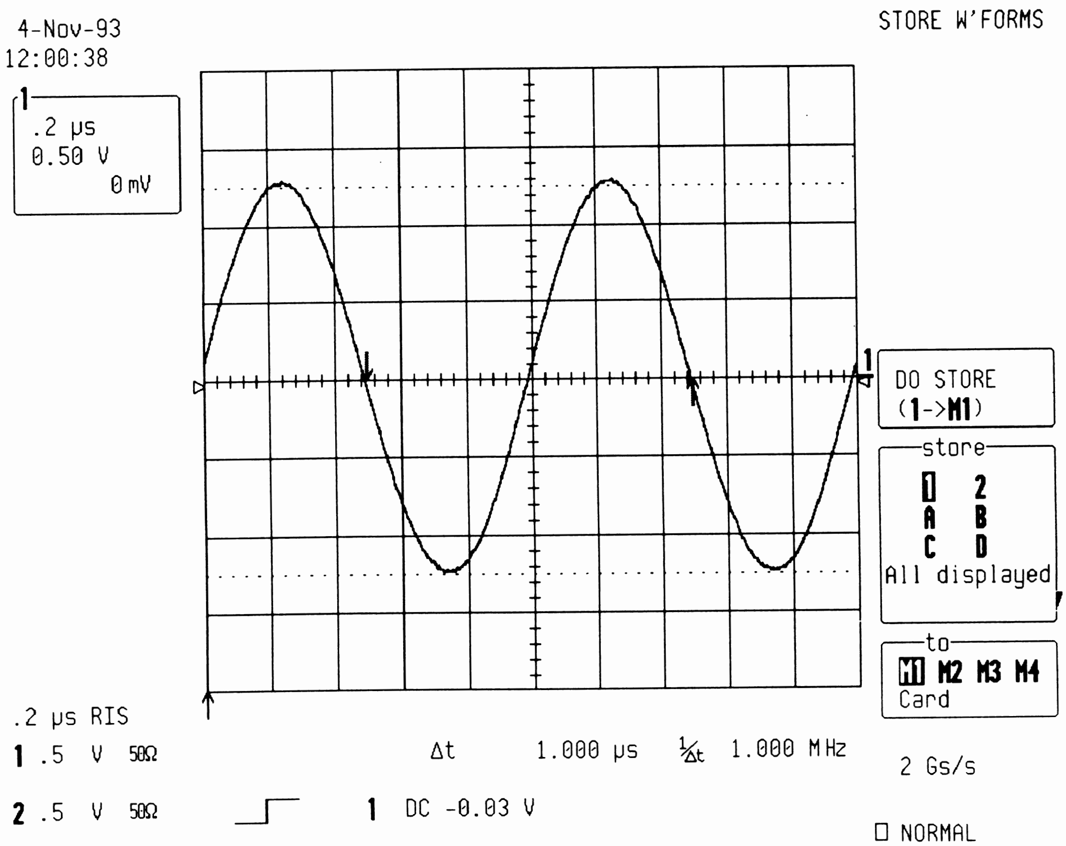
- Trigger setup : Edge
- Trigger on : 1
- Coupling 1 : DC
- Slope 1 : Pos
- Mode : Norm
- Holdoff : Off
- Delay : 0 %
- Timebase : .2 μsec/div

- Cursors/Measure : Off

Adjust the generator output amplitude and Ch1 offset to get a five divisions peak to peak amplitude sine wave.

- Store Channel 1 in memory 1


4-Nov-93
12:00:07
TRIGGER SETUP
1
.2 µs
0.50 V
0 mV
Edge SMART
trigger on
1 2
Ext Ext10
coupling 1
DC AC
slope 1
Pos Neg
holdoff
- - -
Off Time Evts
.2 µs RIS
1 .5 V 50Ω
Δt 1.000 µs 1/Δt 1.000 MHz
2 Gs/s
2 .5 V 50Ω
1 DC -0.03 V
NORMAL


4-Nov-93
12:00:38
STORE W'FORMS
1
.2 µs
0.50 V
0 mV
DO STORE
(1->M1)
store
1 2
A B
C D
All displayed
to
M1 M2 M3 M4
Card
.2 µs RIS
1 .5 V 50Ω
Δt 1.000 µs 1/Δt 1.000 MHz
2 Gs/s
2 .5 V 50Ω
1 DC -0.03 V
NORMAL

- Set Post-trigger delay to 1.0000 msec

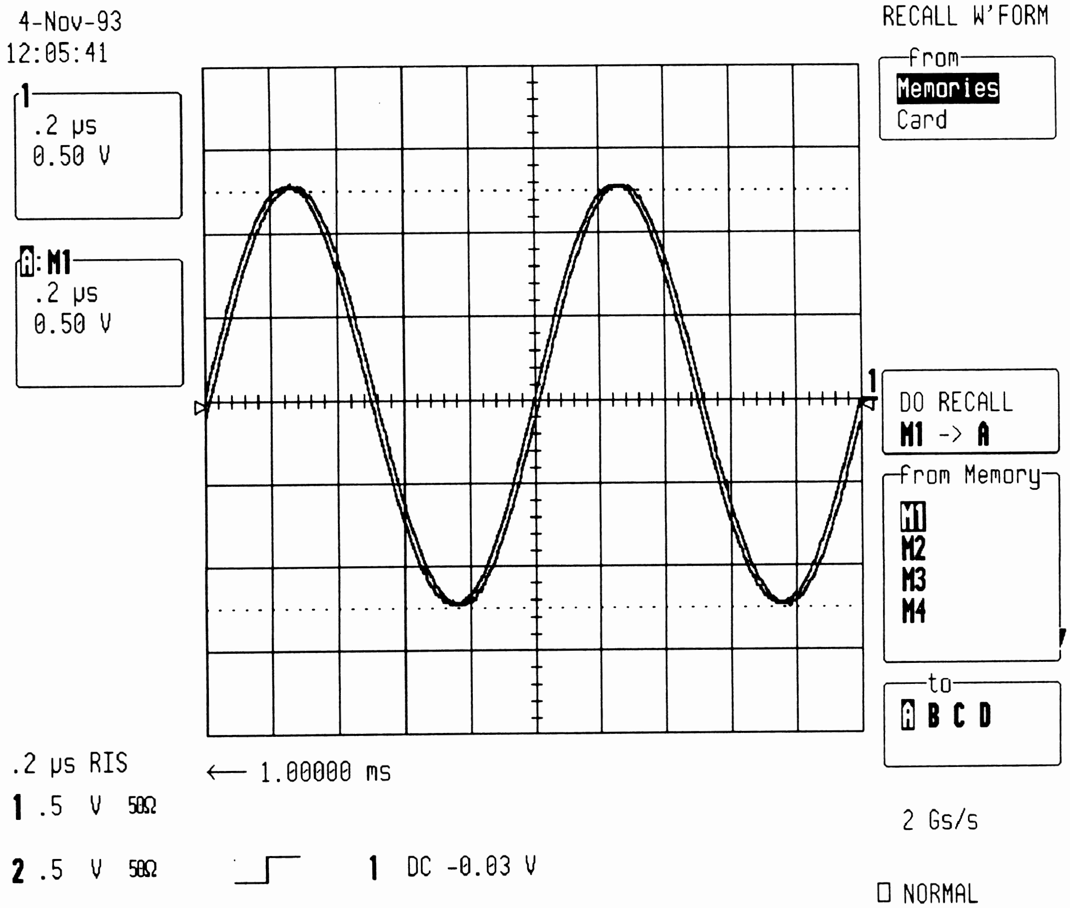
```
 4-Nov-93                                                        STATUS
12:01:58
                     ACQUISITION STATUS                          Acquisition
                                                                 System
                          1          2                           Text & Times
Vertical                                                         Waveform
        V/div          .5  V      .5  V
        Probe            x1         x1
       Offset           0 mV       0 mV
     Coupling         DC50Ω      DC50Ω

   Bandwidth Limit OFF

Time base
     Time/div          .2 µs      Time/pnt  .5 ns (  2 Gs/s )
     RIS ON,             typically needs 520 triggers for 100 bins


Trigger                Edge                       Mode        NORMAL


                          1  DC -0.03 V

     Post-trigger Delay   1.00000 ms
                                                                 2 Gs/s
     The currently preselected Smart Trigger type is
               GLITCH                                            □ NORMAL
```

This allows the accuracy of the time base clock to be checked 1000 periods after the trigger point.

- Recall memory 1 to A

- Turn on trace A

Check that the displayed Channel 1 trace is aligned with the sine wave from memory 1.

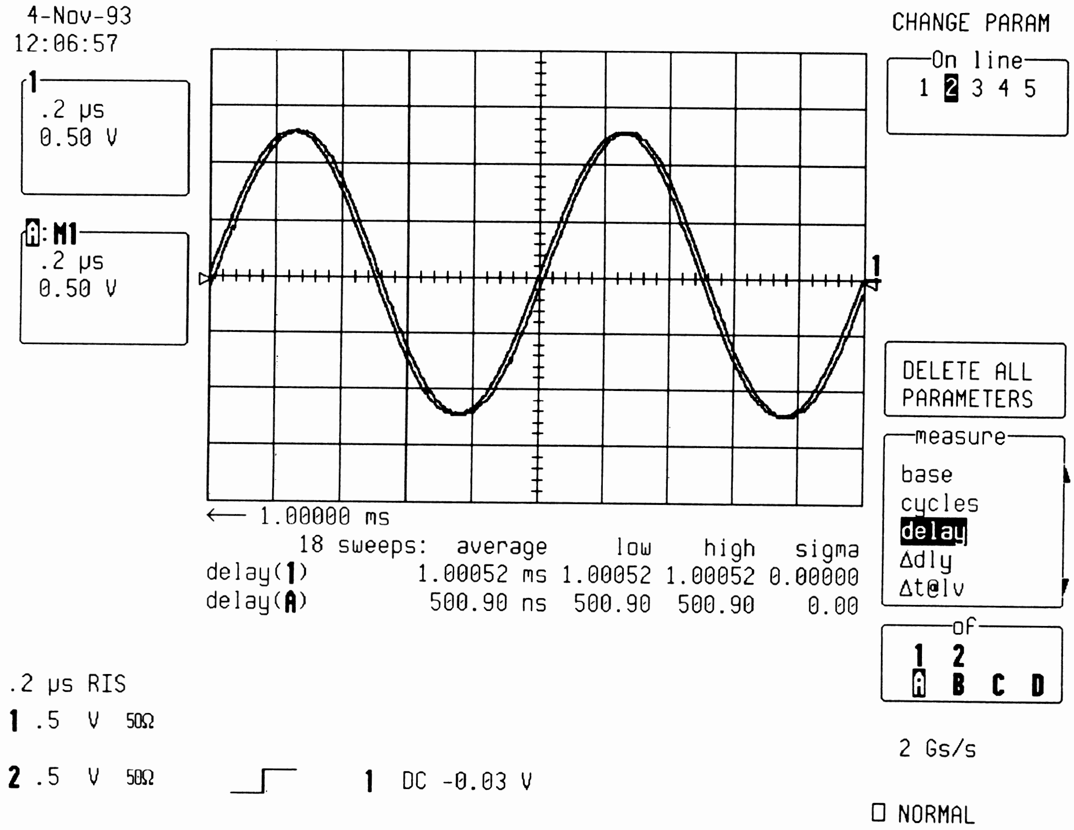


- Press	: Cursors/Measure
- Measure	: Parameters
- Mode	: Custom
- Statistics	: On

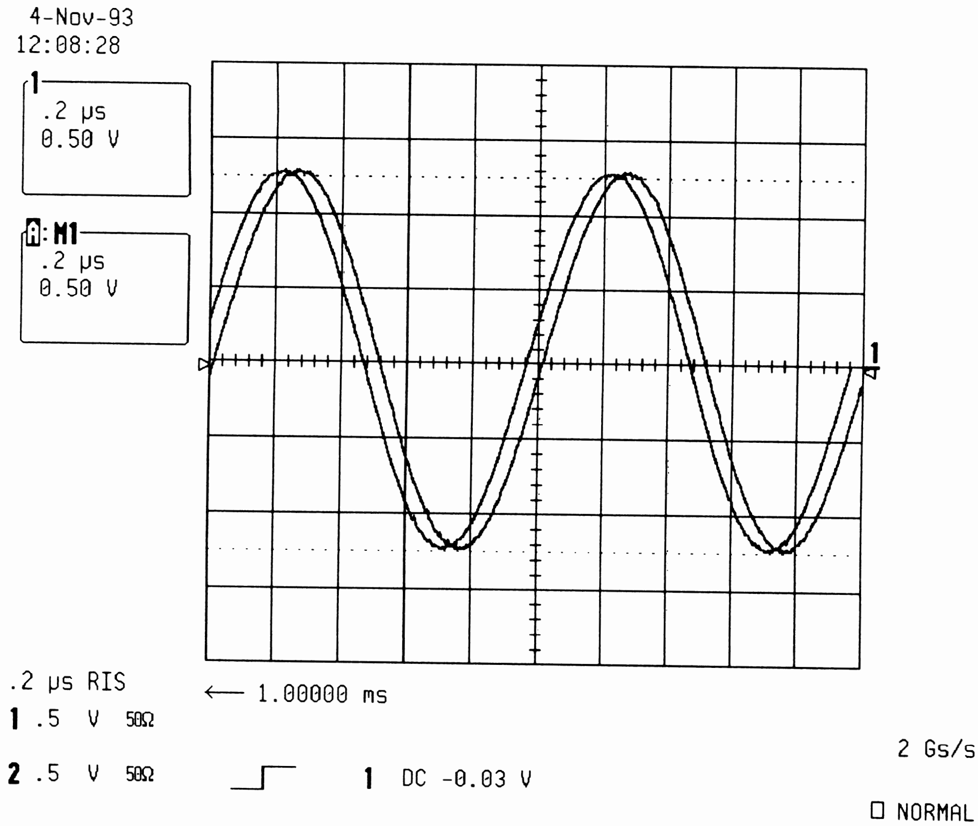
- Change parameters

- On line 1	: Delay of 1
- On line 2	: Delay of A

Check that (delay(A) - delay(1) + 1 msec) $\leq \pm$ 0.00005 msec corresponding to 50ppm.



A difference of ± 0.05 µsec corresponds to ± 50 ppm. See screen dump below :



5.13 Overshoot Verification

Specification

Overshoot < 10 %

Description

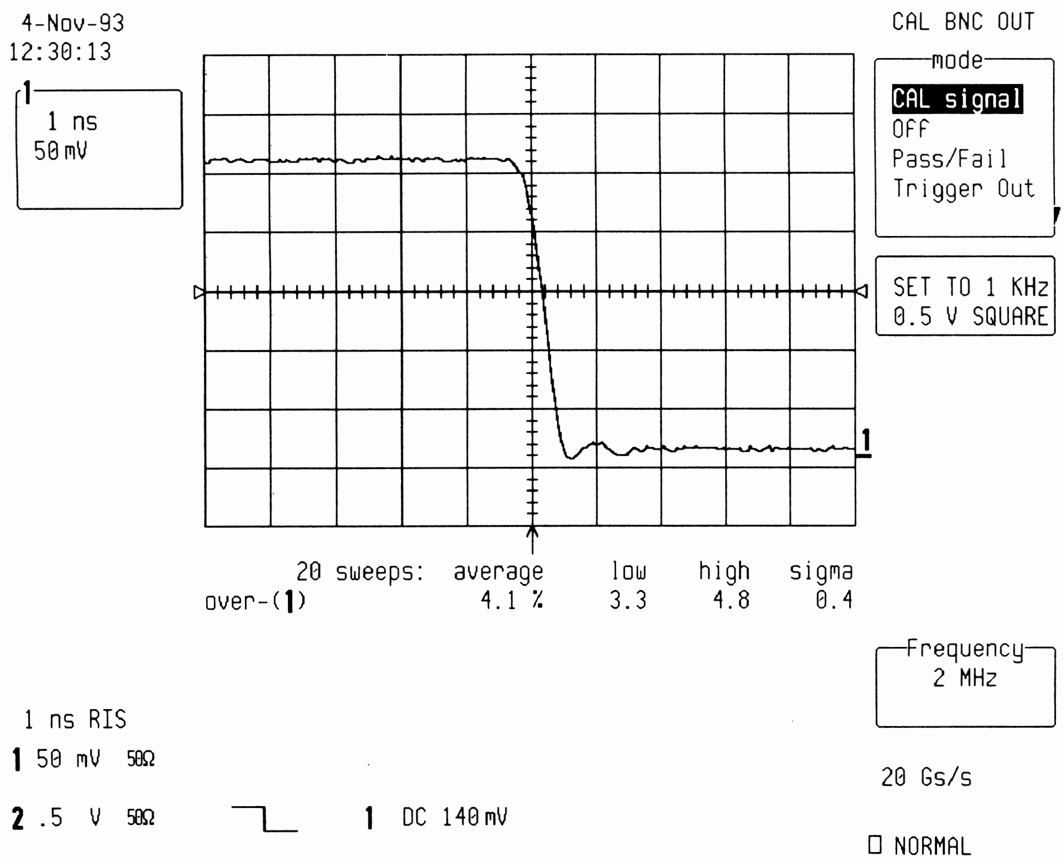
The probe calibrator with a frequency of 2 MHz is applied to the input channel.

Overshoot Verification Procedure

- Connect the Probe Calibrator output to Channel 1, using a 5 nsec BNC cable.

- Select	: Utilities
- Press	: Cal BNC Setup
- Mode	: Cal signal
- Set Frequency	: 2 MHz
- Turn on trace	: Ch1
- Display setup	: Standard, Persistence off, Dot join on, Single grid
- Input coupling	: Ch1 : DC 50 Ω
- V/div. offset	: Normal
- Probe atten	: X1
- Input offset	: - 140 mV
- Input gain	: 50 mV/div
- Trigger setup	: Edge
- Trigger on	: 1
- Trigger level	: DC 140 mV
- Coupling 1	: DC
- Slope 1	: Neg
- Mode	: Normal
- Holdoff	: Off
- Timebase	: 1 nsec/div
- Delay	: 50 % Pre-Trigger
- Cursors/Measure	: Parameters
- Mode	: Custom
- Statistics	: On
- Change Parameters	:
- On line 1	: Over - of Channel 1

Check that the Overshoot is < 10 %



5.14 Probe Calibrator Verification

Specification

Amplitude	: 250 mV into 50 Ω
Frequency	: 500 Hz to 2 MHz
Rise time	: typically 750 psec
Fall time	: typically 500 psec
Flatness	: < 1 %

Probe Calibrator Verification Procedure

- Connect the Probe Calibrator output to Channel 1, using a 5 nsec BNC cable

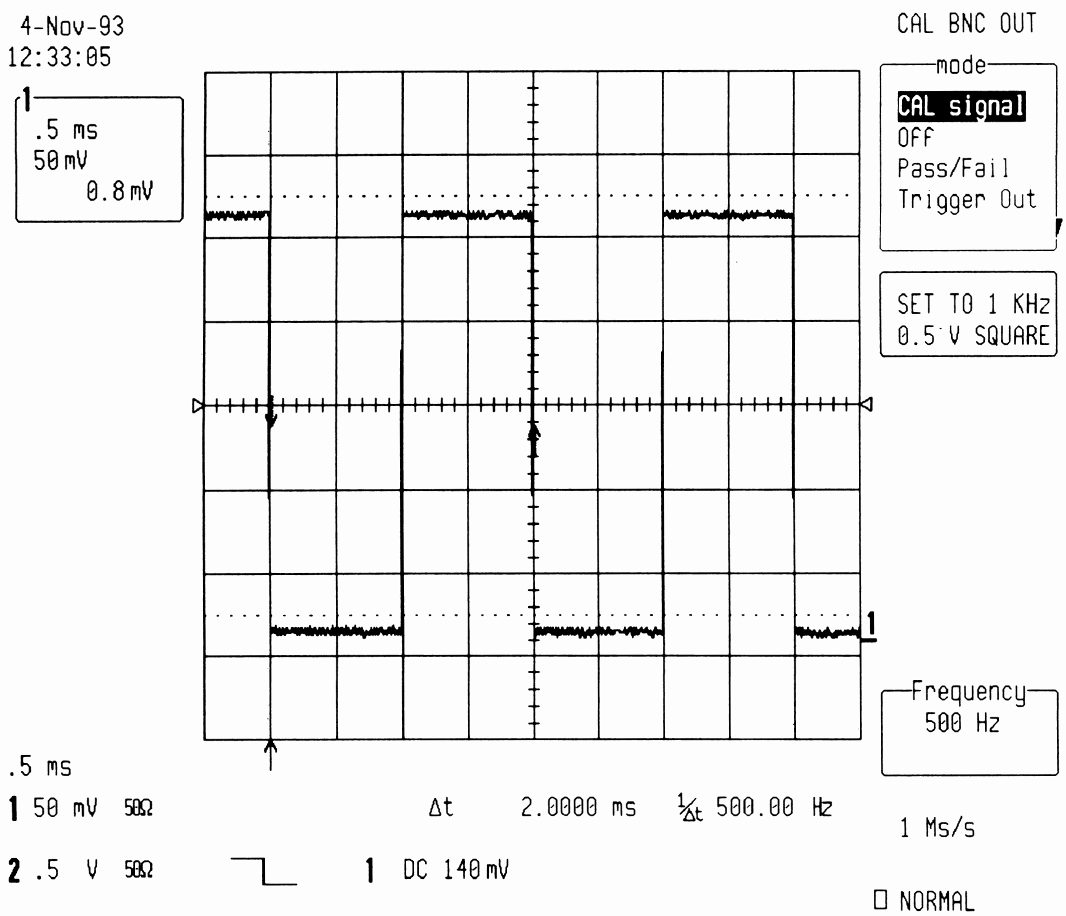
- Select	: Utilities
- Press	: Cal BNC Setup
- Mode	: Cal signal
- Set Frequency	: 500 Hz

- Turn on trace	: Ch1
- Display setup	: Standard, Persistence off, Dot join on, Single grid

- Input coupling	: Ch1 : DC 50 Ω
- V/div offset	: Normal

- Probe atten	: X1
- Input offset	: - 140 mV
- Input gain	: 50 mV/div
- Trigger setup	: Edge
- Trigger on	: 1
- Trigger level	: DC 140 mV
- Coupling 1	: DC
- Slope 1	: Neg
- Mode	: Normal
- Holdoff	: Off
- Timebase	: .5 msec/div
- Delay	: 10 % Pre-Trigger
- Cursors/Measure	: Cursors
- Mode	: Time
- Type	: Relative

Check that the frequency is 500 Hz, and the amplitude 250 mV.

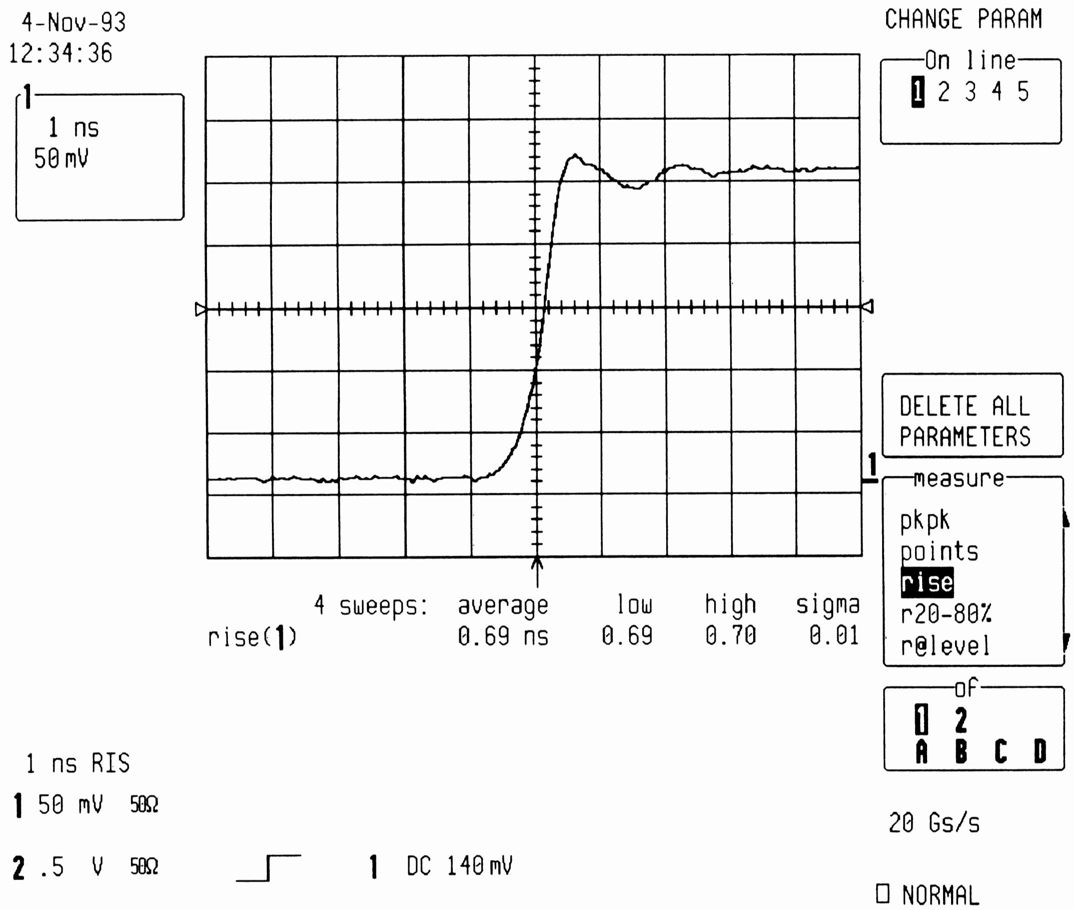


- Set frequency to 1 KHz and check correct amplitude and frequency.

- Set frequency : 2 MHz
- Trigger Slope 1 : Pos
- Mode : Normal
- Timebase : 1 nsec/div
- Delay : 50 % Pre-Trigger

- Cursors/Measure : Parameters
- Mode : Custom
- Statistics : On
- Change Parameters :
- On line 1 : Rise of Channel 1

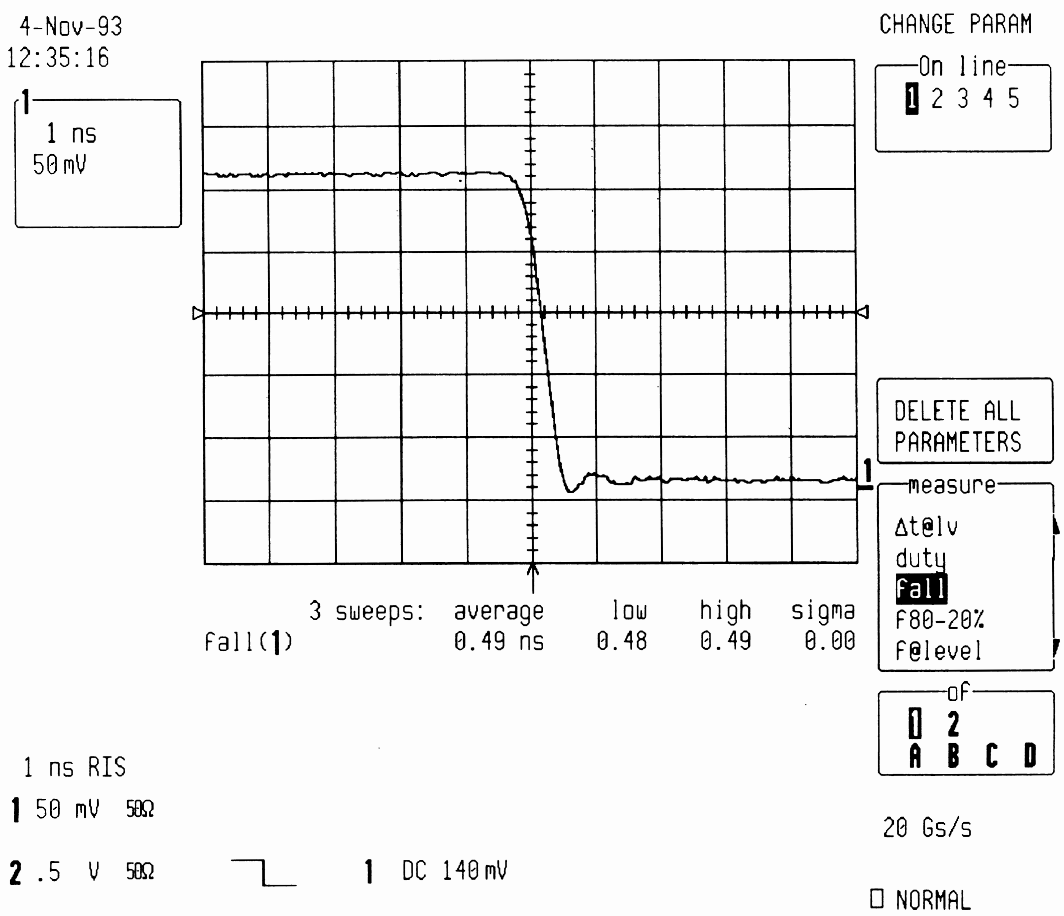
Check that the rise time is typically < 750 psec



- Select Trigger Slope : Neg

- Change Parameters :
- On line 1 : Fall of Channel 1

Check that the fall time is typically < 500 psec



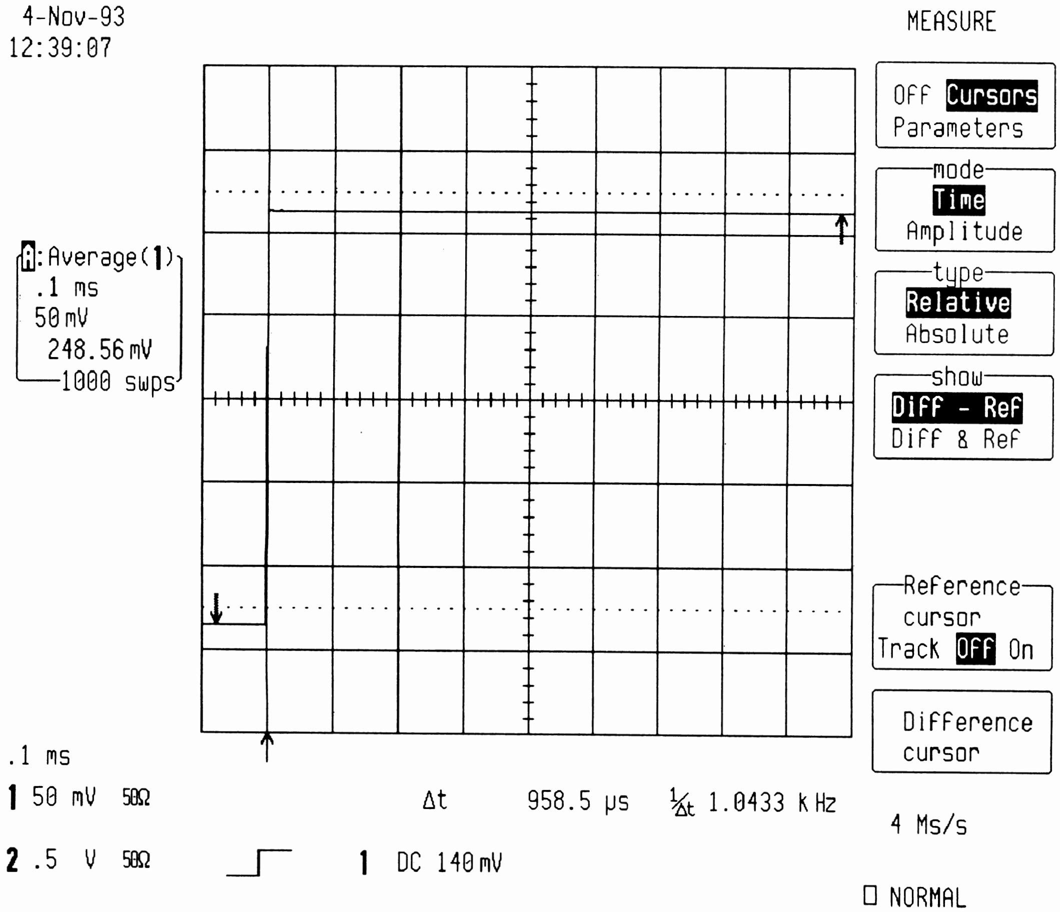
- Set frequency : 500 Hz
- Trigger Slope 1 : Pos
- Timebase : .1 msec/div
- Delay : 10 % Pre-Trigger
- Turn on trace : A
- Select Math Setup
- For Math : Use at most 5000 points
- Redefine A
- Use Math ? : Yes
- Math Type : Average
- Avg Type : Summed
- Of : Channel 1

- Turn off trace : Channel 1

- Cursors/Measure : Cursors
- Mode : Time
- Type : Relative

- Move the reference and difference cursors as shown below.

- After 1000 sweeps readout the amplitude. i.e : 248.56 mV

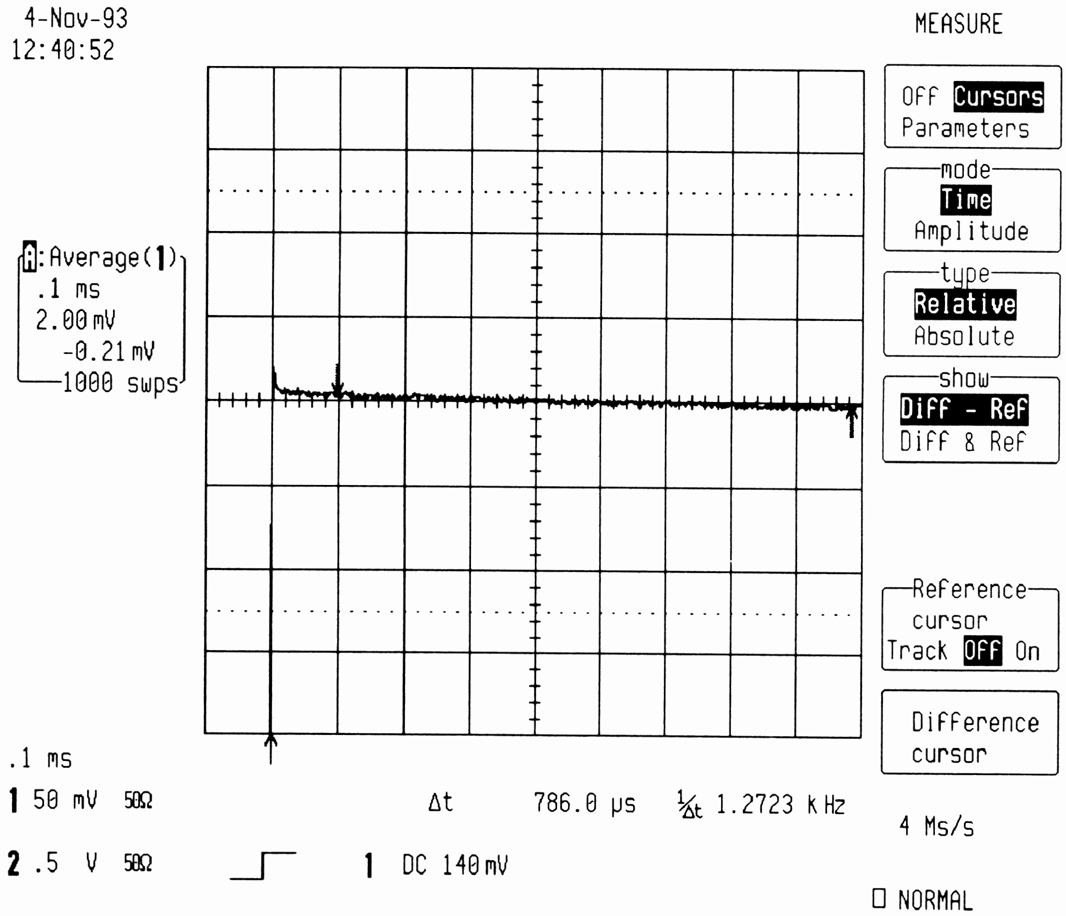


- Change vertical position of zoom, and place trace A in the middle of the screen.

- Expand A with vertical Zoom up to 2 mV

- Move the reference and difference cursors as shown below.

- Readout the amplitude. i.e : - 0.21 mV



- Calculate the non flatness in % of the signal amplitude

  i.e : (- 0.21 mV - 248.56 mV) : 248.56 mV = - 0.01 %

  Flatness must be < ± 1%

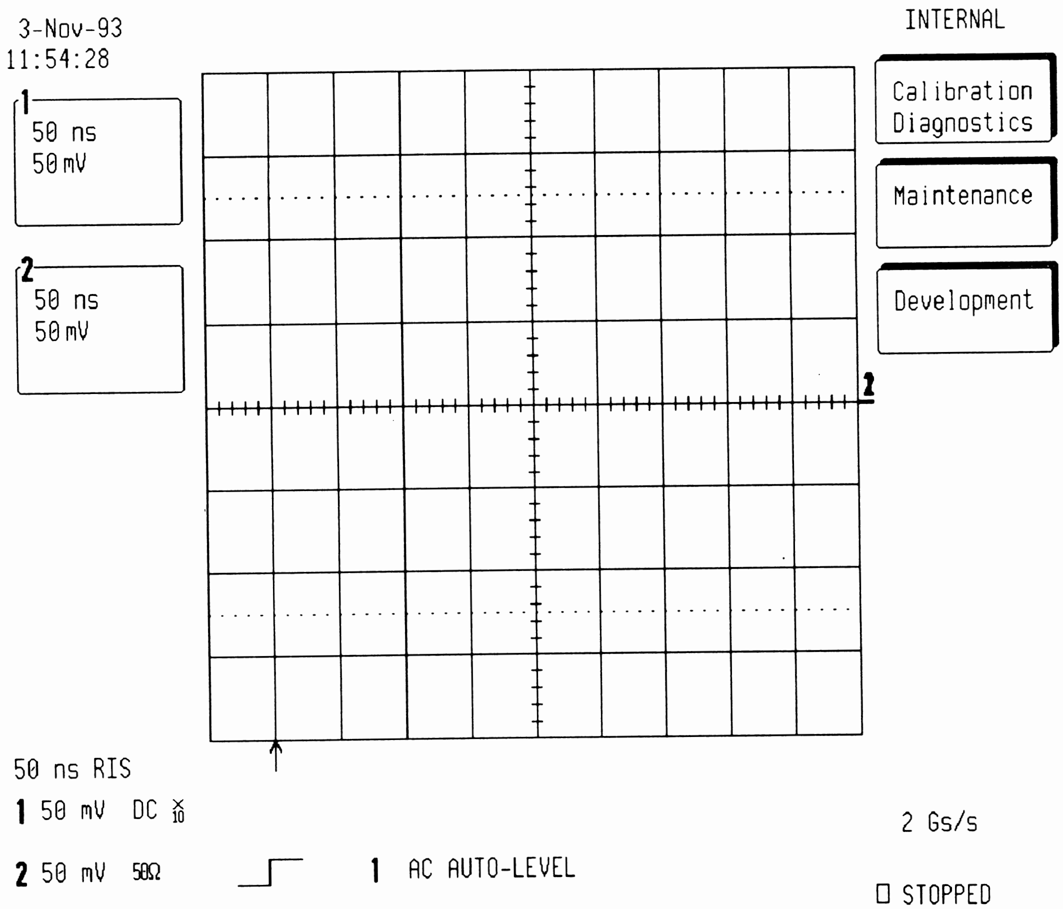
SECTION 6 INTERNAL CALIBRATION and DIAGNOSTICS

6.1 Introduction

The 9320 internal calibration and diagnostics menu is entered by simultaneously depressing the third and fourth menu push buttons on the right hand side of the CRT and then by depressing the fifth.

To quickly check the performance of the 9320 oscilloscope, select the calibration diagnostics.

Press the recalibrate completely button to do a full recalibration of the front end. it is advisable to perform this type of check when the scope is in a stable condition.



6.2 Diagnostic Summary

Press diagnostic summary.

This is a handy tool to perform a quick but comprehensive internal performance check, without touching the acquisition settings. The failures are indicated by channel identifiers.

If no problem is detected, the fields are left blank.

```
 3-Nov-93                                                            CALIBRATION
11:13:19
              Calibration Diagnostic Summary                        Diagnostic
                                                                     Summary
Gain and Offset Calibration:
                            Gain   Off2   Acc    Resid
ADC zero reading                                                    Diagnostic
gain measurement                                                     Results
gain is negative
gain control range
offset control range
final gain setting                                                  Diagnostic
final offset setting                                               Measurements

Trigger Level Calibration:
control
hysteresis
                                                                    Recalibrate
                                                                    Completely


Failures are indicated by channel identifiers.  Fields are left
blank if no problem detected or a failure occurred previously.
Monitor:  rc     6; 1: Δg   -37, Δo     0                       □
```

The gain and offset calibration results displayed for Channel 1 and Channel 2 are independent of the following conditions:

- Time base
- Trigger mode and coupling
- Variable gain
- Offset

6.2.1 Gain and Offset Calibration Description

ADC zero reading : Failed to get 0 reading from ADC for some choice of Vgain, CAL signal, and Voff2 while varying the Offset

Gain measurement : Failed to measure gain, the gain was not what was expected.

Gain is negative : Measured a negative Gain or broken channel.

Gain control range : Gain - the available range didn't include the interval (0.95*0.005, 1.05*0.025) V/div

Off2 - Voff2 couldn't not be chosen so as to give |ADC| < 1 div
The shape of the offset curve is unreasonable.

Acc - the 3 points used for the gain measurement didn't lie on a straight line.

Offset control range : Not used

Final gain setting : Gain - An error is detected if the Gain adjustment didn't converge to desired Gain.

Off2 - the attenuators didn't agree with the board test.

Final offset setting : An error is detected if the 3 Offset calibration points didn't lie on a straight line.

6.2.2 Trigger Level Calibration

The control of the trigger hysteresis is done in the trigger mode DC and AC.
If an error occured 1, 2, or E is displayed corresponding to Channel 1, Channel 2, or External.

Control : Failed if no transition of discriminator observed when stepping the treshold level.

Hysteresis : Failed to get hysteresis in range 1-6 mv @ 10 mv/div

6.3 Diagnostic Results

6.3.1 Gain Curves

- Press diagnostic results
- Select results for gain
- Press recalibrate completely
- Select show results for Channel 1

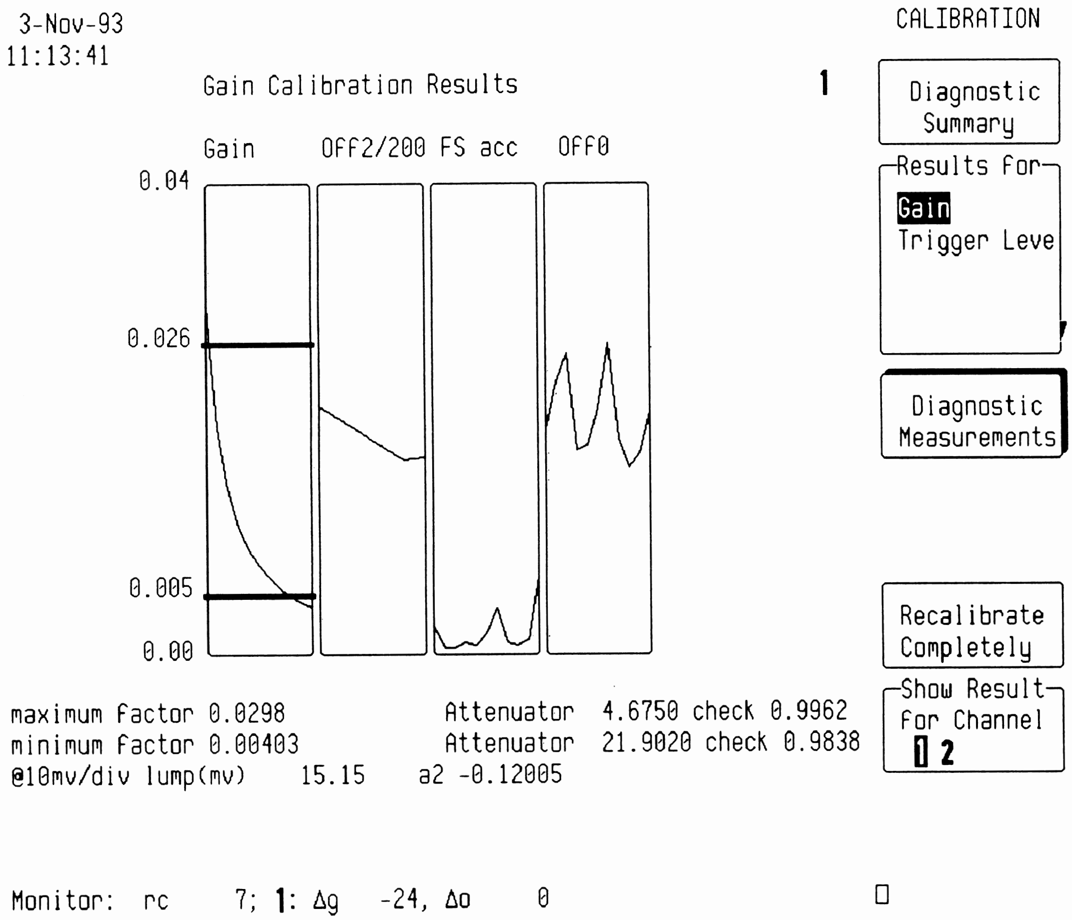
Variable gain range, checked by software must be better than 0.005 to at least 0.026. With regards to the illustration, the lower portion of the curve must extend below 0.005 limit, and the upper portion above the 0.026 limit.

If this is not true the Gain control range summary shows a violation for Channel 1. The maximum and minimum gain factors are displayed.

The attenuator values measured in board test are shown. The check value should be near 1.000. If it deviates significantly the Final Gain summary shows an Off2 violation.

The offset curve @ 10 mv/div is also given. A significant deviation of the a2 value gives a Gain control range Off2 error in the summary.

Repeat the test for Channel 2.



6.3.2 Trigger Level Calibration

- Select results for trigger level

For Channel 1 and Channel 2 the hysteresis value is given in Volt.The trigger range is ± 0.5 V for the steep curve. The boxed region is zoomed to give the two lines with a vertical scale of ± 0.1 V.

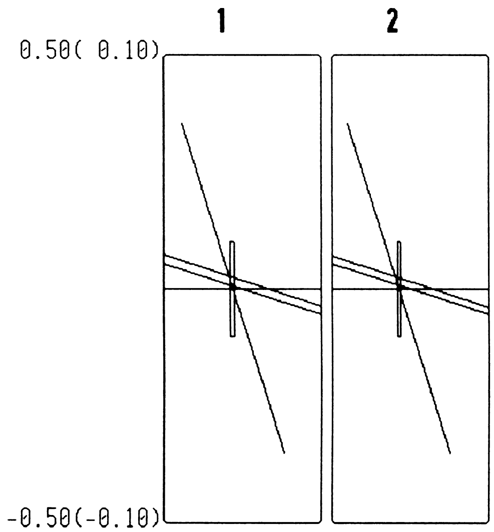
The DAC voltages used for the AC AUTOLEVEL triggers are given. The slope and offset of the curve relating trigger threshold to DAC setting are given.

- Press recalibrate completely

The hysteresis in V should be 0.0035 ± 0.0025

3-Nov-93
11:14:04

Trigger Level Calibration Results



hysteresis [V]	0.0037	0.0032
offset [V]	-0.0621	-0.0803
ACslope+ [V]	0.243	0.194
ACslope- [V]	0.335	0.262
g1 [dac_v/level]	-0.479	-0.479

Monitor: rc 7; **1**: Δg -24, Δo 0

CALIBRATION

Diagnostic Summary

Results For
Gain
Trigger Leve

Diagnostic Measurements

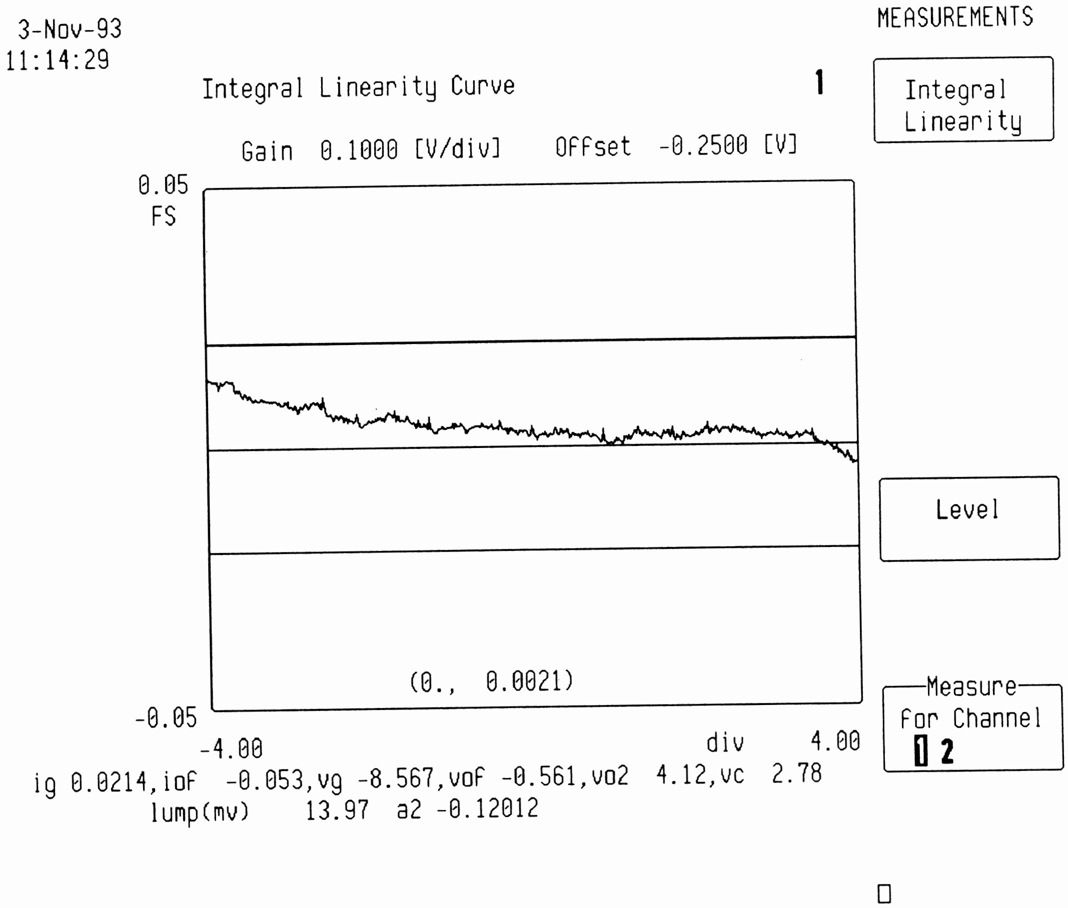
Recalibrate Completely

6.3.3 Integral Linearity

- Press diagnostic measurements

- Select integral linearity

The curve should be within the ± 0.02 * FS bars, for offset = 0.0 V.



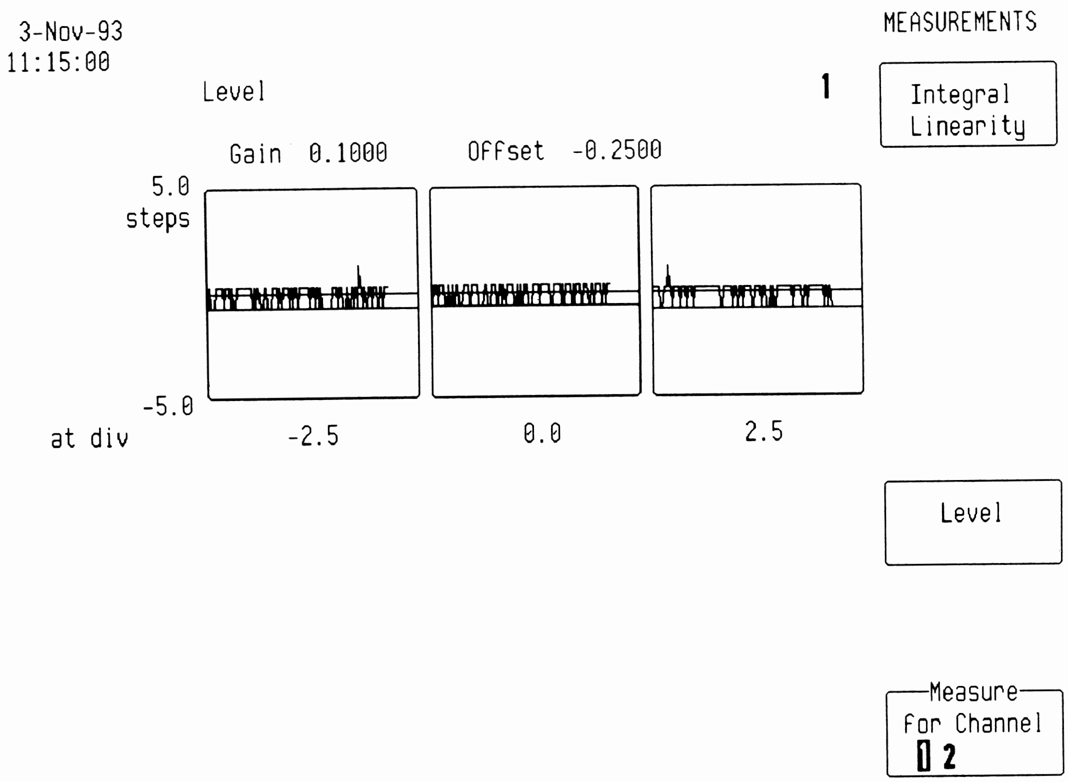
Repeat the test for Channel 2.

- Press level

The three plots show raw ADC data displayed around their mean value for 3 different CAL levels.

The data should be narrow and random.

The theoretical level is shown by the second horizontal line which should be near (< 4 steps) to the measured value for Offset = 0.



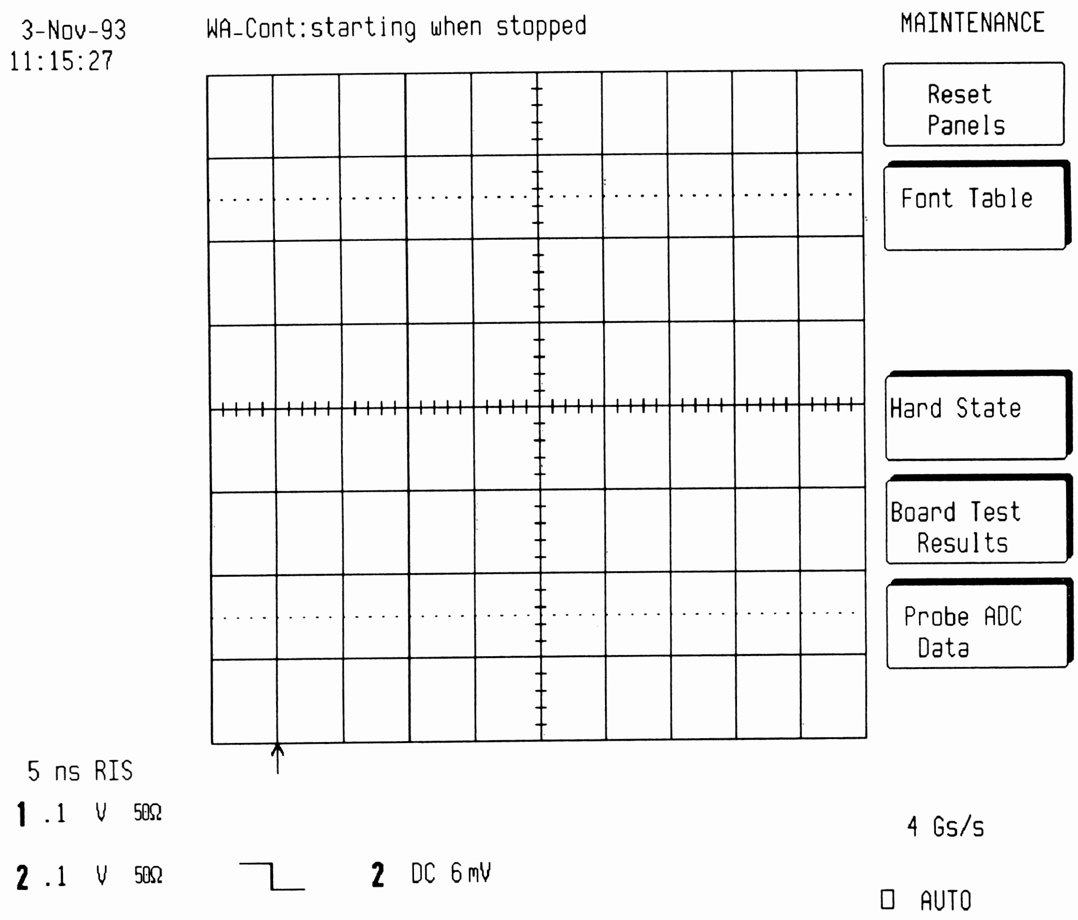
Repeat the test for Channel 2.

6.4 Board Test Results

- From the Internal menu press Maintenance

- Select Board Test Results

This menu displays the board calibration measured at the factory, the calibration values are loaded in the I2C Prom.



6.4.1 Header

The header block indicates the following information :

- The revision of the printed circuit board : i.e Rev C
- The engineering change order level : i.e ECO 1003
- The work order number : i.e WO 9339-0004
- The tested date : i.e tested 1993-10-04 it should be : ≥ 1993-xx-xx.
  If the date says 1990-04-01 it is a sign that the I2C prom on the -3 board could not be read correctly.

6.4.2 Time

- ITCAL is the 16 bit DAC setting of the TDC interpolator for 10 psec resolution.
  i.e : 95E9

- CAL represents the DAC setting for the three following values : -.4 V, 0.0 V, +.4 V
  i.e : - 0.4 V = E6BE, 0.0 V = 8010, + .4 V = 1961

```
 3-Nov-93                                                   Board Test
11:21:33



Header:    block lengths 20 114 12 Test version  56  2 chans
      Rev: C, ECO 1003, WO 9339-0004, Tested: 1993-10-04 14:20

Time:     itcal 95E9  CAL -0.4v E6BE 0.00v 8010 +0.4v 1961
Trigger:    External offset 7646  slope 00A8 hysteresis 0074
            atten*1000  4660
    low Glitch:    1    2    3    5    7   10   15   20   32   50
                 0000 670B 87DD 9688 9B7C 9F24 A25A A3D9 A57E A677
   high Glitch:   50   70  100  150  225  325  475  700 1000 10000
                 974B 9C10 9FAA A274 A454 A57F A655 A6EA A749 A818
Trigger times:    Edge    Pattern    HiFreq     Points
                  -1785    -1910    -1813     1     1     1
Icomp gains(mv/div*5):      20     25     50    100   125   200

Vertical: off1   Atten*1000    icomp-dac * 6
    8173     4675    21902    71    92   107   133   164   184
    81A3     4690    21770    71    92   107   133   164   184
```

6.4.3 Trigger

- External offset represents the 16 bit DAC setting for 0 V threshold of the external trigger, positive slope. i.e : 7646.

- Slope is the DAC change of setting for a 10 mV threshold change

- Hysteresis is the 16 bit DAC settings correspond to the Hysteresis value. i.e : 0074.

- Atten *1000 is the attenuator value * 1000 of the external trigger /10 i.e : 4660.

- Low glitch and High glitch are the calibration values of the fast glitch trigger.
  low glitch : DAC settings for the range 1 nsec up to 50 nsec.
  high glitch : DAC settings for the range 50 nsec up to 10000 nsec.

6.4.4 Trigger Times

- Edge is the time correction with a step of 10 psec, when the trigger is set to Edge. i.e : -1785.

- Pattern is the time correction with a step of 10 psec, when the trigger is set to Pattern. i.e : - 1910.

- Hifreq is the time correction with a step of 10 psec, when the High frequency trigger mode is set. i.e : -1813.

6.4.5 Current

- Icomp gains (mV/div*5) give the gain value used for the ICOM-DAC measurements that follow.
  These are : 4 mV, 5 mV, 10 mV, 20 mV, 25 mV, and 40mV/div.

6.4.6 Vertical Offset and Gain

- Offl is the DAC settings of the offset value set to zero, for Channel 1 and Channel 2.

- The first column represents the offset values of Ch1, Ch2 with no attenuator.

- The second column is the value * 1000 of Ch1, Ch2, ÷ 5 attenuator.

- The third column is the value * 1000 of Ch1, Ch2, ÷ 20 attenuator.

- ICOM-DAC * 6 represents the DAC settings of Channel 1 and Channel 2 of the buffer amplifier to get 4 mV, 5 mV, 10 mV, 20 mV, 25 mV, and 40 mV.

6.5 Probe Bus Verification

- From the Internal menu press Maintenance

- Select probe ADC data

This menu displays the probe bus and probe ring status.

With no probe connected to the input, check that the menu identicates:
physical channel a, b, c, d, ext = 251 ± 3.

```
20-Oct-93                                                   Probe PROM
 6:14:06
Physical channel a    251
Physical channel b    252
Physical channel c    252
Physical channel d    251
Physical channel ext  252

ADC values: CAL  252, MON  125, Temperature   89 =   27 C

Interrupts since start-up:
a  :2 b  :0 c  :0 d  :0 ext:0 cal:0 mon:0 T  :11
```

Connect a AP020 LeCroy active probe on channel 1 and check :

- the probe is identified on physical channel c
- the physical channel c readout has changed to 21
- an interrupt has been detected on c :

```
 3-Nov-93                                                          Probe PROM
11:53:59
Physical channel a    252
Physical channel b    253
Physical channel c     21  AP020
           108   41 5030 3230  406 9316   21 1106 4120    0
          1506 3dcc cccd 210a 400f 117b 388f 1091 220b c000
             0 4000    0  124  701 4642  100 3406   10   42
          3604  204 4106 3204 48f5 a0ff
Physical channel d    252
Physical channel ext  252

ADC values: CAL  253, MON  225, Temperature   90 =   28 C

Interrupts since start-up:
a  :0 b  :0 c  :11 d  :6 ext:0 cal:0 mon:0 T  :2
```

Connect a LeCroy passive probe with probe ring i.e PP002 on channel 1 and check :

- the probe X10 is identified on physical channel c
- the readout of physical channel c has changed to 195
- an interrupt has been detected on c :

```
 3-Nov-93                                                          Probe PROM
11:58:17
Physical channel a    252
Physical channel b    253
Physical channel c    195  x10
Physical channel d    252
Physical channel ext  252

ADC values: CAL  253, MON  225, Temperature   90 =   28 C

Interrupts since start-up:
a  :0 b  :0 c  :13 d  :6 ext:0 cal:0 mon:0 T  :2
```

Repeat the tests for Channel 2 and External Trigger. Check that the probe is identified on physical channel d or ext.

SECTION 7 MAINTENANCE

7.1 Introduction

This section contains information necessary to disassemble, assemble, maintain, calibrate and troubleshoot the LeCroy 9320 oscilloscope.

7.2 Disassembly and Assembly Procedure

The disassembly and assembly procedures detailed below refer to the assembly and disassembly diagram 7.2.3, and the view of figures 7.1, 7.2, 7.3, 7.4, 7.5 and 7.6. Please study the diagram and figures before attempting disassembly.

WARNING

Before removing any parts from the LeCroy 9320, be sure to read carefully the instructions referring to those parts, noting any precautions needed to avoid problems caused by mechanical behavior, high voltage supplies, etc.

CAUTION

The usual precautions against static electricity are required, (see 1.10)

7.2.1 Removal of the Upper Cover (5.10)

The top cover (5.10) is secured by two M4x5 screws (5.12) on both sides of the front panel assembly (2), and by two M4x8 screws (5.11) on the rear panel (3). Remove the screws and carefully slide the cover off the unit to the rear. Removal of the top cover gives access to the boards and parts listed in section 7.2.3.

7.2.2 Removal of the 93XX-PS 1715 Power Supply (4)

WARNING

Ensure the line cord is disconnected. Remove the following:

- Top cover (7.2.1).
- One M4X8 screw (5.2) from left side of the bottom cover (1.1).
- Two M4X8 screws (5.1) from left side of the rear panel (3).

Disconnect the following:

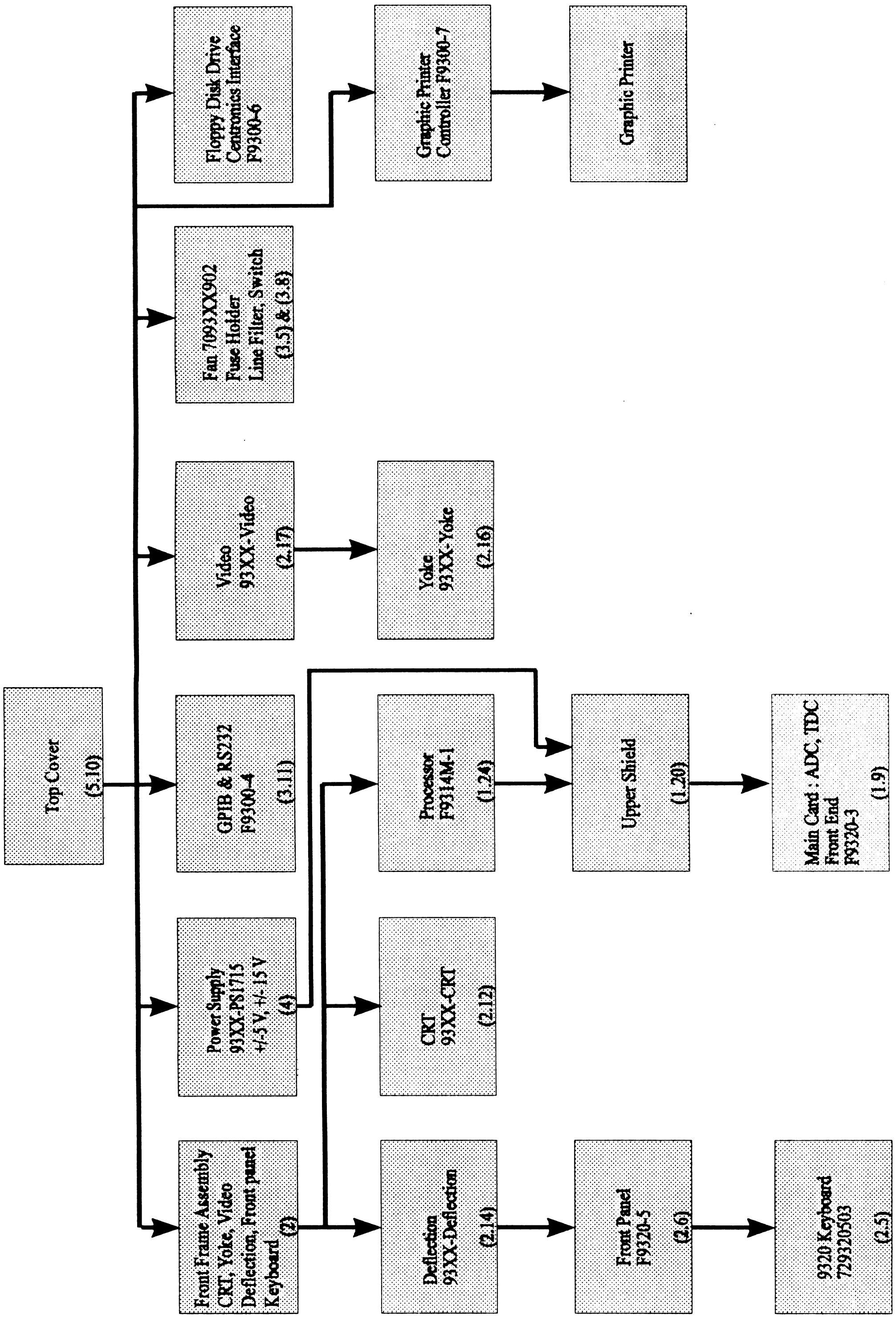
- Base card power cable (5.9) from connector J601.
- PS1715 line input cable (3.17) from connector J6.

The power supply can now be removed vertically from the oscilloscope.

7.2.3 Disassembly and Assembly Diagram

Disassembly : If it becomes necessary to replace a board or a part, use the disassembly diagram to disassemble the unit. Any board can be removed if items higher in the diagram and connected by a line are already out.

Assembly : Reassemble the unit in the reverse order.



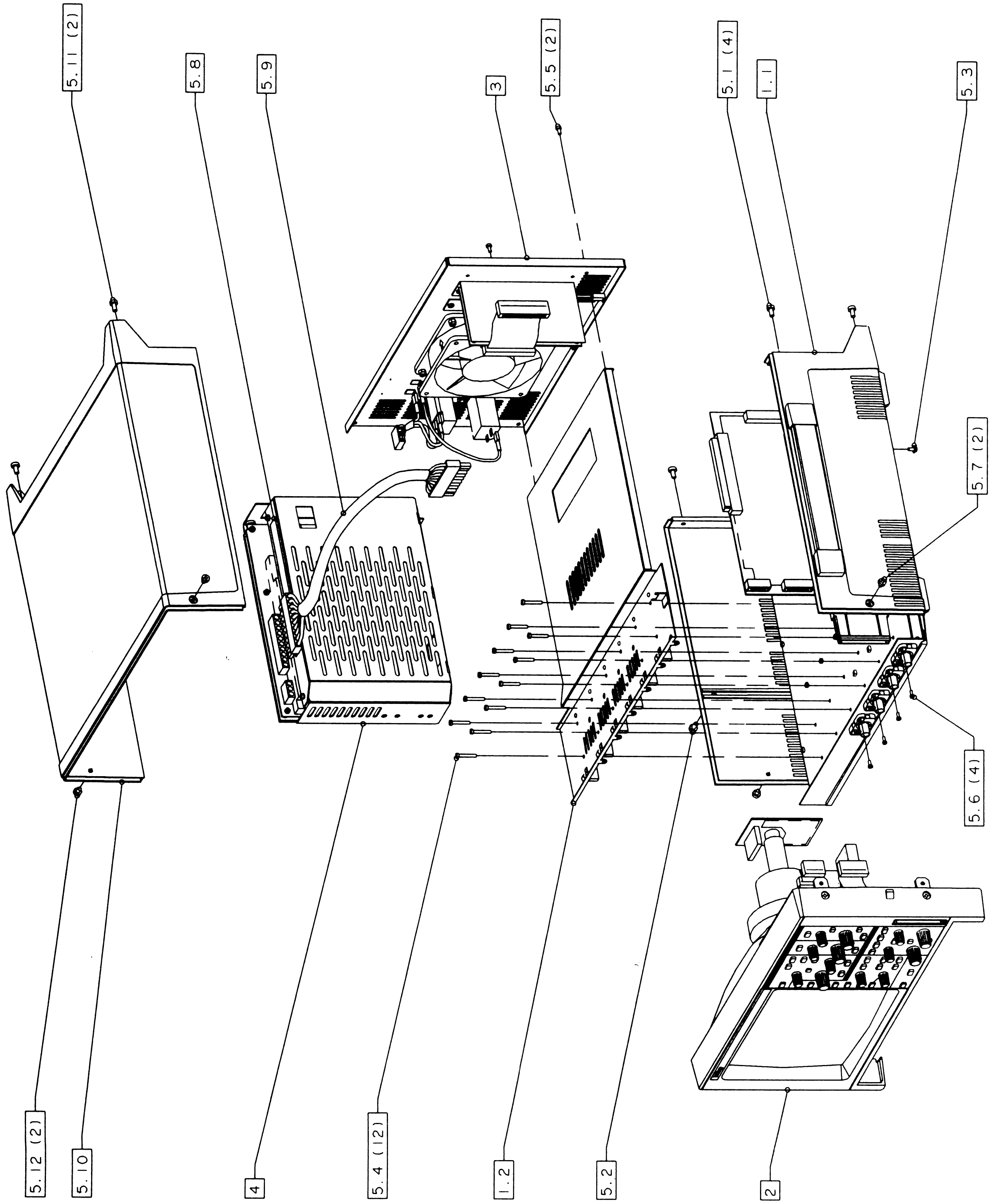


FIGURE 7.1: 9320 DSO EXPLODED VIEW

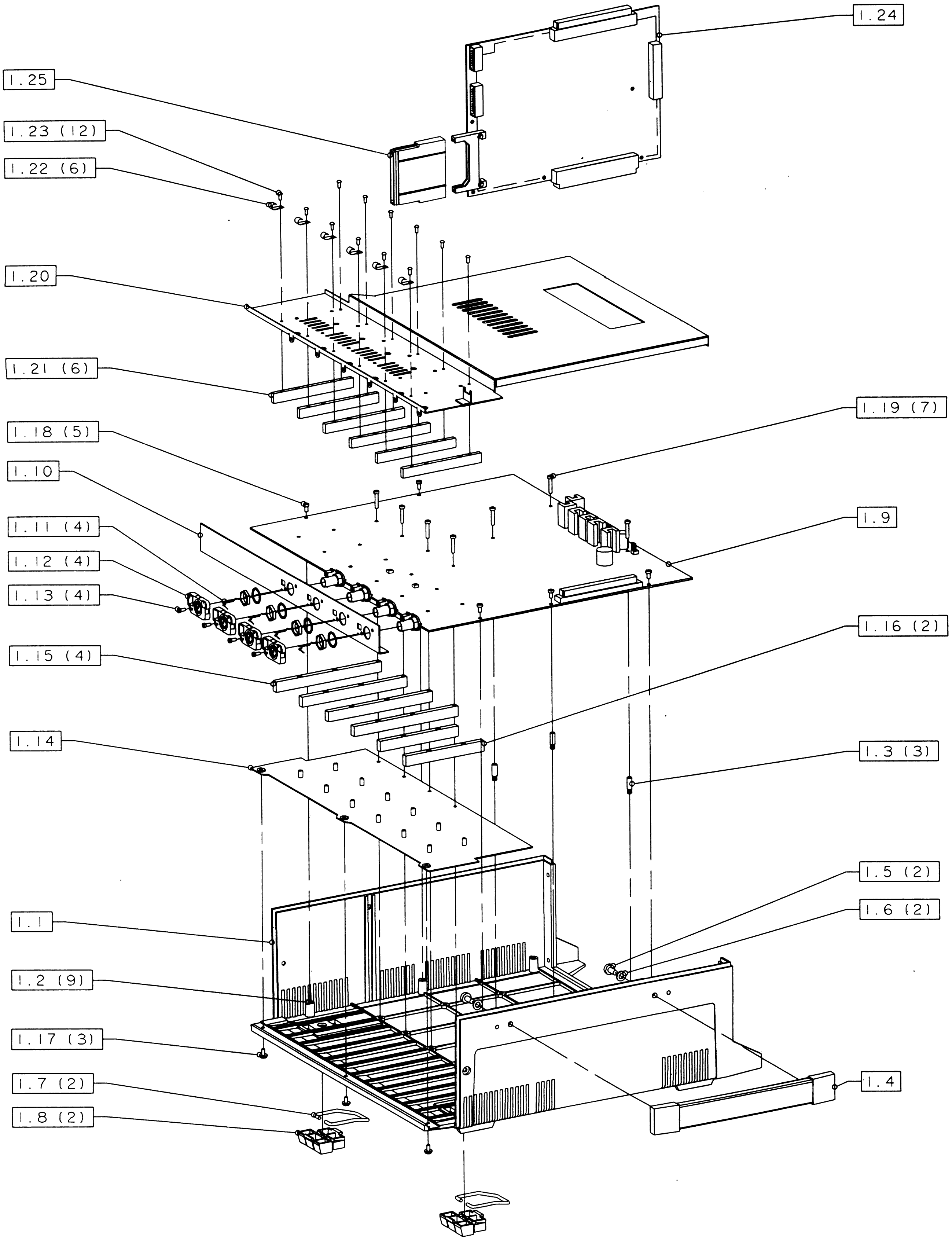


FIGURE 7.2: 9320 LOWER COVER EXPLODED VIEW

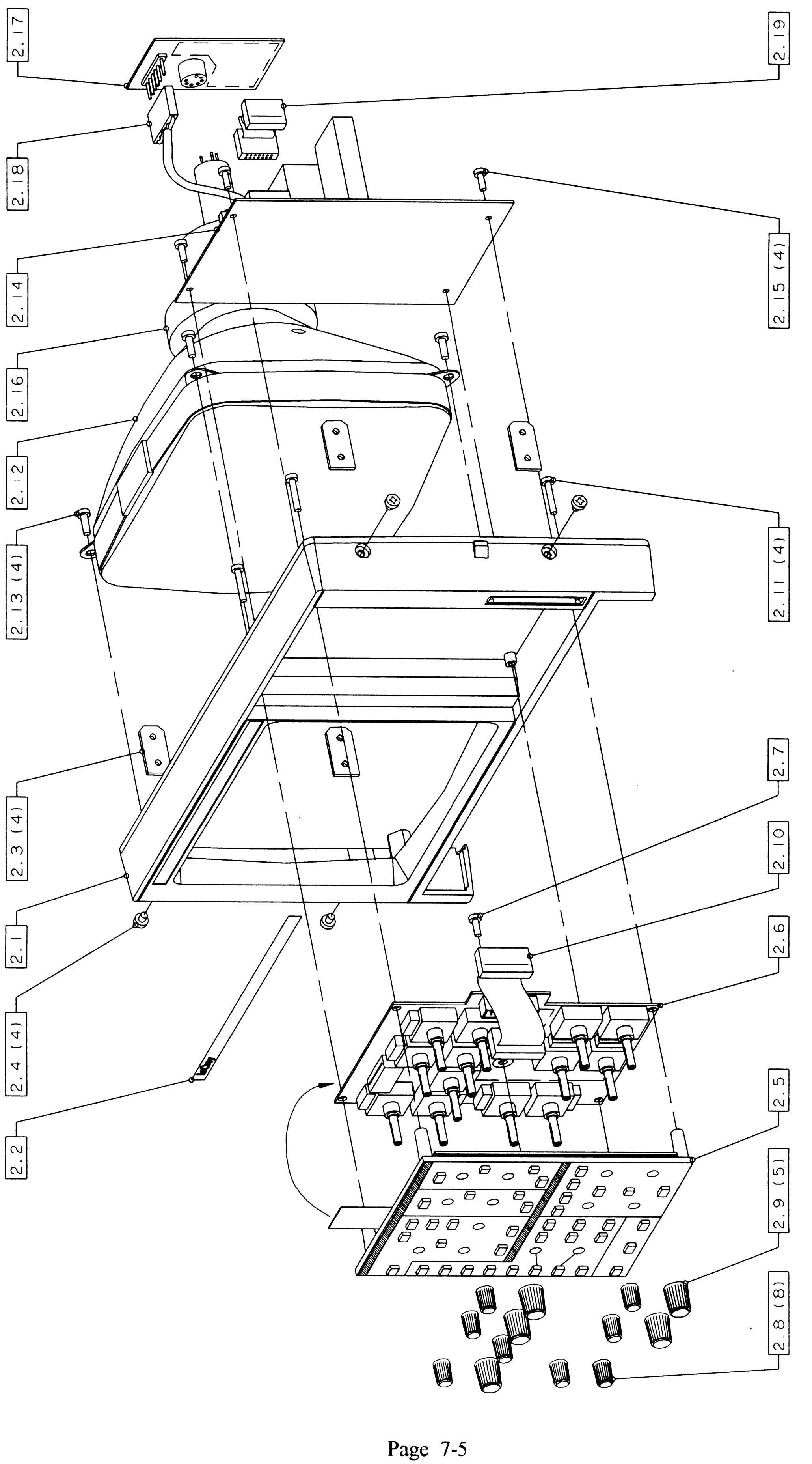


FIGURE 7.3: 9320 FRONT FRAME EXPLODED VIEW

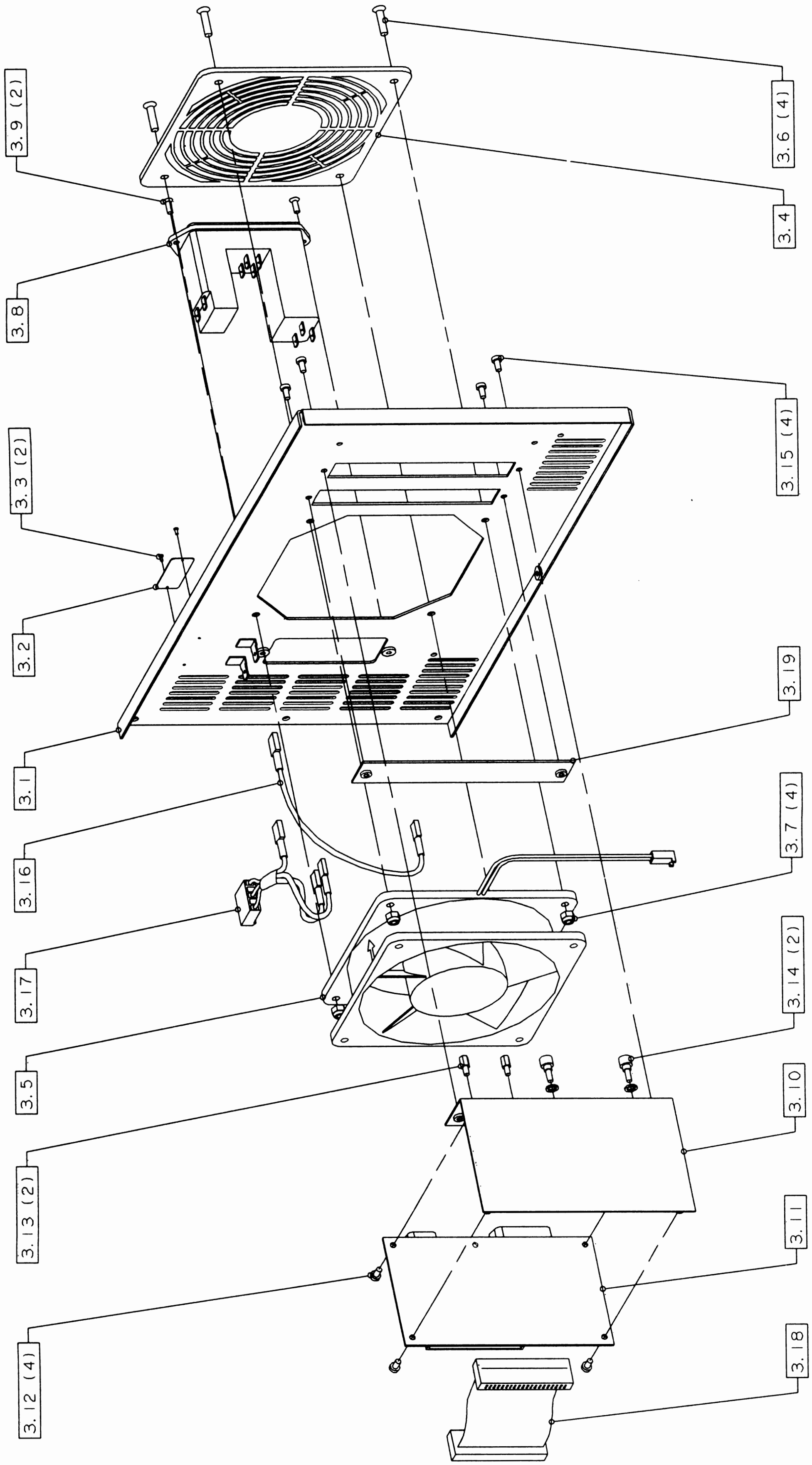


FIGURE 7.4: 9320 REAR PANEL EXPLODED VIEW

7.2.4 Removal of the F9300-4 GPIB/RS232 Interface (3.11)

The GPIB/RS232 interface (3.11) is vertically mounted on the rear panel (3.1).

Remove the following:

- Top cover (7.2.1).
- Two M3x6 screws (3.15) and washers from the rear panel (3.1).

Disconnect the flat cable (3.18) from the processor board (1.24) connector J5.

The GPIB/RS232 board can be removed forwards from the rear panel.

7.2.5 Removal of the Fan (3.5)

Remove the following:

- Top cover of 9320 (7.2.1)
- Four screws (3.6) and nuts (3.7) from the rear panel (3.1).
- Disconnect the fan power cable from the main card F9320-3 connector J602.
- Remove the fan grid (3.4).

The fan (3.5) can be removed from the unit.

CAUTION

Note the air flow, the fan extracts air from the unit and expels it.

7.2.6 Removal of the Fuse Holder (3.8)

WARNING

Disconnect the power cord.

Remove the following:

- Top cover (7.2.1).
- Two screws (3.9) from the rear panel.
- Disconnect the power cable (3.17) from the power supply connector J6.
- Disconnect the earth cable (3.16).

The fuse holder assembly (3.8) can be removed from the rear panel (3.1).

7.2.7 Removal of the 93XX-Video (2.17)

- Remove the top cover (7.2.1).
- Disconnect the ground cable from CRT (black wire)
- Disconnect the monitor cable (2.18) from the deflection board, connector W202 and W203.

Ease the video board (2.17) carefully toward the back of the DSO, until it is free.

7.2.8 Removal of the 93XX-Yoke (2.16)

- Remove the top cover (7.2.1).
- Remove the 93XX-video board (7.2.7)
- Disconnect the cable from the deflection board connector W201.
- Loose the screw on the yoke ring holder.

The deflection yoke (2.16) can be removed from the cathode ray tube (2.12).

7.2.9 Removal of the front frame Assembly (2)

Remove the following:

- Top cover (7.2.1)
- Two screws (5.7) that secure the front frame assembly (2) to the lower cover (1.1).
- Disconnect the front panel flat cable (2.10) from the processor board (1.24) connector J4.
- Disconnect the deflection flat cable (2.19) from the processor board (1.24) connector J6.

The front frame assembly (2) with the CRT (2.12), yoke (2.16), video (2.17), deflection (2.14), front panel (2.6) and keyboard (2.5) can with care be removed forward from the unit.

CAUTION

Hold the CRT very carefully, or place soft padding under it.

7.2.10 Removal of the 93XX-Deflection (2.14)

The deflection board (2.14) is situated to the back of the front panel (2.1).

Remove the following

- Top cover (7.2.1).
- Front frame assembly (7.2.9).
- Disconnect the monitor cable (2.18) which lead to the video board (2.17), connector W202 and W203.
- Disconnect the cable from the deflection yoke, connector W201.
- Disconnect the EHT plug from the receptable at the right side of the CRT (2.12).

WARNING

Touch the free end of the EHT cable to the ground, this ensures that no significant charge remains. The CRT must be discharged similarly, using a tool or a long screw driver which is first placed to the ground and on the CRT receptable.

Remove the four M35x10 screws (2.15) that secure the deflection board to the plastic front frame.

The board (2.14) can now be removed from the unit.

7.2.11 Removal of the 93XX-CRT (2.12)

It is necessary to remove the front frame assembly (7.2.9). The CRT is secured to the plastic front frame by four screws (2.13).

- Remove the 93XX-video (7.2.7).
- Remove the 93XX-yoke (7.2.8).
- Disconnect the EHT cable from the deflection board. - Discharge the tube.
- Remove the four screws.

The CRT can now be removed from the front frame.

WARNING

Use care when handling the CRT. Avoid striking it on any object which may cause the tube to implode. Store the cathode ray tube face down on a soft surface.
To avoid electrical shock the CRT should be discharged after the 9320 oscilloscope is powered OFF. After disconnecting the EHT plug, ground the CRT anode lead to the metallic display support, repeat the operation to fully dissipate the charge.

7.2.12 Removal of the F9320-5 Front Panel (2.6)

Remove the following:

- Upper cover (7.2.1).
- Front frame assembly (7.2.9).
- 93XX-deflection board (7.2.10).
- Four screws (2.11) that secure the front panel.

The front panel (2.6) with the keyboard (2.5) can be removed forward from the unit.

7.2.13 Removal of the 9320 Keyboard (2.5)

Remove the following:

- Upper cover (7.2.1).
- Front frame assembly (7.2.9).
- 93XX-deflection board (7.2.10).
- F9320-5 front panel (7.2.12).
- The 13 rotary knobs (2.8 and 2.9).Take great care of the soft plastic
- One screw (2.7) that secures the keyboard to the front panel.

- Disconnect the flat ribbon cable from the front panel connector J2, and remove the keyboard P/N : 729320503.

CAUTION

When removing or installing the keyboard or the front panel, be careful of the fragile flat ribbon cable and connector.

7.2.14 Removal of the F9314M-1 Processor (1.24)

The processor board is located along the right side of the instrument.

Remove the following:

- Top cover (7.2.1).
- Front frame assembly (7.2.9).
- Disconnect the flat cable (3.18) from the F9300-4 GPIB interface connector J5

The processor can be removed vertically from the main card (1.9) F9320-3 connector J600

CAUTION

Static electricity can damage components (RAM, Eproms, microprocessor...). Antistatic precautions are required.

7.2.15 Removal of the F9320 Main Card (1.9)

Remove the following:

- Top cover (7.2.1).
- Front frame assembly (7.2.9).
- Power supply (7.2.2).
- Processor (7.2.14).

The main board with the upper shield (1.2) is horizontally mounted to the lower case cover (1.1).

Remove the twelve M3x20 screws (5.4), two M3x6 (5.5) and six M2.5x6 that secure the upper shield (1.2) to the board, rear panel and front panel.

- Disconnect the fan cable from connector J602.

The upper shield (1.20) can be removed forward from the board.

Remove the five M3x6 screws (1.18), seven M3x16 (1.19) and three M3x6 flat head screws (1.17) that secure the board to the lower cover (1.1).

The main board F9320-3 with base shield and front panel can be removed from the scope.

CAUTION

Antistatic precautions are required.

7.2.16 Removal of the Handle (1.4)

The handle with two black end caps is secured to the right side of the lower cover (1.1) by two screws (1.5) and washers (1.6).

- Remove the upper cover (7.2.1), processor board (7.2.14).

The handle can be removed from the lower case.

7.2.17 Removal of the Foot Support (1.8)

The two foot supports are clipped on the lower cover (1.1).

Remove the foot (1.7) or the support (1.8) by inserting a small flat screwdriver under the support

7.2.18 Removal of the 93XX-FD01 Floppy Disk Drive Option

- Remove the upper cover (7.2.1).
- Disconnect the flat ribbon cable from the F9300-6 interface (see figure 7.5).
- Remove the two M3x6 screws that secure the floppy drive support to the upper cover.
- Remove the support 70FD01021 and frame 70FD01031 from the cover. - Remove the four M2.5x4 screws that secure the floppy to the support

The floppy disk drive can be removed from the frame

7.2.19 Removal of the 93XX-GP01 Graphic Printer and F9300-7 Controller Option

- Remove the upper cover (7.2.1).
- Disconnect the power cable (780210030) from the 93XX-PS1715 power supply (see figure 7.6).
- Disconnect the flat ribbon cable (780791604) from the F9300-7 controller (see figure 7.6).
- Disconnect the flat ribbon cable (780721022) between the F9300-6 interface and F9300-7 controller.
- Remove the four M3x6 screws that secure the F9300-7 controller to frame (70GP01031).
- Remove the F9300-7 controller
- Remove the two M3x6 screws that secure the printer to the frame

The graphic printer can now be removed from the upper cover.

7.2.20 Removal of the F9300-6 Centronics Interface Option

- Remove the upper cover (7.2.1).
- Remove the two M3x6 screws from the rear panel
- Disconnect the flat cable from the F9300-4 GPIB/RS232 board (see figure 7.5 or 7.6).

The graphic printer, floppy disk drive, and centronics interface board can be removed forward from the rear panel.

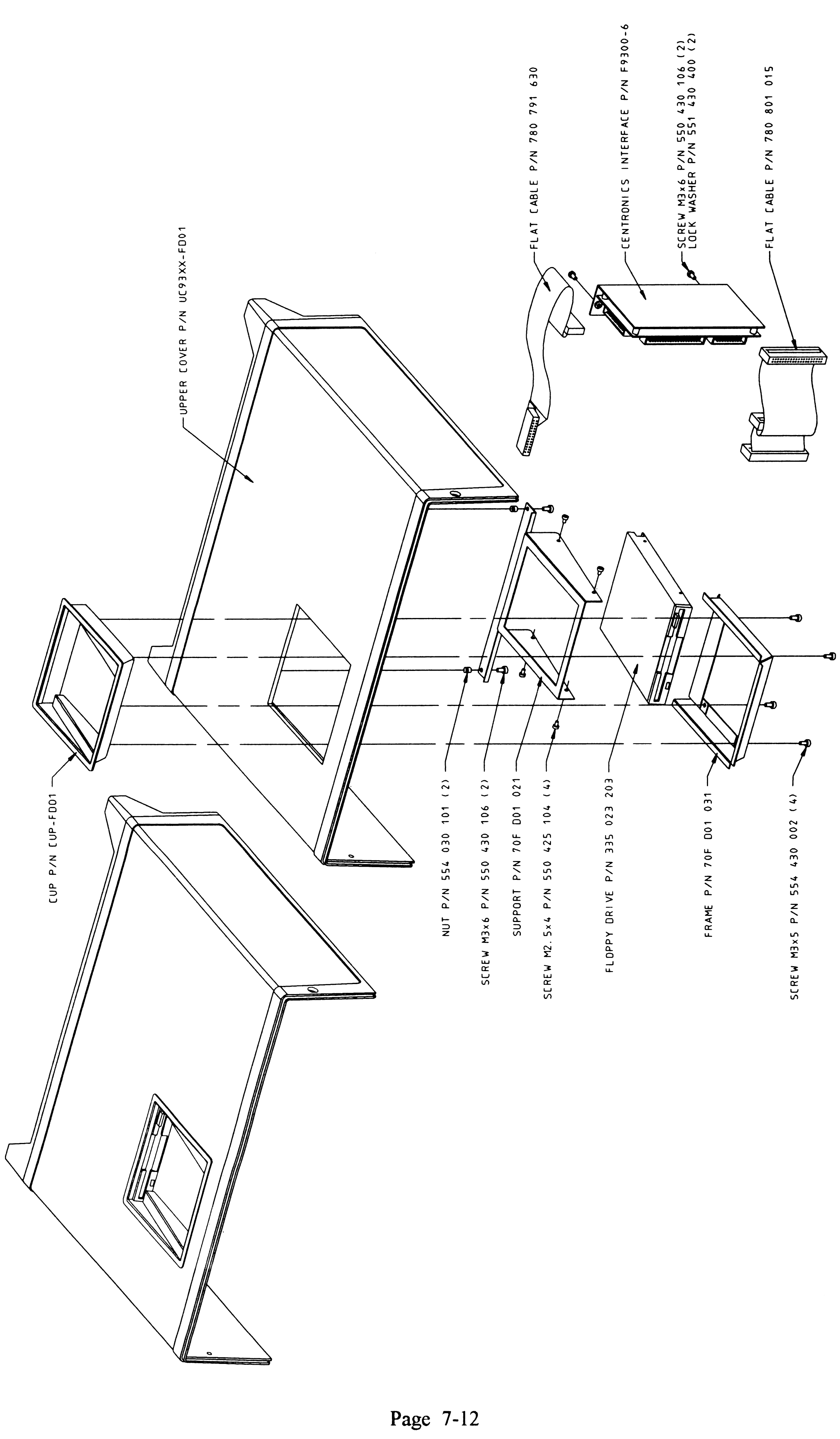


FIGURE 7.5: 9320-FD01 ASSEMBLY: FLOPPY OPTION

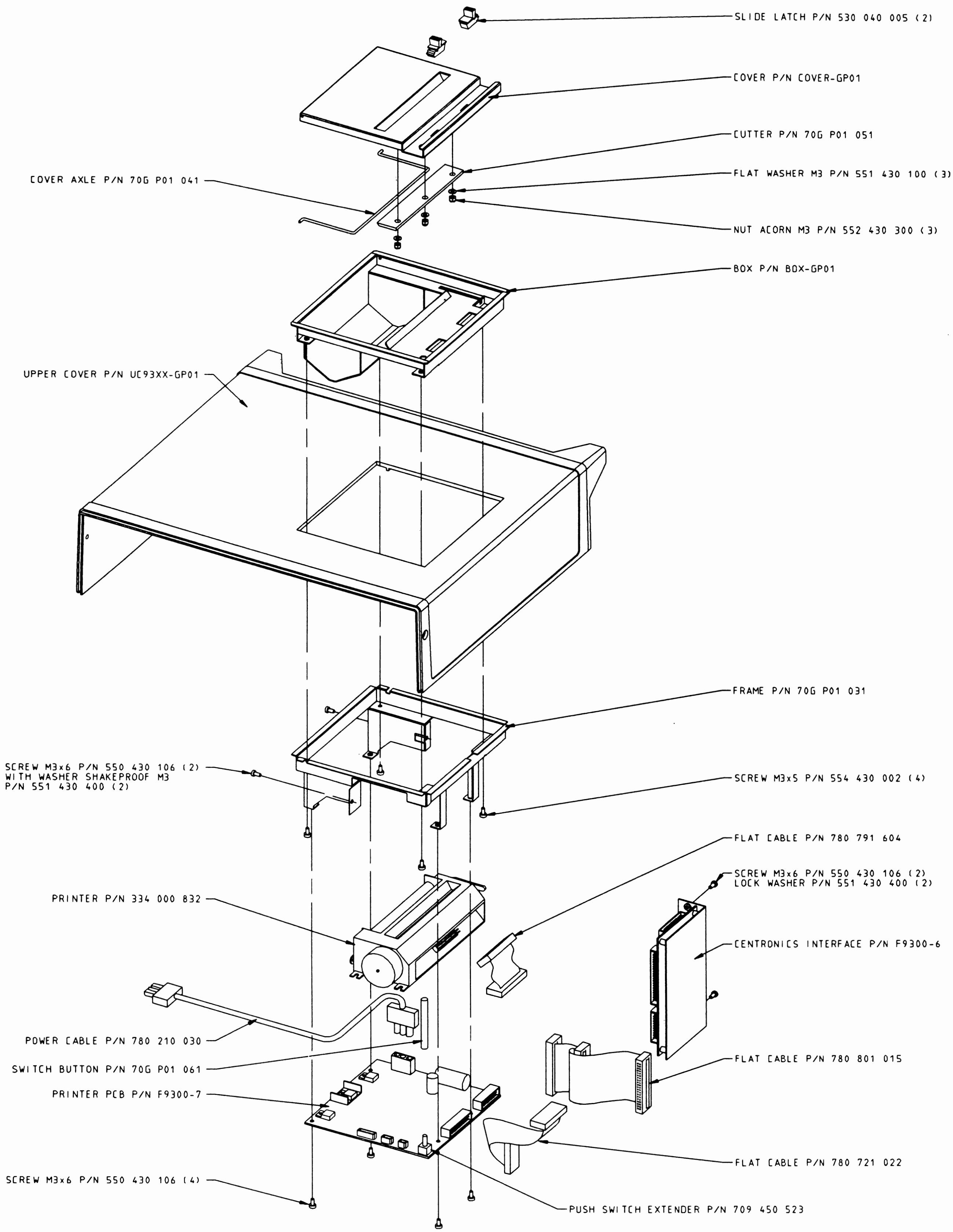


FIGURE 7.6: 9320-GP01 ASSEMBLY: PRINTER OPTION

7.3 Software Upgrade Procedure

The processor board carries the program memory (768 Kbytes) contained in four Eproms (Loc A22, A27, A29, A38), the character font Eprom (Loc A1) used by the graphic processor of the raster scan display, and the software option selection GAL (Loc A19). After any software change, a general instrument reset is mandatory. Simultaneously press the autosetup button, the top menu button and the return button.

7.3.1 Upgrading Firmware

LeCroy Corporation has a policy of continually improving and upgrading its products. The firmware can be upgraded to the latest version by changing the four Eproms 1H, 1L, 2H, 2L on the processor board at locations A22, A27, A29 and A38 (see figure 7.7). Access is possible by removing the upper cover (7.2.1).

The Eproms can be removed by using an IC extractor. Make sure that the guiding notch in the chip is aligned with the PCB. Same procedure for the character font Eprom at location A1.

7.3.2 Changing Software Options

The software option selection GAL is located on the processor board at location A19 (see figure 7.7). Insert or replace the GAL to select new options.

Make sure that the orientation notches are correctly aligned with the PCB.

7.3.3 Software Option Selection GAL

As of today the following software options are available:

0000:	Standard	GAL not necessary
0001:	WP01	Advanced Math package
0002:	WP02	Basic FFT package
0200:	CARD	Memory card

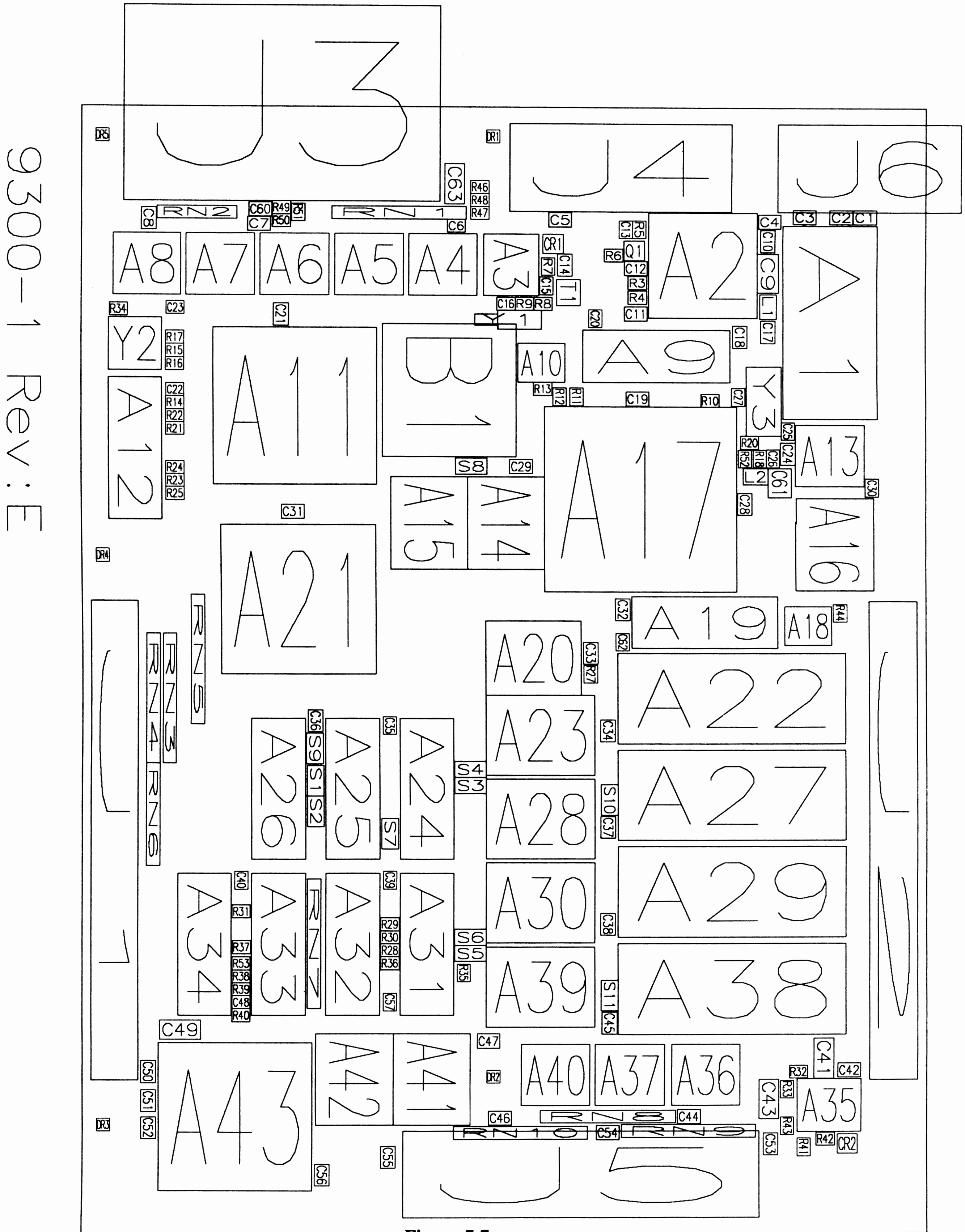

9300-1 Rev:E
J3
J4
J6
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
A21
A22
A23
A24
A25
A26
A27
A28
A29
A30
A31
A32
A33
A34
A35
A36
A37
A38
A39
A40
A41
A42
A43
B1
Y2
Y3
J5

Figure 7.7

OPTIONS			
Memory Card	WP01	WP02	GAL DESCRIPTION
no	no	no	GAL NOT NECESSARY
no	no	yes	CLE 001-A
no	yes	no	CLE 002-A
no	yes	yes	CLE 003-A
yes	no	no	CLE 200-A
yes	no	yes	CLE 201-A
yes	yes	no	CLE 202-A
yes	yes	yes	CLE 203-A

GAL CLE XXX-R : XXX : Software option, R : Release

3-Nov-93
9:44:16

STATUS

Acquisition
System
Text & Times
Waveform

Serial Number 932001347

Soft Version 9320_ 03.3

Soft Options
WP01 WP02
CKIO MC01

Hard Options
GPIB R232
CLBZ I2C

20 Ms/s

AUTO

7.3.4 Processor Board Exchange Procedure

The replacement board is supplied without any firmware or options. Therefore the existing GAL (Loc A19) and eproms (Loc A22, A27, A29, A38) must be transfered from the faulty board to the new board. After upgrading firmware or changing the software option, check that the scope boots correctly. Then check in the system summary, by using the show status button on the front panel, the software version, software options and serial number.

The serial number of the 9320 oscilloscope is loaded in the real time clock memory which is battery backed up. If it becomes necessary to replace the processor board, the serial number must be loaded in the memory of the new board by using LeCroy program " LeCalsoft " under GPIB remote control.

To run " LeCalsoft " type SKP.exe, in the main menu type S, and follow the instructions, use five digits to enter the serial number (i.e. 01347).

7.4 Equipment and Spare Parts Recommended for Service

7.4.1 Equipment

The following equipment is needed to provide the technician access to the 9320 subassemblies during repair and calibration (see section 5 and 6).

Instrument	Qty	Specifications	Recommended
Signal Generator (sine wave)	1	Frequency : 500 KHz to 1 GHz Accuracy : 0.001 % Amplitude : 1 V peak to peak	Marconi 2030
Signal Generator (sine wave)	1	Frequency : 5 KHz Amplitude : 6 V peak to peak	Topward TFG-8101
DC precision Power Supply	1	Amplitude : 10 V, DC Accuracy : < 0.1 %	Tektronix PS5004
Digital Multimeter	1	5 digits	Keithley 199
Power meter	1	dBm mode	HP 436A
Fast pulser	1	Rise time < 500 psec	LeCroy 4969
Digital scope	1	Bandwith 350 MHz	LeCroy 9450A
Cable	1	BNC, 50 Ω, length 20 cm (7.87 inches)	Suhner
Cable	1	BNC, 50 Ω, length 100 cm (39.37 inches)	Suhner
BNC T adapter	1	BNC, 50 Ω, T adapter	Suhner
SMA power splitter	1	50 Ω, 6 dB, 0.5 W	Suhner 4901.19A
SMA adapter	1	50 Ω,	Suhner SMA 50-1
Cable	2	BNC to SMA, 50 Ω length 100 cm (39.37 inches)	Suhner RG 58 C/U

7.4.2 Spare Parts

In order to make the repair of 9320 oscilloscope at board level, a minimum stock of boards is at least one each:

- F9314M-1	:	Processor board
- F9320-3	:	Main board
- F9300-4	:	GPIB/RS232 interface
- F9320-5	:	Front panel with keyboard
- 93XX-Display	:	Raster monitor kit
- 93XX-PS1715	:	Power supply

If the unit is equipped with the 93XX-FD01 option :

- F9300-6	:	Floppy, Graphic printer, Centronics Interface
- 335023203	:	Floppy disk drive

If the unit is equipped with the 93XX-GP01 option :

- F9300-6	:	Graphic printer, Floppy, Centronics Interface
- F9300-7	:	Graphic printer controller
- 334000832	:	LPT5446 Seiko Graphic printer

The other parts (fan, fuse holder, scope handle, covers, rear panel...) are not on the above list because they are reliable parts and the probability of failure is very low.

7.5 Troubleshooting and Flow Charts

7.5.1 Introduction

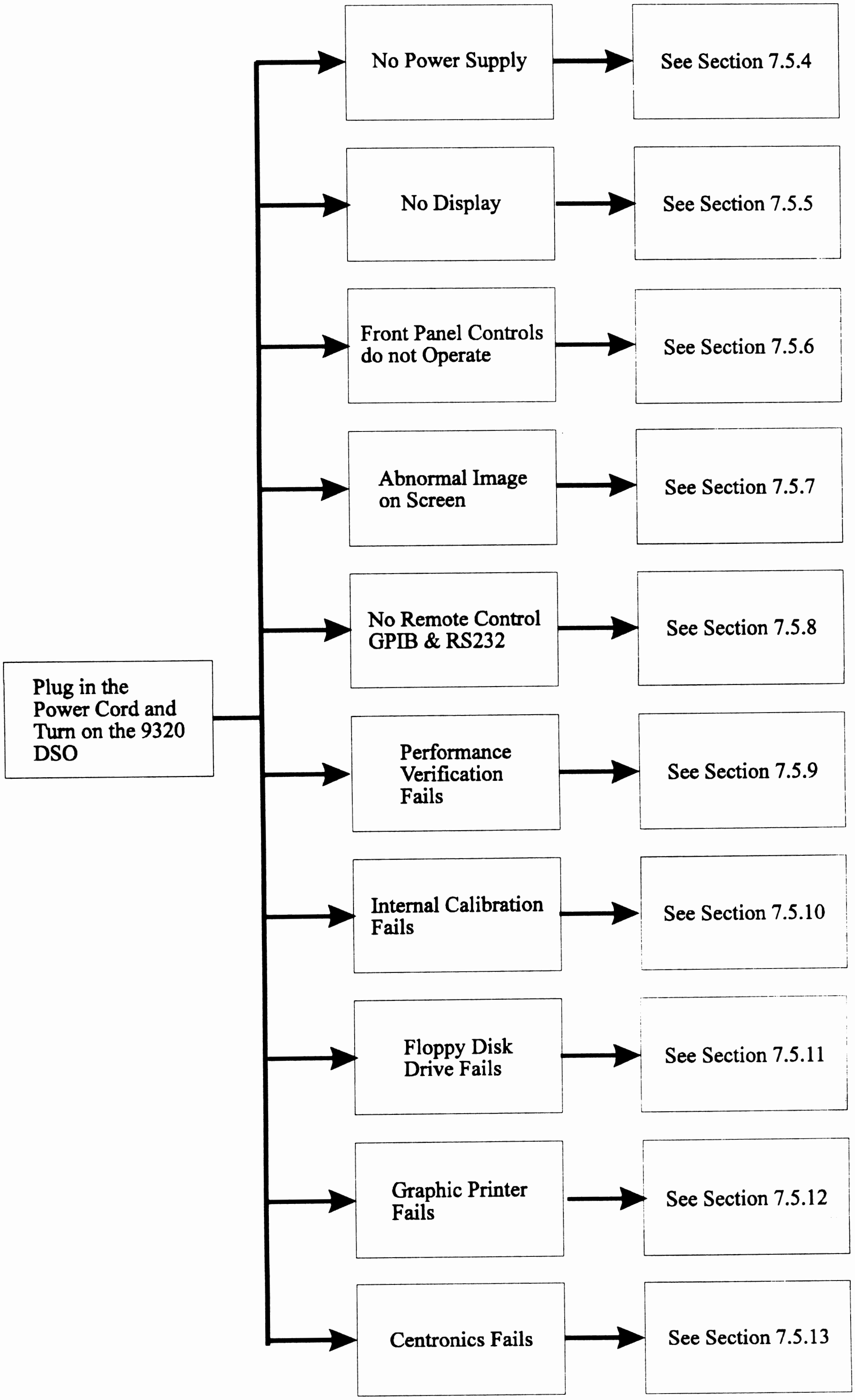
The troubleshooting information contained in this section is intended for use by qualified personnel having a basic understanding of electronics (analog and digital). In order to simplify servicing and minimize downtime, the following list of possible symptoms, likely causes, and troubleshooting steps have been prepared.

The first step in troubleshooting is to check for obvious items like blown fuses.
The power supply is the next item to check before proceeding to more detailed troubleshooting, since noise or low power supply voltages can cause a variety of digital and analog problems.

7.5.2 Initial Troublesooting Chart

Most procedures in this section will allow troubleshooting down to the board level.

Defective circuit boards will be repaired or exchange by the regional LeCroy service office or the local representative (see section 1.4).


Plug in the Power Cord and Turn on the 9320 DSO
No Power Supply
See Section 7.5.4
No Display
See Section 7.5.5
Front Panel Controls do not Operate
See Section 7.5.6
Abnormal Image on Screen
See Section 7.5.7
No Remote Control GPIB & RS232
See Section 7.5.8
Performance Verification Fails
See Section 7.5.9
Internal Calibration Fails
See Section 7.5.10
Floppy Disk Drive Fails
See Section 7.5.11
Graphic Printer Fails
See Section 7.5.12
Centronics Fails
See Section 7.5.13

7.5.3 Line Voltage Autoranging

The 9320 oscilloscope operates from a 115 V (90 to 132 V) or 220 V (180 to 250 V) normal power source at 45 Hz to 66 Hz.
No voltage selection is required since the instrument automatically adapts to the line voltage which is present.
The instrument operates at line frequencies up to 440 Hz. However, at frequencies above 60 Hz, the leakage current from phase to ground slightly exceeds the safety recommendations for industrial instruments in some countries.
This current reaches 4 mA Max at 250 V/400 Hz.

7.5.4 No Power Supply

7.5.4.1 Line Fuses Replacement

The power supply of the oscilloscope is protected against short circuits and overload by means of two 5A/250 V fuses located above the main plugs.

WARNING

Disconnect the instrument from the power line and from other equipment before replacing fuses.

To replace line fuses, proceed as follow:

- Turn off the power and disconnect the line cord from the instrument

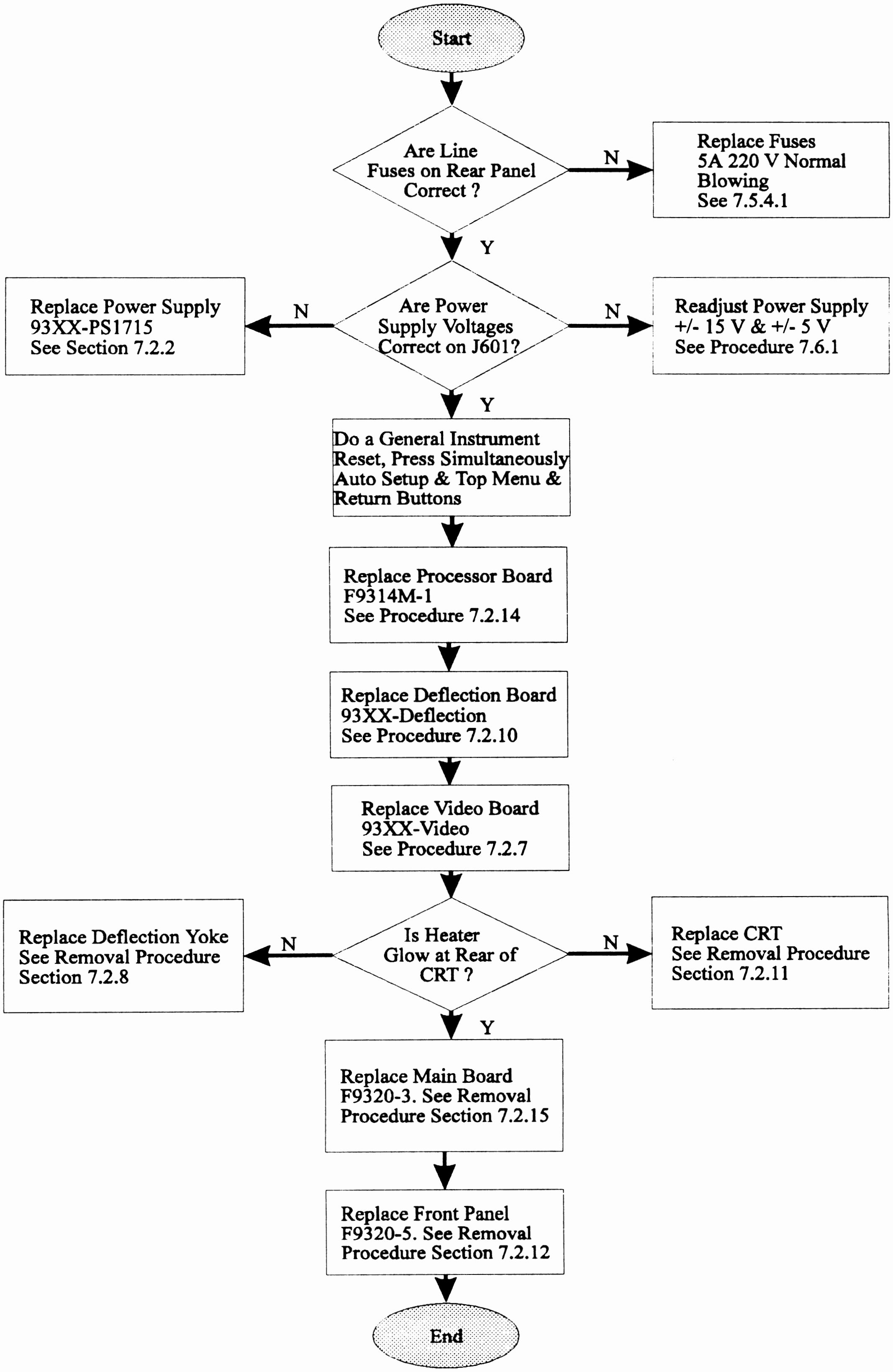
- Open the fuse box by inserting a small flat screwdriver under the plastic cover and remove the fuse carrier from the holder

- Remove the 5 amp fuse and replace it with the proper type:

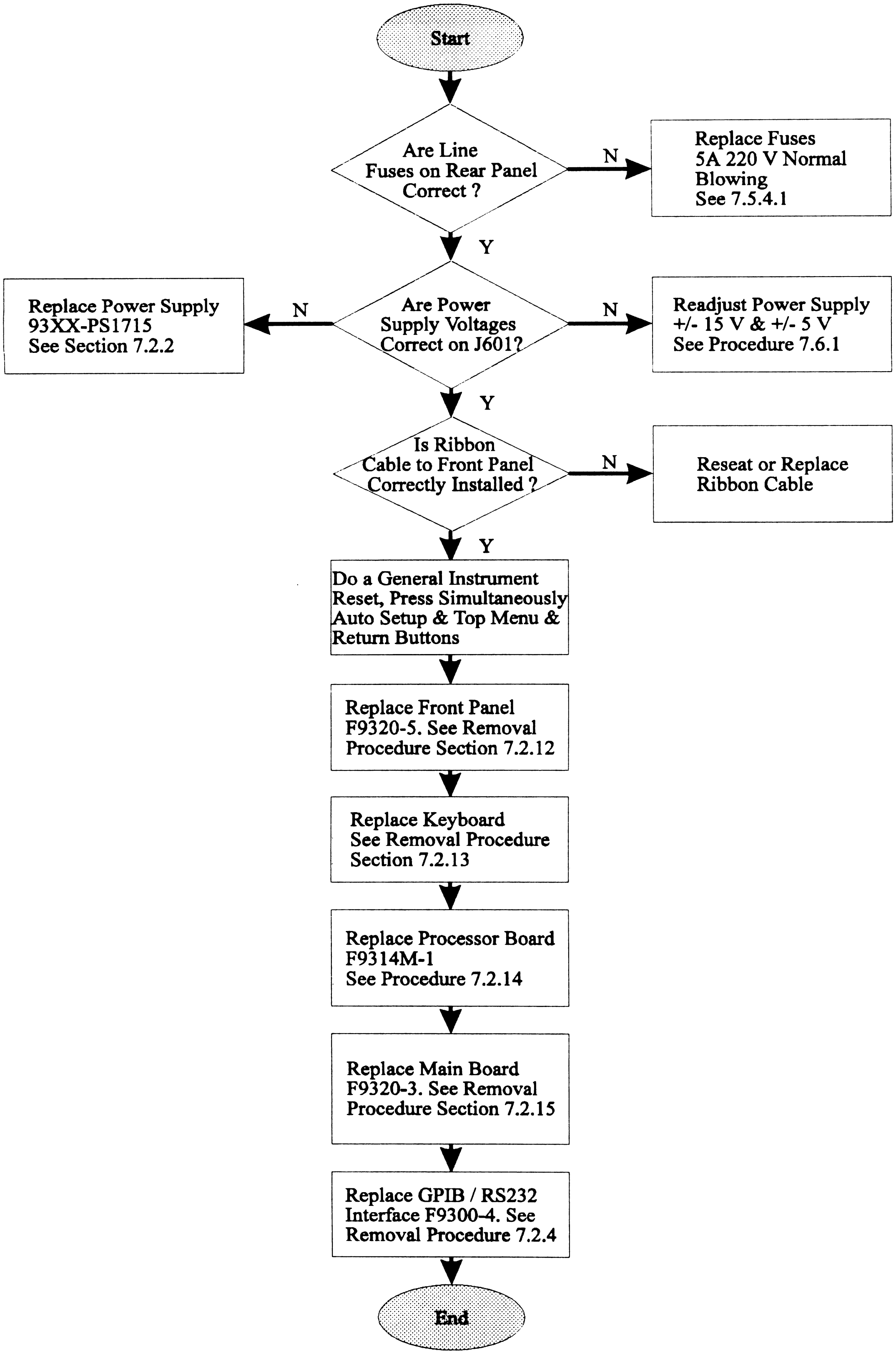
  5 amp/250 V, 3AG normal blowing.

  LeCroy part number: 433 162 500

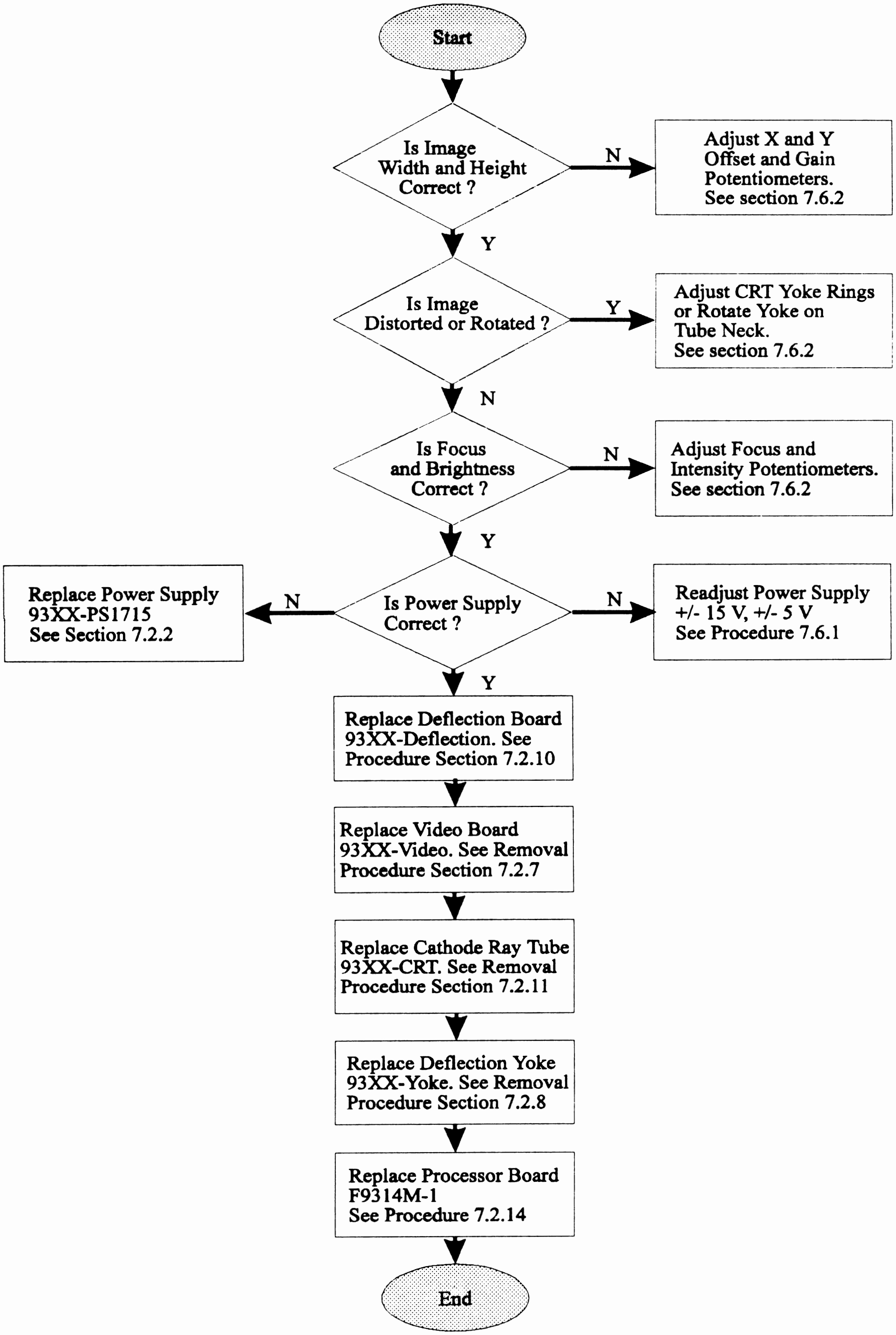
7.5.5 No Display



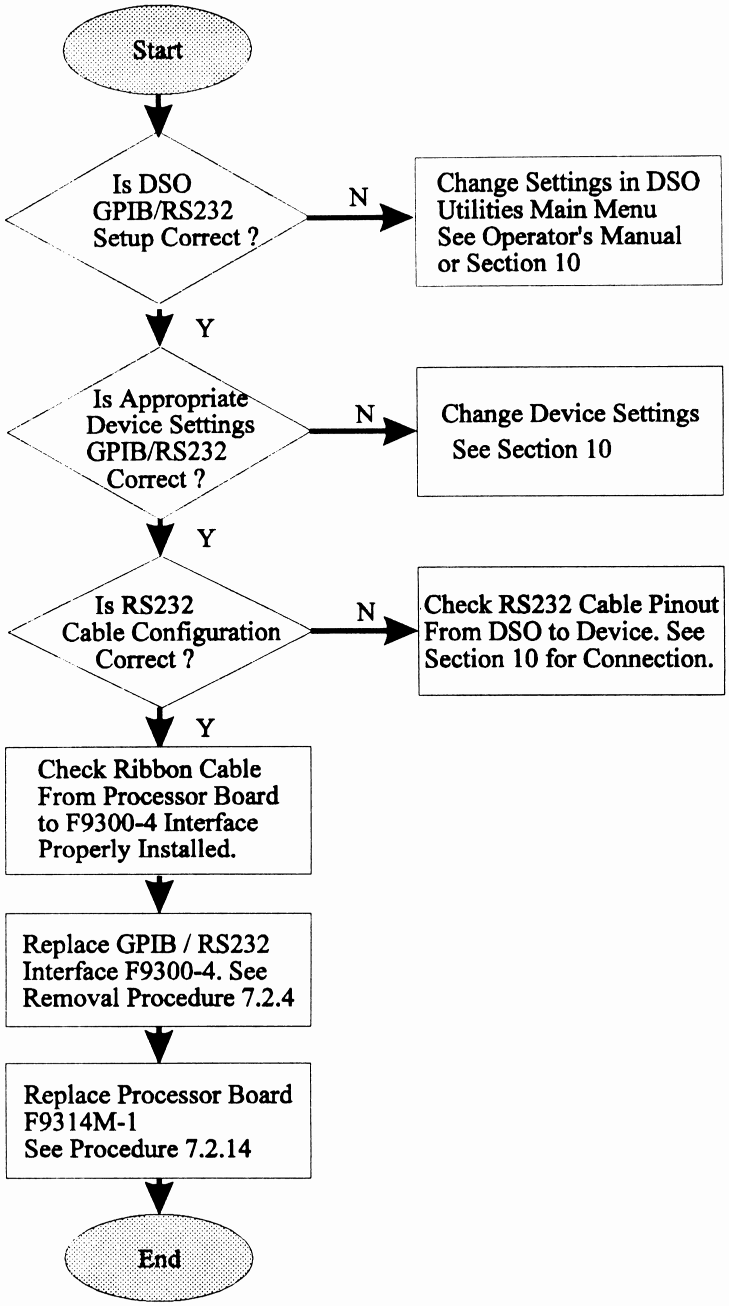
7.5.6 Front Panel Controls Do Not Operate



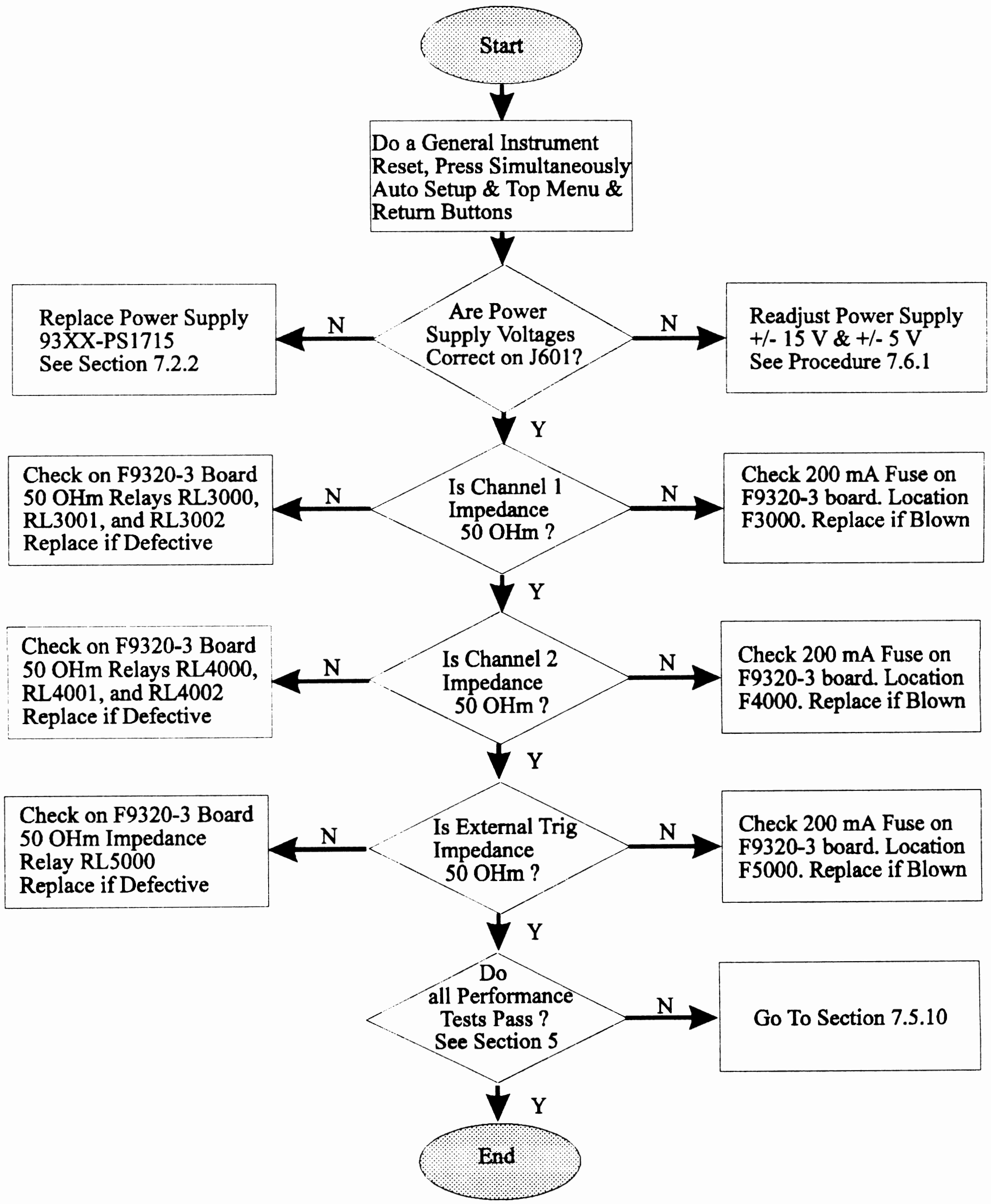
7.5.7 Abnormal Image On Screen



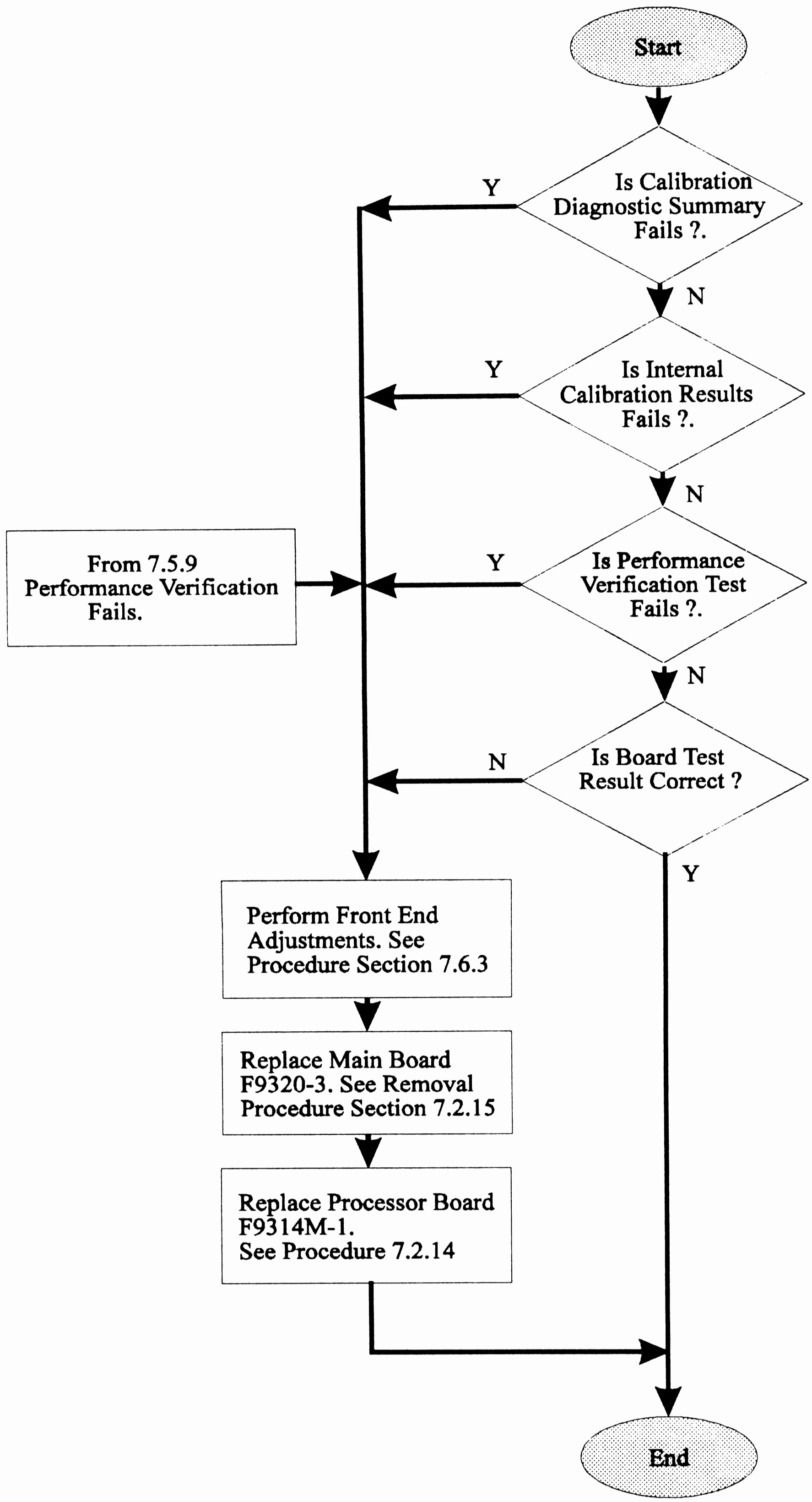
7.5.8 No Remote Control GPIB and RS232



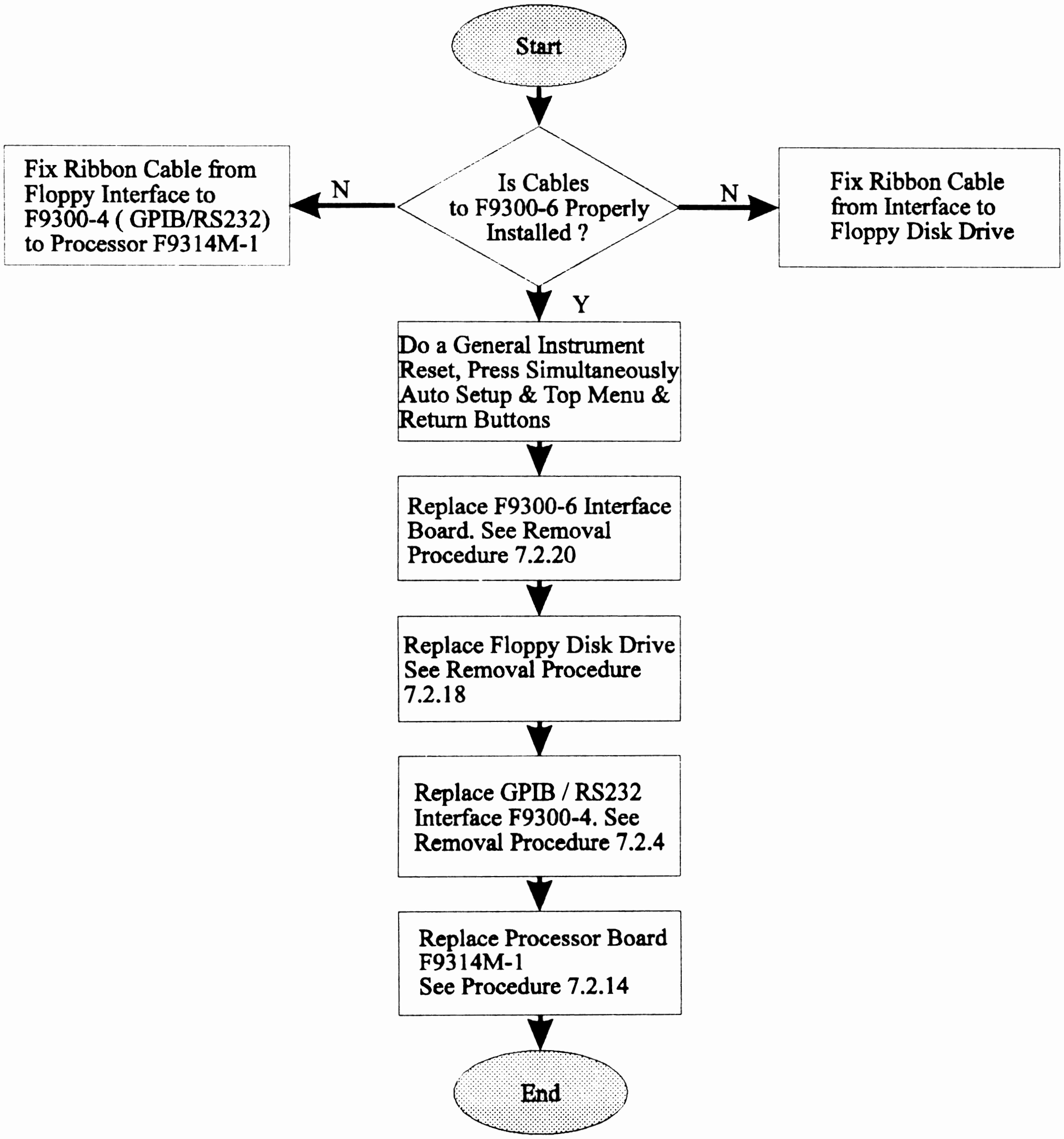
7.5.9 Performance Verification Fails



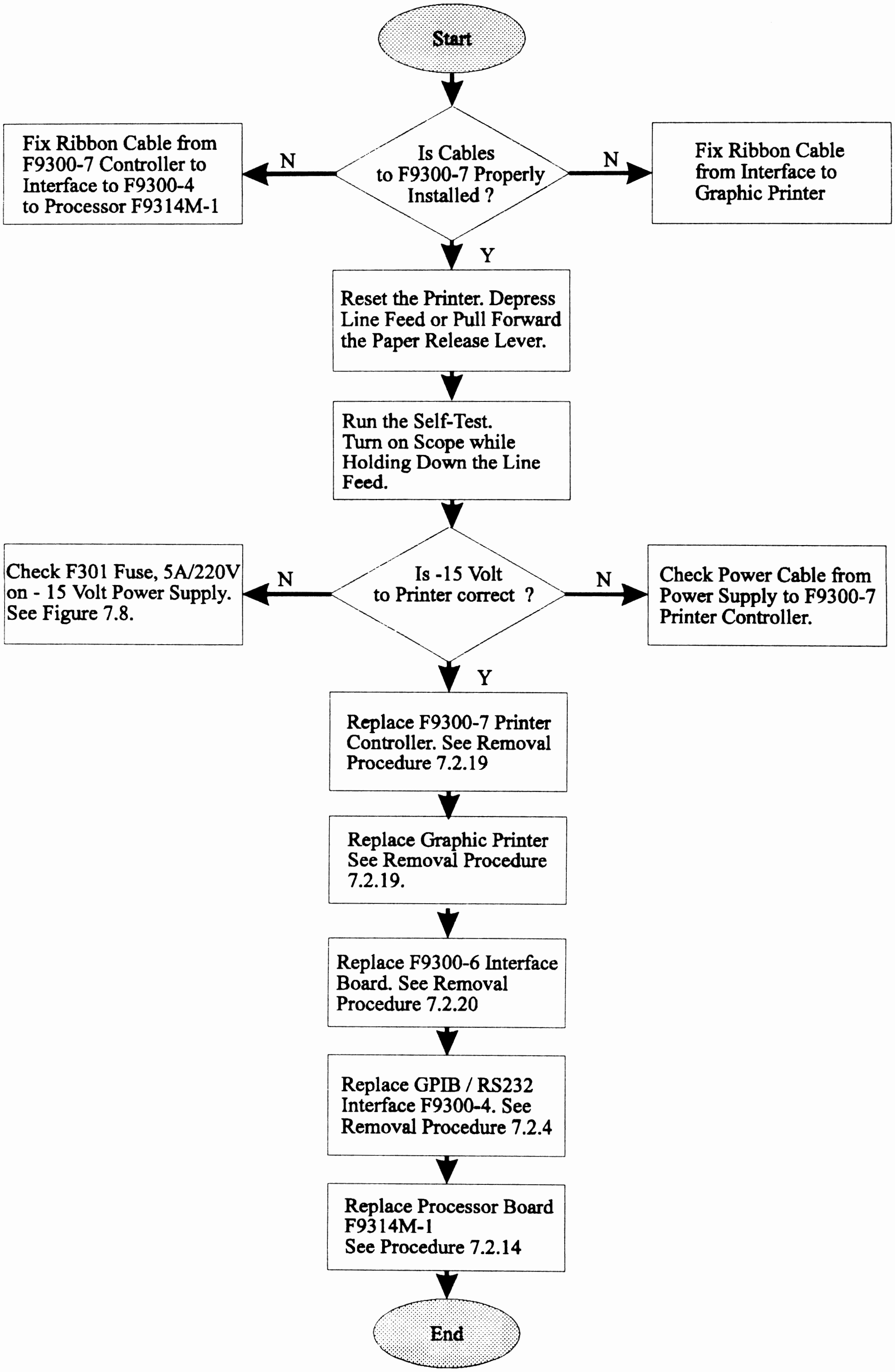
7.5.10 Internal Calibration Fails



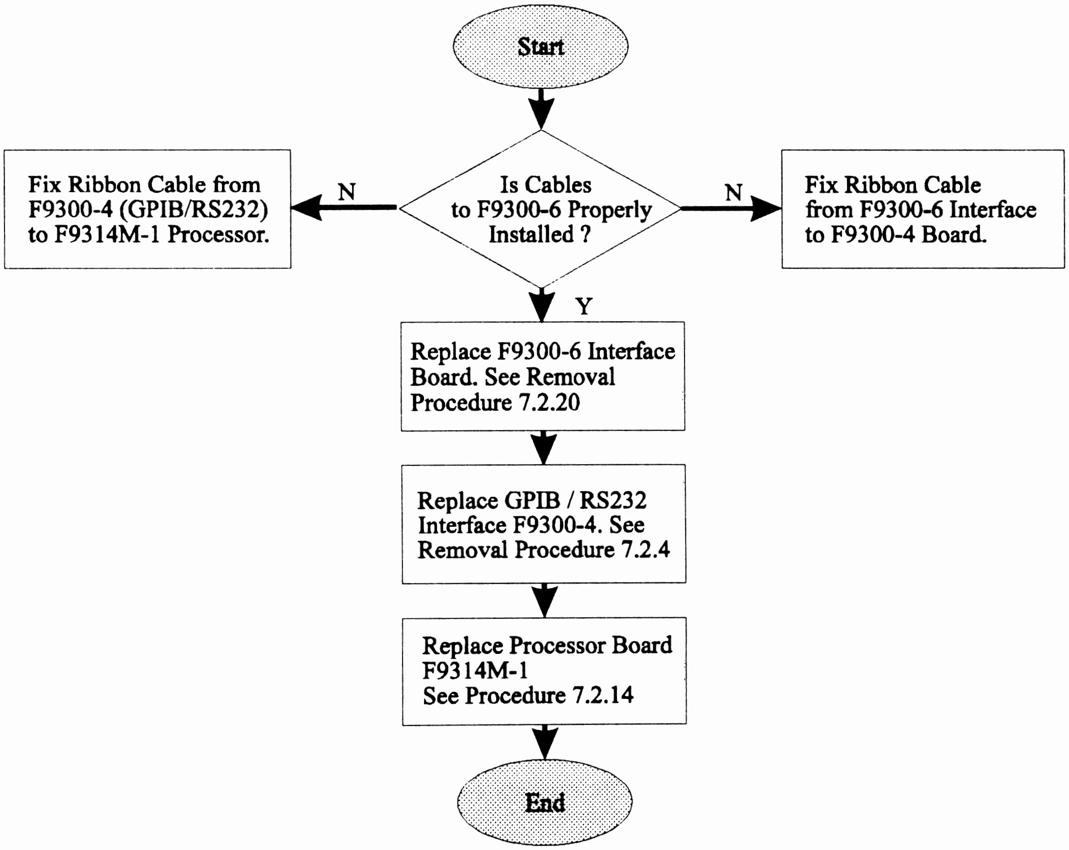
7.5.11 Floppy Disk Drive Fails



7.5.12 Graphic Printer Fails



7.5.13 Centronics Fails



7.6 Calibration Procedures

The following section includes the adjustments required for the power supply, front end and display. It is recommended that they be verified at one year intervals.

7.6.1 93XX-PS1715 Power Supply Calibration

The four voltages are adjustable by ± 5% of the nominal value.

The reference for the measurements are the pins on connector J601 located on the main board F9320-3.

From right to left:

Pin 10 :	-15.1 V	(Min = -14.85 V, Max = -15.15 V)
Pin 9 :	+15.1 V	(Min = +14.85 V, Max = +15.15 V)
Pin 8 :	- 5.2 V	(Min = - 5.15 V, Max = - 5.25 V)
Pin 6 :	GND	
Pin 5 :	+ 5.2 V	(Min = + 5.15 V, Max = - 5.25 V)

For the calibration of the power supply proceed as follow:

- Turn off the power
- Remove the top cover (7.2.1)
- Remove the front frame assembly (7.2.9) and put it to the right of the unit.

- By using two extension cables, reconnect the processor board to the front panel (J4) and to the deflection board (J6).

The front frame assembly is now reconnected to the processor through the extension cables.
The four potentiometers are accessible from the front through holes in the power supply chassis.

Turn on the power and perform the adjustments (see figure 7.8).

Turn the potentiometer clockwise to increase the tension or counterclockwise to decrease the voltage.

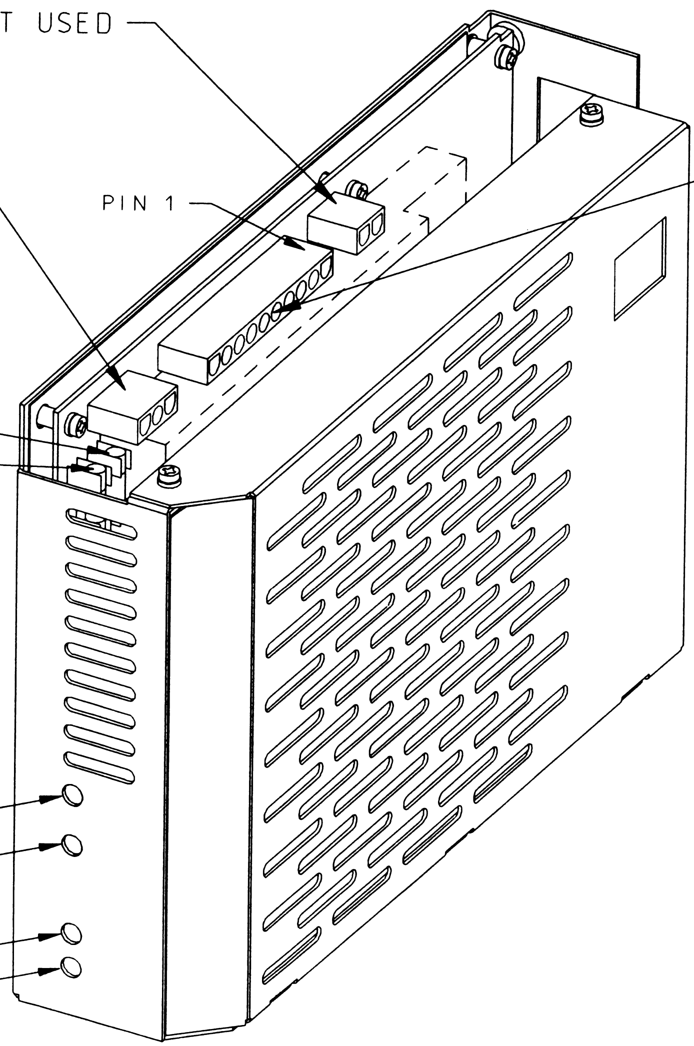


FIGURE 7.8: 93XX-PS1715 POWER SUPPLY

7.6.2 93XX-Display Adjustment Procedure

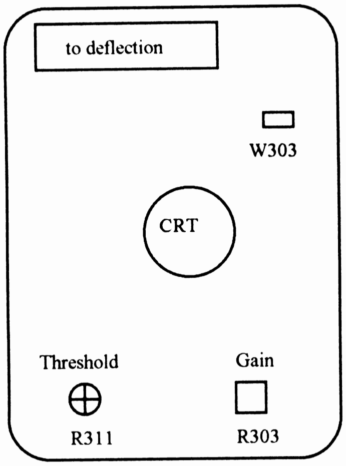
7.6.2.1 Introduction

There is a total of 12 potentiometers or variable coils to adjust the deflection and video board.

Video: (2 adjustments)

- Threshold : Level of the video board.

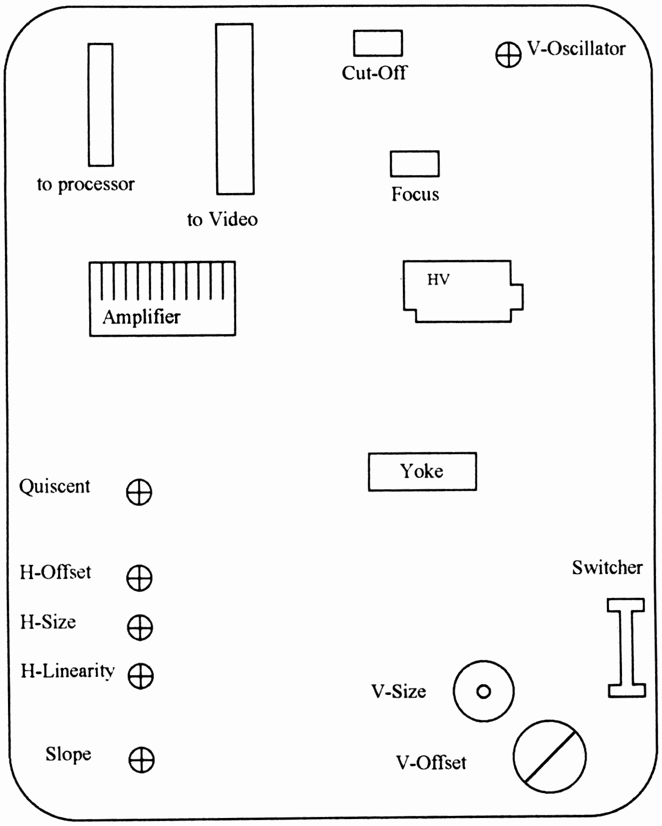
- Gain : Intensity of the screen.



Video board component side

Deflection : (10 adjustments)

- Vosc : Frequency of the vertical oscillator.
- Slope : Speed of the horizontal ramp.
- Focus : Focus of the screen.
- Cut off : Cathode ray tube cut off.
- Quiescent : Standby current of the horizontal deflection amplifier.
- H Linearity : Horizontal linearity.
- H Size : Horizontal size (Max 165mm).
- H Offset : Horizontal position.
- V Size : Vertical size (Max 120mm).
- V Offset : Vertical position.



Deflection board component side

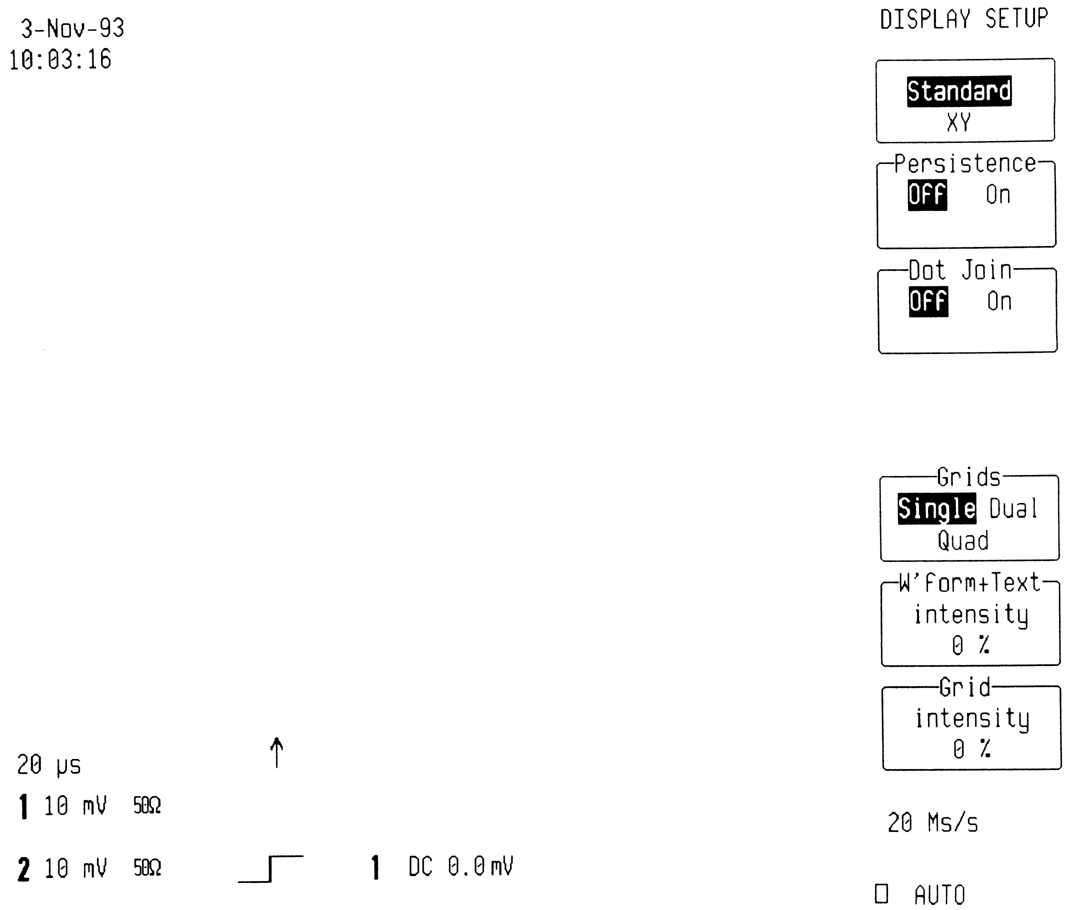
7.6.2.2 Coarse Adjustment

- Depress display button.
- Set W'form + text intensity to 0%.
- Set grid intensity to 0%

- Turn fully clockwise the intensity potentiometer on the video board.

- On the video board connect a digital multimeter on test point : W303

Adjust threshold potentiometer to get 2 V ± 0.1 V on W303.



- Set W'form intensity to 100%.
- Set grid intensity to 60%.

- Adjust H-size, H-offset, V-size, V-offset to center the image in the screen.
  The vertical position should be adjusted to get the push buttons of the front panel in front of the software menus, use the utilities set up.
  The small magnets mounted on the deflection yoke influence the vertical position.

- Turn the quiescent potentiometer clockwise until the default of the horizontal lines just disappears from the vertical center of the screen.

- Increase the cut off until a vertical line appears on the right side of the screen.

- Adjust the slope potentiometer to get 5mm gap between the highlighted vertical line and the right border of the selection menus.

- Adjust H-linearity to get the best linearity.

7.6.2.3 Fine Adjustment

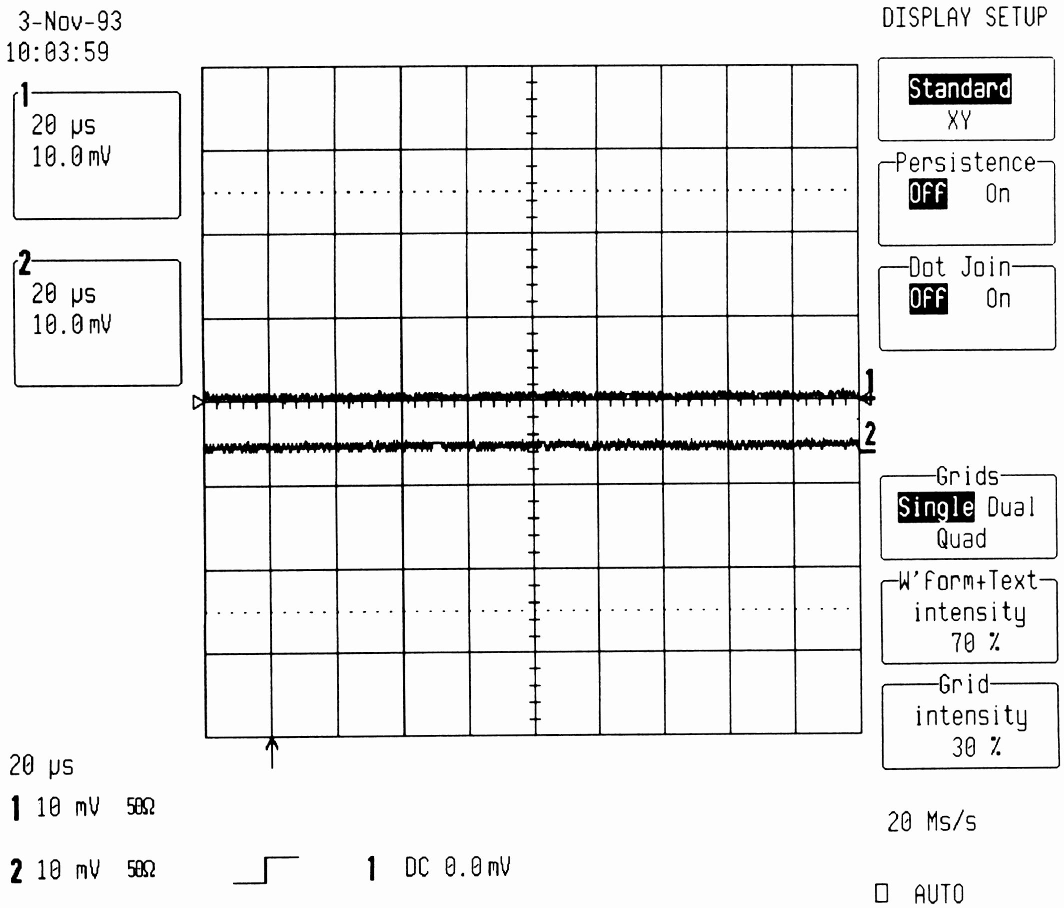
The final adjustment of the intensity, cut off, and focus must be made in a dark room.

- Set W'form intensity to 30%.
- Set grid intensity to 0%.

- Adjust the cut off potentiometer until the highlighted vertical line disappears from the right side of the screen.

- Set W'form intensity to 20%.
- Display four traces.
- On the video board adjust the gain potentiometer (intensity) in order to get the text just readable.

- Set W'form + text intensity to 70%.
- Set grid intensity to 30%



- Adjust the focus (usually fully clockwise) for most uniform focus over the entire screen.

- In a standard luminosity environment set W'form + text to 90%, and grid intensity to 60%.

- Verify the intensity, focus, and contrast adjustment, for best definition of the displayed text.

CAUTION

never change the Vosc calibration.

7.6.3 Front End Test and Calibration Procedure

7.6.3.1 Introduction

The adjustments describe in the following calibration procedure require extension of the front panel assembly out of the scope, using two flat cables.

In order to access the front end potentiometers and variable caps located underneath the Cathode Ray tube and deflection board, dismount the front panel assembly from the scope and reconnect it to the processor board connectors J4 and J6, using the extension cable set.

Once the top cover is removed and the front panel is disassembled from the scope, extra cooling of the main board is required. It's mandatory to disconnect the existing Fan from connector J602, located on F9320-3 card, and to use a Fan with the air flow oriented to the front end section of the board.

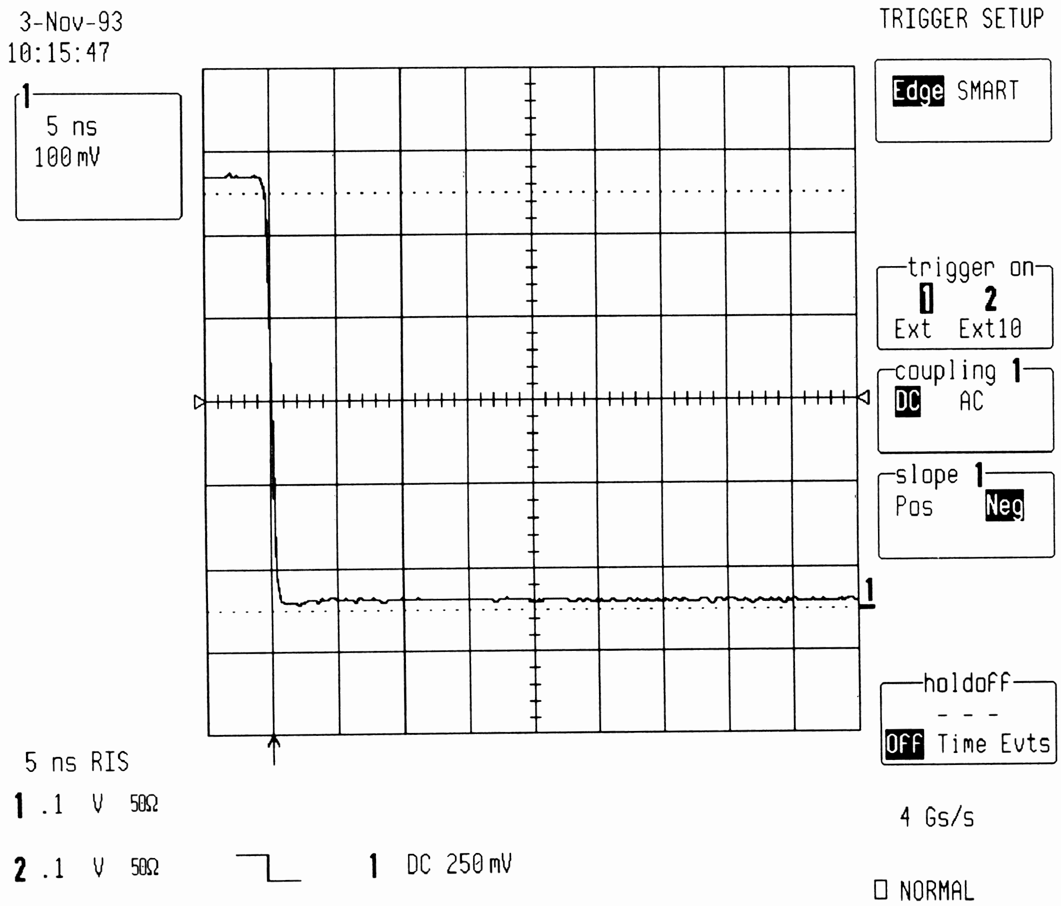
7.6.3.2 Channel 1 Gain HF Adjustment

Set the DSO as follows :

- Turn on trace	:	Ch1
- Display setup	:	Standard, Persistence off, Dot join on, Single grid
- Input coupling	:	Ch1 DC 50 Ω
- V/div. offset	:	Normal
- Probe atten	:	X1
- Input gain	:	100 mV/div
- Input offset	:	- 250 mV
- Trigger setup	:	Edge
- Trigger on	:	1
- Coupling 1	:	DC
- Slope 1	:	Neg
- Holdoff	:	Off
- Trigger level	:	DC 250 mV
- Mode	:	Norm
- Timebase	:	5 nsec/div.

Apply the pulse generator LeCroy 4969 (or equivalent rise time < 500 psec) to Channel 1.

Set pulser to 61.05 μsec.



- Turn on trace	:	A
- Select Math Setup	:	A
- For Math	:	Use at most 5000 points
- Redefine A	:	A = Average of 1
- Use Math ?	:	Yes
- Math Type	:	Average
- Avg Type	:	Summed
- Of	:	Channel 1

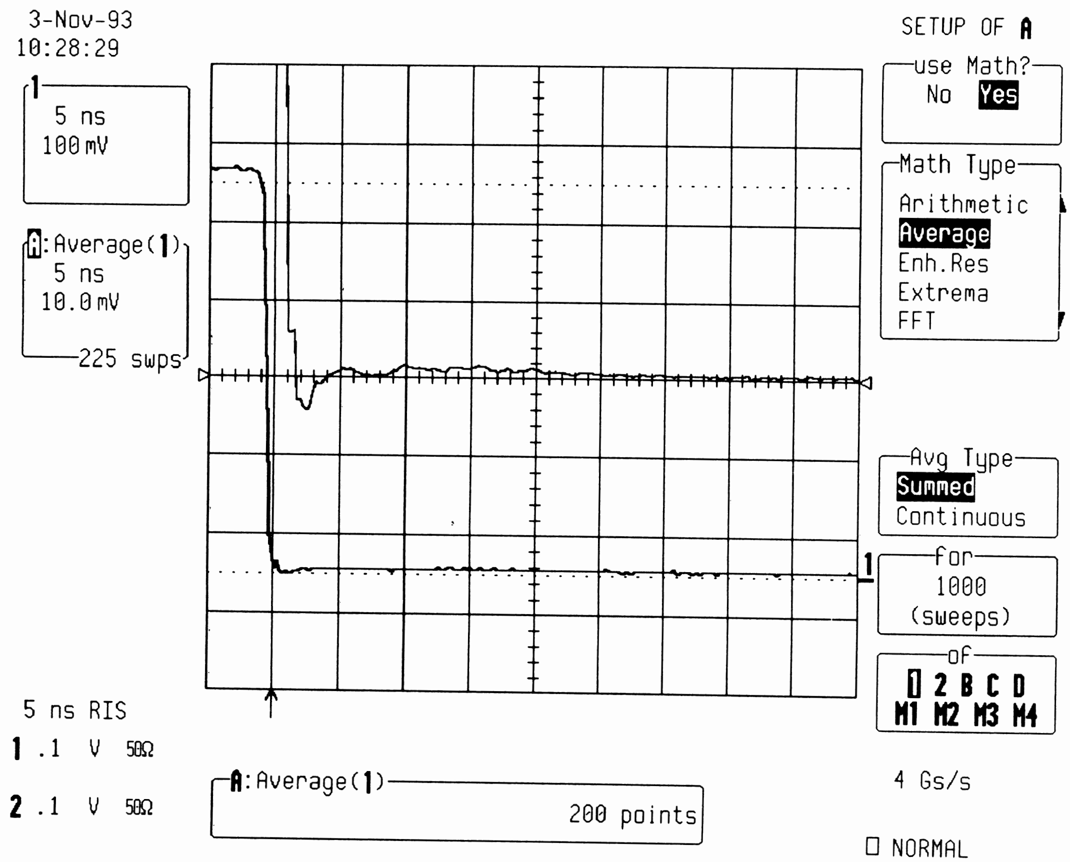
- Expand A with vertical Zoom

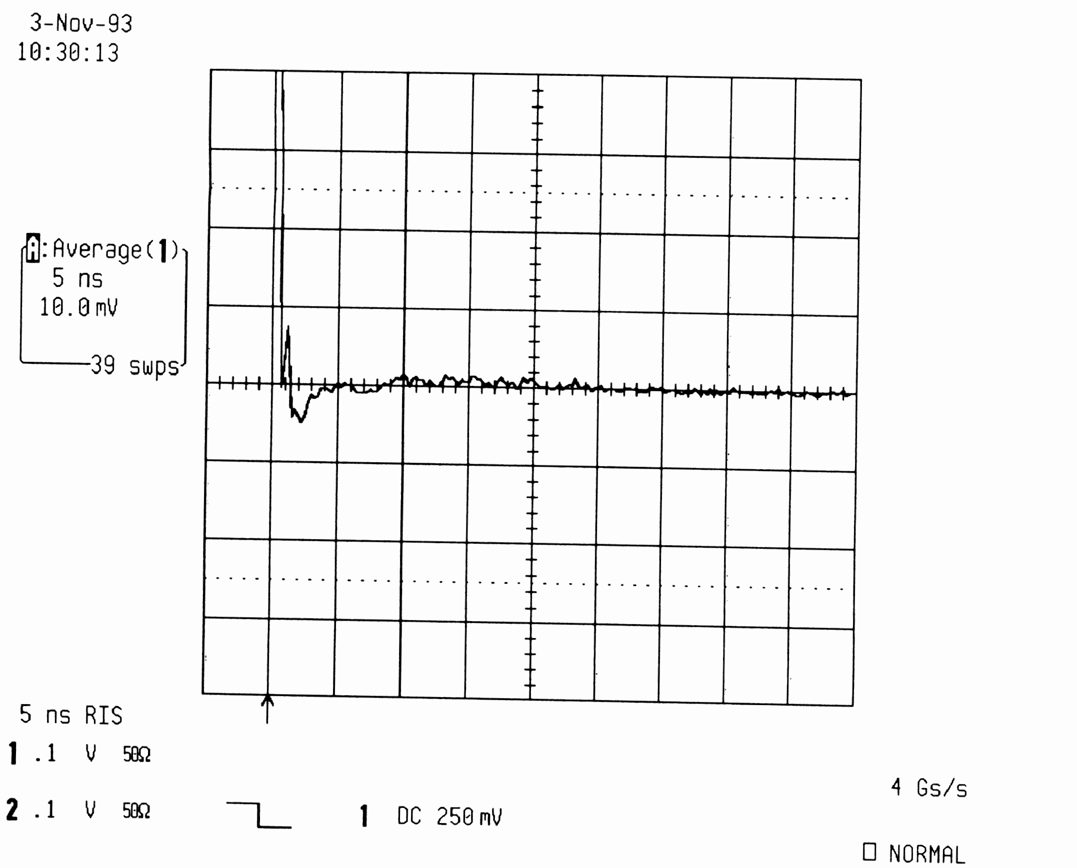
- A: Average (1) : 10.0 mV

- Place trace A in the middle of the screen with the vertical position cursor.

- Turn off : Trace 1

Adjut potentiometer R3021 in order to get a flat square wave


3-Nov-93
10:28:29
1
5 ns
100 mV
A: Average(1)
5 ns
10.0 mV
225 swps
5 ns RIS
1 .1 V 50Ω
2 .1 V 50Ω
A: Average(1)
200 points
SETUP OF A
use Math?
No Yes
Math Type
Arithmetic
Average
Enh.Res
Extrema
FFT
Avg Type
Summed
Continuous
for
1000
(sweeps)
of
1 2 B C D
M1 M2 M3 M4
4 Gs/s
NORMAL

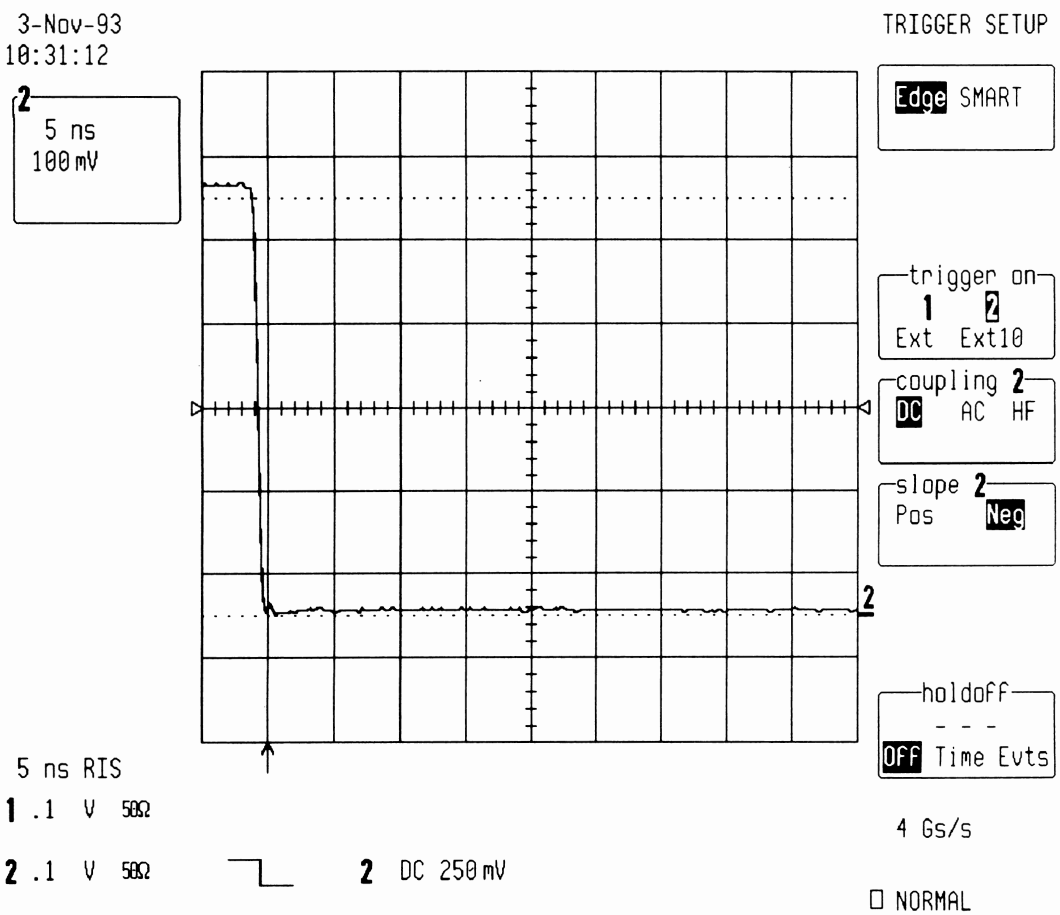

3-Nov-93
10:30:13
A: Average(1)
5 ns
10.0 mV
39 swps
5 ns RIS
1 .1 V 50Ω
2 .1 V 50Ω
1 DC 250 mV
4 Gs/s
NORMAL

7.6.3.3 Channel 2 Gain HF Adjustment

Set the DSO as follows :

- Turn on trace	:	Ch2
- Display setup	:	Standard, Persistence off, Dot join on, Single grid
- Input coupling	:	Ch2 DC 50 Ω
- V/div. offset	:	Normal
- Probe atten	:	X1
- Input gain	:	100 mV/div
- Input offset	:	- 250 mV
- Trigger setup	:	Edge
- Trigger on	:	2
- Coupling 2	:	DC
- Slope 2	:	Neg
- Holdoff	:	Off
- Trigger level	:	DC 250 mV
- Mode	:	Norm
- Timebase	:	5 nsec/div.

Apply the pulse generator LeCroy 4969 to Channel 2.

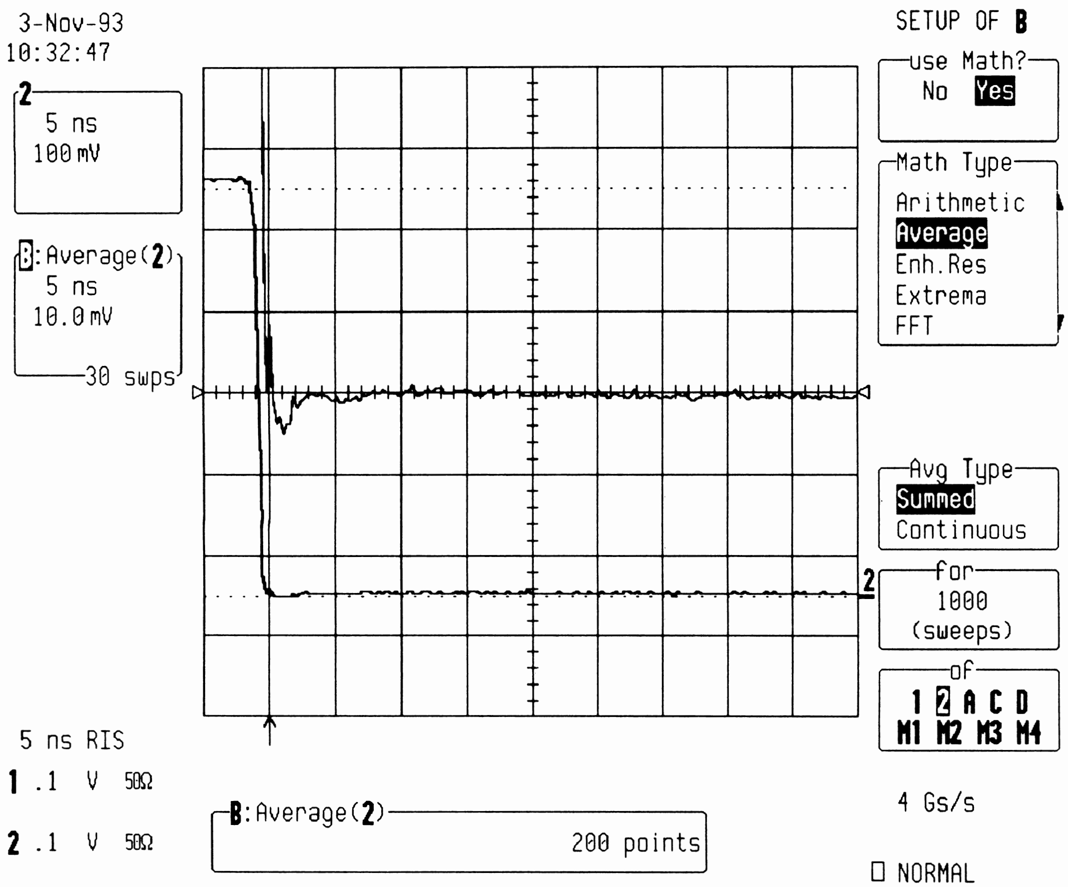


- Turn on trace	:	B
- Select Math Setup	:	B
- For Math	:	Use at most 5000 points
- Redefine B	:	B = Average of 2
- Use Math ?	:	Yes
- Math Type	:	Average
- Avg Type	:	Summed
- Of	:	Channel 2

- Expand B with vertical Zoom
- B: Average (2) : 10.0 mV

- Place trace B in the middle of the screen with the vertical position cursor.
- Turn off : Trace 2

Adjut potentiometer R4021 in order to get a flat square wave

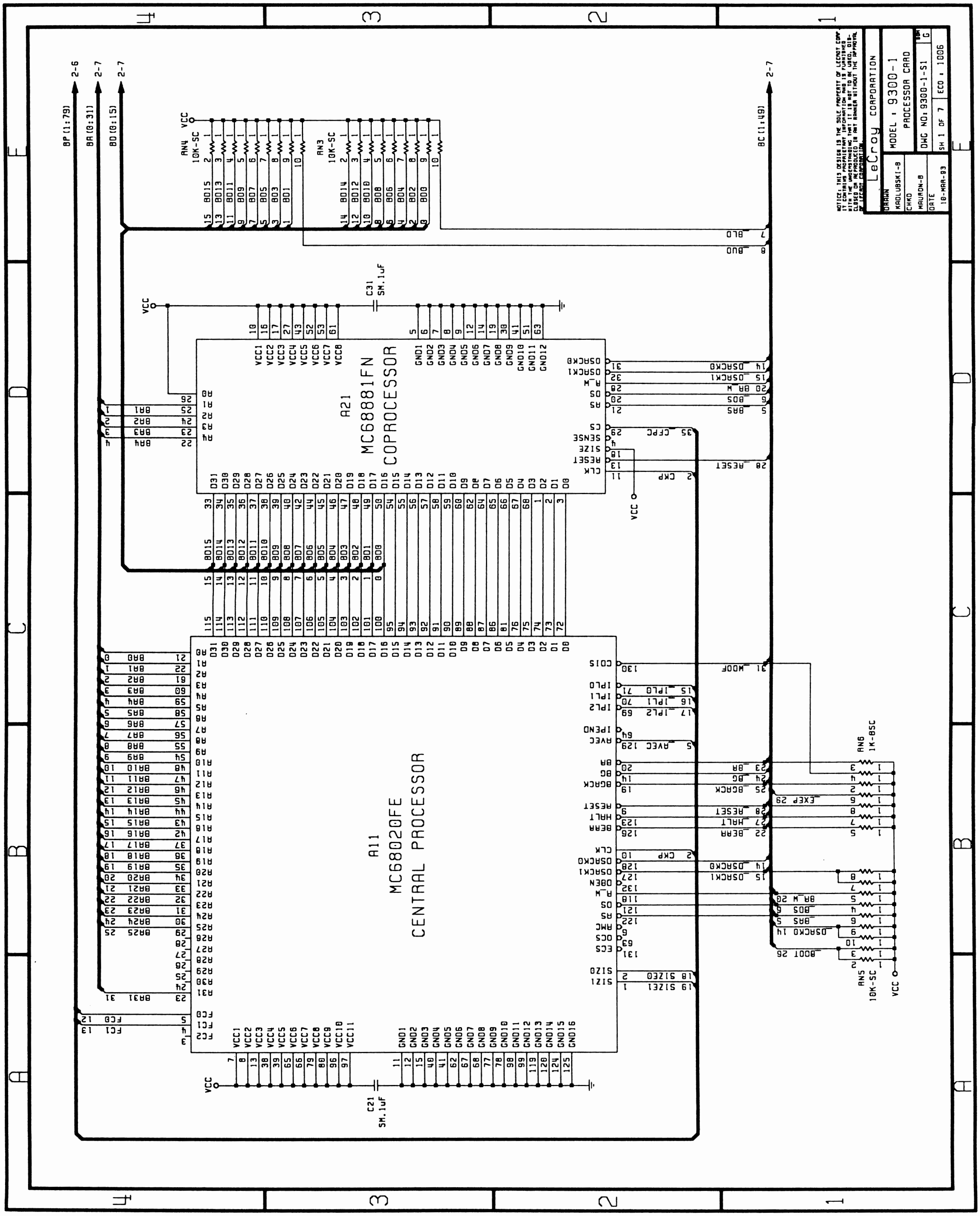


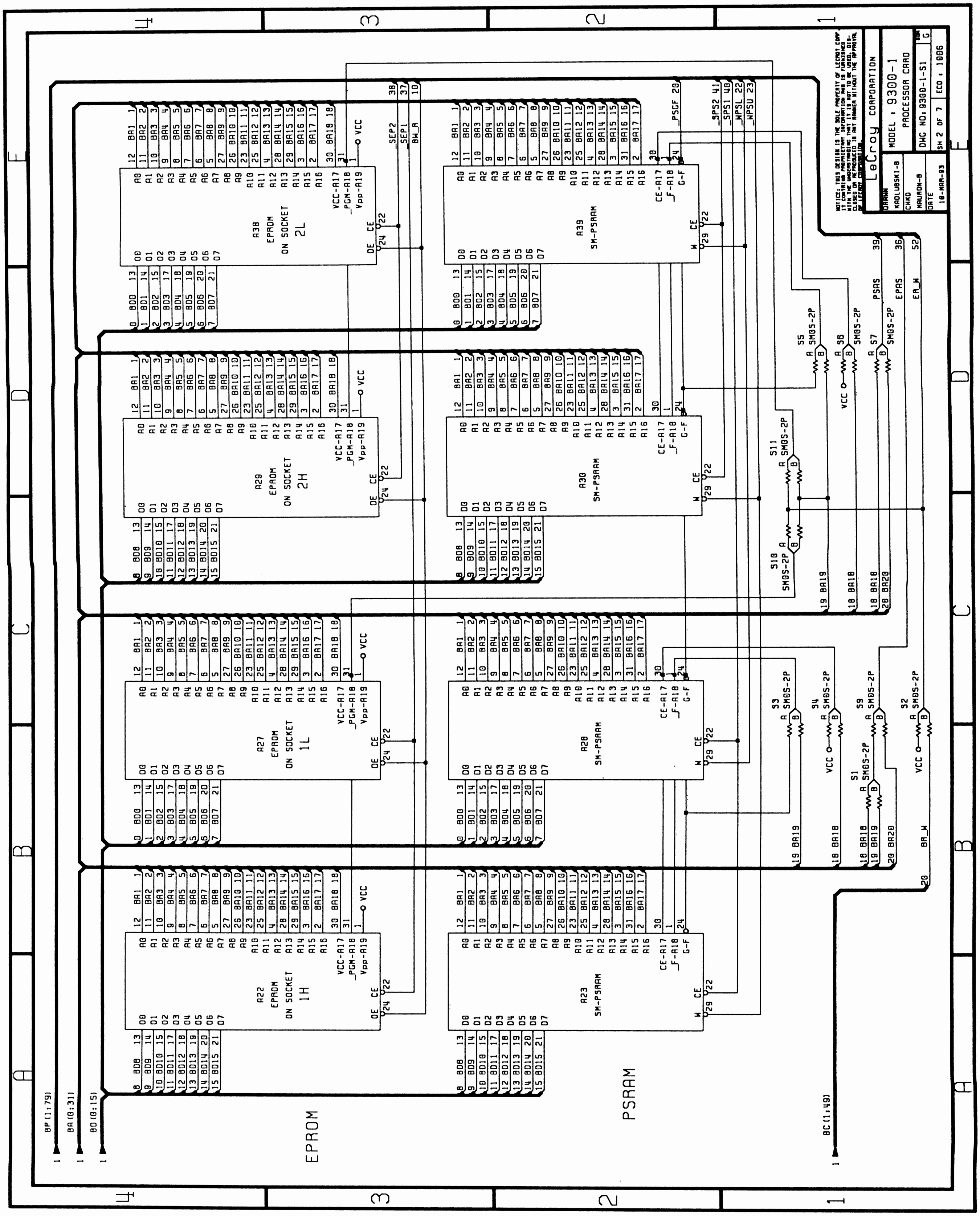
SECTION 8 SCHEMATICS, LAYOUTS, PARTS LIST

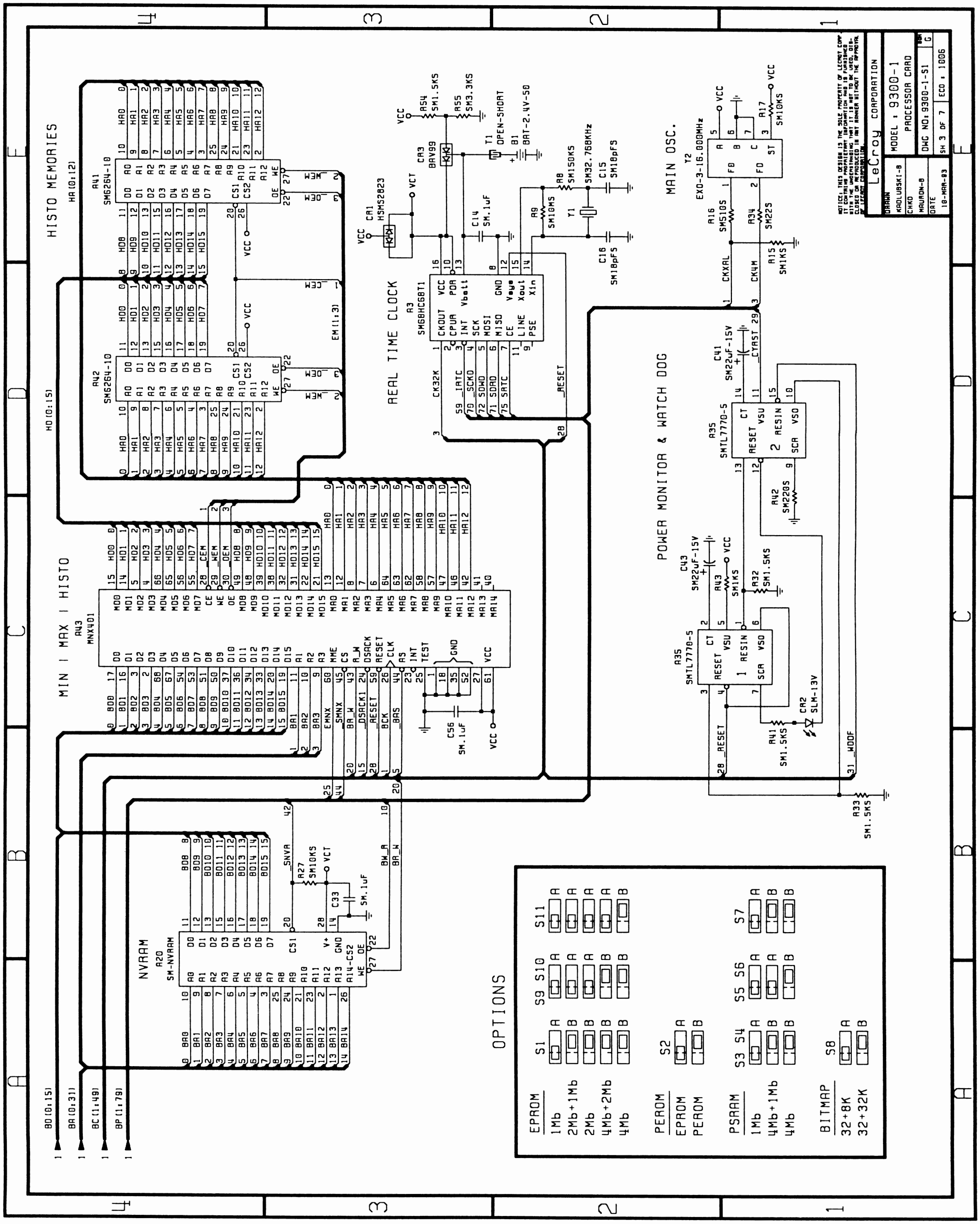
9320 Digital Oscilloscope

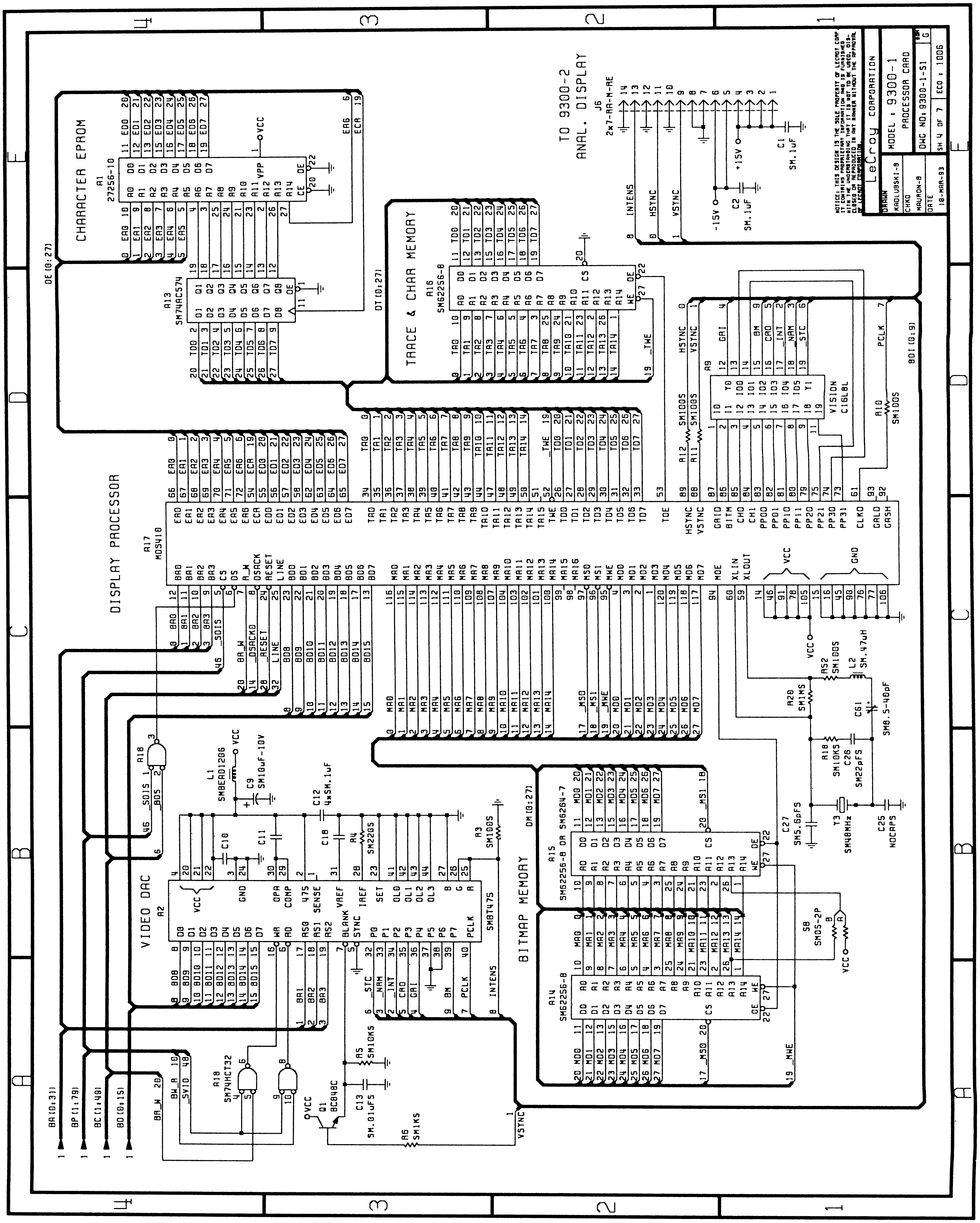
PART: 9320   DESC: 1 GHz DUAL CHANNEL 20 Ms/s DSO

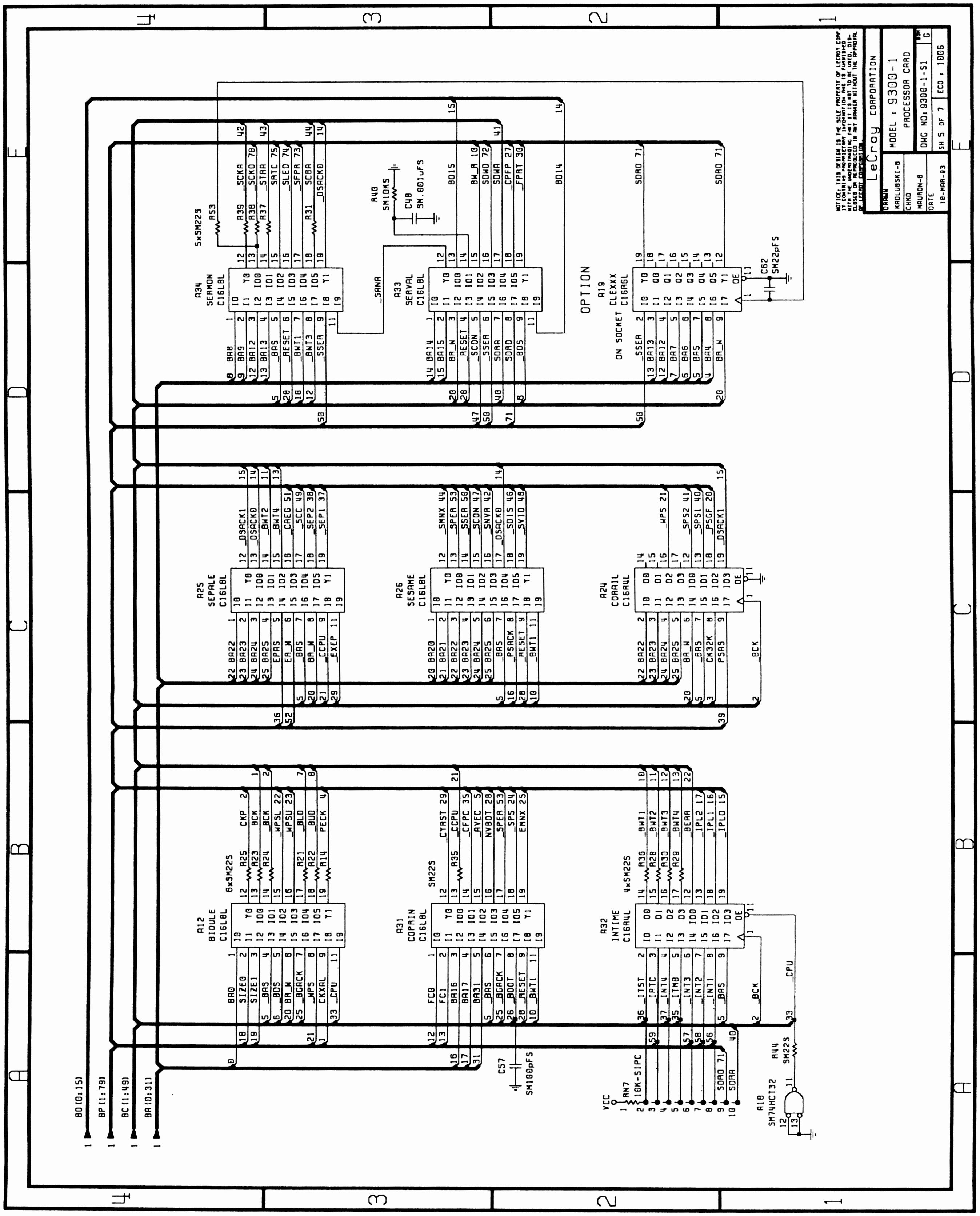
COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
205750000	IC AND-OR GATE ARRAY 16V8	1
554500001	TAPPING SCREW W/U-THREAD	2
709320013	FRONT LABEL	1
709320913	SERIAL NUMBER PLATE	1
ACCESSORIES-9320	ACCESSORIES FOR 9320	1
F9300-4	GPIB + RS232 INTERFACE CARD	1
F9314M-1	PROCESSOR CARD WITH 2Mb RAM	1
F9320-3	MAIN CARD DUAL 20Ms/s, 1GHz	1
F9320-5	DUAL CHANNEL FRONT PANEL	1
M932X	MECHANICAL FOR 932X-SERIES	1

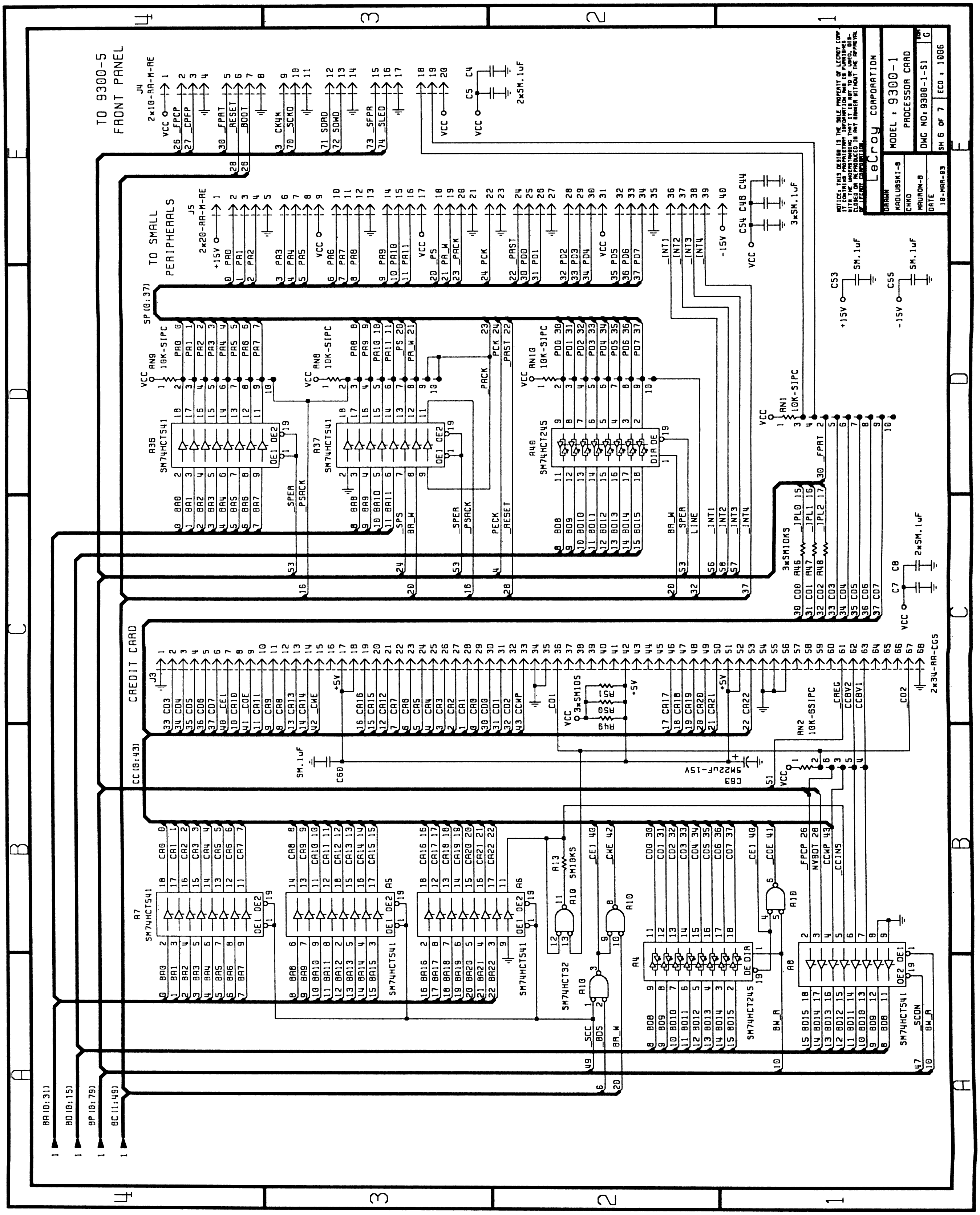

A11
MC68020FE
CENTRAL PROCESSOR
A21
MC68881FN
COPROCESSOR
LeCroy CORPORATION
MODEL : 9300-1
PROCESSOR CARD
DWG NO: 9300-1-S1
SH 1 OF 7
ECO : 1006

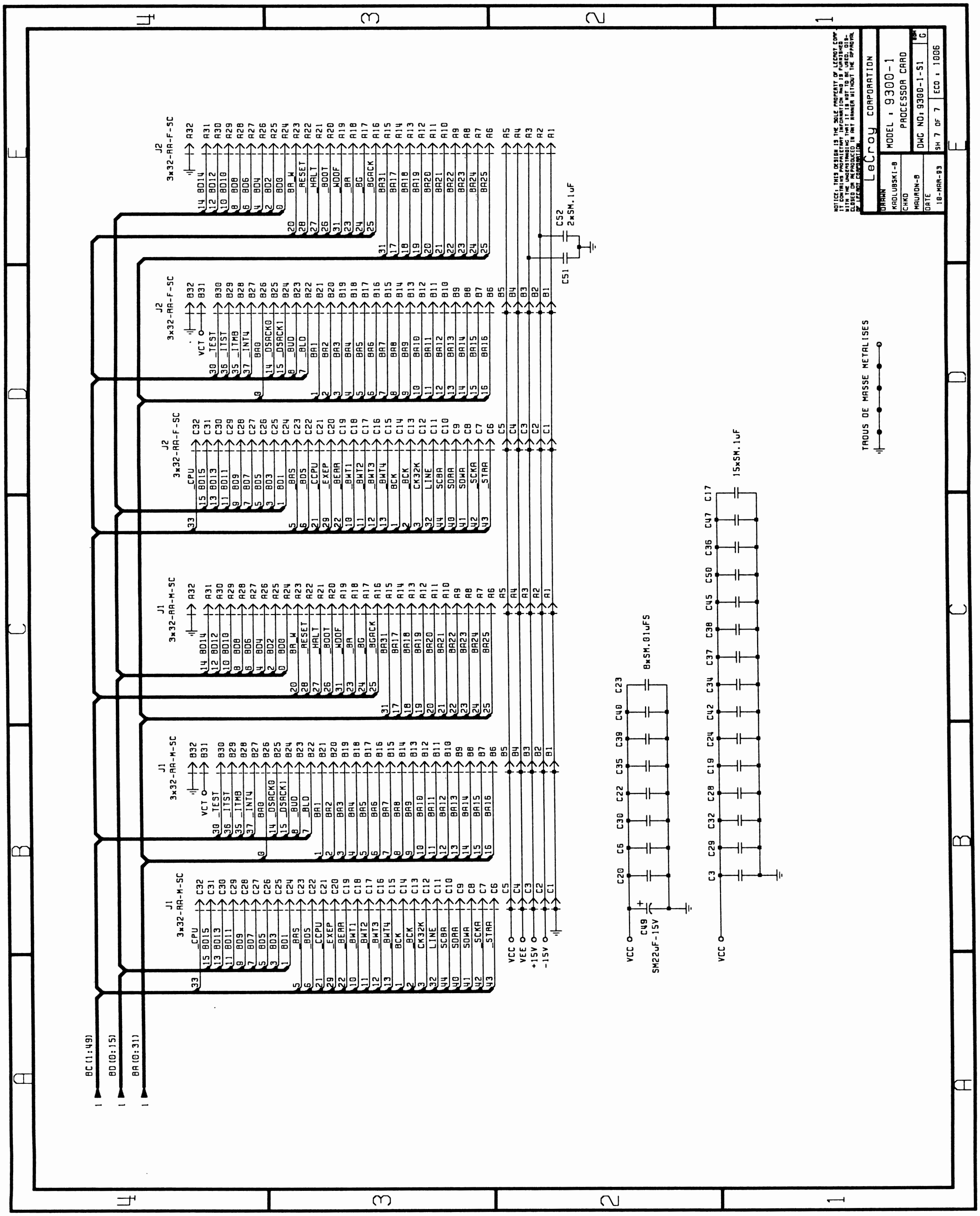

LeCroy CORPORATION
MODEL : 9300-1
PROCESSOR CARD
DWG NO: 9300-1-S1
EPROM
PSRAM

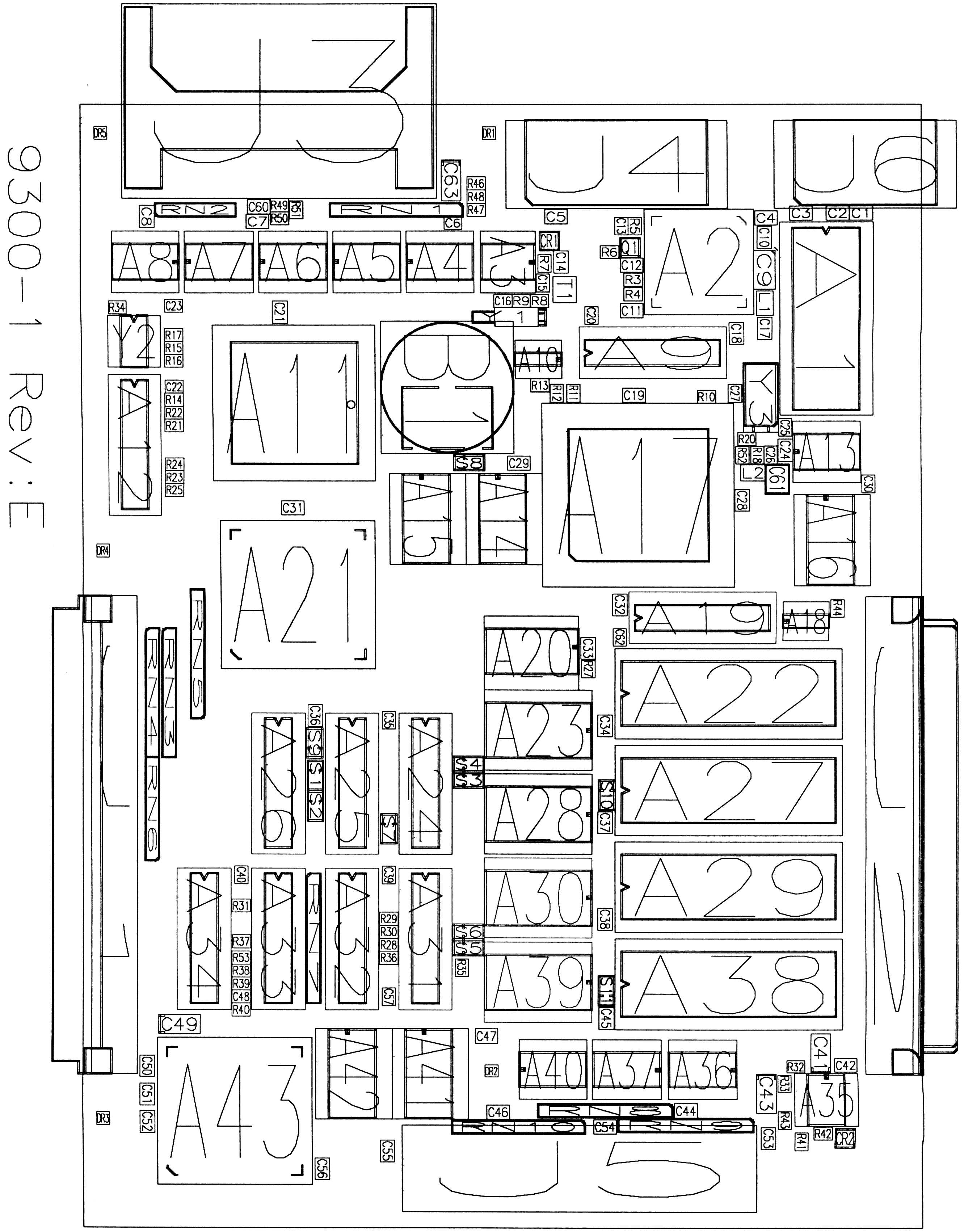

HISTO MEMORIES
MIN | MAX | HISTO
REAL TIME CLOCK
MAIN OSC.
POWER MONITOR & WATCH DOG
NVRAM
OPTIONS
LeCroy CORPORATION
MODEL: 9300-1
PROCESSOR CARD
DWG NO: 9300-1-S1


CHARACTER EPROM
TRACE & CHAR MEMORY
TO 9300-2
ANAL. DISPLAY
DISPLAY PROCESSOR
VIDEO DAC
BITMAP MEMORY
LeCroy CORPORATION
MODEL : 9300-1
PROCESSOR CARD
DWG NO. 9300-1-S1
SH 4 OF 7
ECO : 1006
18-MAR-93


LeCroy CORPORATION
MODEL : 9300-1
PROCESSOR CARD
DWG NO: 9300-1-S1
SH 5 OF 7
ECO : 1006
18-MAR-93
R34 SERMON C16L8L
R33 SERVAL C16L8L
OPTION
R19 CLEXXX C16R6L
ON SOCKET
R25 SEPALE C16L8L
R26 SESAME C16L8L
R24 CORAIL C16R4L
R12 BIDULE C16L8L
R31 COPAIN C16L8L
R32 INTIME C16R4L
R18 SM74HCT32
BD(0:15)
BP(1:79)
BC(1:49)
BA(0:31)


TO 9300-5 FRONT PANEL
TO SMALL PERIPHERALS
CREDIT CARD
LeCroy CORPORATION
MODEL : 9300-1
PROCESSOR CARD
DWG NO: 9300-1-S1


LeCroy CORPORATION
MODEL : 9300-1
PROCESSOR CARD
DWG NO: 9300-1-S1
SH 7 OF 7
ECO : 1006
DRAWN KROLUBSKI-B
CHKD MAURON-B
DATE 18-MAR-93
TROUS DE MASSE METALLISES


9300-1 Rev:E
J4
J6
J5
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
A21
A22
A23
A24
A25
A26
A27
A28
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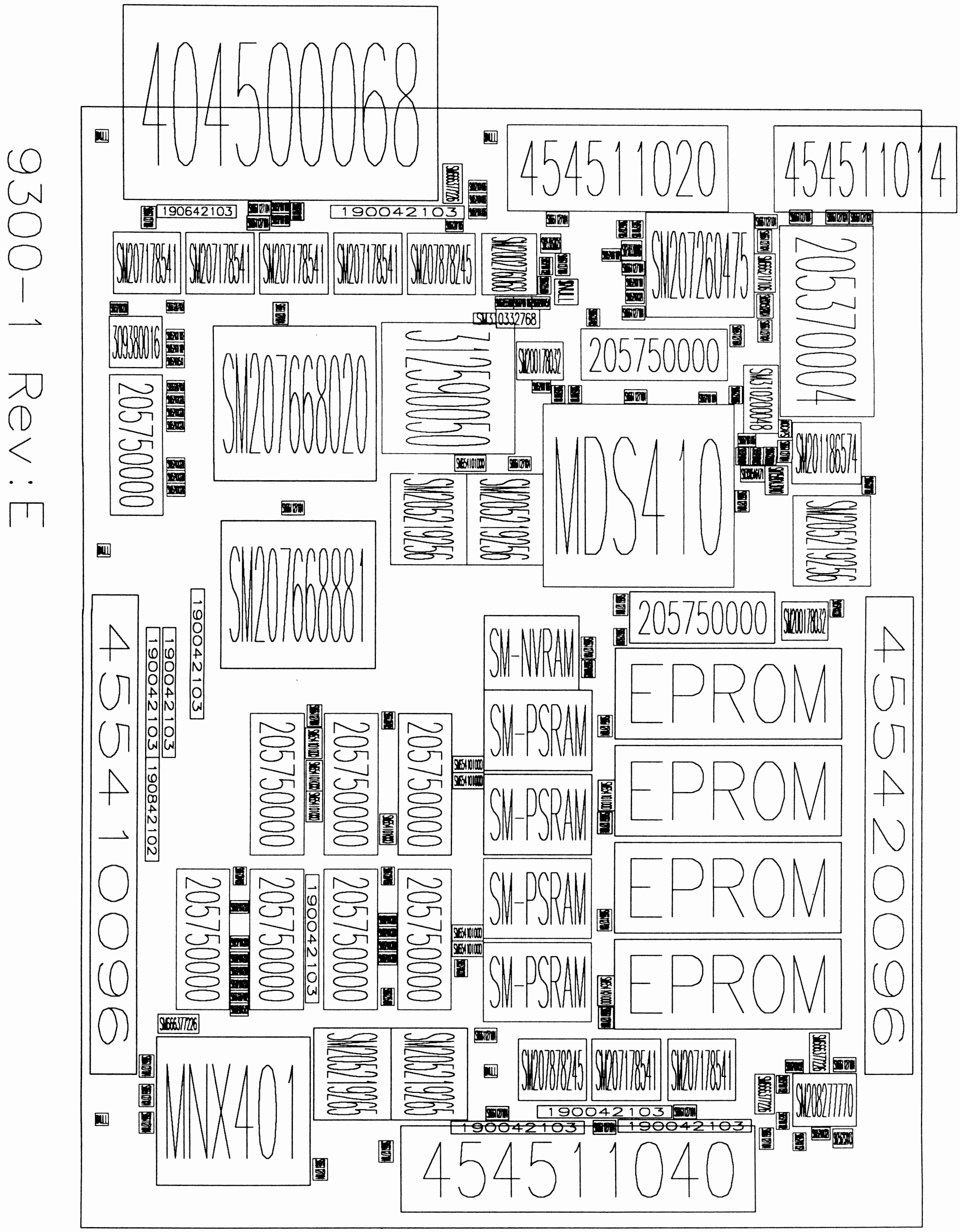
A36
A37
A38
A39
A40
A41
A42
A43


9300-1 Rev:E
40450068
454511020
454511014
190642103
190042103
SM207178541
SM207878245
SM207260475
205370004
309380016
SM207668020
312590050
205750000
MDS410
SM201186574
SM205219256
SM207668881
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455420096
SM-NVRAM
SM-PSRAM
EPROM
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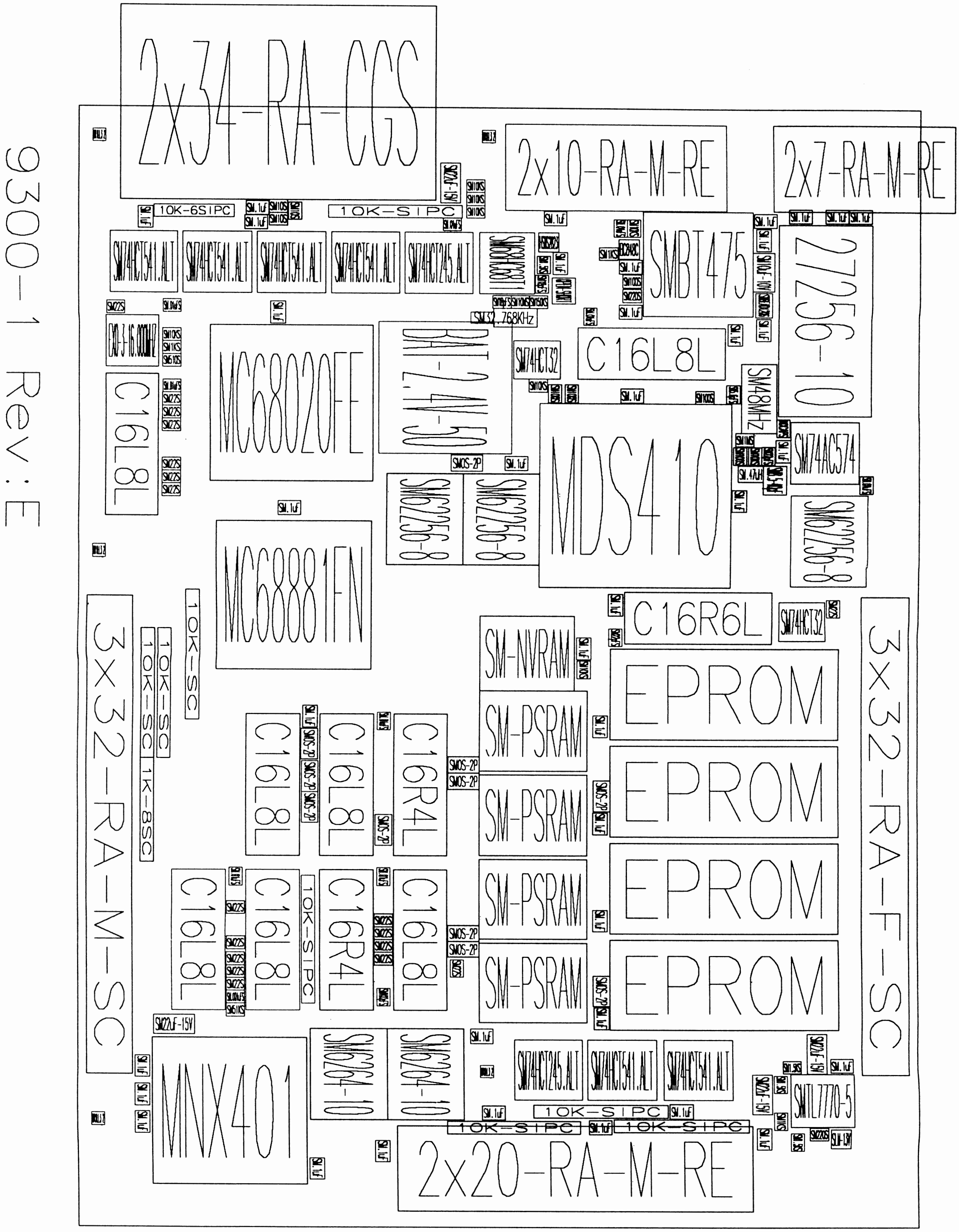
MNX401
SM205219265
SM208277770
454511040


9300-1 Rev:E
2x34-RA-CGS
2x10-RA-M-RE
2x7-RA-M-RE
SMBT475
27256-10
MC68020FE
C16L8L
MDS410
MC68881FN
C16R6L
SM-NVRAM
SM-PSRAM
EPROM
3X32-RA-M-SC
3X32-RA-F-SC
C16R4L
MNX401
2x20-RA-M-RE

A1	205370004	27256-10	DIP28
A2	SM207260475	SMBT475	PLCC_44
A3	SM200276068	SM68HC68T1	SOIC_16L
A4	SM207878245	SM74HCT245.ALT	SOIC_20
A5	SM207178541	SM74HCT541.ALT	SOIC_20
A6	SM207178541	SM74HCT541.ALT	SOIC_20
A7	SM207178541	SM74HCT541.ALT	SOIC_20
A8	SM207178541	SM74HCT541.ALT	SOIC_20
A9	205750000	C16L8L	DIP20
A10	SM200178032	SM74HCT32	SOIC_14
A11	SM207668020	MC68020FE	QUAD_FP_132P
A12	205750000	C16L8L	DIP20
A13	SM201186574	SM74AC574	SOIC_20
A14	SM205219256	SM62256-8	SOIC_28
A15	SM205219256	SM62256-8	SOIC_28
A16	SM205219256	SM62256-8	SOIC_28
A17	MDS410	MDS410	PQFP_120
A18	SM200178032	SM74HCT32	SOIC_14
A19	205750000	C16R6L	DIP20
A20	SM-NVRAM	SM-NVRAM	SOIC_28
A21	SM207668881	MC68881FN	PLCC_68
A22	EPROM	EPROM	DIP32
A23	SM-PSRAM	SM-PSRAM	SOIC_32L
A24	205750000	C16R4L	DIP20
A25	205750000	C16L8L	DIP20
A26	205750000	C16L8L	DIP20
A27	EPROM	EPROM	DIP32
A28	SM-PSRAM	SM-PSRAM	SOIC_32L
A29	EPROM	EPROM	DIP32
A30	SM-PSRAM	SM-PSRAM	SOIC_32L
A31	205750000	C16L8L	DIP20
A32	205750000	C16R4L	DIP20
A33	205750000	C16L8L	DIP20
A34	205750000	C16L8L	DIP20
A35	SM208277770	SMTL7770-5	SOIC_16L
A36	SM207178541	SM74HCT541.ALT	SOIC_20
A37	SM207178541	SM74HCT541.ALT	SOIC_20
A38	EPROM	EPROM	DIP32
A39	SM-PSRAM	SM-PSRAM	SOIC_32L
A40	SM207878245	SM74HCT245.ALT	SOIC_20
A41	SM205219265	SM6264-10	SOIC_28
A42	SM205219265	SM6264-10	SOIC_28
A43	MNX401	MNX401	PLCC_68
B1	312590050	BAT-2.4V-50	BAT_MPF_R
C1	SM661127104	SM.1uF	SM1206
C2	SM661127104	SM.1uF	SM1206
C3	SM661127104	SM.1uF	SM1206
C4	SM661127104	SM.1uF	SM1206
C5	SM661127104	SM.1uF	SM1206
C6	SM661207103	SM.01uFS	SM0805
C7	SM661127104	SM.1uF	SM1206
C8	SM661127104	SM.1uF	SM1206
C9	SM666217106	SM10uF-10V	SMCAPC
C10	SM661127104	SM.1uF	SM1206
C11	SM661127104	SM.1uF	SM1206
C12	SM661127104	SM.1uF	SM1206
C13	SM661207103	SM.01uFS	SM0805
C14	SM661127104	SM.1uF	SM1206
C15	SM661255180	SM18pFS	SM0805
C16	SM661255180	SM18pFS	SM0805
C17	SM661127104	SM.1uF	SM1206
C18	SM661127104	SM.1uF	SM1206
C19	SM661127104	SM.1uF	SM1206
C20	SM661207103	SM.01uFS	SM0805

C21	SM661127104	SM.1uF	SM1206
C22	SM661207103	SM.01uFS	SM0805
C23	SM661207103	SM.01uFS	SM0805
C24	SM661127104	SM.1uF	SM1206
C26	SM661255220	SM22pFS	SM0805
C27	SM661255056	SM5.6pFS	SM0805
C28	SM661127104	SM.1uF	SM1206
C29	SM661127104	SM.1uF	SM1206
C30	SM661207103	SM.01uFS	SM0805
C31	SM661127104	SM.1uF	SM1206
C32	SM661127104	SM.1uF	SM1206
C33	SM661127104	SM.1uF	SM1206
C34	SM661127104	SM.1uF	SM1206
C35	SM661207103	SM.01uFS	SM0805
C36	SM661127104	SM.1uF	SM1206
C37	SM661127104	SM.1uF	SM1206
C38	SM661127104	SM.1uF	SM1206
C39	SM661207103	SM.01uFS	SM0805
C40	SM661207103	SM.01uFS	SM0805
C41	SM666377226	SM22uF-15V	SMCAPETD5
C42	SM661127104	SM.1uF	SM1206
C43	SM666377226	SM22uF-15V	SMCAPETD5
C44	SM661127104	SM.1uF	SM1206
C45	SM661127104	SM.1uF	SM1206
C46	SM661127104	SM.1uF	SM1206
C47	SM661127104	SM.1uF	SM1206
C48	SM661207102	SM.001uFS	SM0805
C49	SM666377226	SM22uF-15V	SMCAPETD5
C50	SM661127104	SM.1uF	SM1206
C51	SM661127104	SM.1uF	SM1206
C52	SM661127104	SM.1uF	SM1206
C53	SM661127104	SM.1uF	SM1206
C54	SM661127104	SM.1uF	SM1206
C55	SM661127104	SM.1uF	SM1206
C56	SM661127104	SM.1uF	SM1206
C57	SM661255101	SM100pFS	SM0805
C60	SM661127104	SM.1uF	SM1206
C61	SM158043040	SM8.5-40pF	SMCAPVAR
C62	SM661255220	SM22pFS	SM0805
C63	SM666377226	SM22uF-15V	SMCAPETD5
CR1	SM253032823	HSMS2823	SOT23
CR2	SM256232013	SLM-13V	SOT23
J1	455410096	3x32-RA-M-SC	CONN3X32_RA_M_SC
J2	455420096	3x32-RA-F-SC	CONN3X32_RA_F_SC
J3	404500068	2x34-RA-CGS	CONN4X17_RA_CGS
J4	454511020	2x10-RA-M-RE	CONN2X10_RA_M_RE
J5	454511040	2x20-RA-M-RE	CONN2X20_RA_M_RE
J6	454511014	2x7-RA-M-RE	CONN2X7_RA_M_RE
L1	SM301502001	SMBEAD1206	SMSELF
L2	SM300546471	SM.47uH	SMSELF
Q1	SM270330848	BC848C	SOT23
R3	SM652101101	SM100S	SM0805
R4	SM652101221	SM220S	SM0805
R5	SM652101103	SM10KS	SM0805
R6	SM652101102	SM1KS	SM0805
R7	SM652101152	SM1.5KS	SM0805
R8	SM652101154	SM150KS	SM0805
R9	SM652101106	SM10MS	SM0805
R10	SM652101101	SM100S	SM0805
R11	SM652101101	SM100S	SM0805
R12	SM652101101	SM100S	SM0805
R13	SM652101103	SM10KS	SM0805
R14	SM652101220	SM22S	SM0805
R15	SM652101102	SM1KS	SM0805

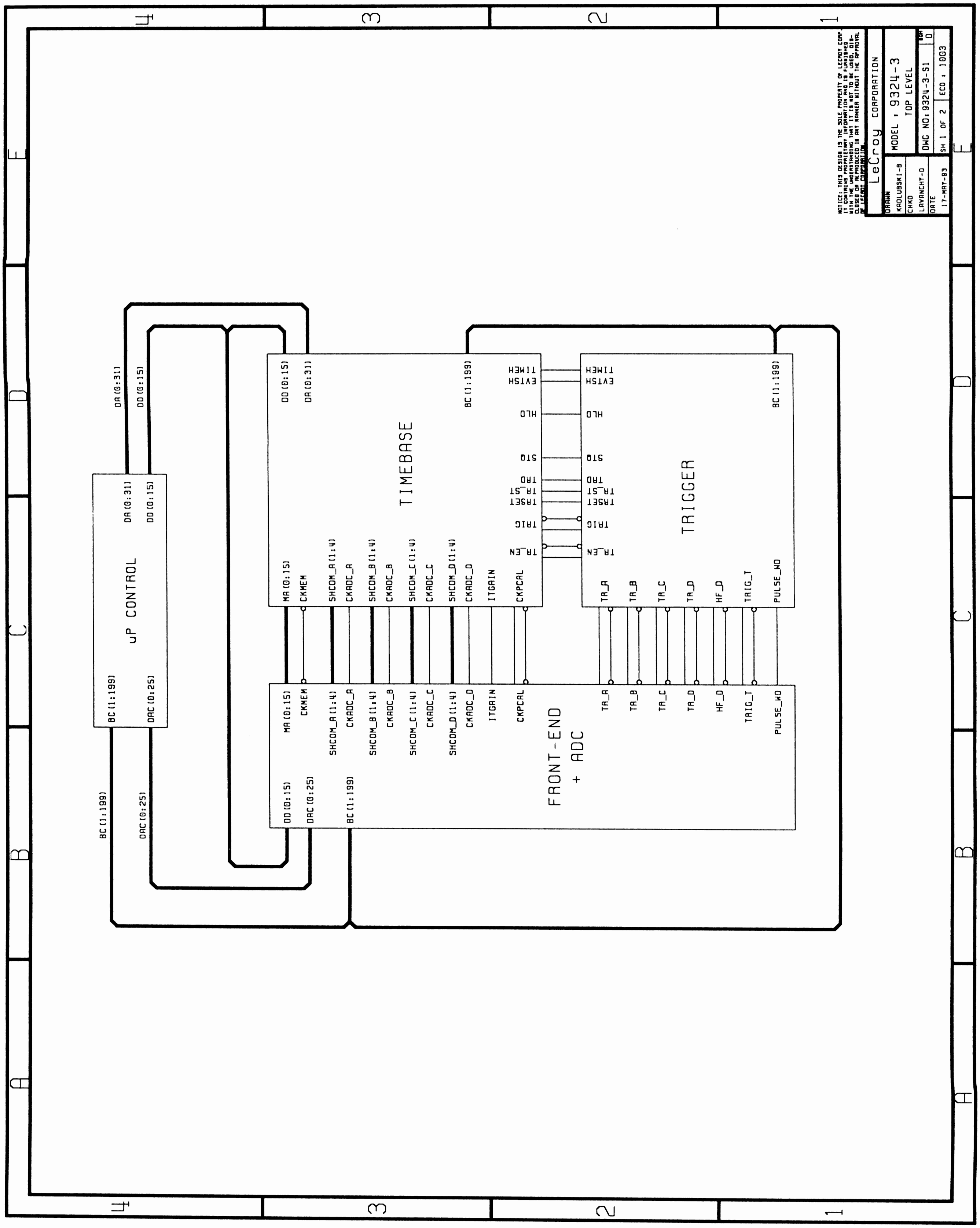
PART: F9314M-1 **DESC: PROCESSOR CARD WITH 2Mb RAM**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
190042103	RESISTOR NETWORK 10 K	1
190642103	RESISTOR NETWORK 10 K	1
190842102	RES NETWORK 1 K	1
205301000	UV E-PROM CMOS 1MBIT	2
205370004	IC CMOS UV EPROM 32K X 8 27C	1
205370020	IC UV EPROM CMOS 2MBIT	2
205750000	IC AND-OR GATE ARRAY 16V8	9
309380016	CRYSTAL OSC (PROGR) 16 MHZ	1
312590070	BATTERY LITHIUM 3V 70MAH	1
400331020	SOCKET IC ST DIP-20	1
400360028	SOCKET IC ST DIP-28	1
400360032	SOCKET IC ST DIP-32	4
404500068	CONN BD TO BD 68 POS	1
454511014	HDR SOLD TAIL/MALE/14/RT	1
454511020	HDR SOLD TAIL/MALE 20	1
454511040	HDR SOLD TAIL/MALE/40/RT	1
455410096	CONN RT ANGLE MALE 96 S-CLIP	1
455420096	HDR RT ANGLE FEM 96 S-CLIP	1
550130108	SCREW CYL HD M3X8	2
552130101	NUT HEX M3	2
719300103	PC BD PREASS'Y 9300-1 E	1
MDS410	IC RSDP GATE ARRAY MDS410	1
MNX401	ICMIN MAX GATEARR. MNX401	1
SM158043040	CAP VARIABLE 8.5 - 40 PF	1
SM200178032	IC 2-IN OR HCT32	2
SM200276068	IC RTC SERIAL 68HC68T1	1
SM201186574	IC OCTAL D-TYP FLOP 74AC574	1
SM205219256	IC 32K X 8 SRAM MS62256	2
SM205219264	IC 8K X 8 SRAM 70 NSEC 6264	4
SM205290512	IC 512K X 8 PSRAM HM658512	4
SM207178541	IC BUFFER/LINE DR HCT541	6
SM207260475	IC RAMDAC 256W 50MHZ BT475	1
SM207668020	IC 32-BIT U-PROC 68020	1
SM207668881	IC CO-PROCESSOR 68881	1
SM207878245	IC BUS TRANSCVR HCT 245	2
SM208277770	IC DUAL PWR SUPPLY SUP 7770-5	1
SM236030099	DIODE SO-PKG BAV99	1
SM253032823	DIODE SCHOTTKY 2823	1
SM256232013	DIODE LIGHT EMITTING RED	1
SM270330848	TRANSISTOR NPN BC848C	1
SM300546471	INDUCTOR .47UH	1
SM301502001	BEAD (FERRITE CHIP)	1
SM310200048	CRYSTAL 48 MHZ MA416	1
SM310332768	XTAL 32768HZ SMD MC316	1

R16	SM652101511	SM510S	SM0805
R17	SM652101103	SM10KS	SM0805
R18	SM652101103	SM10KS	SM0805
R20	SM652101105	SM1MS	SM0805
R21	SM652101220	SM22S	SM0805
R22	SM652101220	SM22S	SM0805
R23	SM652101220	SM22S	SM0805
R24	SM652101220	SM22S	SM0805
R25	SM652101220	SM22S	SM0805
R27	SM652101103	SM10KS	SM0805
R28	SM652101220	SM22S	SM0805
R29	SM652101220	SM22S	SM0805
R30	SM652101220	SM22S	SM0805
R31	SM652101220	SM22S	SM0805
R32	SM652101152	SM1.5KS	SM0805
R33	SM652101152	SM1.5KS	SM0805
R34	SM652101220	SM22S	SM0805
R35	SM652101220	SM22S	SM0805
R36	SM652101220	SM22S	SM0805
R37	SM652101220	SM22S	SM0805
R38	SM652101220	SM22S	SM0805
R39	SM652101220	SM22S	SM0805
R40	SM652101103	SM10KS	SM0805
R41	SM652101152	SM1.5KS	SM0805
R42	SM652101221	SM220S	SM0805
R43	SM652101102	SM1KS	SM0805
R44	SM652101220	SM22S	SM0805
R46	SM652101103	SM10KS	SM0805
R47	SM652101103	SM10KS	SM0805
R48	SM652101103	SM10KS	SM0805
R49	SM652101100	SM10S	SM0805
R50	SM652101100	SM10S	SM0805
R51	SM652101100	SM10S	SM0805
R52	SM652101101	SM100S	SM0805
R53	SM652101220	SM22S	SM0805
RN1	190042103	10K-SIPC	SIP10RES
RN2	190642103	10K-6SIPC	SIP6RES
RN3	190042103	10K-SC	SIP10RES
RN4	190042103	10K-SC	SIP10RES
RN5	190042103	10K-SC	SIP10RES
RN6	190842102	1K-8SC	SIP8RES
RN7	190042103	10K-SIPC	SIP10RES
RN8	190042103	10K-SIPC	SIP10RES
RN9	190042103	10K-SIPC	SIP10RES
RN10	190042103	10K-SIPC	SIP10RES
S1	SM654101000	SM0S-2P	SM0805_2P
S2	SM654101000	SM0S-2P	SM0805_2P
S3	SM654101000	SM0S-2P	SM0805_2P
S4	SM654101000	SM0S-2P	SM0805_2P
S5	SM654101000	SM0S-2P	SM0805_2P
S6	SM654101000	SM0S-2P	SM0805_2P
S7	SM654101000	SM0S-2P	SM0805_2P
S8	SM654101000	SM0S-2P	SM0805_2P
S9	SM654101000	SM0S-2P	SM0805_2P
S10	SM654101000	SM0S-2P	SM0805_2P
S11	SM654101000	SM0S-2P	SM0805_2P
Y1	SM310332768	SM32.768KHz	MC_316
Y2	309380016	EXO-3-16.000MHZ	DIP8
Y3	SM310200048	SM48MHz	MA_416

PART: F9314M-1 **DESC: PROCESSOR CARD WITH 2Mb RAM**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
SM652101100	RES CHIP (E24) 1% 10 OHMS	4
SM652101101	RES CHIP (E24) 1% 100 OHM	5
SM652101102	RES CHIP (E24) 1% 1 K	3
SM652101103	RES CHIP (E24) 1% 10 K	9
SM652101105	RES CHIP (E24) 1% 1 M	1
SM652101106	RES CHIP (E24) 1% 10 MEG	1
SM652101152	RES CHIP (E24) 1% 1.5 K	3
SM652101154	RES CHIP (E24) 1% 150 K	1
SM652101220	RES CHIP (E24) 1% 22 OHMS	17
SM652101221	RES CHIP (E24) 1% 220 OHM	2
SM652101332	RES CHIP (E24) 1% 3.3 K	1
SM652101511	RES CHIP (E24) 1% 510 OHM	1
SM653185152	RES THICK FILM 1.5 K	1
SM654101000	CHIP JUMPER ZERO OHMS	11
SM661127104	CAP CERA CHIP 20% .1 UF	37
SM661207102	CAP CERA CHIP 10% .001UF	1
SM661207103	CAP CERA CHIP 20% .01UF	9
SM661207104	CAP CERA CHIP 20% .1 UF	1
SM661255056	CAP CERA CHIP 5.6 PF	1
SM661255101	CAP CERA CHIP 5% 100 PF	1
SM661255180	CAP CERA CHIP 5% 18PF	2
SM661255220	CAP CERA CHIP 5% 22 PF	2
SM666217106	CAP MOLD TANT CHIP 10 UF	1
SM666377226	CAP MOLD TANT CHIP 22 UF	4

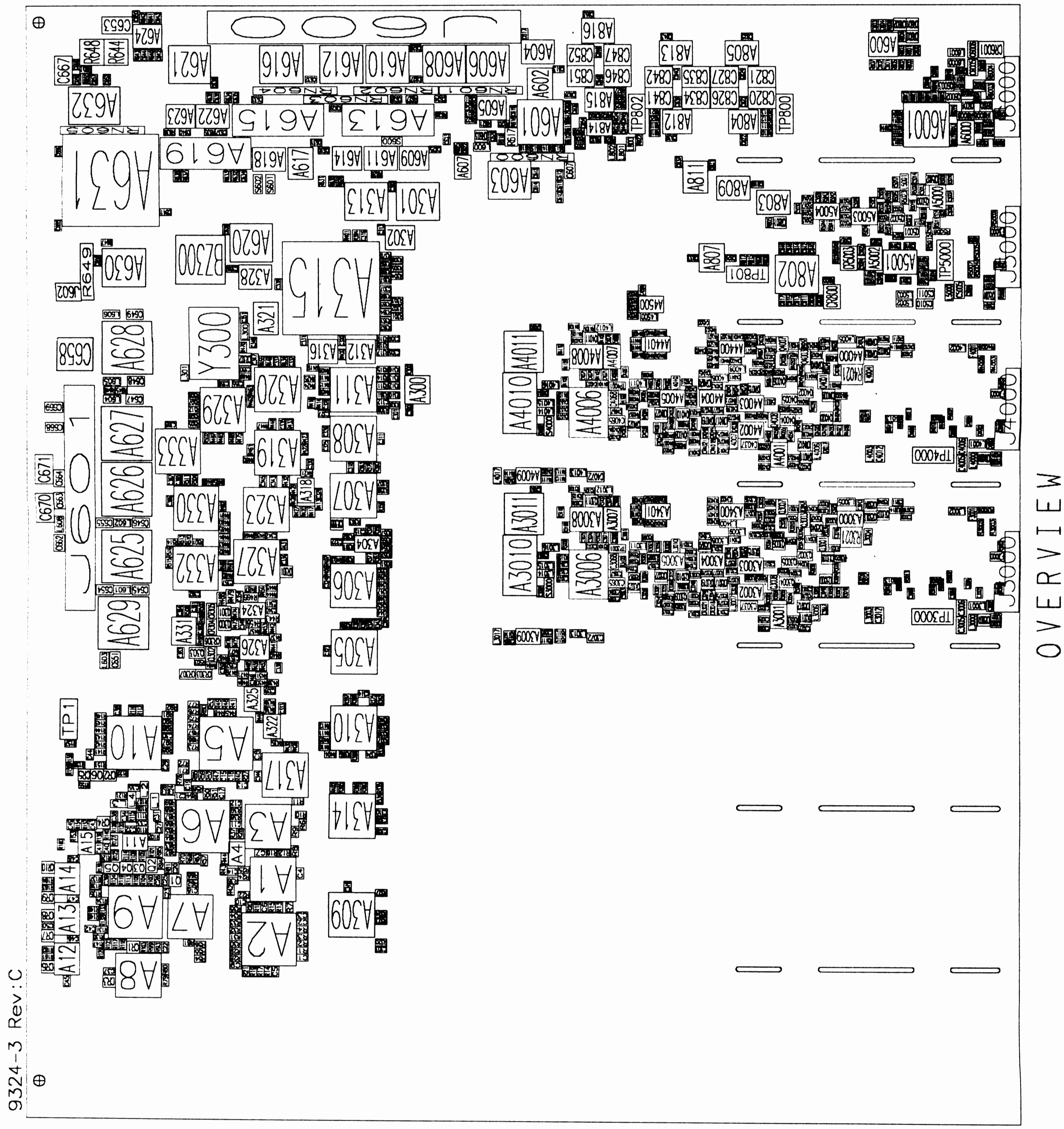

LeCroy CORPORATION
MODEL : 9324-3
TOP LEVEL
DWG NO: 9324-3-S1
SH 1 OF 2
ECO : 1003
TIMEBASE
TRIGGER
uP CONTROL
FRONT-END
+ ADC

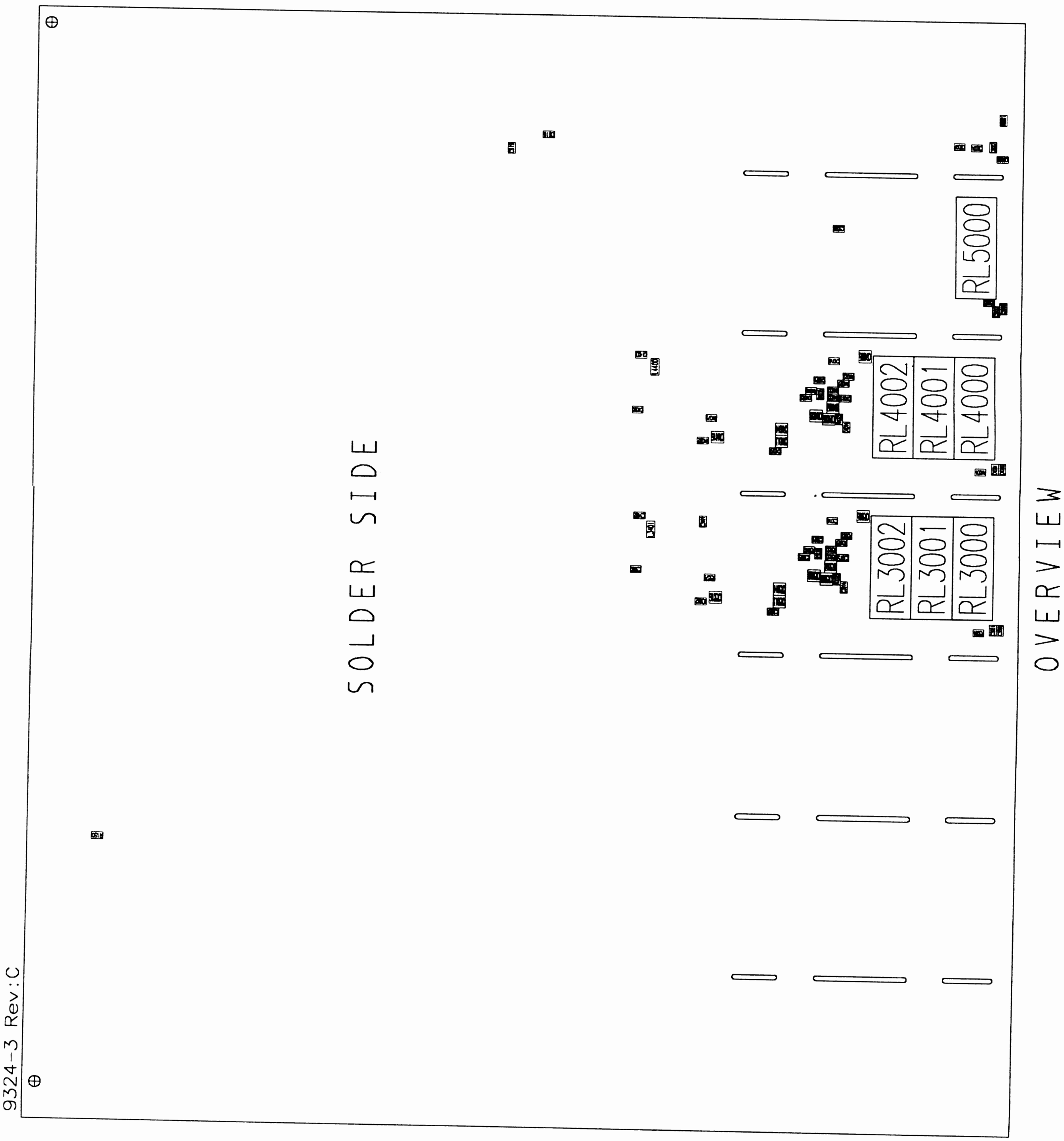
COMPONENT NOT MOUNTED ON THE 9320-3 :

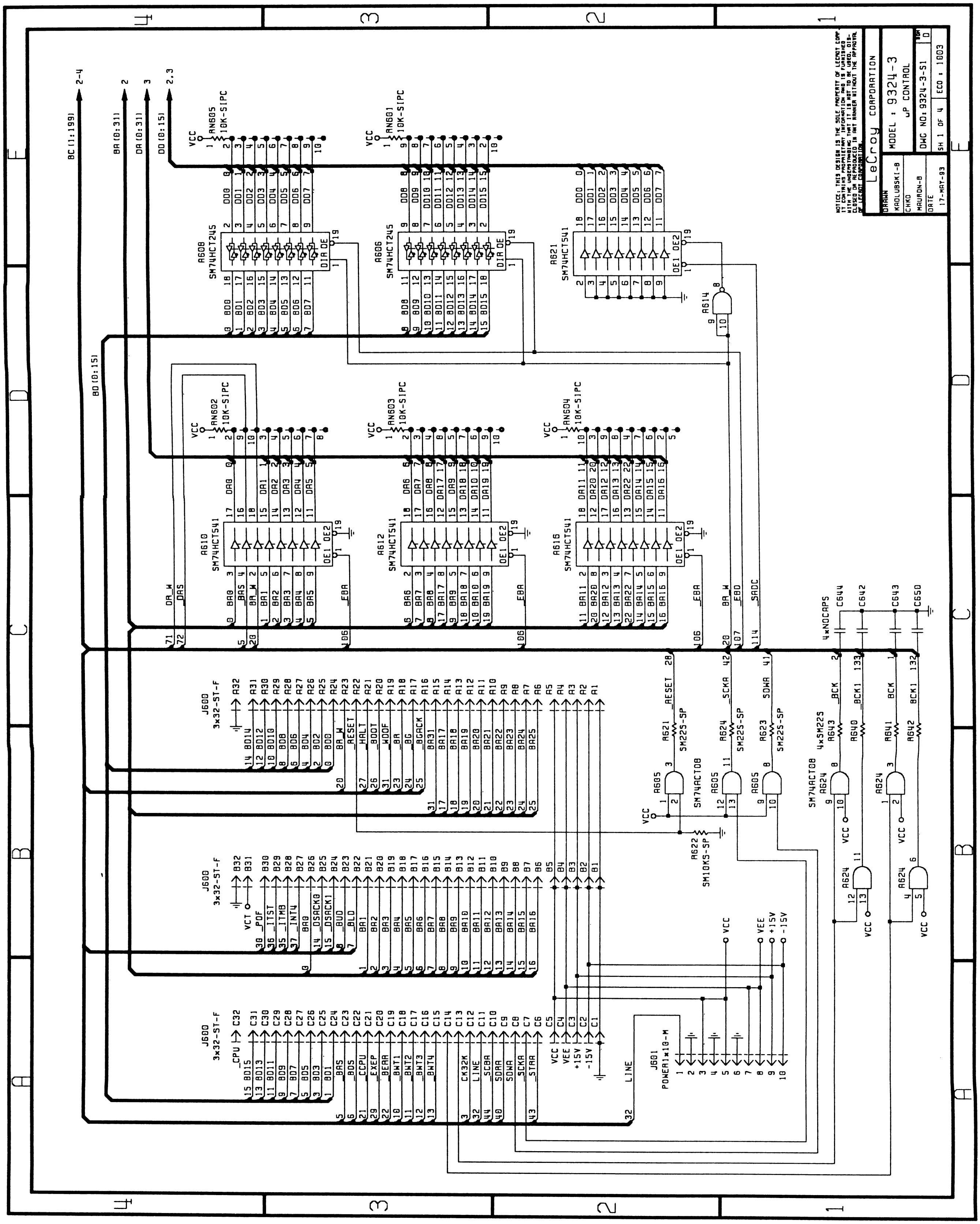
FE / ADC CHANNELS :	A & B
uP CONTROL (SHEET4)	
- LM340T-12	A633
- SM2.2uF-20V	C661
- SMBEAD1206	L607
FE / ADC CONTROL (SHEET1)	
- SMLF347	A800
- SMDG201	A801
- SM.01uF-NPO	C801 - C802 - C807 - C808
- SM10KS	R801 - R802 - R803 - R804
- SMBEAD1206	L803 - L804
FE / ADC CONTROL (SHEET2)	
- SMLF347	A806
- SM74HC594	A808
- SMULN2003	A810
- SM10KS	R806 - R807 - R814 - R816
FE / ADC CONTROL (SHEET3)	
- SM.01uFS	C800 - C803 - C804 - C805 C828 - C830 - C832 - C836
TIMEBASE (SHEET4)	
- SM10EL11	A303
- SM.01uFS	C321
- SM0S	R321- R322 - R325 - R326 R373 - R387
- SM22S	R328 - R330 - R331
- SM51S	R333 - R341 - R381
- SM56S	R384 - R385
- SM200S	R329 - R332 - R371 - R372
TIMEBASE (SHEET5)	
- SM.01uFS	C317
TRIGGER (SHEET3)	
- SM0S	R5 - R23

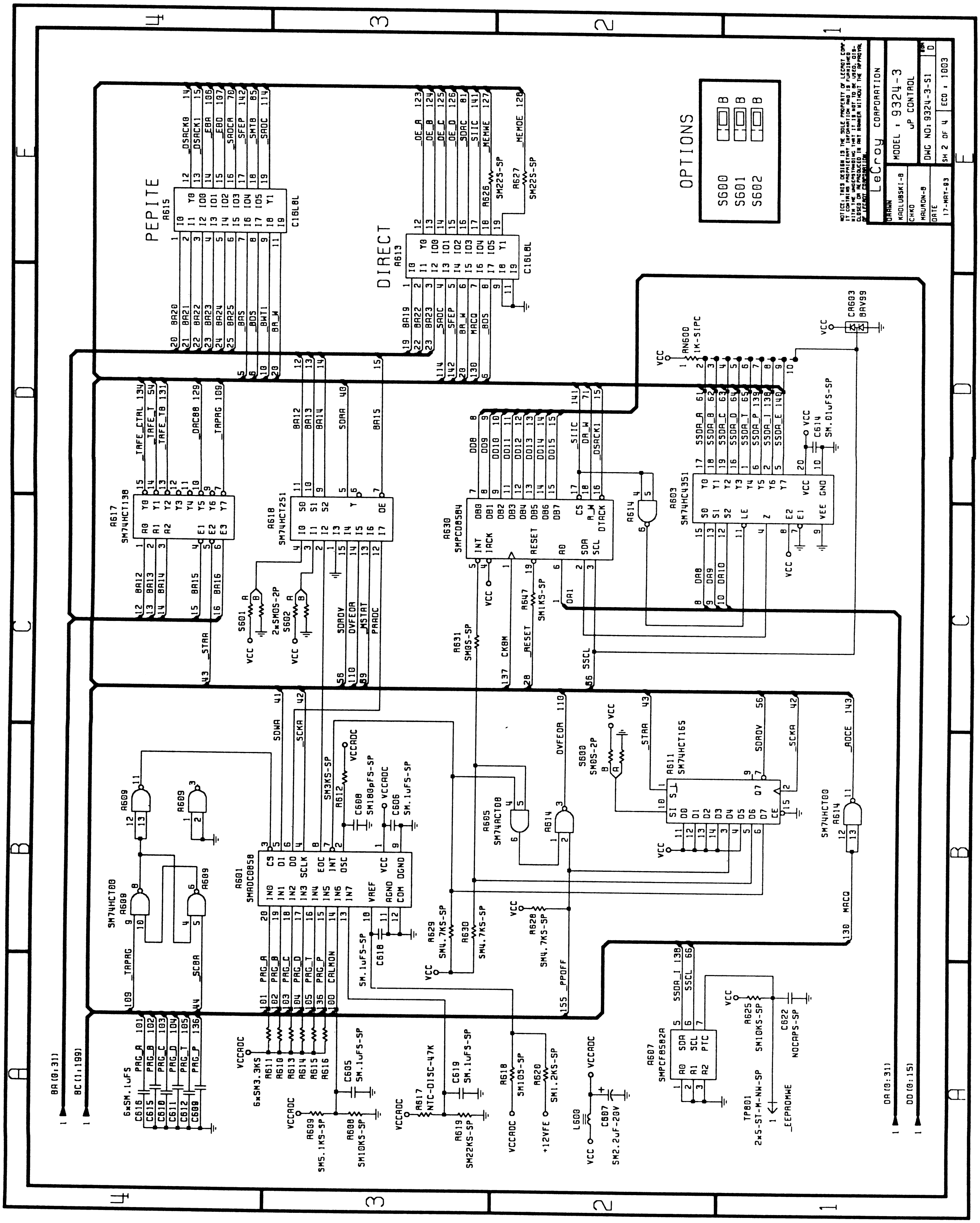
LeCroy CORPORATION

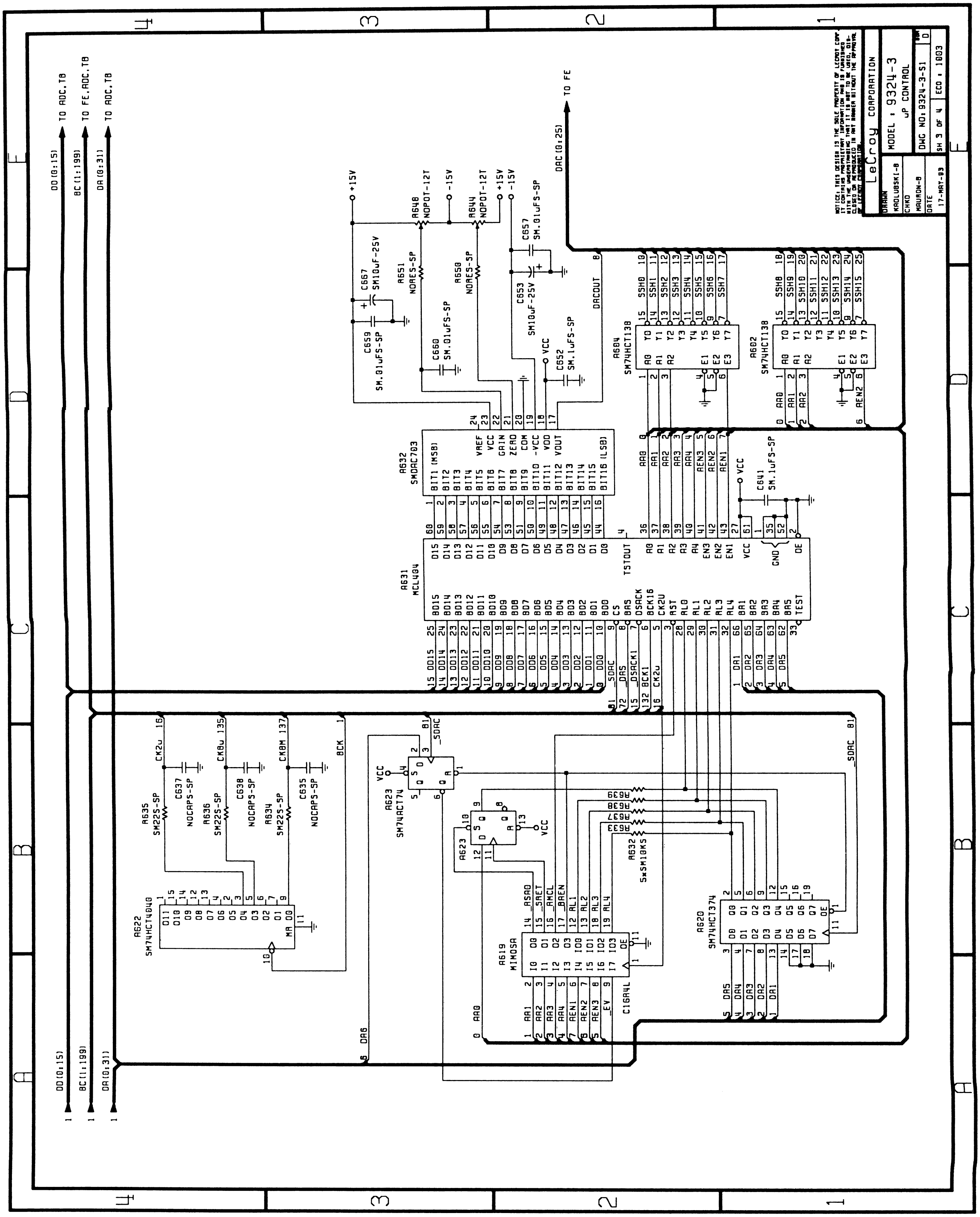
DRAWN KADLUBSKI-B	MODEL : 9324-3 TOP LEVEL
CHKD LAVANCHY-D	DWG NO: 9324-3-S1 — D
DATE 17-MAY-93	SH 2 OF 2 — ECO : 1003

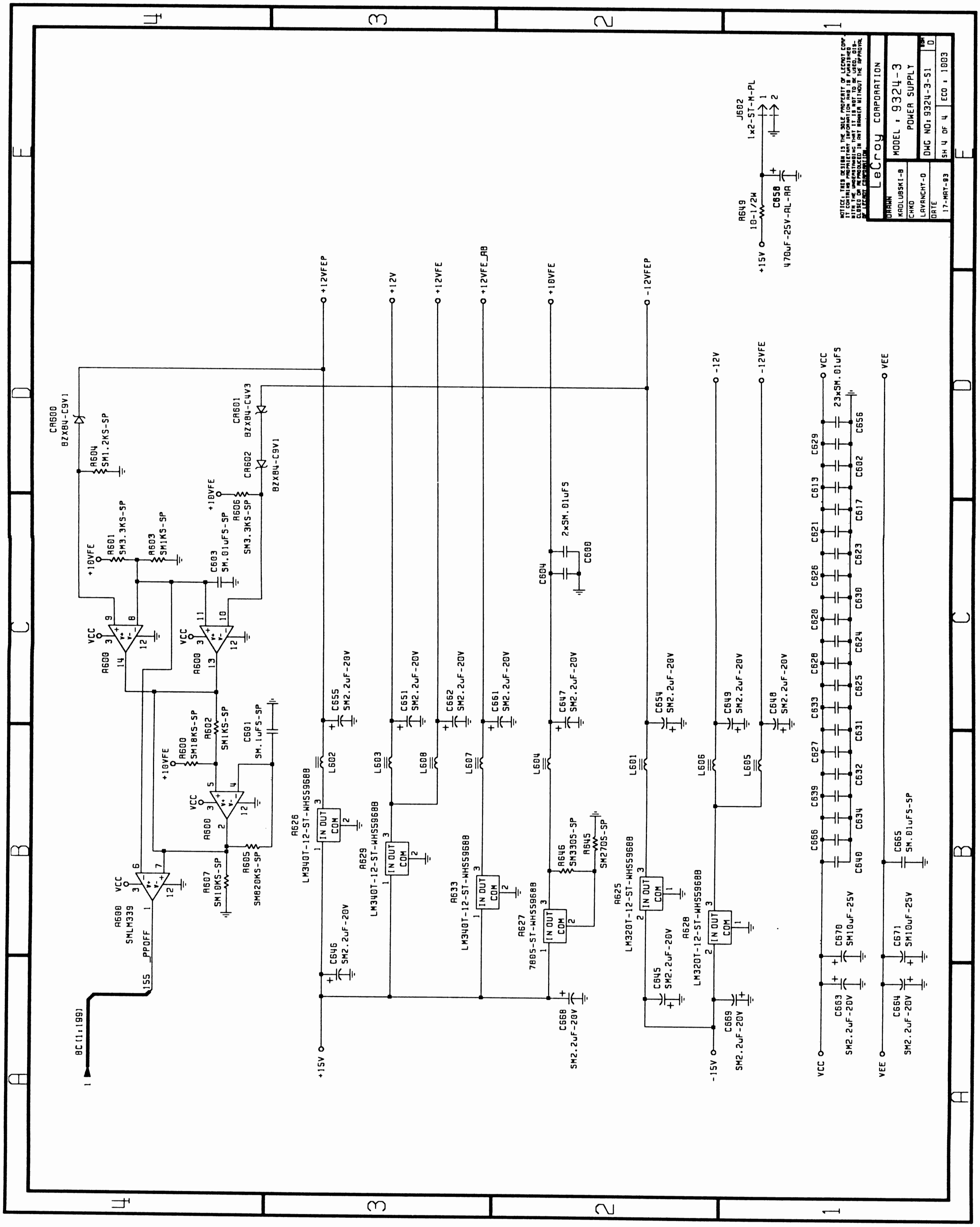

OVERVIEW
9324-3 Rev:C

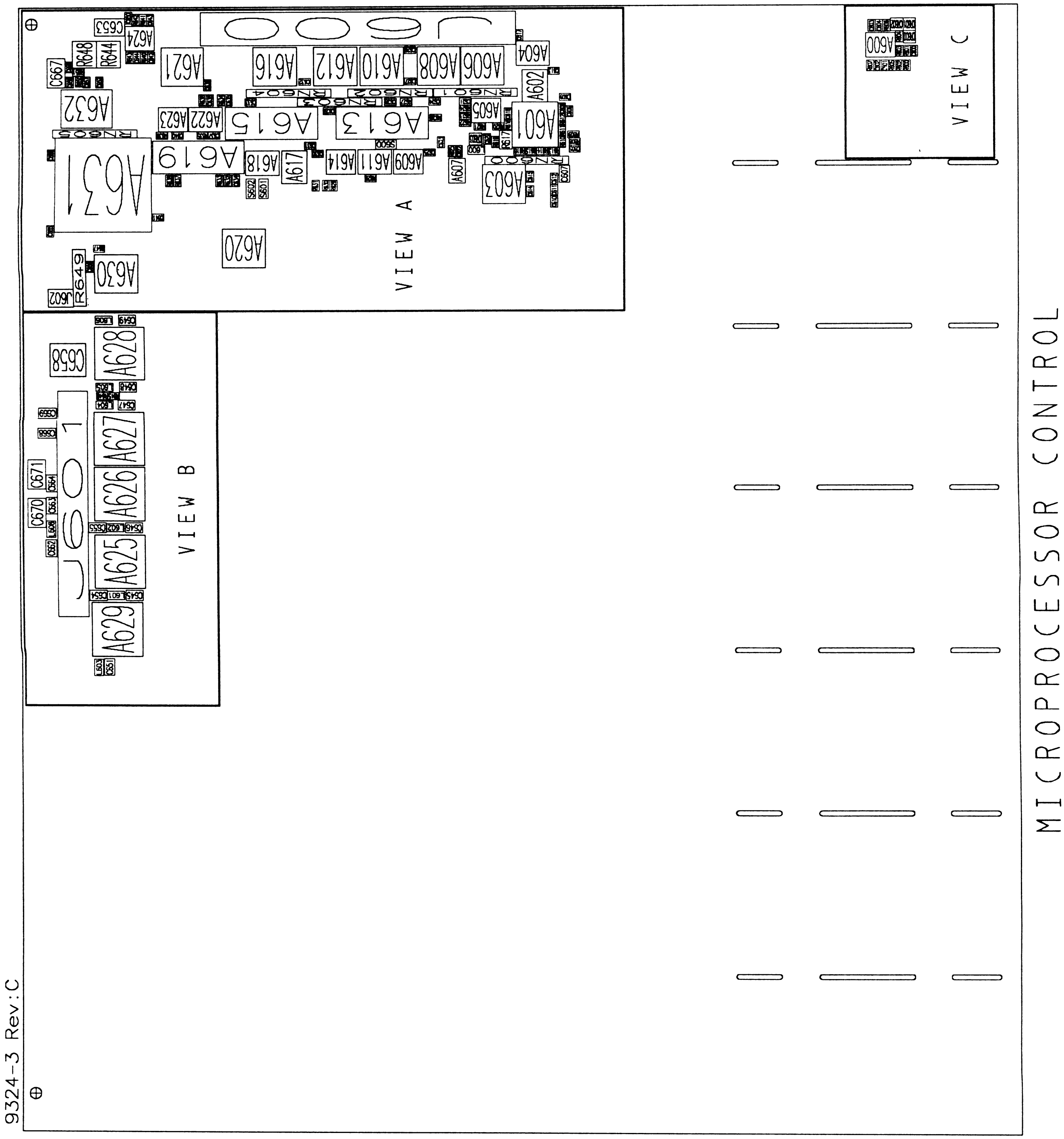

SOLDER SIDE
OVERVIEW
RL5000
RL4002
RL4001
RL4000
RL3002
RL3001
RL3000
9324-3 Rev:C

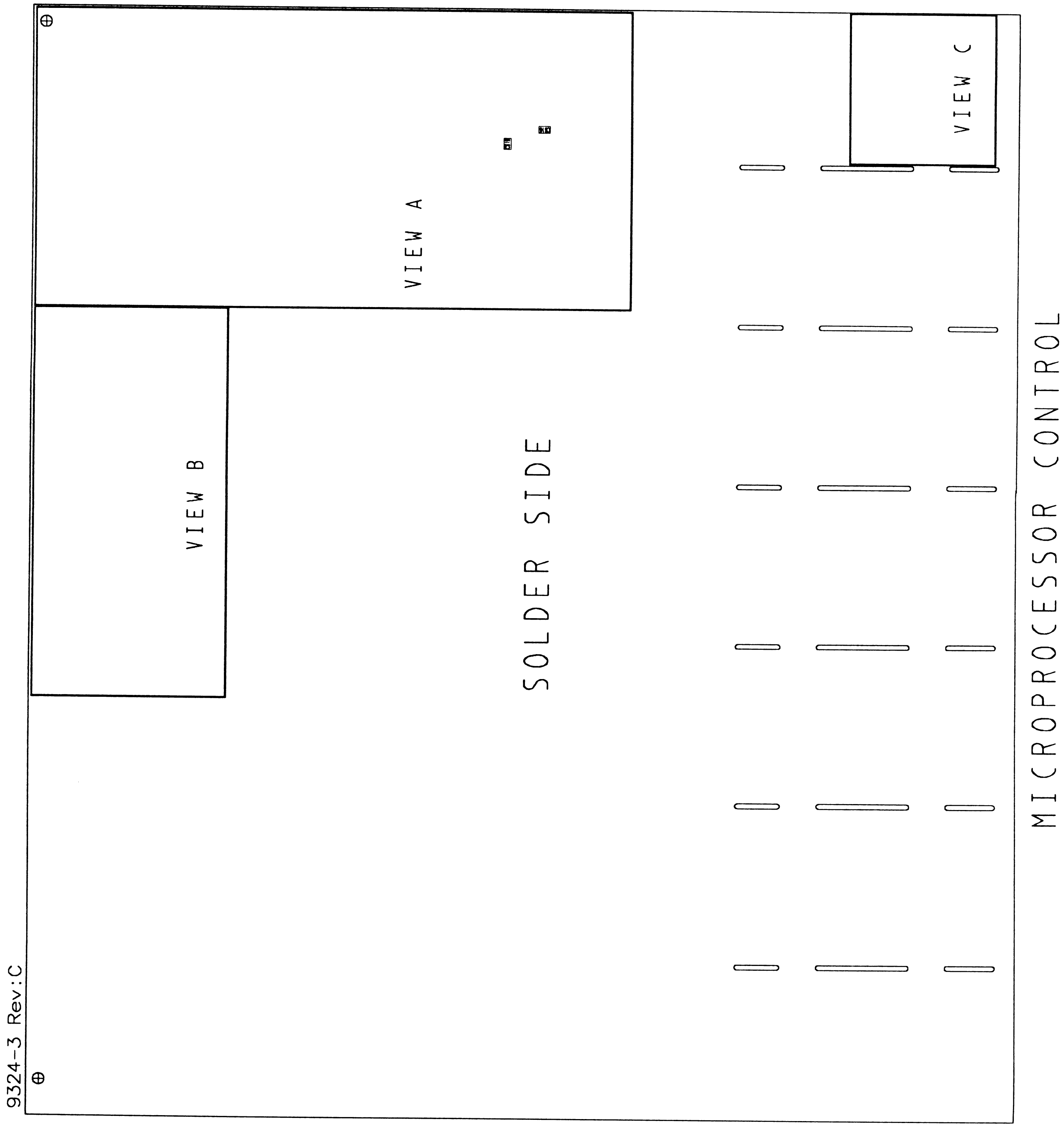

LeCroy CORPORATION
MODEL : 9324-3
uP CONTROL
DWG NO: 9324-3-S1
SH 1 OF 4
ECO : 1803
17-MAY-93

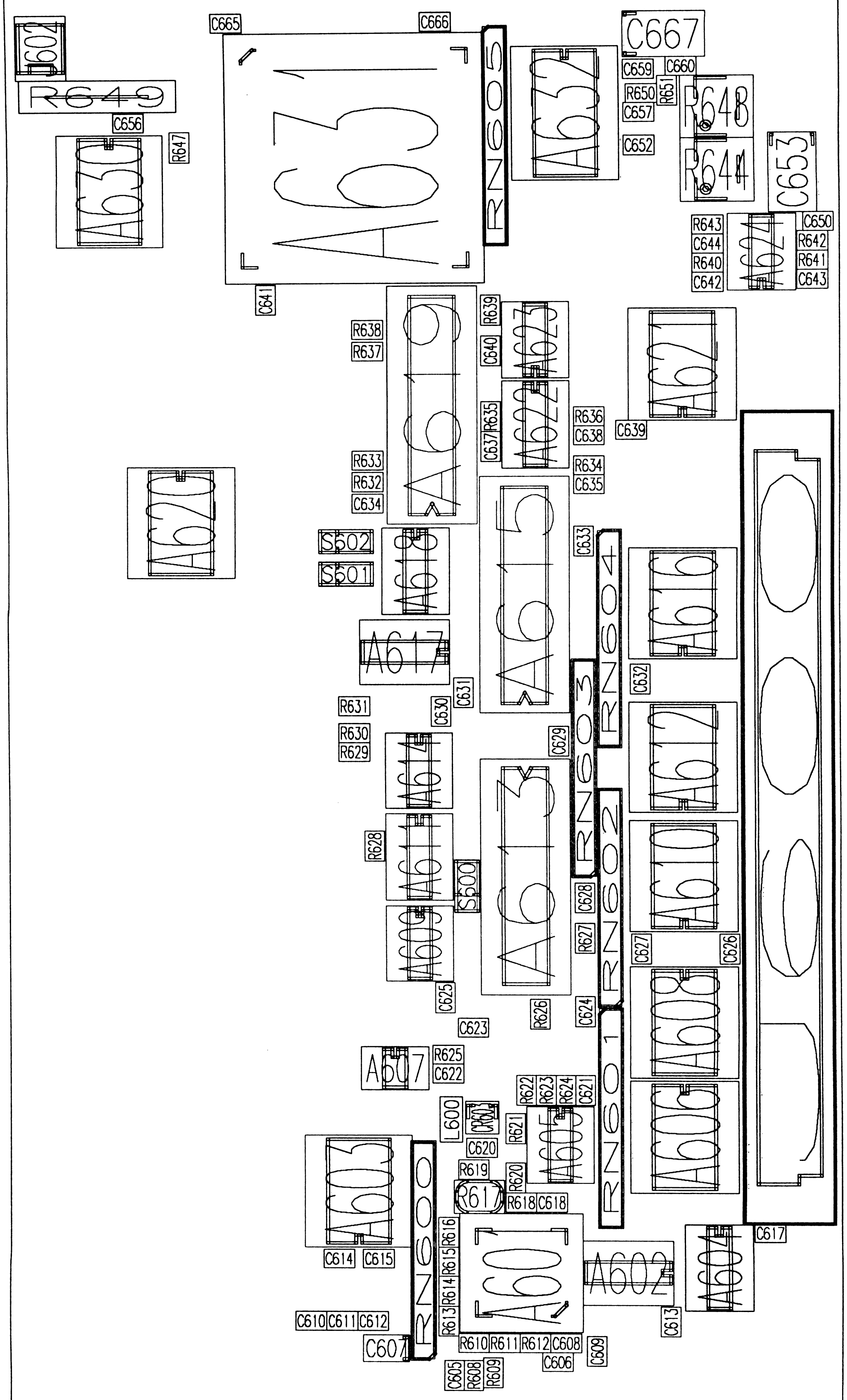

PEPITE
DIRECT
OPTIONS
S600
S601
S602
LeCroy CORPORATION
MODEL : 9324-3
uP CONTROL
DWG NO: 9324-3-S1


LeCroy CORPORATION
MODEL : 9324-3
uP CONTROL
DWG NO: 9324-3-S1

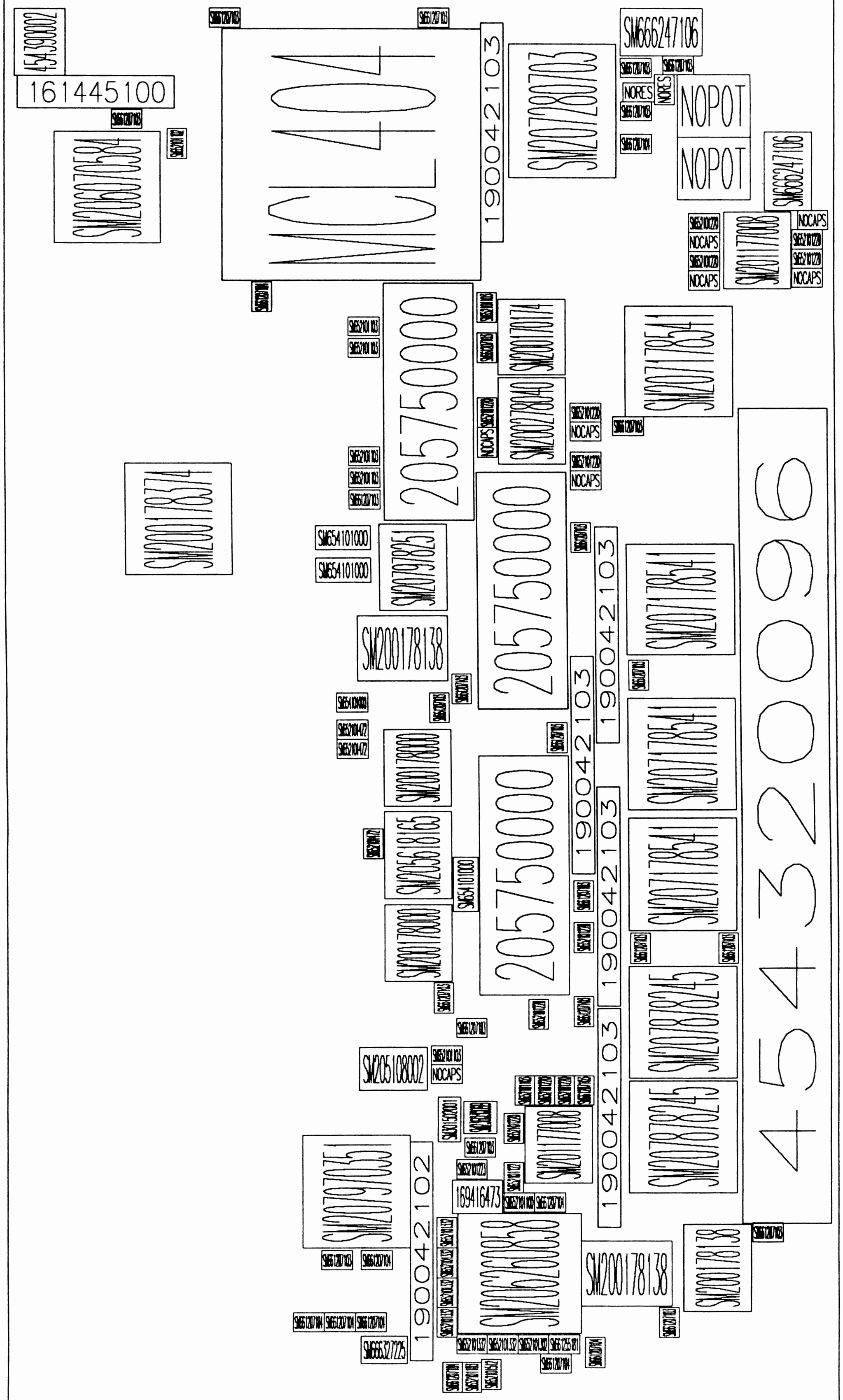

LeCroy CORPORATION
MODEL: 9324-3
POWER SUPPLY
DWG NO: 9324-3-S1


VIEW A
VIEW B
VIEW C
MICROPROCESSOR CONTROL
9324-3 Rev:C

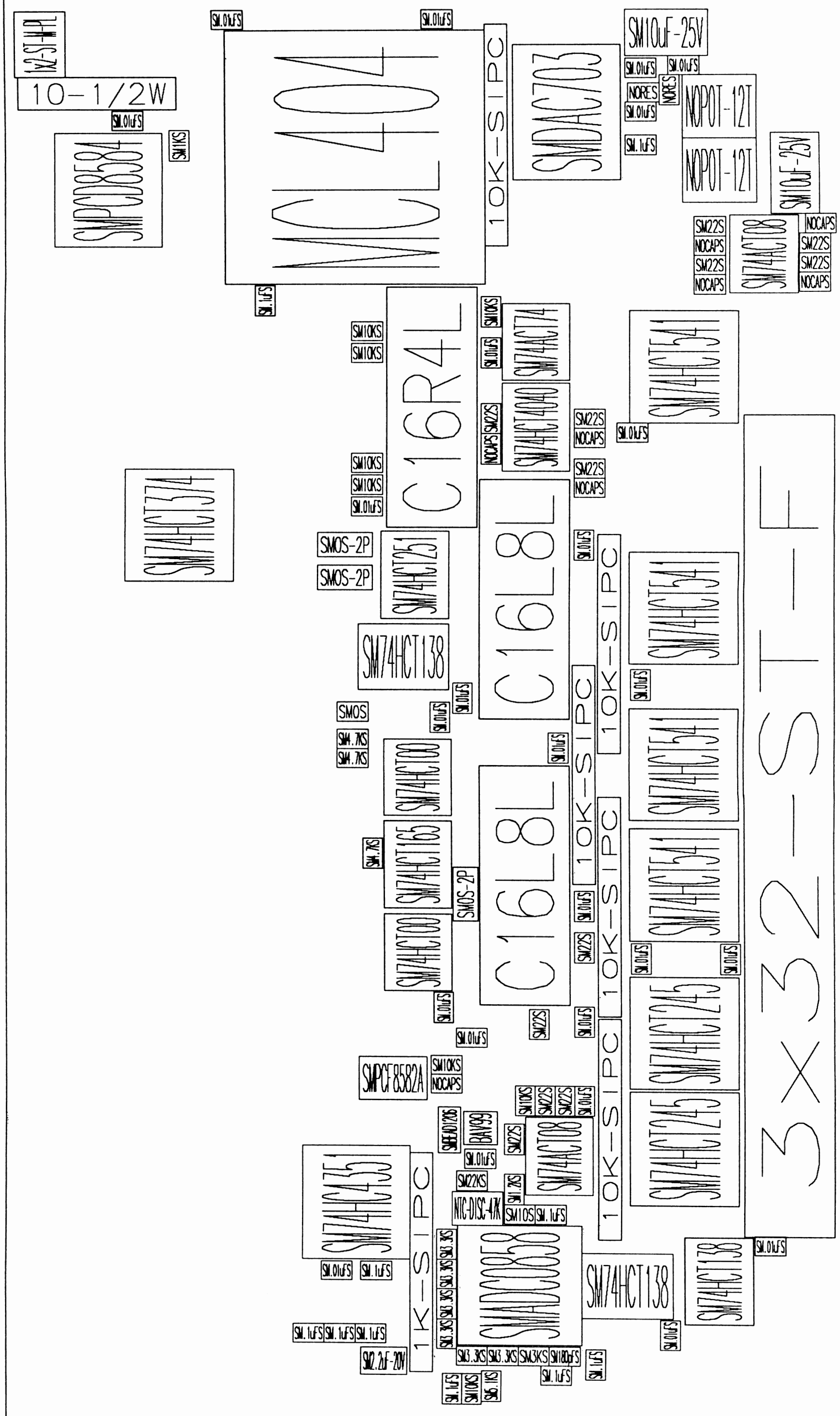

VIEW A
VIEW B
VIEW C
SOLDER SIDE
MICROPROCESSOR CONTROL
9324-3 Rev:C



CONTROL VIEW A



CONTROL VIEW A



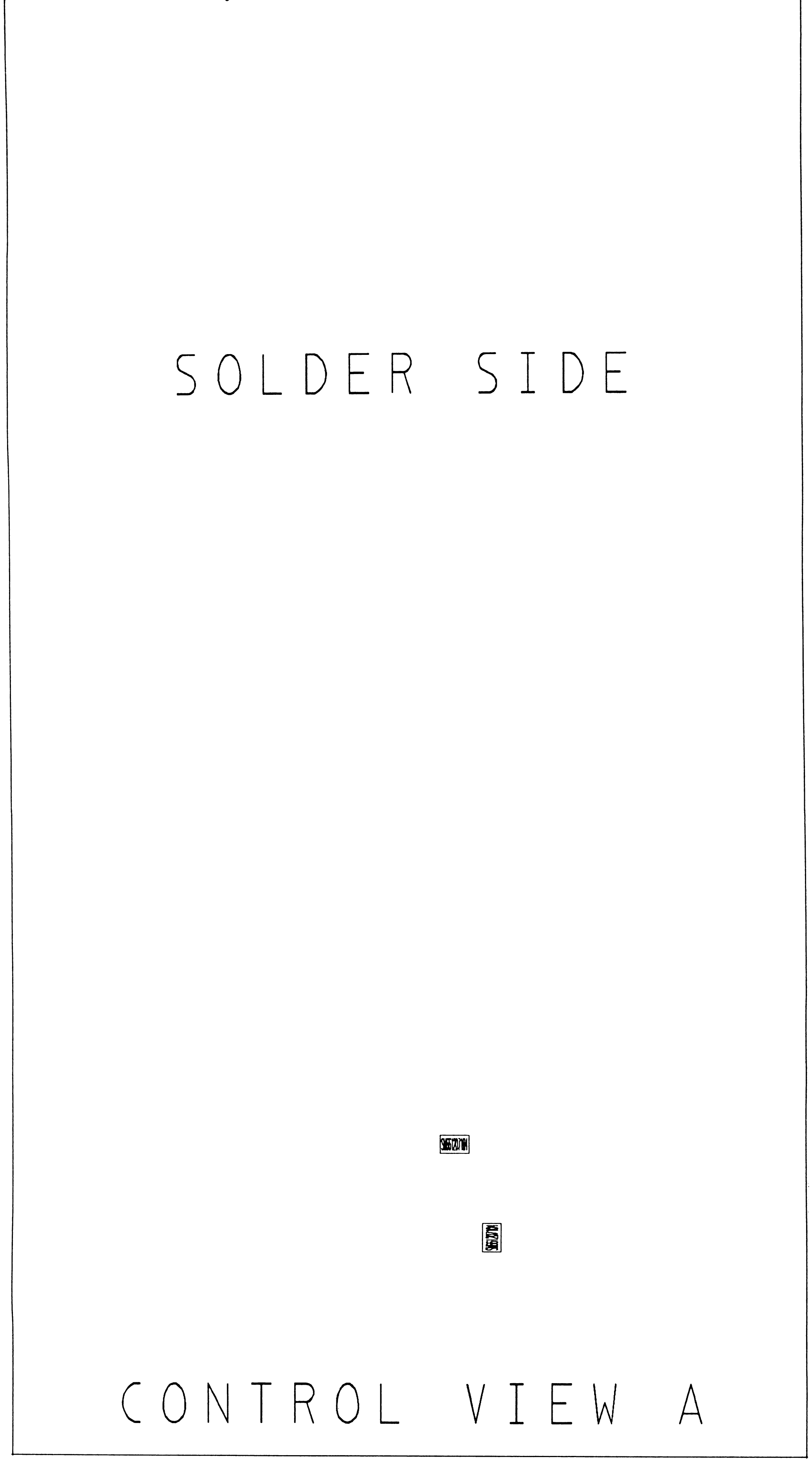
CONTROL VIEW A

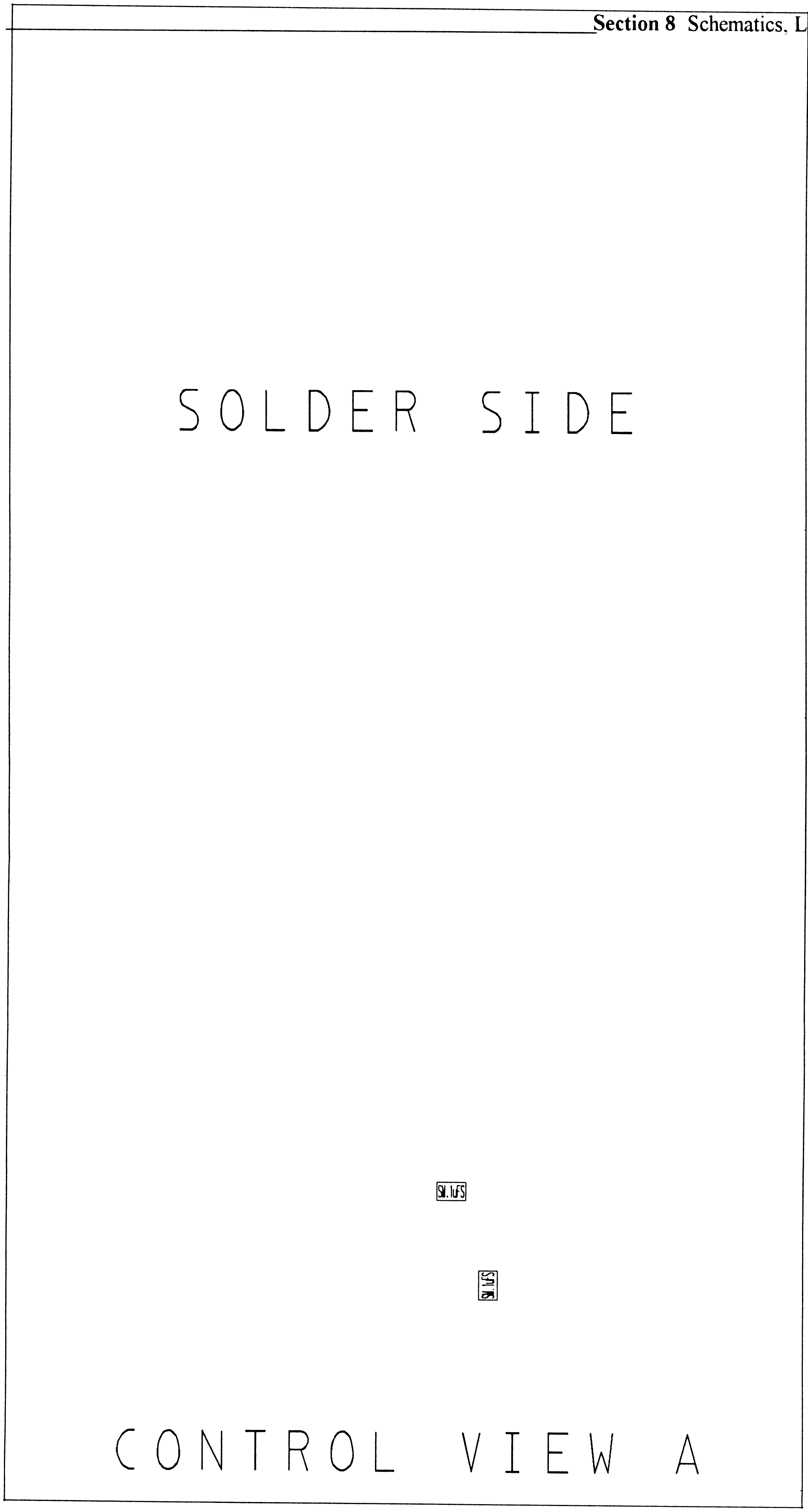
SOLDER SIDE

C619

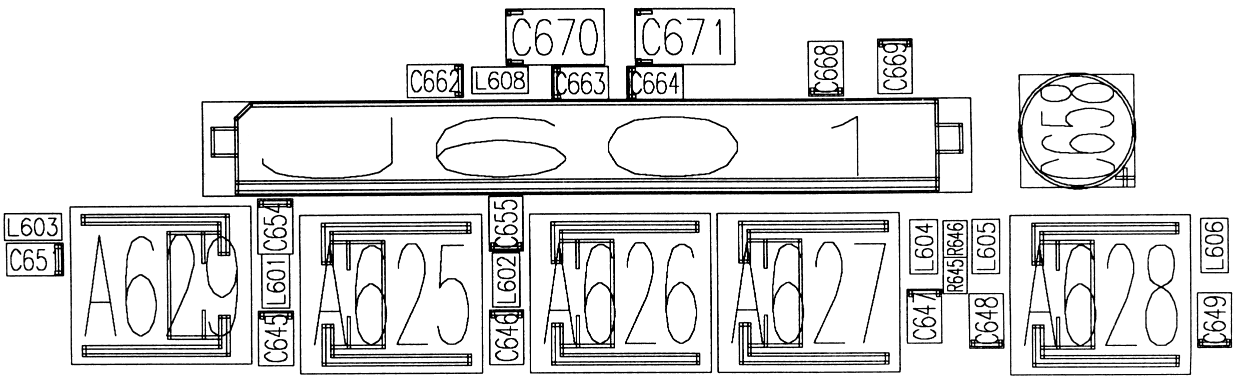
C616

CONTROL VIEW A

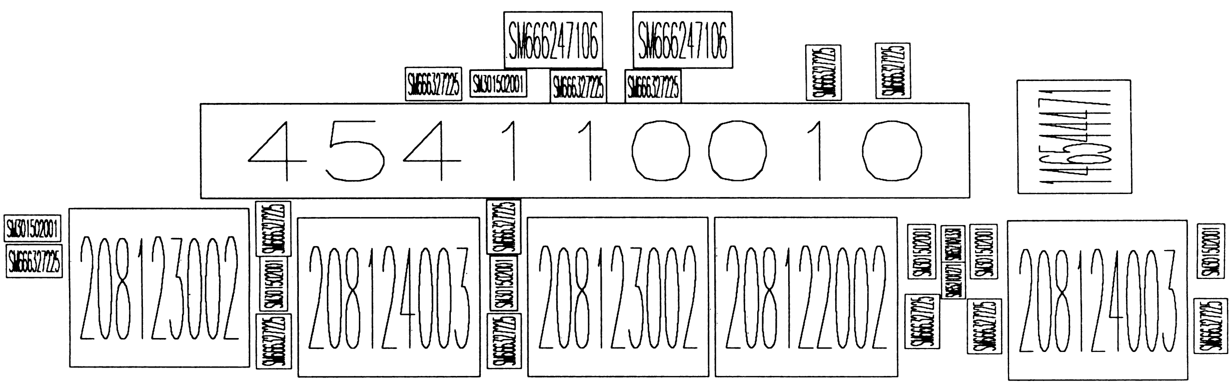

SOLDER SIDE
CONTROL VIEW A

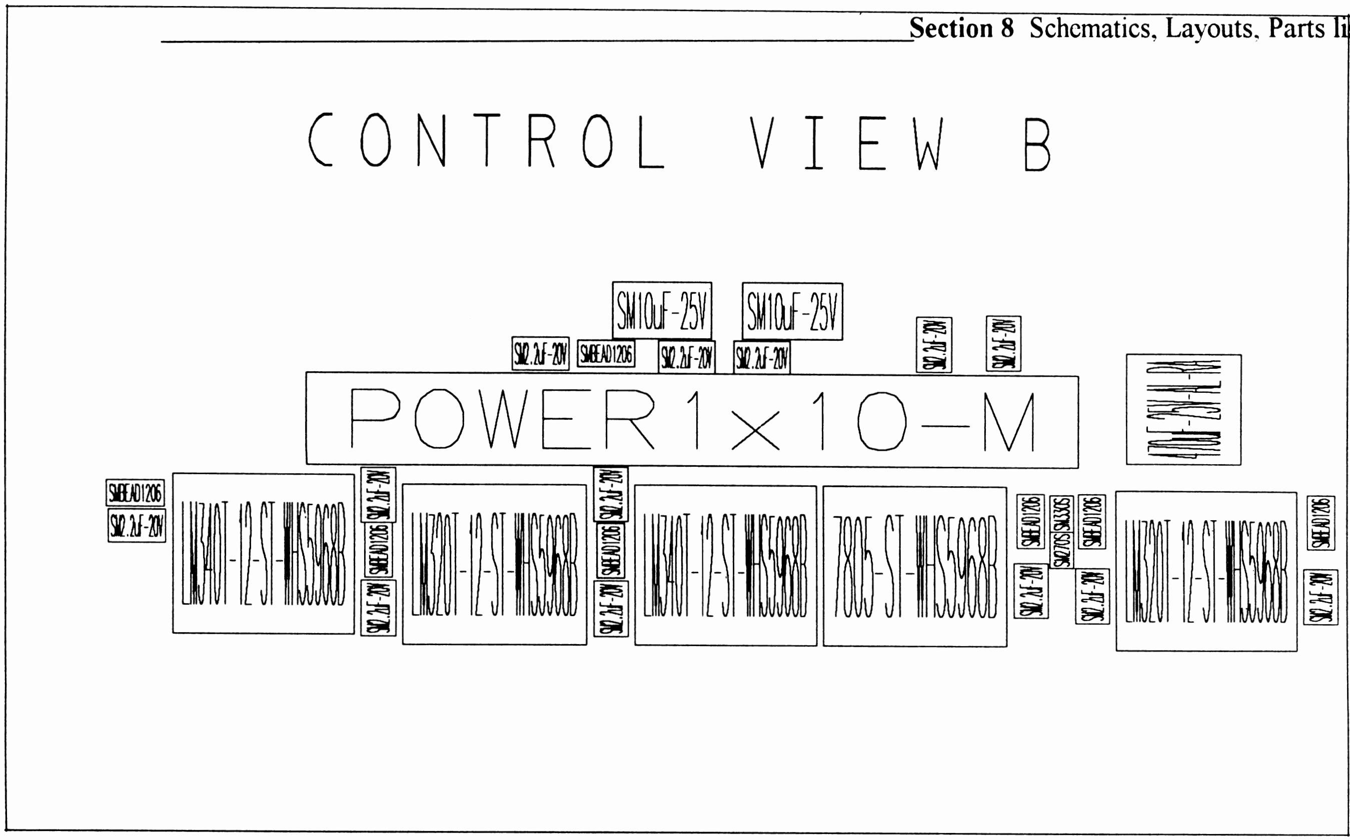

SOLDER SIDE
SM.1uFS
SM.1uFS
CONTROL VIEW A

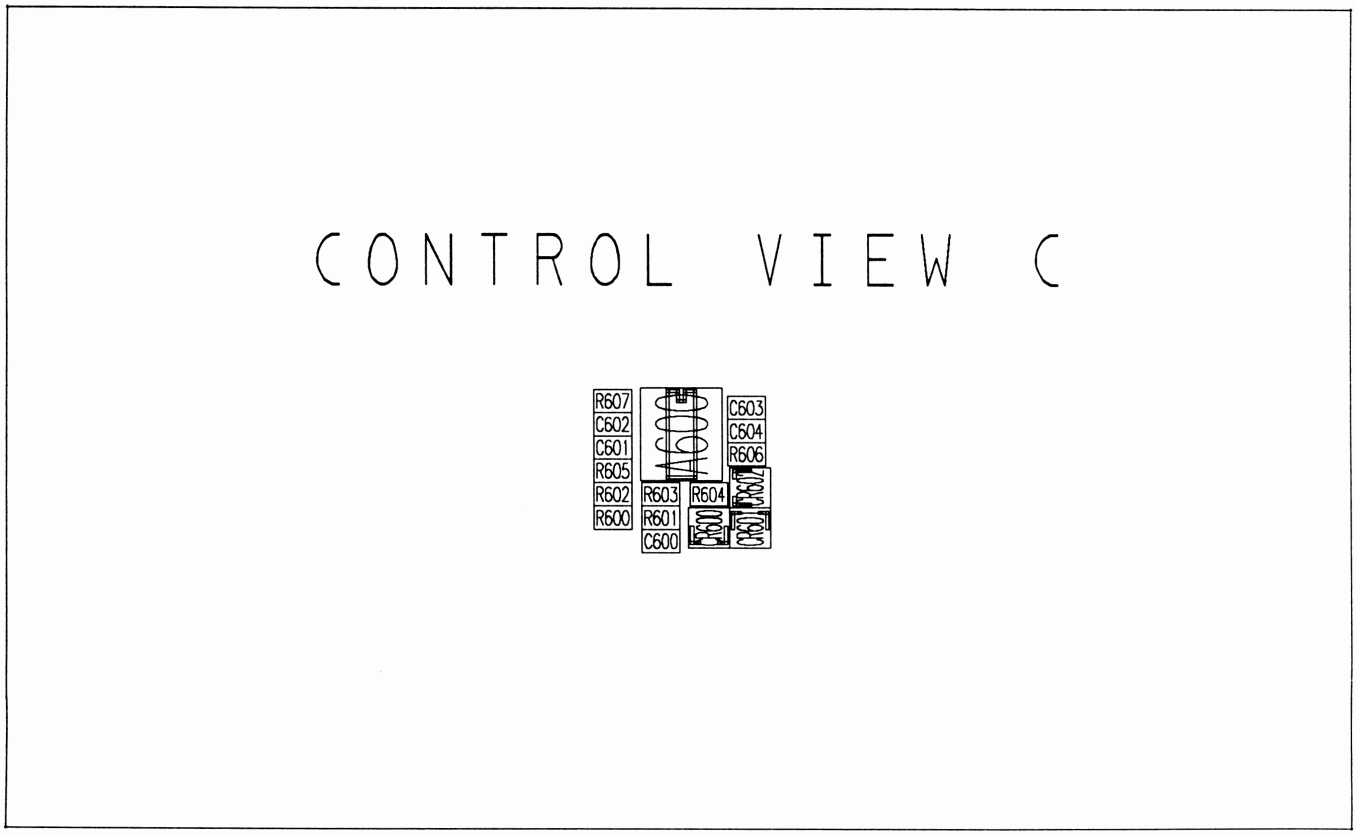
CONTROL VIEW B



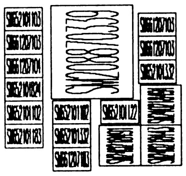
CONTROL VIEW B



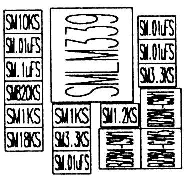

CONTROL VIEW B
SM10uF-25V
SM10uF-25V
SMBEAD1206
POWER1x10-M
7805-ST-WHS5968B

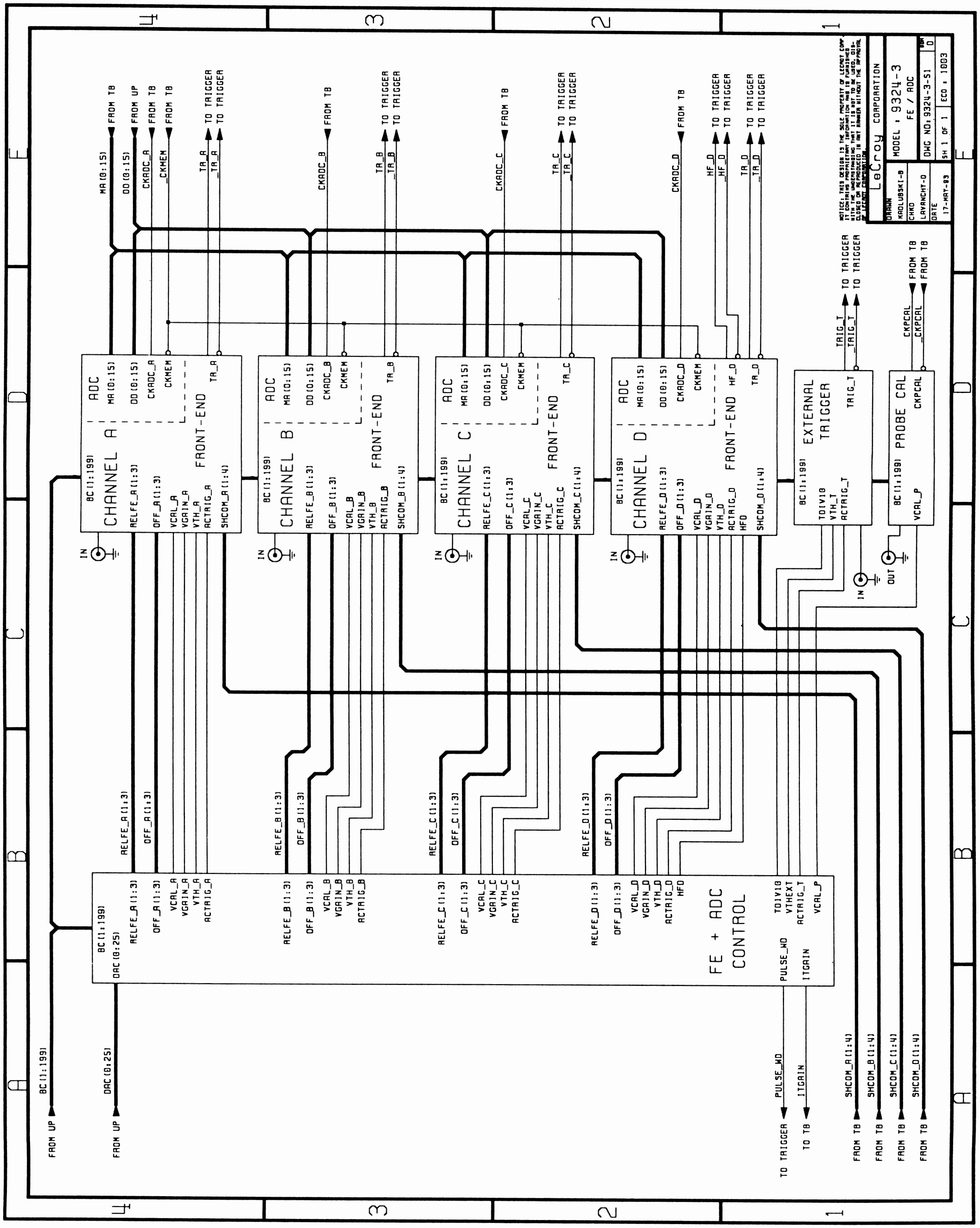

CONTROL VIEW C
R607
C602
C601
R605
R602
R600
R603
R601
C600
R604
C603
C604
R606

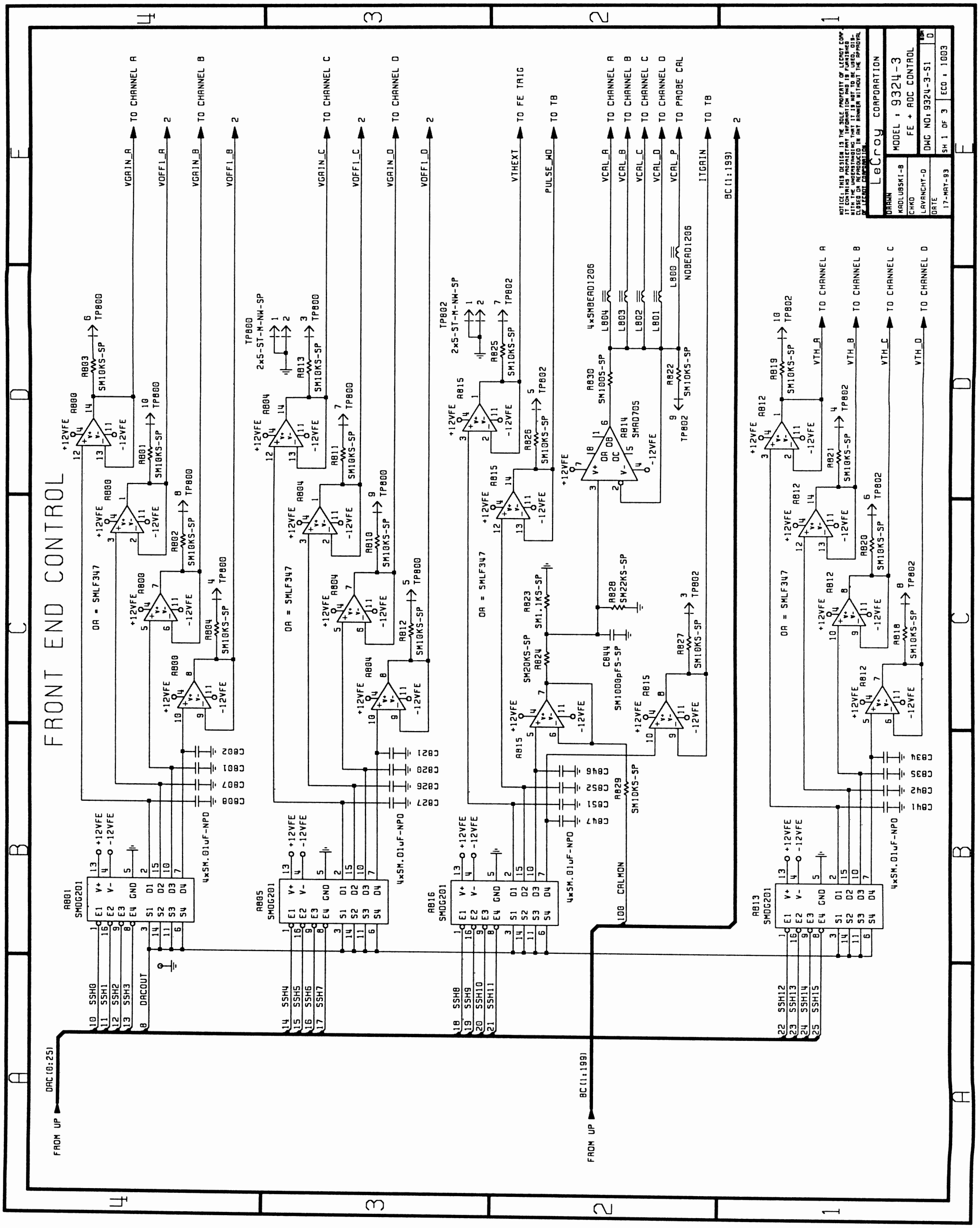
CONTROL VIEW C

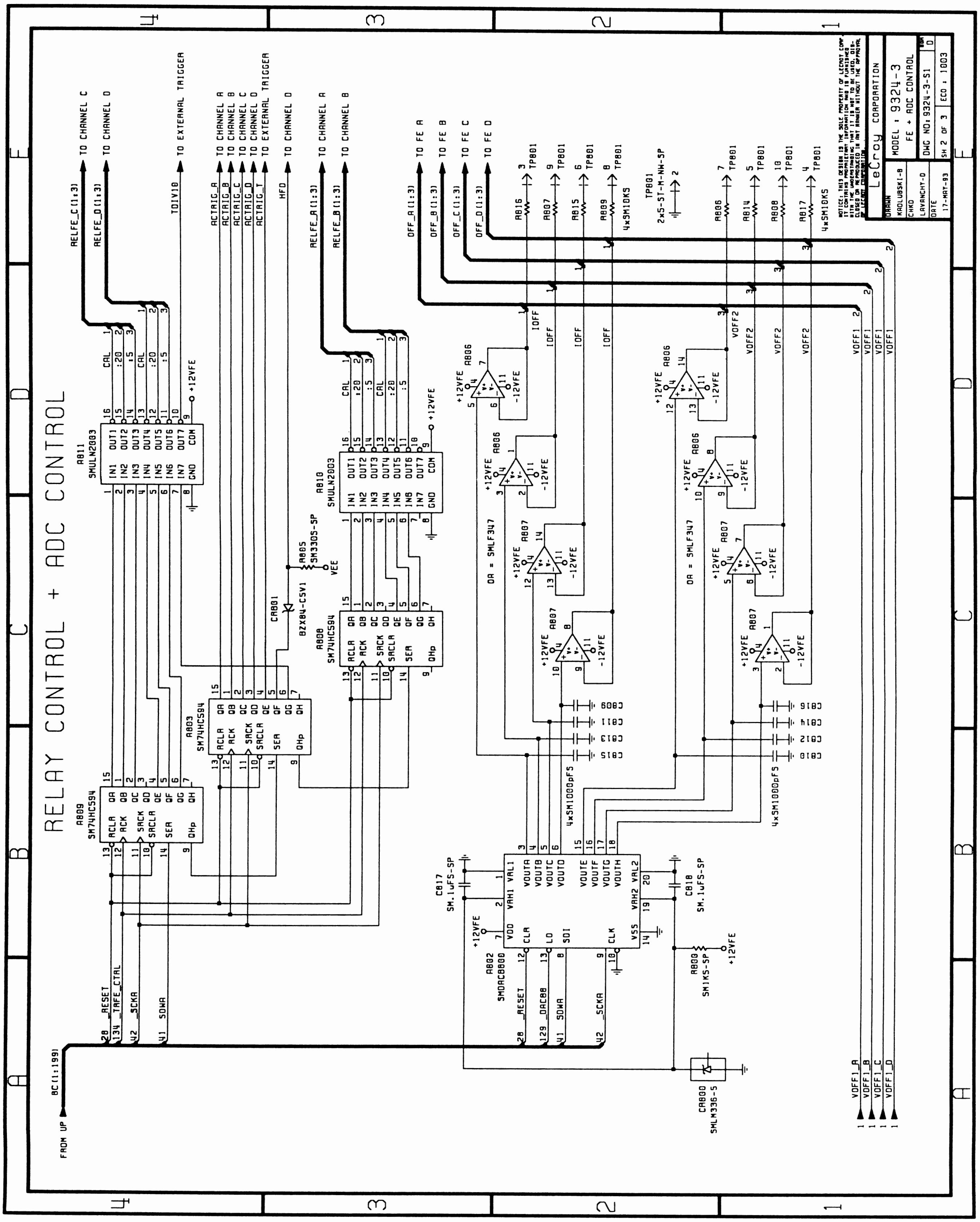


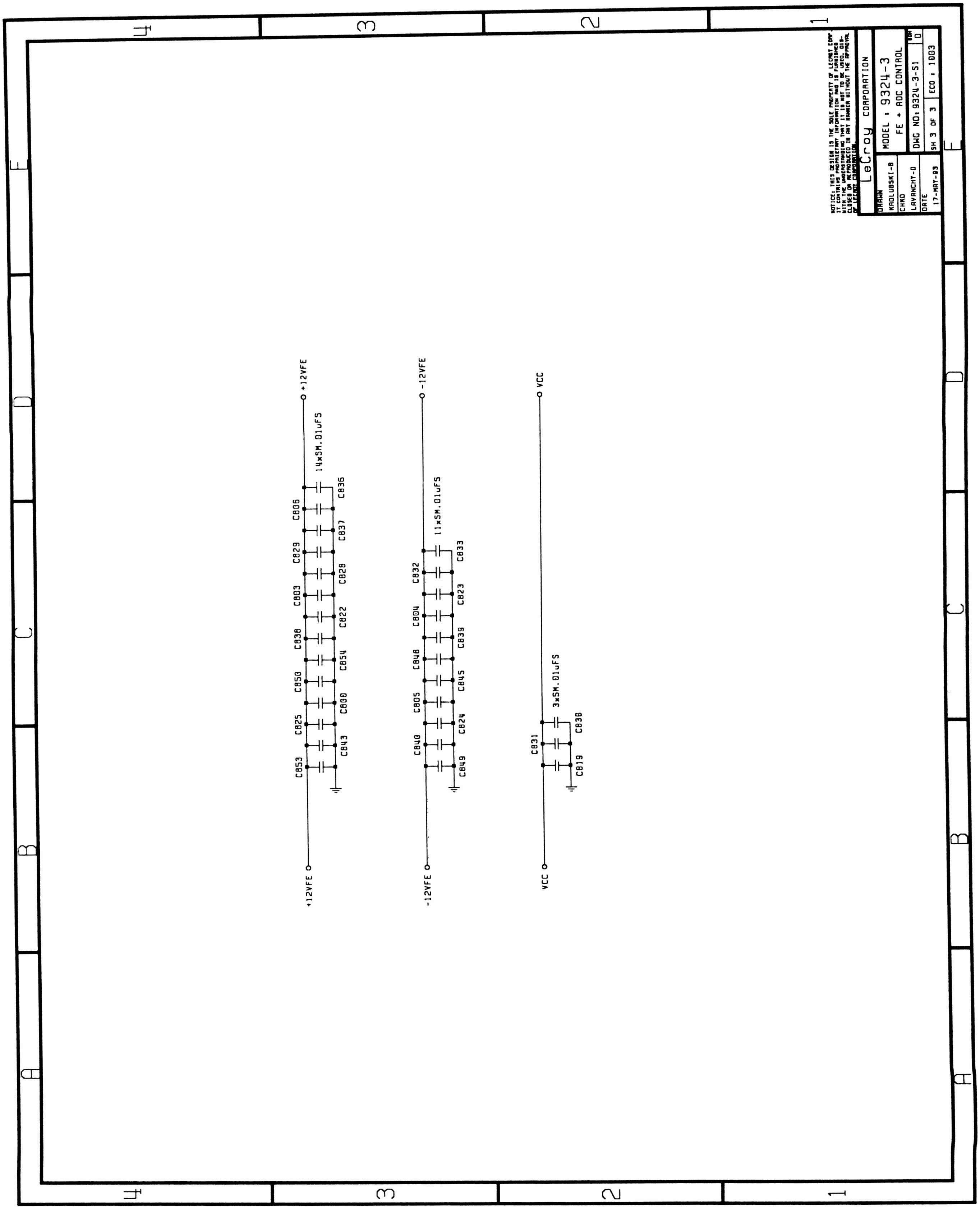
CONTROL VIEW C

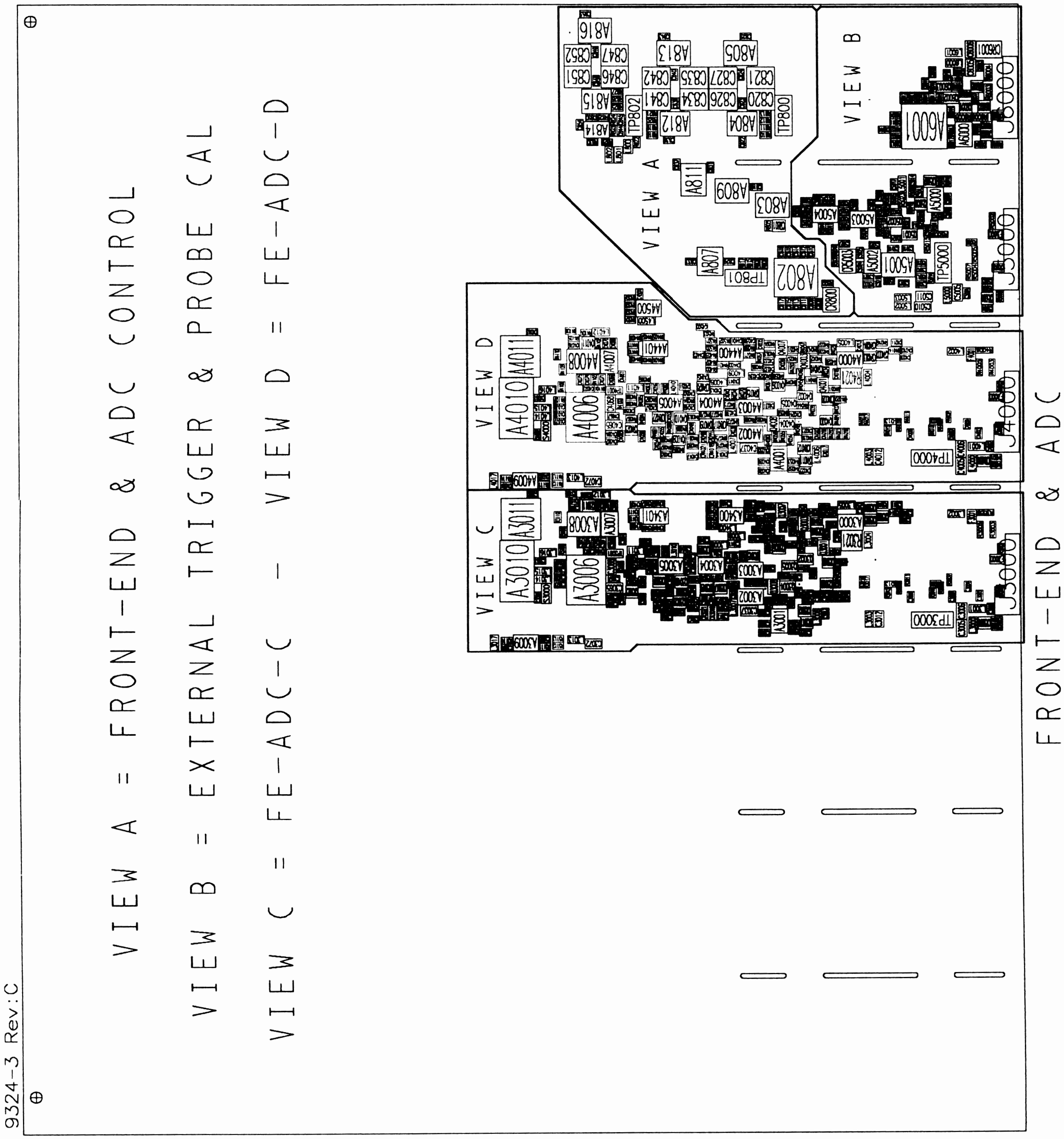


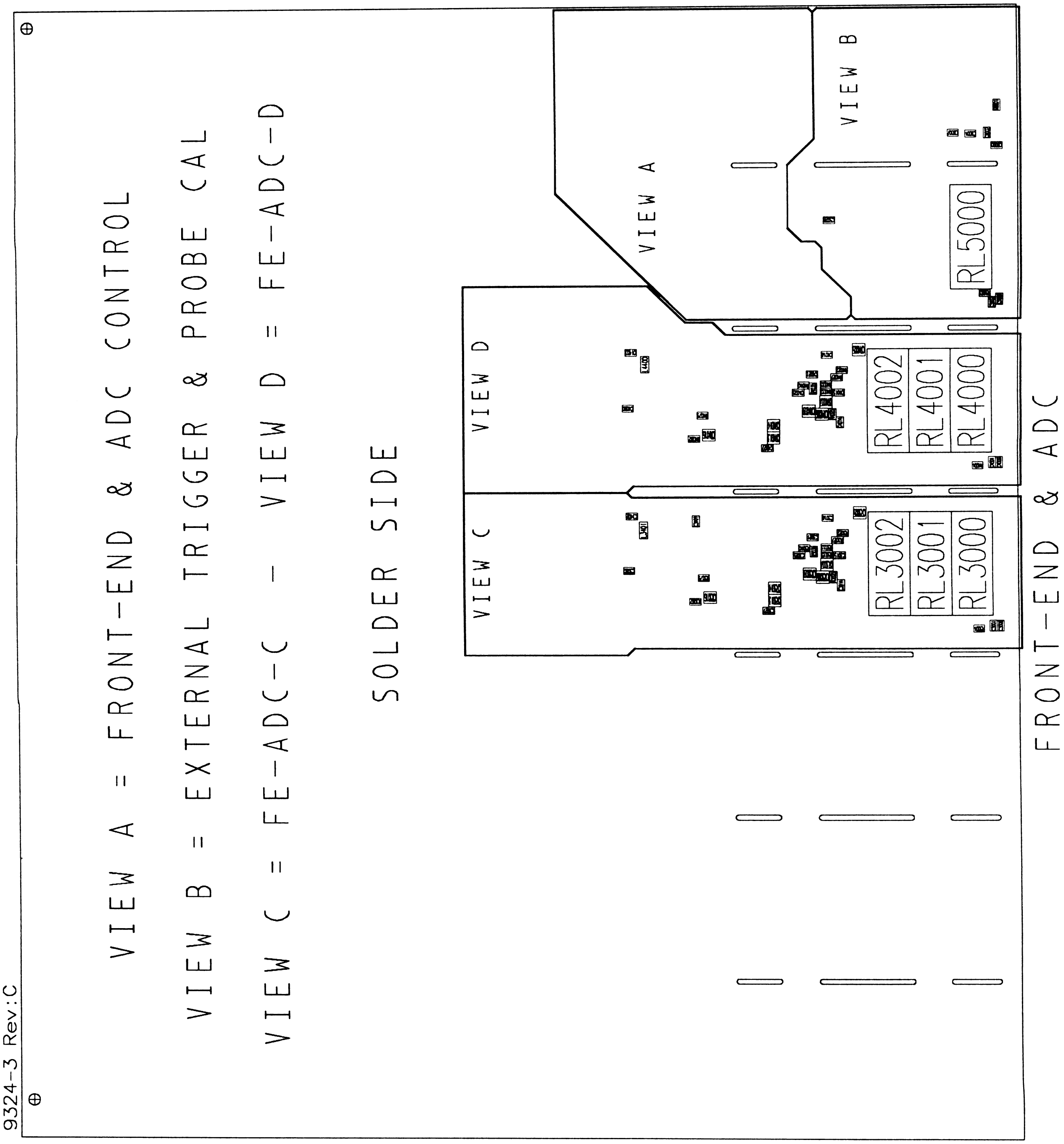

CHANNEL A
CHANNEL B
CHANNEL C
CHANNEL D
ADC
FRONT-END
EXTERNAL TRIGGER
PROBE CAL
FE + ADC CONTROL
LeCroy CORPORATION
MODEL : 9324-3
FE / ADC
DWG NO: 9324-3-S1

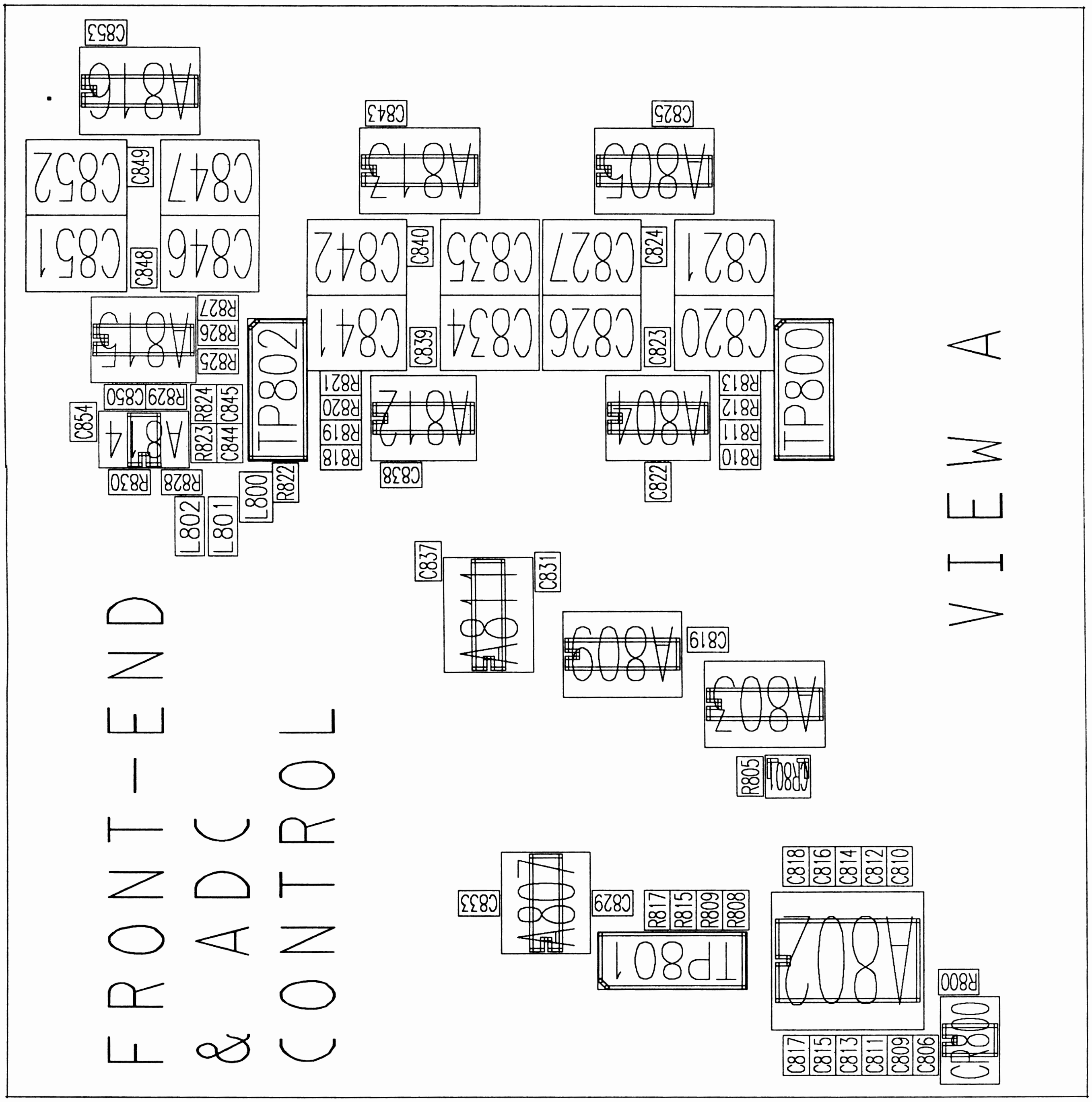

FRONT END CONTROL
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CONTROL
DWG NO: 9324-3-S1
SH 1 OF 3
ECO : 1003
17-MAY-93

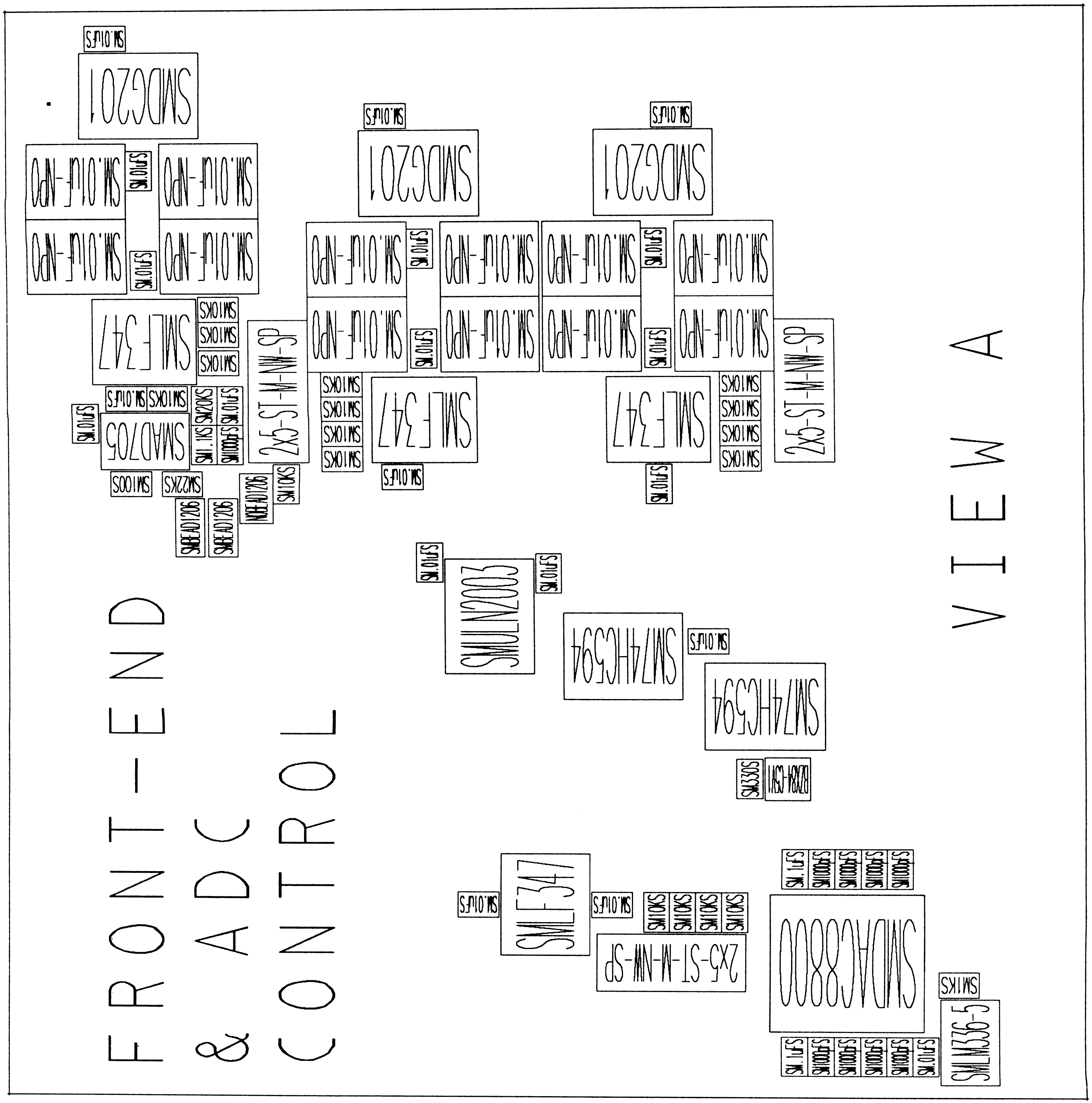

RELAY CONTROL + ADC CONTROL
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CONTROL
DWG NO: 9324-3-S1
SH 2 OF 3
ECO : 1003
KADLUBSKI-B
LAVANCHY-D
17-MAY-93

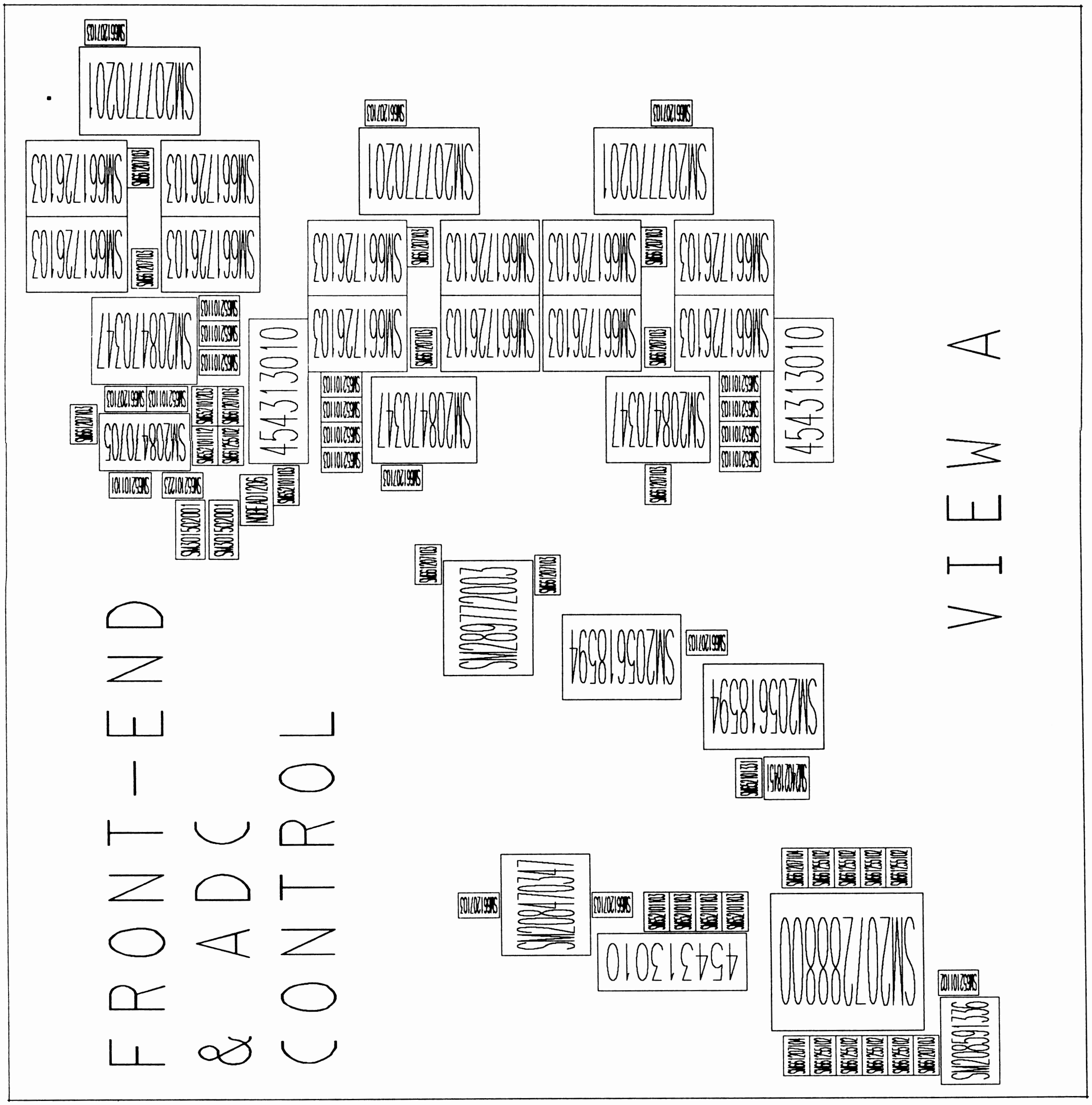

+12VFE
14xSM.01uFS
C836
C806
C837
C829
C828
C803
C822
C838
C854
C850
C825
C843
C853
-12VFE
11xSM.01uFS
C833
C832
C823
C804
C839
C848
C845
C805
C824
C840
C849
VCC
3xSM.01uFS
C830
C831
C819
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CONTROL
DRAWN
KADLUBSKI-B
CHKD
LAVANCHY-D
DATE
17-MAY-93
DWG NO: 9324-3-S1
SH 3 OF 3
ECO : 1003

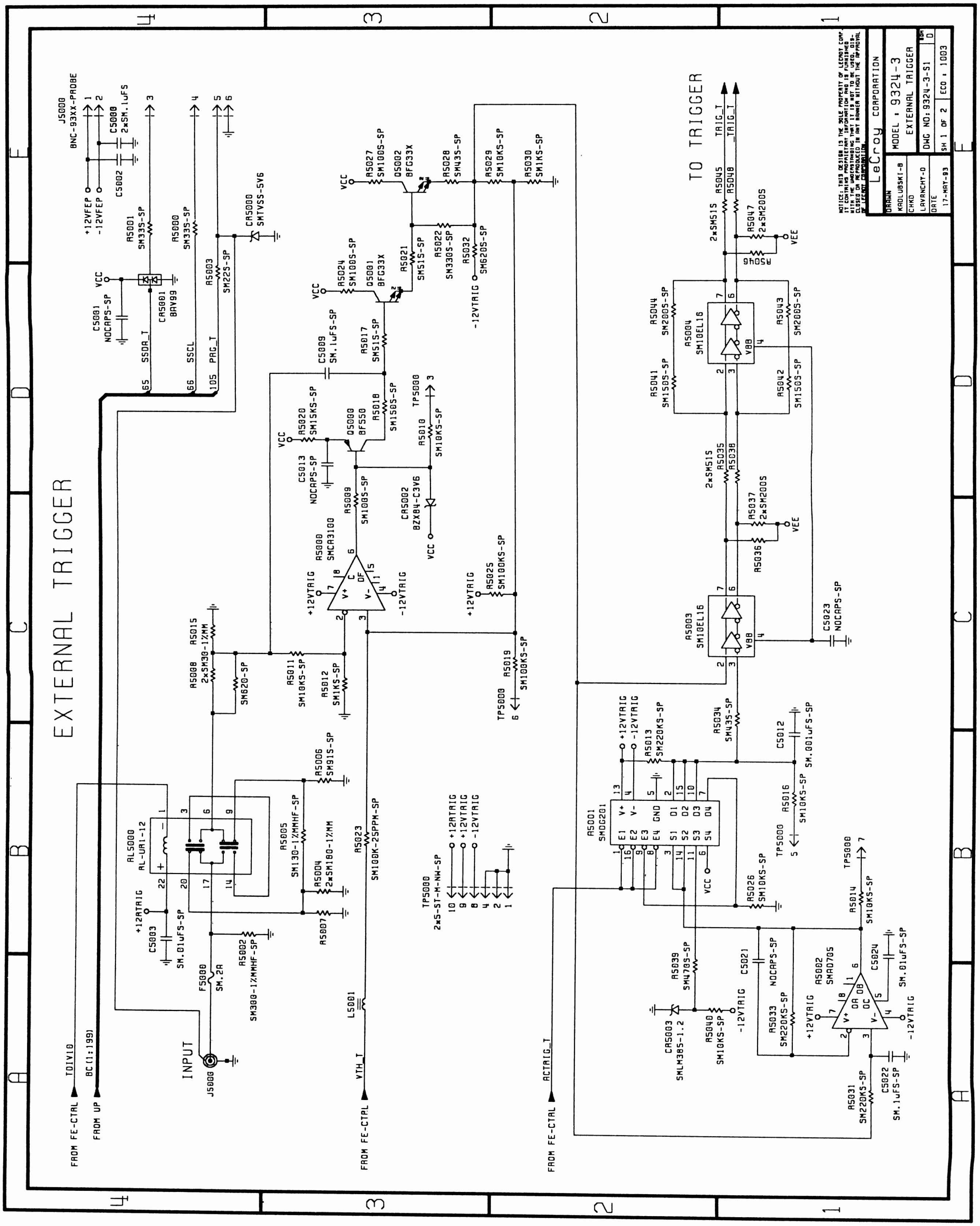

9324-3 Rev:C
VIEW A = FRONT-END & ADC CONTROL
VIEW B = EXTERNAL TRIGGER & PROBE CAL
VIEW C = FE-ADC-C - VIEW D = FE-ADC-D
FRONT-END & ADC
VIEW A
VIEW B
VIEW C
VIEW D

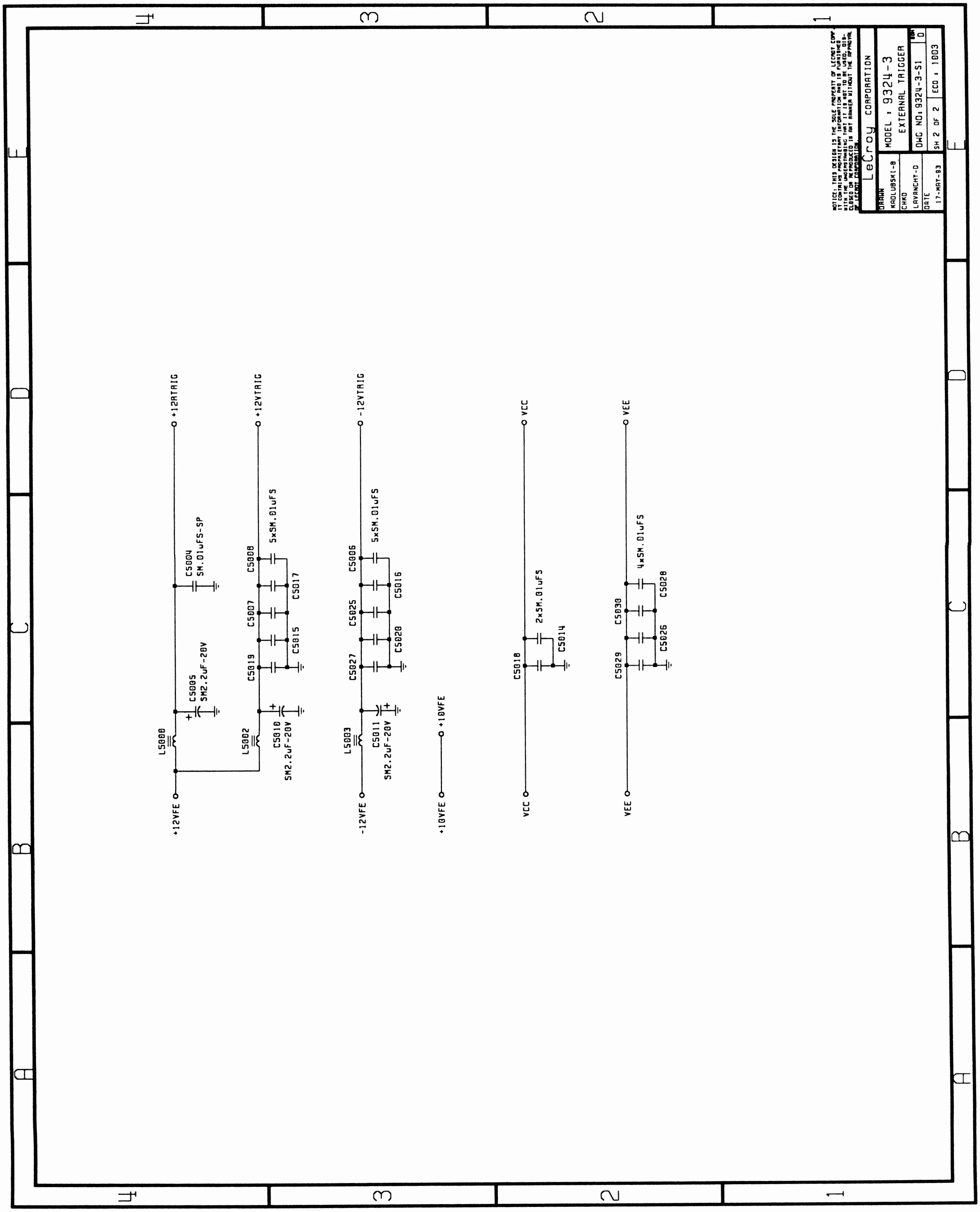

9324-3 Rev:C
VIEW A = FRONT-END & ADC CONTROL
VIEW B = EXTERNAL TRIGGER & PROBE CAL
VIEW C = FE-ADC-C - VIEW D = FE-ADC-D
SOLDER SIDE
VIEW A
VIEW B
VIEW C
VIEW D
RL5000
RL4002
RL4001
RL4000
RL3002
RL3001
RL3000
FRONT-END & ADC

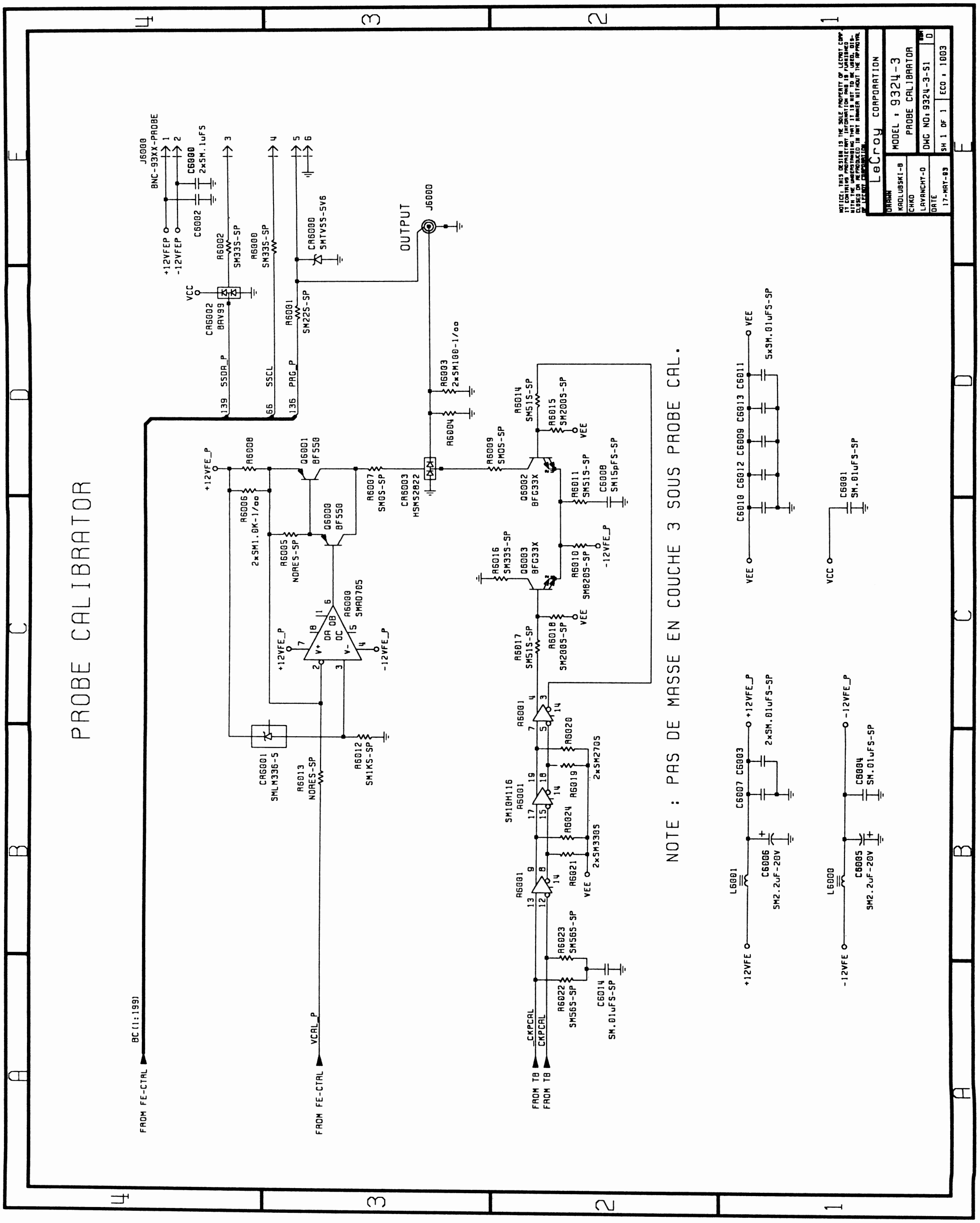

FRONT-END
& ADC
CONTROL
VIEW A
TP800
TP801
TP802
A802
A803
A804
A805
A807
A809
A811
A812
A813
A814
A815
A816
CR800
L800
L801
L802

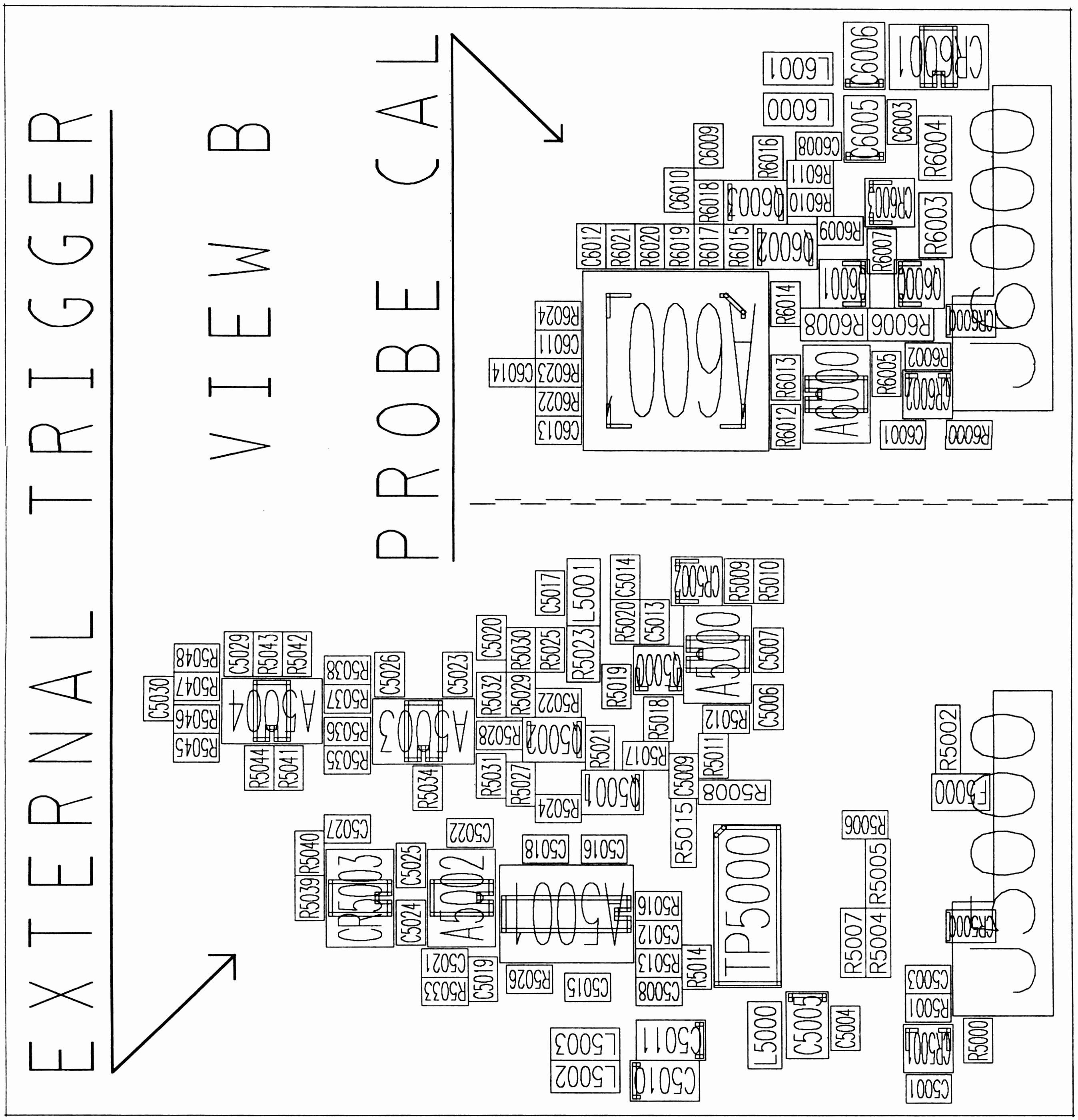

FRONT-END & ADC CONTROL
VIEW A

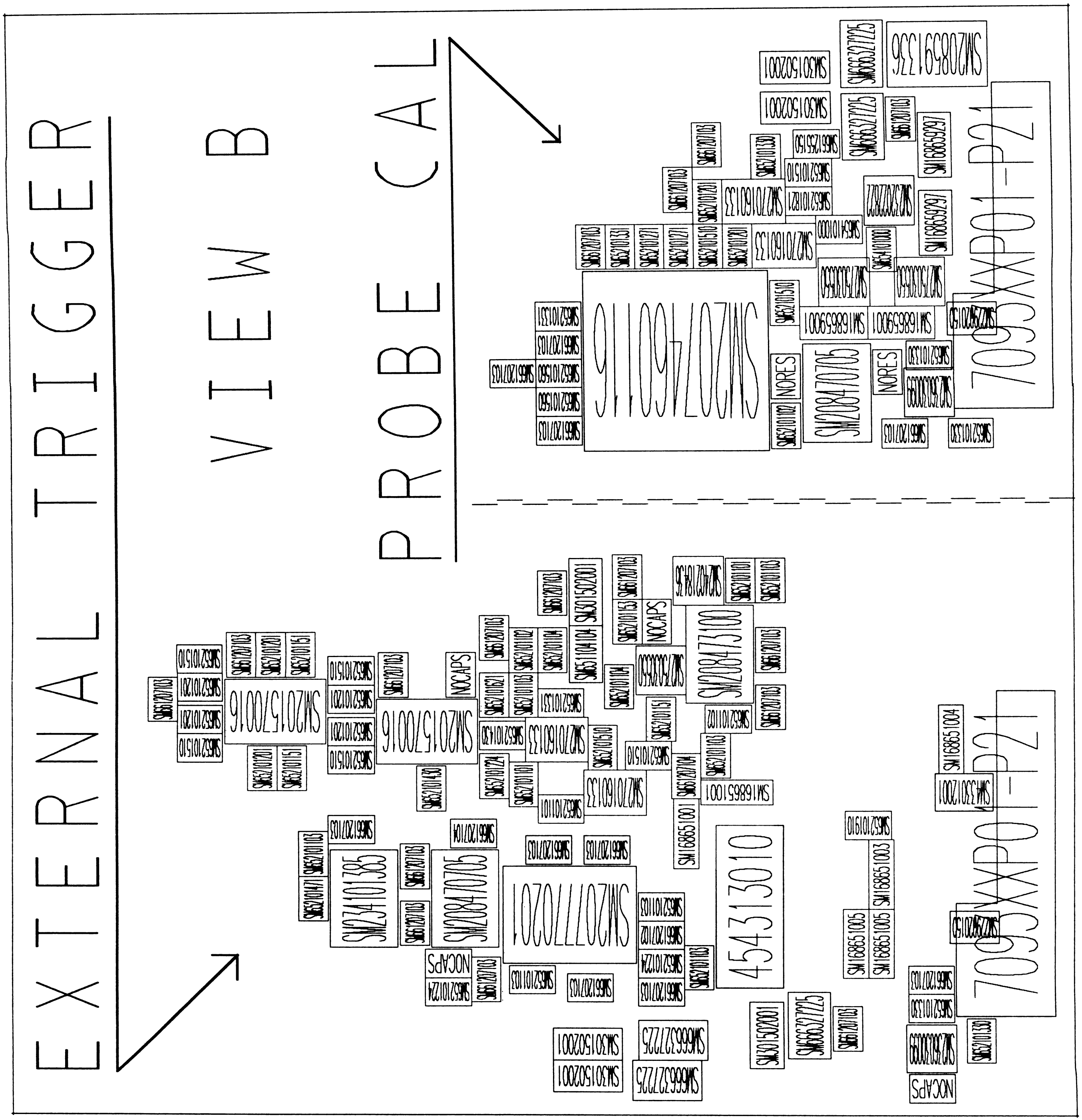

FRONT-END
& ADC
CONTROL
VIEW A

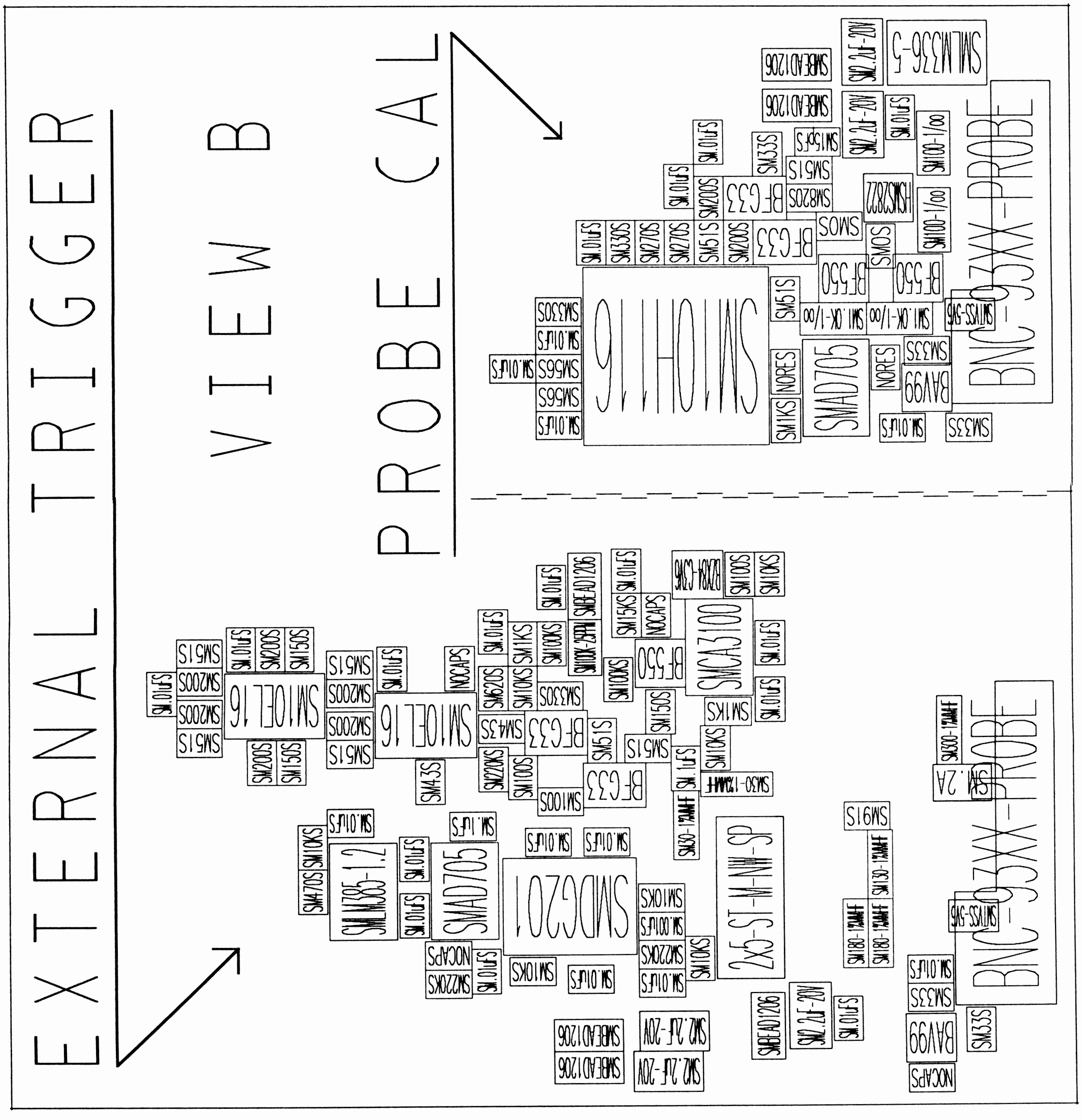

EXTERNAL TRIGGER
TO TRIGGER
TRIG_T
INPUT
J5000
FROM FE-CTRL
FROM UP
TDIV10
BC(1:199)
VTH_T
ACTRIG_T
J5000
BNC-93XX-PROBE
LeCroy CORPORATION
MODEL : 9324-3
EXTERNAL TRIGGER
DWG NO: 9324-3-S1
SH 1 OF 2
ECO : 1003
DRAWN KADLUBSKI-B
CHKD LAVANCHY-D
DATE 17-MAY-93
RL5000
AL-UA1-12
A5001
SMDG201
A5003
SM10EL16
A5004
SM10EL16
A5000
SMCA3100
A5002
SMAD705
TP5000
2xS-ST-M-NH-SP

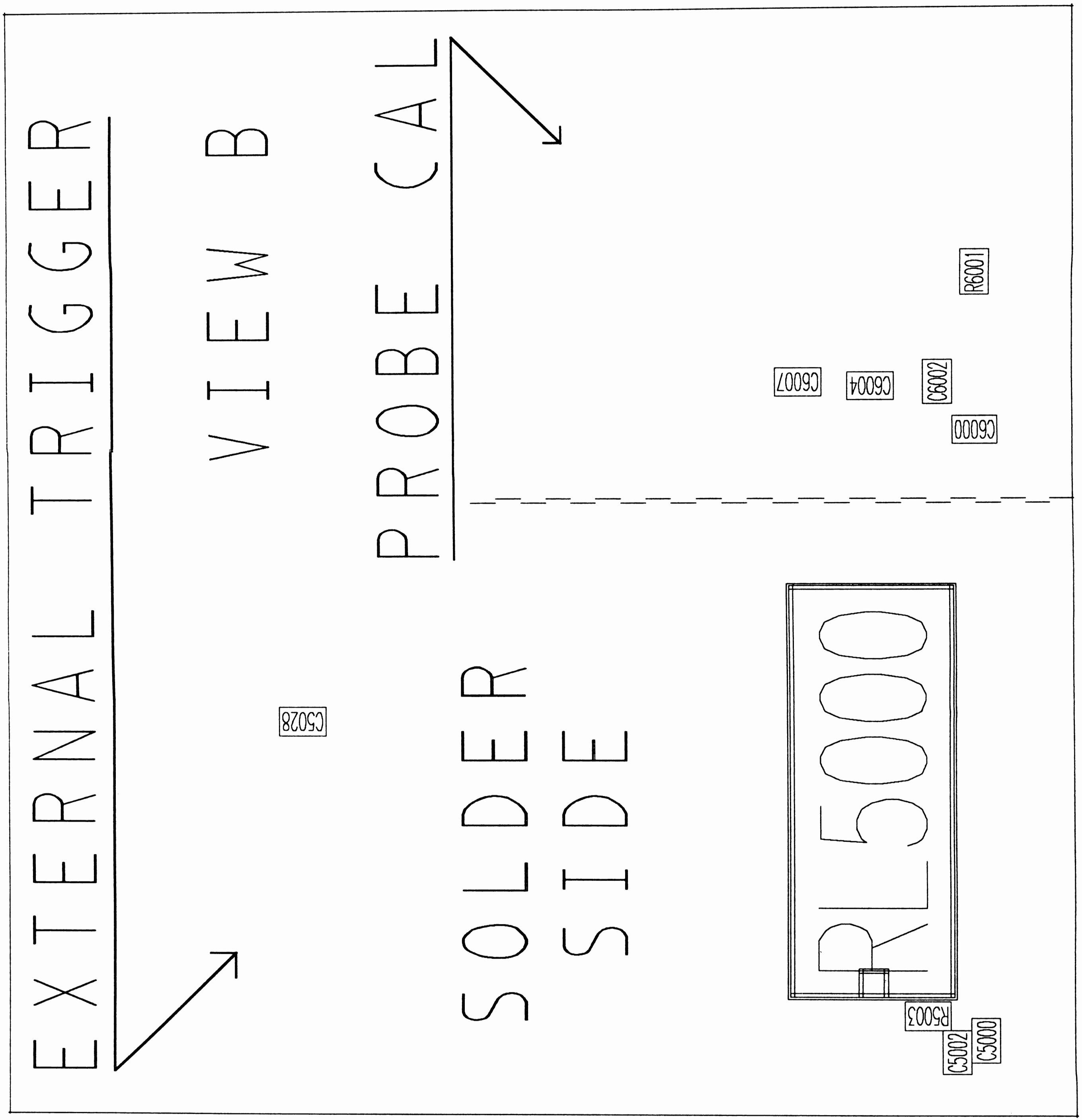

LeCroy CORPORATION
MODEL : 9324-3
EXTERNAL TRIGGER
DRAWN KADLUBSKI-B
CHKD
LAYANCHT-D
DATE 17-MAY-93
DWG NO: 9324-3-S1
SH 2 OF 2
ECO : 1003
+12RTRIG
+12VTRIG
-12VTRIG
VCC
VEE
+12VFE
-12VFE
+10VFE
L5000
L5002
L5003
C5004 5M.01uFS-SP
C5005 5M2.2uF-20V
C5010 5M2.2uF-20V
C5011 5M2.2uF-20V
5x5M.01uFS
2x5M.01uFS
4x5M.01uFS
C5007
C5008
C5019
C5015
C5017
C5006
C5025
C5027
C5016
C5020
C5018
C5014
C5029
C5030
C5026
C5028

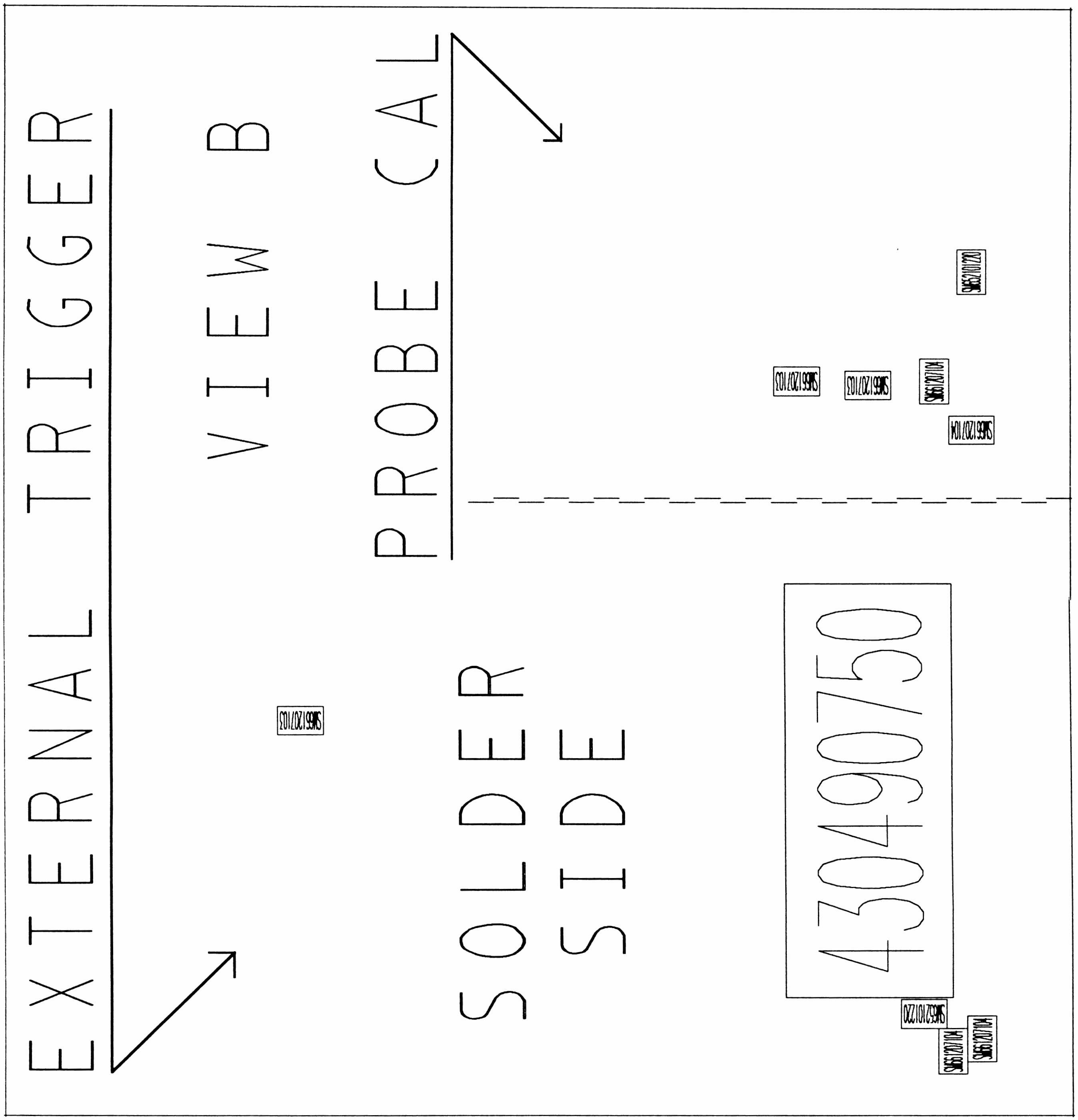

PROBE CALIBRATOR
NOTE : PAS DE MASSE EN COUCHE 3 SOUS PROBE CAL.
OUTPUT
J6000
FROM FE-CTRL
BC(1:199)
VCAL_P
FROM TB
CKPCAL
LeCroy CORPORATION
MODEL : 9324-3
PROBE CALIBRATOR
DWG NO: 9324-3-S1
SH 1 OF 1
ECO : 1003
DRAWN KAOLUBSKI-B
CHKD LAVANCHY-D
DATE 17-MAY-93

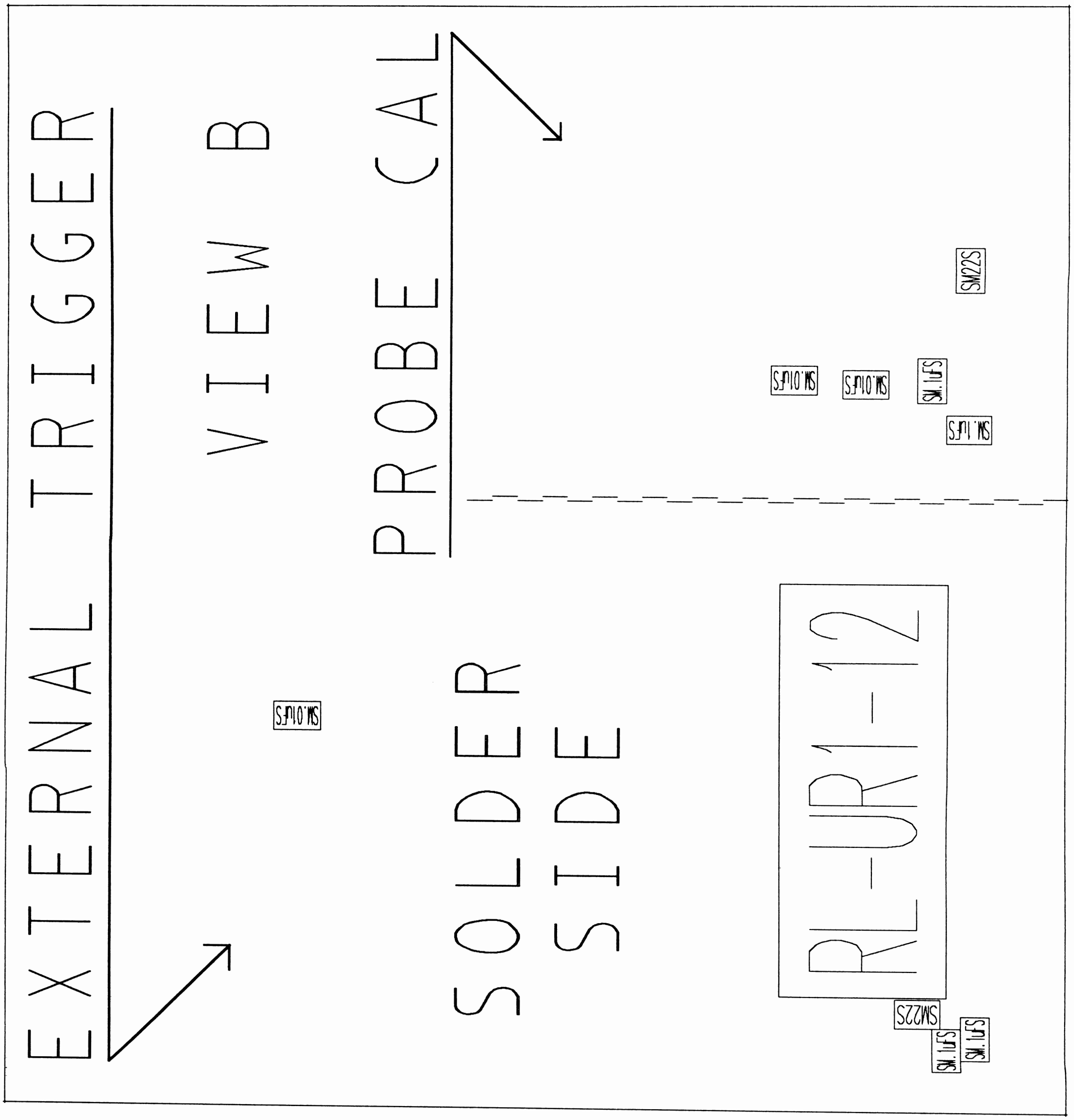

EXTERNAL TRIGGER
VIEW B
PROBE CAL

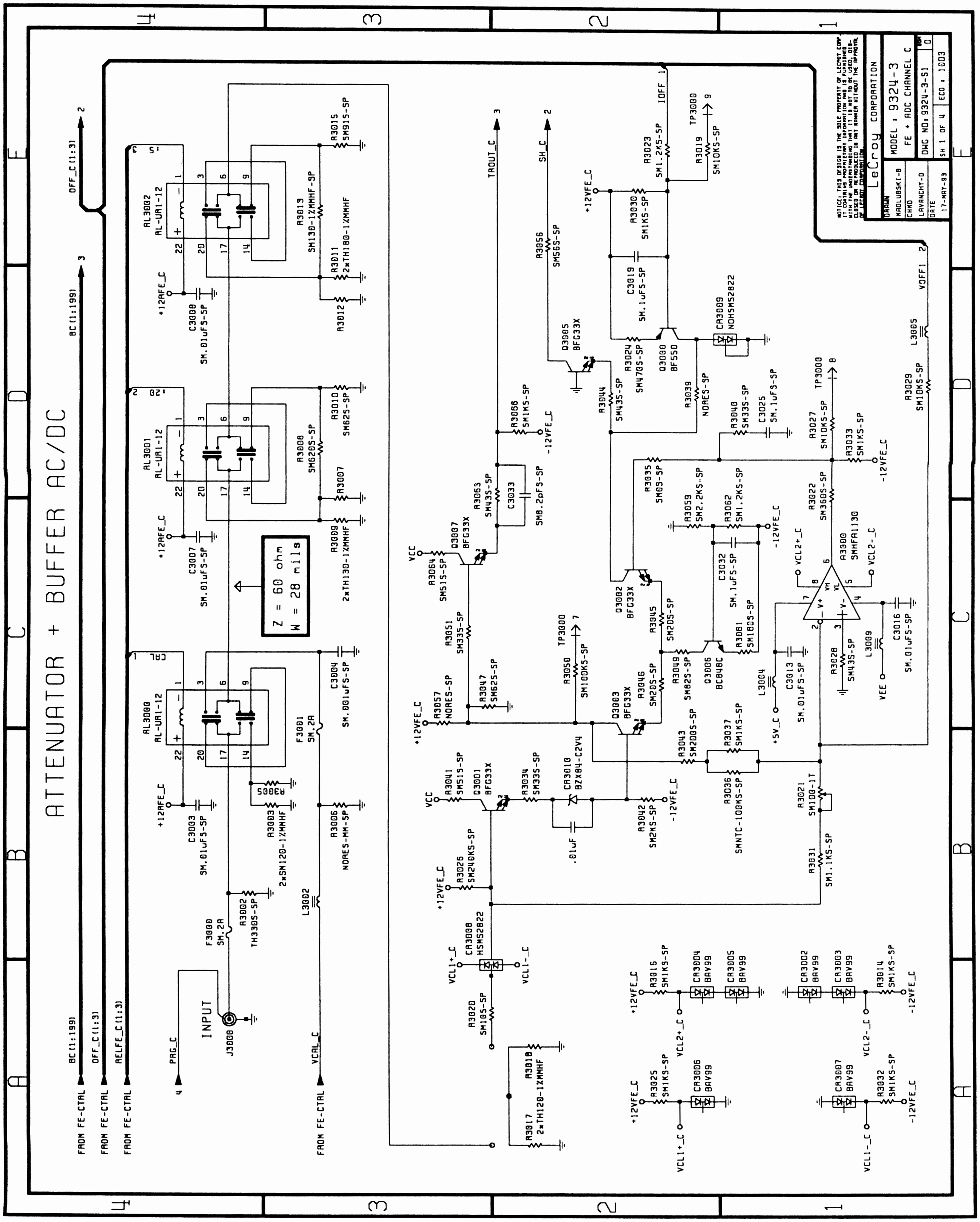

EXTERNAL TRIGGER
VIEW B
PROBE CAL

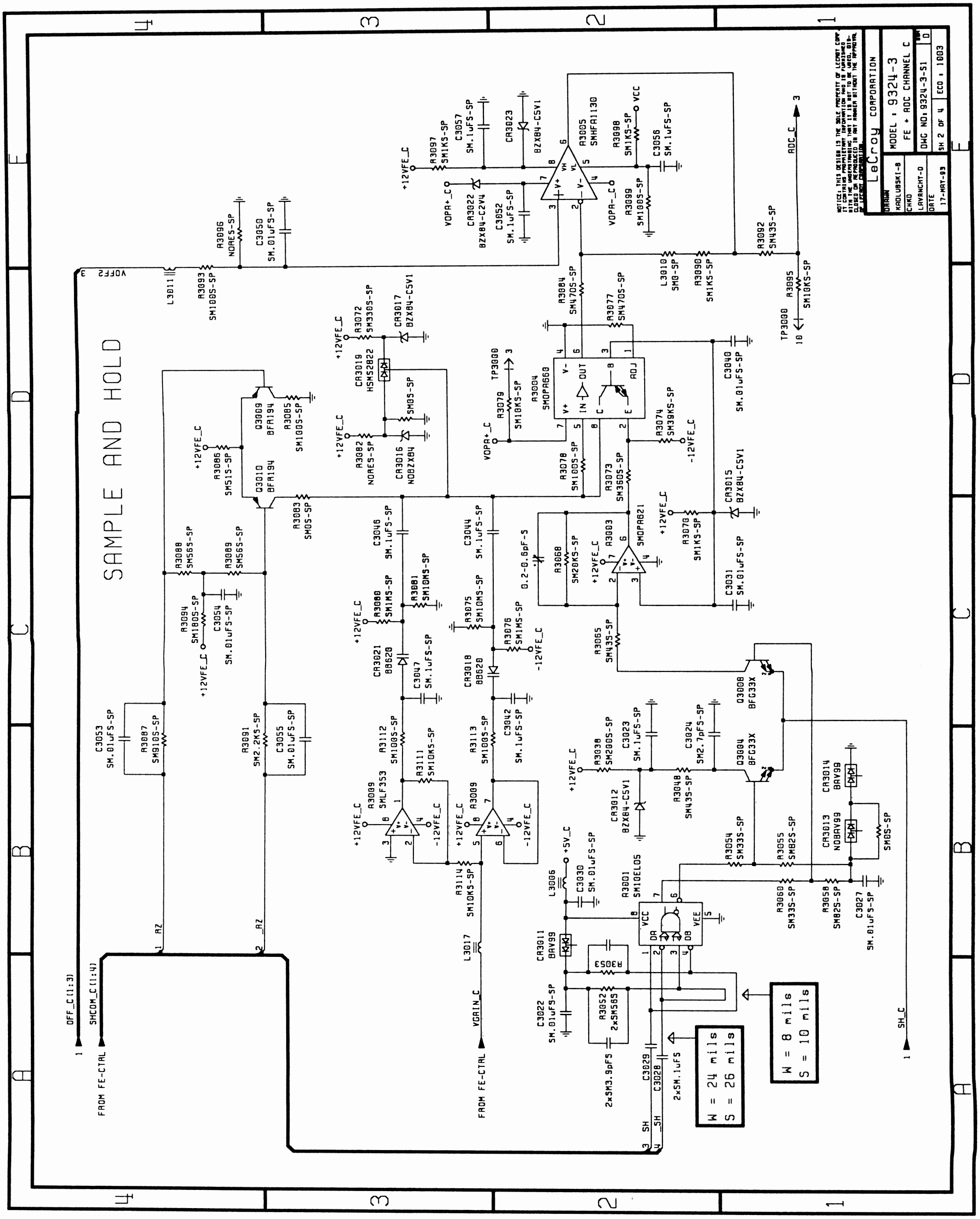

EXTERNAL TRIGGER
VIEW B
PROBE CAL

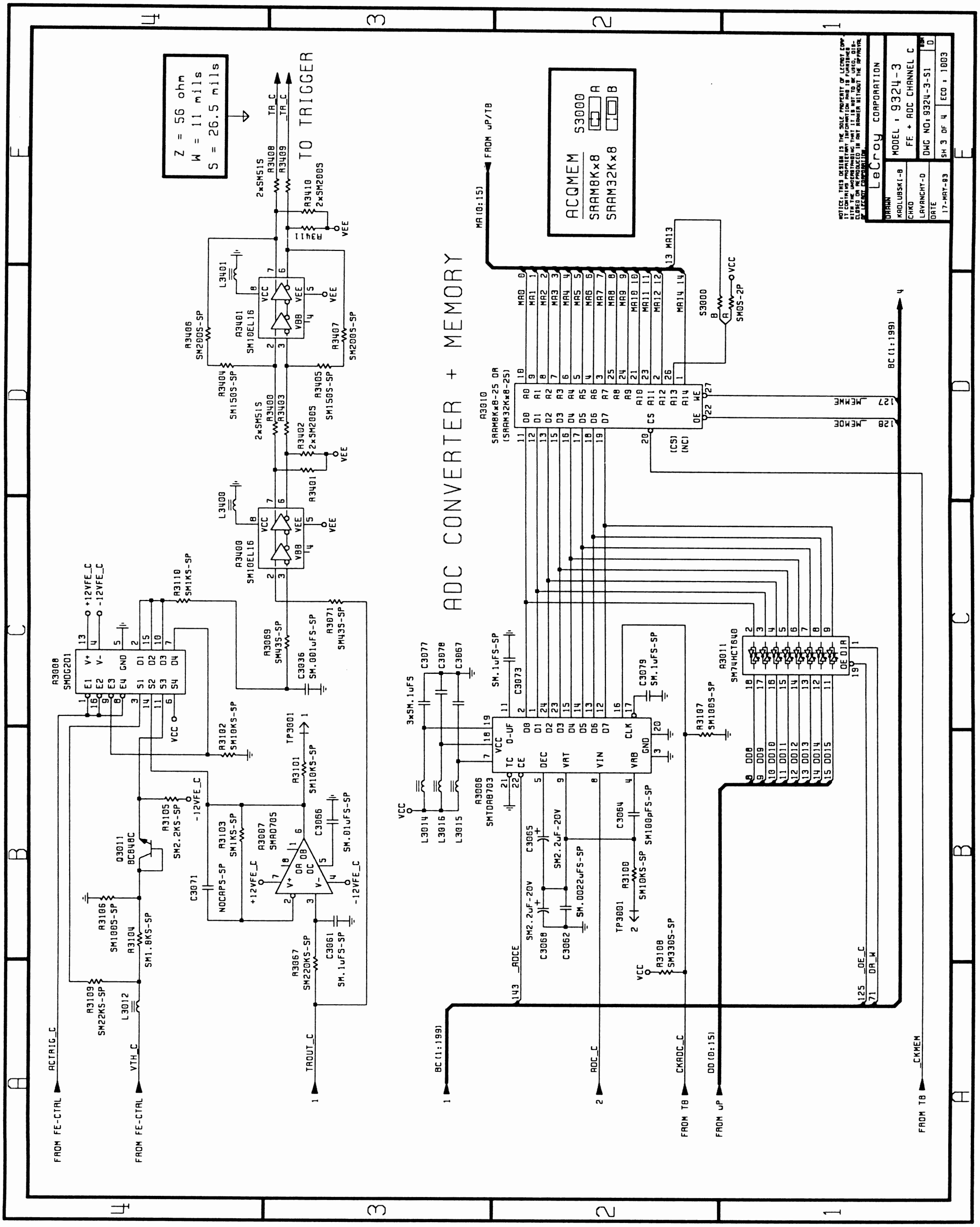

EXTERNAL TRIGGER
VIEW B
PROBE CAL
SOLDER SIDE
RL5000
R6001
C6007
C6004
C6002
C6000
C5028
R5003
C5002
C5000


EXTERNAL TRIGGER
VIEW B
PROBE CAL
SOLDER SIDE
430490750

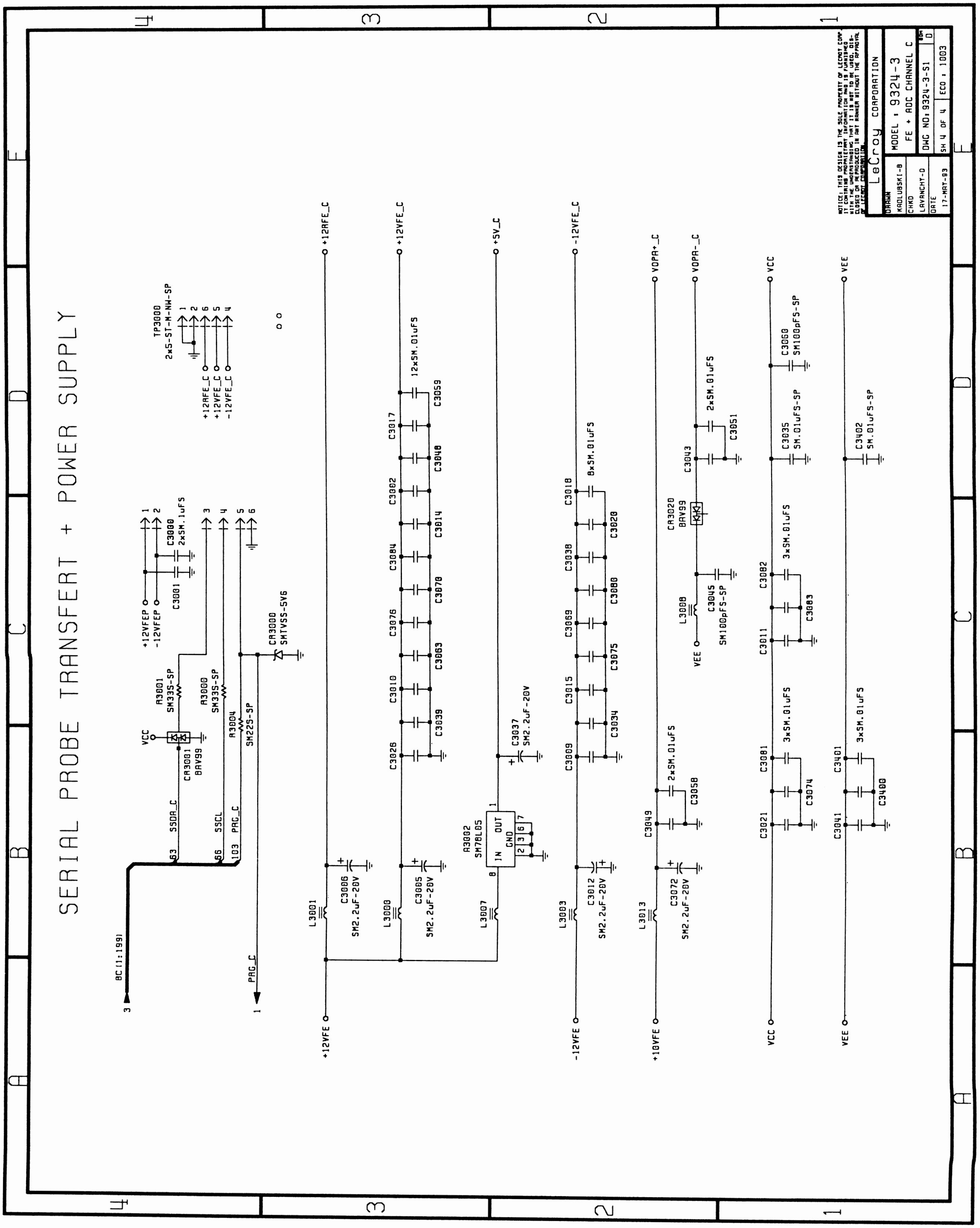

EXTERNAL TRIGGER
VIEW B
PROBE CAL
SOLDER SIDE
RL-UR1-12

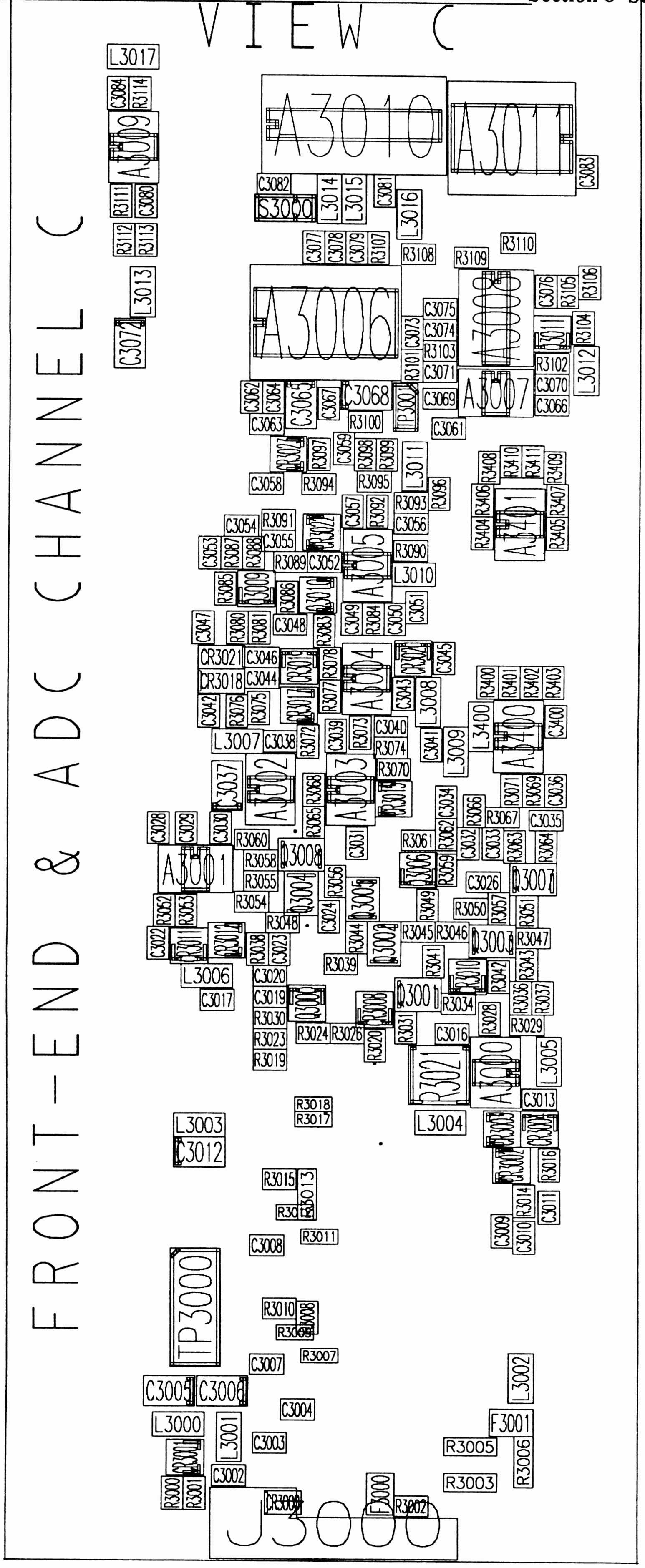

ATTENUATOR + BUFFER AC/DC
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CHANNEL C
DWG NO: 9324-3-S1
SH 1 OF 4
ECO : 1003
DRAWN KADLUBSKI-B
LAVANCHY-D
DATE 17-MAY-93

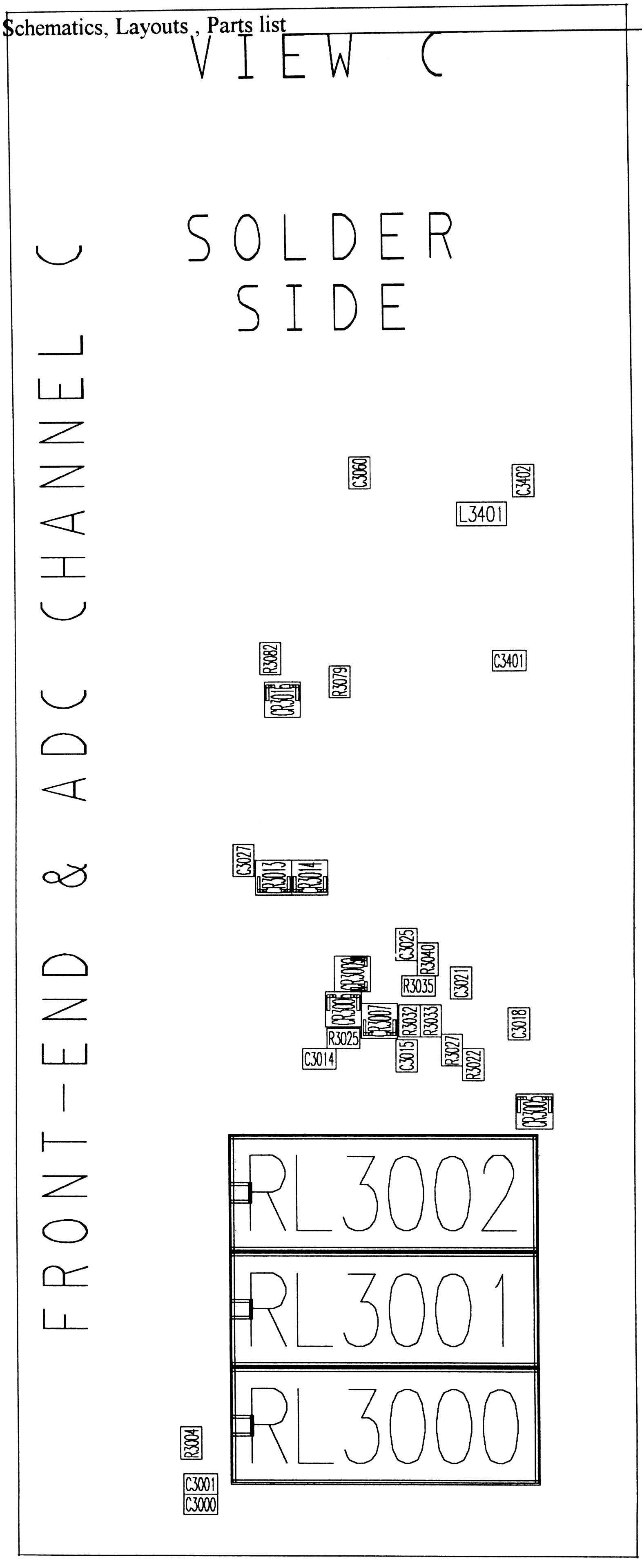

SAMPLE AND HOLD
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CHANNEL C
DWG NO: 9324-3-S1
SH 2 OF 4
FROM FE-CTRL
W = 24 mils
S = 26 mils
W = 8 mils
S = 10 mils

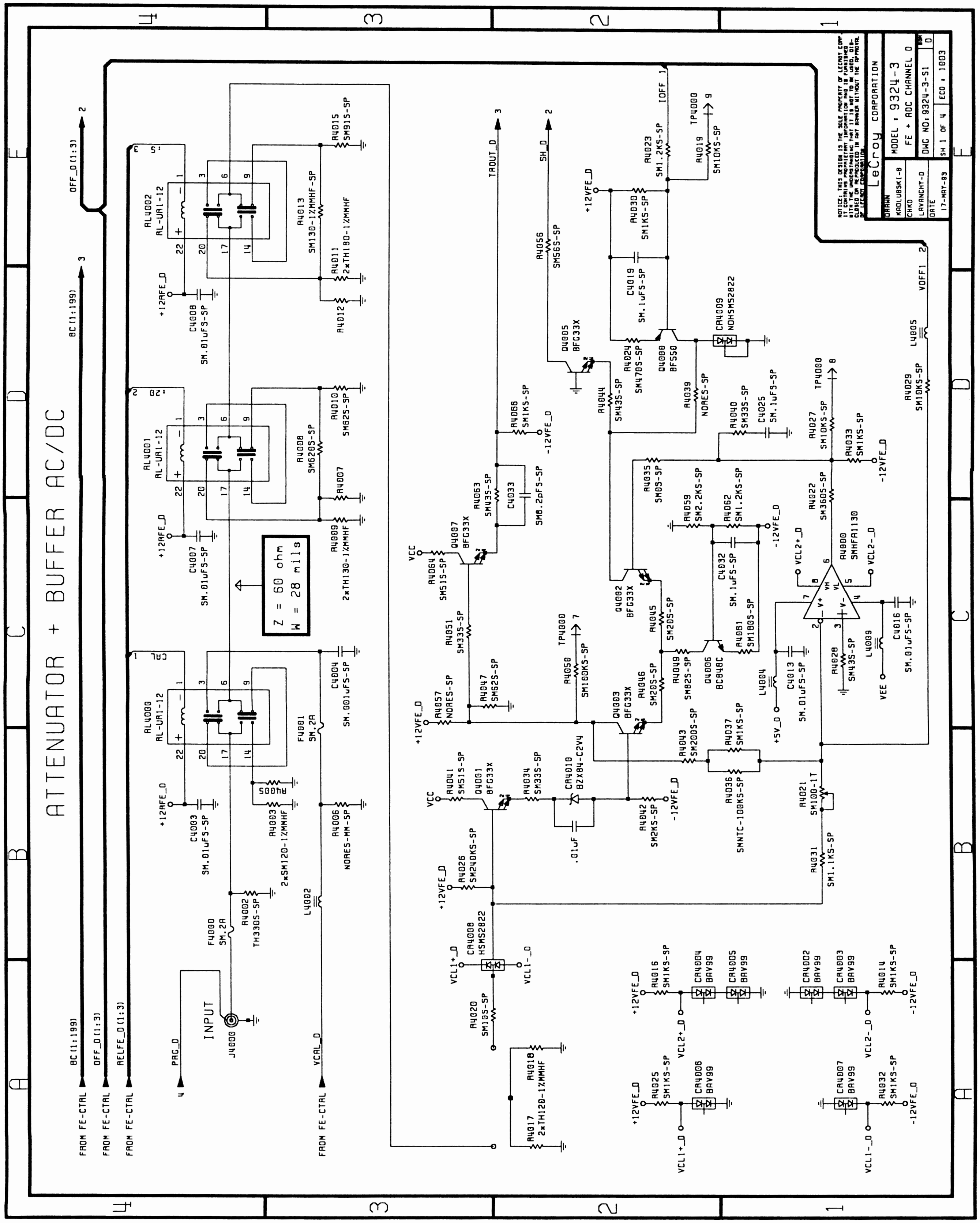


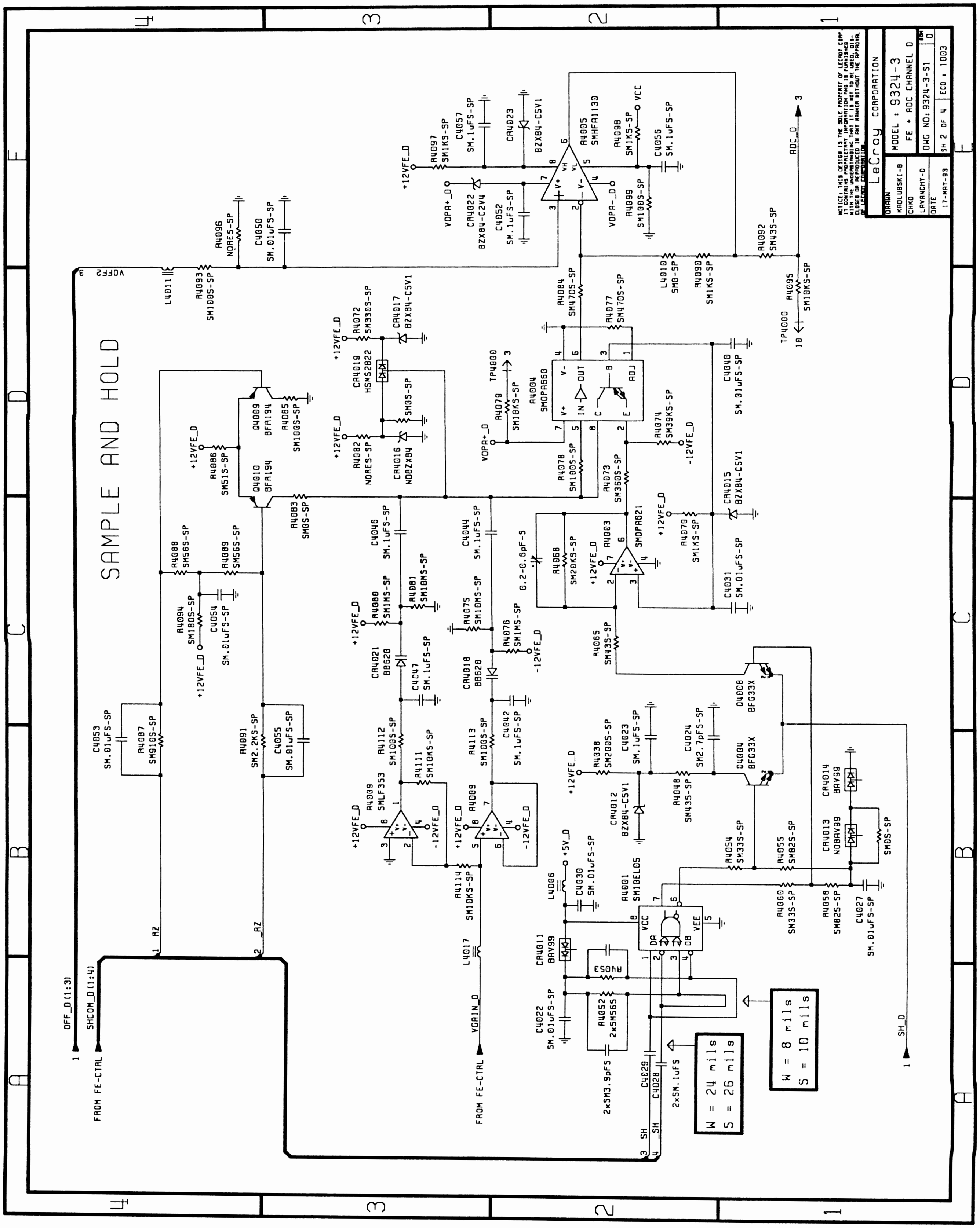
ADC CONVERTER + MEMORY
TO TRIGGER
Z = 56 ohm
W = 11 mils
S = 26.5 mils
ACQMEM
SRAM8Kx8
SRAM32Kx8
S3000
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CHANNEL C
DWG NO: 9324-3-S1
SH 3 OF 4
ECO : 1803

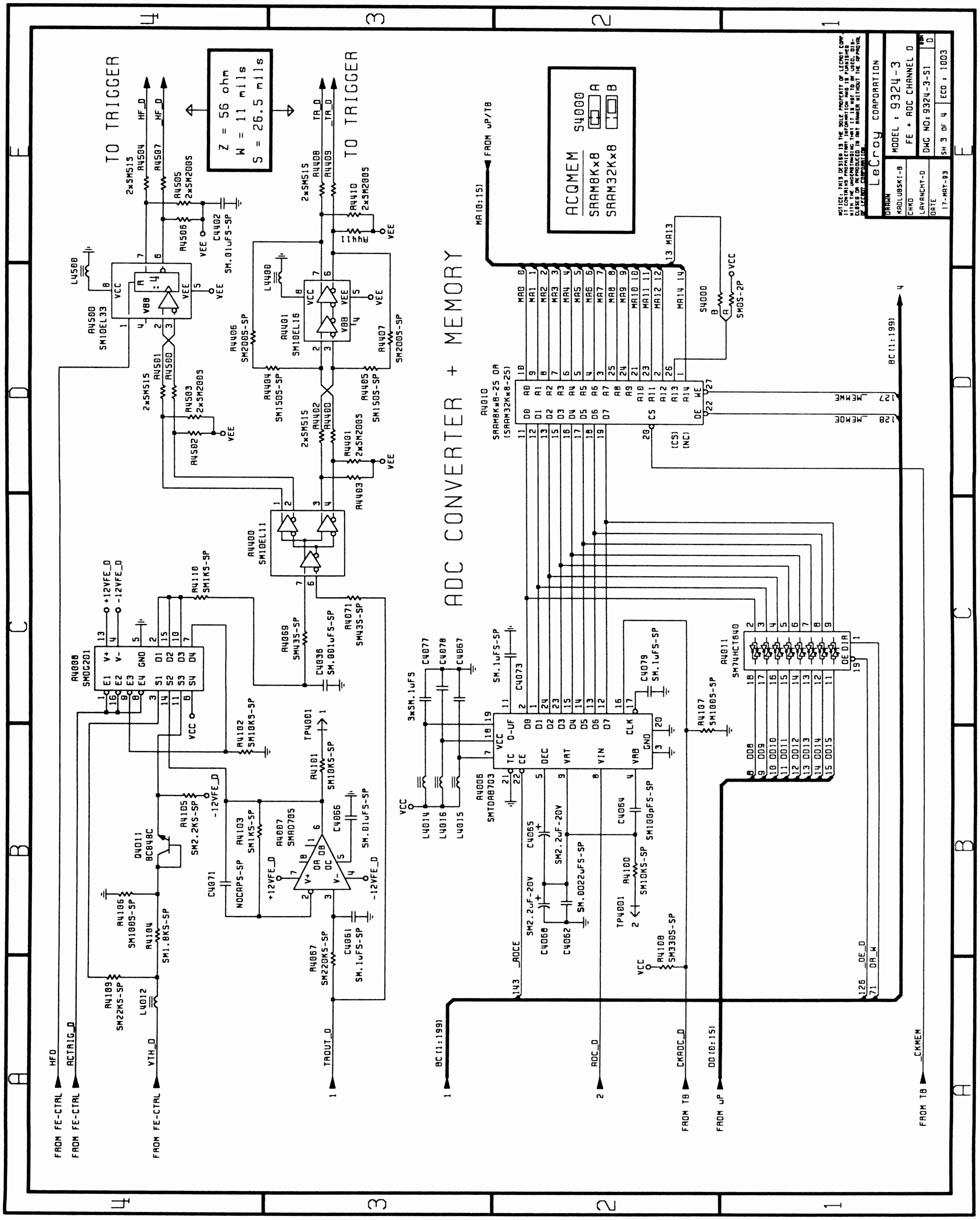

SERIAL PROBE TRANSFERT + POWER SUPPLY
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CHANNEL C
DWG NO: 9324-3-S1
SH 4 OF 4
ECO : 1003
DRAWN KADLUBSKI-B
CHKD LAVANCHY-D
DATE 17-MAY-93

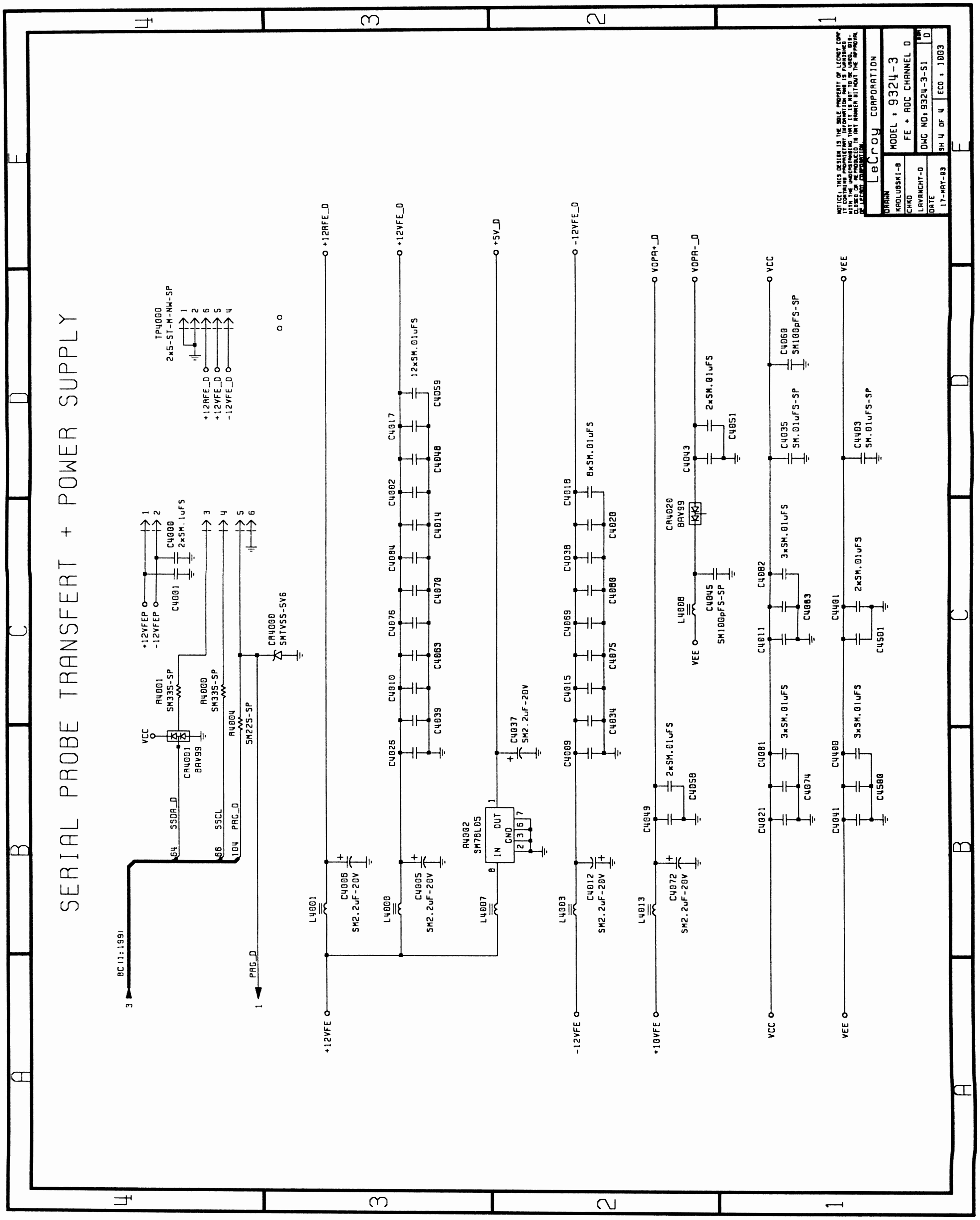

VIEW C
FRONT-END & ADC CHANNEL C

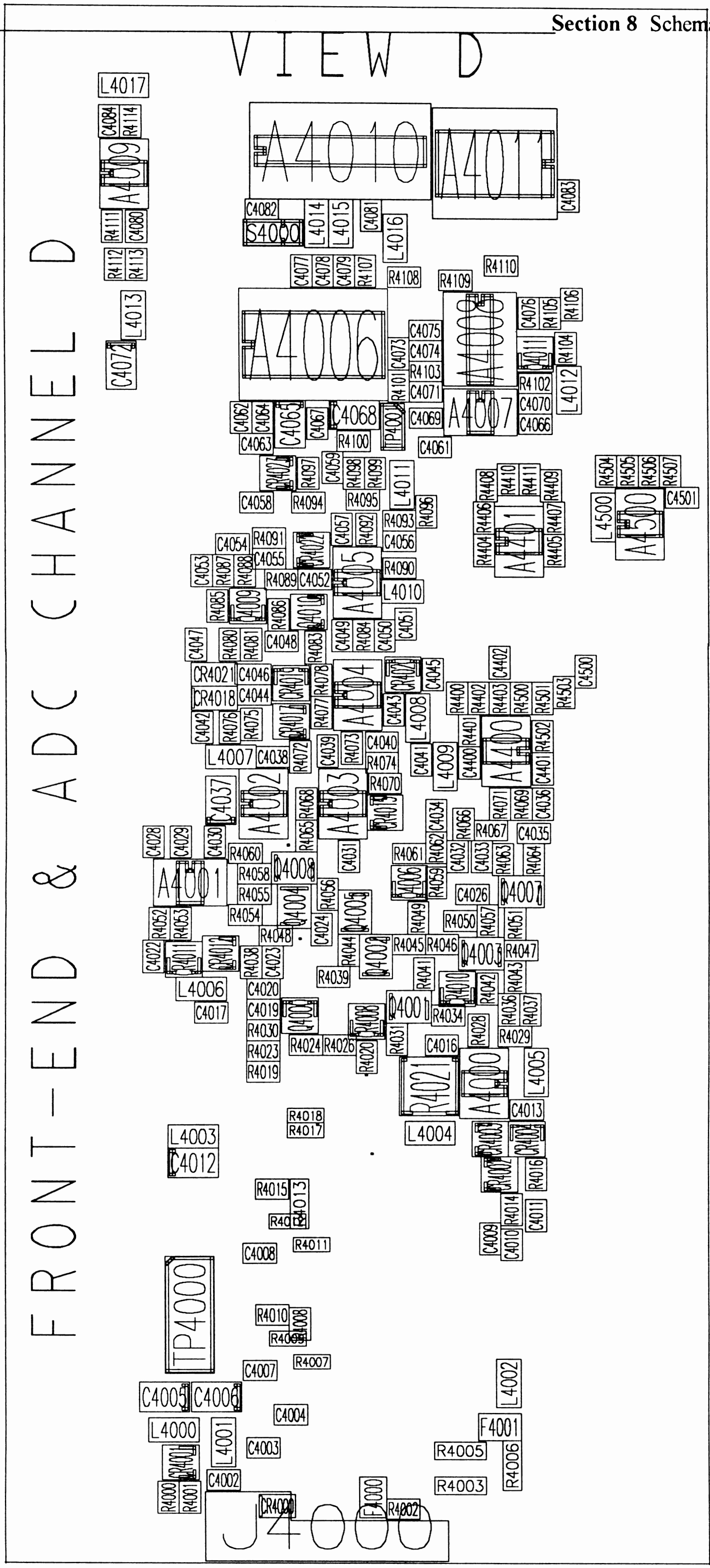

VIEW C
SOLDER
SIDE
FRONT-END & ADC CHANNEL C
C3060
C3402
L3401
R3082
R3079
C3401
C3027
R3013
R3014
C3025
R3040
R3035
C3021
R3025
C3014
C3015
R3032
R3033
R3027
R3022
C3018
RL3002
RL3001
RL3000
R3004
C3001
C3000

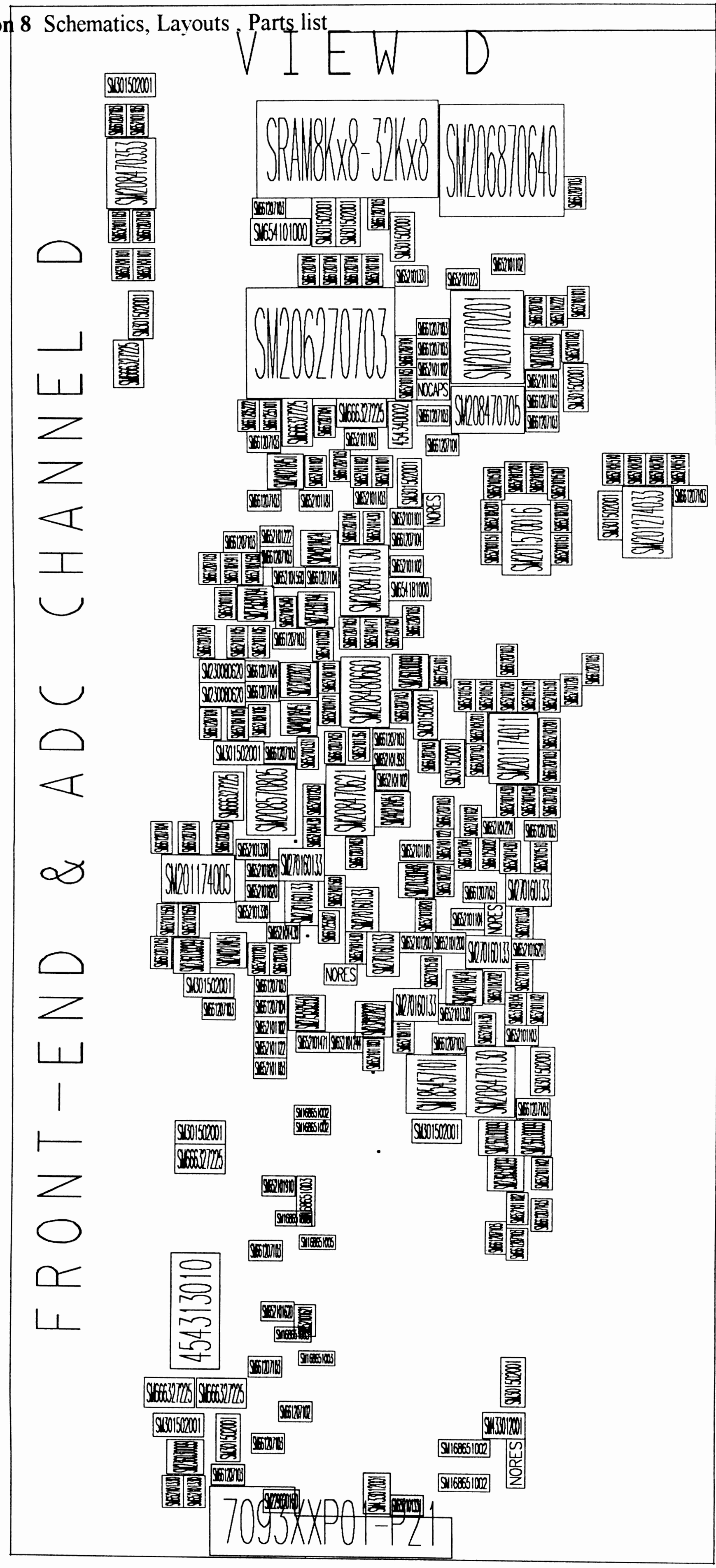

ATTENUATOR + BUFFER AC/DC
Z = 60 ohm
W = 28 mils
INPUT
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CHANNEL 0
DWG NO: 9324-3-S1

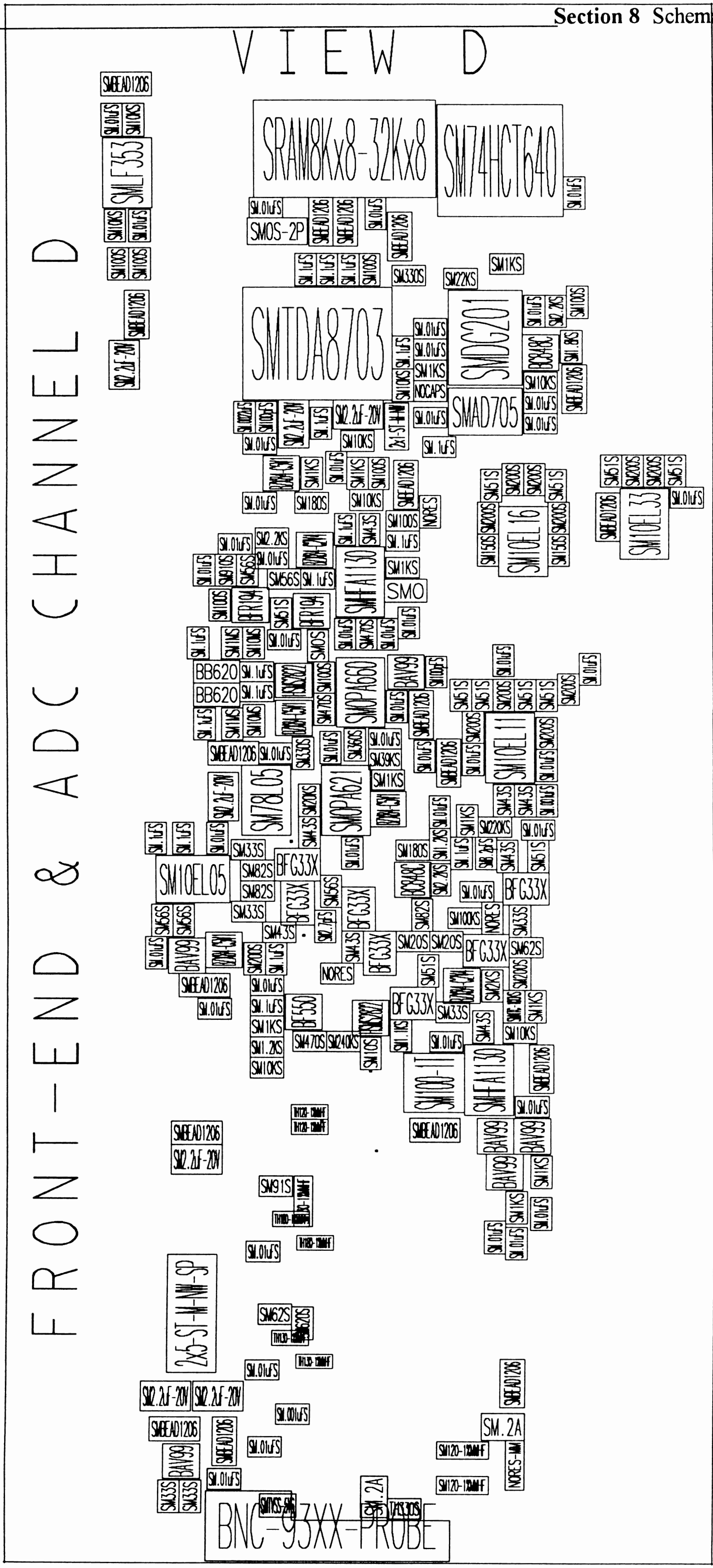

SAMPLE AND HOLD
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CHANNEL D
DWG NO: 9324-3-S1
SH 2 OF 4
ECO : 1003
W = 24 mils
S = 26 mils
W = 8 mils
S = 10 mils

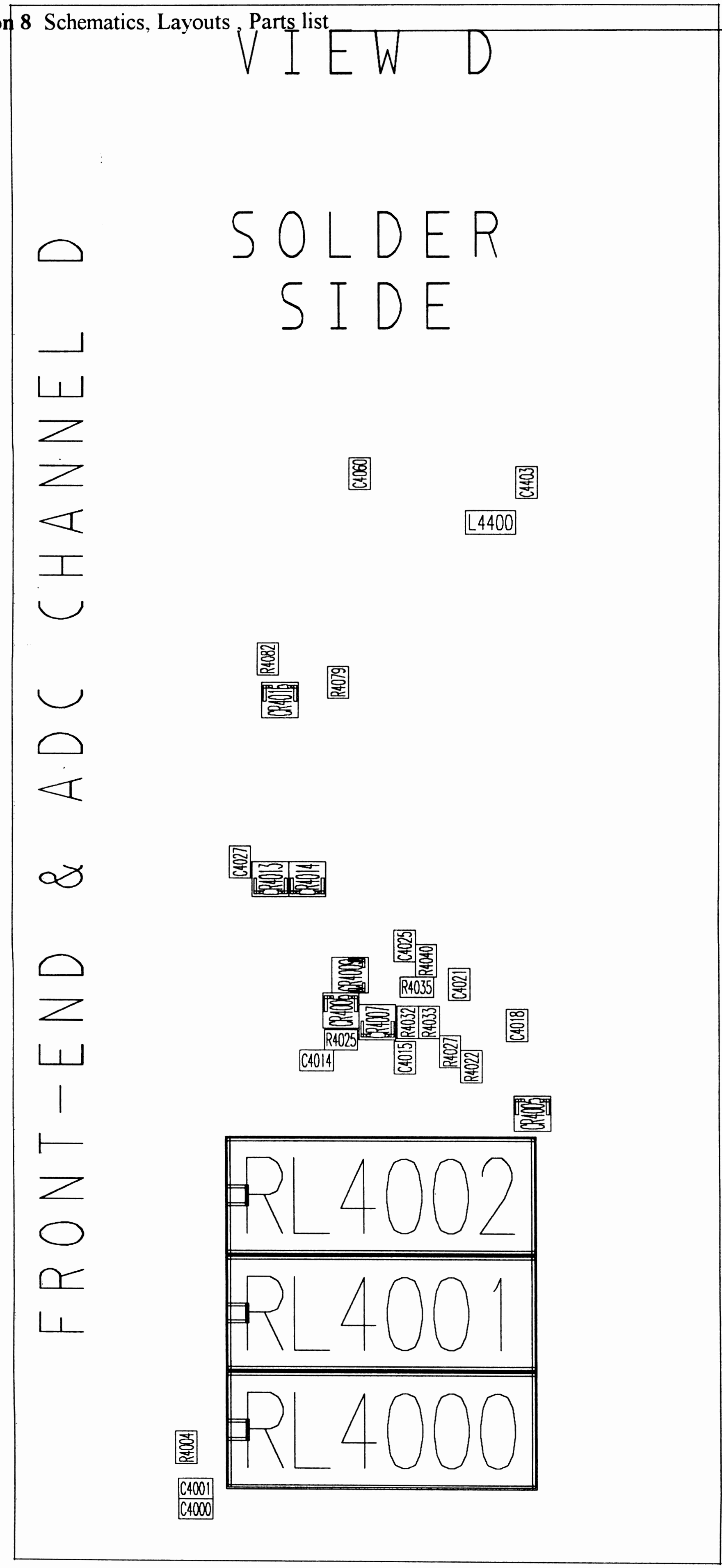

ADC CONVERTER + MEMORY
TO TRIGGER
TO TRIGGER
Z = 56 ohm
W = 11 mils
S = 26.5 mils
ACQMEM
SRAM8Kx8
SRAM32Kx8
S4000
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CHANNEL D
DWG NO: 9324-3-S1

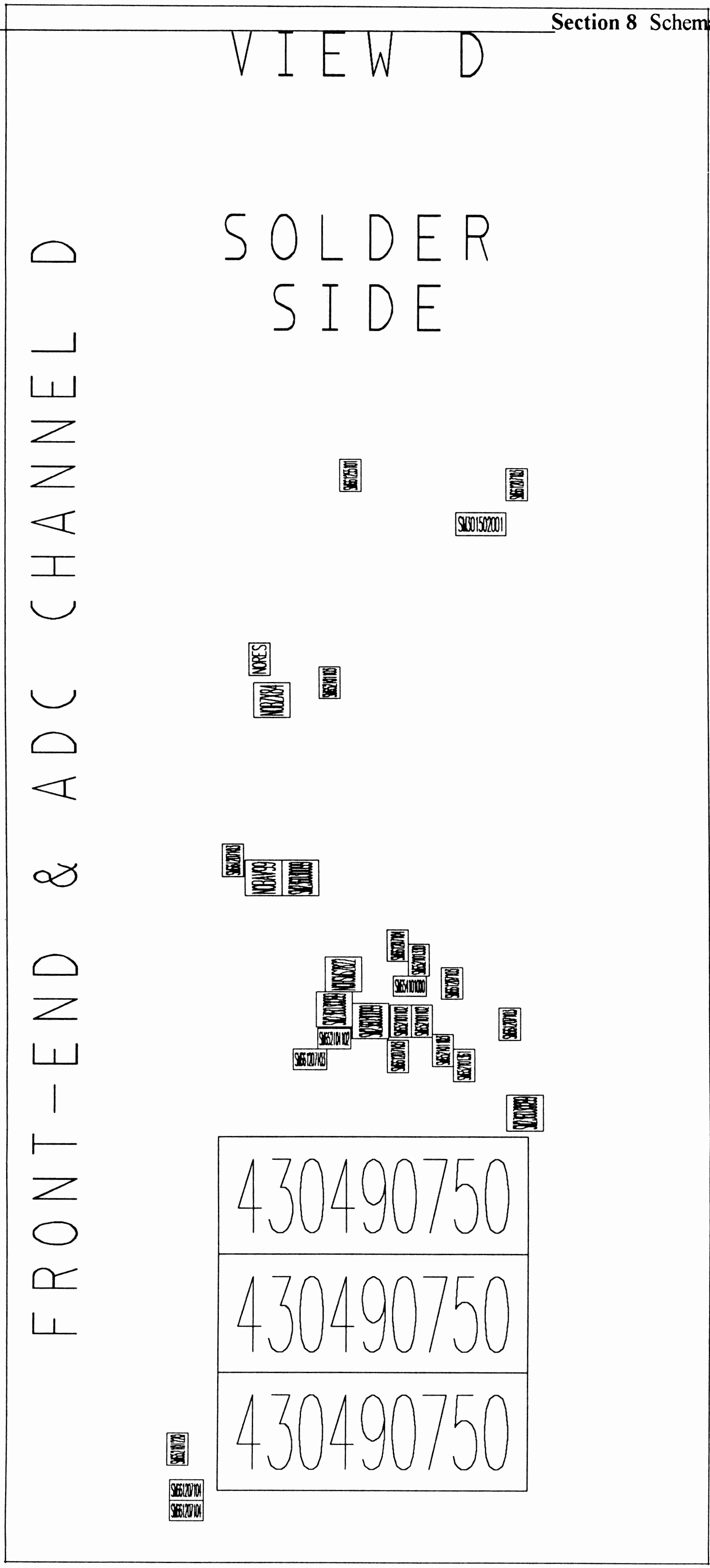

SERIAL PROBE TRANSFERT + POWER SUPPLY
LeCroy CORPORATION
MODEL : 9324-3
FE + ADC CHANNEL D
DWG NO: 9324-3-S1
SH 4 OF 4
ECO : 1003
DRAWN KAOLUBSKI-B
CHKD LAVANCHT-O
DATE 17-MAY-93

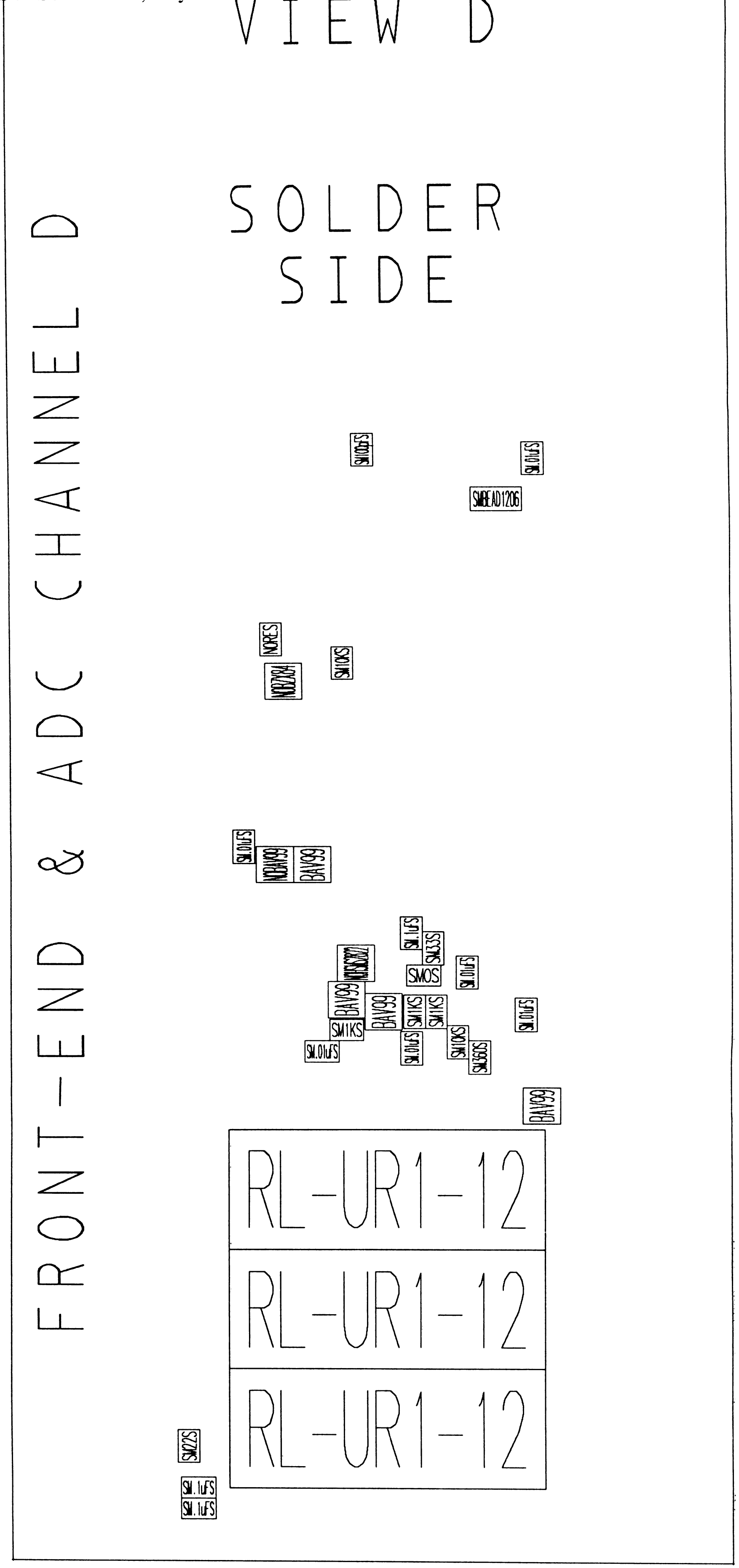

VIEW D
FRONT-END & ADC CHANNEL D

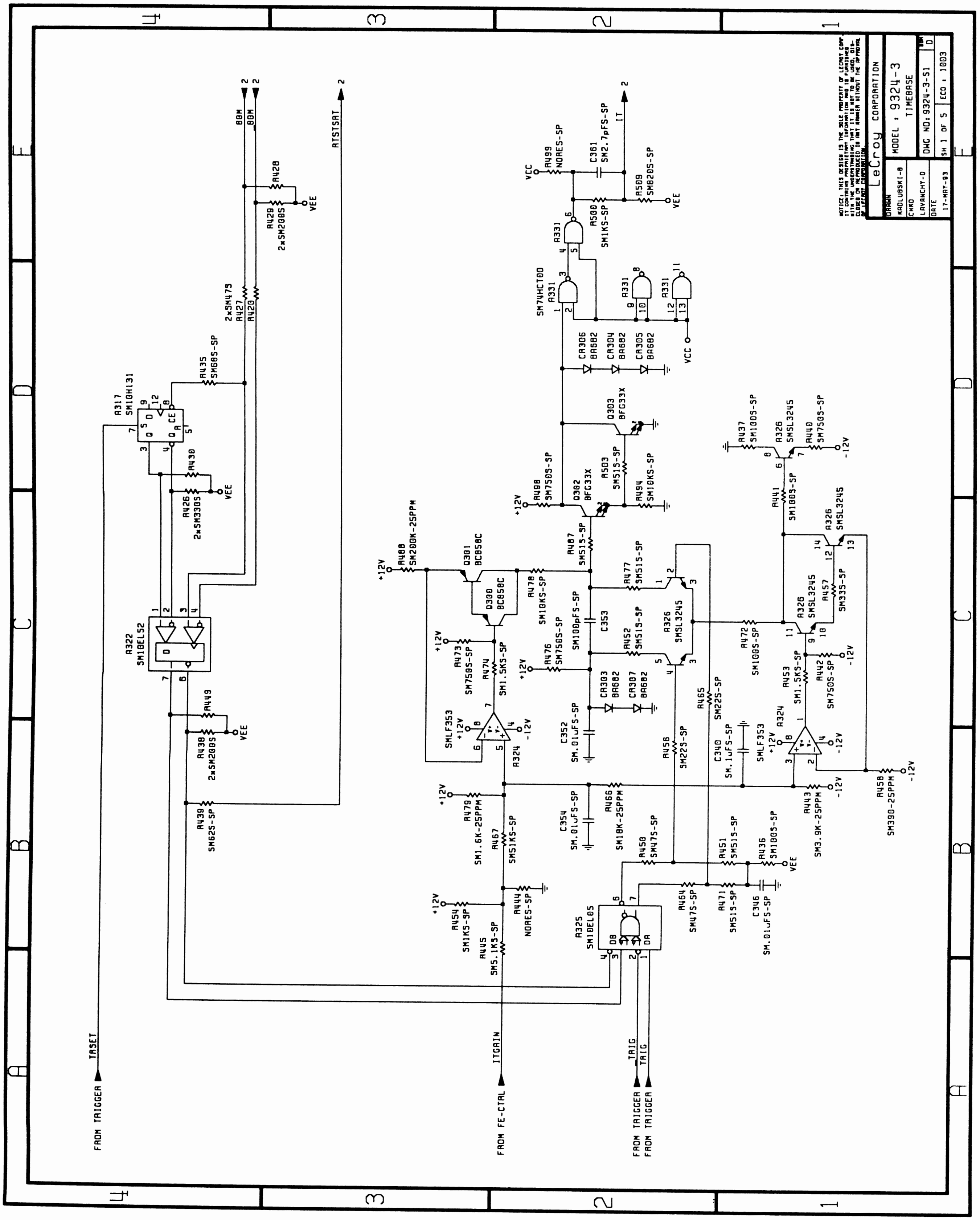

VIEW D
FRONT-END & ADC CHANNEL D
SRAM8Kx8-32Kx8
SM206870640
SM206270703
SM201174005
4543130I0
7093XXP01-P21

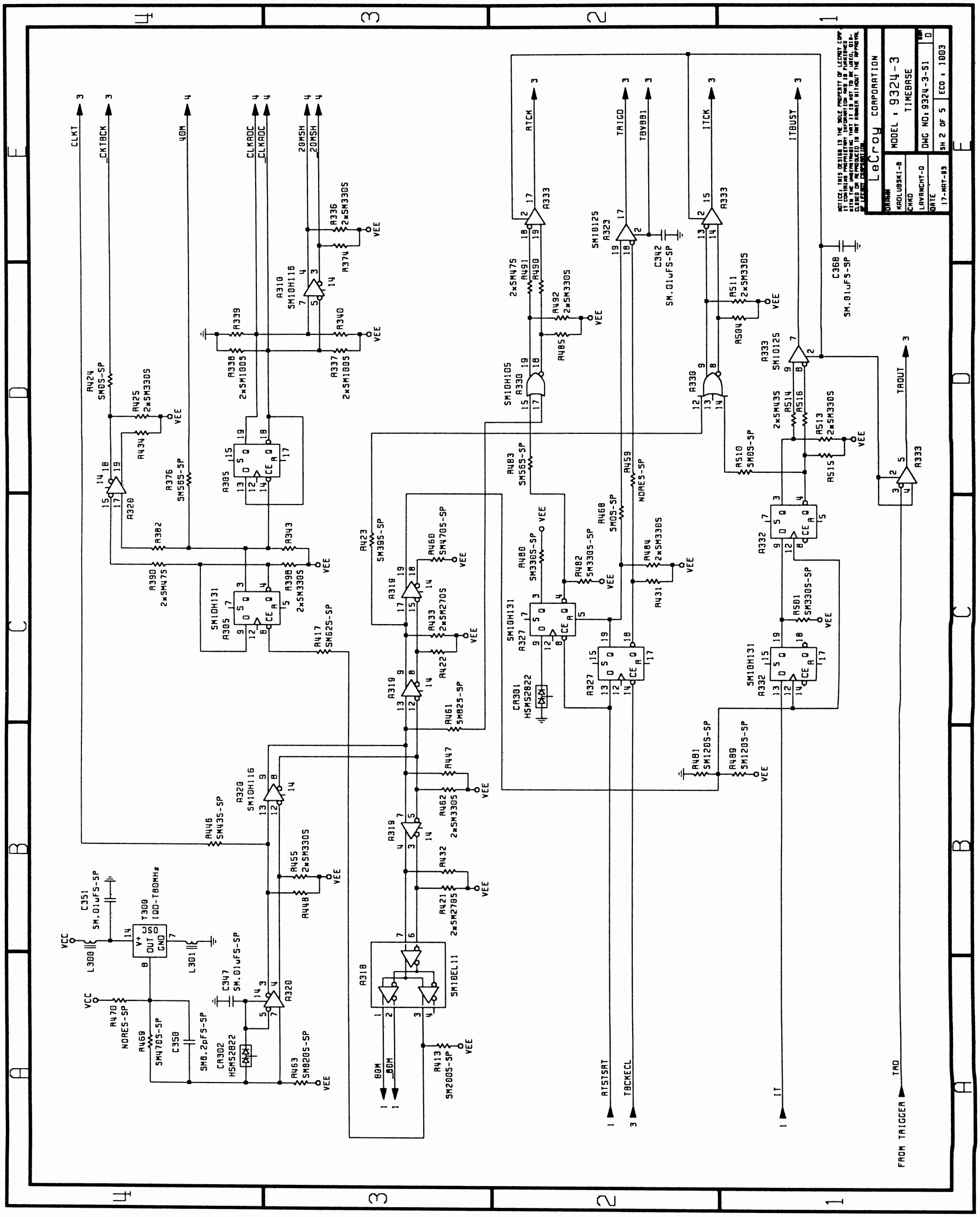

VIEW D
FRONT-END & ADC CHANNEL D
SRAM8Kx8-32Kx8
SM74HCT640
SMTDA8703
SMDG201
SMAD705
SMLF353
SMOS-2P
SM10EL16
SM10EL33
SM10EL11
SM10EL05
SMOPA660
SMOPA621
SM78L05
BFG33X
BF550
BB620
SMO
BNC-93XX-PROBE
2x5-ST-M-NW-SP
SM.2A

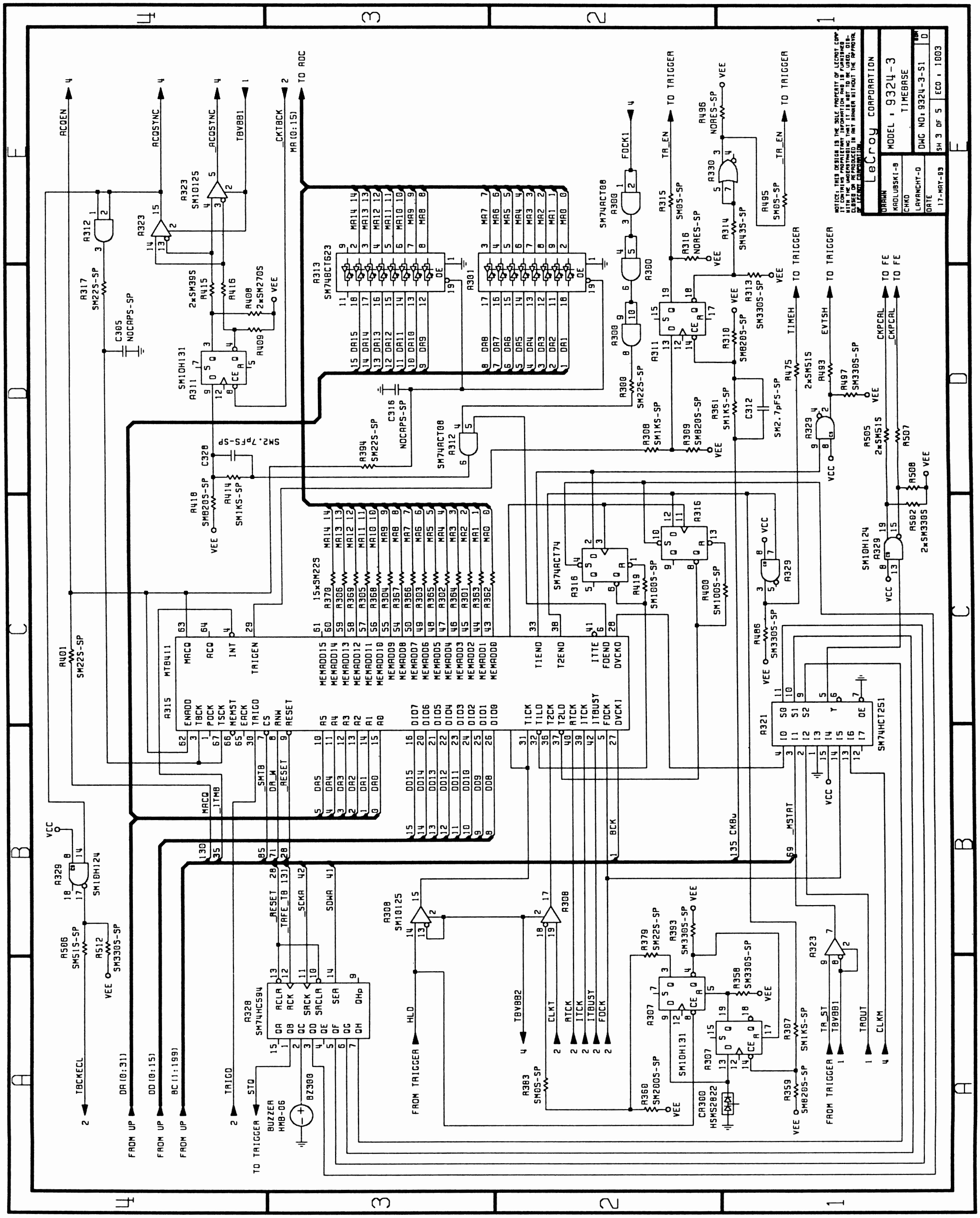

VIEW D
SOLDER SIDE
FRONT-END & ADC CHANNEL D
C4060
C4403
L4400
R4082
R4079
C4027
R4035
C4021
C4018
R4025
C4014
C4015
R4032
R4033
R4027
R4022
R4040
C4025
RL4002
RL4001
RL4000
R4004
C4001
C4000

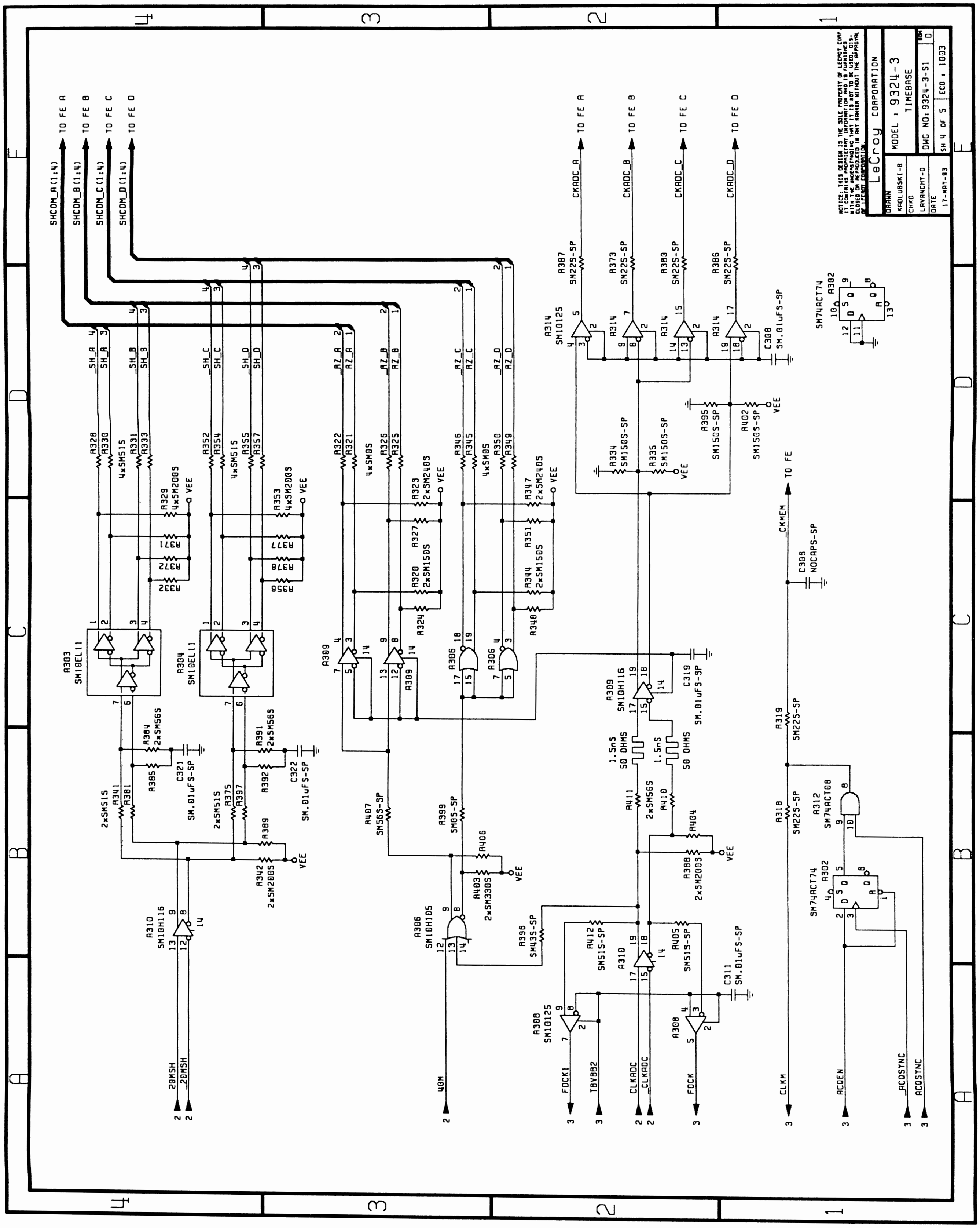

VIEW D
SOLDER SIDE
FRONT-END & ADC CHANNEL D
430490750
430490750
430490750

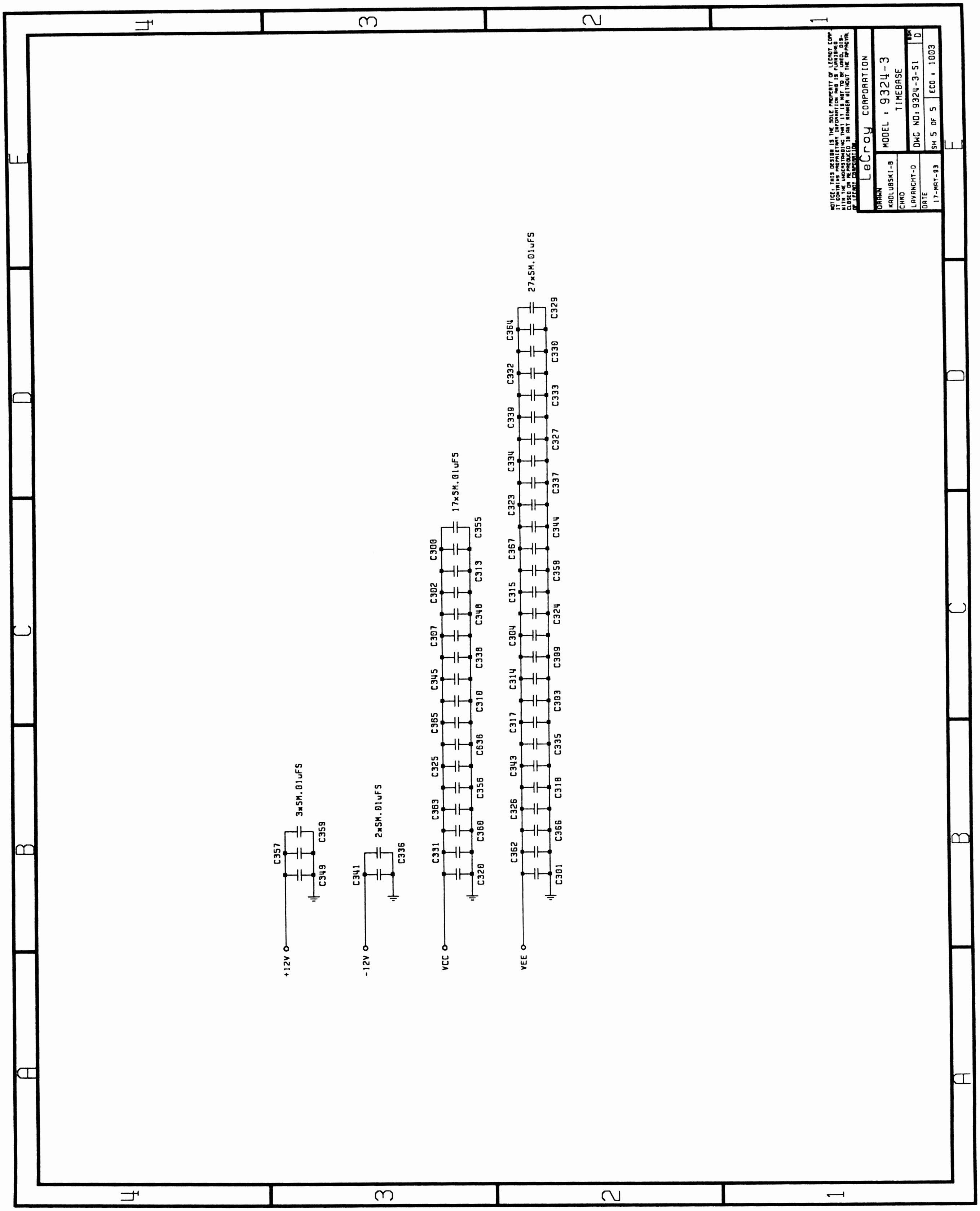

VIEW D
SOLDER SIDE
FRONT-END & ADC CHANNEL D
SMBEAD1206
BAV99
BAV99
SMOS
SM1KS
SM.01uFS
BAV99
RL-UR1-12
RL-UR1-12
RL-UR1-12
SM22S
SM.1uFS
SM.1uFS

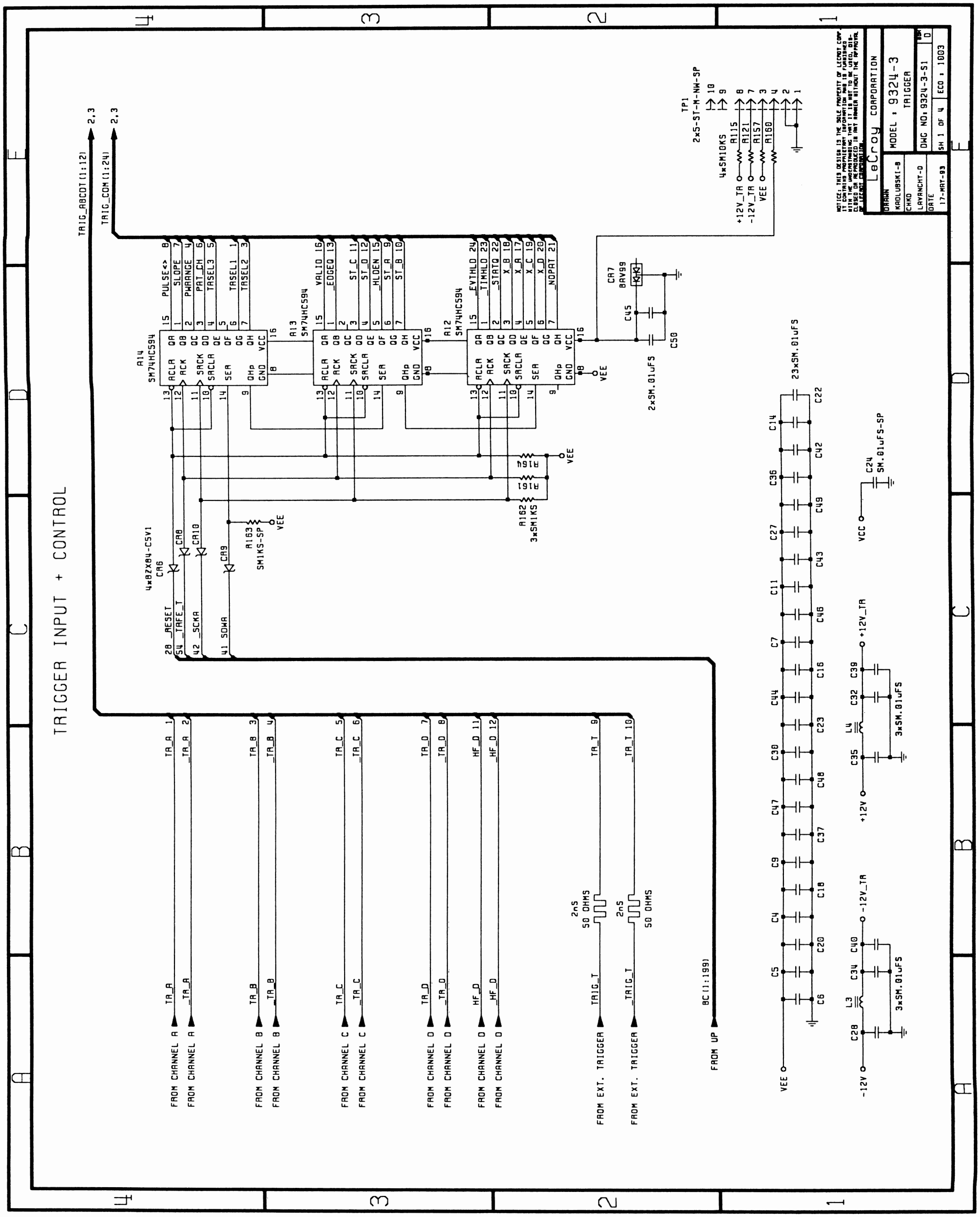

LeCroy CORPORATION
MODEL : 9324-3
TIMEBASE
FROM TRIGGER
TRSET
FROM FE-CTRL
ITGAIN
FROM TRIGGER
TRIG
RTSTSAT
BOM

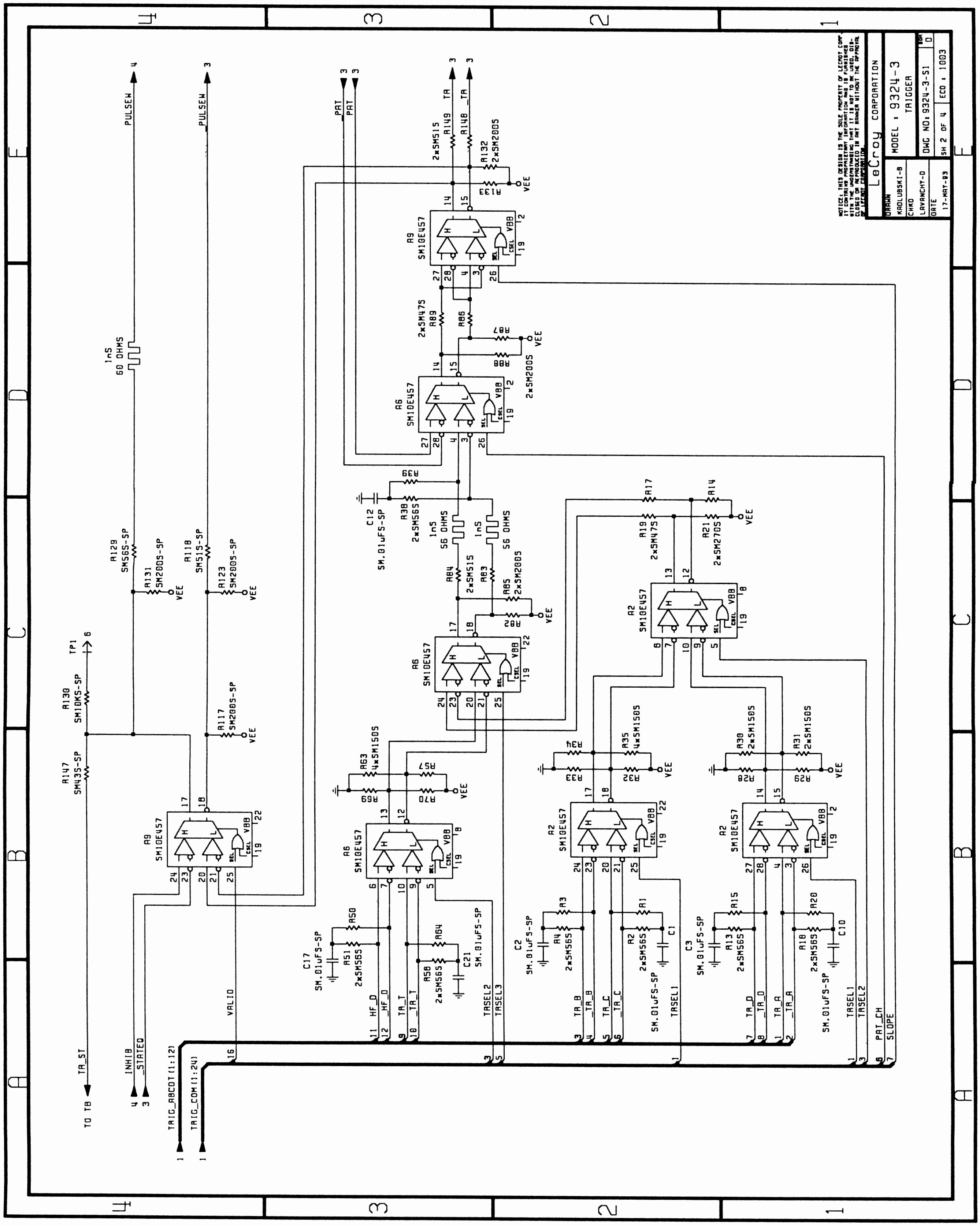

LeCroy CORPORATION
MODEL : 9324-3
TIMEBASE
DWG NO: 9324-3-S1
SH 2 OF 5
ECO : 1003
17-MAY-93


LeCroy CORPORATION
MODEL : 9324-3
TIMEBASE
DWG NO: 9324-3-S1


LeCroy CORPORATION
MODEL : 9324-3
TIMEBASE
DWG NO: 9324-3-S1
SH 4 OF 5
ECO : 1003
17-MAY-93


LeCroy CORPORATION
MODEL : 9324-3
TIMEBASE
DWG NO: 9324-3-S1
SH 5 OF 5
ECO : 1003
DRAWN
CHKD
DATE
17-MAY-93
+12V
-12V
VCC
VEE
3xSM.01uFS
2xSM.01uFS
17xSM.01uFS
27xSM.01uFS


TRIGGER INPUT + CONTROL
LeCroy CORPORATION
MODEL : 9324-3
TRIGGER
DWG NO: 9324-3-S1
SH 1 OF 4
ECO : 1003
DATE 17-MAY-93


LeCroy CORPORATION
MODEL : 9324-3
TRIGGER
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SH 2 OF 4
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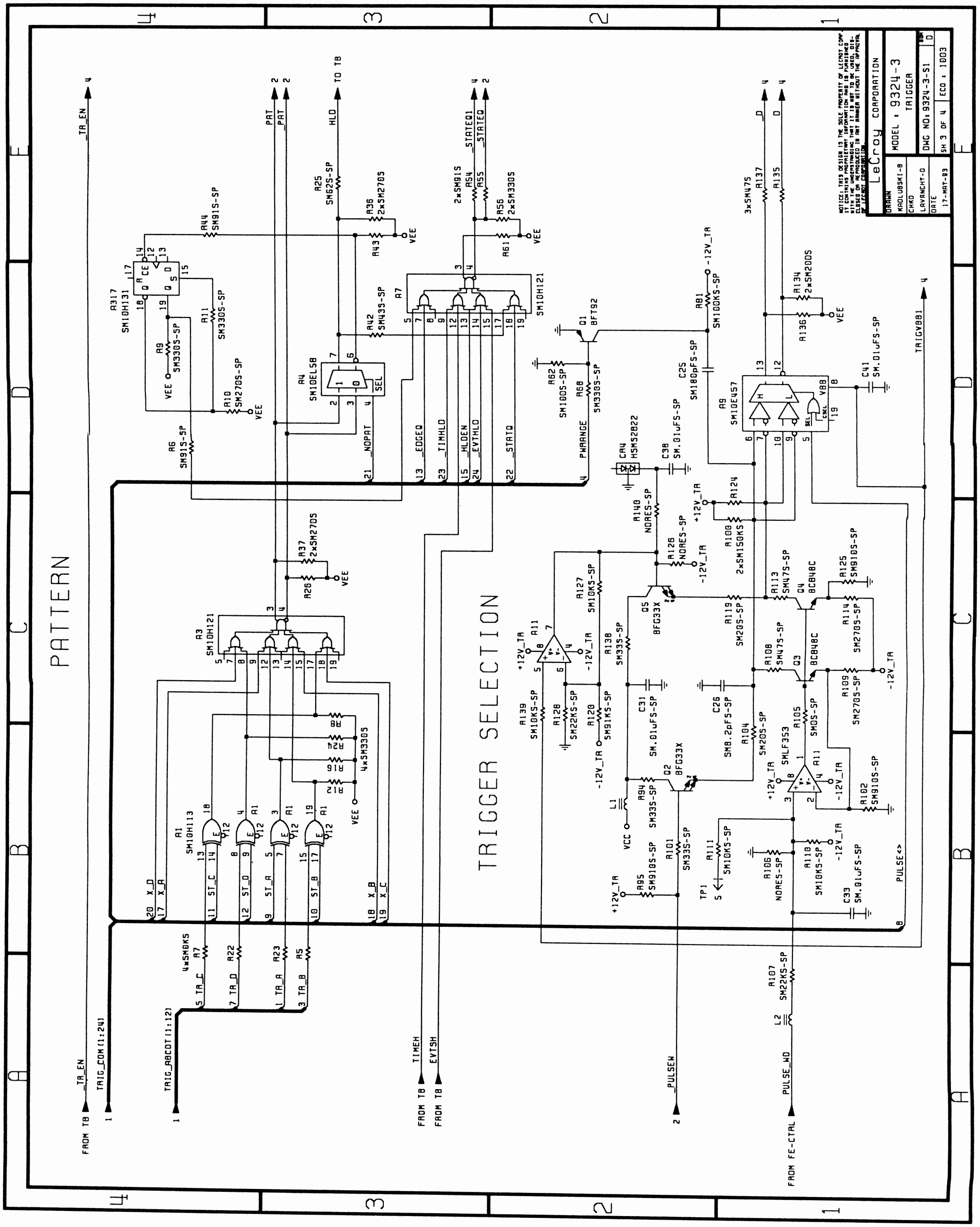
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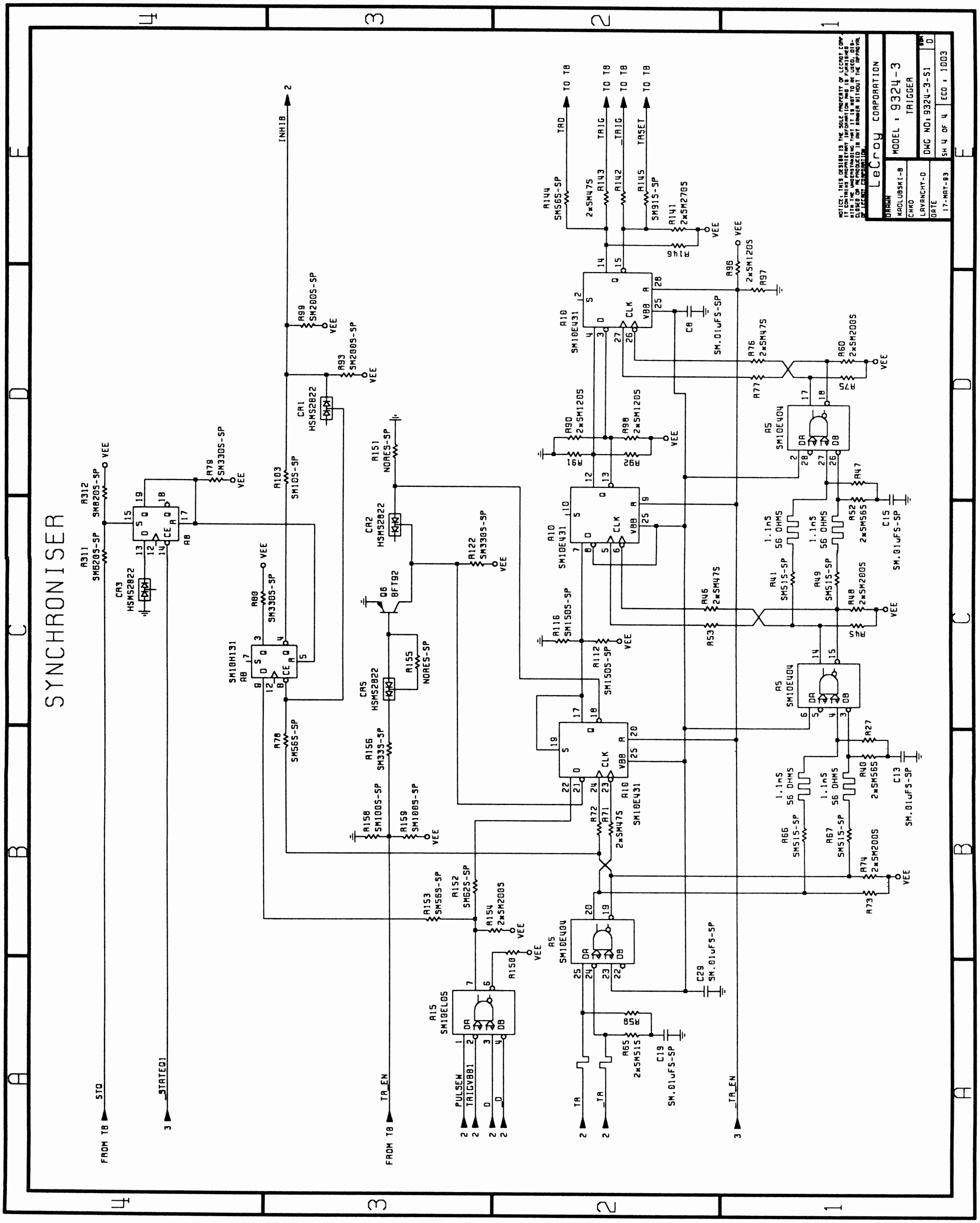
17-MAY-93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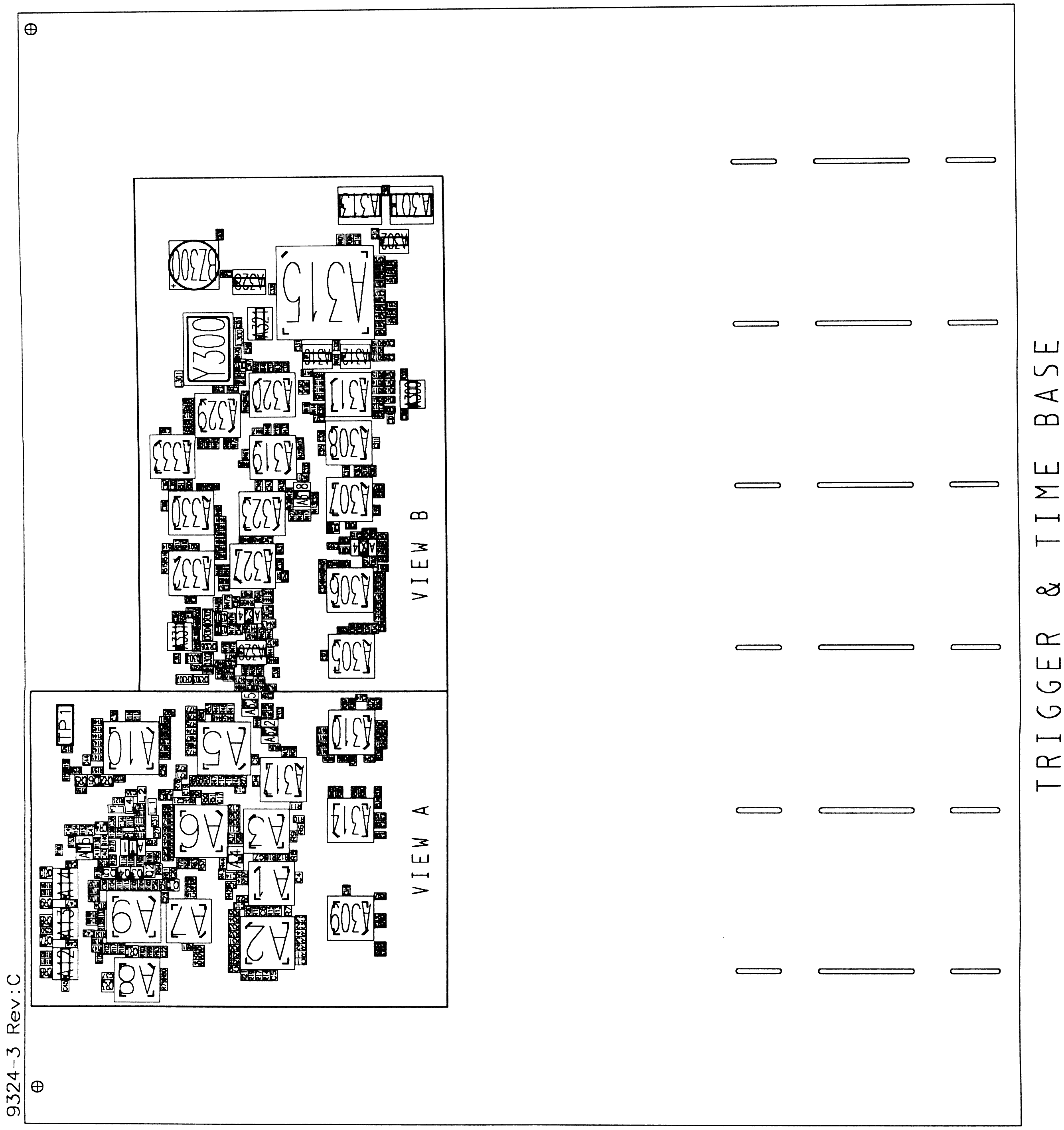
DATE 17-MAY-93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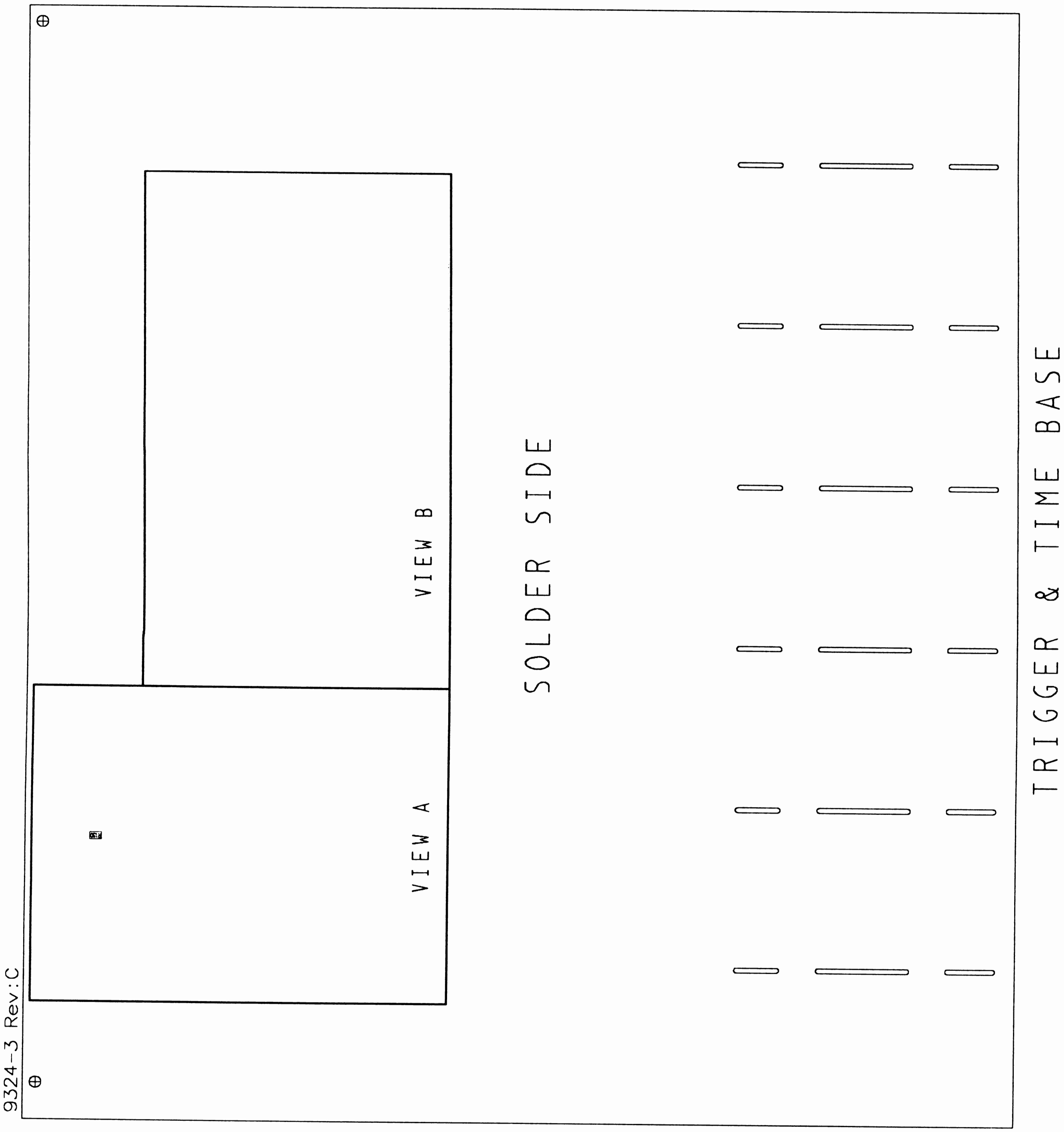
VIEW A
VIEW B
9324-3 Rev:C



VIEW B
VIEW A
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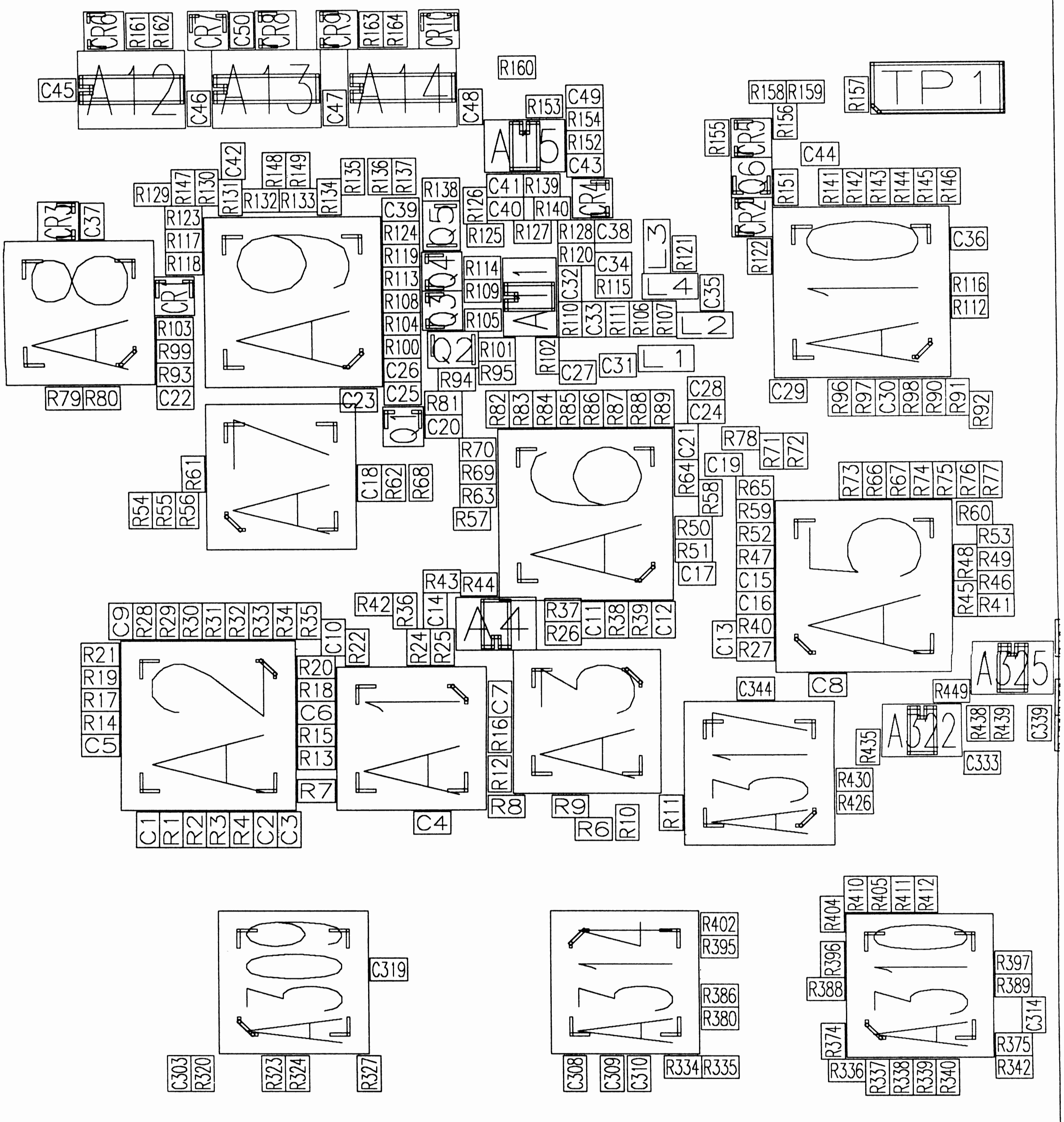
9324-3 Rev:C



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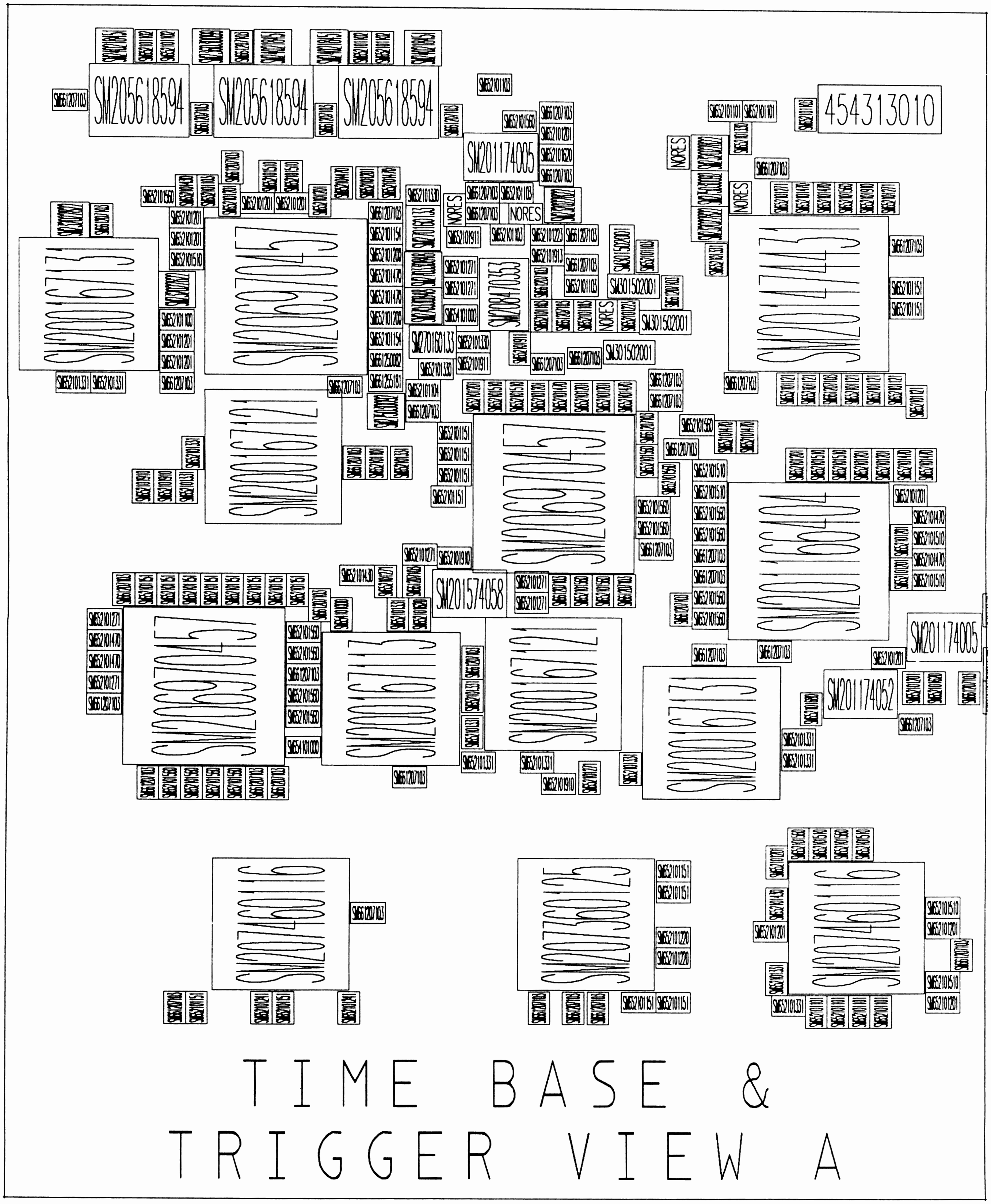
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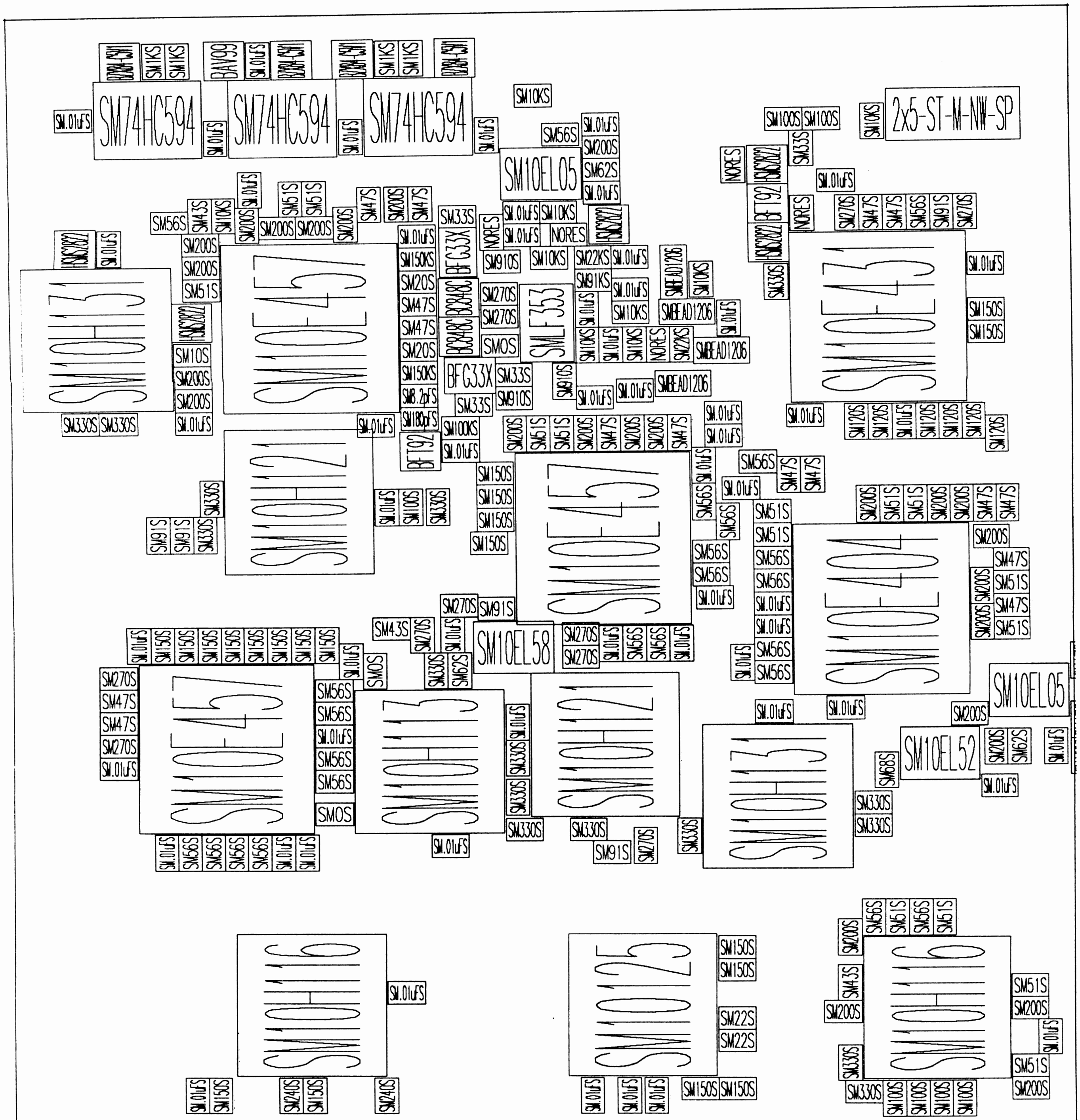

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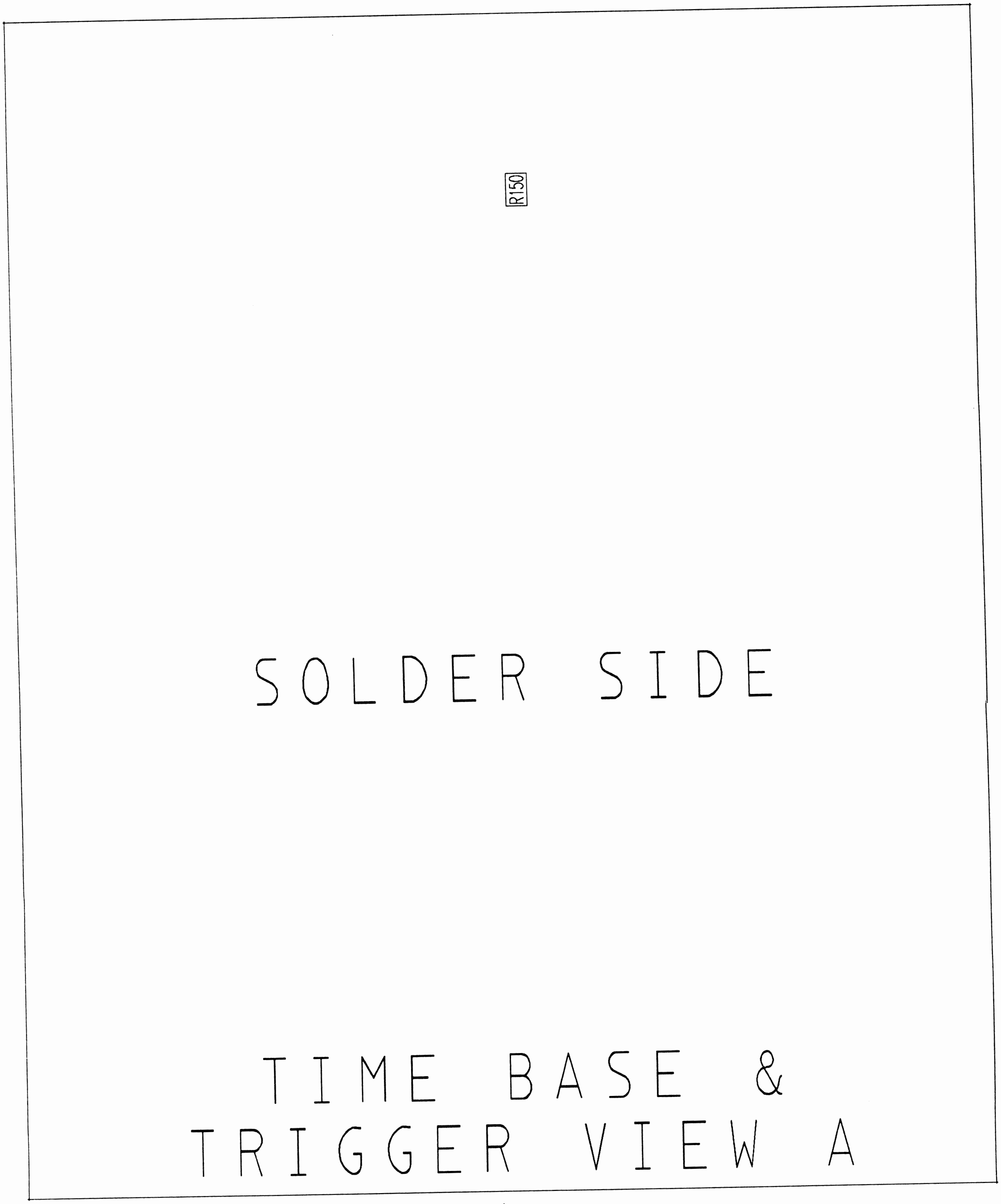
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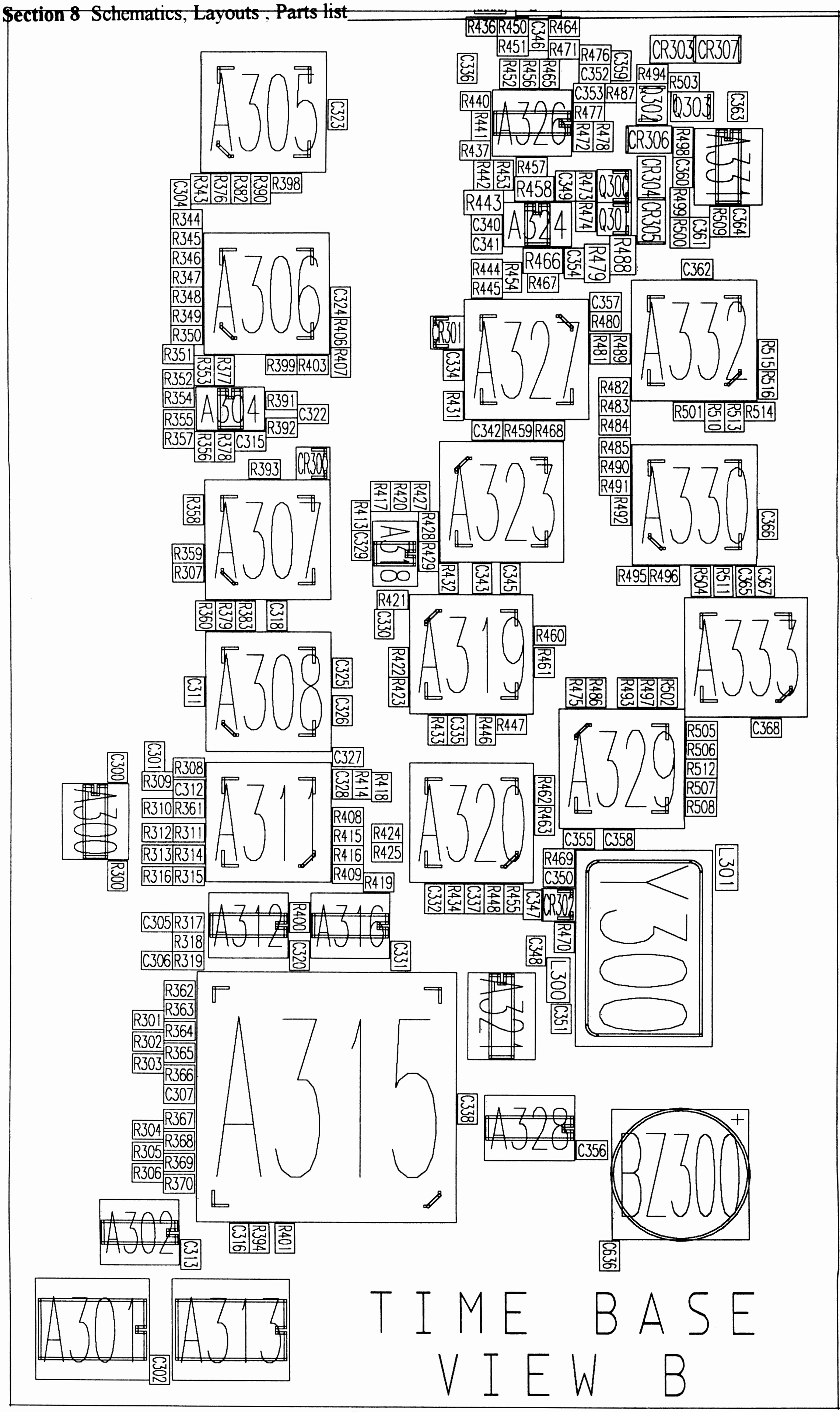
SOLDER SIDE

TIME BASE &
TRIGGER VIEW A

SM200S

TIME BASE & TRIGGER VIEW A



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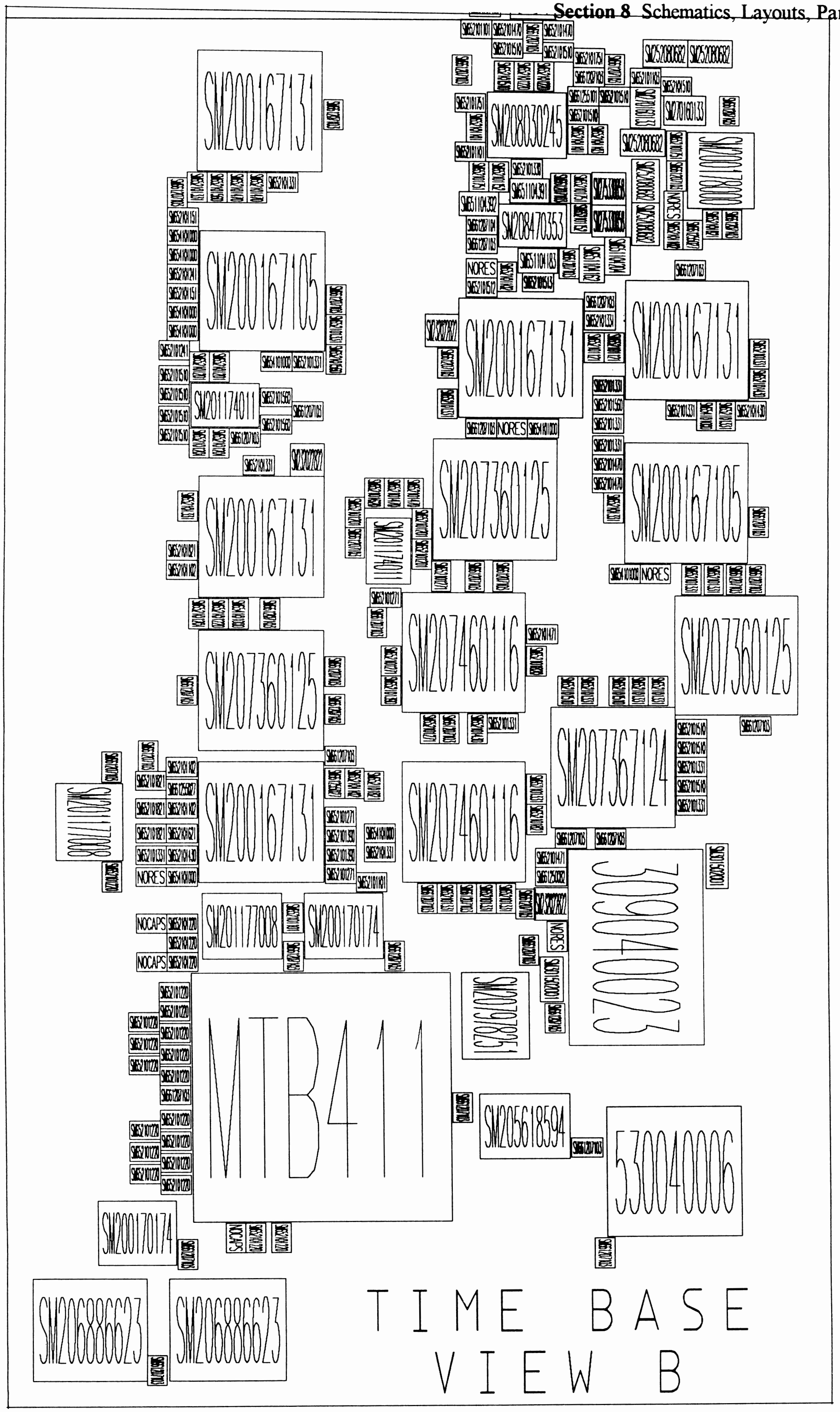
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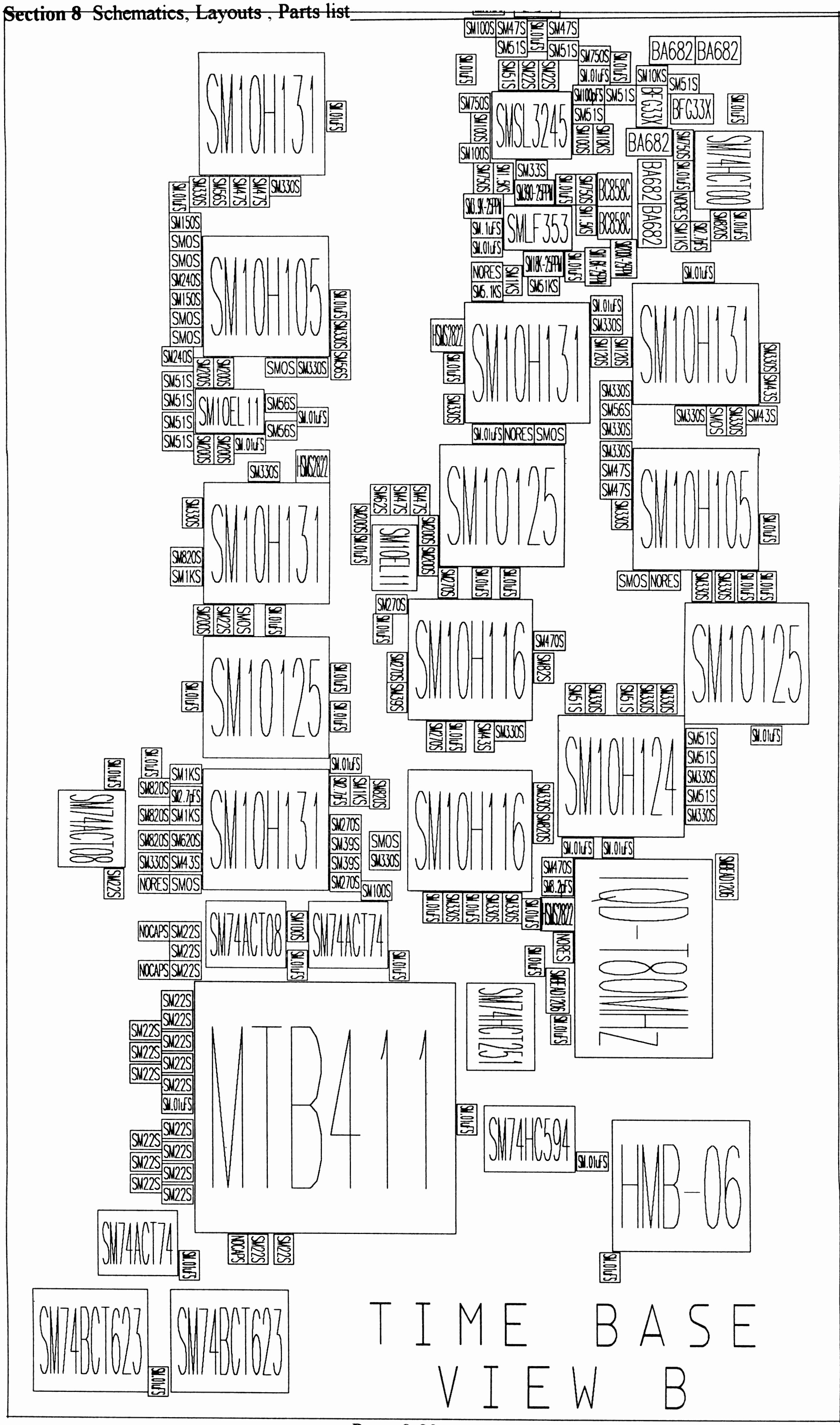
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C809	SM661255102	SM1000pFS	SM0805SP
C810	SM661255102	SM1000pFS	SM0805SP
C811	SM661255102	SM1000pFS	SM0805SP
C812	SM661255102	SM1000pFS	SM0805SP
C813	SM661255102	SM1000pFS	SM0805SP
C814	SM661255102	SM1000pFS	SM0805SP
C815	SM661255102	SM1000pFS	SM0805SP

C816	SM661255102	SM1000pFS	SM0805SP
C817	SM661207104	SM.1uFS	SM0805SP
C818	SM661207104	SM.1uFS	SM0805SP
C819	SM661207103	SM.01uFS	SM0805SP
C820	SM661726103	SM.01uF-NPO	SM2220
C821	SM661726103	SM.01uF-NPO	SM2220
C822	SM661207103	SM.01uFS	SM0805SP
C823	SM661207103	SM.01uFS	SM0805SP
C824	SM661207103	SM.01uFS	SM0805SP
C825	SM661207103	SM.01uFS	SM0805SP
C826	SM661726103	SM.01uF-NPO	SM2220
C827	SM661726103	SM.01uF-NPO	SM2220
C829	SM661207103	SM.01uFS	SM0805SP
C831	SM661207103	SM.01uFS	SM0805SP
C833	SM661207103	SM.01uFS	SM0805SP
C834	SM661726103	SM.01uF-NPO	SM2220
C835	SM661726103	SM.01uF-NPO	SM2220
C837	SM661207103	SM.01uFS	SM0805SP
C838	SM661207103	SM.01uFS	SM0805SP
C839	SM661207103	SM.01uFS	SM0805SP
C840	SM661207103	SM.01uFS	SM0805SP
C841	SM661726103	SM.01uF-NPO	SM2220
C842	SM661726103	SM.01uF-NPO	SM2220
C843	SM661207103	SM.01uFS	SM0805SP
C844	SM661255102	SM1000pFS	SM0805SP
C845	SM661207103	SM.01uFS	SM0805SP
C846	SM661726103	SM.01uF-NPO	SM2220
C847	SM661726103	SM.01uF-NPO	SM2220
C848	SM661207103	SM.01uFS	SM0805SP
C849	SM661207103	SM.01uFS	SM0805SP
C850	SM661207103	SM.01uFS	SM0805SP
C851	SM661726103	SM.01uF-NPO	SM2220
C852	SM661726103	SM.01uF-NPO	SM2220
C853	SM661207103	SM.01uFS	SM0805SP
C854	SM661207103	SM.01uFS	SM0805SP
C3000	SM661207104	SM.1uFS	SM0805SP
C3001	SM661207104	SM.1uFS	SM0805SP
C3002	SM661207103	SM.01uFS	SM0805SP
C3003	SM661207103	SM.01uFS	SM0805SP
C3004	SM661207102	SM.001uFS	SM0805SP
C3005	SM666327225	SM2.2uF-20V	SMCAPETD2
C3006	SM666327225	SM2.2uF-20V	SMCAPETD2
C3007	SM661207103	SM.01uFS	SM0805SP
C3008	SM661207103	SM.01uFS	SM0805SP
C3009	SM661207103	SM.01uFS	SM0805SP
C3010	SM661207103	SM.01uFS	SM0805SP
C3011	SM661207103	SM.01uFS	SM0805SP
C3012	SM666327225	SM2.2uF-20V	SMCAPETD2
C3013	SM661207103	SM.01uFS	SM0805SP
C3014	SM661207103	SM.01uFS	SM0805SP
C3015	SM661207103	SM.01uFS	SM0805SP
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C3021	SM661207103	SM.01uFS	SM0805SP
C3022	SM661207103	SM.01uFS	SM0805SP
C3023	SM661207104	SM.1uFS	SM0805SP
C3024	SM661255027	SM2.7pFS	SM0805SP
C3025	SM661207104	SM.1uFS	SM0805SP
C3026	SM661207103	SM.01uFS	SM0805SP
C3027	SM661207103	SM.01uFS	SM0805SP

C3028	SM661207104	SM.1uFS	SM0805SP
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C3030	SM661207103	SM.01uFS	SM0805SP
C3031	SM661207103	SM.01uFS	SM0805SP
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C3035	SM661207103	SM.01uFS	SM0805SP
C3036	SM661207102	SM.001uFS	SM0805SP
C3037	SM666327225	SM2.2uF-20V	SMCAPETD2
C3038	SM661207103	SM.01uFS	SM0805SP
C3039	SM661207103	SM.01uFS	SM0805SP
C3040	SM661207103	SM.01uFS	SM0805SP
C3041	SM661207103	SM.01uFS	SM0805SP
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C3061	SM661207104	SM.1uFS	SM0805SP
C3062	SM661205222	SM.0022uFS	SM0805SP
C3063	SM661207103	SM.01uFS	SM0805SP
C3064	SM661255101	SM100pFS	SM0805SP
C3065	SM666327225	SM2.2uF-20V	SMCAPETD2
C3066	SM661207103	SM.01uFS	SM0805SP
C3067	SM661207104	SM.1uFS	SM0805SP
C3068	SM666327225	SM2.2uF-20V	SMCAPETD2
C3069	SM661207103	SM.01uFS	SM0805SP
C3070	SM661207103	SM.01uFS	SM0805SP
C3072	SM666327225	SM2.2uF-20V	SMCAPETD2
C3073	SM661207104	SM.1uFS	SM0805SP
C3074	SM661207103	SM.01uFS	SM0805SP
C3075	SM661207103	SM.01uFS	SM0805SP
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C3084	SM661207103	SM.01uFS	SM0805SP
C3400	SM661207103	SM.01uFS	SM0805SP
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C3402	SM661207103	SM.01uFS	SM0805SP
C4000	SM661207104	SM.1uFS	SM0805SP
C4001	SM661207104	SM.1uFS	SM0805SP
C4002	SM661207103	SM.01uFS	SM0805SP
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C4004	SM661207102	SM.001uFS	SM0805SP
C4005	SM666327225	SM2.2uF-20V	SMCAPETD2
C4006	SM666327225	SM2.2uF-20V	SMCAPETD2
C4007	SM661207103	SM.01uFS	SM0805SP
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C4009	SM661207103	SM.01uFS	SM0805SP
C4010	SM661207103	SM.01uFS	SM0805SP
C4011	SM661207103	SM.01uFS	SM0805SP
C4012	SM666327225	SM2.2uF-20V	SMCAPETD2
C4013	SM661207103	SM.01uFS	SM0805SP
C4014	SM661207103	SM.01uFS	SM0805SP
C4015	SM661207103	SM.01uFS	SM0805SP
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C4022	SM661207103	SM.01uFS	SM0805SP
C4023	SM661207104	SM.1uFS	SM0805SP
C4024	SM661255027	SM2.7pFS	SM0805SP
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C4026	SM661207103	SM.01uFS	SM0805SP
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C4062	SM661205222	SM.0022uFS	SM0805SP
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C4066	SM661207103	SM.01uFS	SM0805SP

C4067	SM661207104	SM.1uFS	SM0805SP
C4068	SM666327225	SM2.2uF-20V	SMCAPETD2
C4069	SM661207103	SM.01uFS	SM0805SP
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C4072	SM666327225	SM2.2uF-20V	SMCAPETD2
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C4401	SM661207103	SM.01uFS	SM0805SP
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C4500	SM661207103	SM.01uFS	SM0805SP
C4501	SM661207103	SM.01uFS	SM0805SP
C5000	SM661207104	SM.1uFS	SM0805SP
C5002	SM661207104	SM.1uFS	SM0805SP
C5003	SM661207103	SM.01uFS	SM0805SP
C5004	SM661207103	SM.01uFS	SM0805SP
C5005	SM666327225	SM2.2uF-20V	SMCAPETD2
C5006	SM661207103	SM.01uFS	SM0805SP
C5007	SM661207103	SM.01uFS	SM0805SP
C5008	SM661207103	SM.01uFS	SM0805SP
C5009	SM661207104	SM.1uFS	SM0805SP
C5010	SM666327225	SM2.2uF-20V	SMCAPETD2
C5011	SM666327225	SM2.2uF-20V	SMCAPETD2
C5012	SM661207102	SM.001uFS	SM0805SP
C5014	SM661207103	SM.01uFS	SM0805SP
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C6000	SM661207104	SM.1uFS	SM0805SP
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C6002	SM661207104	SM.1uFS	SM0805SP
C6003	SM661207103	SM.01uFS	SM0805SP
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C6006	SM666327225	SM2.2uF-20V	SMCAPETD2
C6007	SM661207103	SM.01uFS	SM0805SP
C6008	SM661255150	SM15pFS	SM0805SP
C6009	SM661207103	SM.01uFS	SM0805SP
C6010	SM661207103	SM.01uFS	SM0805SP
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CR2	SM232022822	HSMS2822	SOT23
CR3	SM232022822	HSMS2822	SOT23
CR4	SM232022822	HSMS2822	SOT23
CR5	SM232022822	HSMS2822	SOT23
CR6	SM240218451	BZX84-C5V1	SOT23
CR7	SM236030099	BAV99	SOT23
CR8	SM240218451	BZX84-C5V1	SOT23
CR9	SM240218451	BZX84-C5V1	SOT23
CR10	SM240218451	BZX84-C5V1	SOT23
CR300	SM232022822	HSMS2822	SOT23
CR301	SM232022822	HSMS2822	SOT23
CR302	SM232022822	HSMS2822	SOT23
CR303	SM252080682	BA682	SOD80
CR304	SM252080682	BA682	SOD80
CR305	SM252080682	BA682	SOD80
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CR307	SM252080682	BA682	SOD80
CR600	SM240218491	BZX84-C9V1	SOT23
CR601	SM240218443	BZX84-C4V3	SOT23
CR602	SM240218491	BZX84-C9V1	SOT23
CR603	SM236030099	BAV99	SOT23
CR800	SM208591336	SMLM336-5	SOIC_8
CR801	SM240218451	BZX84-C5V1	SOT23
CR3000	SM229020150	SMTVSS-5V6	SMDIO_0805
CR3001	SM236030099	BAV99	SOT23
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CR3006	SM236030099	BAV99	SOT23
CR3007	SM236030099	BAV99	SOT23
CR3008	SM232022822	HSMS2822	SOT23
CR3010	SM240218424	BZX84-C2V4	SOT23
CR3011	SM236030099	BAV99	SOT23
CR3012	SM240218451	BZX84-C5V1	SOT23
CR3014	SM236030099	BAV99	SOT23
CR3015	SM240218451	BZX84-C5V1	SOT23
CR3017	SM240218451	BZX84-C5V1	SOT23
CR3018	SM230080620	BB620	MINIPLAST
CR3019	SM232022822	HSMS2822	SOT23
CR3020	SM236030099	BAV99	SOT23
CR3021	SM230080620	BB620	MINIPLAST
CR3022	SM240218424	BZX84-C2V4	SOT23
CR3023	SM240218451	BZX84-C5V1	SOT23
CR4000	SM229020150	SMTVSS-5V6	SMDIO_0805
CR4001	SM236030099	BAV99	SOT23
CR4002	SM236030099	BAV99	SOT23
CR4003	SM236030099	BAV99	SOT23
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CR4022	SM240218424	BZX84-C2V4	SOT23
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CR5003	SM234101385	SMLM385-1.2	SOIC_8
CR6000	SM229020150	SMTVSS-5V6	SMDIO_0805
CR6001	SM208591336	SMLM336-5	SOIC_8
CR6002	SM236030099	BAV99	SOT23
CR6003	SM232022822	HSMS2822	SOT23
F3000	SM433012001	SM.2A	SM1206
F3001	SM433012001	SM.2A	SM1206
F4000	SM433012001	SM.2A	SM1206
F4001	SM433012001	SM.2A	SM1206
F5000	SM433012001	SM.2A	SM1206
J600	454320096	3x32-ST-F	CONN3X32_ST_F
J601	454110010	POWER1x10-M	POWER1X10_M
J602	454390002	1x2-ST-M-PL	CONN1X2_ST_M_PL
J3000	7093XXP01-P21	BNC-93XX-PROBE	BNC_93XX_PROBE
J4000	7093XXP01-P21	BNC-93XX-PROBE	BNC_93XX_PROBE
J5000	7093XXP01-P21	BNC-93XX-PROBE	BNC_93XX_PROBE
J6000	7093XXP01-P21	BNC-93XX-PROBE	BNC_93XX_PROBE
L1	SM301502001	SMBEAD1206	SMBEAD1206
L2	SM301502001	SMBEAD1206	SMBEAD1206
L3	SM301502001	SMBEAD1206	SMBEAD1206
L4	SM301502001	SMBEAD1206	SMBEAD1206
L300	SM301502001	SMBEAD1206	SMBEAD1206
L301	SM301502001	SMBEAD1206	SMBEAD1206
L600	SM301502001	SMBEAD1206	SMBEAD1206
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L606	SM301502001	SMBEAD1206	SMBEAD1206
L608	SM301502001	SMBEAD1206	SMBEAD1206
L801	SM301502001	SMBEAD1206	SMBEAD1206
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L3000	SM301502001	SMBEAD1206	SMBEAD1206
L3001	SM301502001	SMBEAD1206	SMBEAD1206
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Q6	SM275030092	BFT92	SOT23
Q300	SM275330858	BC858C	SOT23
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R506	SM652101510	SM51S	SM0805SP
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R508	SM652101331	SM330S	SM0805SP
R509	SM652101821	SM820S	SM0805SP
R510	SM654101000	SM0S	SM0805SP
R511	SM652101331	SM330S	SM0805SP
R512	SM652101331	SM330S	SM0805SP
R513	SM652101331	SM330S	SM0805SP
R514	SM652101430	SM43S	SM0805SP
R515	SM652101331	SM330S	SM0805SP
R516	SM652101430	SM43S	SM0805SP
R600	SM652101183	SM18KS	SM0805SP
R601	SM652101332	SM3.3KS	SM0805SP
R602	SM652101102	SM1KS	SM0805SP
R603	SM652101102	SM1KS	SM0805SP
R604	SM652101122	SM1.2KS	SM0805SP
R605	SM652101824	SM820KS	SM0805SP
R606	SM652101332	SM3.3KS	SM0805SP
R607	SM652101103	SM10KS	SM0805SP
R608	SM652101103	SM10KS	SM0805SP
R609	SM652101512	SM5.1KS	SM0805SP
R610	SM652101332	SM3.3KS	SM0805SP
R611	SM652101332	SM3.3KS	SM0805SP
R612	SM652101302	SM3KS	SM0805SP
R613	SM652101332	SM3.3KS	SM0805SP
R614	SM652101332	SM3.3KS	SM0805SP
R615	SM652101332	SM3.3KS	SM0805SP
R616	SM652101332	SM3.3KS	SM0805SP
R617	169416473	NTC-DISC-47K	NTC_DISC
R618	SM652101100	SM10S	SM0805SP
R619	SM652101223	SM22KS	SM0805SP
R620	SM652101122	SM1.2KS	SM0805SP
R621	SM652101220	SM22S	SM0805SP
R622	SM652101103	SM10KS	SM0805SP
R623	SM652101220	SM22S	SM0805SP
R624	SM652101220	SM22S	SM0805SP
R625	SM652101103	SM10KS	SM0805SP

R626	SM652101220	SM22S	SM0805SP
R627	SM652101220	SM22S	SM0805SP
R628	SM652101472	SM4.7KS	SM0805SP
R629	SM652101472	SM4.7KS	SM0805SP
R630	SM652101472	SM4.7KS	SM0805SP
R631	SM654101000	SM0S	SM0805SP
R632	SM652101103	SM10KS	SM0805SP
R633	SM652101103	SM10KS	SM0805SP
R634	SM652101220	SM22S	SM0805SP
R635	SM652101220	SM22S	SM0805SP
R636	SM652101220	SM22S	SM0805SP
R637	SM652101103	SM10KS	SM0805SP
R638	SM652101103	SM10KS	SM0805SP
R639	SM652101103	SM10KS	SM0805SP
R640	SM652101220	SM22S	SM0805SP
R641	SM652101220	SM22S	SM0805SP
R642	SM652101220	SM22S	SM0805SP
R643	SM652101220	SM22S	SM0805SP
R645	SM652101271	SM270S	SM0805SP
R646	SM652101331	SM330S	SM0805SP
R647	SM652101102	SM1KS	SM0805SP
R649	161445100	10-1/2W	RES20
R800	SM652101102	SM1KS	SM0805SP
R805	SM652101331	SM330S	SM0805SP
R808	SM652101103	SM10KS	SM0805SP
R809	SM652101103	SM10KS	SM0805SP
R810	SM652101103	SM10KS	SM0805SP
R811	SM652101103	SM10KS	SM0805SP
R812	SM652101103	SM10KS	SM0805SP
R813	SM652101103	SM10KS	SM0805SP
R815	SM652101103	SM10KS	SM0805SP
R817	SM652101103	SM10KS	SM0805SP
R818	SM652101103	SM10KS	SM0805SP
R819	SM652101103	SM10KS	SM0805SP
R820	SM652101103	SM10KS	SM0805SP
R821	SM652101103	SM10KS	SM0805SP
R822	SM652101103	SM10KS	SM0805SP
R823	SM652101112	SM1.1KS	SM0805SP
R824	SM652101203	SM20KS	SM0805SP
R825	SM652101103	SM10KS	SM0805SP
R826	SM652101103	SM10KS	SM0805SP
R827	SM652101103	SM10KS	SM0805SP
R828	SM652101223	SM22KS	SM0805SP
R829	SM652101103	SM10KS	SM0805SP
R830	SM652101101	SM100S	SM0805SP
R3000	SM652101330	SM33S	SM0805SP
R3001	SM652101330	SM33S	SM0805SP
R3002	SM652101331	TH330S	SM0805SP
R3003	SM168651002	SM120-1%MMHF	SMRES_MINIMELFSP
R3004	SM652101220	SM22S	SM0805SP
R3005	SM168651002	SM120-1%MMHF	SMRES_MINIMELFSP
R3007	SM168651003	TH130-1%MMHF	THRES_MINIMELFSP
R3008	SM652101621	SM620S	SM0805SP
R3009	SM168651003	TH130-1%MMHF	THRES_MINIMELFSP
R3010	SM652101620	SM62S	SM0805SP
R3011	SM168651005	TH180-1%MMHF	THRES_MINIMELFSP
R3012	SM168651005	TH180-1%MMHF	THRES_MINIMELFSP
R3013	SM168651003	SM130-1%MMHF	SMRES_MINIMELFSP
R3014	SM652101102	SM1KS	SM0805SP
R3015	SM652101910	SM91S	SM0805SP
R3016	SM652101102	SM1KS	SM0805SP
R3017	SM168651002	TH120-1%MMHF	THRES_MINIMELFSP
R3018	SM168651002	TH120-1%MMHF	THRES_MINIMELFSP

R3019	SM652101103	SM10KS	SM0805SP
R3020	SM652101100	SM10S	SM0805SP
R3021	SM185457101	SM100-1T	SMPOT_ST4
R3022	SM652101361	SM360S	SM0805SP
R3023	SM652101122	SM1.2KS	SM0805SP
R3024	SM652101471	SM470S	SM0805SP
R3025	SM652101102	SM1KS	SM0805SP
R3026	SM652101244	SM240KS	SM0805SP
R3027	SM652101103	SM10KS	SM0805SP
R3028	SM652101430	SM43S	SM0805SP
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R3030	SM652101102	SM1KS	SM0805SP
R3031	SM652101112	SM1.1KS	SM0805SP
R3032	SM652101102	SM1KS	SM0805SP
R3033	SM652101102	SM1KS	SM0805SP
R3034	SM652101330	SM33S	SM0805SP
R3035	SM654101000	SM0S	SM0805SP
R3036	SM653190104	SMNTC-100KS	SM0805SP
R3037	SM652101102	SM1KS	SM0805SP
R3038	SM652101201	SM200S	SM0805SP
R3040	SM652101330	SM33S	SM0805SP
R3041	SM652101510	SM51S	SM0805SP
R3042	SM652101202	SM2KS	SM0805SP
R3043	SM652101201	SM200S	SM0805SP
R3044	SM652101430	SM43S	SM0805SP
R3045	SM652101200	SM20S	SM0805SP
R3046	SM652101200	SM20S	SM0805SP
R3047	SM652101620	SM62S	SM0805SP
R3048	SM652101430	SM43S	SM0805SP
R3049	SM652101820	SM82S	SM0805SP
R3050	SM652101104	SM100KS	SM0805SP
R3051	SM652101330	SM33S	SM0805SP
R3052	SM652101560	SM56S	SM0805SP
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R3054	SM652101330	SM33S	SM0805SP
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R3058	SM652101820	SM82S	SM0805SP
R3059	SM652101222	SM2.2KS	SM0805SP
R3060	SM652101330	SM33S	SM0805SP
R3061	SM652101181	SM180S	SM0805SP
R3062	SM652101122	SM1.2KS	SM0805SP
R3063	SM652101430	SM43S	SM0805SP
R3064	SM652101510	SM51S	SM0805SP
R3065	SM652101430	SM43S	SM0805SP
R3066	SM652101102	SM1KS	SM0805SP
R3067	SM652101224	SM220KS	SM0805SP
R3068	SM652101203	SM20KS	SM0805SP
R3069	SM652101430	SM43S	SM0805SP
R3070	SM652101102	SM1KS	SM0805SP
R3071	SM652101430	SM43S	SM0805SP
R3072	SM652101331	SM330S	SM0805SP
R3073	SM652101361	SM360S	SM0805SP
R3074	SM652101393	SM39KS	SM0805SP
R3075	SM652101106	SM10MS	SM0805SP
R3076	SM652101105	SM1MS	SM0805SP
R3077	SM652101471	SM470S	SM0805SP
R3078	SM652101101	SM100S	SM0805SP
R3079	SM652101103	SM10KS	SM0805SP
R3080	SM652101105	SM1MS	SM0805SP
R3081	SM652101106	SM10MS	SM0805SP
R3083	SM654101000	SM0S	SM0805SP
R3084	SM652101471	SM470S	SM0805SP

R3085	SM652101101	SM100S	SM0805SP
R3086	SM652101510	SM51S	SM0805SP
R3087	SM652101911	SM910S	SM0805SP
R3088	SM652101560	SM56S	SM0805SP
R3089	SM652101560	SM56S	SM0805SP
R3090	SM652101102	SM1KS	SM0805SP
R3091	SM652101222	SM2.2KS	SM0805SP
R3092	SM652101430	SM43S	SM0805SP
R3093	SM652101101	SM100S	SM0805SP
R3094	SM652101181	SM180S	SM0805SP
R3095	SM652101103	SM10KS	SM0805SP
R3097	SM652101102	SM1KS	SM0805SP
R3098	SM652101102	SM1KS	SM0805SP
R3099	SM652101101	SM100S	SM0805SP
R3100	SM652101103	SM10KS	SM0805SP
R3101	SM652101103	SM10KS	SM0805SP
R3102	SM652101103	SM10KS	SM0805SP
R3103	SM652101102	SM1KS	SM0805SP
R3104	SM652101182	SM1.8KS	SM0805SP
R3105	SM652101222	SM2.2KS	SM0805SP
R3106	SM652101101	SM100S	SM0805SP
R3107	SM652101101	SM100S	SM0805SP
R3108	SM652101331	SM330S	SM0805SP
R3109	SM652101223	SM22KS	SM0805SP
R3110	SM652101102	SM1KS	SM0805SP
R3111	SM652101103	SM10KS	SM0805SP
R3112	SM652101101	SM100S	SM0805SP
R3113	SM652101101	SM100S	SM0805SP
R3114	SM652101103	SM10KS	SM0805SP
R3400	SM652101510	SM51S	SM0805SP
R3401	SM652101201	SM200S	SM0805SP
R3402	SM652101201	SM200S	SM0805SP
R3403	SM652101510	SM51S	SM0805SP
R3404	SM652101151	SM150S	SM0805SP
R3405	SM652101151	SM150S	SM0805SP
R3406	SM652101201	SM200S	SM0805SP
R3407	SM652101201	SM200S	SM0805SP
R3408	SM652101510	SM51S	SM0805SP
R3409	SM652101510	SM51S	SM0805SP
R3410	SM652101201	SM200S	SM0805SP
R3411	SM652101201	SM200S	SM0805SP
R4000	SM652101330	SM33S	SM0805SP
R4001	SM652101330	SM33S	SM0805SP
R4002	SM652101331	TH330S	SM0805SP
R4003	SM168651002	SM120-1%MMHF	SMRES_MINIMELFSP
R4004	SM652101220	SM22S	SM0805SP
R4005	SM168651002	SM120-1%MMHF	SMRES_MINIMELFSP
R4007	SM168651003	TH130-1%MMHF	THRES_MINIMELFSP
R4008	SM652101621	SM620S	SM0805SP
R4009	SM168651003	TH130-1%MMHF	THRES_MINIMELFSP
R4010	SM652101620	SM62S	SM0805SP
R4011	SM168651005	TH180-1%MMHF	THRES_MINIMELFSP
R4012	SM168651005	TH180-1%MMHF	THRES_MINIMELFSP
R4013	SM168651003	SM130-1%MMHF	SMRES_MINIMELFSP
R4014	SM652101102	SM1KS	SM0805SP
R4015	SM652101910	SM91S	SM0805SP
R4016	SM652101102	SM1KS	SM0805SP
R4017	SM168651002	TH120-1%MMHF	THRES_MINIMELFSP
R4018	SM168651002	TH120-1%MMHF	THRES_MINIMELFSP
R4019	SM652101103	SM10KS	SM0805SP
R4020	SM652101100	SM10S	SM0805SP
R4021	SM185457101	SM100-1T	SMPOT_ST4
R4022	SM652101361	SM360S	SM0805SP

R4023	SM652101122	SM1.2KS	SM0805SP
R4024	SM652101471	SM470S	SM0805SP
R4025	SM652101102	SM1KS	SM0805SP
R4026	SM652101244	SM240KS	SM0805SP
R4027	SM652101103	SM10KS	SM0805SP
R4028	SM652101430	SM43S	SM0805SP
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R4030	SM652101102	SM1KS	SM0805SP
R4031	SM652101112	SM1.1KS	SM0805SP
R4032	SM652101102	SM1KS	SM0805SP
R4033	SM652101102	SM1KS	SM0805SP
R4034	SM652101330	SM33S	SM0805SP
R4035	SM654101000	SM0S	SM0805SP
R4036	SM653190104	SMNTC-100KS	SM0805SP
R4037	SM652101102	SM1KS	SM0805SP
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R4040	SM652101330	SM33S	SM0805SP
R4041	SM652101510	SM51S	SM0805SP
R4042	SM652101202	SM2KS	SM0805SP
R4043	SM652101201	SM200S	SM0805SP
R4044	SM652101430	SM43S	SM0805SP
R4045	SM652101200	SM20S	SM0805SP
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R4047	SM652101620	SM62S	SM0805SP
R4048	SM652101430	SM43S	SM0805SP
R4049	SM652101820	SM82S	SM0805SP
R4050	SM652101104	SM100KS	SM0805SP
R4051	SM652101330	SM33S	SM0805SP
R4052	SM652101560	SM56S	SM0805SP
R4053	SM652101560	SM56S	SM0805SP
R4054	SM652101330	SM33S	SM0805SP
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R4058	SM652101820	SM82S	SM0805SP
R4059	SM652101222	SM2.2KS	SM0805SP
R4060	SM652101330	SM33S	SM0805SP
R4061	SM652101181	SM180S	SM0805SP
R4062	SM652101122	SM1.2KS	SM0805SP
R4063	SM652101430	SM43S	SM0805SP
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R4065	SM652101430	SM43S	SM0805SP
R4066	SM652101102	SM1KS	SM0805SP
R4067	SM652101224	SM220KS	SM0805SP
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R4071	SM652101430	SM43S	SM0805SP
R4072	SM652101331	SM330S	SM0805SP
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R4078	SM652101101	SM100S	SM0805SP
R4079	SM652101103	SM10KS	SM0805SP
R4080	SM652101105	SM1MS	SM0805SP
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R4083	SM654101000	SM0S	SM0805SP
R4084	SM652101471	SM470S	SM0805SP
R4085	SM652101101	SM100S	SM0805SP
R4086	SM652101510	SM51S	SM0805SP
R4087	SM652101911	SM910S	SM0805SP
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R4089	SM652101560	SM56S	SM0805SP
R4090	SM652101102	SM1KS	SM0805SP
R4091	SM652101222	SM2.2KS	SM0805SP
R4092	SM652101430	SM43S	SM0805SP
R4093	SM652101101	SM100S	SM0805SP
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R4099	SM652101101	SM100S	SM0805SP
R4100	SM652101103	SM10KS	SM0805SP
R4101	SM652101103	SM10KS	SM0805SP
R4102	SM652101103	SM10KS	SM0805SP
R4103	SM652101102	SM1KS	SM0805SP
R4104	SM652101182	SM1.8KS	SM0805SP
R4105	SM652101222	SM2.2KS	SM0805SP
R4106	SM652101101	SM100S	SM0805SP
R4107	SM652101101	SM100S	SM0805SP
R4108	SM652101331	SM330S	SM0805SP
R4109	SM652101223	SM22KS	SM0805SP
R4110	SM652101102	SM1KS	SM0805SP
R4111	SM652101103	SM10KS	SM0805SP
R4112	SM652101101	SM100S	SM0805SP
R4113	SM652101101	SM100S	SM0805SP
R4114	SM652101103	SM10KS	SM0805SP
R4400	SM652101510	SM51S	SM0805SP
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R4404	SM652101151	SM150S	SM0805SP
R4405	SM652101151	SM150S	SM0805SP
R4406	SM652101201	SM200S	SM0805SP
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R4408	SM652101510	SM51S	SM0805SP
R4409	SM652101510	SM51S	SM0805SP
R4410	SM652101201	SM200S	SM0805SP
R4411	SM652101201	SM200S	SM0805SP
R4500	SM652101510	SM51S	SM0805SP
R4501	SM652101510	SM51S	SM0805SP
R4502	SM652101201	SM200S	SM0805SP
R4503	SM652101201	SM200S	SM0805SP
R4504	SM652101510	SM51S	SM0805SP
R4505	SM652101201	SM200S	SM0805SP
R4506	SM652101201	SM200S	SM0805SP
R4507	SM652101510	SM51S	SM0805SP
R5000	SM652101330	SM33S	SM0805SP
R5001	SM652101330	SM33S	SM0805SP
R5002	SM168651004	SM300-1%MMHF	SMRES_MINIMELFSP
R5003	SM652101220	SM22S	SM0805SP
R5004	SM168651005	SM180-1%MMHF	SMRES_MINIMELFSP
R5005	SM168651003	SM130-1%MMHF	SMRES_MINIMELFSP
R5006	SM652101910	SM91S	SM0805SP
R5007	SM168651005	SM180-1%MMHF	SMRES_MINIMELFSP
R5008	SM168651001	SM30-1%MMHF	SMRES_MINIMELFSP
R5009	SM652101101	SM100S	SM0805SP
R5010	SM652101103	SM10KS	SM0805SP
R5011	SM652101103	SM10KS	SM0805SP
R5012	SM652101102	SM1KS	SM0805SP
R5013	SM652101224	SM220KS	SM0805SP
R5014	SM652101103	SM10KS	SM0805SP
R5015	SM168651001	SM30-1%MMHF	SMRES_MINIMELFSP
R5016	SM652101103	SM10KS	SM0805SP
R5017	SM652101510	SM51S	SM0805SP

R5018	SM652101151	SM150S	SM0805SP
R5019	SM652101104	SM100KS	SM0805SP
R5020	SM652101153	SM15KS	SM0805SP
R5021	SM652101510	SM51S	SM0805SP
R5022	SM652101331	SM330S	SM0805SP
R5023	SM651104104	SM100K-25PPM	SM1206SP
R5024	SM652101101	SM100S	SM0805SP
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R5026	SM652101103	SM10KS	SM0805SP
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R5028	SM652101430	SM43S	SM0805SP
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R5036	SM652101201	SM200S	SM0805SP
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R5038	SM652101510	SM51S	SM0805SP
R5039	SM652101471	SM470S	SM0805SP
R5040	SM652101103	SM10KS	SM0805SP
R5041	SM652101151	SM150S	SM0805SP
R5042	SM652101151	SM150S	SM0805SP
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R5044	SM652101201	SM200S	SM0805SP
R5045	SM652101510	SM51S	SM0805SP
R5046	SM652101201	SM200S	SM0805SP
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R5048	SM652101510	SM51S	SM0805SP
R6000	SM652101330	SM33S	SM0805SP
R6001	SM652101220	SM22S	SM0805SP
R6002	SM652101330	SM33S	SM0805SP
R6003	SM168659297	SM100-1/oo	SMRES_MINIMELF
R6004	SM168659297	SM100-1/oo	SMRES_MINIMELF
R6006	SM168659001	SM1.0K-1/oo	SMRES_MINIMELF
R6007	SM654101000	SM0S	SM0805SP
R6008	SM168659001	SM1.0K-1/oo	SMRES_MINIMELF
R6009	SM654101000	SM0S	SM0805SP
R6010	SM652101821	SM820S	SM0805SP
R6011	SM652101510	SM51S	SM0805SP
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R6014	SM652101510	SM51S	SM0805SP
R6015	SM652101201	SM200S	SM0805SP
R6016	SM652101330	SM33S	SM0805SP
R6017	SM652101510	SM51S	SM0805SP
R6018	SM652101201	SM200S	SM0805SP
R6019	SM652101271	SM270S	SM0805SP
R6020	SM652101271	SM270S	SM0805SP
R6021	SM652101331	SM330S	SM0805SP
R6022	SM652101560	SM56S	SM0805SP
R6023	SM652101560	SM56S	SM0805SP
R6024	SM652101331	SM330S	SM0805SP
RL3000	430490750	RL-UR1-12	RELAYSG5Y_254P
RL3001	430490750	RL-UR1-12	RELAYSG5Y_254P
RL3002	430490750	RL-UR1-12	RELAYSG5Y_254P
RL4000	430490750	RL-UR1-12	RELAYSG5Y_254P
RL4001	430490750	RL-UR1-12	RELAYSG5Y_254P
RL4002	430490750	RL-UR1-12	RELAYSG5Y_254P
RL5000	430490750	RL-UR1-12	RELAYSG5Y_254P
RN600	190042102	1K-SIPC	SIP10RES
RN601	190042103	10K-SIPC	SIP10RES

RN602	190042103	10K-SIPC	SIP10RES
RN603	190042103	10K-SIPC	SIP10RES
RN604	190042103	10K-SIPC	SIP10RES
RN605	190042103	10K-SIPC	SIP10RES
S600	SM654101000	SM0S-2P	SM0805_2P
S601	SM654101000	SM0S-2P	SM0805_2P
S602	SM654101000	SM0S-2P	SM0805_2P
S3000	SM654101000	SM0S-2P	SM0805_2P
S4000	SM654101000	SM0S-2P	SM0805_2P
TP1	454313010	2x5-ST-M-NW-SP	CONN2X5_ST_M_NW
TP800	454313010	2x5-ST-M-NW-SP	CONN2X5_ST_M_NW
TP801	454313010	2x5-ST-M-NW-SP	CONN2X5_ST_M_NW
TP802	454313010	2x5-ST-M-NW-SP	CONN2X5_ST_M_NW
TP3000	454313010	2x5-ST-M-NW-SP	CONN2X5_ST_M_NW
TP3001	454340002	2x1-ST-M-NW	CONN2X1_ST_M_NW
TP4000	454313010	2x5-ST-M-NW-SP	CONN2X5_ST_M_NW
TP4001	454340002	2x1-ST-M-NW	CONN2X1_ST_M_NW
TP5000	454313010	2x5-ST-M-NW-SP	CONN2X5_ST_M_NW
Y300	309040023	IQD-T80MHz	$1100_QUARTZ

PART: F9320-3 **DESC: MAIN CARD DUAL 20Ms/s, 1GHz**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
103327103	CAP CERA MONO 50V .01 UF	2
146544471	CAP MINI ALUM 20% 470UF	1
158899002	CAP VARIABLE .2 - .6 PF	2
161445100	RES COMP 1/2W 5% 10 OHMS	1
169416473	RESISTOR DISC NTC 47 K	1
190042102	RESISTOR NETWORK 1 K	1
190042103	RESISTOR NETWORK 10 K	5
205750000	IC AND-OR GATE ARRAY 16V8	3
208122002	IC VOLT REG POS UA7805	1
208123002	IC +12 VOLT REG LM340T-12	2
208124003	IC VOLT REG NEG LM320T-12	2
309040023	CRYSTAL OSCILLATOR TTL 80MHZ	1
430490750	RELAY HF DPDT 75 OHMS	7
454110010	HDR SOLD TAIL/MALE PIN 10	1
454313010	HDR DIP SOLD TO PCB 2X5	7
454320096	HDR DIP SOLD TO FEM 96	1
454340002	HDR MALE PIN TO WW 02	2
454390002	HDR FRICTION LOCK 2-PIN	1
505019968	HEAT SINK VERTICAL MTG	5
530040006	BUZZER 85DB 4 TO 7V	1
554425003	SCREW S/TAP PHIL M2.5X6 BLACK	4
585252236	RIVET HOLLOW 2.5X6MM	2
709324331	BASE SHIELD	1
709324341	SHIELD LOWER PARTITION	4
7093XX361	SHIELD LOWER PARTITION	2
7093XXP01	RIGHT ANGLE RECEPT. CONNECTOR	4
7093XXP21	BULKHEAD RECEPTACLE FEMALE BNC	4
7093XXP41	PROBE HOLDER	4
7093XXP91	PROBE RING CONTACT	4
719324303	PC BD PREASS'Y 9324-3	1
719324313	PC BD PREASS'Y T-COIL	2
FP9320-3	MAIN CARD PANEL 9320-3	1
MCL404	IC MEM GATE ARRAY MCL404	1
MTB411	IC TIME BASE GATE-ARRAY	1
SM168651001	RES METAL FILM 1% 30 OHMS	2
SM168651002	RES METAL FILM 1% 120 OHMS	8
SM168651003	RES METAL FILM 1% 130 OHMS	7
SM168651004	RES METAL FILM 1% 300 OHMS	1
SM168651005	RES METAL FILM 1% 180 OHMS	6
SM168659001	RES METAL FILM .1% 1.00K	1
SM168659297	RES METAL FILM .1% 100 OHMS	2
SM185457101	RES VARI CERMET 100 OHMS	2
SM200167105	IC 2-3-2 OR/NOR 10H105	2
SM200167113	IC 2-IN XOR 10H113	1

PART: F9320-3 **DESC: MAIN CARD DUAL 20Ms/s, 1GHz**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
SM200167121	IC OR-AND/O-A-INV 10H121	2
SM200167131	IC M-S TYP D FLOP 10H131	7
SM200170174	IC D-TYPE FLOP 74ACT74	3
SM200178000	IC 2-INPUT NAND HCT00	3
SM200178138	IC 3-8 LINE DECOD HCT 138	3
SM200178374	IC D-TYP FLOP 74HCT374	1
SM200278040	IC COUNTER HCT4040	1
SM201166404	IC 4 DIFF AND/NAND 10E404	1
SM201174005	IC ECL 2-IN DIF AND/NAND	4
SM201174011	IC ECL 1:2 DIF CLOCK DRVR	3
SM201174052	IC ECL DIF CLK DATA F-F	1
SM201177008	IC 4X2 INPUT AND 74ACT08	4
SM201274033	IC ECL DIV:4 10EL33D	1
SM201474431	IC 3 DIF FLIP/FLOP MC10E431	1
SM201570016	IC ECL DIF RECEIVER 10EL16D	5
SM201574058	IC ECL 2:1 MUX 10EL58D	1
SM205108002	IC EEPROM 2K BIT IIC BUS	1
SM205228863	IC 8K X 8 STATIC RAM 25NS	2
SM205618165	IC 8-BIT SHIFT REG 74HCT165	1
SM205618594	IC 8-BIT SHIFT REG 74HC594T	6
SM206070584	IC BUS CONTROLLER	1
SM206260858	IC OCT 8-BIT ADC SYSTEM	1
SM206270703	IC 8-BIT ADC 8703	2
SM206870640	IC INV BUS TRANSCVR HCT640	2
SM206886623	IC OCTAL BUS TRANSCVR. BCT623	2
SM206970457	IC 3 DIF 2:1 MUX MC10E457	3
SM207178541	IC BUFFER/LINE DR HCT541	4
SM207280703	IC 16-BIT DAC 703	1
SM207288800	IC OCTAL 8-BIT CMOS D/A CONV	1
SM207360125	IC TRANSLATO MC10125	4
SM207367124	IC TRANSLATOR 10H124	1
SM207460116	IC LINE RECEIVER 10H116	5
SM207770201	IC ANALOG SWITCH DG201	6
SM207878245	IC BUS TRANSCVR HCT 245	2
SM207970351	IC OCTAL ANALOG MUX/DEMUX	1
SM207978251	IC 8-IN MUX 3-ST 74HCT251	2
SM208030245	IC TRANS ARRAY NPNX6 SL3245	1
SM208470130	IC FAST OP AMP HFA1130	4
SM208470347	IC J-FET OP AMP 347	4
SM208470353	IC DUAL OP AMP 353	4
SM208470621	IC HIGH SPEED OP AMP	2
SM208470705	IC OP AMP PICOAMP INPUT AD705	5
SM208473100	IC OP AMP CA3100	1
SM208480660	IC OP AMP OPA660	2

PART: F9320-3 DESC: MAIN CARD DUAL 20Ms/s, 1GHz

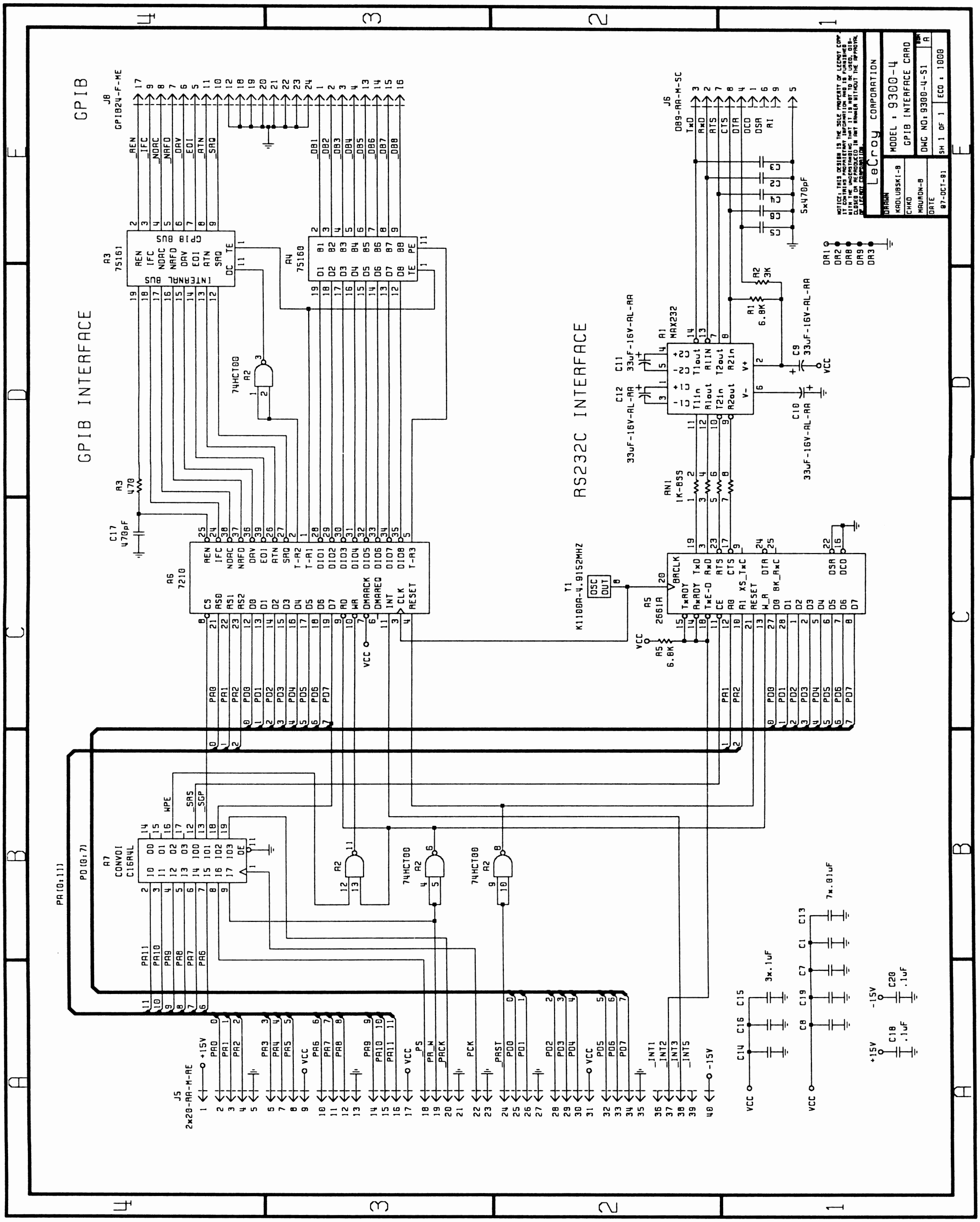
COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
SM208570805	IC POS VOLT REG 78L05	2
SM208591336	IC VOLT REF DIODE LM336	2
SM208870339	IC VOLT COMPARATOR 339	1
SM229020150	MLC TRANS VOLT SUPPRESSOR	4
SM230080620	DIODE TUNING SMD BB620	4
SM232022822	DIODE ARRAY SCHTTKY 2822	13
SM234101385	DIODE VOLT REG 385-1.2	1
SM236030099	DIODE SO-PKG BAV99	24
SM240218424	DIODE ZENER BZX84C2V4	4
SM240218436	DIODE ZENER BZX84C3V6	1
SM240218443	DIODE ZENER BZX84C4V3	1
SM240218451	DIODE ZENER BZX84C5V1	13
SM240218491	DIODE ZENER BZX84C9V1	2
SM252080682	DIODE PIN BA682	5
SM270160133	TRANSISTOR NPN HF BFG33X	22
SM270330848	TRANSISTOR NPN BC848C	6
SM275030092	TRANSISTOR PNP BFT92	2
SM275030194	TRANSISTOR PNP BFR 194	4
SM275030550	TRANSISTOR PNP BF550	5
SM275330858	TRANSISTOR PNP BC858C	2
SM289772003	TRANSISTOR ARRAY 2003	1
SM301502001	BEAD (FERRITE CHIP)	60
SM433012001	FUSE THIN FILM 200 MA	5
SM651104104	RES CHIP 1% 25PPM 100K	1
SM651104162	RES CHIP 1% 25PPM 1.6K	1
SM651104183	RES CHIP 1% 25PPM 18 K	1
SM651104204	RES CHIP 1% 25PPM 200 K	1
SM651104391	RES CHIP 1% 25PPM 390 OHMS	1
SM651104392	RES CHIP 1% 25PPM 3.9K	1
SM652101100	RES CHIP (E24) 1% 10 OHMS	4
SM652101101	RES CHIP (E24) 1% 100 OHM	33
SM652101102	RES CHIP (E24) 1% 1 K	45
SM652101103	RES CHIP (E24) 1% 10 K	64
SM652101104	RES CHIP (E24) 1% 100 K	5
SM652101105	RES CHIP (E24) 1% 1 M	4
SM652101106	RES CHIP (E24) 1% 10 MEG	4
SM652101112	RES CHIP (E24) 1% 1.1 K	3
SM652101121	RES CHIP (E24) 1% 120 OHM	8
SM652101122	RES CHIP (E24) 1% 1.2 K	6
SM652101151	RES CHIP (E24) 1% 150 OHM	29
SM652101152	RES CHIP (E24) 1% 1.5 K	2
SM652101153	RES CHIP (E24) 1% 15 K	1
SM652101154	RES CHIP (E24) 1% 150 K	2
SM652101181	RES CHIP (E24) 1% 180 OHM	4

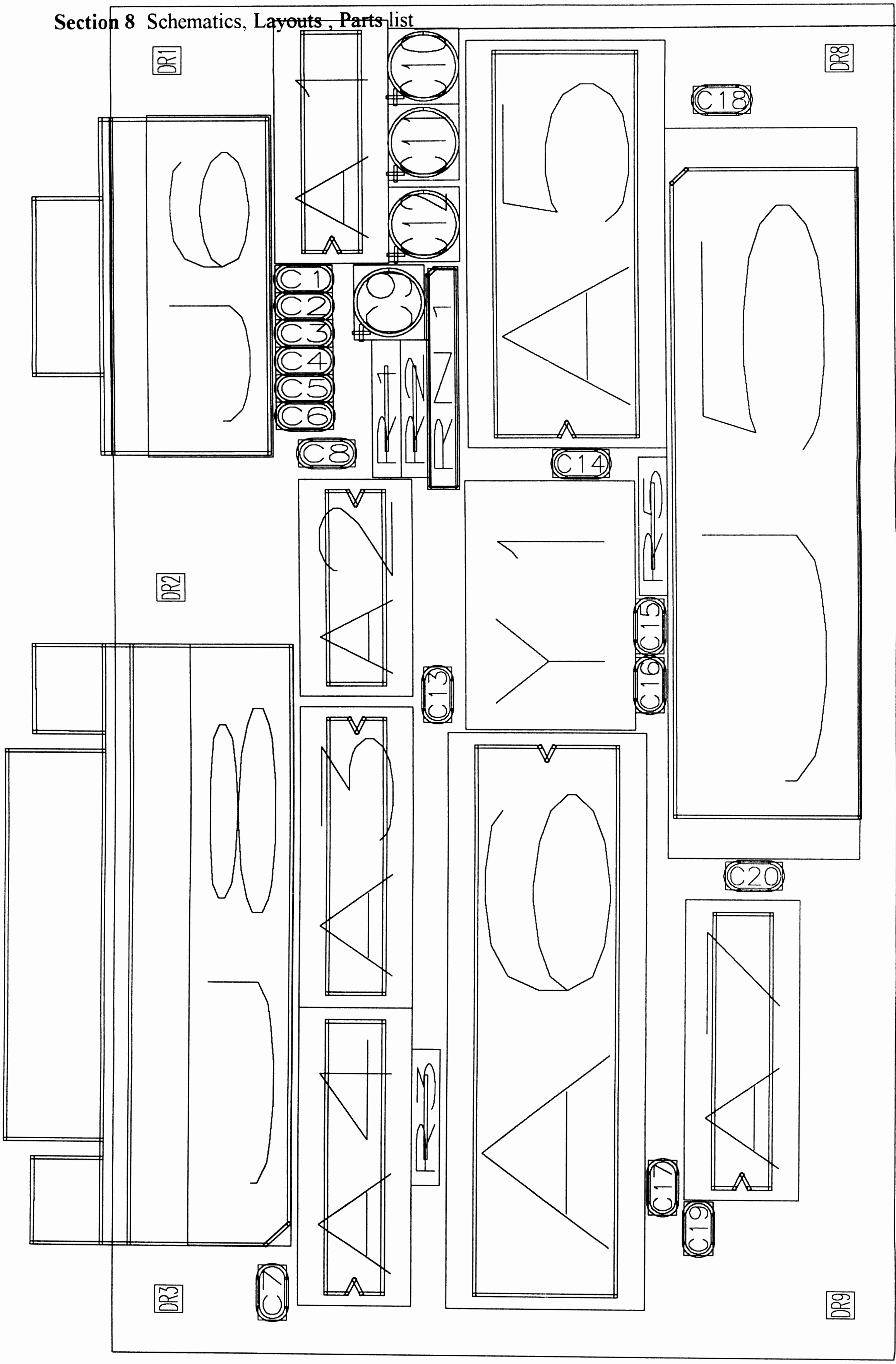
PART: F9320-3 **DESC: MAIN CARD DUAL 20Ms/s, 1GHz**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
SM652101182	RES CHIP (E24) 1% 1.8 K	2
SM652101183	RES CHIP (E24) 1% 18 K	1
SM652101200	RES CHIP (E24) 1% 20 OHMS	6
SM652101201	RES CHIP (E24) 1% 200 OHM	63
SM652101202	RES CHIP (E24) 1% 2 K	2
SM652101203	RES CHIP (E24) 1% 20 K	3
SM652101220	RES CHIP (E24) 1% 22 OHMS	42
SM652101222	RES CHIP (E24) 1% 2.2 K	6
SM652101223	RES CHIP (E24) 1% 22 K	6
SM652101224	RES CHIP (E24) 1% 220 K	5
SM652101241	RES CHIP (E24) 1% 240 OHM	4
SM652101244	RES CHIP (E24) 1% 240K	2
SM652101271	RES CHIP (E24) 1% 270 OHM	20
SM652101302	RES CHIP (E24) 1% 3 K	1
SM652101330	RES CHIP (E24) 1% 33 OHMS	24
SM652101331	RES CHIP (E24) 1% 330 OHM	56
SM652101332	RES CHIP (E24) 1% 3.3 K	8
SM652101361	RES CHIP (E24) 1% 360 OHM	4
SM652101390	RES CHIP (E24) 1% 39 OHMS	3
SM652101393	RES CHIP (E24) 1% 39 K	2
SM652101430	RES CHIP (E24) 1% 43 OHMS	25
SM652101470	RES CHIP (E24) 47 OHMS	24
SM652101471	RES CHIP (E24) 1% 470 OHM	9
SM652101472	RES CHIP (E24) 1% 4.7 K	3
SM652101510	RES CHIP (E24) 1% 51 OHMS	57
SM652101512	RES CHIP (E24) 1% 5.1 K	2
SM652101513	RES CHIP (E24) 1% 51 K	1
SM652101560	RES CHIP (E24) 1% 56 OHM	41
SM652101620	RES CHIP (E24) 1% 62 OHMS	8
SM652101621	RES CHIP (E24) 1% 620 OHM	4
SM652101680	RES CHIP (E24) 1% 68 OHMS	1
SM652101751	RES CHIP (E24) 1% 750 OHM	5
SM652101820	RES CHIP (E24) 1% 82 OHMS	7
SM652101821	RES CHIP (E24) 1% 820 OHM	8
SM652101824	RES CHIP (E24) 1% 820 K	1
SM652101910	RES CHIP (E24) 1% 91 OHMS	8
SM652101911	RES CHIP (E24) 1% 910 OHM	5
SM652101913	RES CHIP (E24) 1% 91 K	1
SM653185621	RES THICK FILM 620 OHMS	1
SM653190104	RES PTAT 100K SMD0805	2
SM654101000	CHIP JUMPER ZERO OHMS	30
SM654181000	CHIP JUMPER ZERO OHMS	2
SM661205222	CAP CERA CHIP 5% 2200 PF	2
SM661207102	CAP CERA CHIP 10% .001UF	5

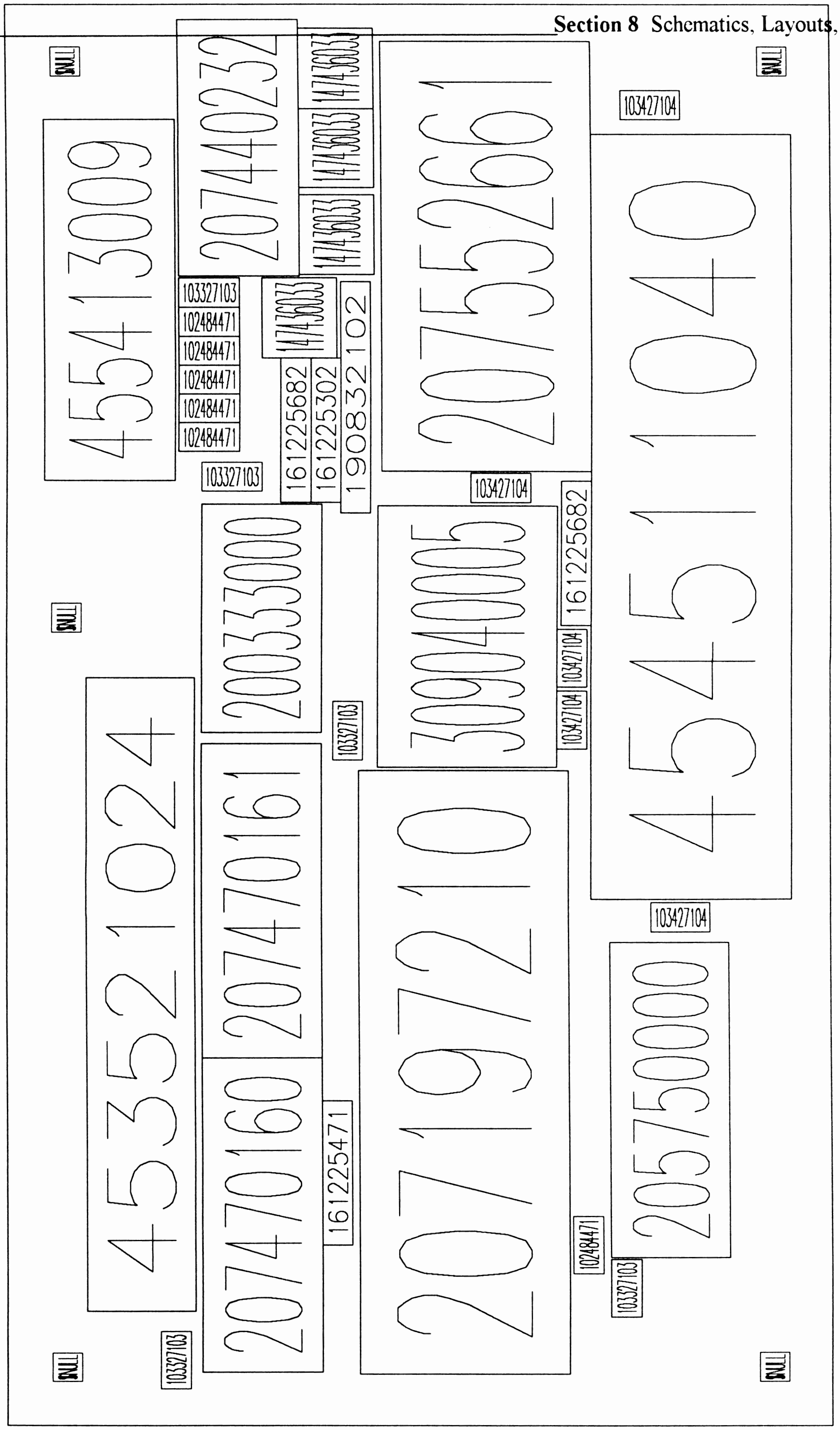
PART: F9320-3 **DESC: MAIN CARD DUAL 20Ms/s, 1GHz**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
SM661207103	CAP CERA CHIP 20% .01UF	290
SM661207104	CAP CERA CHIP 20% .1 UF	64
SM661250082	CAP CERA CHIP .1% 8.2 PF	4
SM661255027	CAP CERA CHIP 2.7 PF	5
SM661255039	CAP CERA CHIP 3.9 PF	4
SM661255101	CAP CERA CHIP 5% 100 PF	7
SM661255102	CAP CERA CHIP 5% 1000 PF	9
SM661255150	CAP CERA CHIP 5% 15 PF	1
SM661255181	CAP CERA CHIP 5% 180 PF	2
SM661726103	CAP CERA CHIP 10% .01 UF	12
SM666247106	CAP MOLD TANT CHIP 10 UF	4
SM666327225	CAP MOLD TANT CHIP 2.2 UF	33


GPIB
GPIB INTERFACE
RS232C INTERFACE
LeCroy CORPORATION
MODEL : 9300-4
GPIB INTERFACE CARD
DWG NO: 9300-4-S1



9300-4 REV:D



9300-4 REV:D

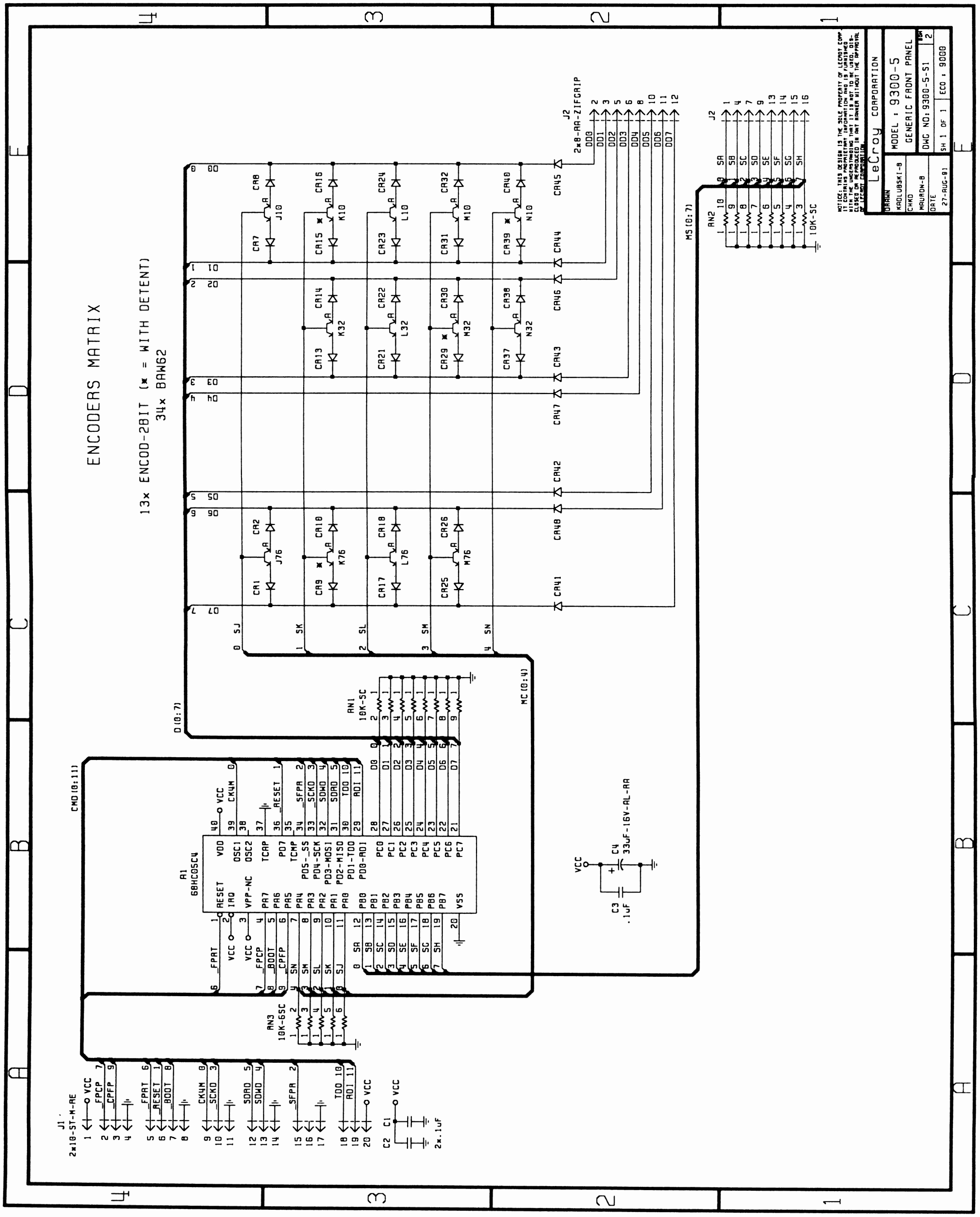

DB9-RA-M-SC
MAX232
2661A
.1uF
.01uF
470pF
470pF
470pF
470pF
470pF
.01uF
6.8K
3K
1K-8SS
.1uF
2x20-RA-M-RE
74HCT00
6.8K
.1uF
.1uF
.01uF
GPIB24-F-ME
75161
7210
.1uF
75160
470
C16R4L
470pF
.01uF
.01uF

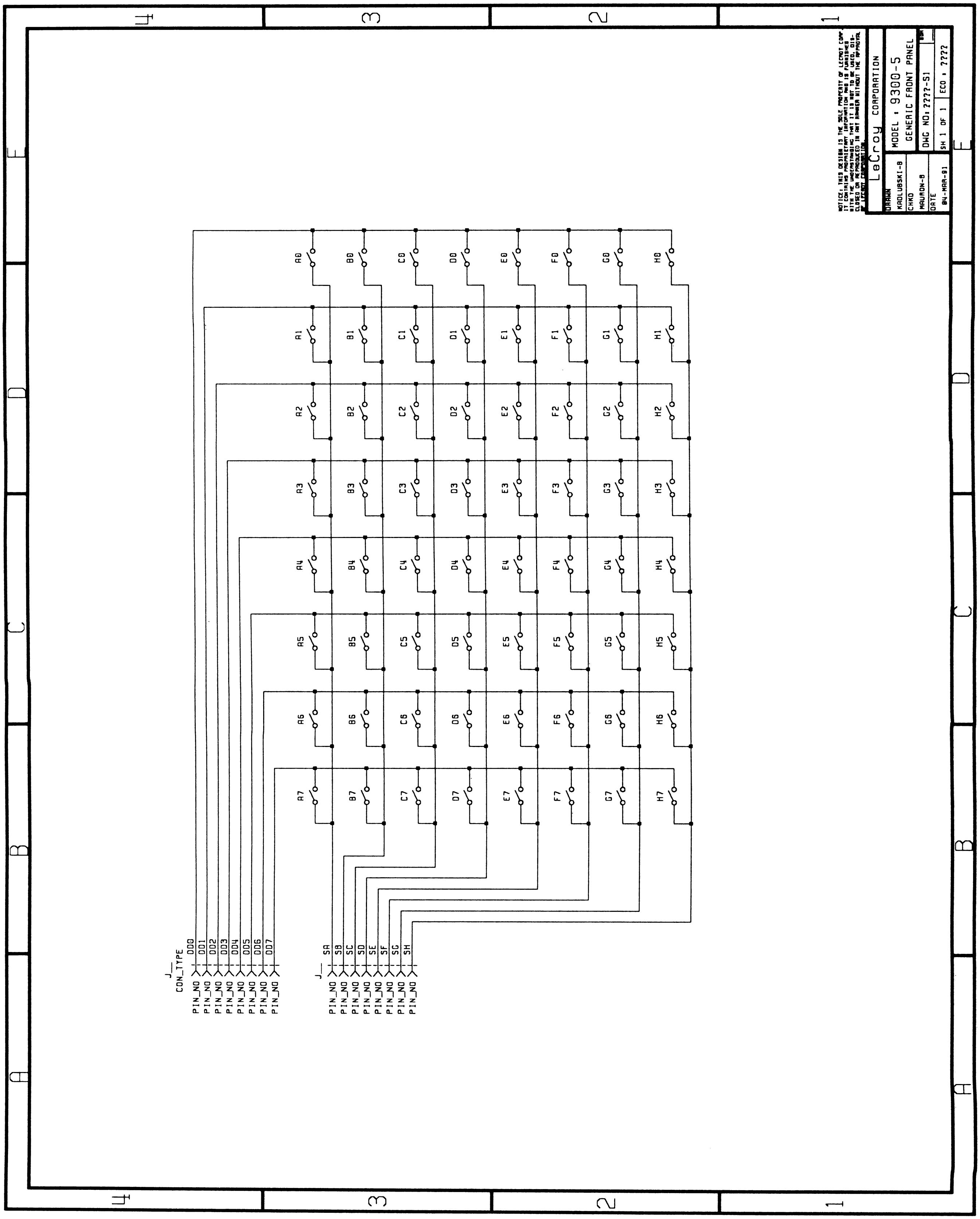
9300-4 REV:D

A1	207440232	MAX232	DIP16
A2	200333000	74HCT00	DIP14
A3	207470161	75161	DIP20
A4	207470160	75160	DIP20
A5	207552661	2661A	DIP28
A6	207197210	7210	DIP40
A7	205750000	C16R4L	DIP20
C1	103327103	.01uF	SMONOBP
C2	102484471	470pF	SMONO
C3	102484471	470pF	SMONO
C4	102484471	470pF	SMONO
C5	102484471	470pF	SMONO
C6	102484471	470pF	SMONO
C7	103327103	.01uF	SMONOBP
C8	103327103	.01uF	SMONOBP
C9	147436033	33uF-16V-AL-RA	TCAP
C10	147436033	33uF-16V-AL-RA	TCAP
C11	147436033	33uF-16V-AL-RA	TCAP
C12	147436033	33uF-16V-AL-RA	TCAP
C13	103327103	.01uF	SMONOBP
C14	103427104	.1uF	SMONOBP
C15	103427104	.1uF	SMONOBP
C16	103427104	.1uF	SMONOBP
C17	102484471	470pF	SMONO
C18	103427104	.1uF	SMONOBP
C19	103327103	.01uF	SMONOBP
C20	103427104	.1uF	SMONOBP
J5	454511040	2x20-RA-M-RE	CONN2X20_RA_M_RE
J6	455413009	DB9-RA-M-SC	DB9_RA_M_SC
J8	453521024	GPIB24-F-ME	GPIB24_F_ME
R1	161225682	6.8K	RES05
R2	161225302	3K	RES05
R3	161225471	470	RES05
R5	161225682	6.8K	RES05
RN1	190832102	1K-8SS	SIP8RES
Y1	309040005	K1100A-4.9152MHZ	$1100_QUARTZ

PART: F9300-4 **DESC: GPIB + RS232 INTERFACE CARD**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
102484471	CAP CERA DISC 100V 470 PF	6
103327103	CAP CERA MONO 50V .01 UF	5
103427104	CAP CERA MONO 100V .1 UF	5
147436033	CAP ALUM METAL CAN 33 UF	4
161225302	RES COMP 1/8W 5% 3 K	1
161225471	RES COMP 1/8W 5% 470 OHMS	1
161225682	RES CARBON FILM 6.8 K	2
190832102	RES NETWORK 1 K	1
200333000	IC QUAD 2-IN NAND HCT00	1
205750000	IC AND-OR GATE ARRAY 16V8	1
207197210	IC BUS INTERF CONTR 7210	1
207440232	IC XMTR/RCVR MAX 232	1
207470160	IC OCTAL BUS XCVR 75160A	1
207470161	IC OCTL BUS XCEIR 75161A	1
207552661	IC INTERFACE 2661A	1
309040005	CRYSTAL OSCIL. 4.9152MHZ	1
453521024	CONN RT ANGLE IEEE FEM 24	1
454511040	HDR SOLD TAIL/MALE/40/RT	1
455413009	CONN RT ANGLE MALE 9 S-CLIP	1
455980002	MOUNTING HDW FOR CONN SHELL	2
550130108	SCREW CYL HD M3X8	2
550430106	SCREW CYL HD PHIL M3X6	1
551430400	WASHER SHAKEPROOF M3	1
709300411	GPIB-RS232 INTERFACE BRACKET D	1
709300421	LABEL RS232-IEEE488-2 A	1
719300403	PC BD PREASS'Y 9300-4 D	1


ENCODERS MATRIX
13x ENCOD-2BIT (* = WITH DETENT)
34x BAW62
LeCroy CORPORATION
MODEL : 9300-5
GENERIC FRONT PANEL
DWG NO: 9300-5-S1
27-AUG-91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MODEL : 9300-5
GENERIC FRONT PANEL
DWG NO: 2222-S1
SH 1 OF 1
ECO : 2222
DRAWN
KADLUBSKI-B
CHKD
MAURON-B
DATE
04-MAR-91
CON_TYPE
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DO1
DO2
DO3
DO4
DO5
DO6
DO7
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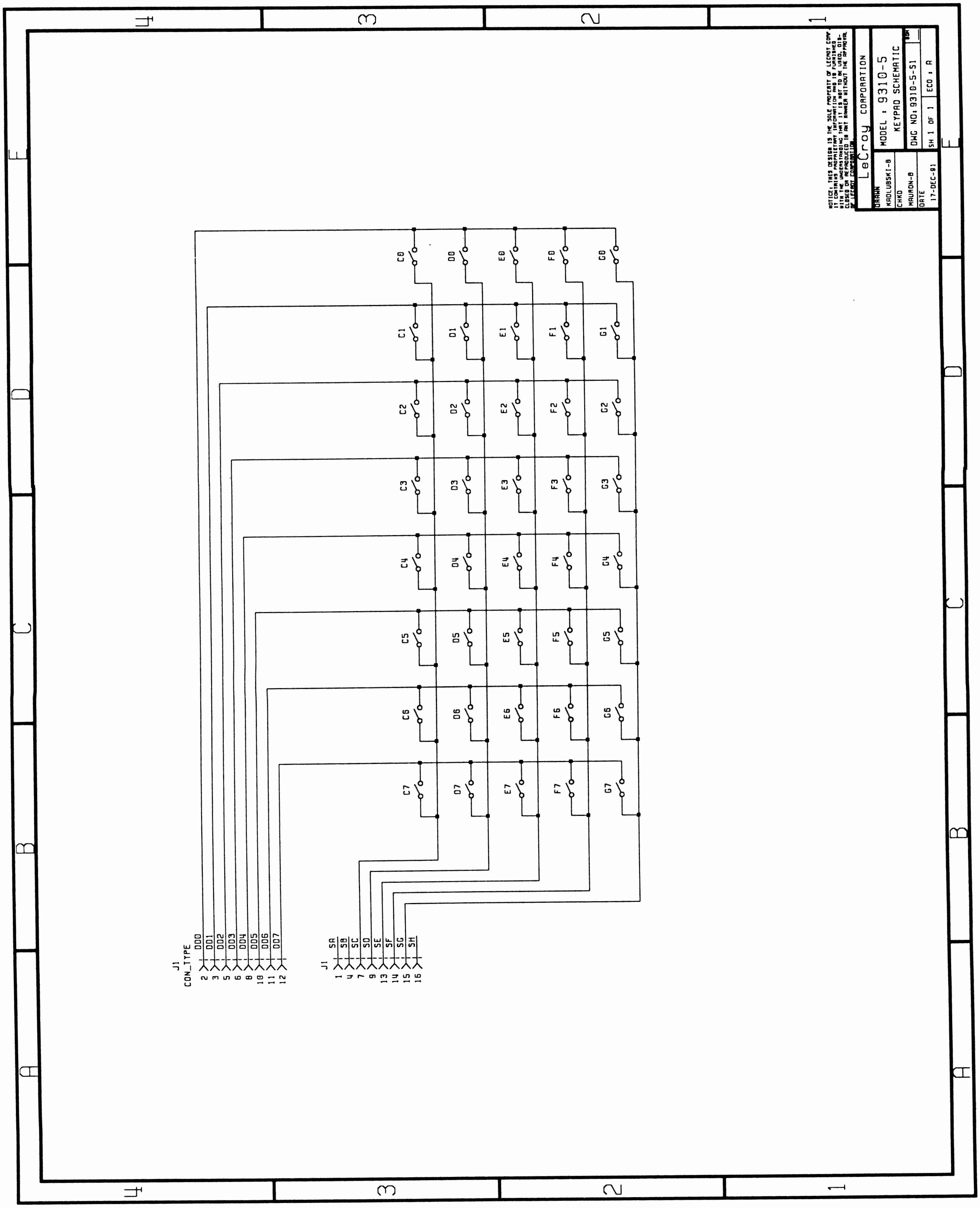
SB
SC
SD
SE
SF
SG
SH
PIN_NO


LeCroy CORPORATION
MODEL : 9310-5
KEYPAD SCHEMATIC
DWG NO: 9310-5-S1
SH 1 OF 1
ECO : A
DRAWN KADLUBSKI-B
CHKD MAURON-B
DATE 17-DEC-91
J1
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DD2
DD3
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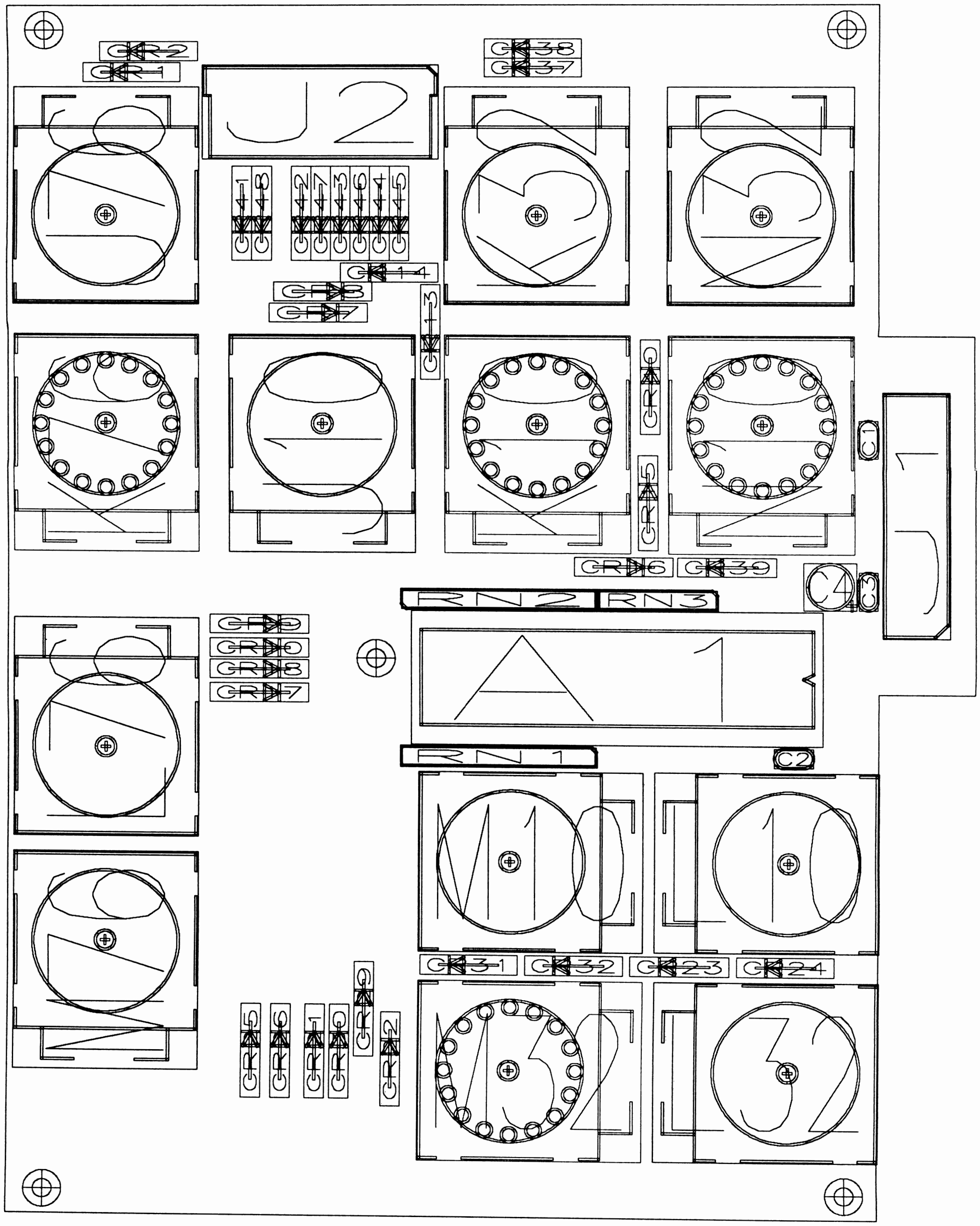
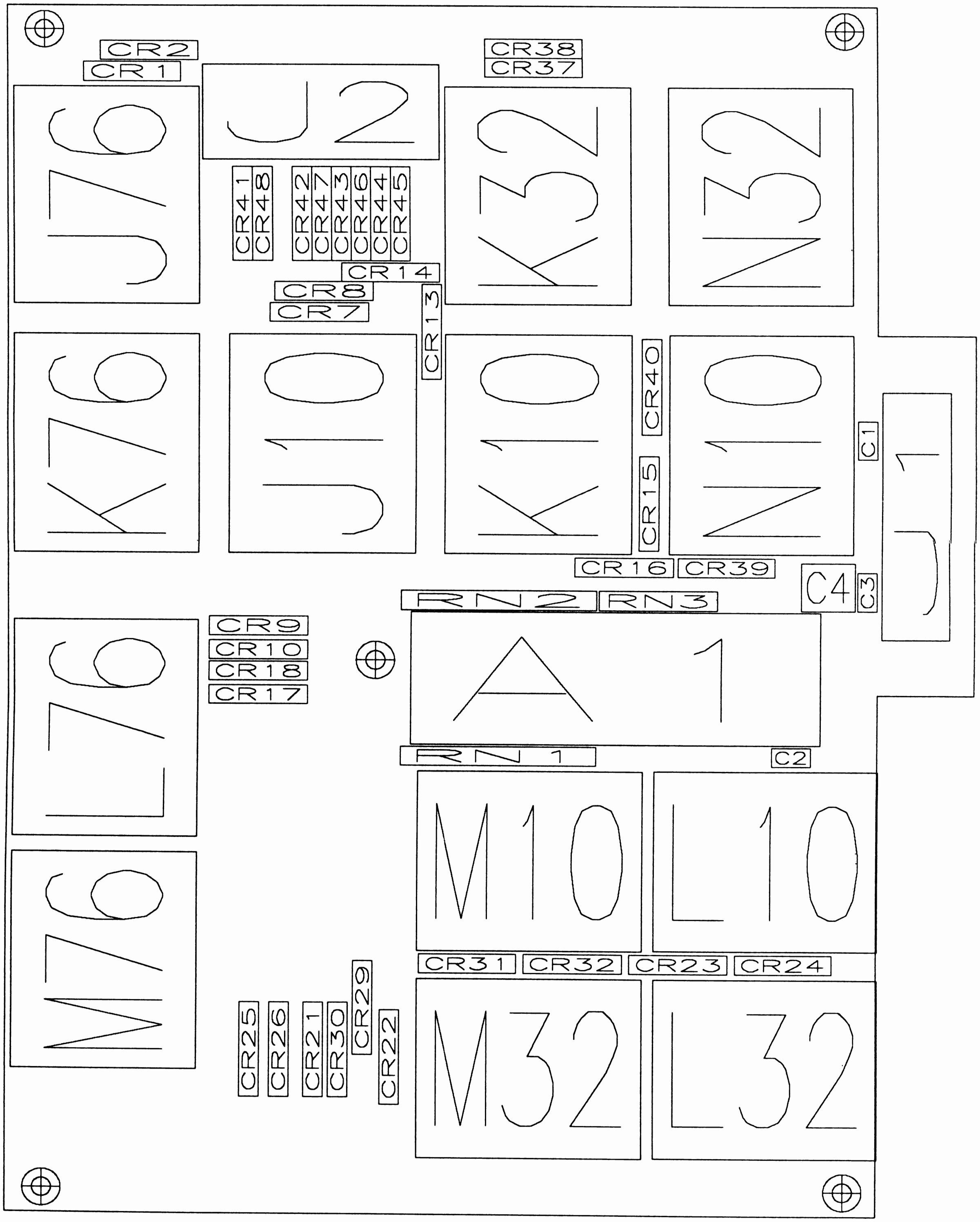
SD
SE
SF
SG
SH



931x-5 REV.A


CR2
CR1
J2
CR38
CR37
J76
CR41
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CR42
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CR43
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CR44
CR45
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N32
CR14
CR8
CR7
CR13
K76
J10
K10
CR40
N10
C1
J1
CR15
CR16
CR39
C4
C3
RN2
RN3
CR9
CR10
CR18
CR17
A1
L76
RN1
C2
M10
L10
M76
CR31
CR32
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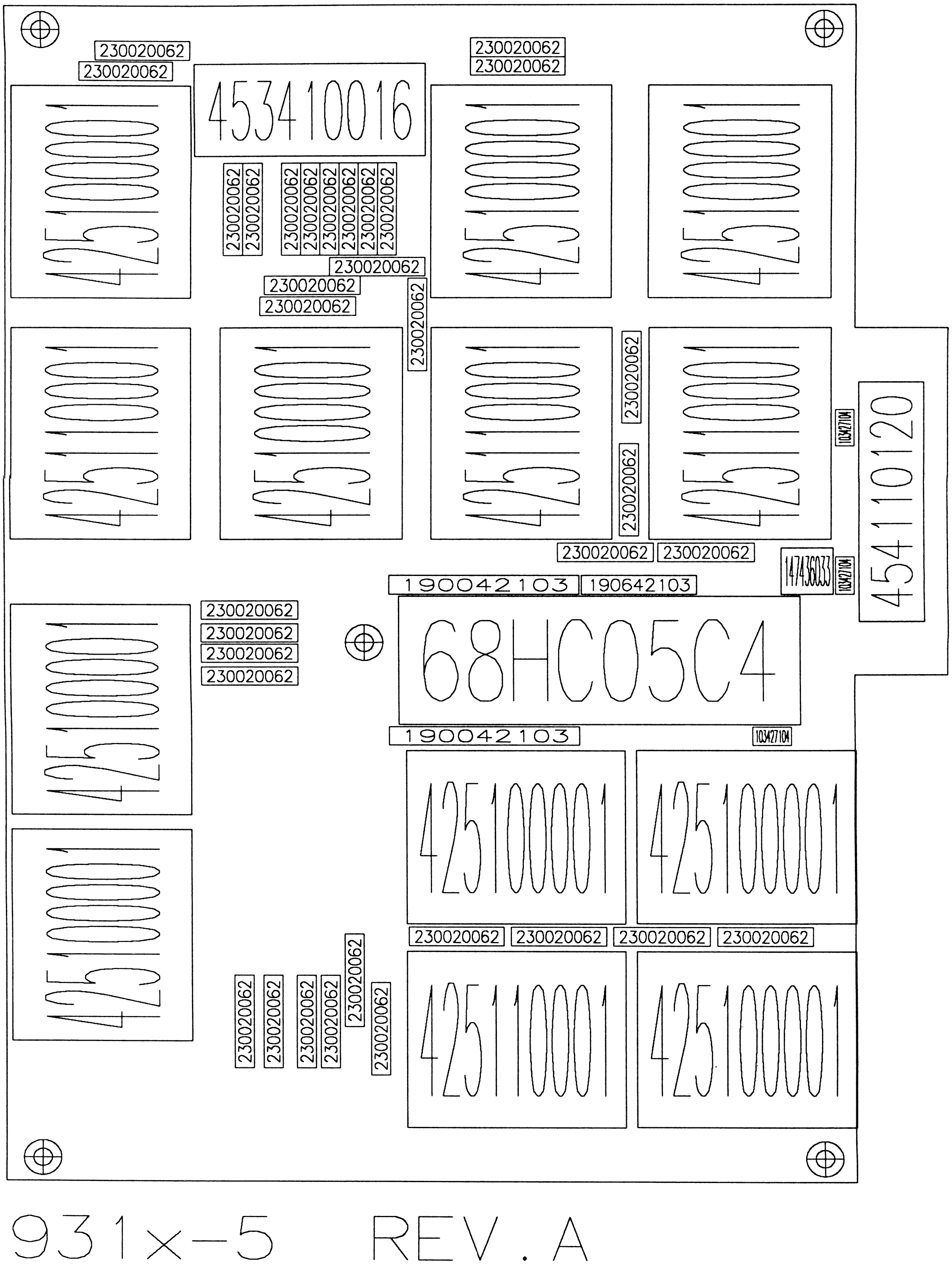
CR24
CR29
CR25
CR26
CR21
CR30
CR22
M32
L32

931x-5 REV. A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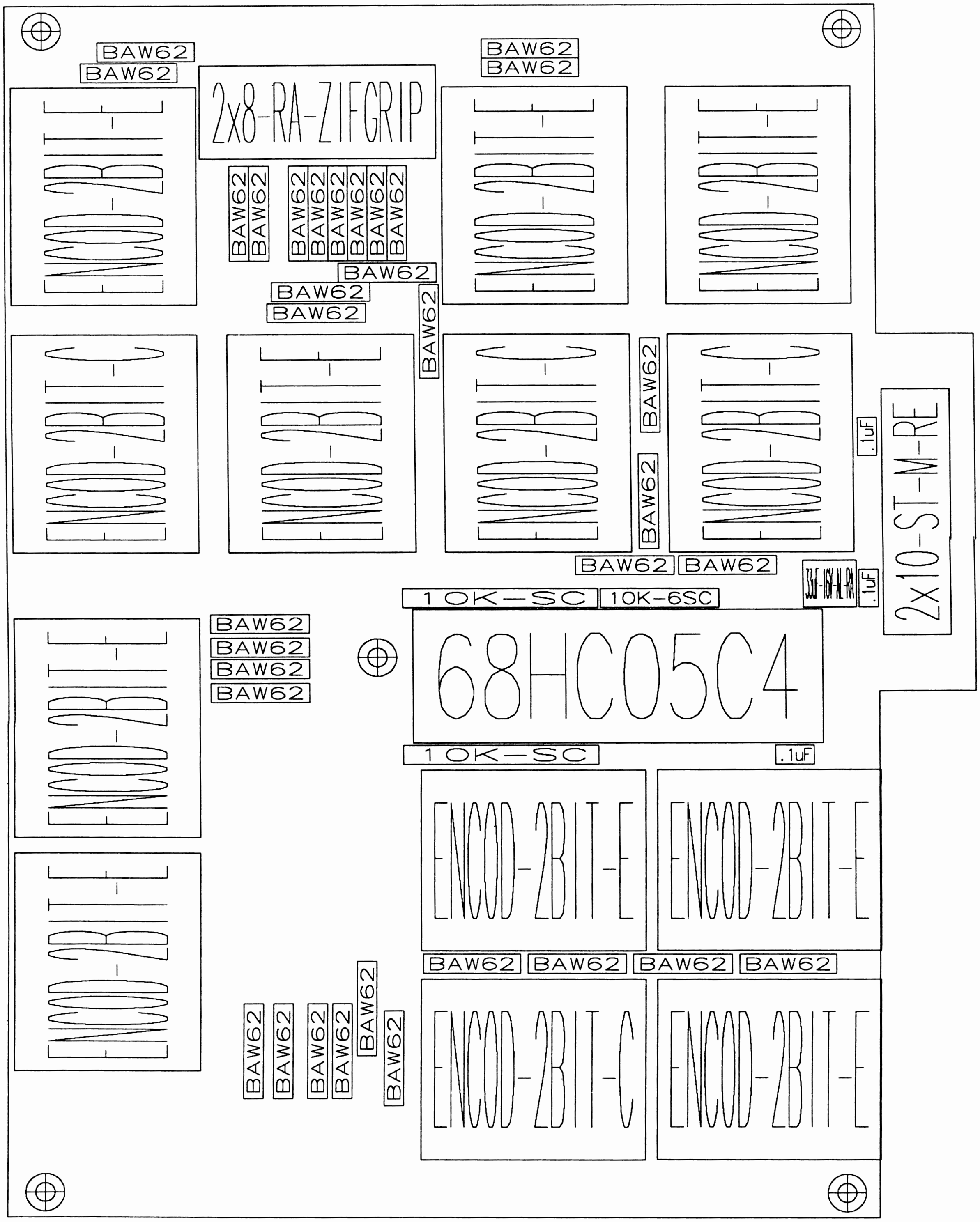
931x-5 REV.A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BAW62
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ENCOD-2BIT-C
10K-SC
10K-6SC
68HC05C4
.1uF
2x10-ST-M-RE

931x-5 REV.A

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CR7	230020062	BAW62	DO35
CR8	230020062	BAW62	DO35
CR9	230020062	BAW62	DO35
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CR41	230020062	BAW62	DO35
CR42	230020062	BAW62	DO35
CR43	230020062	BAW62	DO35
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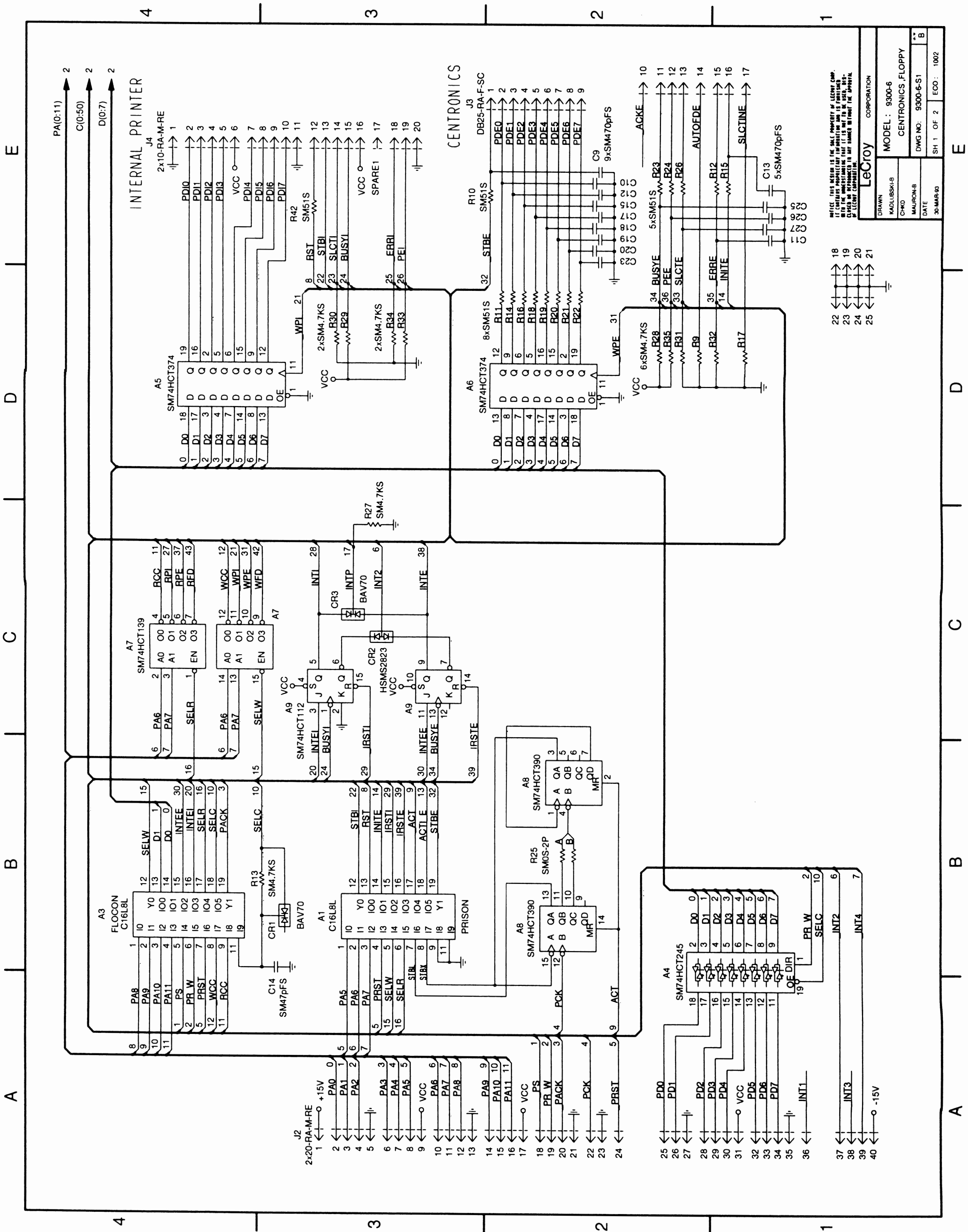
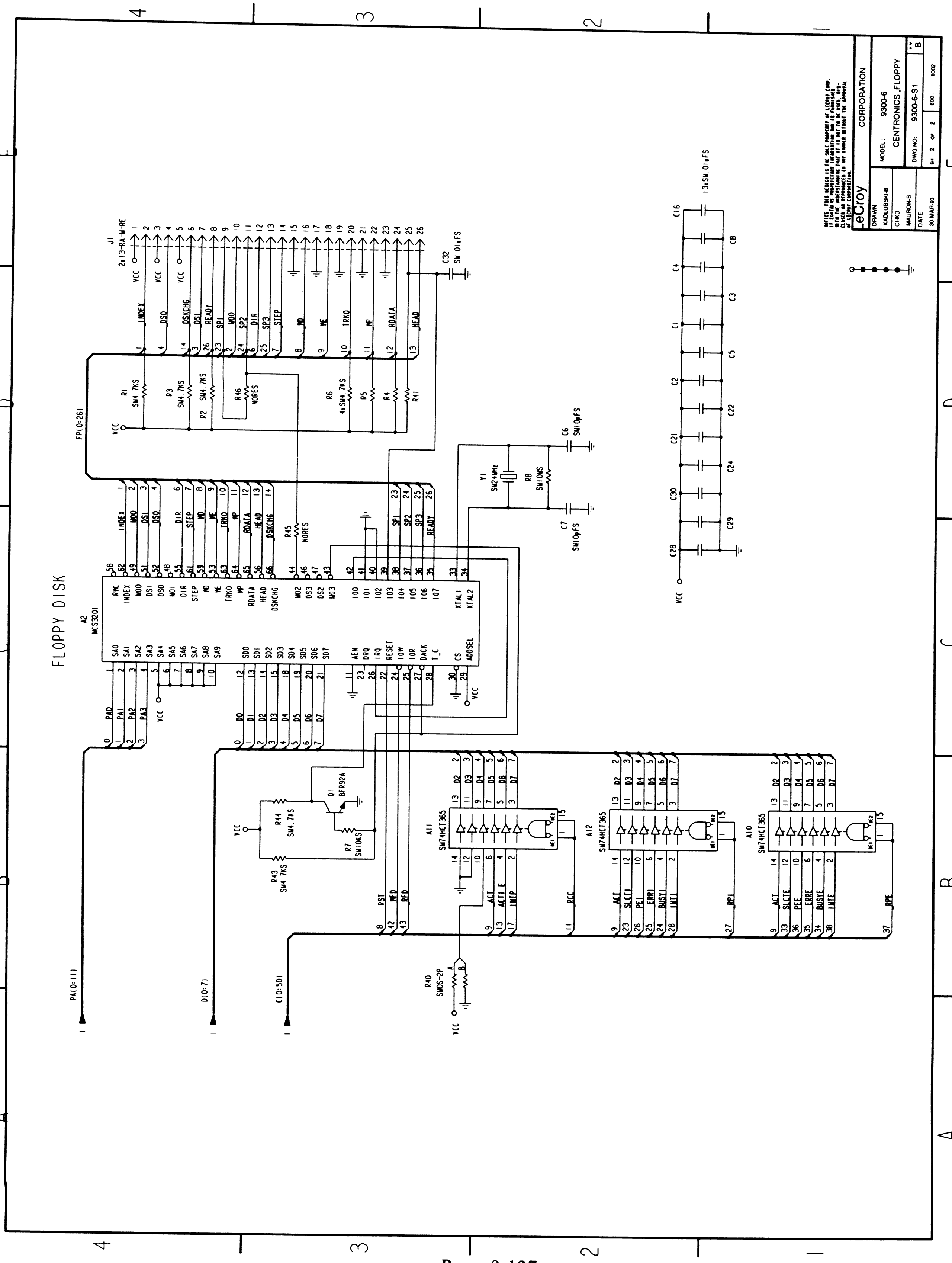
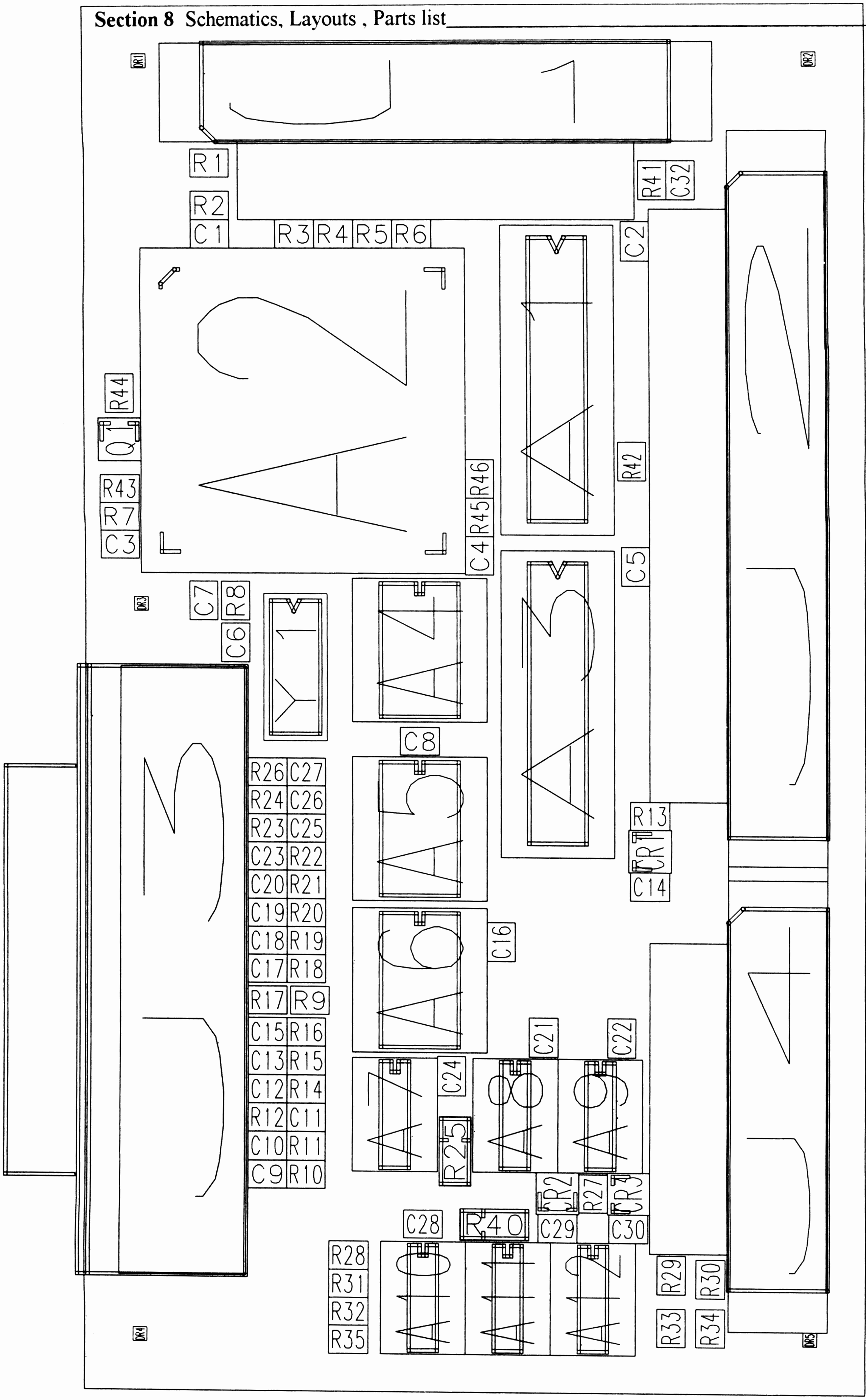
CR45	230020062	BAW62	DO35
CR46	230020062	BAW62	DO35
CR47	230020062	BAW62	DO35
CR48	230020062	BAW62	DO35
RN3	190642103	10K-6SC	SIP6RES
RN1	190042103	10K-SC	SIP10RES
RN2	190042103	10K-SC	SIP10RES
K10	425110001	ENCOD-2BIT-C	ENCOD_2BIT_C
K76	425110001	ENCOD-2BIT-C	ENCOD_2BIT_C
M32	425110001	ENCOD-2BIT-C	ENCOD_2BIT_C
N10	425110001	ENCOD-2BIT-C	ENCOD_2BIT_C
J10	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
J76	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
K32	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
L10	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
L32	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
L76	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
M10	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
M76	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
N32	425100001	ENCOD-2BIT-E	ENCOD_2BIT_E
C4	147436033	33uF-16V-AL-RA	TCAP
C1	103427104	.1uF	SMONOBP
C2	103427104	.1uF	SMONOBP
C3	103427104	.1uF	SMONOBP
A1	68HC05C4	68HC05C4	DIP40
J1	454110120	2x10-ST-M-RE	CONN2X10_ST_M_RE
J2	453410016	2x8-RA-ZIFGRIP	CONN2X8_RA_ZIFGRIP

PART: F9320-5 **DESC: DUAL CHANNEL FRONT PANEL**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
103427104	CAP CERA MONO 100V .1 UF	3
147436033	CAP ALUM METAL CAN 33 UF	1
190042103	RESISTOR NETWORK 10 K	2
190642103	RESISTOR NETWORK 10 K	1
230020062	DIODE SWITCHING BAW62	34
425100001	ENCODER DIGITAL 24 POS	9
425110001	ENCODER DIGITAL 24 POS	4
453410016	CONN FLEX CIRCUIT 16-POS	1
454110120	HDR SLD TAIL/MALE/20/STRAIGHT	1
554435004	SCREW PT PHIL KA35X10	1
7093XX511	KNOB 10MM DIAMETRE	8
7093XX521	KNOB 14MM DIAMETRE	5
719300503	PC BD PREASS'Y 9300-5	1
729320503	FP KEY BOARD ASS'Y 9320-5	1
MFP414	IC FRT PANEL PROCESSOR MFP414	1


INTERNAL PRINTER
CENTRONICS
LeCroy CORPORATION
MODEL : 9300-6
CENTRONICS,FLOPPY
DWG NO: 9300-6-S1
SH 1 OF 2


FLOPPY DISK
LeCroy
CORPORATION
MODEL: 9300-6
CENTRONICS, FLOPPY
DWG NO: 9300-6-S1


R1
R2
C1
R3
R4
R5
R6
R41
C32
C2
R44
Q1
R43
R7
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R45
C4
R42
C5
C7
R8
C6
C8
R26
C27
R24
C26
R23
C25
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R22
C20
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C14
C16
C21
C22
C24
R25
CR2
R27
CR3
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C29
C30
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R31
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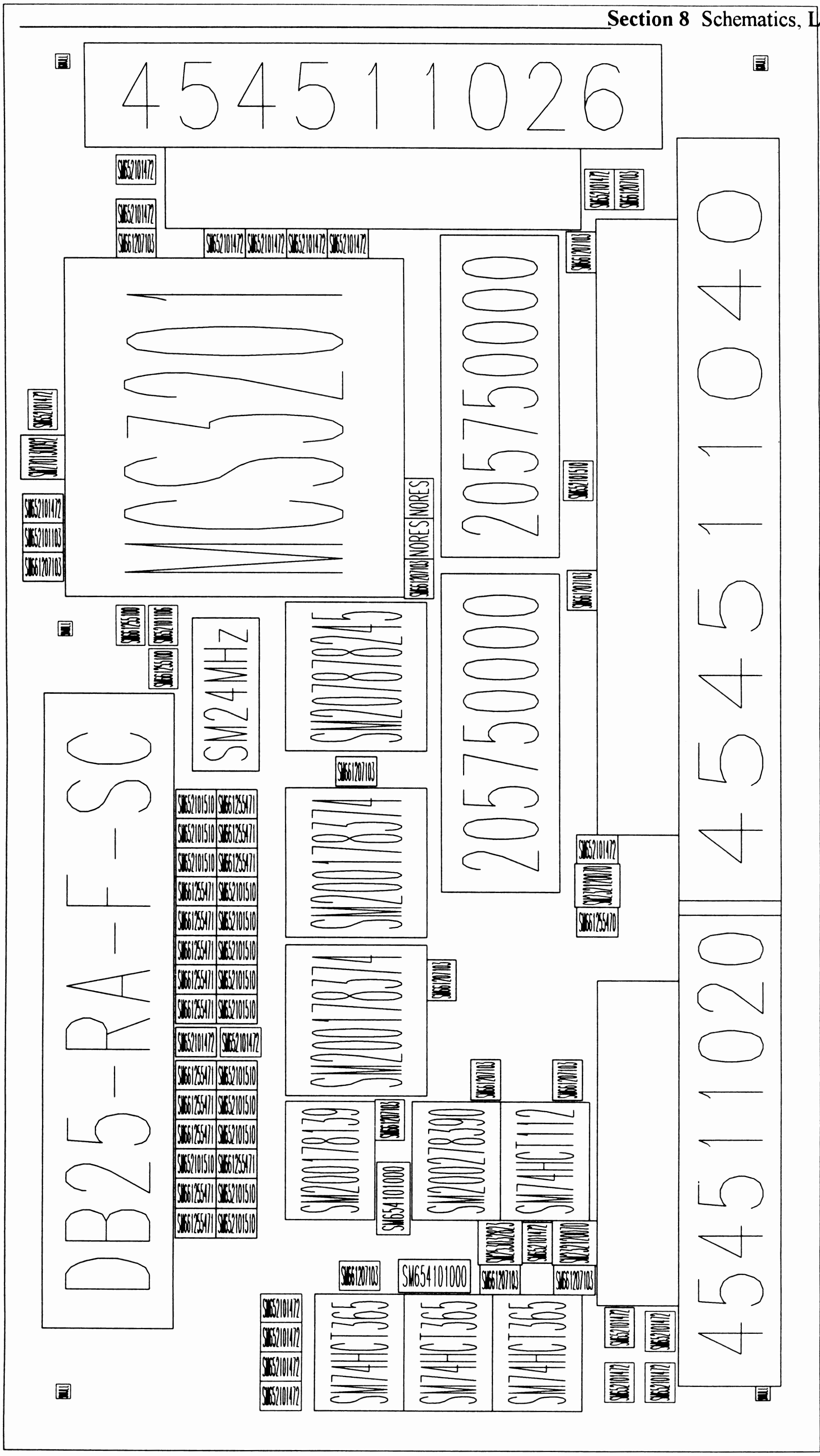
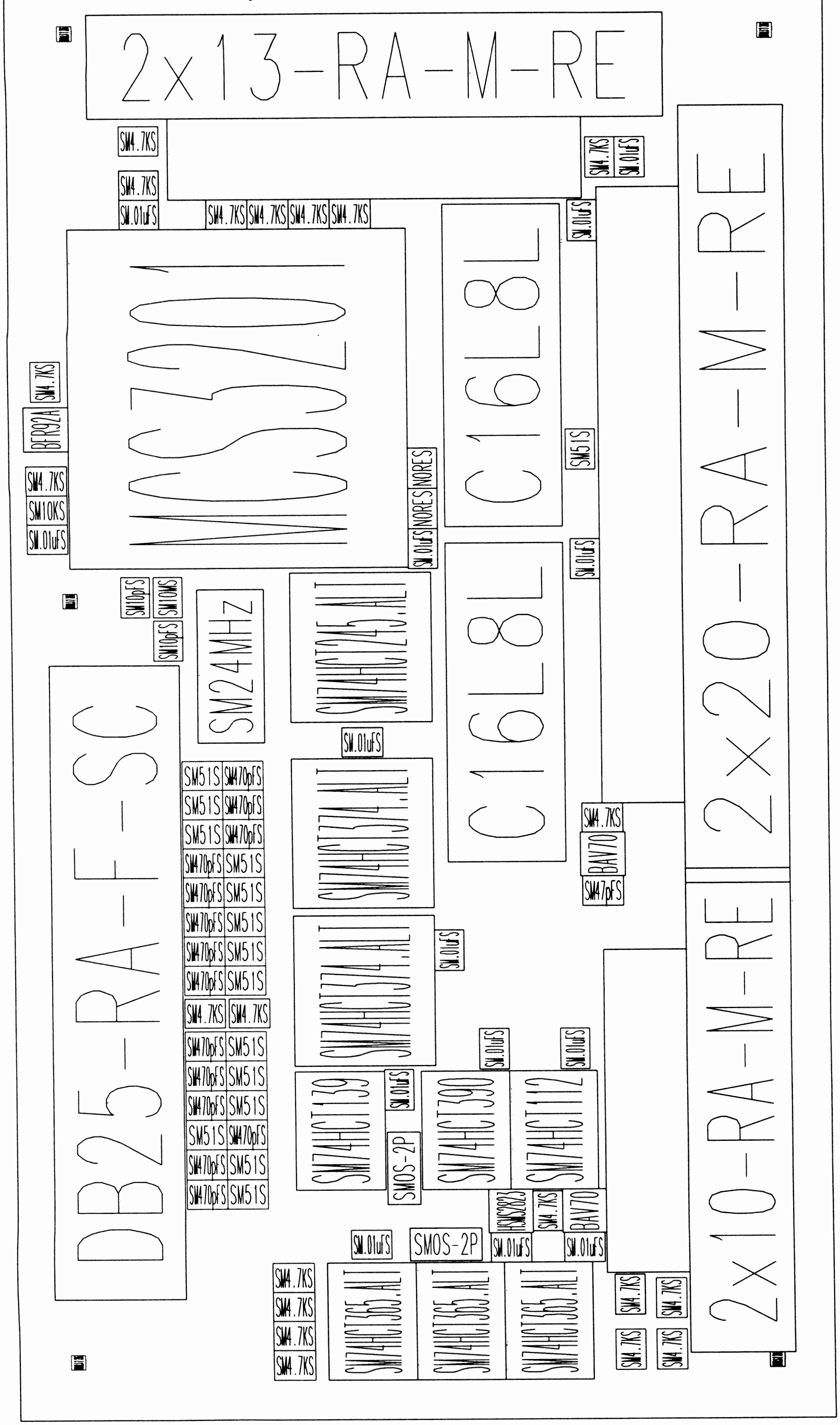
R35
R29
R30
R33
R34

9300-6 Rev. C



9300-6 Rev.C


2x13-RA-M-RE
SM4.7KS
SM.01uFS
MCS3201
C16L8L
2x20-RA-M-RE
BFR92A
SM10KS
NORES
SM51S
SM10pFS
SM10MS
SM24MHz
SM74HCT245.ALT
DB25-RA-F-SC
SM470pFS
SM74HCT374.ALT
BAV70
SM47pFS
SM74HCT139
SM74HCT390
SM74HCT112
SMOS-2P
HSMS2823
2x10-RA-M-RE
SM74HCT365.ALT

A1	205750000	C16L8L	DIP20
A2	SM227063201	MCS3201	PLCC_68
A3	205750000	C16L8L	DIP20
A4	SM207878245	SM74HCT245	SOIC_20
A5	SM200178374	SM74HCT374	SOIC_20
A6	SM200178374	SM74HCT374	SOIC_20
A7	SM200178139	SM74HCT139	SOIC_16
A8	SM200278390	SM74HCT390	SOIC_16
A9	SM201170112	SM74HCT112	SOIC_16
A10	SM207170036	SM74HCT365	SOIC_16
A11	SM207170036	SM74HCT365	SOIC_16
A12	SM207170036	SM74HCT365	SOIC_16
C1	SM661207103	SM.01uFS	SM0805
C2	SM661207103	SM.01uFS	SM0805
C3	SM661207103	SM.01uFS	SM0805
C4	SM661207103	SM.01uFS	SM0805
C5	SM661207103	SM.01uFS	SM0805
C6	SM661255100	SM10pFS	SM0805
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C26	SM661255471	SM470pFS	SM0805
C27	SM661255471	SM470pFS	SM0805
C28	SM661207103	SM.01uFS	SM0805
C29	SM661207103	SM.01uFS	SM0805
C30	SM661207103	SM.01uFS	SM0805
C32	SM661207103	SM.01uFS	SM0805
CR1	SM232120070	BAV70	SOT23
CR2	SM253032823	HSMS2823	SOT23
CR3	SM232120070	BAV70	SOT23
J1	454511026	2x13-RA-M-RE	CONN2X13_RA_M_RE
J2	454511040	2x20-RA-M-RE	CONN2X20_RA_M_RE
J3	454520025	DB25-RA-F-SC	DB25_RA_F_SC
J4	454511020	2x10-RA-M-RE	CONN2X10_RA_M_RE
Q1	SM270130092	BFR92A	SOT23
R1	SM652101472	SM4.7KS	SM0805
R2	SM652101472	SM4.7KS	SM0805
R3	SM652101472	SM4.7KS	SM0805
R4	SM652101472	SM4.7KS	SM0805
R5	SM652101472	SM4.7KS	SM0805
R6	SM652101472	SM4.7KS	SM0805
R7	SM652101103	SM10KS	SM0805
R8	SM652101106	SM10MS	SM0805
R9	SM652101472	SM4.7KS	SM0805
R10	SM652101510	SM51S	SM0805
R11	SM652101510	SM51S	SM0805
R12	SM652101510	SM51S	SM0805
R13	SM652101472	SM4.7KS	SM0805

R14	SM652101510	SM51S	SM0805
R15	SM652101510	SM51S	SM0805
R16	SM652101510	SM51S	SM0805
R17	SM652101472	SM4.7KS	SM0805
R18	SM652101510	SM51S	SM0805
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R23	SM652101510	SM51S	SM0805
R24	SM652101510	SM51S	SM0805
R25	SM654101000	SM0S-2P	SM0805_2P
R26	SM652101510	SM51S	SM0805
R27	SM652101472	SM4.7KS	SM0805
R28	SM652101472	SM4.7KS	SM0805
R29	SM652101472	SM4.7KS	SM0805
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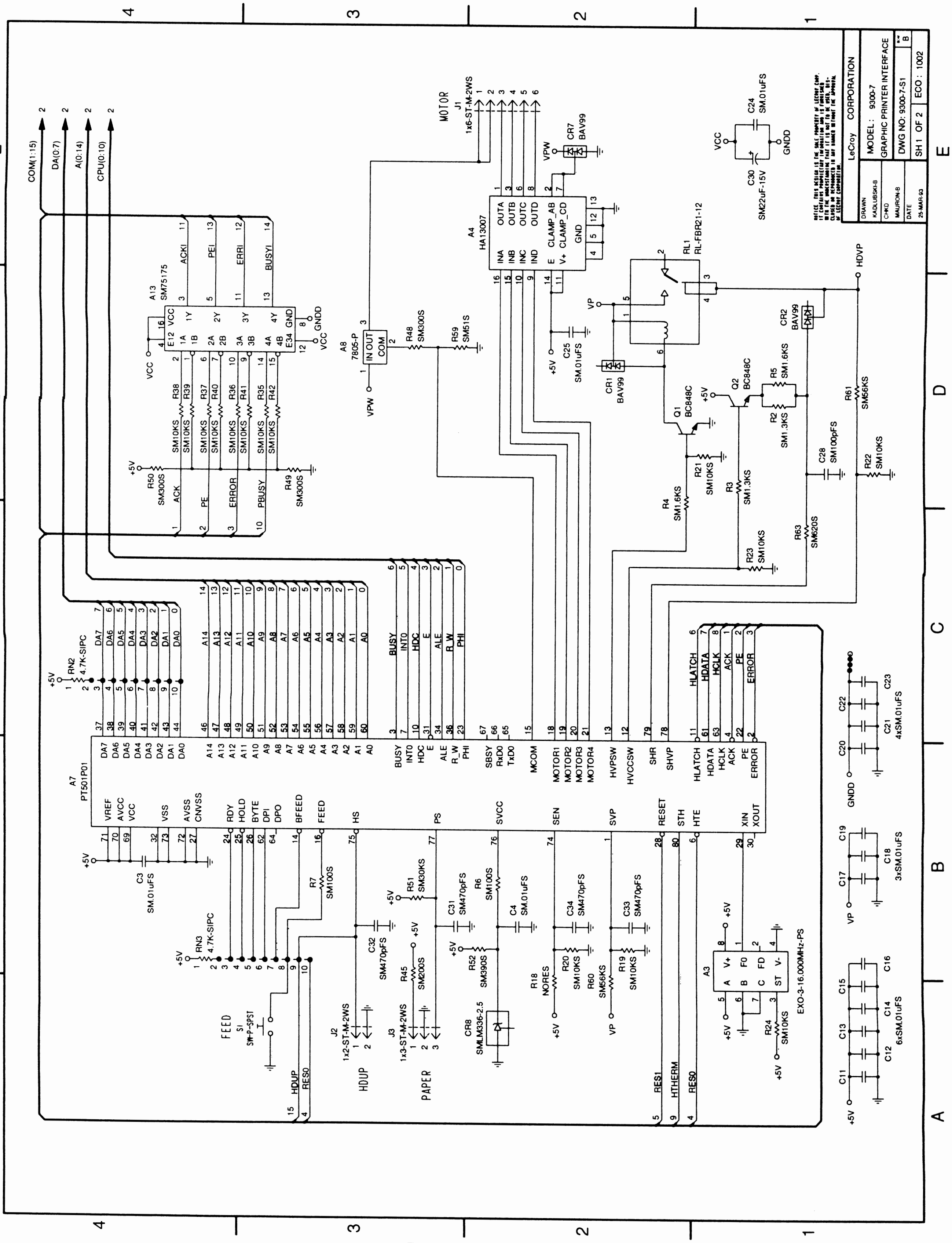
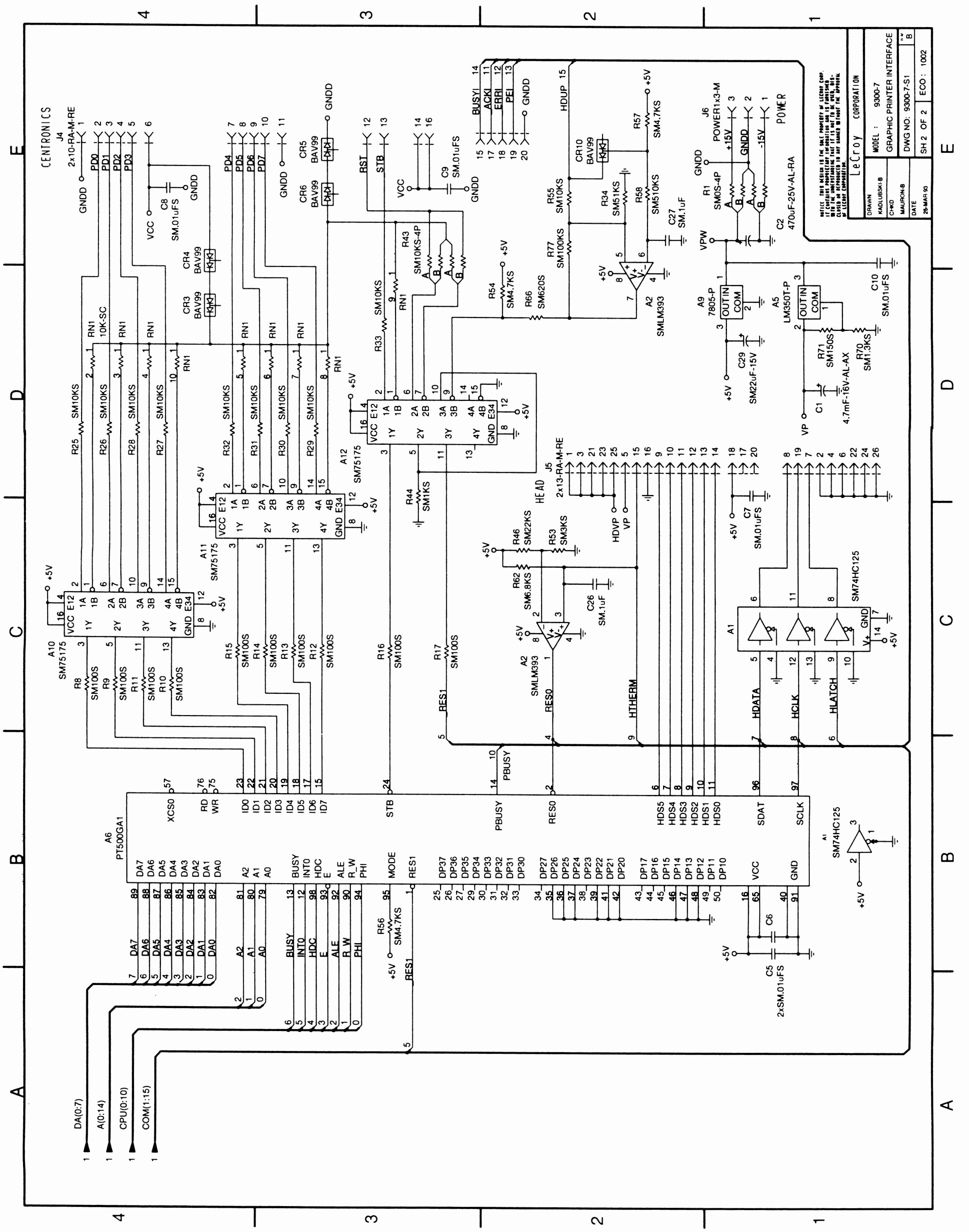
R32	SM652101472	SM4.7KS	SM0805
R33	SM652101472	SM4.7KS	SM0805
R34	SM652101472	SM4.7KS	SM0805
R35	SM652101472	SM4.7KS	SM0805
R40	SM654101000	SM0S-2P	SM0805_2P
R41	SM652101472	SM4.7KS	SM0805
R42	SM652101510	SM51S	SM0805
R43	SM652101472	SM4.7KS	SM0805
R44	SM652101472	SM4.7KS	SM0805
Y1	SM310900024	SM24MHz	FPX_SM

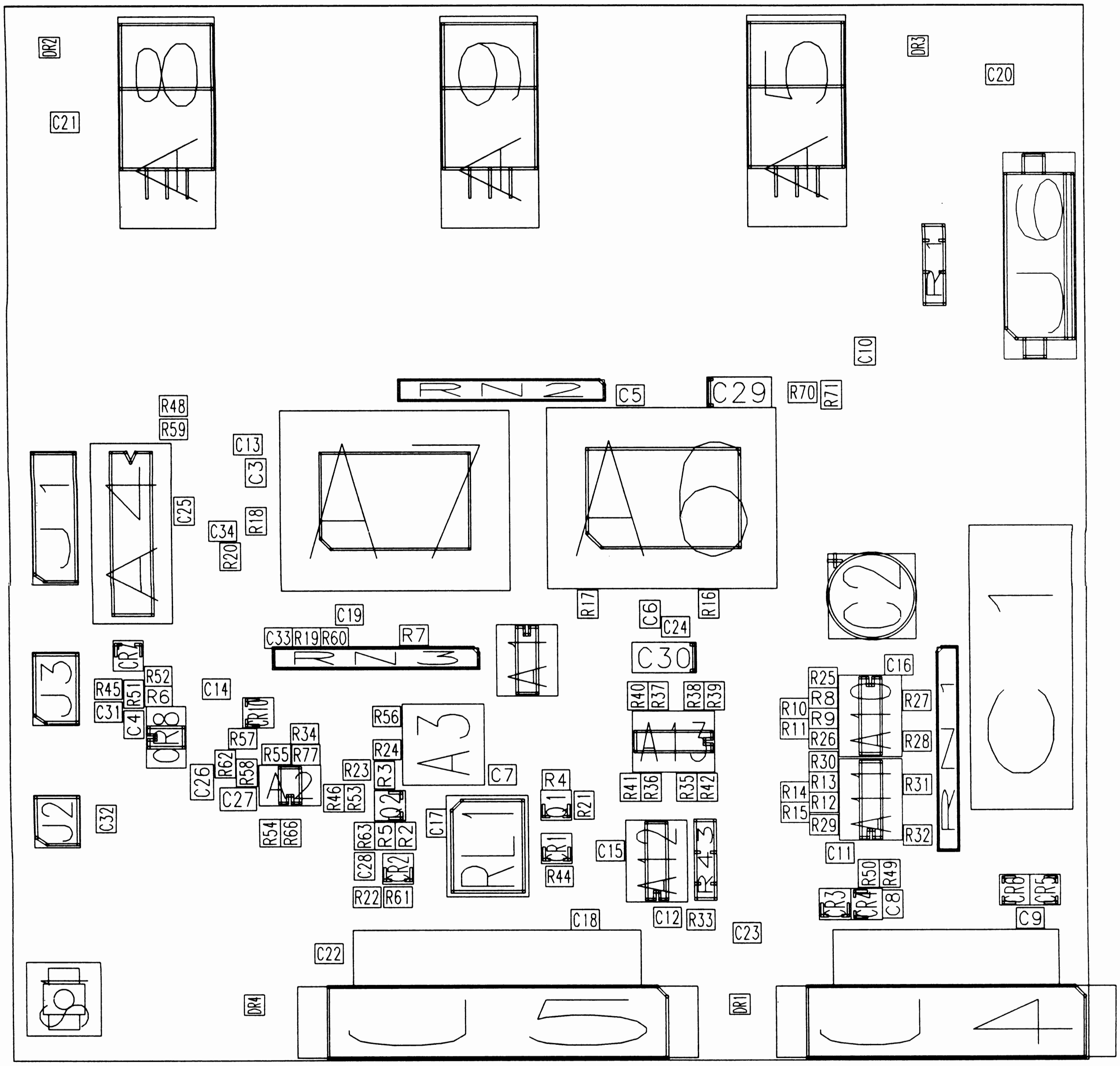
PART: F9300-6 **DESC: CENTRONICS/FLOPPY/PRINTER INTERFACE**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
205750000	IC AND-OR GATE ARRAY 16V8	2
454511020	HDR SOLD TAIL/MALE 20	1
454511026	HDR SOLD TAIL/MALE 26	1
454511040	HDR SOLD TAIL/MALE/40/RT	1
454520025	CONN RT ANGLE FEM 25 S-CLIP	1
455980002	MOUNTING HDW FOR CONN SHELL	2
550430106	SCREW CYL HD PHIL M3X6	4
551430400	WASHER SHAKEPROOF M3	4
709300611	CENTR. FLOPPY INTERF. BRACKET B	1
709300621	LABEL PARA-INTERF. CENTRONICS A	1
719300603	PC BD PREASS'Y 9300-6 C	1
SM200178139	IC 2-TO-4-LINE DEC HCT139	1
SM200178374	IC D-TYP FLOP 74HCT374	2
SM200278390	IC 4-BIT RIPPLE COUNTER	1
SM201170112	IC DUAL JK FF WITH SET-RESET	1
SM207170036	IC HEX BUFFER 3-STATE	3
SM207878245	IC BUS TRANSCVR HCT 245	1
SM227063201	IC IBM PC FLOPPY DISK CONTR.	1
SM232120070	DIODE ARRAY BAV70	1
SM253032823	DIODE SCHOTTKY 2823	1
SM270130092	TRANSISTOR NPN BFR92A	1
SM310900024	CRYSTAL 24 MHZ SMD	1
SM652101103	RES CHIP (E24) 1% 10 K	1
SM652101106	RES CHIP (E24) 1% 10 MEG	1
SM652101472	RES CHIP (E24) 1% 4.7 K	21
SM652101510	RES CHIP (E24) 1% 51 OHMS	15
SM654101000	CHIP JUMPER ZERO OHMS	2
SM661207103	CAP CERA CHIP 20% .01UF	14
SM661255100	CAP CERA CHIP 10PF	2
SM661255470	CAP CERA CHIP 47PF	1
SM661255471	CAP CERA CHIP 5% 470 PF	14


LeCroy CORPORATION
MODEL : 9300-7
GRAPHIC PRINTER INTERFACE
DWG NO: 9300-7-S1
SH 1 OF 2
ECO : 1002
DRAWN KADLUBSKI-B
CHKD MAURON-B
DATE 25-MAR-93


LeCroy CORPORATION
MODEL: 9300-7
GRAPHIC PRINTER INTERFACE
DWG NO: 9300-7-S1
SH 2 OF 2
ECO: 1002

9300-7 Rev:C



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R59
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R20
J1
A4
A7
A6
C2
C1
C19
C33
R19
R60
R7
RN3
R17
C6
C24
R16
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J3
R52
R45
R51
R6
C31
C4
C14
R56
R34
R57
R55
R77
R24
A3
R23
R3
C26
R62
R58
C27
R46
R53
C7
R4
R21
R54
R66
R63
R5
R2
C17
RL1
C28
R22
R61
R44
C15
R40
R37
R38
R39
R41
R36
R35
R42
R25
R8
R9
R10
R11
R26
R30
R13
R14
R12
R15
R29
C16
R27
R28
R31
R32
RN1
C11
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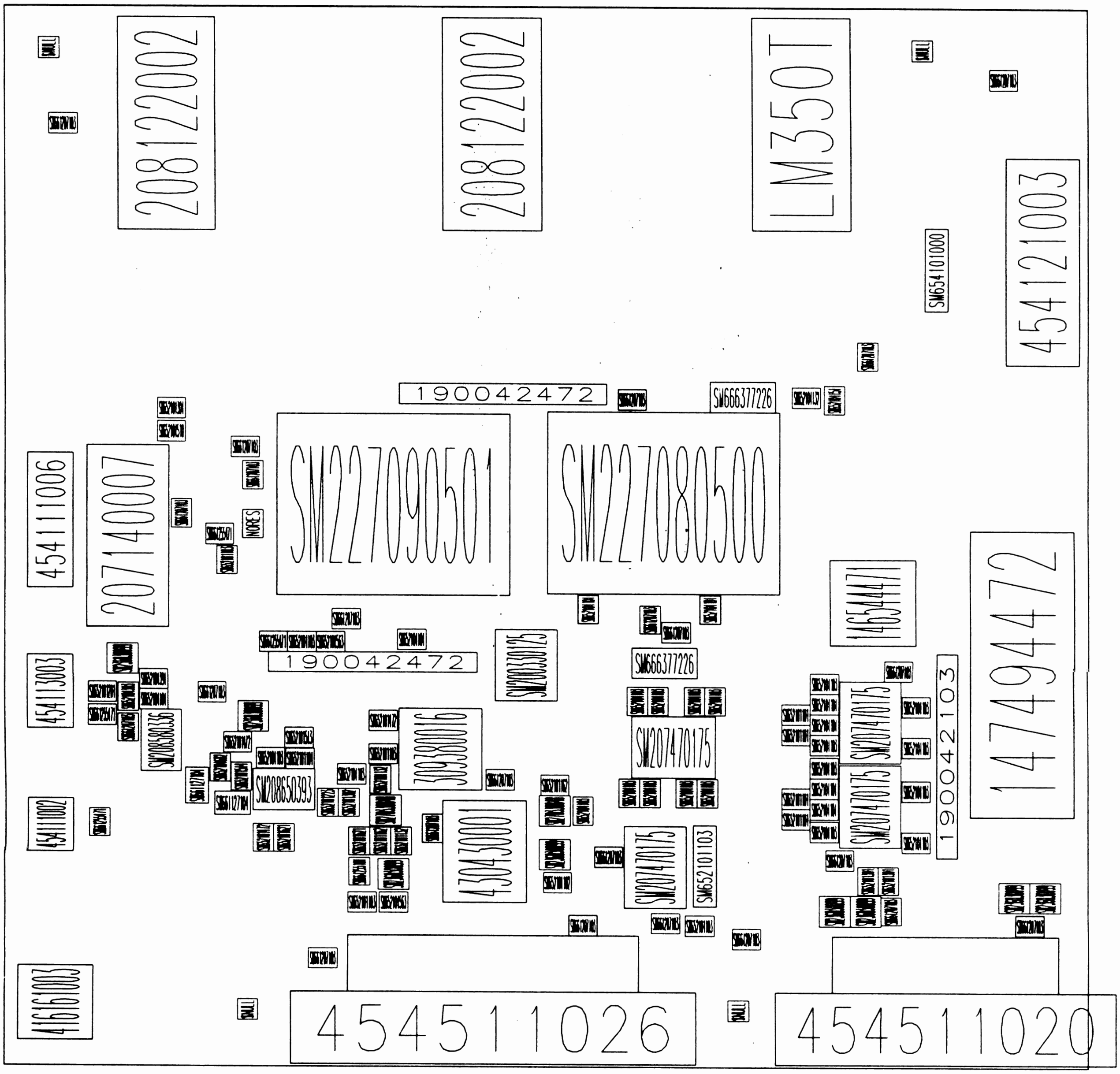
R33
C23
C22
J2
C32
J5
J4

9300-7 Rev:C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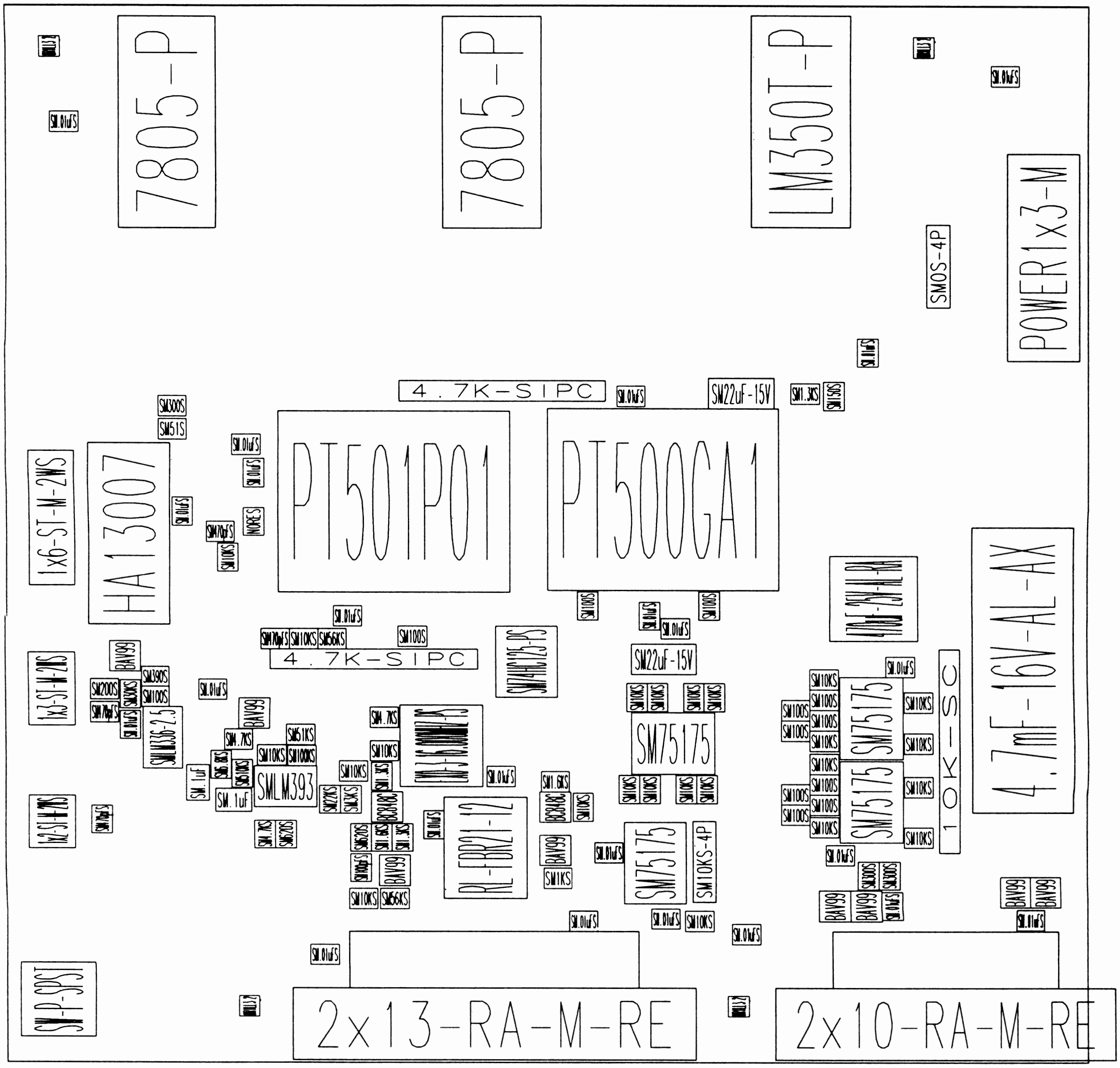
9300-7 Rev:C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SMOS-4P
4.7K-SIPC
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PT500GA1
HA13007
1x6-ST-M-2WS
SM22uF-15V
4.7K-SIPC
4.7mF-16V-AL-AX
10K-SC
SM75175
SM75175
SM75175
SM75175
SMLM393
RL-FBR21-12
SM10KS-4P
2x13-RA-M-RE
2x10-RA-M-RE

A1	SM200330125	SM74HC125-PS	SOIC_14
A2	SM208650393	SMLM393	SOIC_8
A3	309380016	EXO-3-16.000MHZ-PS	DIP8
A4	207140007	HA13007	DIP16
A5	208590350	LM350T-P	TO220_PLATED
A6	SM227080500	PT500GA1	PQFP_100
A7	SM227090501	PT501P01	PQFP_80
A8	208122002	7805-P	TO220_PLATED
A9	208122002	7805-P	TO220_PLATED
A10	SM207470175	SM75175	SOIC_16
A11	SM207470175	SM75175	SOIC_16
A12	SM207470175	SM75175	SOIC_16
A13	SM207470175	SM75175	SOIC_16
C1	147494472	4.7mF-16V-AL-AX	A_P1377_L1200X610
C2	146544471	470uF-25V-AL-RA	R_P200_D420POL
C3	SM661207103	SM.01uFS	SM0805
C4	SM661207103	SM.01uFS	SM0805
C5	SM661207103	SM.01uFS	SM0805
C6	SM661207103	SM.01uFS	SM0805
C7	SM661207103	SM.01uFS	SM0805
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C14	SM661207103	SM.01uFS	SM0805
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C16	SM661207103	SM.01uFS	SM0805
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C18	SM661207103	SM.01uFS	SM0805
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C20	SM661207103	SM.01uFS	SM0805
C21	SM661207103	SM.01uFS	SM0805
C22	SM661207103	SM.01uFS	SM0805
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C24	SM661207103	SM.01uFS	SM0805
C25	SM661207103	SM.01uFS	SM0805
C26	SM661127104	SM.1uF	SM1206
C27	SM661127104	SM.1uF	SM1206
C28	SM661255101	SM100pFS	SM0805
C29	SM666377226	SM22uF-15V	SMCAPETD5
C30	SM666377226	SM22uF-15V	SMCAPETD5
C31	SM661255471	SM470pFS	SM0805
C32	SM661255471	SM470pFS	SM0805
C33	SM661255471	SM470pFS	SM0805
C34	SM661255471	SM470pFS	SM0805
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CR2	SM236030099	BAV99	SOT23
CR3	SM236030099	BAV99	SOT23
CR4	SM236030099	BAV99	SOT23
CR5	SM236030099	BAV99	SOT23
CR6	SM236030099	BAV99	SOT23
CR7	SM236030099	BAV99	SOT23
CR8	SM208580336	SMLM336-2.5	SOIC_8
CR10	SM236030099	BAV99	SOT23
J1	454111006	1x6-ST-M-2WS	CONN1X6_ST_M_2WS
J2	454111002	1x2-ST-M-2WS	CONN1X2_ST_M_2WS
J3	454113003	1x3-ST-M-2WS	CONN1X3_ST_M_2WS
J4	454511020	2x10-RA-M-RE	CONN2X10_RA_M_RE
J5	454511026	2x13-RA-M-RE	CONN2X13_RA_M_RE
J6	454121003	POWER1x3-M	POWER1X3_M
Q1	SM270330848	BC848C	SOT23
Q2	SM270330848	BC848C	SOT23

R1	SM654101000	SM0S-4P	SM0805_4P
R2	SM652101132	SM1.3KS	SM0805
R3	SM652101132	SM1.3KS	SM0805
R4	SM652101162	SM1.6KS	SM0805
R5	SM652101162	SM1.6KS	SM0805
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R10	SM652101101	SM100S	SM0805
R11	SM652101101	SM100S	SM0805
R12	SM652101101	SM100S	SM0805
R13	SM652101101	SM100S	SM0805
R14	SM652101101	SM100S	SM0805
R15	SM652101101	SM100S	SM0805
R16	SM652101101	SM100S	SM0805
R17	SM652101101	SM100S	SM0805
R19	SM652101103	SM10KS	SM0805
R20	SM652101103	SM10KS	SM0805
R21	SM652101103	SM10KS	SM0805
R22	SM652101103	SM10KS	SM0805
R23	SM652101103	SM10KS	SM0805
R24	SM652101103	SM10KS	SM0805
R25	SM652101103	SM10KS	SM0805
R26	SM652101103	SM10KS	SM0805
R27	SM652101103	SM10KS	SM0805
R28	SM652101103	SM10KS	SM0805
R29	SM652101103	SM10KS	SM0805
R30	SM652101103	SM10KS	SM0805
R31	SM652101103	SM10KS	SM0805
R32	SM652101103	SM10KS	SM0805
R33	SM652101103	SM10KS	SM0805
R34	SM652101513	SM51KS	SM0805
R35	SM652101103	SM10KS	SM0805
R36	SM652101103	SM10KS	SM0805
R37	SM652101103	SM10KS	SM0805
R38	SM652101103	SM10KS	SM0805
R39	SM652101103	SM10KS	SM0805
R40	SM652101103	SM10KS	SM0805
R41	SM652101103	SM10KS	SM0805
R42	SM652101103	SM10KS	SM0805
R43	SM652101103	SM10KS-4P	SM0805_4P
R44	SM652101102	SM1KS	SM0805
R45	SM652101201	SM200S	SM0805
R46	SM652101223	SM22KS	SM0805
R48	SM652101301	SM300S	SM0805
R49	SM652101301	SM300S	SM0805
R50	SM652101301	SM300S	SM0805
R51	SM652101303	SM30KS	SM0805
R52	SM652101391	SM390S	SM0805
R53	SM652101302	SM3KS	SM0805
R54	SM652101472	SM4.7KS	SM0805
R55	SM652101103	SM10KS	SM0805
R56	SM652101472	SM4.7KS	SM0805
R57	SM652101472	SM4.7KS	SM0805
R58	SM652101514	SM510KS	SM0805
R59	SM652101510	SM51S	SM0805
R60	SM652101563	SM56KS	SM0805
R61	SM652101563	SM56KS	SM0805
R62	SM652101682	SM6.8KS	SM0805
R63	SM652101621	SM620S	SM0805
R66	SM652101621	SM620S	SM0805
R70	SM652101132	SM1.3KS	SM0805
R71	SM652101151	SM150S	SM0805

R77	SM652101104	SM100KS	SM0805
RL1	430430001	RL-FBR21-12	RL_FBR20
RN1	190042103	10K-SC	SIP10RES
RN2	190042472	4.7K-SIPC	SIP10RES
RN3	190042472	4.7K-SIPC	SIP10RES
S1	416161003	SW-P-SPST	SW_P_SPST

PART: F9300-7 **DESC: LTP 5446 PRINTER CONTROLLER**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
146544471	CAP MINI ALUM 20% 470UF	1
147494472	CAP ALU COMPACT AXIAL 4700 UF	1
190042103	RESISTOR NETWORK 10 K	1
190042472	RESISTOR NETWORK 4.7 K	2
207140007	IC QUAD STEP MOTOR DRIVER	1
208122002	IC VOLT REG POS UA7805	2
208590350	IC ADJ POWER REG 3A LM350	1
309380016	CRYSTAL OSC (PROGR) 16 MHZ	1
416161003	SWITCH PUSHBUTTON SPST	1
430430002	RELAY 1 FORM C SPDT	1
454111002	HEADER STRAIGHT 2-PINS	1
454111006	HEADER STRAIGHT 6-PINS	1
454113003	HEADER STRAIGHT 3-PINS	1
454121003	BLOC FOR SOCKETS 3-PIN	1
454511020	HDR SOLD TAIL/MALE 20	1
454511026	HDR SOLD TAIL/MALE 26	1
554435401	RIVET "RIVSCREW" M 3.5	3
719300703	PC BD PREASS'Y 9300-7	1
SM200330125	IC QUAD BUFFER 74HC125	1
SM207470175	IC QUAD DIFF LINE RECEIVER	4
SM208580336	IC REF DIODE LM336-2.5V	1
SM208650393	IC DUAL VOLT COMP LM393M	1
SM227080500	IC THERM PRINTER GATE ARRAY	1
SM227090501	IC THERM PRINTER CPU	1
SM236030099	DIODE SO-PKG BAV99	8
SM270330848	TRANSISTOR NPN BC848C	2
SM652101101	RES CHIP (E24) 1% 100 OHM	12
SM652101102	RES CHIP (E24) 1% 1 K	1
SM652101103	RES CHIP (E24) 1% 10 K	25
SM652101104	RES CHIP (E24) 1% 100 K	1
SM652101132	RES CHIP (E24) 1% 1.3 K	3
SM652101151	RES CHIP (E24) 1% 150 OHM	1
SM652101162	RES CHIP (E24) 1% 1.6 K	2
SM652101201	RES CHIP (E24) 1% 200 OHM	1
SM652101223	RES CHIP (E24) 1% 22 K	1
SM652101301	RES CHIP (E24) 1% 300 OHM	3
SM652101302	RES CHIP (E24) 1% 3 K	1
SM652101303	RES CHIP (E24) 1% 30 K	1
SM652101391	RES CHIP (E24) 1% 390 OHM	1
SM652101472	RES CHIP (E24) 1% 4.7 K	3
SM652101510	RES CHIP (E24) 1% 51 OHMS	1
SM652101513	RES CHIP (E24) 1% 51 K	1
SM652101514	RES CHIP (E24) 1% 510 K	1
SM652101563	RES CHIP (E24) 1% 56 K	2

PART: F9300-7 **DESC: LTP 5446 PRINTER CONTROLLER**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
SM652101621	RES CHIP (E24) 1% 620 OHM	2
SM652101682	RES CHIP (E24) 1% 6.8 K	1
SM654101000	CHIP JUMPER ZERO OHMS	1
SM661127104	CAP CERA CHIP 20% .1 UF	2
SM661207103	CAP CERA CHIP 20% .01UF	23
SM661255101	CAP CERA CHIP 5% 100 PF	1
SM661255471	CAP CERA CHIP 5% 470 PF	4
SM666377226	CAP MOLD TANT CHIP 22 UF	2

PART: M932X **DESC: MECHANICAL FOR 932X-SERIES**

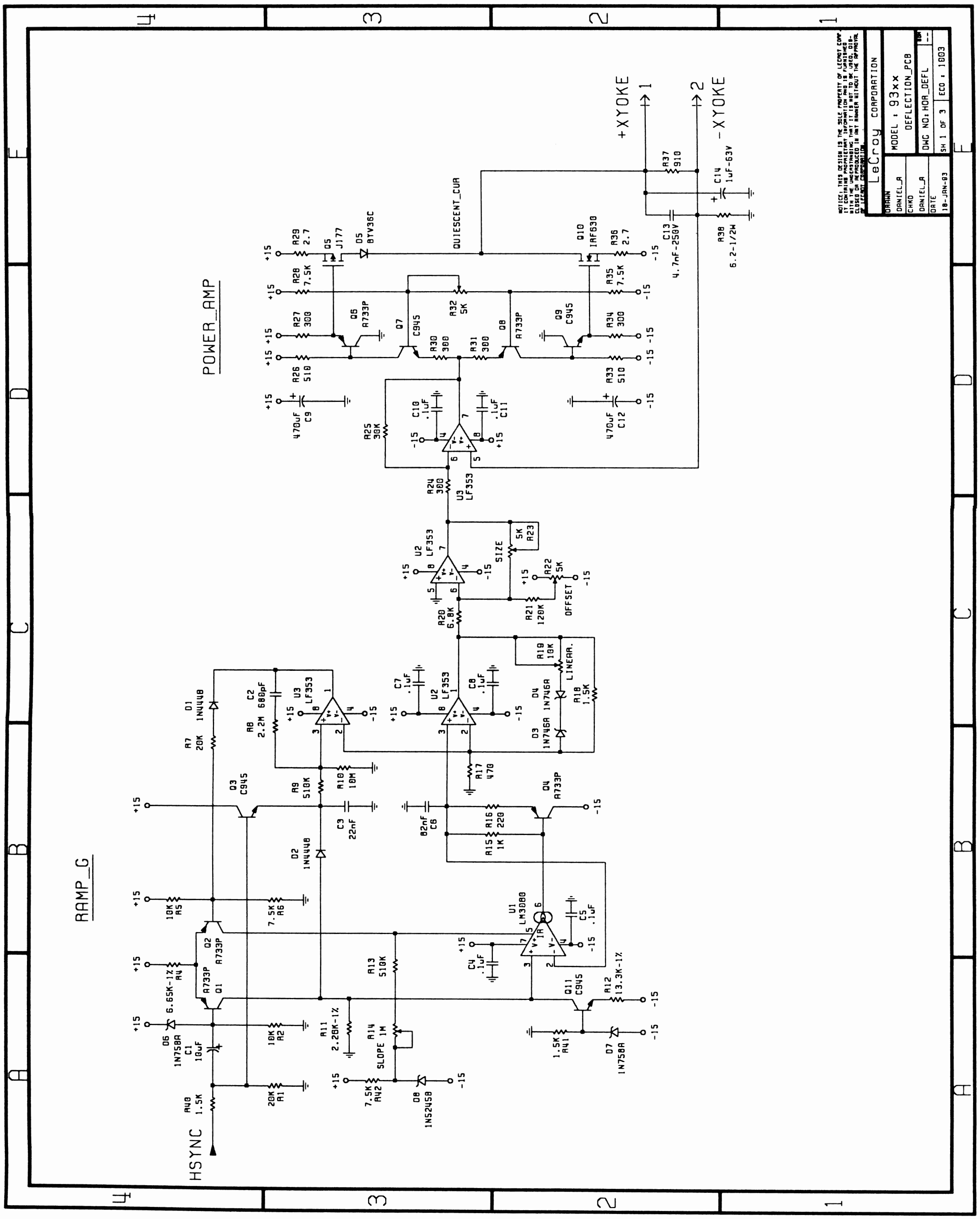
COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
377051005	LABEL "DANGER-------ONLY"	1
377131001	LABEL (GROUND SYMBOL)	1
407036002	FUSE HOLDER 2 POLE BLK 6.3X32	1
433162500	FUSE 250V/5A	2
434690002	LINE INPUT MODULE 250V/6A	1
485023462	FOOT BUMPON GREY	4
530301009	BLK HANDLE W/2 BLACK END CAPS	1
530904000	FAN GRID FOR SERIE 4000	1
550430106	SCREW CYL HD PHIL M3X6	9
550430116	SCREW CYL HD PHIL M3X16	7
550430120	SCREW CYL HD PHIL M3X20	12
550430508	SCREW FLAT HD PHIL M3X8	2
550430706	SCREW ECO-FIX M3X6	6
550440516	SCREW FLAT HD PHIL M4X16	4
550440605	SCREW OVAL HD PHIL M4X5	8
550440608	SCREW OVAL PHIL M4X8	7
551430400	WASHER SHAKEPROOF M3	4
551450400	WASHER SHAKEPROOF M5	2
552440300	NUT OPEN-END ACORN M4	4
554030101	NUT BANC-LOK TYPE MV M3	9
554425003	SCREW S/TAP PHIL M2.5X6 BLACK	6
554425004	NAIL RIVET 2.5X6	12
554435003	SCREW PT PHIL KA35X20	4
554435004	SCREW PT PHIL KA35X10	4
554440001	SCREW PT PHIL KA 40 X 12	4
554440202	FLAT WASHER M4	4
560032008	SCREW PHILIPS 10-32X1/2	2
594120003	TIEWRAP	1
709324321	MAIN CARD 9324-3 SHIELDING	1
7093XX041	FOOT SUPPORT 93XX	2

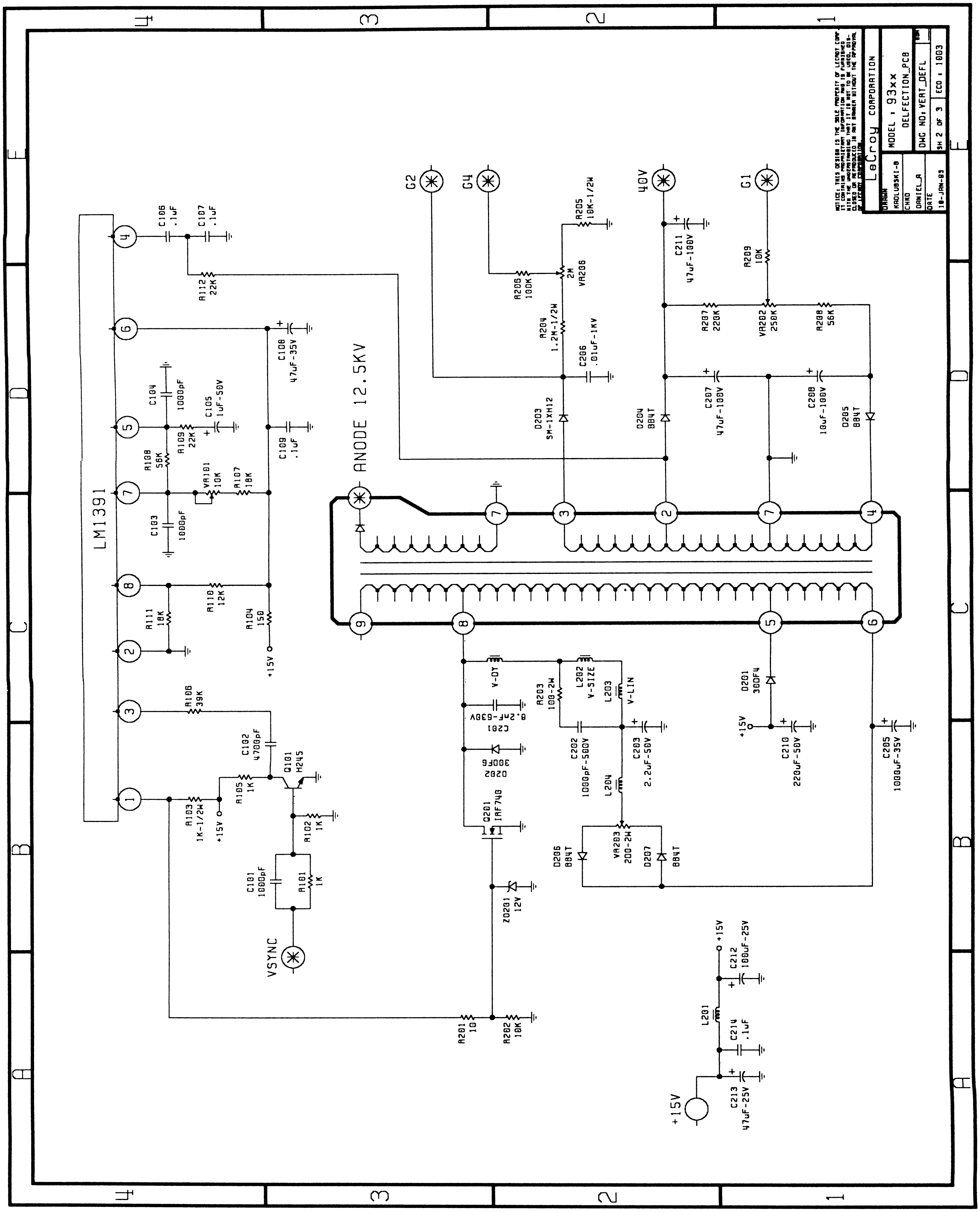
PART: M932X **DESC: MECHANICAL FOR 932X-SERIES**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
7093XX051	FOOT 93XX	2
7093XX091	FRONT FRAME BRACKET 93XX	4
7093XX321	MAIN CARD STANDOFF 12MM	3
7093XX351	SHIELD UPPER PARTITION	6
7093XX371	SHIELD CONTACT	6
7093XX902	FAN 93XX-9 ASSEMBLY	1
7093XX931	INTERF. HOLE CLOSURE 93XX-9	1
709424096	INSERTION GUIDE FOR MC	1
780220030	BASE CARD POWER CABLE	1
780661104	FLAT CABLE 2X7 (4 CM)	1
780671107	FLAT CABLE 2X20 (7CM)	1
780681611	PS1715 LINE INPUT CABLE	1
780721105	FLAT CABLE 2X10 (5,5CM)	1
780754515	GROUND CABLE YEL/GREEN 15CM	1
93XX-DISPLAY	RASTER MONITOR KIT	1
93XX-PS1715	DSO POWER SUPPLY W/SHIELDING	1
FF93XX	FRONT FRAME DSO 93XX	1
LC93XX	LOWER COVER DSO 93XX	1
RP93XX-9	REAR PANEL 93XX-9	1

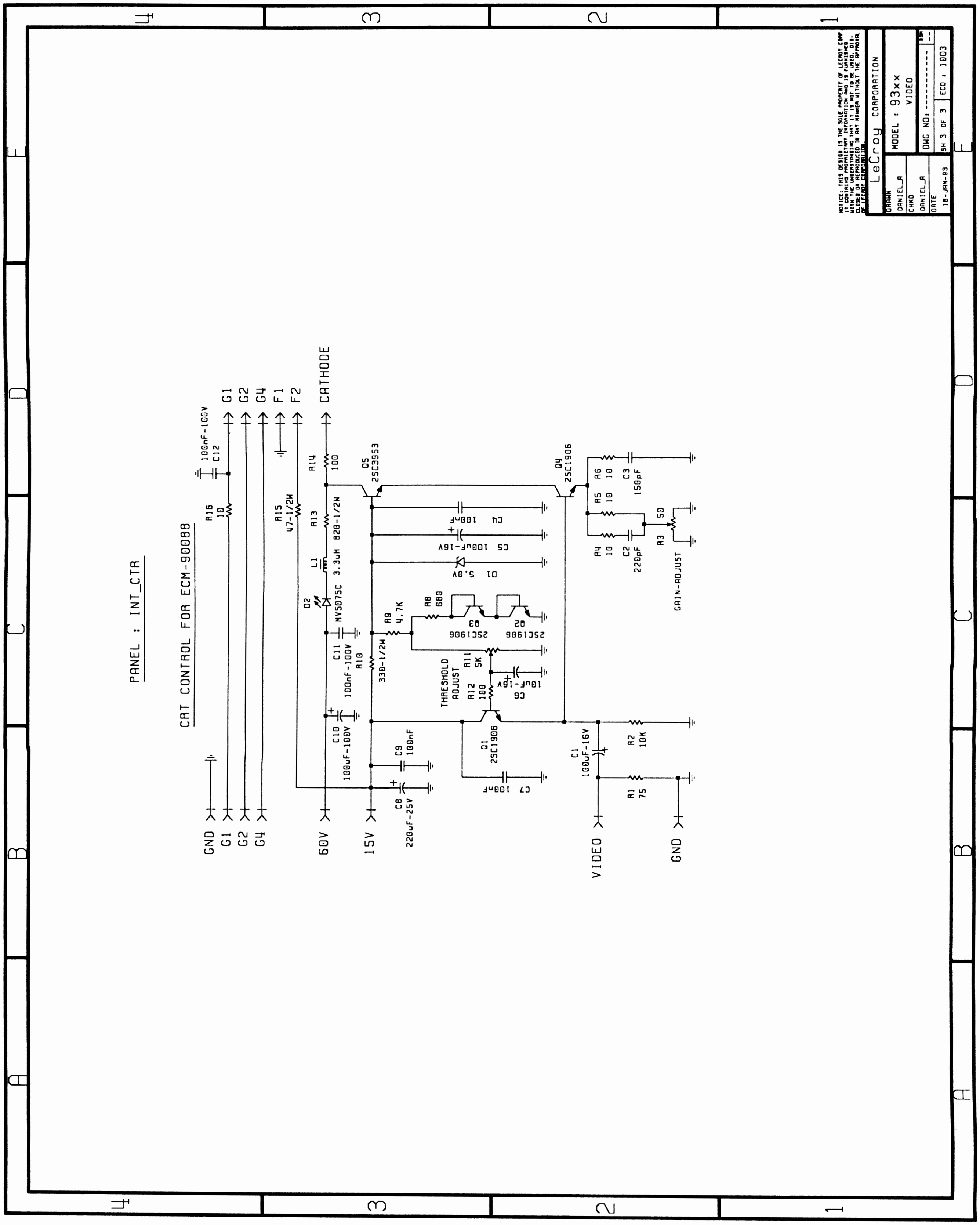
PART: ACCESSORIES-9320 **DESC: ACCESSORIES FOR 9320**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
407099008	PLUG FOR AC LINE -ENGLAND	1
433162500	FUSE 250V/5A	2
589202100	AC CORD/PLUG FOR FRANCE	1
589202200	AC CORD/PLUG FOR GERMANY	2
589203100	AC CORD/"SEV-ASE" PLUG	1
589203218	AC CORD/US-CANADA PLUG	5
597930001	CARTON FOR 93XX	1
597930002	ETHAFOAM FOR 93XX	2
597940014	PLASTIC BAG FOR 94XX & 93XX	2
597940015	MANUAL/ACCESSORY CTN 9400	2
7093XX061	FRONT COVER 93XX	1
931X-RCM-E	931X SERIES REMOTE CONTROL MAN A	1
932X-OM-E	9320/24 OPERATOR'S MANUAL ENG. A	1
PP062	PROBE OSCILLOSCOPE 500 OHM	2


LeCroy CORPORATION
MODEL : 93xx
DEFLECTION_PCB
DWG NO: HOR_DEFL
DRAWN DANIEL_A
CHKD DANIEL_A
DATE 18-JAN-93
SH 1 OF 3
ECO : 1003
POWER_AMP
RAMP_G
HSYNC
+XYOKE
-XYOKE
QUIESCENT_CUR
SIZE
OFFSET
LINEAR.
SLOPE 1M
U1 LM3080
U2 LF353
U3 LF353


LeCroy CORPORATION
MODEL : 93xx
DELFECTION_PCB
DWG NO: VERT_DEFL
SH 2 OF 3
ECO : 1003
DRAWN KADLUBSKI-B
CHKD DANIEL_A
DATE 18-JAN-93
LM1391
ANODE 12.5KV
VSYNC
G1
G2
G4
40V
+15V
V-DY
V-SIZE
V-LIN
Q101 H245
Q201 IRF740
ZD201 12V
D201 30DF4
D202 30DF6
D203 SM-1XH12
D204 884T
D205 884T
D206 884T
D207 884T
L201
L202
L203
L204
VR101 10K
VR202 250K
VR203 200-2W
VR206 2M
R101 1K
R102 1K
R103 1K-1/2W
R104 150
R105 1K
R106 39K
R107 18K
R108 56K
R109 22K
R110 12K
R111 18K
R112 22K
R201 10
R202 10K
R203 100-2W
R204 1.2M-1/2W
R205 10K-1/2W
R206 100K
R207 220K
R208 56K
R209 10K
C101 1000pF
C102 4700pF
C103 1000pF
C104 1000pF
C105 1uF-50V
C106 .1uF
C107 .1uF
C108 47uF-35V
C109 .1uF
C201 8.2nF-630V
C202 1000pF-500V
C203 2.2uF-50V
C205 1000uF-35V
C206 .01uF-1KV
C207 47uF-100V
C208 10uF-100V
C210 220uF-50V
C211 47uF-100V
C212 100uF-25V
C213 47uF-25V
C214 .1uF

C1	10uF	–
C2	680pF	–
C3	22nF	–
C4	.1uF	–
C5	.1uF	–
C6	82nF	–
C7	.1uF	–
C8	.1uF	–
C9	470uF	–
C10	.1uF	–
C11	.1uF	–
C12	470uF	–
C13	4.7nF-250V	–
C14	1uF-63V	–
C101	1000pF	–
C102	4700pF	–
C103	1000pF	–
C104	1000pF	–
C105	1uF-50V	–
C106	.1uF	–
C107	.1uF	–
C108	47uF-35V	–
C109	.1uF	–
C201	8.2nF-630V	–
C202	1000pF-500V	–
C203	2.2uF-50V	–
C205	1000uF-35V	–
C206	.01uF-1KV	–
C207	47uF-100V	–
C208	10uF-100V	–
C210	220uF-50V	–
C211	47uF-100V	–
C212	100uF-25V	–
C213	47uF-25V	–
C214	.1uF	–
D1	1N4448	–
D2	1N4448	–
D3	1N746A	–
D4	1N746A	–
D5	BYV36C	–
D6	1N758D	–
D7	1N758D	–
D8	1N5245B	–
D201	30DF4	–
D202	30DF6	–
D203	SM-1XH12	–
D204	BB4T	–
D205	BB4T	–
D206	BB4T	–
D207	BB4T	–
L201	5nH	–
V-DY	V-DY	–
L202	V-SIZE	–
L203	V-LIN	–
L204	5nH	–
Q1	A733P	–
Q2	A733P	–
Q3	C945	–
Q4	A733P	–
Q5	J177	–
Q6	A733P	–
Q7	C945	–
Q8	A733P	–
Q9	C945	–
Q10	IRF630	–
Q11	C945	–
Q101	H245	–
Q201	IRF740	–
R1	20K	–
R2	10K	–
R4	6.65K-1%	–
R5	10K	–
R6	7.5K	–
R7	20K	–
R8	2.2M	
R9	510K	
R10	10M	
R11	2.26K-1%	
R12	13.3K-1%	
R13	510K	
R14	1M	
R15	1K	
R16	220	
R17	470	
R18	1.5K	
R19	10K	
R20	6.8K	
R21	220K	
R22	5K	
R23	5K	
R24	300	
R25	30K	
R26	510	
R27	300	
R28	7.5K	
R29	2.7	
R30	300	
R31	300	
R32	5K	
R33	510	
R34	300	
R35	7.5K	
R36	2.7	
R37	910	
R38	6.2-1/2W	
R40	1.5K	
R41	1.5K	
R42	7.5K	
R101	1K	
R102	1K	
R103	1K-1/2W	
R104	150	
R105	1K	
R106	39K	
R107	18K	
R108	56K	
R109	22K	
R110	12K	
R111	18K	
R112	22K	
R201	10	
R202	10K	
R203	100-2W	
R204	1.2M-1/2W	
R205	10K-1/2W	
R206	100K	
R207	220K	
R208	56K	
R209	10K	
T201	HT	
U1	LM3080	
U2	LF353	
U3	LF353	
VR101	10K	
VR202	250K	
VR203	200-2W	
VR206	2M	
ZD201	12V	


PANEL : INT_CTR
CRT CONTROL FOR ECM-90088
GND
G1
G2
G4
60V
15V
VIDEO
GND
G1
G2
G4
F1
F2
CATHODE
THRESHOLD ADJUST
GAIN-ADJUST
R16 10
C12 100nF-100V
R15 47-1/2W
R13 820-1/2W
R14 100
L1 3.3uH
D2 MV5075C
Q5 2SC3953
Q4 2SC1906
Q3 2SC1906
Q2 2SC1906
Q1 2SC1906
C11 100nF-100V
R10 330-1/2W
C10 100uF-100V
C9 100nF
C8 220uF-25V
C4 100nF
C5 100uF-16V
D1 5.6V
R9 4.7K
R8 680
R11 5K
R12 100
C6 10uF-16V
C7 100nF
C1 100uF-16V
R2 10K
R1 75
R6 10
C3 150pF
R5 10
R4 10
C2 220pF
R3 50
LeCroy CORPORATION
MODEL : 93xx VIDEO
DRAWN DANIEL_R
CHKD DANIEL_R
DATE 18-JAN-93
SH 3 OF 3
ECO : 1003

C1	100uF-16V
C2	220pF
C3	150pF
C4	100nF
C5	100uF-16V
C6	10uF-16V
C7	100nF
C8	220uF-25V
C9	100nF
C10	100uF-100V
C11	100nF-100V
C12	100nF-100V
D1	5.0V
D2	MV5075C
L1	3.3uH
Q1	2SC1906
Q2	2SC1906
Q3	2SC1906
Q4	2SC1906
Q5	2SC3953
R1	75
R2	10K
R3	50
R4	10
R5	10
R6	10
R8	680
R9	4.7K
R10	330-1/2W
R11	5K
R12	100
R13	820-1/2W
R14	100
R15	47-1/2W
R16	10

PART: 93XX-FDGP **DESC: GRAPHIC PRINTER & FLOPPY DISK**

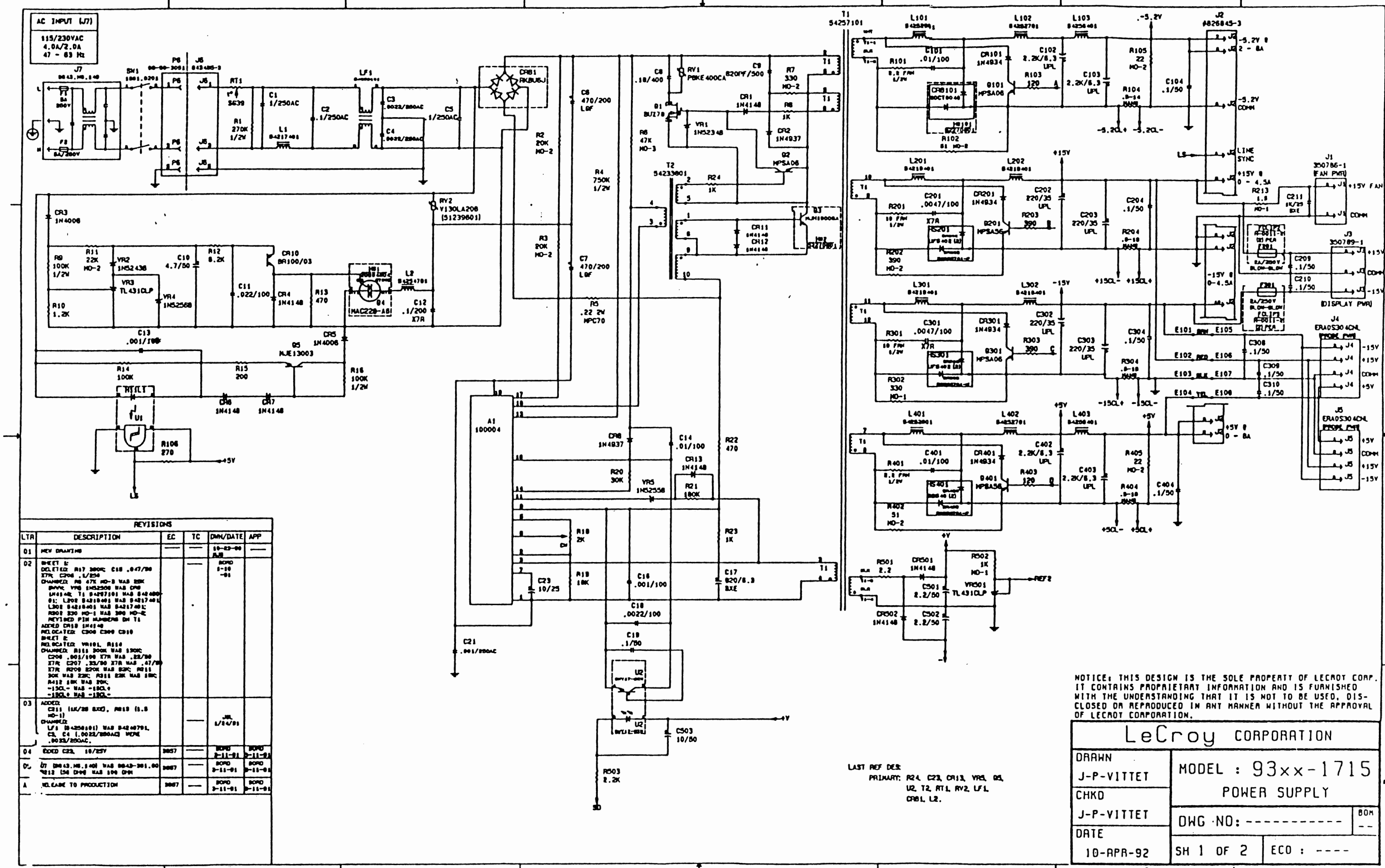
COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
334000402	THERMAL PAPER FOR SEIKO PRINT	1
334000832	THERMAL PRINTER UNIT	1
335023203	FLOPPY DISK DRIVE 31/2"	1
530040005	SLIDE LATCH TAB STYLE	2
550425104	SCREW CYL HD PHIL M2,5X4	4
550430106	SCREW CYL HD PHIL M3X6	10
551430100	FLAT WASHER M3	3
551430400	WASHER SHAKEPROOF M3	2
552430300	NUT OPEN-END ACORN M3	3
554030101	NUT BANC-LOK TYPE MV M3	2
554430002	SCREW S/TAP PHIL M3X5	8
709450523	PUSH SWITCH EXTENDER	1
70FD01021	FLOPPY DISK DRIVE SUPPORT	1
70FD01031	FLOPPY DISK DRIVE FRAME	1
70GP01031	GRAPHIC PRINTER FRAME	1
70GP01041	GRAPHIC PRINTER COVER AXLE	1
70GP01051	GRAPHIC PRINTER CUTTER	1
70GP01061	GRAPHIC PRINTER SWITCH BUTTON	1
780210030	DISPLAY POWER CABLE	1
780721022	FLAT CABLE 2X10 (22CM)	1
780791604	FLAT CABLE 2X13 (4CM)	1
780791630	FLAT CABLE 2X13 (30CM)	1
780801012	FLAT CABLE 2X20 (3 CONNECT.)	1
BOX-GP01	GP01 GRAPHIC PRINTER BOX	1
COVER-GP01	GP01 GRAPHIC PRINTER COVER	1
CUP-FD01	FD01 FLOPPY DISK DRIVE CUP	1
F9300-6	CENTRONICS/FLOPPY/PRINTER INT	1
F9300-7	LTP 5446 PRINTER CONTROLLER	1
UC93XX-FDGP	UPPER COVER FOR FD/GP OPTIONS	1

PART: 93XX-FD01 **DESC: FLOPPY DISK**

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
335023203	FLOPPY DISK DRIVE 31/2"	1
550425104	SCREW CYL HD PHIL M2,5X4	4
550430106	SCREW CYL HD PHIL M3X6	4
551430400	WASHER SHAKEPROOF M3	2
551430400	WASHER SHAKEPROOF M3	2
554030101	NUT BANC-LOK TYPE MV M3	2
554430002	SCREW S/TAP PHIL M3X5	4
70FD01021	FLOPPY DISK DRIVE SUPPORT	1
70FD01031	FLOPPY DISK DRIVE FRAME	1
780791630	FLAT CABLE 2X13 (30CM)	1
780801012	FLAT CABLE 2X20 (3 CONNECT.)	1
CUP-FD01	FD01 FLOPPY DISK DRIVE CUP	1
F9300-6	CENTRONICS/FLOPPY/PRINTER INT. B	1
UC93XX-FD01	UPPER COVER FOR FD01 OPTION	1

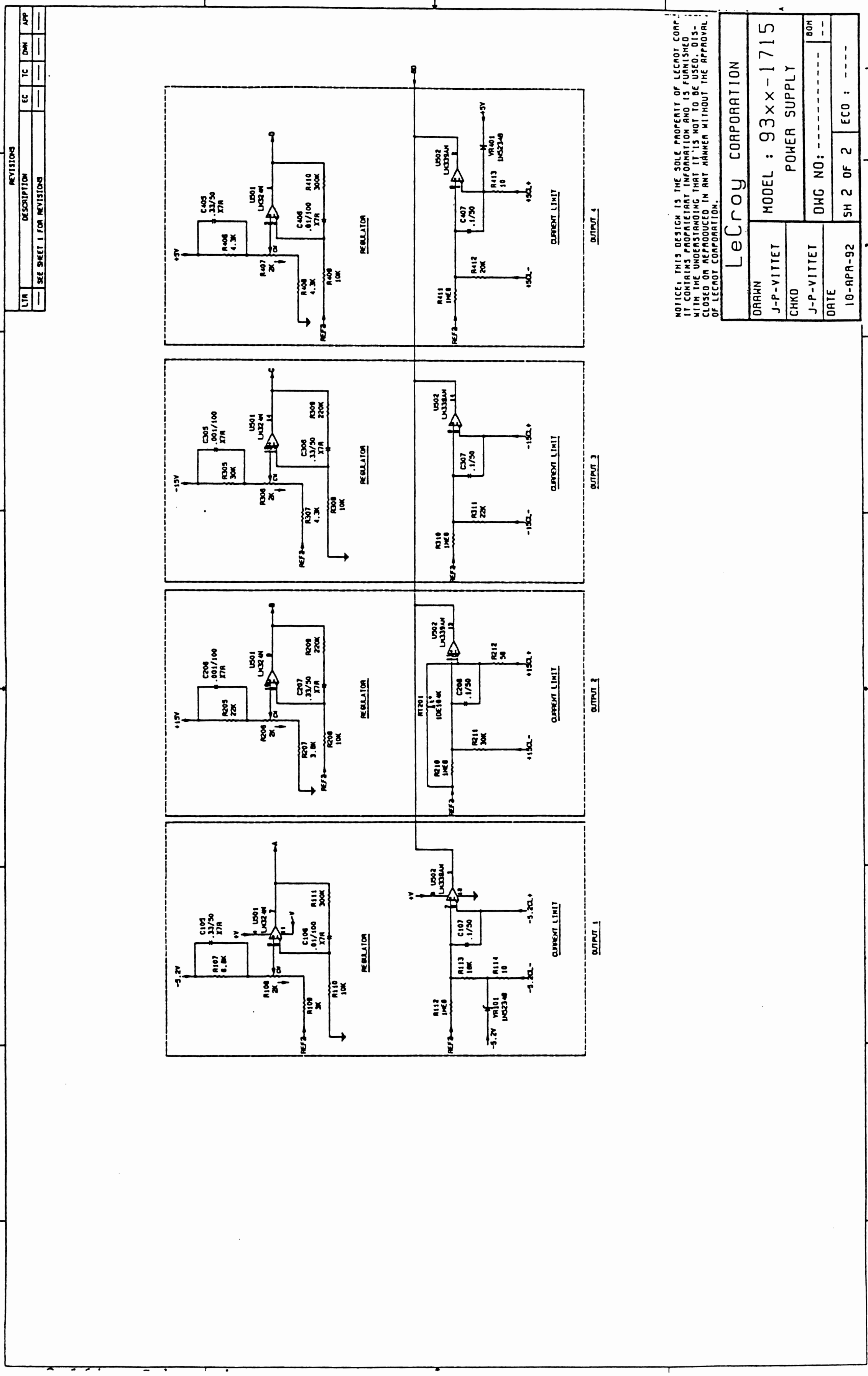
PART: 93XX-GP01 DESC: GRAPHICS PRINTER

COMPONENT	PART DESCRIPTION	QTY PER ASSEMBLY
34000402	THERMAL PAPER FOR SEIKO PRINT	1
334000832	THERMAL PRINTER UNIT	1
530040005	SLIDE LATCH TAB STYLE	2
550430106	SCREW CYL HD PHIL M3X6	8
551430100	FLAT WASHER M3	3
551430400	WASHER SHAKEPROOF M3	2
552430300	NUT OPEN-END ACORN M3	3
554430002	SCREW S/TAP PHIL M3X5	4
709450523	PUSH SWITCH EXTENDER	1
70GP01031	GRAPHIC PRINTER FRAME	1
70GP01041	GRAPHIC PRINTER COVER AXLE	1
70GP01051	GRAPHIC PRINTER CUTTER	1
70GP01061	GRAPHIC PRINTER SWITCH BUTTON	1
780210030	DISPLAY POWER CABLE	1
780721022	FLAT CABLE 2X10 (22CM)	1
780791604	FLAT CABLE 2X13 (4CM)	1
780801012	FLAT CABLE 2X20 (3 CONNECT.)	1
BOX-GP01	GP01 GRAPHIC PRINTER BOX	1
COVER-GP01	GP01 GRAPHIC PRINTER COVER	1
F9300-6	CENTRONICS/FLOPPY/PRINTER INT	1
F9300-7	LTP 5446 PRINTER CONTROLLER	1
UC93XX-GP01	UPPER COVER FOR GP01 OPTION	1



REVISIONS					
LTR	DESCRIPTION	EC	TC	DWN/DATE	APP
01	NEW DRAWING	—	—	10-23-90	—
02	SHEET 1: DELETED: R17 300K; C18 .047/50 X7R; C206 .1/250 CHANGED: R6 47K MO-3 WAS 20K ... VR5 1N5255B WAS CR9 1N4148; T1 54257101 WAS 542400-01; L202 54218401 WAS 54217401; L302 54218401 WAS 54217401; R302 330 MO-1 WAS 390 MO-2; REVISED PIN NUMBERS ON T1 ADDED CR13 1N4148 RELOCATED: C308 C309 C310 SHEET 2: RELOCATED: VR101, R114 CHANGED: R111 300K WAS 150K; C206 .001/100 X7R WAS .22/50 X7R; C207 .33/50 X7R WAS .47/50 X7R; R209 220K WAS 82K; R211 30K WAS 22K; R311 82K WAS 18K; R412 18K WAS 20K; -15CL- WAS -15CL+ -15CL+ WAS -15CL-		—	BORD 1-10-91	
03	ADDED: C211 (1K/25 BXE), R213 (1.8 MO-1) CHANGED: LF1 (54250101) WAS 54240791, C3, C4 (.0022/250AC) WERE .0033/250AC.		—	JBL 1/24/91	
04	ADDED C23, 10/25V	3057	—	BORD 3-11-91	BORD 3-11-91
05	J7 (8043.N6.140) WAS 8043-301.00 R212 (56 OHM) WAS 100 OHM	3057	—	BORD 3-11-91	BORD 3-11-91
A	RELEASE TO PRODUCTION	3057	—	BORD 3-11-91	BORD 3-11-91

LeCroy CORPORATION		
DRAWN J-P-VITTET	MODEL : 93xx-1715 POWER SUPPLY	
CHKD J-P-VITTET	DWG NO: -----------	BOM --
DATE 10-APR-92	SH 1 OF 2	ECO : ----


LeCroy CORPORATION
MODEL : 93xx-1715
POWER SUPPLY
DWG NO:
SH 2 OF 2
ECO :
DRAWN
J-P-VITTET
CHKD
J-P-VITTET
DATE
10-APR-92

SECTION 9 MECHANICAL PARTS

9320 Digital Oscilloscope

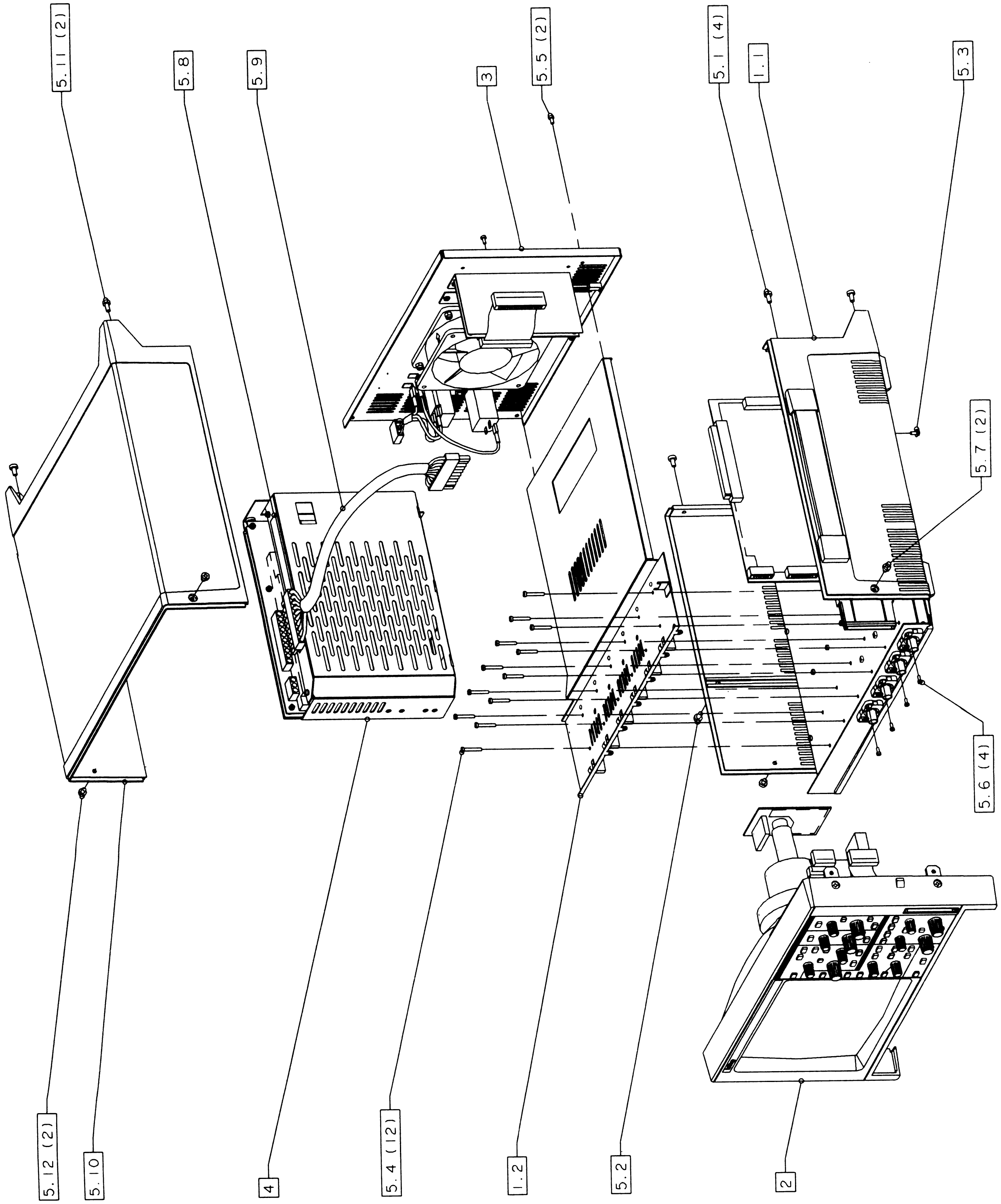


FIGURE 9.1: 9320 DSO EXPLODED VIEW

	9320 Assembly	Part Description	Quantity per Assembly
1.1	9320 lower cover assembly		1
1.2	9320 upper shield assembly		1
2.	9320 front frame assembly		1
3.	Rear panel assembly		1
4.	PS 1715 power supply	93XX-PS1715	1
5.1	Screw oval head M4x8	550 440 608	4
5.2	Screw oval head M4x8	550 440 608	1
5.3	Screw eco-fix M3x6	550 430 706	1
5.4	Screw cyl head M3x20	550 430 120	12
5.5	Screw eco-fix M3x6	550 430 706	2
5.6	Screw taptite M2,5x6	554 425 003	6
5.7	Screw oval head M4x5	550 440 605	2
5.8	Label "Danger ... only"	377 051 005	1
5.9	Main card power cable	780 220 030	1
5.10	Upper cover	UC 93XX	1
5.11	Screw oval head M4x8	550 440 608	2
5.12	Screw oval head M4x5	550 440 605	2

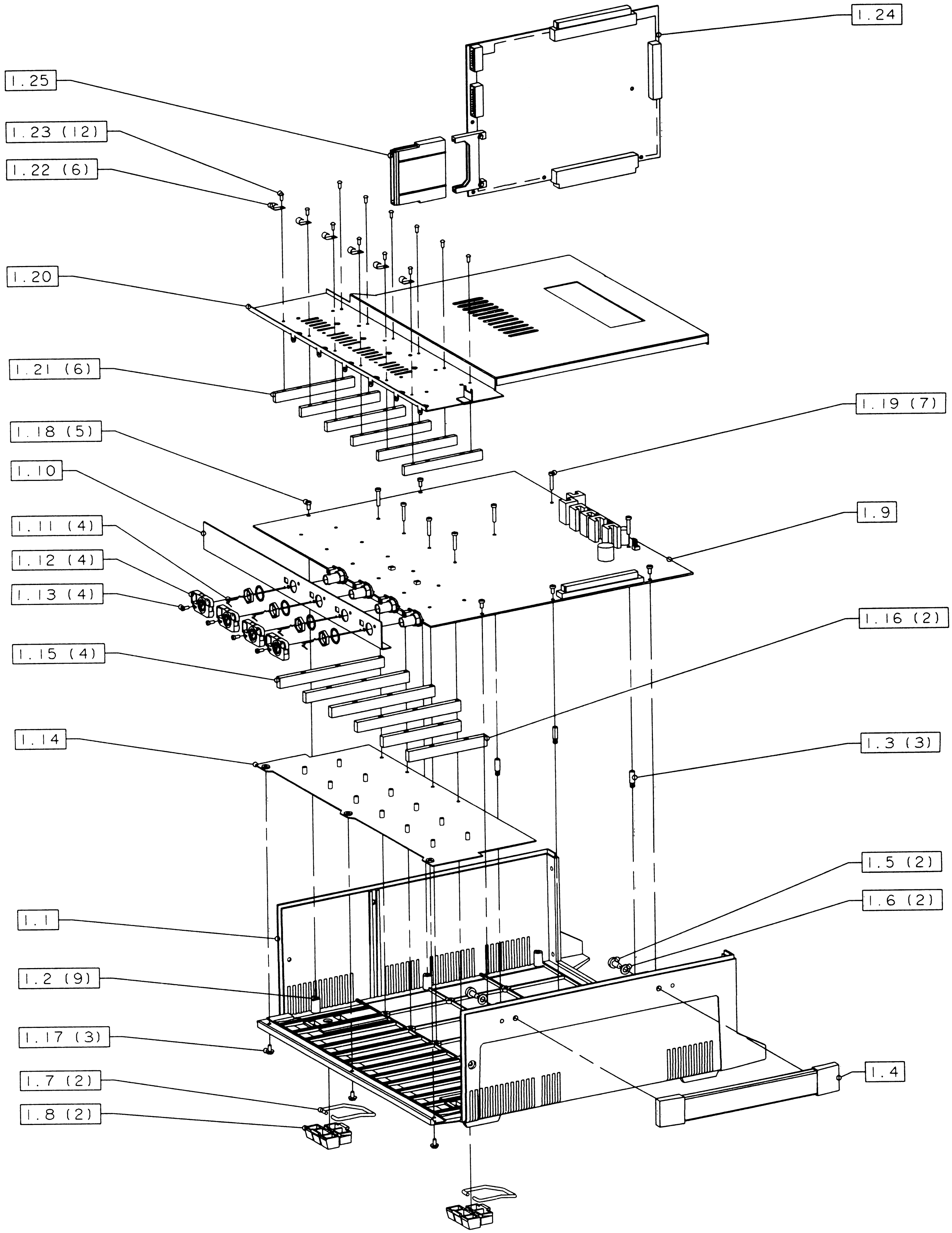


FIGURE 9.2: 9320 LOWER COVER EXPLODED VIEW

1.	9320 Lower Cover Assembly	Part Description	Quantity per Assembly
1.1	Lower cover	LC 93XX	1
1.2	Nut Banc-Lock M3	554 030 101	9
1.3	Main card standoff M3	709 3XX 321	3
1.4	Handle with caps	530 301 009	1
1.5	Screw cyl head 10-32 x 1/2	560 032 008	2
1.6	Lockwasher M5	551 450 400	2
1.7	Foot	709 3XX 051	2
1.8	Foot support	709 3XX 041	2
1.9	Main board 9320	F9320-3	1
1.10	Main board panel 9320	FP9320-3	1
1.11	Probe ring contact	709 3XX P91	6
1.12	Probe holder	709 3XX P41	6
1.13	Screw taptite M2,5x6	554 425 003	6
1.14	9320 base shield	709 324 331	1
1.15	9320 lower partition shield	709 324 341	4
1.16	Lower partition shield	709 3XX 361	2
1.17	Screw eco-fix M3x6	550 430 706	3
1.18	Screw cyl head M3x6	550 430 106	5
1.19	Screw cyl head M3x16	550 430 116	7
1.20	9320 upper shield	709 324 321	1
1.21	Upper partition shield	709 3XX 351	6
1.22	Shield contact	709 3XX 371	6
1.23	Nail rivet M2,5x6	554 425 004	12
1.24	Processor card	F9314M-1	1
1.25	Memory card insertion guide	709 424 096	1

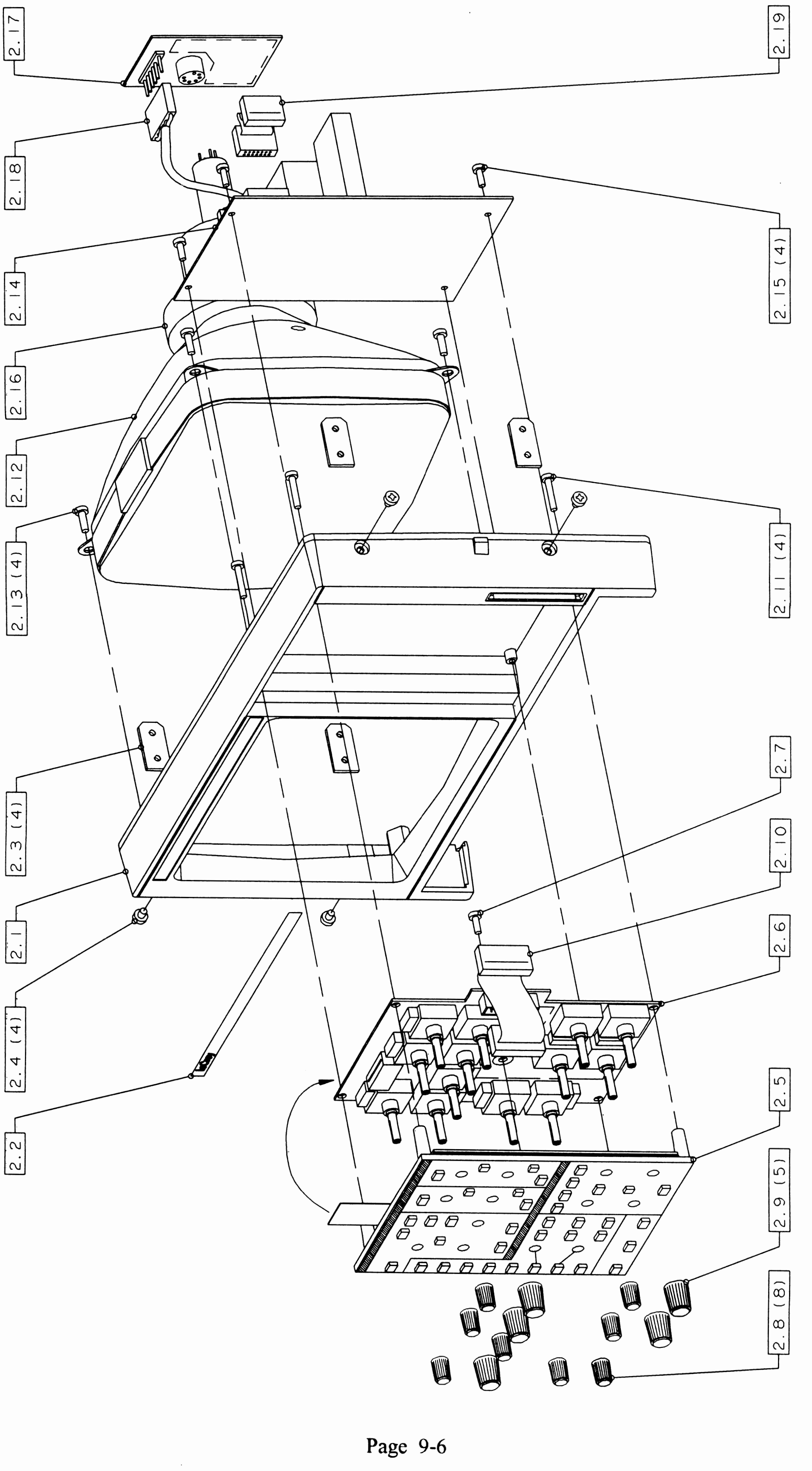


FIGURE 9.3: 9320 FRONT FRAME EXPLODED VIEW

2.	9320 Front Panel Assembly	Part Description	Quantity per Assembly
2.1	Front frame	FF 9320	1
2.2	Front label	709 320 013	1
2.3	Front frame bracket	709 3XX 091	4
2.4	Screw oval head M4x5	550 440 605	4
2.5	Front panel keyboard ass'y	729 320 503	1
2.6	Front panel pcb ass'y	F9320-5	1
2.7	Screw PT KA 35x10	554 435 004	1
2.8	Knob diameter 10mm	709 3XX 511	8
2.9	Knob diameter 14mm	709 3XX 521	5
2.10	20 lines flat cable	780 721 105	1
2.11	Screw PT KA 35x20	554 435 003	4
2.12	9 inch CRT	93XX-CRT	1
2.13	Screw PT KA 40x12	554 440 001	4
2.14	Deflection board	93XX-Deflection	1
2.15	Screw PT KA 35x10	554 435 004	4
2.16	Deflection yoke	93XX-Yoke	1
2.17	Video board	93XX-Video	1
2.18	Monitor cable		1
2.19	14 lines flat cable	780 661 104	1

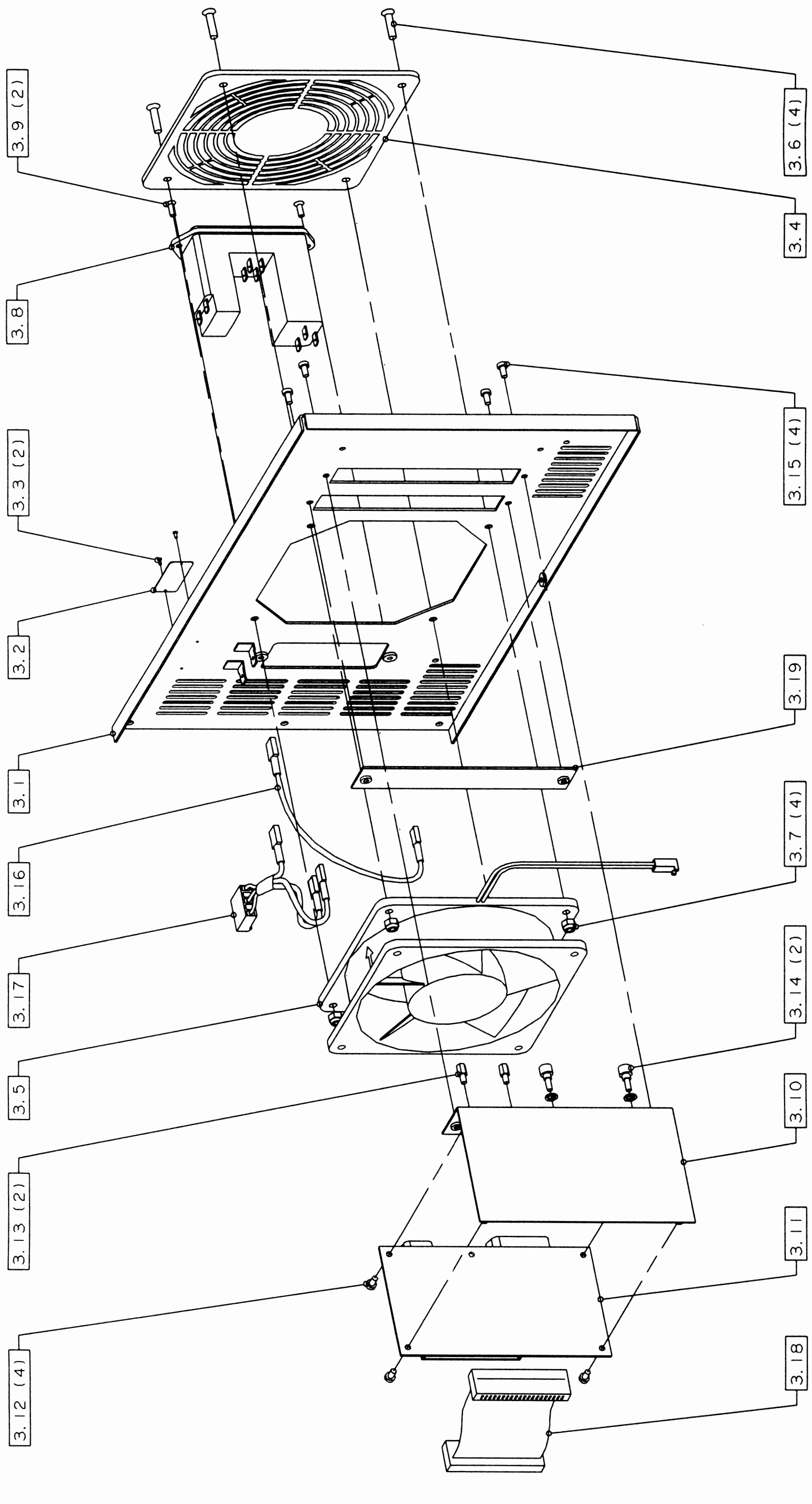


FIGURE 9.4: 9320 REAR PANEL EXPLODED VIEW

3	9320 Rear Panel Assembly	Part Description	Quantity per Assembly
3.1	Rear panel	RP 93XX-9	1
3.2	Serial number plate	709 324 913	1
3.3	Taping screw	554 500 001	2
3.4	Fan grid	530 904 000	1
3.5	Fan asssembly	709 3XX 902	1
3.6	Screw flat head M4x16	550 440 516	4
3.7	Nut acom M4	552 440 300	4
3.8	Line input module	434 690 002	1
	Fuse holder	407 036 002	1
	Fuse 5A / 250 V	433 162 500	2
3.9	Screw flat head M3x8	550 430 508	2
3.10	Interface card bracket	709 300 411	1
3.11	Interface card	F9300-4	1
3.12	Screw cyl head M3x6	550 430 106	4
3.13	Screw lock	455 980 002	2
3.14	Screw lock and washer		2
3.15	Screw cyl head M3x6	550 430 106	4
3.16	Ground wire cable	780 754 515	1
3.17	Line input cable	780 681 611	1
3.18	40 lines flat cable	780 671 110	1
3.19	Interface hole closure	709 3XX 931	1

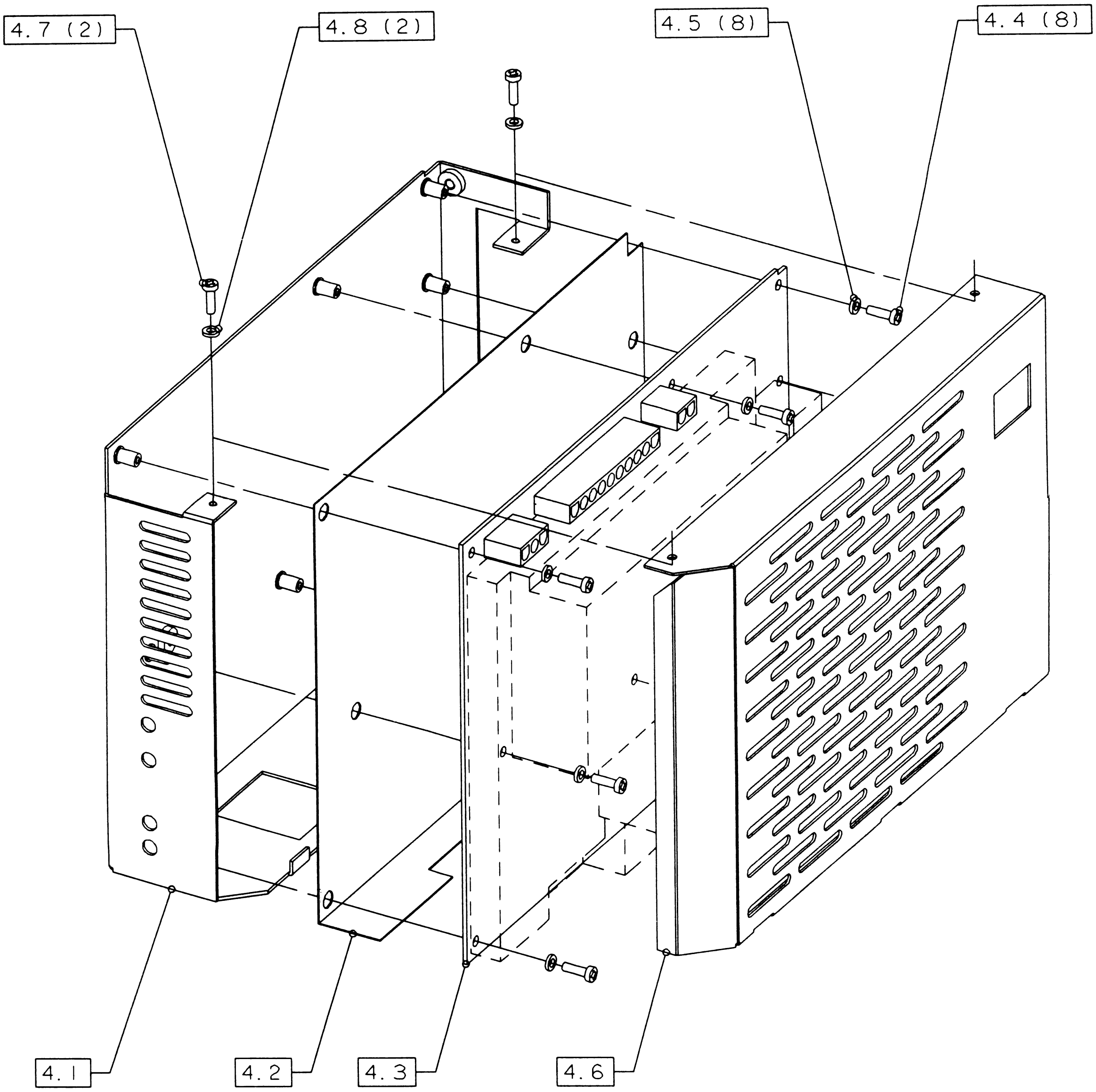


FIGURE 9.5: 93XX-PS1715 POWER SUPPLY EXPLODED VIEW

4.	Power supply 93XX-PS1715	Part Description	Quantity per Assembly
4.1	Chassis	709 3XX 071	1
4.2	Insulator		1
4.3	Power supply board	93XX-PS 1701	1
4.4	Screw cyl head M3x6	550 430 106	8
4.5	Lockwasher M3	551 430 400	8
4.6	shielding	709 3XX 081	1
4.7	Screw cyl head M3x6	550 430 106	2
4.8	Lockwasher M3	551 430 400	2

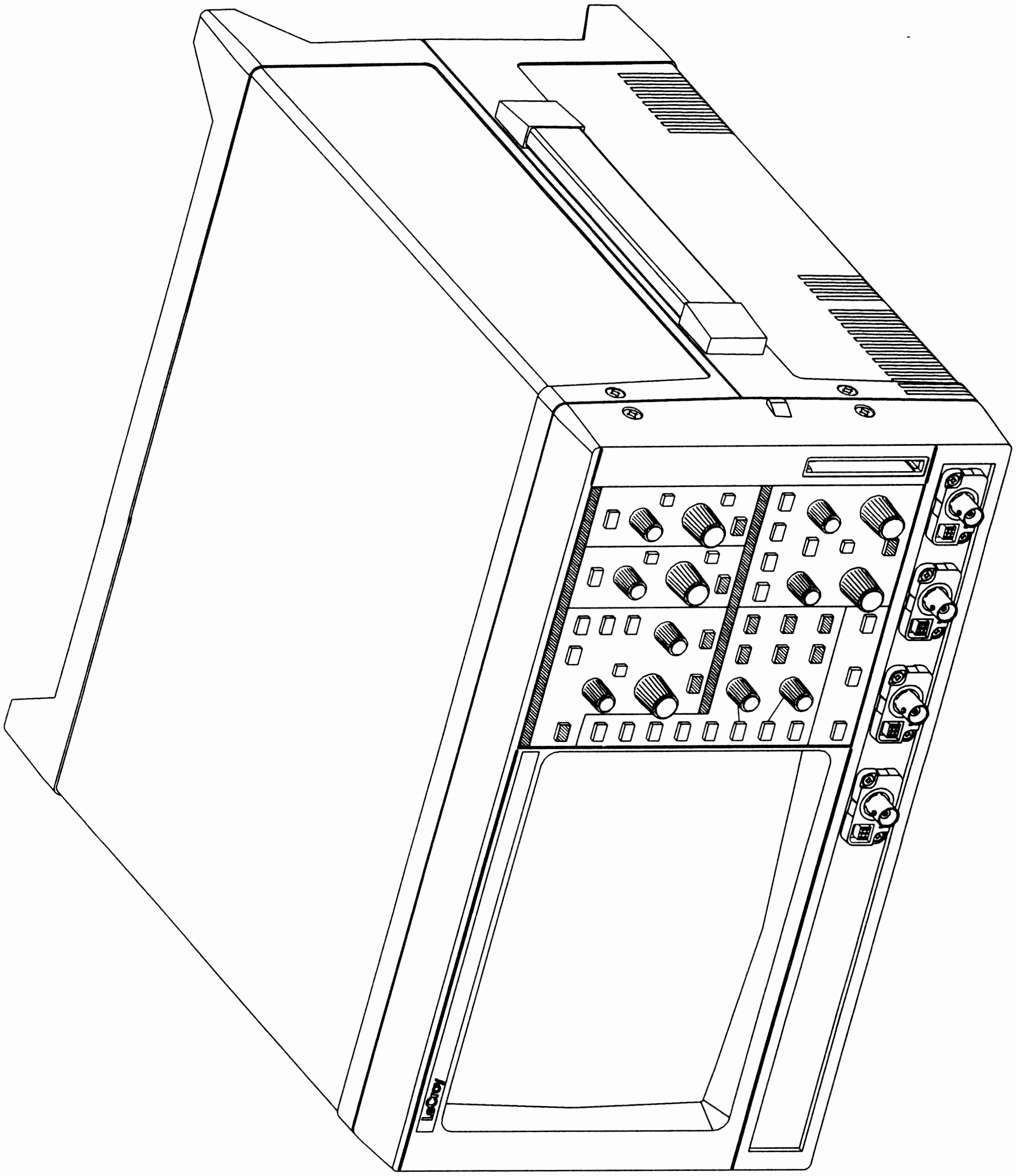


FIGURE 9.6: 9320 DSO FRONT VIEW

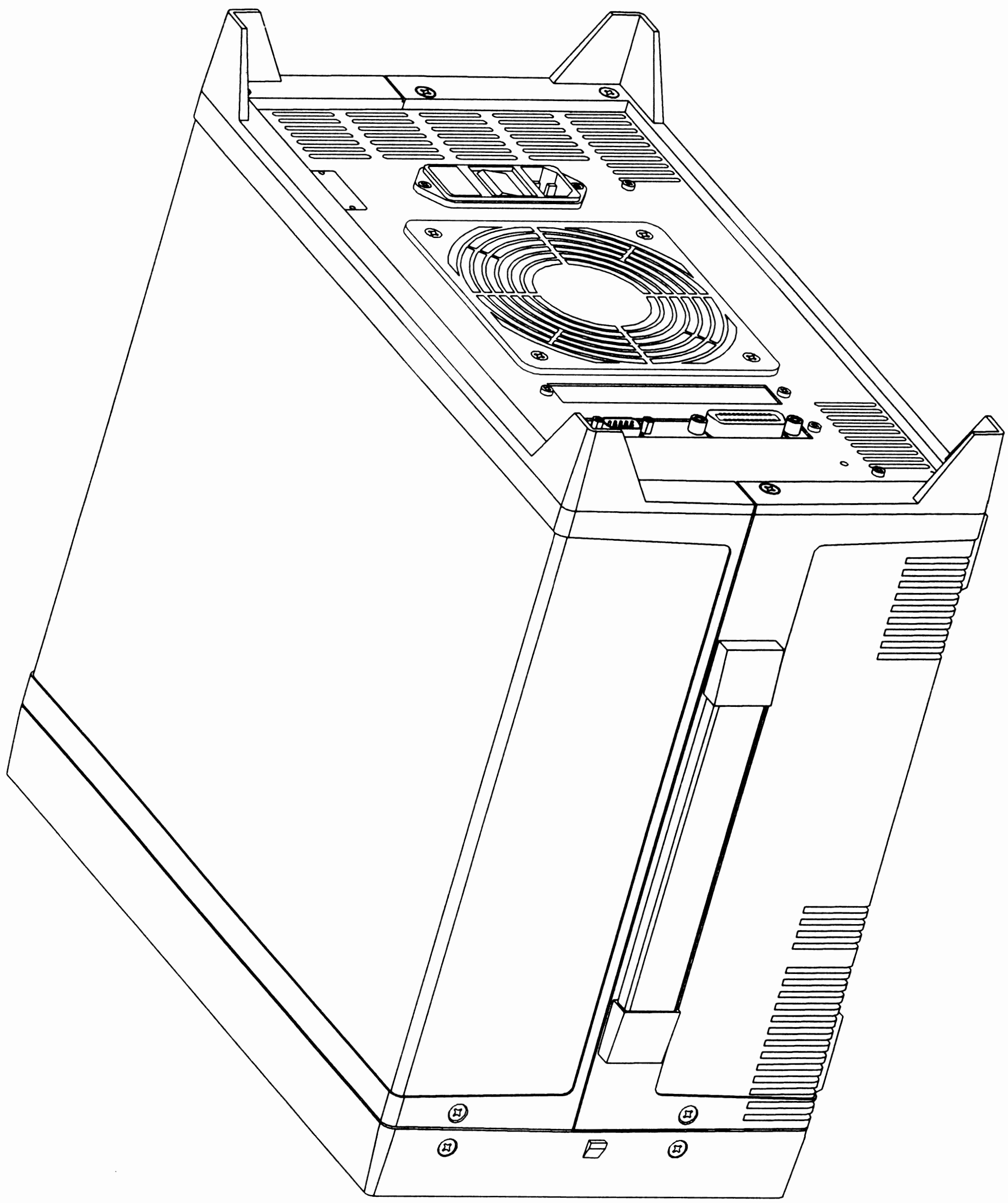


FIGURE 9.7: 9320 DSO REAR VIEW

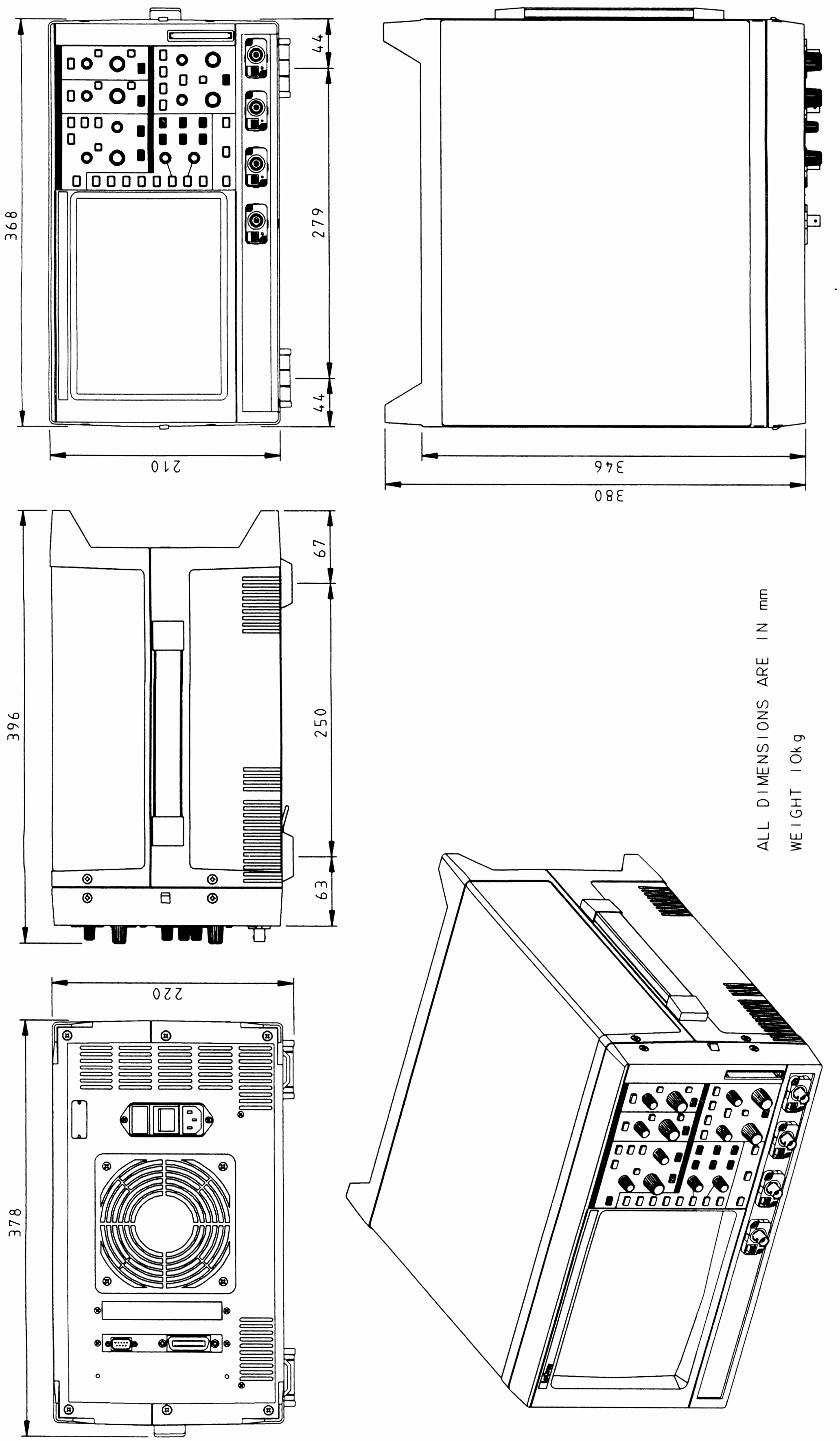
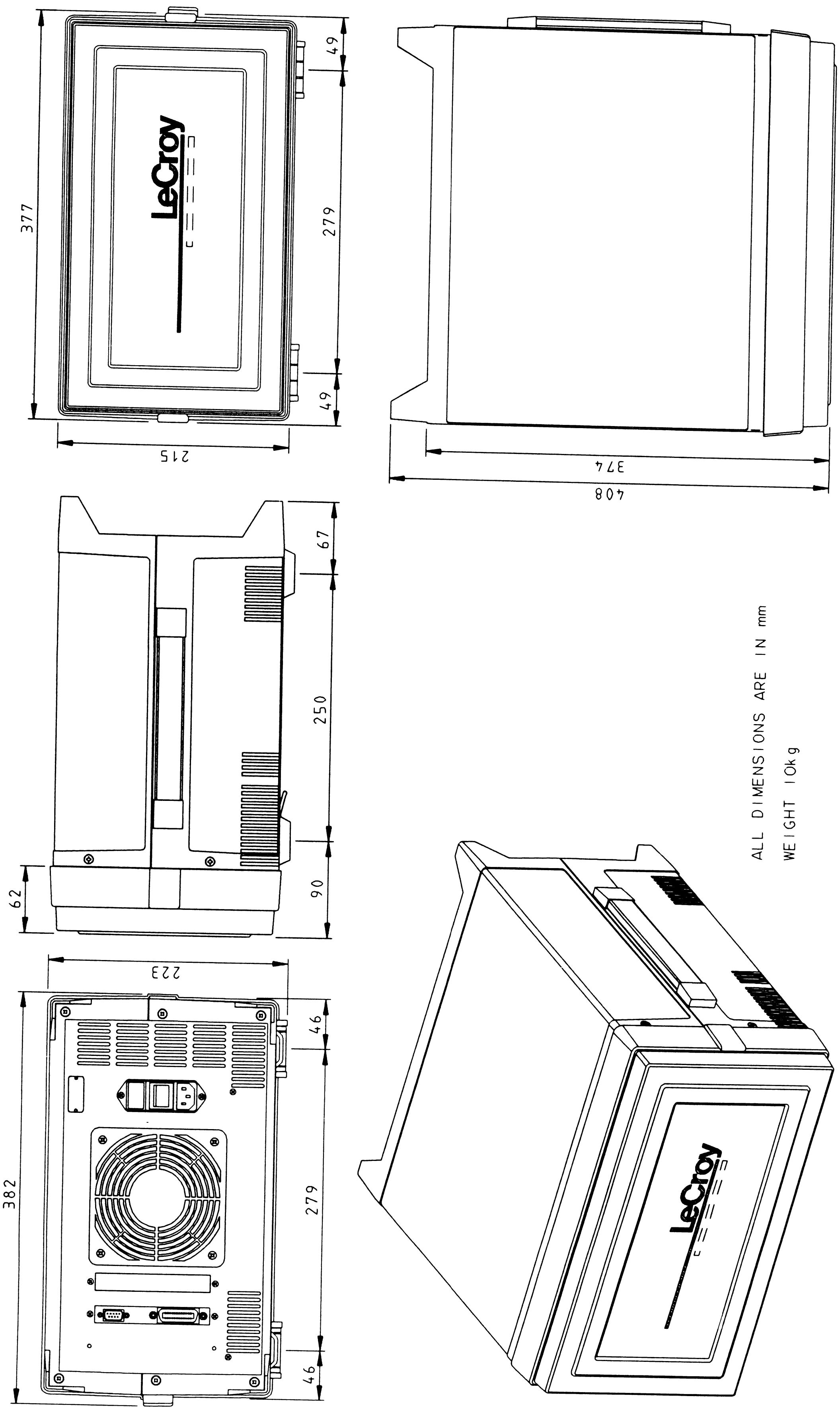


FIGURE 9.8: 9320 DSO DIMENSIONS



ALL DIMENSIONS ARE IN mm
WEIGHT 10kg

FIGURE 9.9: 9320 DSO DIMENSIONS WITH PROTECTIVE COVER

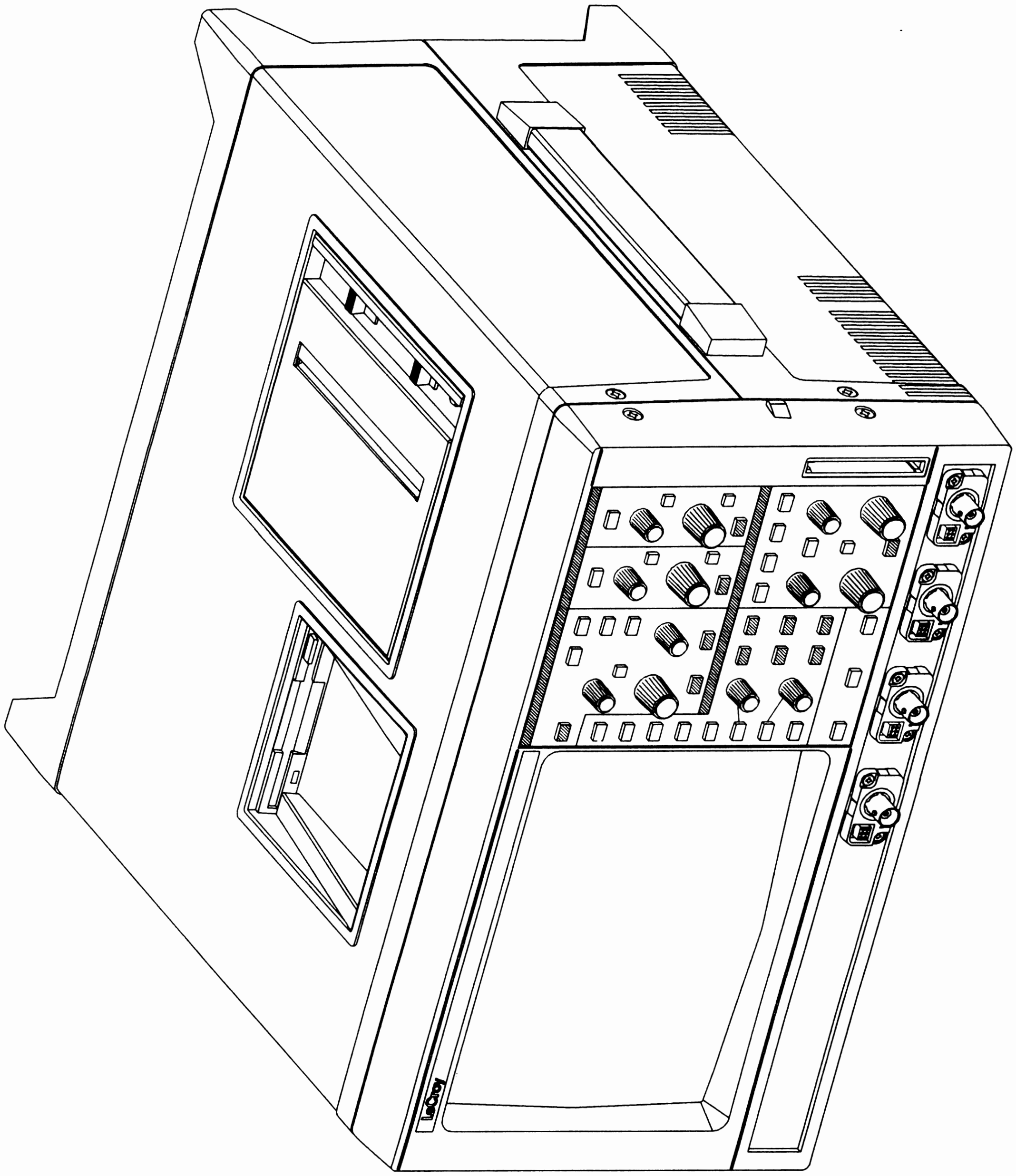


FIGURE 9.10: 9320 DSO WITH FLOPPY AND PRINTER OPTIONS

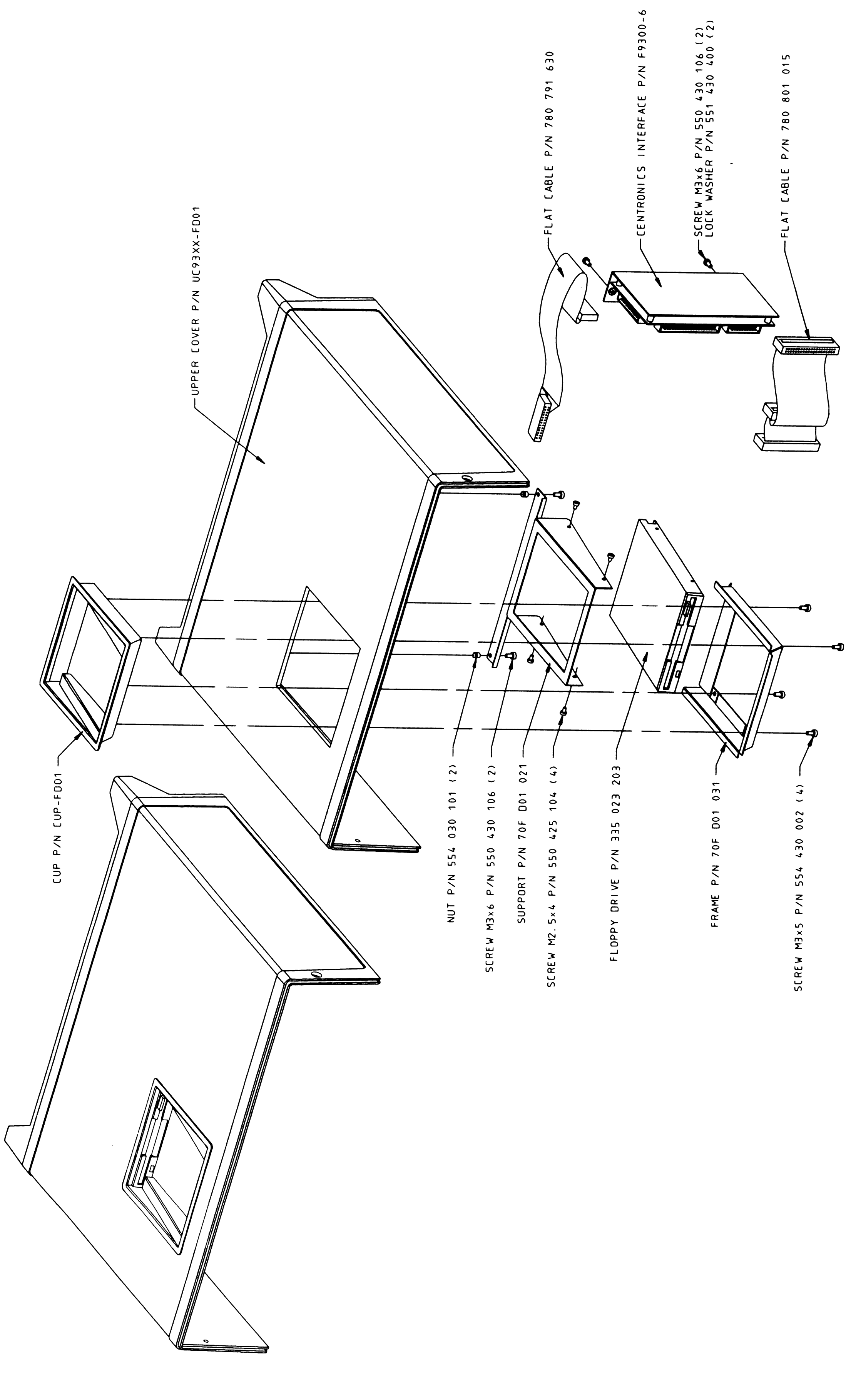
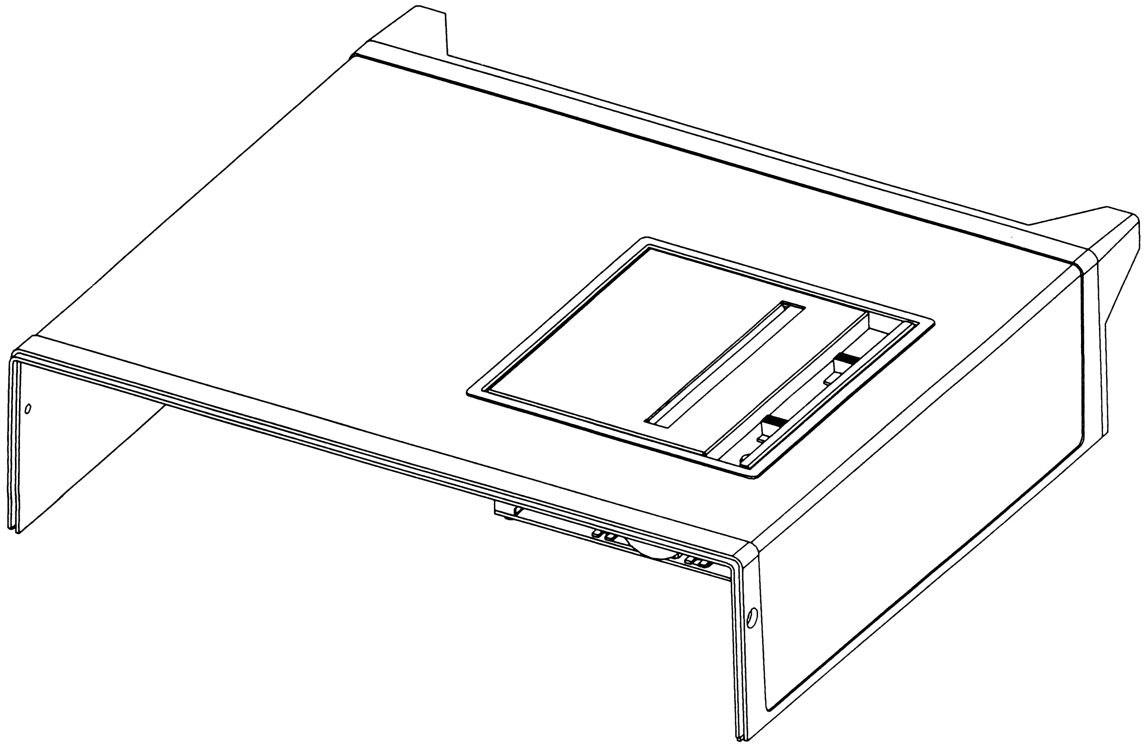


FIGURE 9.11: 9320-FD01 ASSEMBLY: FLOPPY OPTION



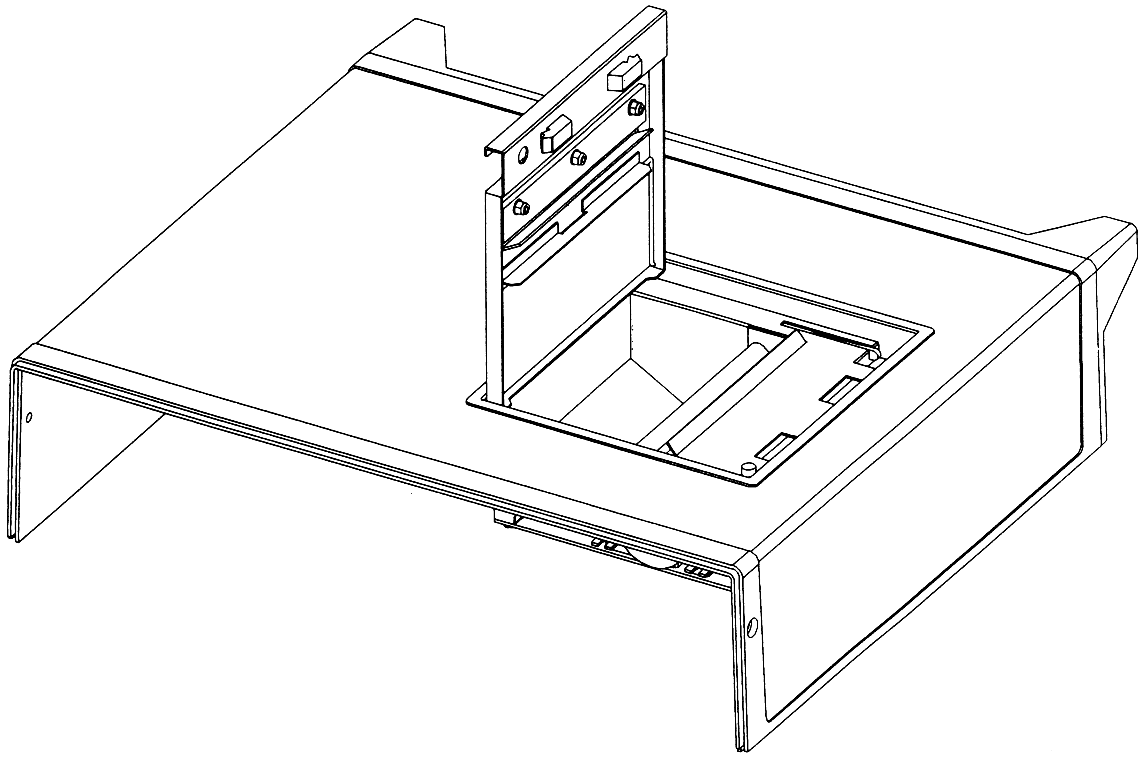


FIGURE 9.12: 9320-GP01 PRINTER OPTION

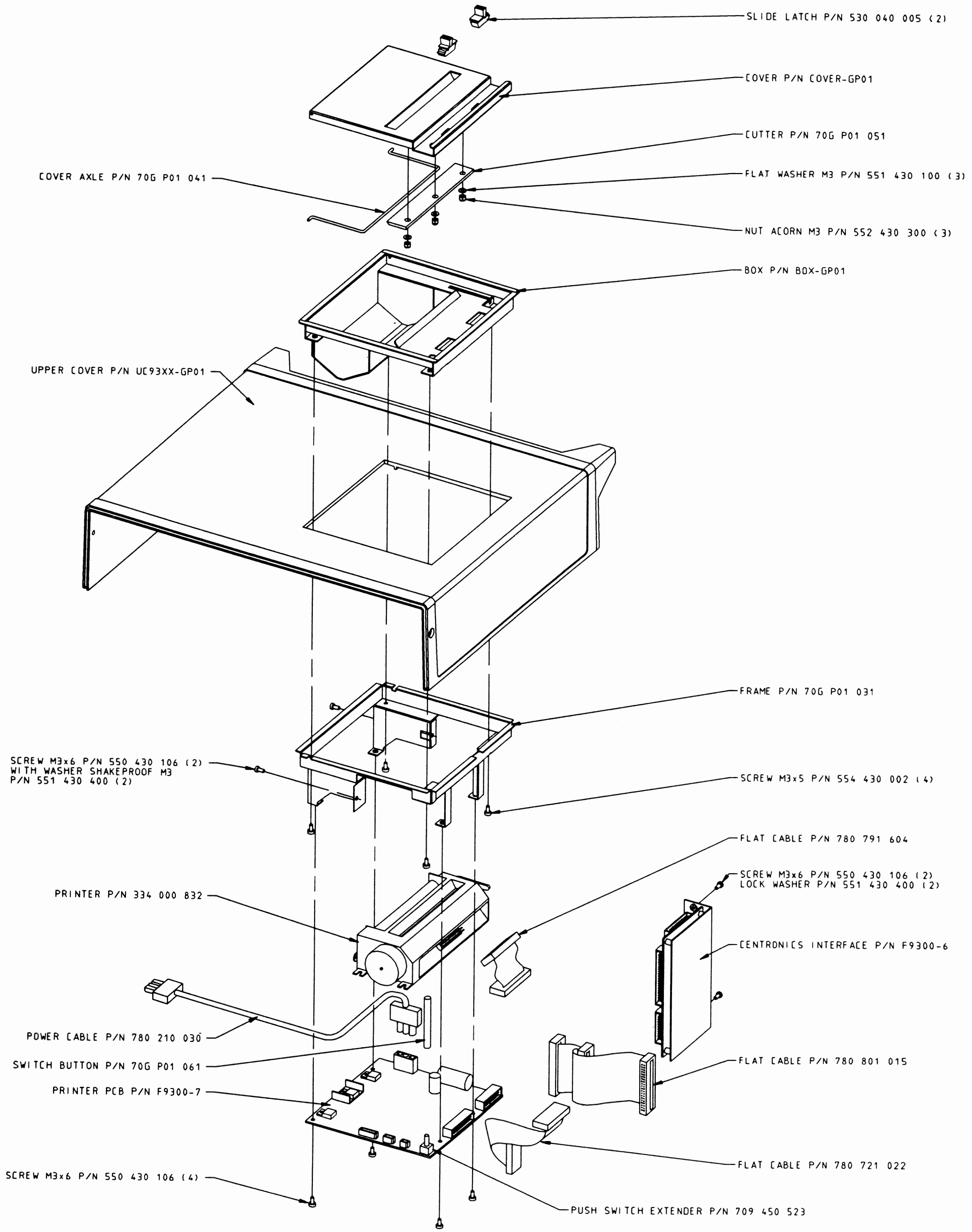


FIGURE 9.13: 9320-GP01 ASSEMBLY: PRINTER OPTION

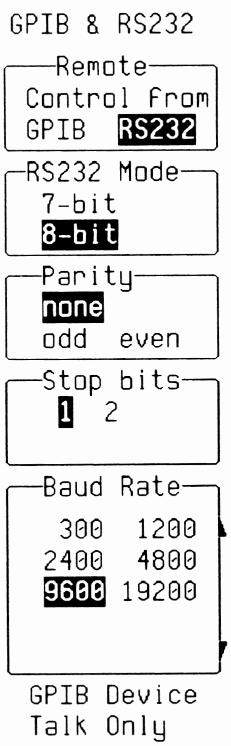
SECTION 10 CONNECTING the 9320 to a PLOTTER or a PRINTER

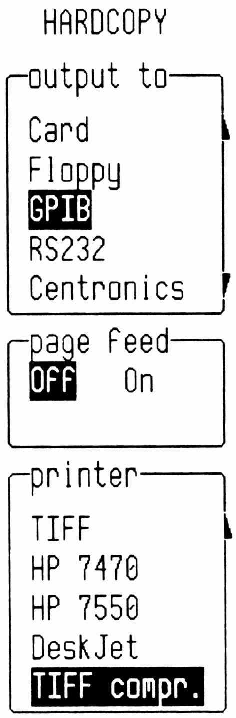
10.1 Introduction

LeCroy oscilloscopes are supplied with a list of plotters and printers known to work with them.

This list is not final, so any suggestions are welcome.

HP plotter responses to some RS-232 configuration commands have been evolved. Consequently, the 9320 generation DSO support HP plotters of two types, 7470A and 7550A. The only difference lies in the RS-232 initialization codes. They may however, despite these changes, work with HPGL compatible plotters from other manufacturers. If the HPGL data is used as input for a CAD or word processing system, it might be necessary to remove the data preceding the in command. Before connecting a plotter to a 9320 do not forget to select the appropriate settings in the printer setup menu and the GPIB & RS-232 setup menu.





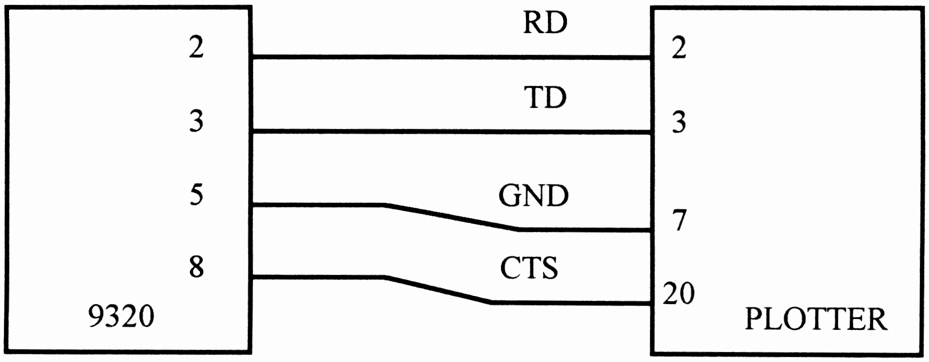
RS-232 connection

The following settings are assumed for the scope.
Baud rate : 9600
Character : 8 bits
Parity : none
Stop bits : 1
Any exceptions will be mentioned.

RS 232 interface

Pin	1 :	DCD
	2 :	RD
	3 :	TD
	4 :	DTR
	5 :	GND
	6 :	DSR
	7 :	RTS
	8 :	CTS
	9 :	RI

A cable with the following pinout can be used in almost every case:



The cable has D25 connector with male pins on the plotter side, and a D9 connector with female pins on the 9320 oscilloscope side.

GPIB Connection

To have a plot done through GPIB initiated with the front panel screen dump push button, you must set the 9320 in talk only mode by selecting remote control from RS-232, and the plotter in listen only mode.

If a computer controls the GPIB Bus, both the scope and the plotter must be set in addressed mode (remote control from GPIB). Remark: the listen only mode does not work on some old HP plotters such as HP7585B or HP7475. The plotter must be set to listener before being able to receive any commands, which is a violation of the GPIB standard.

10.2 Plotters

10.2.1 HP 7470A Plotter

Switch settings:
- RS-232 Connection:
  S1 and S2 : 0 0
  Y/D : D
  A4/US : User selectable
  B4 to B1 : 1 0 1 0

- GPIB listen only:
  A4/US : User selectable
  16 to 1 : 1 1 1 1 1

- GPIB Addressed:
  A4/US : User selectable
  16 to 1 : 0 0 1 1 1

10.2.2 HP 7550A Plotter

Responses to some ESC characters commands are not the same in this plotter as in older HP models like the 7470A. In fact, ESC sequences of commands which give excellent results in the 7470A can prevent any handshake in RS-232.

Problems of this kind have been reported in the case of ESC.R and ESC.@ commands. When combined with ESC.I and ESC.N, ESC.@ breaks up all handshakes.

- RS-232 configuration:

- Enter into display 5 (HP-IB MONITOR...).
- Select STANDARD OF STANDARD/ENHANCED.
- Enter into SERIAL sub-menu (display 6)
- For DATA_FLOW, select REMOTE. Either STANDALONE or EAVESDROP may be chosen.
- Enter into display 7 (DUPLEX, PARITY, BAUD).
- Select FULL duplex.
- Configuration PARITY and BAUD rate to the same values as on the DSO.

A standard cable may be used.
Do not start a plot while a sheet of paper is being loaded!

- GPIB configuration:

If the scope is in TALK ONLY, the plotter must be in LISTEN ONLY. Selection will be done at display 5.

- Note : Its seems that the plotter must be powered off, then on again, to take any configuration change into account.

10.2.3 Hitachi 672 Graph Plotter (or NSA 672)

As this plotter is compatible with the 7470A, select this mode on the plotter menu page.

Switch settings

- RS-232 Connection:
  Sw. A, 1 and 2 : 1 1 (ISO A3) or (ISO A4).
  Sw. A, 3 to 8 : 1 0 1 1 0 1
  Sw. B : 1 1 1 1

- Note: When switches are set to ISO A4, the pen must be manually repositioned at the top of the page (or plotter reset by powering it off and on) before loading a new sheet of paper.

10.3 Printers

Interfacing is possible through RS-232, GPIB directly, and in option through Centronics. The parallel interface F9300-6 (Centronics) is an option, see section 4.5.

10.3.1 Centronics Printers

Most printers use a Centronics parallel connection which makes direct connection possible if the 9320 is equipped with the optional Centronics interface F9300-6 board. If the printer has a Centronics connector then it's a parallel printer, and the F9300-6 board is required or a serial to parallel converter.

If a serial to parallel converter is used, in the printer setup menu select device type Epson, and remote control from RS-232.

RS-232 Remote control port settings:
Baud rate : 9600 or 19200
Characters length (bits): 8
Parity : none
Number of stop bits : 1

The following printers and printer switch positions have been tested via serial to parallel adapter.

	Switch 1	Switch 2
1. Epson LQ-1000	1, 2, 3, 4 : ON	2, 6, 7 : ON
2. Diconix 150P	1: ON	2, 6, 7 : ON
3. HP-ThinkJet 2225C	2, 4, 5 : ON	
4. HP-DeskJet 550 C	all down	6 up for 19200 bauds

Note: all Epson and Epson Compatible printers are likely to work if the switches are set properly. (Some experimentation may be required).

Some available serial to parallel converters need power through the RS-232 lines. Do not use them, as we do not guarantee that the serial port is able to furnish enough power.

10.3.2 RS-232 Printers

10.3.2.1 Epson FX80

It is possible to use the standard RS-232 cable. Such a printer has the optional RS-232 interface "#8143" installed. The configuration that follows is valid for the default scope setting. The standard cable is usable.

In the particular case of an FX850:

- the main switches SW1 SW2 remain at the factory configuration

SW1 :	1	2	3	4	5	6	7	8
	OFF	OFF	ON	OFF	OFF	ON	ON	ON

SW2 :	1	2	3	4
	ON	OFF	OFF	OFF

- the 8143 switches are set to:

1	2	3	4	5	6	7	8
ON	OFF	OFF	OFF	n/a	OFF	OFF	ON

- the 8143 jumpers remain at the factory settings:

J1	J2	J3	J4	J5	JC	JNOR	JRVE	JF	JX
OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	ON	OFF

Note: Epson printers only support XON/XOFF support handshake if they have a print buffer. Such printer are:

FX, FX+, JX-80, LQ-800/1000, EX-800 and LQ-25000.
Otherwise, use DTR/RTS handshake.

10.3.2.2 Citizen 120D

To use this printer with the default RS-232 setting and default printer setting of the 9320, select the following switch configuration:

DIP switch bank 1 : all OFF except 3 and 8, DIP switch bank 2 : all OFF.

10.3.2.3 HP LaserJet

Make sure that page feed is ON in the plotter menu to use the LaserJet. It is advisable to start out in single density with a size of A5. Then, depending upon the internal buffer size on the LaserJet, the image size and/or density can be increased. At one point, the internal buffer size of the DSO is also reached. The image is simply truncated, indicating that either density or size have to be reduced.

10.3.2.4 HP QuietJet

10.3.2.5 HP ThinkJet

To use printer with the default RS-232 setting and with the default cable select the following switch configuration:

- mode switch:

1	2	3	4		5	6	7	8
0	0	0	0 : 11" page length 1 : 12" page length		0	0	0	0

- RS-232 switch:

1	2	3	4	5
1	0	0	0	0

(use DTR handshake) (8bits, parity none) (9600 bauds)

Note: it may be possible that old ThinkJet recognize only the Epson protocol. If it is the case use the Epson.

10.3.2.6 HP DeskJet 550C

The standard cable is usable. The printer has been tested at 19200 bauds with the following configuration :

Switch 1 or Bank A : all down
Switch 2 or Bank B : 6 up for 19200 bauds, all the other down

10.3.2.7 Brother Printers

The Brother M-1509 and M-1709 have been tested with a serial connection. On the oscilloscope select "Epson FX-80 or compatible printer".

The switch settings are identical for both the printers:

		1	2	3	4	5	6	7	8
- SW1	:	ON	ON	ON	OFF	ON	n/a	n/a	ON

		1	2	3	4	5	6	7	8
- SW1	:		←		ALL OFF			→	

		1	2	3	4	5	6	7	8
- SW1	:	OFF	OFF	OFF	OFF	11" : OFF 12" : ON	OFF	ON	OFF

10.3.3 GPIB Printers

10.3.3.1 HP QuietJet

Make sure the dip switches on the backplane of the printer are set to

- SRQ enable:	0
- GPIB listen only:	
Listen always:	1
A5 to A1:	0 0 1 1 1
- GPIB Addressed:	
Listen always:	0
A5 to A1:	0 0 1 1 1

10.3.3.2 HP ThinkJet (HP 2225A)

Make sure the dip switches on the backplane of the printer are set to

- SRQ Enable:	0
- GPIB listen only:	
Listen always	1
A5 to A1:	0 0 1 1 1
- GPIB Addressed:	
Listen always:	0
A5 to A1:	0 0 1 1 1

10.3.3.3 HP PaintJet (black/white only)

Make sure the dip switches near the GPIB connector are set to:

- GPIB Listen only:	
NORM/SCS:	NORM
A3 to A1:	1 1 1
PC8/ROM8:	N/A
ENG/MET:	has to match paper size ENG = 11" MET = 12"
- GPIB addressed:	
NORM/SCS:	NORM
A3 to A1:	any combination except 1 1 1 (correspond to add. 0-6)
PC8/ROM8:	N/A
ENG/MET:	has to match paper size ENG = 11" MET = 12"

10.4 Information on GPIB

10.4.1 Introduction

This section is a simple description of the GPIB interface as an aid to understanding the interface in the 9320 DSO: it is not intended as a complete specification of the system.

The GPIB system is designed for the interaction of a number of devices, which may transmit or receive information as required. The system includes data lines over which the actual data are sent, bus management lines for control, and handshake lines to ensure correct acceptance of data at the right destination. The main features of the bus are summarized below:

Maximum number of devices	15
Maximum bus length	20 meters or 2 meters per device, whichever is less
Connection	star or chain

Note that more than half of any connected devices must be powered up, even if they will not be used.

Data lines	8 DIO	1 to 8
Handshake lines	DAV	Data available
	NRFD	Not ready for data
	NDAC	not data accepted
Bus management lines	EOI	End or identity
	IFC	Interface clear
	SRQ	Service request
	ATN	Attention
	REN	Remote enable

Active level	+0.4 V
Inactive level	+3,3 V

Note that all signal lines are active low, and that they are wire 0Red to allow participation by all devices.
In addition, there are 8 ground lines, making a total of 24 lines.

10.4.2 Functions in the GPIB

In order to allow satisfactory interconnection of several devices the following functions must be provided

- Enabling any device to transmit data
- Preventing any device from transmitting data
- Enabling any device to receive data
- Preventing any device to receive data
- Transmitting data to a specific device
- Ensuring that only one device is transmitting
- Ensuring that transmitting takes place only when reception is possible
- Enabling any device to request servicing
- Identify type of data to be sent

Any device can be activated into the "talk" or "listen" state, and can be deactivated by the commands "untalk" and "unlisten". Also a device can be a "controller".

Maximum number of current talkers	1
Maximum number of current listeners	14
Maximum number of current controllers	1

Function of bus lines:

- DAV Data available; talker says the data on the line are valid.

- NRFD Not ready for data; listener says it is not ready for more data. All listeners must release the NRFD line, i.e., let it go high, before talker can send.

- NDAC Not data accepted; listener says it has not yet accepted the data. Talker must hold all data lines steady until all listeners have released this line, i.e., it goes high.

Clearly, the NRFD and NDAC are easy to implement by a wired OR system, so that any one device asserting the signal prevents progress to the next step. Progress is made at the speed of the slowest listener. A simple timing diagram is given in figure 10.1, and another way of presenting the system is given in figure 10.2.

The bus management lines functions as follows:

- EOI End Or Identify; talker sends this with last byte of a block transfer to indicate last byte. Also used with ATN to parallel poll devices for their status bit.

- IFC InterFace Clear; places the GPIB system into a quiescent state.

- SRQ Service ReQuest; any device can send it to the controller to indicate need for attention, and to request interruption of current operations.

- ATN ATeNtion; controller sends this to specify whether DIO lines are to be used for interface messages, e.g., addressing, or for data.

- REN Remote ENable; selects a device as being under local or remote control.

Addressing of the devices on the GPIB bus consult a specialized GPIB-IEEE488 document.

The principles of GPIB are quite simple - the system must wait for all users, and lines are wire ORed so that all can pull the lines down. The handshake sequence is illustrated in two ways. In figure 10.1 the signal waveforms are sketched, while figure 10.2 is a flowchart.

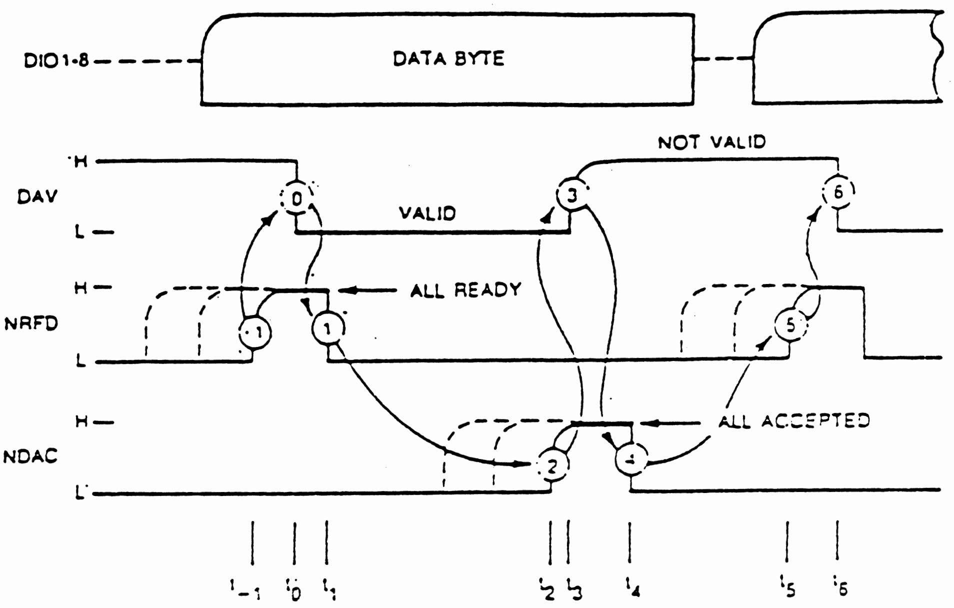


Figure 10.1

DATA BYTE TRANSFER IN GPIB IEEE-488

The handshake timing sequence proceeds as follows:

Preliminary	The source checks for presence of listeners and places the next data byte on the data lines DI01-8.
t-1	Acceptors one by one become ready for byte. Last one allows NRFD to go high.
t0	Sources pulls down DAV to validate data.
t1	The first litener to accept the data pulls down NRFD to show it is no longer ready for a new byte.
t2	The listeners one by one accept the data, and the last one lets NDAC go high.
t3	The source sets DAV high to show this byte is no longer valid.
t4	The listeners one by one accept this, the first one pulling NDAC low for the next cycle.
t5	As for t-1.

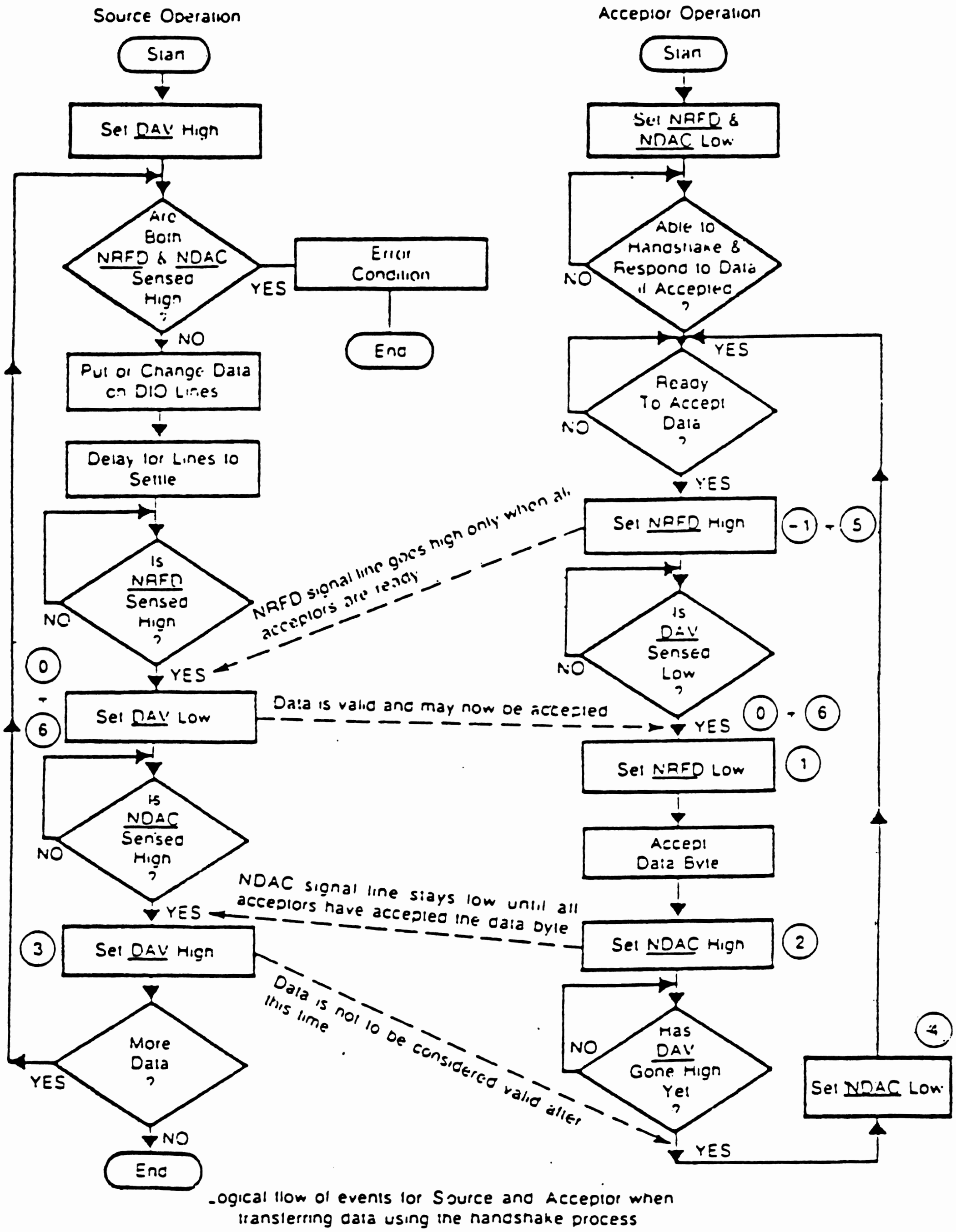


Figure 10.2

HANDSHAKE TIMING SEQUENCE IN GPIB IEEE-488

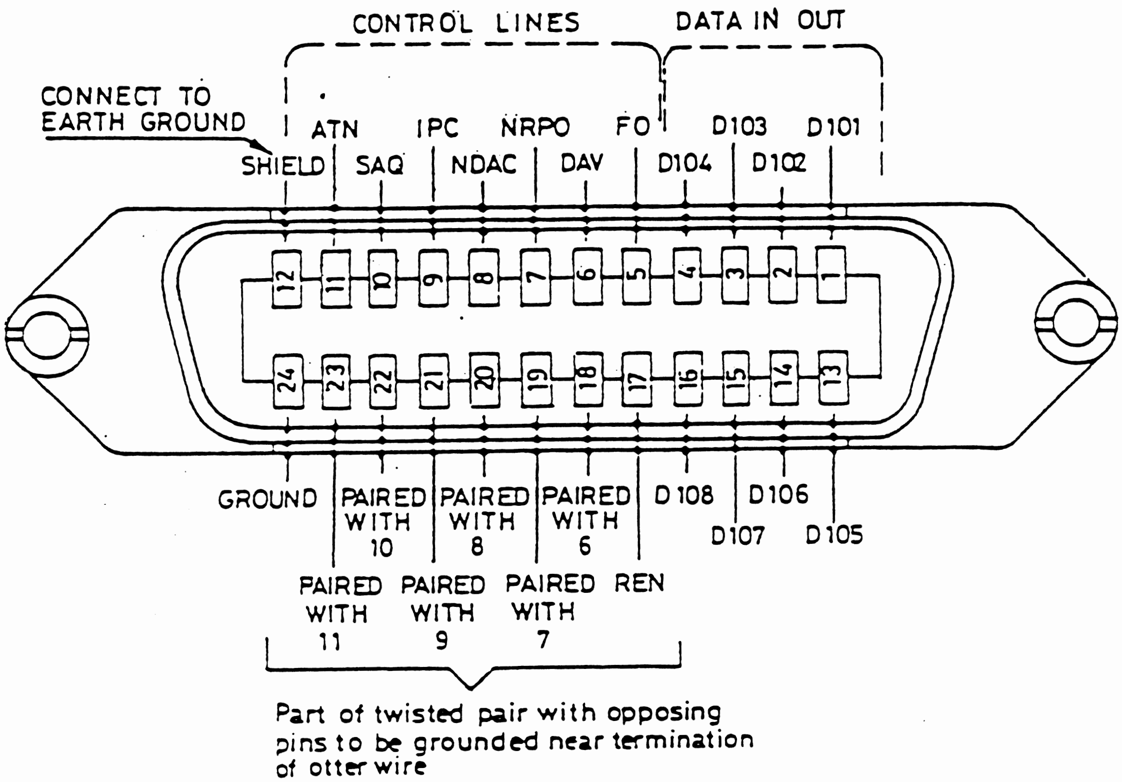


Figure 10.3

GPIB IEEE-488 INTERFACE