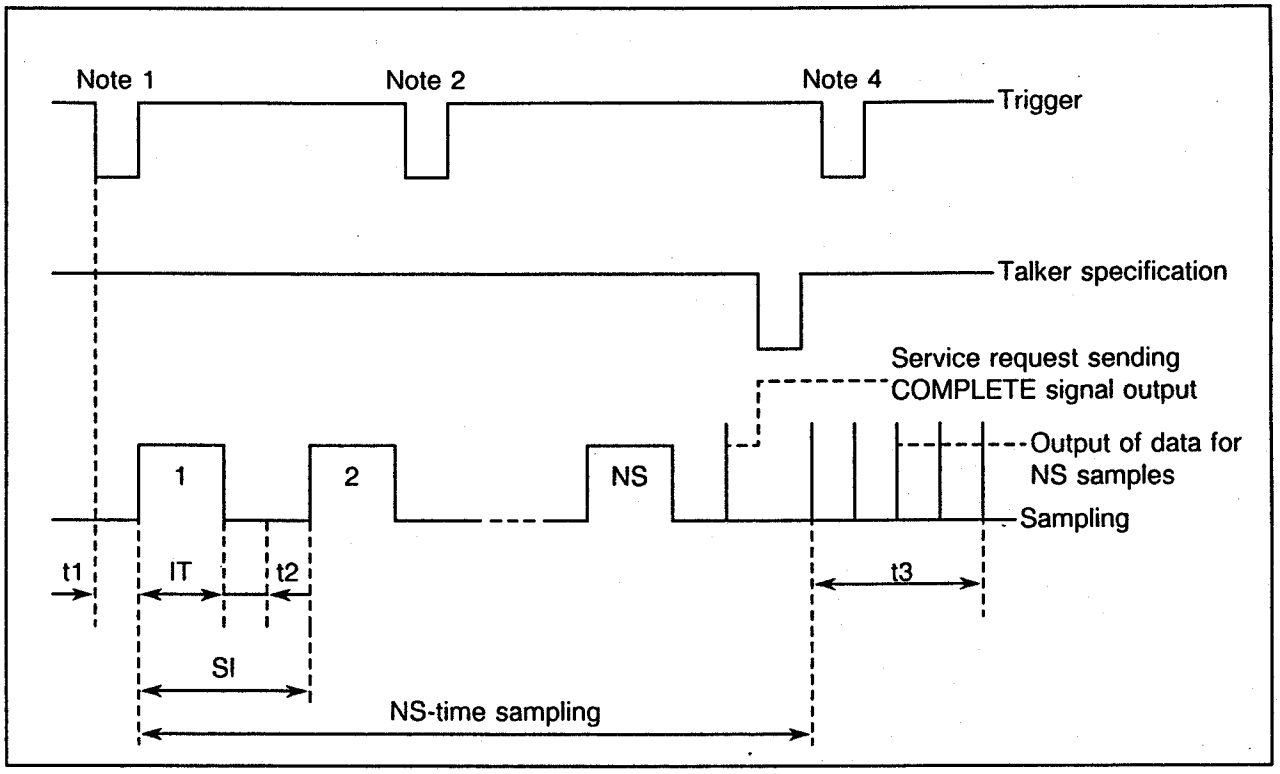
4. MULTI-SAMPLING BULK OUTPUT

Multi-sampling bulk output is the sampling mode selectable only in the GPIB system.

4.1 Measurement Operation in MULTI BULK Sampling Mode

When the trigger signal is input, sampling is performed NS times at intervals of SI. The BUSY lamp is lit during this sampling. After sampling is performed NS times, the sampling complete and data output ready service request is sent in the "SO"mode. At the same time, the COMPLETE signal is output. When data output is requested, all measurement data for NS samples are output to the GPIB at a time.



- DELAY : Fixed to 0 ms
- IT : Integral time
- SI : Sampling interval
- A CAL : Fixed to OFF
- A ZERO : OFF
- t1 : Internal delay time between reception of trigger signal and start of measurement
- t2 : 2ms (internal processing time)
- t3 : Hand shake time

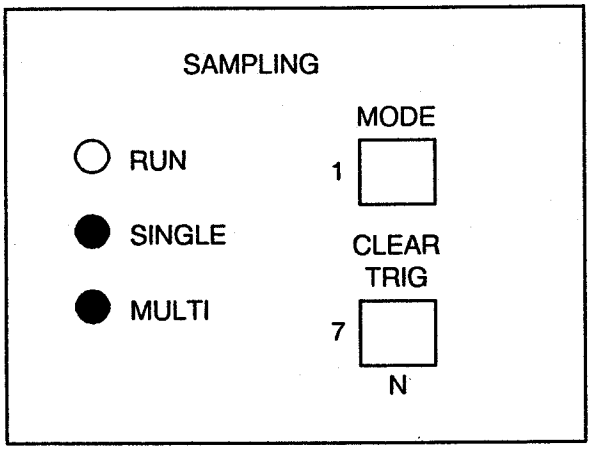
CAUTION

1. The trigger signal can be input from the GPIB and trigger signal input terminal.
2. The trigger signal sent during NS sample measurement is ignored.
3. The trigger signal sent from the trigger signal input terminal during the following processing is ignored:
   - "AC" A CAL Execution
   - "TE" TEST Execution
   - "LFd" LINE Althernation
   - "ITd" IT Alternation
   - "AZ1" A ZERO ON Alternation
   - "Fd" FUNCTION Alternation
   - "Rd" RANGE Alternation
   - "NL1" NULL ON Alternation
   - "ABd" SLOW Alternation
4. Upon reception of the trigger signal during data output, NS-time sampling measurement is started, and further data output is performed in an idle time.
   The second and following trigger signals during data output are ignored.

4.2 MULTI BULK Sampling Mode Setting

To set the MULTI BULK sampling mode, specify "M3" from the GPIB. Program code "M3" should be set independently.

When the MULTI BULK sampling mode is set, the SINGLE and MULTI lamps come on. At the same time, the data in the previous sampling mode is cleared and blanks are displayed on the display unit.



When the MULTI BULK sampling mode is set, the following parameters are automatically set.

- D OUT : Mode 0
- A CAL : OFF
- AUTO : OFF
- DELAY : 0 ms
- NS : 1 to 1000
- STORE : OFF
- RECALL : OFF
- SMOOTH : OFF
- COMPUTE : OFF

CAUTION

1. When the MULTI BULK mode is set, the A CAL parameter is set to OFF. To execute automatic calibration, instruct it with code "AC".
2. In the MULTI BULK mode, NS is changed to 1000 if NS is larger than 1000.

4.3 Parameter Setting in MULTI BULK Sampling Mode

The parameters automatically set for the MULTI BULK mode shown in section 4.2 cannot be changed while the MULTI BULK mode is set except for the NS parameter.

In the MULTI BULK mode, the set range and conditions of the following parameters are changed.

- IT : 6.666 or 8.333ms can be specified for the integral time. Specify "ITdd" from the GPIB.

"IT9"	Integral time: 6.666ms, Number of digits displayed: Equivalent to 6 1/2 digits
"IT10"	Integral time: 8.333ms, Number of digits displayed: Equivalent to 6 1/2 digits

  If the integral time is set to 6.666ms or 8.333ms and the sampling mode is set to other than the MULTI BULK mode, the IT parameter is automatically changed to 10ms.

- SI : The sampling interval can be set at intervals of 0.5ms. Specify "SId..d.d" from the GPIB to set the sampling interval. If the SI parameter is set at intervals of 0.5ms and the sampling mode is set to other than the MULTI BULK mode, the SI parameter is automatically set by discarding the values with fractions (0.5ms).

If the measurement conditions are changed in the MULTI BULK mode after completion of NS-time measurement and generation of outputtable data, the data of the measurement under the previous conditions is cleared. If the measurement conditions are changed during NS-time measurement, however, the data of the measurement under the previous conditions is not cleared.

4.4 End of MULTI BULK Sampling Mode

To change the sampling mode from the MULTI BULK mode to other mode, specify "Md" or press the MODE key. Then, the measurement data in the MULTI BULK mode is cleared.

4.5 Initialization for MULTI BULK Sampling Mode

Pay attention to the following points concerning the initialization for the MULTI BULK sampling mode.

- If the power is turned ON or program code "C" is instructed, the sampling mode is not initialized.
- If the parameters are initialized or program code "Z" is instructed, the sampling mode is initialized to RUN.

4.6 Output in MULTI BULK Sampling Mode

In the MULTI BULK sampling mode, the measurement data is output only to the GPIB. The measurement data is not output to the display. In response to the data output request from the GPIB, the measurement data of NS samples is output to the GPIB alogether.

The output format for the MULTI BULK sampling mode is as follows:

E±dd SL DATA(1) DATA(2) --------- DATA(NS) DL
① ② ③ ③ ④

			Number of bytes
① Exponent	:	4 bytes (ASCII)	4
② String delimiter	:	CR + LF	2
③ Data	:	4 bytes (binary) * NS	4 * NS
④ Block delimiter	:	CR + LF (EOI)/LF/(EOI)	0 to 2

CAUTION

1. Specify CR + LF in "SL2" for the string delimiter. If other one is specified, the operation will be stopped upon a string delimiter output.
2. If measurement data overflow occurs, the data is output as follows:
   Data overflow in + : 99999999
   Data overflow in - : -99999999

4.7 Program Examples

(1) HP version program example

```
10    !
20    !
30    !
40    DIM Head$[10]
50    INTEGER Tq,Cnt,Ccnt
60    REAL Y(1000),X,Z
70    Tq=701
80    Cnt=10
90    Ccnt=Cnt*2-1
100   ALLOCATE INTEGER Dbuf(Ccnt)
110   !
120   ON INTR 7 GOSUB Srq
130   OUTPUT Tq;"DL2,SL2,CS,SO,MS174,AZO"
140   OUTPUT Tq;"NS",Cnt
150   OUTPUT Tq;"M3"
160   !
170   OUTPUT Tq;"IT3,SI50"
180   ENABLE INTR 7;2
190   !
200   OUTPUT Tq;"E"
210   Wait_f=0
220   IF Wait_f=1 THEN 200
230   GOTO 220
240   !
250 Srq:STATUS 7,1;X
260   S=SPOLL(Tq)
270   IF S<>81 THEN 390
280   ENTER Tq;Head$
290   PRINT Head$
300   ENTER Tq USING "#,W";Dbuf(*)
310   FOR I=0 TO Cnt-1
320     X=Dbuf(2*I)*2^16
330     Z=Dbuf(2*I+1)
340     IF Z<0 THEN Z=Z+65536
350     Y(I)=Z+X
360     PRINT Y(I)
370   NEXT I
380   Wait_f=1
390   ENABLE INTR 7;2
400   RETURN
410   !
420   DEALLOCATE Dbuf(*)
430   END
```

(Output data)

```
E-07
 9. 98262E+6
 9. 98262E+6
 9. 98262E+6
 9. 98262E+6
 9. 98261E+6
 9. 98261E+6
 9. 98262E+6
 9. 98262E+6
 9. 98262E+6
 9. 98261E+6
```

	Description
10	!
20	!
30	!
40	Defines the header data area.
50	Defines the variable name.
60	Defines the data area.
70	Sets R6871E's address to variable "Tq".
80	Substitutes the number of sampling times to the variable.
90	Calculates the area for binary data from the number of sampling times.
100	Allocates the memory area for binary data.
110	!
120	Defines the interrupt processing routine.
130	"DL1" : Block delimiter: EOI "SL2" : String delimiter: CRLF "CS" : Clears the status bytes. "SO" : SRQ send ON "MS174" : Masks the status bytes. "AZO" : Sets the automatic zero calibration to OFF.
140	"NS10" : The number of sampling times: 10
150	"M3" : Sampling mode: MULTI BULK
160	!
170	"IT3" : Integral time: 1PLC "SI50" : Sampling interval: 50ms
180	Permission of SRQ receiving
190	!
200	"E" : Trigger
210	Substitutes 0 to the flag (Wait__ f).
220	Branches to 200 if the flag (Wait__ f) is set to 1.

	Description
230	Branches to 220.
240	!
250	Interrupt processing routine name : Polling to read the status.
260	
270	Branches to 390 otherwise the status byte is 81.
280	Reception of the header data.
290	Display of the header data.
300	Reads the binary data.
310	Loops for 10 sampling data.
320	Calculates the highest 2 bytes.
330	Calculates the lowest 2 bytes.
340	Converts the negative value to the positive value.
350	Substitutes the data to the buffer.
360	Displays the data.
370	Loop.
380	Substitutes 1 to the flag (Wait__ f).
390	Permission of SRQ receiving
400	RETURN
410	!
420	Release the binary data memory area.
430	End of the program.

(2) PC version program example

```
10    '*****************************************************
20    '      MULTI SAMPLING BULK OUTPUT
30    '
40    '      SAMPLING MODE : MULTI BULK
50    '*****************************************************
60    '
70    DIM HEAD$(10), Y(1000)
80    NS=10
90    UNL=&H3F : UNT=&H5F : MTA=&H40 : MLA=&H20
100   A71=1    : APC=IEEE(1) AND &H1F
110   TLK=MTA+A71 : LSN=MLA+APC
120   CMD DELIM=0
130   ISET IFC : ISET REN
140   POLL A71,S
150   GOSUB *CLRSRQ
160   ON SRQ GOSUB *SRQINT
170   '
180   GOSUB *SETPARA
190   SRQ ON
200   '
210   NS.END=0
220   PRINT @A71;"E"
230   WHILE NS.END=0 : WEND
240   GOTO 210
250   END
260   '
270   *SETPARA
280     PRINT @A71;"DL2,SL2,CS,SO,MS172,AZO"
290     PRINT @71;"M3"
300   '
310     PRINT @71;"IT3,SI50,"+"NS"+STR$(NS)
320     RETURN
330   '
340   *SRQINT
350     POLL A71,S
360     IF S <>81 THEN 490
370     INPUT @A71;HEAD$ : PRINT HEAD$
380     WBYTE UNL,TLK,LSN;
390     FOR I=0 TO NS-1
400       RBYTE;Y1
410       RBYTE;Y2
420       RBYTE;Y3
430       RBYTE;Y4
440       YY1=Y1*2^8+Y2 : YY2=Y3*2^8+Y4
450       IF 2^15<=YY1 THEN YY1=YY1-2^16
```

(cont'd)

```
460       Y(I)=YY1*2^16+YY2 : PRINT Y(I)
470     NEXT I
480     NS.END=1
490     SRQ ON
500     RETURN
510   '
520   *CLRSRQ
530     DEF SEG=&H60
540     A%=PEEK(&H9F3)
550     A%=A% AND &HBF
560     POKE &H9F3,A%
570     RETURN
580   '
```

	Description
60	'
70	Defines the data area.
80	Substitutes 10, the number of sampling times to variable "NS".
90	Allocates the interface message code to the variable.
100	Substitutes R6871E's address and controller's address to variable "A71" and variable "APC" respectively.
110	Substitutes the talker address and listener address to each variable.
120	Specifies CR + LF for the delimiter.
130	Interface clear remote enable.
140	Serial polling.
150	Clears the SRQ signal in the GPIB of the PC9801.
160	Specifies the heading address for the SRQ subroutine.
170	'
180	Set each parameter for R6871E.
190	Permission of SRQ receiving.
200	'
210	Clears the interrupt processing completion flag.

	Description
220	"E": Trigger.
230	Loop until the interrupt processing is completed.
240	Branches to 210 for performing sampling NS times.
250	Completes program execution.
260	'
270-320	Sets each parameter for R6871E.
280	"DL2" : Plotter delimiter (EOI) "SL2" : String delimiter : CR, LF "CS" : Clears the status bytes "SO" : SRQ sending : ON "MS172" : Masks the status bytes excluding bits 0, 1, 4 and 6. "AZO" : Automatic zero calibration : OFF
290	"M3" : Sampling mode : MULTI BULK
300	'
310	"IT3" : Integral time : 1PLC "SI50" : Sampling interval : 50ms "NS10" : Number of sampling times : 10
320	RETURN
330	'
340-500	Interrupt processing routine.
350	Serial polling.
360	Branched to 490 if no service request is output after sampling is completed specified times.
370	Receives and displays the specified data.
380	Set this unit as the talker and the controller as the listener.
390-470	Loop by the specified number of sampling times.
400-430	Read the data by one byte from higher bytes. (4 bytes for one block of data)
440	Calculates the highest 2 bytes and lowest 2 bytes.
450	Generates the negative value.
460	Substitutes the data to the buffer and displays.

	Description
470	Counter +1, Loops back to 390.
480	Sets the interrupt processing completion flag.
490	Permission of SRQ receiving.
500	RETURN
510	'
520-570	Clears the SRQ signal in the GPIB of PC9801.
580	'

MEMO

5. GPIB INTERFACE

5.1 General

The R6871E/E-DC is equipped with the GPIB interface in standard configuration, allowing connection with the IEEE standard 488-1978 measurement bus GPIB.

The standard and functions of the GPIB interface are described here in this chapter.

5.2 Outline of the GPIB

The GPIB is an interface system that can connect the measuring device with the controller and peripheral devices with a simple cable (bus line).

Compared with conventional interfaces, the GPIB is superior in its expandability, easy to use, and has electrical as well as mechanical and functional compatibility with products of other manufacturers. A single bus cable can structure simple to high function automatic measuring systems.

In the GPIB system, the "address" of the various devices connected to the bus line must first be set. These devices can act as the controller, the talker, and/or the listener.

During system operation, a single "talker" can send data to the bus line, but multiple "listener" can receive the data.

The controller specifies the address of the "talker" and the"listener", to transmit data form the "talker" to the "listener" or the controller itself ("talker") can set measurement conditions to the "listener".

8 data lines of bit parallel, byte serial form are used for data transmission between each device, and transmission is done to both direction asynchronously. As the system is an asynchronous system, high-speed devices and low-speed devices can freely be mixed and connected together.

The data (message) transmitted and received between the devices includes measurement data, measurement conditions (program), or various commands. The data is expressed in ASCII codes.

Besides the above 8 data lines, the GPIB has 3 hand-shake lines to control asynchronous data exchange between devices as well as 5 control lines to control the information flow on the bus.

- The hand-shake line uses the following signals.

  DAV (data valid) : A symbol that indicates whether the data is effective.
  NRFD (not ready for data) : A symbol that indicates the data reception ready status.
  NDAC (data not accepted) : A symbol that indicates end of reception.

- The following signals are used in the control line.

  ATN (attention) : A signal used to distinguish whether the signal on the data line is address, command, or other information.

IFC (interface clear)	:	A signal used to clear the interface.
EOI (end or identify)	:	A signal used to end transmission of information.
SRQ (service request)	:	A signal used to request service from an optional device to the controller.
REN (remote enable)	:	A signal used for remote control of remote-programmable devices

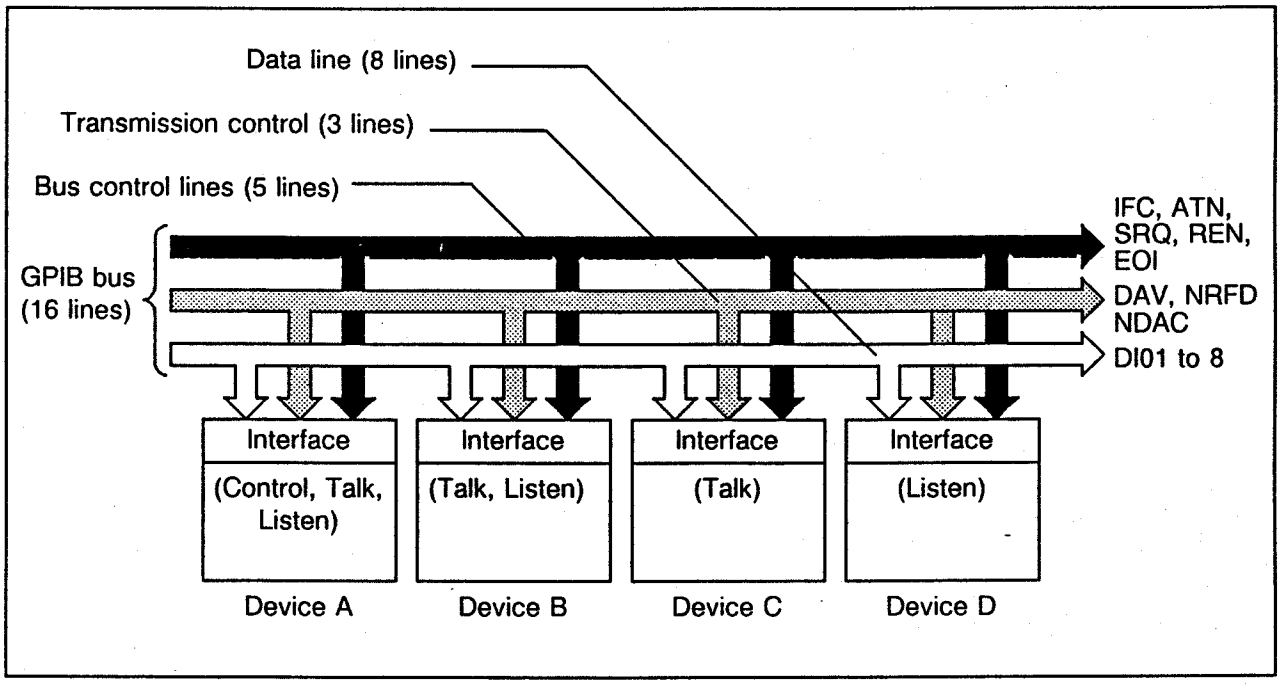


Figure 5-1 GPIB

5.3 Specification of the GPIB

Standard	:	IEEE standard 488-1978
Used code	:	ASCII code
Logical level	:	Logical 0 "High" state : +2.4V or more Logical 1 "Low" state : +0.4V or less
Signal line termination	:	The 16 bus lines are terminated as shown below.

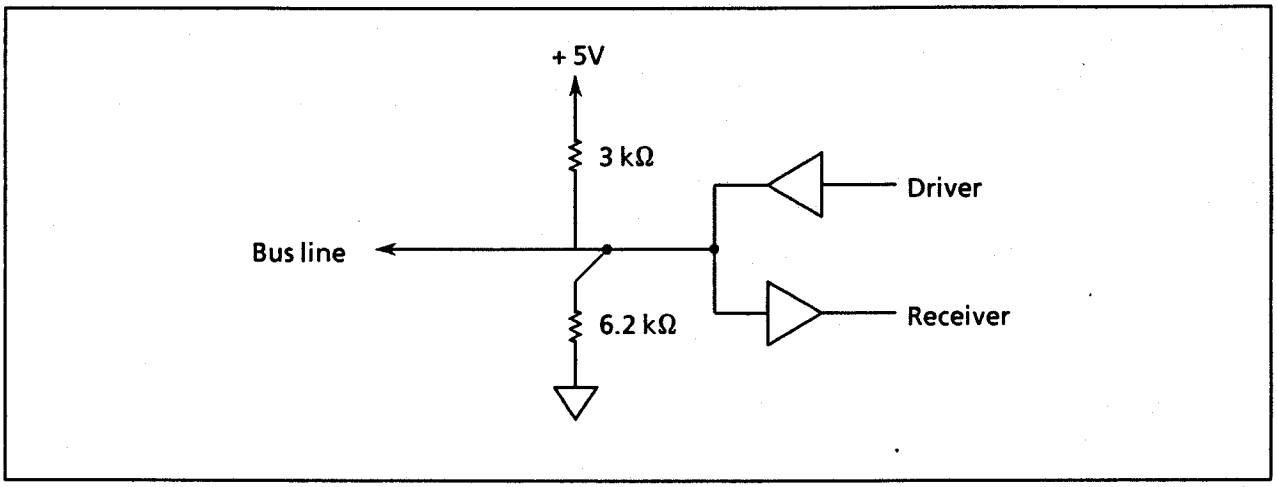
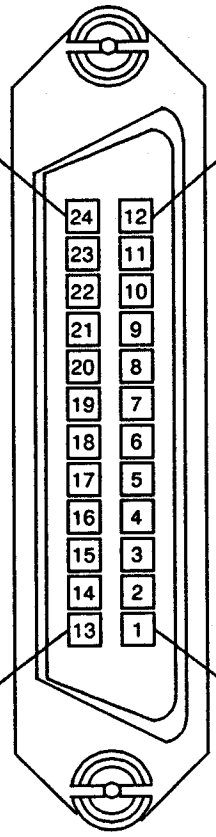


Figure 5-2 Termination of Signal Lines

Driver specification	:	Try state system "Low" status output voltage : +0.4V or less 4.8mA "High" status output voltage : +2.4V or more –5.2mA
Receiver specifications	:	"Low" status with +0.6V or less "High" status with +2.0V or more
Bus cable length	:	Total length of bus cable is (devices connected to the bus) × 2m or less, and must not exceed 20m.
Address designation	:	By selecting the GPIB key on the front panel, 31 kinds of talk address/listen address can be optionally set.
Connector	:	24-pin GPIB connector 57FE-20240-20SD35 (Daiichi Denshi Kogyo's product or equivalent)

24-pin GPIB connector

Signal name	Pin No.
GND LOGIC	24
GND (ATN)	23
GND (SRQ)	22
GND (IFC)	21
GND (NDAC)	20
GND (NRFD)	19
GND (DAV)	18
REN	17
DIO 8	16
DIO 7	15
DIO 6	14
DIO 5	13



Pin No.	Signal name
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO 4
3	DIO 3
2	DIO 2
1	DIO 1

Figure 5-3 GPIB Connector Pin Arrangement

Interface functions : See Table 5-1.

Table 5-1 Interface Functions

Code	Function and description
SH1	Source hand-shake function
AH1	Acceptor hand-shake function
T5	Basic talker function, serial pole function, talk only mode function, talker reset function by listener designation
L4	Basic listener function, listener reset function by talker designation
SR1	Service request function
RL1	Remote/local switching function
PP0	No parallel function
DC1	Device-clear function ("SDC", "DCL" commands can be used)
DT1	Device trigger function ("GET" command can be used)
C0	No controller function
E2	3-state bus driver is used

5.4 How to Handle the GPIB

5.4.1 Connection with the System Devices

The GPIB system is structured by multiple devices, and preparation of the entire system must be done taking care of the following points.

(1) Refer to the instruction manuals of the R6871E/E-DC, controller and peripheral devices, to check the status and operation of each devices, before connection.

(2) Be careful not to leave the connection cable with the measuring device and the bus cables connected to the controller, etc. unnecessarily long. The bus cable length must not exceed the standard. The length of all bus cables must be kept (number of devices connected to the bus) × 2m or less, and must not exceed 20m.

We also offer the following standard bus cables.

Table 5-2 Standard Bus Cable (Option)

Length	Name
0.5m	408JE-1P5
1m	408JE-101
2m	408JE-102
4m	408JE-104

(3) When connecting the bus cable, be careful not to connect 3 or more connectors. Also tighten the connector firmly with the fix-screws.
The bus cable connector are piggy-back type with both male and female on a single connector, and can be connected together.

(4) Check the electrical conditions, grounding state, or if necessary, the setting conditions of each system device before supplying power to each system device.
The power of all devices connected to the bus must be turned ON. If there is a single device which power is not supplied, the operation of the entire system cannot be assured.

(5) Before fitting or removing the bus cable, always remove the power cable out of the wall outlet.

5.4.2 Preparation for Operation

The following preparation must be done before measurement from the GPIB.

(1) Connect the object of measurement to the R6871E/E-DC.

(2) Check the following three points by the GPIB key on the front panel.

(a) Device address (0 to 30)

(b) The R6871E/E-DC address mode (Addressible/Talk only)

(c) Format mode when outputting measurement data (Header ON/OFF)

(3) If other panel setting is required, set as necessary.

*1 Refer to 2.8 for how to set.

*2 On device address
There are also controllers in which addresses 0 to 30 as well as the corresponding ASCII code must be written.
Refer to the following Table 5-3 for the corresponding ASCII codes.

Table 5-3 ASCII Code - Address Code Cross Reference Table

ASCII code character		Decimal codes
LISTEN	TALK	
SP	@	00
!	A	01
"	B	02
#	C	03
$	D	04
%	E	05
&	F	06
'	G	07
(	H	08
)	I	09
*	J	10
+	K	11
,	L	12
-	M	13
.	N	14
/	O	15
0	P	16
1	Q	17
2	R	18
3	S	19
4	T	20
5	U	21
6	V	22
7	W	23
8	X	24
9	Y	25
:	Z	26
;	[	27
<	\	28
=	]	29
>	–	30

5.4.3 General Notes on Operation

(1) Notes on using the only-mode

> CAUTION
>
> When using the only-mode, do not use (operate) the controller at the same time.
> When the controller is used under the only-mode, normal operation cannot be guaranteed.

(a) Refer to 2.8 for how to set the only-mode.

(b) Also set the address mode of the other device connected via the bus line to only-mode.

(2) Notes on changing the address setting during operation
When the address of the main device is changed during operation, operation can be continued, but in case the old address is specified from the controller, it will be ignored.

(3) The status of this device is as shown in the following Table 5-4 when power is supplied or when various commands are received.

(4) In case "ATN" interrupts message transmission between devices, the "ATN" is granted priority, and the previous state will be cleared.

Table 5-4 Interface Functions

Command Code	Talker (with lamp)	Listener (with lamp)	Remote (with lamp)	SRQ (with lamp)	Status byte	Transmis-sion data
POWER ON	Clear	Clear	Local	Clear	Clear	Clear
IFC	Clear	Clear	—	—	—	—
"DCL", "SDC" command	Clear	—	—	Clear	Clear	Clear
"C"*, "Z"* code	Clear	Set	Remote	Clear	Clear	Clear
"GET" command	Clear	—	—	—	Clear bit b0	Clear
"E"* code	Clear	Set	Remote	—	Clear bit b0	Clear
Talker designation to this device	Set	Clear	—	—	—	—
Talker reset command	Clear	—	—	—	—	—
Listener designation to this device	Clear	Set	—	—	—	—
Listener reset command	—	Clear	—	—	—	—
Serial polling	—	Clear	—	Clear	—	—

(Note) "*" is the program code.

5.5 Talker Format

The talker format can be divided into basic format, data memory output format, statistical operation output format, statistical operation output format and multi-sampling bulk output format.

The output data is output in ASCII code. In the multi-sampling bulk output format, however, the mantissa data is output in binary notation.

Next comes explanation on these formats.

5.5.1 Basic Format

(1) The basic format is expressed in the following form.

XXYZ ± dd.dddddd E ± dd CR/LF(EOI) . . . . . (1)
① ② ③ ④

① Header
② Mantissa part
③ Exponential part
④ Delimiter

There are 12 types of pattern available for the basic format.

ⓐ XXYZ ± dd.dddE ± ddCR/LF(EOI)
ⓑ XXYZ ± dd.dddE ± ddLF
ⓒ XXYZ ± dd.dddE ± dd(EOI)
ⓓ ± dd.dddE ± ddCR/LF(EOI)
ⓔ ± dd.dddE ± ddLF
ⓕ ± dd.dddE ± dd(EOI)
ⓖ XXYZ ± dd.ddddE ± ddCR/LF(EOI)
ⓗ ± dd.ddddE ± dd(EOI)
ⓘ XXY ± Z dd.dddddE ± ddCR/LF(EOI)
ⓙ ± dd.dddddE ± dd(EOI)
ⓚ XXYZ ± dd.ddddddE ± ddCR/LF(EOI)
ⓛ ± dd.ddddddE ± dd(EOI)

When the above is arranged with headers, measurement digits, delimiters, number of characters (bytes), it becomes as shown in the following table.

Table 5-5 Basic Format

	Header	Measurement digits	Delimiter	Number of characters (bytes)
ⓐ	ON	4 1/2 digits	CR/LF (EOI)	17
ⓑ	ON	4 1/2 digits	LF	16
ⓒ	ON	4 1/2 digits	(EOI)	15
ⓓ	OFF	4 1/2 digits	CR/LF (EOI)	13
ⓔ	OFF	4 1/2 digits	LF	12
ⓔ	OFF	4 1/2 digits	(EOI)	11 (Minimum)
ⓖ	ON	5 1/2 digits	CR/LF (EOI)	18
ⓗ	OFF	5 1/2 digits	(EOI)	12
ⓘ	ON	6 1/2 digits	CR/LF (EOI)	19
ⓙ	OFF	6 1/2 digits	(EOI)	13
ⓚ	ON	7 1/2 digits	CR/LF (EOI)	20 (Maximum)
ⓛ	OFF	7 1/2 digits	(EOI)	14

CAUTION

Both "CR" and "LF" already exist as ASCII codes, so they are both counted as 1 byte. The single line signal "EOI" is transmitted by another signal line, and is not counted as a character (byte).

(2) Description

① Header (4-digit alpha-numerical character or omitted): XXYZ

The header expressed the type of output data. Structure by 2 main header characters (XX) and 2 subheader characters (YZ).
The main header (XX) and subheader (YZ) represents the following.

ⓐ Main header (XX) . . . . . Type of measurement function

ⓑ Subheader (Y) . . . . . Type of primary operation

ⓒ Subheader (Z) . . . . . Type of secondary operation

The header is omitted when the header mode is set OFF. The types of measurement function, primary operation, and secondary operation of the main and subheaders are given in the following 3 tables.

Table 5-6 Interface Basic Format Header (1/2)

Main header (XX)	Type of output data
DV	DC voltage measurement
AV	AC voltage measurement
	(DC + AC) voltage measurement
DI	DC measurement
AI	AC measurement
	(DC + AC) current measurement
R	Resistance measurement

Subheader (Y)	Type of primary operation, etc.
␣ (Space)	Off
S	Scaling
P	% deviation
D	delta
M	multiply
B	Decibel conversion
R	Real value
W	dBm conversion
T	Resistance value temperature amendment
O	Over-scale data
E	Operation error data

Table 5-6 Interface Basic Format Header (2/2)

Subheader (Z)	Type of secondary operation
␣ (Space)	Off
H	Comparator 1, comparator 2 R(HIGH1), R(HIGH2)
P	Comparator 1, comparator 2 R(PASS)
L	Comparator 1, comparator 2 R(LOW1), R(LOW2)
C	Statistical processing (number of samples)
X	Statistical processing (Maximum value)
N	Statistical processing (Minimum value)
A	Statistical processing (Average)
K	Statistical processing (Inconstant width)
S	Statistical processing (Standard deviation)
Y	Statistical processing (Upper control line)
Z	Statistical processing (Lower control line)

(Example) Actual example of basic format header

DV␣␣ : Direct current voltage measurement data

DVM␣ : Data gained by primary operation processing (multiply) after measurement of the direct current voltage.

R␣TH : Data gained by primary operation processing (resistance value temperature conversion), secondary operation processing (comparator), resulted HIGH after measurement of the resistance.

Note: When comparator 1 or 2 is executed in the second function, header H is output if the result of function is R(HIGH1) or R(HIGH2), or header L is output if the result is R(LOW1) or R(LOW2). When the result of the function of comparator 1 is R(HIGH1) or R(HIGH2), and R(LOW1) or R(LOW2), the header is to be space ' '.

② Mantissa part
(polarity + decimal point + 4 1/2 to 7 1/2 digit number): ±dd.dddddd

The mantissa part of the measured value outputs digits and decimal position corresponding to the display of this device in 7 to 10-byte variable length including polarity and decimal point.
" + " or "-" code is output as polarity for direct current voltage/current and 2-line resistance measurement.
The space code " " is output in other cases.
The mantissa part and exponential part under various measurement conditions are shown in Table 5-7.

③ Exponential part
("E" + polarity + 2-digit numeral) : E±dd

The exponential part data is decided according to the measurement function and measurement range. This is done to express all measurement data by the basic units (V, A, Ω).
Table 5-7 is the mantissa part and exponential part under various measurement conditions.
The exponential part is related to the unit of the measurement range.
Note the measurement range unit in the table and the numeral of the exponential part. The following relation can be observed.

μA, μV	E–06
mA, mV, mΩ	E–03
A, V, Ω	E+00
kΩ	E+03
MΩ	E+06

(Example) 2000mV range
When the mantissa part display is 30.0000, it is 30mV. The exponential part of this range is –3, so

$30 \times 10^{-3} = 0.03$ (V)

The above 0.03 is 30mV expressed in the basic unit (V).

Table 5-7 Mantissa and Exponential Parts Under Various Measurement Conditions

Function	Range	Mantissa part	Exponential part
Direct current voltage measurement	200mV	± ddd.dddd	E–03
	2000mV	± dddd.dddd	E–03
	10V, 20V	± dd.dddddd	E + 00
	200V	± ddd.ddddd	E + 00
	1000V	± dddd.dddd	E + 00
Alternative current voltage measurement (Alternating current + Direct current)	200mV	ddd.ddd	E–03
	2000mV	dddd.dd	E–03
	20V	dd.dddd	E + 00
	200V	ddd.ddd	E + 00
	500V	0dd.ddd	E + 00
Direct current voltage measurement	2000μA	± dddd.ddd	E–06
	20mA	± dd.ddddd	E–03
	200mA	± ddd.dddd	E–03
	2000mA	± dddd.ddd	E–03
Alternative current voltage measurement (Alternating current + Direct current)	2000μA	dddd.dd	E–06
	20mA	dd.dddd	E–03
	200mA	ddd.ddd	E–03
	2000mA	dddd.dd	E–03
Resistance measurement (2WΩ)	10Ω	± dd.ddddd	E + 00
	100Ω	± ddd.ddddd	E + 00
	1000Ω	± dddd.dddd	E + 00
	10kΩ	± dd.dddddd	E + 03
	100kΩ	± ddd.ddddd	E + 03
	1000kΩ	± dddd.dddd	E + 03
	10MΩ	± dd.dddddd	E + 06
	100MΩ	± ddd.ddddd	E + 06
	1000MΩ	± dddd.dddd	E + 06
Resistance measurement (4WΩ)	10Ω	dd.ddddd	E + 00
	100Ω	ddd.ddddd	E + 00
	1000Ω	dddd.dddd	E + 00
	10kΩ	dd.dddddd	E + 03
	100kΩ	ddd.ddddd	E + 03
	1000kΩ	dddd.dddd	E + 03
	10MΩ	dd.dddddd	E + 06
	100MΩ	ddd.ddddd	E + 06
	1000MΩ	dddd.dddd	E + 06

d : Numerals from 0 to 9 (Depends on the measurement data)

* The following message is displayed in case of measurement-over.

XXO ±99999.E+19	(4 1/2 digit measurement)
XXO ±999999.E+19	(5 1/2 digit measurement)
XXO ±9999999.E+19	(6 1/2 digit measurement)
XXO ±99999999.E+19	(7 1/2 digit measurement)

* The following message is displayed in case of operation error.

XXE 99999.E+19	(4 1/2 digit measurement)
XXE 999999.E+19	(5 1/2 digit measurement)
XXE 9999999.E+19	(6 1/2 digit measurement)
XXE 99999999.E+19	(7 1/2 digit measurement)

Note: As in the basic format, both the mantissa and exponential parts outputs the digits and decimal position corresponding to the display of this device on execution of operation.
See 5.5.3 for details on the output format of the result of statistical processing operation.

④ Block delimiter

Output to indicate end of one data.
The block delimiter can be selected from the following 3 types, according to the program code "DLd".

(a) Outputs 2-byte data of "CR", "LF". When "LF" is output, the single line signal "EOI" is also output at the same time.

(b) Outputs the 1-byte data of "LF".

(c) Outputs the signal lien signal "EOI" at the same time as the final byte of the data.

CAUTION

Both "CR" and "LF" already exist as ASCII code, so "CR" is counted as 1 byte.
The single line signal "EOI" is sent by another signal line, and is not counted as a character (byte).

5.5.2 Data Memory Output Format

(1) When data stored in data memory is recalled, the following output formats are used.
When batch output of data in data memory is executed:
(program code "BO")

DCNTddddd<u>CR/LF(EOI)</u> . . . . . ①	Output data number (header + five-digit number)
NO ±dddd, XXYZ ±dd.ddddddE ±dd_↓ . . . . . ②	Recall data Data number (header + polarity + four-digit number) Content of data (the same as the basic format)
NO ±dddd, XXYZ ±dd.ddddddE ±dd<u>CR/LF(EOI)</u> ①	

When data is output continuously by specified number from specified data No.
(program code "RD ±d..d, ±d..d")

NO ±dddd, XXYZ ±dd.ddddddE ±dd_↓ . . . . . ②	Recall data
NO ±dddd,XXYZ ±dd.ddddddE ±dd<u>CR/LF(EOI)</u> ①	

When data for specified data No. is output one by one
(program code "RD ±d..d", "RN", "RP")

NO ±dddd, XXYZ ±dd.ddddddE ±dd<u>CR/LF(EOI)</u> ② . . .	Recall data

(2) Explanation

① Block delimiter : Output to indicate the end of one piece of data.

② String delimiter : Output to indicate the end of one string.

Whether data No. is output or not can be specified by program code "NOd".

5.5.3 Output Format of the Result of Statistical Operation

(1) The following formats are used when the result of statistical operation is output.

XXYC ddddd②	Sample number (header + five-digit number)
XXYX ±ddd.dddddE±dd, ...	Maximum value (Same as the basic format)
XXYN ±ddd.dddddE±dd, ...	Minimum value (Same as the basic format)
XXYA ±ddd.dddddE±dd, ...	Average (Same as the basic format)
XXYK ±ddd.dddddE±dd, ...	Inconstant width (Same as the basic format)
XXYS ±d.ddd0000E±dd, ...	Standard deviation (Same as the basic format)
XXYY ±ddd.dddddE±dd, ...	UCL (Same as the basic format)
XXYZ ±ddd.dddddE±ddCR/LF(EOI)①	LCL (Same as the basic format)

(2) Explanation

① Block delimiter

② String delimiter

When the step output mode is set, the part of string delimiter is changed to the block delimiter.

5.5.4 Output Format for MULTI BULK Sampling Mode

(1) The output format for the MULTI BULK sampling mode is as follows:

E ±d d S L DATA(1) DATA(2) . . . . . DATA(NS) D L
① ② ③ ③ ④

Number of bytes

① Exponent	:	4 bytes (ASCII)	4
② String delimiter	:	CR + LF	2
③ Data	:	4 bytes (binary) * NS	4 * NS
④ Block delimiter	:	CR + LF (EOI)/LF/(EOI)	0 to 2

CAUTION

1. Specify CR + LF in "SL2" for the string delimiter. If other one is specified, the operation will be stopped upon a string delimiter output.
2. If measurement data over occurs, the data is output as follows:
   Over data in + : 99999999
   Over data in – : –99999999

5.6 Listener Format

Setting the parameters and control of the operation can be done by the controller of this device.

Table 5-8 is the parameters and the corresponding program codes.

Table 5-8 Program Codes

Item	Code	Description
Measurement function	F1 (Initial value) F2 F3 F4 F5 F6 F8 F9	Direct current voltage measurement (VDC) Alternative current voltage measurement (VAC)*1 2-line resistance measurement (2WΩ) 4-line resistance measurement (4WΩ), network resistance measurement (NW)*2 Direct current current measurement (ADC)*1 Alternative current current measurement (AAC)*1 (Alternative current + Direct current) Voltage measurement V(AC + DC)*1 (Alternative current + Direct current) Current measurement A(AC + DC)*1
Measurment rage	Rd d = 0 (Initial value)	d = 0 to 9 See Table 5 - 9.
Sampling mode	M0 (Initial value) M1 M2 M3	RUN SINGLE MULTI MULTI BULK
Control parameter	 AB0 (Initial value) AB1	Specifies the AC band. SLOW FAST
	AC	Specifies execution of auto-calibration.
	Cl ddd d = 1 (Initial value)	ddd : 0 to 999 Specifies the interval for execution of auto-calibration. The unit is minutes. 0 : off 1 to 999 : Setting can be done in 1-minute interval.
	 AZ0 AZ1 (Initial value)	Specifies whether to include the auto-zero-calibration function. off on

*1 : Only the R6871E is enabled.

*2 : Only the R6871E-OHM is enabled.

Table 5-8 Program Codes (Cont'd)

Item	Code	Description
Control parameter	BZ0 BZ1 BZ2	Specifies the buzzer mode. off on (When the comparator operation result is HIGH/LOW) on (When the comparator operation result is PASS)
	CFd1, d2 d1, d2 = 0 (Initial value)	Specifies the operation function. d1 : 0 to 8, primary operation mode 0 : off 1 : scaling 2 : % deviation 3 : Delta (difference between the previous measurement value) 4 : Multiply (multiplication with the previous measurement value) 5 : Decibel conversion 6 : Real value 7 : dBm conversion 8 : Resistance value temperature amendment d2 : 0 to 3, secondary operation mode 0 : off 1 : Comparator 1 (using HIGH/LOW constant) 2 : Comparator 2 (using LIMIT constant) 3 : Statistical processing • The d2 data cannot be omitted.
	CO0 (Initial value) CO1	Specifies whether the operation function is executed. off on

Table 5-8 Program Codes (Cont'd)

Item	Code	Description
Control parameter		The data output mode is specified.
	DO0 (Initial value)	The output data is output to the display and GPIB. It can be stored in data memory.
	DO1	The output data is output to the GPIB. It can be stored in data memory.
	DO2	The output data is stored in data memory.
	DO3	The output data is stored in data memory in the maximum speed mode. When the MULTI BULK sampling mode is set, the parameter is initialized to DO0.
		The GPIB output format is specified.
	H0	The header is not added on data output.
	H1 (Initial value)	The header is added on data output.
		Specifies the integral time on A/D measurement.
	IT0	100μs
	IT1	1ms
	IT2	10ms
	IT3	1PLC
	IT4 (Initial value)	5PLC
	IT5	10PLC
	IT6	20PLC
	IT7	50PLC
	IT8	100PLC
	IT9	6.666 ms*
	IT10	8.333 ms*
	KNd..d d = 2 (Initial value)	d..d : 2 to 10000 Specifies the number of statistical processing operation samples.

* : Can be set for the MULTI BULK sampling mode.

Table 5-8 Program Codes (Cont'd)

Item	Code	Description
Control parameter	Kn ± d..d E ± d KnMD n = X, Y, Z Initial value X, Z = 1 Y = 0	± d..d : Mantissa data Sign + Numeral of 8 digits or less + decimal point –19999999 to 19999999 E ± d : Exponential data 'E' + Sign + 1-digit numeral E–9 to E + 9 Sets the constant used for operation. • The decimal point can be omitted. • When setting the previous measurement value as the constant, use "KnMD" (n = X, Y, Z). • The exponential data can be omitted.
	HI1 ± d..d E ± d HI2 ± d..d E ± d LO1 ± d..d E ± d LO2 ± d..d E ± d Initial value HI1 = 1	± d..d : Mantissa data Sign + Numeral of 8 digits or less + decimal point –19999999 to 19999999 E ± d : Exponential data 'E' + Sign + 1-digit numeral E–9 to E + 9 Sets the constant used for comparator 1 operation. • The decimal point can be omitted. • The exponential data can be omitted.

Table 5-8 Program Codes (Cont'd)

Item	Code	Description
Control parameter	HI2 = 1 LO1 = 0 LO2 = 0 L1 ± d..d E ± d d..d, d..d Initial value LIMIT = 1 %1 = 10 %2 = 10	$\frac{\pm d..dE \pm d}{\text{LIMIT}}$, $\frac{d..d}{\%1}$, $\frac{d..d}{\%2}$ LIMIT : Mantissa data Sign + Numeral of 8 digits or less + decimal point –19999999 to 19999999 Exponential data 'E' + Sign + 1-digit numeral E–9 to E+9 %1, %2 : 0.000 to 100.0 Decimal point + numeral of 4 digits or less The constant used for the operation of comparator 2. The judgment level is set by deviation %(%1, %2) to the reference value (LIMIT). • The decimal point can be omitted. • The exponential data of the LIMIT can be omitted. • The %1, %2 data cannot be omitted.
		Specifies the power frequency used.
	LF50	50Hz
	LF60	60Hz
		Specifies the measurement digits.
	RE4	4 1/2 digits (19999)
	RE5	5 1/2 digits (199999)
	RE6 (Initial value)	6 1/2 digits (1999999)
	RE7	7 1/2 digits (19999999)

Table 5-8 Program Codes (Cont'd)

Item	Code	Description
Control parameter	NL0(Initial value) NL1	Specifies whether to execute the NULL function. off on
	SM0 (Initial value) SM1	Specifies whether to execute the smoothing function. off on
	TId..d d = 10 (Initial value)	d : 2 to 100 Specifies the count of smoothing
	SId..d d = 250 (Initial value)	d..d: 0 to 60000 Specifies the measurement interval. The unit is ms. Can be set at intervals of 0.5 ms for the MULTI BULK sampling mode.
	TDd..d d = 0 (Initial value)	d..d: 0 to 60000 Specifies the trigger delay time. The unit is ms. It is initialized to 0 ms when the MULTI BULK sampling mode is set.
	NSd..d d = 1 (Initial value)	d..d: 1 to 10000 Specifies the number of samples for multi-sampling, the constant (number of samples) used when using the data memory function. d..d : 1 to 1000 Specifies the number of samples for the MULTI BULK sampling mode.
	SH0 (Initial value) SH1	Specifies the output mode for result of statistical operation. Step output mode in which output is done data by data (use the "RN" code from the 2nd data and after.) Consecutive output mode which outputs 8 data consecutively

Table 5-8 Program Codes (Cont'd)

Item	Code	Description
Control parameter	ST0 (Initial value) ST1	Specifies whether to store the measurement value to the data memory. off on
	Parameters used for recall operation	
	RO0 (Initial value) RO1	Specifies whether to recall data from the data memory. off on
	BO	Commands start of batch output of data stored in the data memory.
	RD ± d..d, ± d..d	Continuously recalls data stored in data memory. ± d..d, ± d..d Direction of continuous recall and data number 1 to 10000 + : Old data→new data – : New data→old data First-recalled data No. • Code (+) can be omitted.
	NO0 NO1 (Initial value)	Specifies whether to output the data number when data is recalled. Do not output. Output.

Table 5-8 Program Codes (Cont'd)

Item	Code	Description
Others	E	Measurement start command code. The same meaning with the "TRIG" of panel. The same processing as the "GET" is done.
	C	Initializes the setting of GPIB. The same processing as the "DCL" and "SDC" is done.
	Z	The initial value is set to each parameter. Also executes the processing of program code "C".
	S0 S1 (Initial value)	Specifies whether to transmit the SRQ signal. Transmit the SRQ signal. Do not transmit the SRQ signal.
	SL0 (Initial value) SL1 SL2	Specifies the data (string delimiter) to be output as the delimiters, when outputting multiple data (output of the recall data, result of statistical operation). "," is output. " " (space) is output. "CR/LF" is output.
	DL0 (Initial value) DL1 DL2	Specifies the block delimiter of data output. Single line signal (EOI) is output when "CR/LF" and "LF" is output. "LF" is output. The single line signal (EOI) is output on output of the final data.
	CS	The status byte is cleared to 0. When SRQ is generated, the SRQ signal is made FALSE (cancel transmission).

Table 5-8 Program Codes (Cont'd)

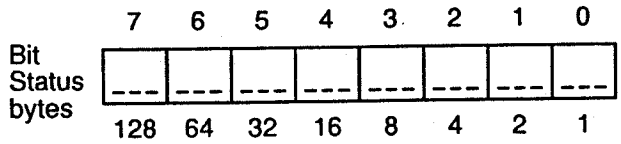
Item	Code	Description
Control parameter	MSddd d = 0 (Initial value)	ddd : 0 to 255 The specified bit in the status byte is masked. The bit to be masked is specified by ddd. The bit where "1" is set is masked (the decimal number set by ddd is converted in binary value to be masked). Note that bit 6 (RQS) cannot be masked. (Setting can be done.) 
	TE	Executes the self diagnosis function.
	SD ± d..d	Setting and calibration of the ± d..d : sign + numeral of 8 digits or less + decimal point calibration value. The ± d..d value specifies whether the calibration is on the zero point or a full-scale calibration. • See the chapter on calibration for the setting range. • d..d allows data of fixed decimal point form only. (No data with exponential part is allowed.) • Set d..d with data corresponding to the display. • (If it is 20V range, it is d..d = 18, and 18V.) • The sign (+) can be omitted.

Table 5-9 Measurement Range Code

Code	VDC	VAC*1 V (AC + DC)*1	ADC*1, AAC*1 A (AC + DC)*1	2/4WΩ NWΩ*3
0	auto	auto	auto	auto
1	—	—	—	1000MΩ
2	—	—	—	10Ω
3	200mV	200mV	—	100Ω
4	2000mV	2000mV	2000μA	1000Ω
5	20V	20V	20mA	10kΩ
6	200V	200V	200mA	100kΩ
7	1000V	500V	2000mA	1000kΩ
8	—	—	—	10MΩ
9	10V*2	—	—	100MΩ

*1 : Only the R6871E is enabled.

*2 : Only for calibration mode.

*3 : Only the R6871E-OHM is enabled. Accuracy is not guaranteed though the measurement operation is done in 10Ω, 100Ω, 100MΩ, or 1000MΩ range.

Notes on setting the program codes

1. 50 characters is the maximum number of program code characters that can be received at once.

   (Explanation)
   In this device, the reception program codes are sequentially read in the internal buffer, and the processing corresponding to the program code is performed as soon as the terminator is received. Therefore, the number of program code characters that can be received at once is limited to 50 characters. The " " (space) code in the terminator and string is not included as a character.

2. Transmit a "LF" (¥12) code at the end of the string of 1 line.

   (Explanation)
   Transmit a "LF" (¥12) code (or "CR", "LF") at the end of the 1-line string. If "LF" is not transmitted, output the single line signal "EOI" when transmitting the final character. (Both "LF" and "EOI" can be output.)
   If neither the "LF" code nor "EOI" signal is output, the end of the string cannot be detected, and the operation stops in a hand-shake wait status.
   The following terminators can be used.

   • CR/LF (EOI) • LF (EOI) • CR (EOI) • (EOI) • CR/LF • LF

3. Each program code can make multiple descriptions in a single string.

   (Explanation)
   Example :
   "F1R4M1" . . . . . The delimiter of each program code is not required.
   "F1, R4" . . . . . "," is used as the delimiter of each program code.
   "F1 R4" . . . . . " " (space) is used as the delimiter of each program code.

   The following program codes must be set individually.
   "COd", "STd", "ROd", "BO", "M3"
   Use program code "E" independently in the MULTI BULK sampling mode.

4. The following characters can be used in remote programming.

   (Explanation)
   The following characters can be used in remote programming.

Numerals	"1" to "9", "0"
Alphabets	"A" to "Z", "a" to "z"
Symbols	",", ".", " + ", "-"
Others	"CR", "LF", " " (space)

   It becomes setting error if characters other than the above are set. (Small letters "a" to "z" are handled in the same way as capital letters "A" to "Z".)

5. When a code which format cannot be used in the setting program was found;

   (Explanation)
   When a code which format cannot be used in the setting program was found, processing will be done normally till immediately before the code, but all later codes will be ignored.

6. The following are factors for generation of syntax errors.

   (Explanation)
   The following are factors for generation of syntax errors.

   - When the received string exceeded 50 characters (the received string is completely ignored)
   - When an unexciting program code is received
   - When the preset data exceeded the specified allowable range
   - When a character that cannot be used is received

   In case the above occurs, error code is displayed on the panel display unit.

7. The following listener codes can be received under calibration mode (when the "EXT CAL" switch on the rear panel is on).
   "Fd", "Rd", "SD ± d..d", "AC", "LFdd",
   "Hd", "DLd", "SLd", "Sd", "MSddd", "CS", "C", "Z"

8. The following listener codes can be received under data memory recall mode (when the "RECALL" key on the front panel is on).
   "COd", "NOd", "ROd", "BO", "RD ± d..d, ± d..d", "RD ± d..d", "RN", "RP",
   "Hd", "DLd", "SLD", "Sd", "MSddd", "CS", "C", "Z"

9. The following listener codes can be received under statistical operation result output mode.
"COd", "SHd", "RN",
"Hd", "DLd", "SLd", "Sd", "MSddd", "CS", "C", "Z"

10. Note the following on data memory operation.
"NOd", "BO", "RD ± d..d, ± d..d", "RD ± d..d" are accepted only under store data number display status.
"RN", "RP" are recall one piece of data by RD/d..d, and accepted when it is under step output mode.
No sequential output mode setting can be done once it enters the step output mode. Exit the recall mode once by "RO0" if necessary.

5.7 Service Request ("SRQ")

5.7.1 General

The service request is a function that informs the operation status by interrupting the controller as soon as the device enters the specified operation status.

The operation status is notified by the status byte. When the device transmits the service request, the controller searches the device one by one in sequence. (This is called serial polling.)

As soon as the device is found, the controller transmits the SPE (serial poll enable) command to this device, to inform that it is ready to accept the status byte. As soon as the device receives this command, it transmits a status byte to the controller.

The controller judges the operation status of the device by this status byte.

5.7.2 Service Request and Status Byte

When specified to the "S0" mode, this device transmits service requests to the controller by the operation statues of the following (1) to (7).

When a service request is transmitted, the status byte is transmitted to the controller by execution of the serial polling of the controller.

When specified to the "S1" mode, no service request is transmitted by the status byte is transmitted.

The bits of the status byte is set according to the operation status of (1) to (7).

Each bit in the status byte can also be masked by program code "MSnnn".

All bits can be cleared by program code "CS".

The following is the relation of the operation status and each bit.

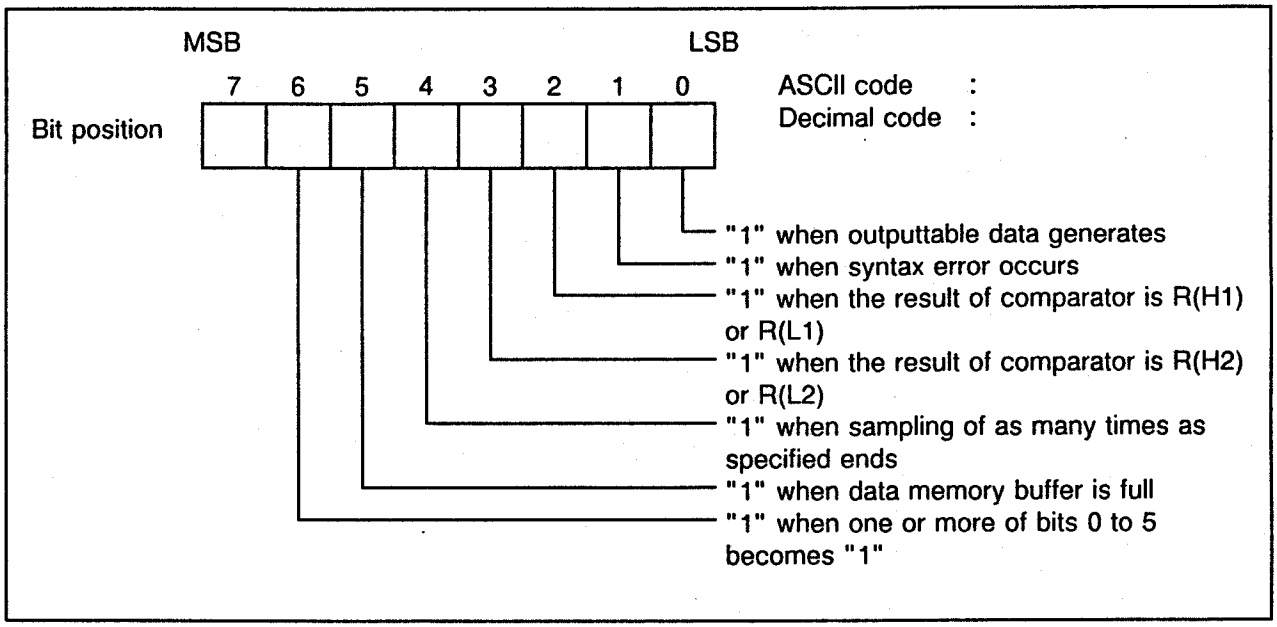
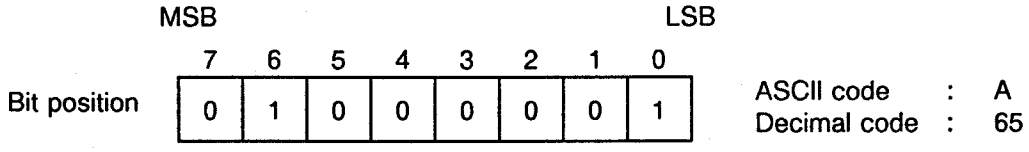


Figure 5-4 Relation of the Operation Status and Each Bit on Service Request

(1) Service request by generation of outputtable data
The following is the status byte in this case.



The service request is dispatched when data that can be output as the measurement data, operation result, or data recalled from the data memory, generates.
The status byte is cleared to 0 when the following status occurs.

① When output of the outputtable data is completed.

② When program code "E" or "GET" command is received while the sampling mode is set at SINGLE or MULTI.

③ When program code "ROd" is received, and when program code "RN" or "RP" is received while data is recalled from the data memory in step output mode.

④ When program code "SHd" is received, and when program code "RN" is received while outputting the result of statistical operation in step output mode.

(2) Service request by generation of syntax error
The following is the status byte in this case.

	MSB							LSB
Bit position	7	6	5	4	3	2	1	0
	0	1	0	0	0	0	1	0

ASCII code : B
Decimal code : 66

The service request is dispatched when there is a setting error in the remote program code. The status byte is cleared to 0 by the next remote program code.

(3) Service request by result of comparator 1, comparator 2
(When the result of operation is R(H1) or R(L1))
The following is the status byte in this case.

	MSB							LSB
Bit position	7	6	5	4	3	2	1	0
	0	1	0	0	0	1	0	0

ASCII code : D
Decimal code : 68

The service request is dispatched when the result of comparator operation is R(H1) or R(L1). The status byte is cleared to 0 as soon as the output of operation result data is completed.

(4) Service request by result of comparator 1, comparator 2
(When the result of operation is R(H2) or R(L2))
The following is the status byte in this case.

	MSB							LSB
Bit position	7	6	5	4	3	2	1	0
	0	1	0	0	1	0	0	0

ASCII code : H
Decimal code : 72

The service request is dispatched when the result of comparator operation is R(H2) or R(L2). The status byte is cleared to 0 as soon as the output of operation result data is completed.

(5) Service request by end of sampling as many times as specified
The following is the status byte in this case.

	MSB							LSB
Bit position	7	6	5	4	3	2	1	0
	0	1	0	1	0	0	0	0

ASCII code : P
Decimal code : 80

① When the sampling mode is MULTI
The service request is dispatched after input of the trigger (measurement start command signal, command) and after sampling is completed for as many times as specified.
The status byte is cleared to 0 when the trigger is input, or when output of 1 data is completed.

② When operation requesting a certain number of sampling is executed
The service request is dispatched as soon as the sampling for as many times as specified (the value of constant "N" for total operation, and the value of constant "X" for RMS operation) is completed.
Cleared when [COMPUTE] is turned OFF or when program code "SHd" is cleared.

③ When smoothing operation is executed
The service request is dispatched when it reaches the specified count (the value of constant "SM TIME") and the result of smoothing operation of as many times as specified is output.

④ When the data memory function is used
The service request is dispatched after trigger input when sampling of as many times as specified ends and [STORE] turns ON or OFF.
The status byte is cleared to 0 when [STORE] is turned ON again, or when [RECALL] is turned ON.

(6) Service request by data memory buffer full status
The following is the status byte in this case.

	MSB							LSB
Bit position	7	6	5	4	3	2	1	0
	0	1	1	0	0	0	0	0

ASCII code :
Decimal code : 96

The service request is dispatched when 10000 data is stored in the data memory (the buffer is full).

The status byte is cleared to 0 when STORE is turned ON again, or when RECALL is turned ON.

Note that status byte, bit 6 is a bit that indicates the service request. "1" is set to bit 6 when one or more bits of bits 0 to 5 become "1".
When all bits of bit 0 to 5 are cleared to 0, bit 6 is also cleared to 0.

The status bytes shown above are all cleared to 0 on power supply, on reception of the "SDC", "DCL" commands, and on reception of program codes "C", "Z", "CS".

5.8 Operation Flow Chart

A rough operation flow chart is given in Figure 5-5.

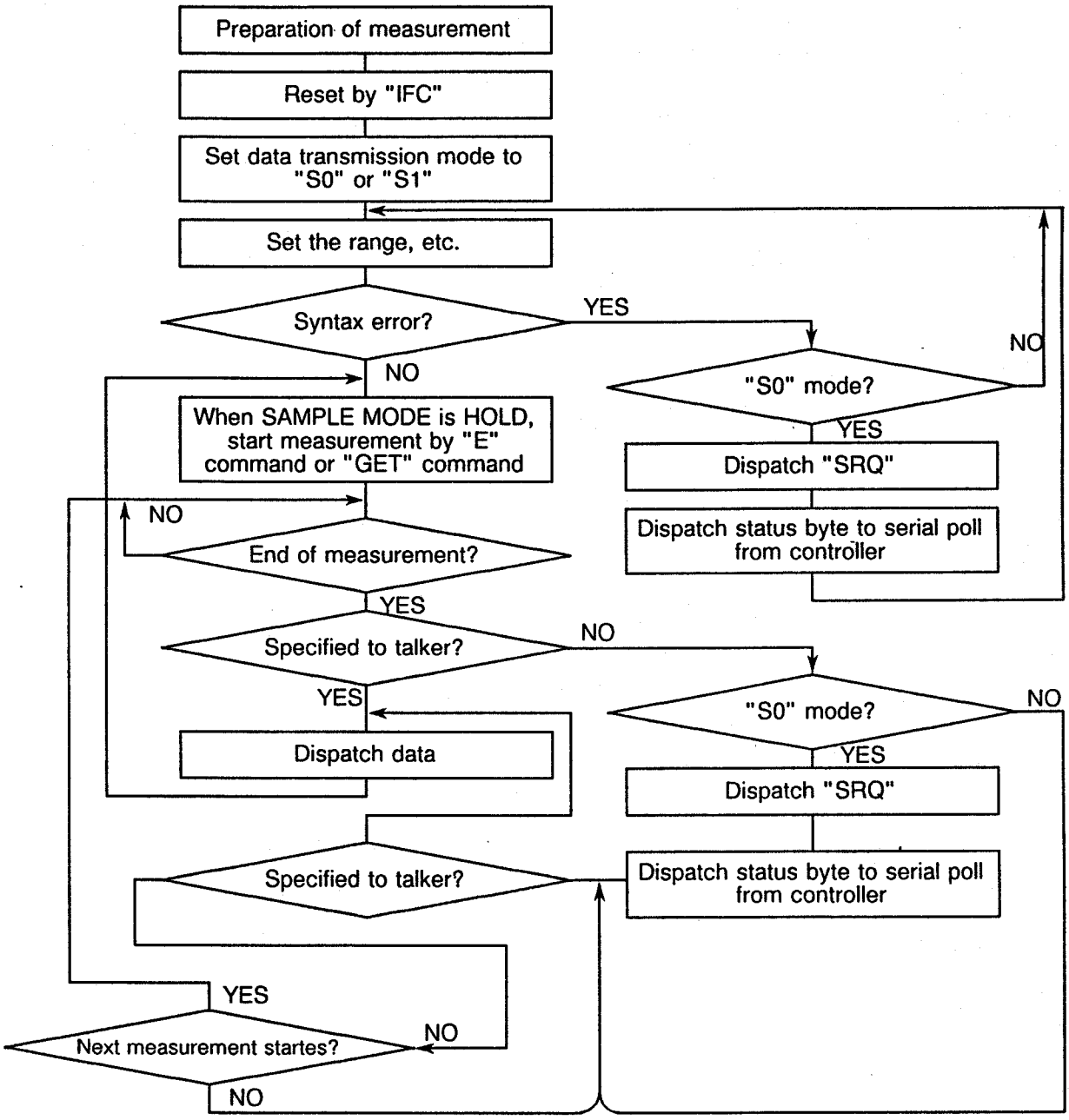


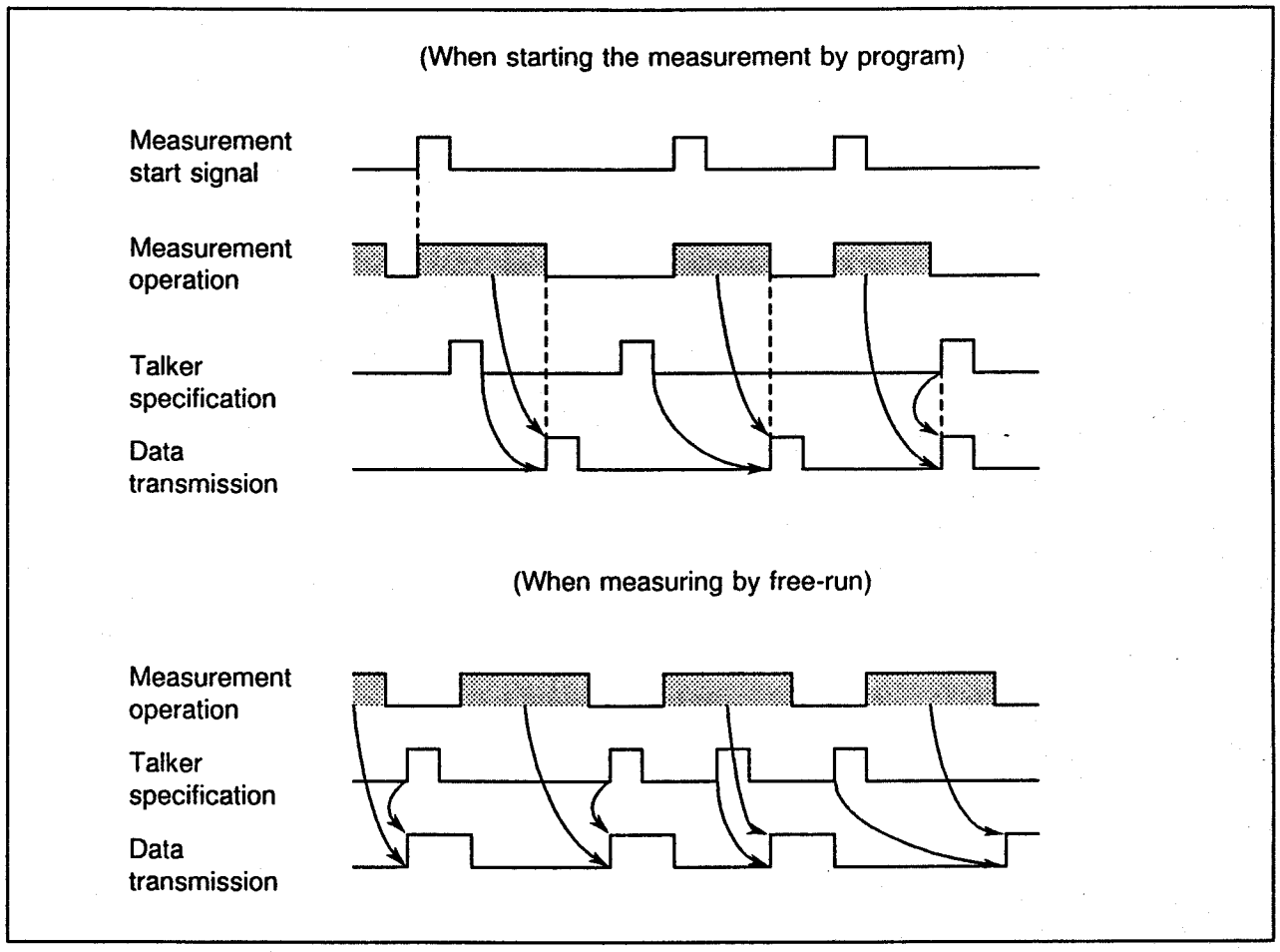
Figure 5-5 GPIB Flow Chart

5.9 Notes on Operation

(1) Operation on service request

Be careful when creating the program, because if service request is generated (under S0 mode) by end of measurement and syntax error, the operation will become as shown in Figure 5-6.

(2) Difference of transmission data by talker-specified timing



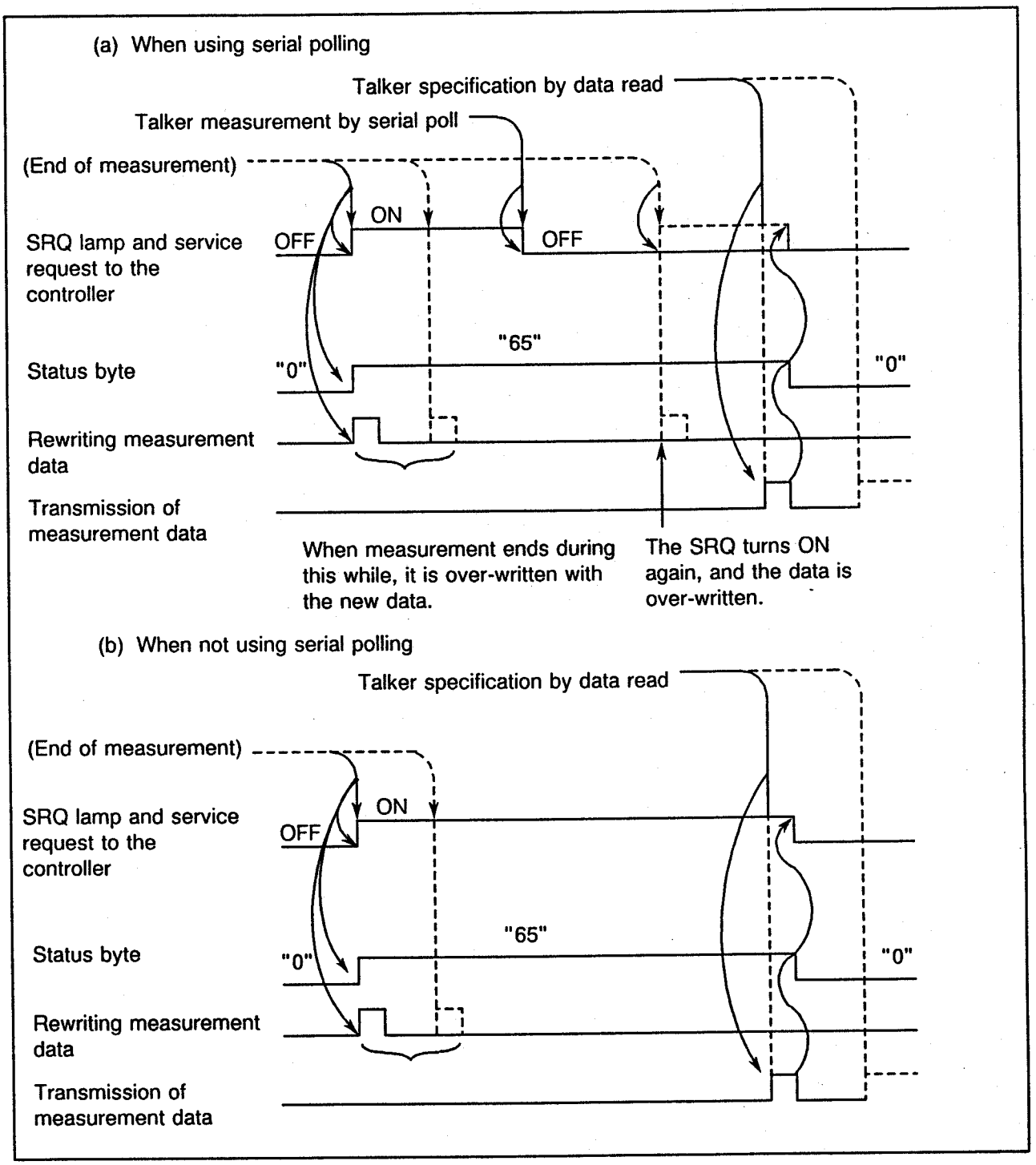


Figure 5-6 Operation Timing on Service Request

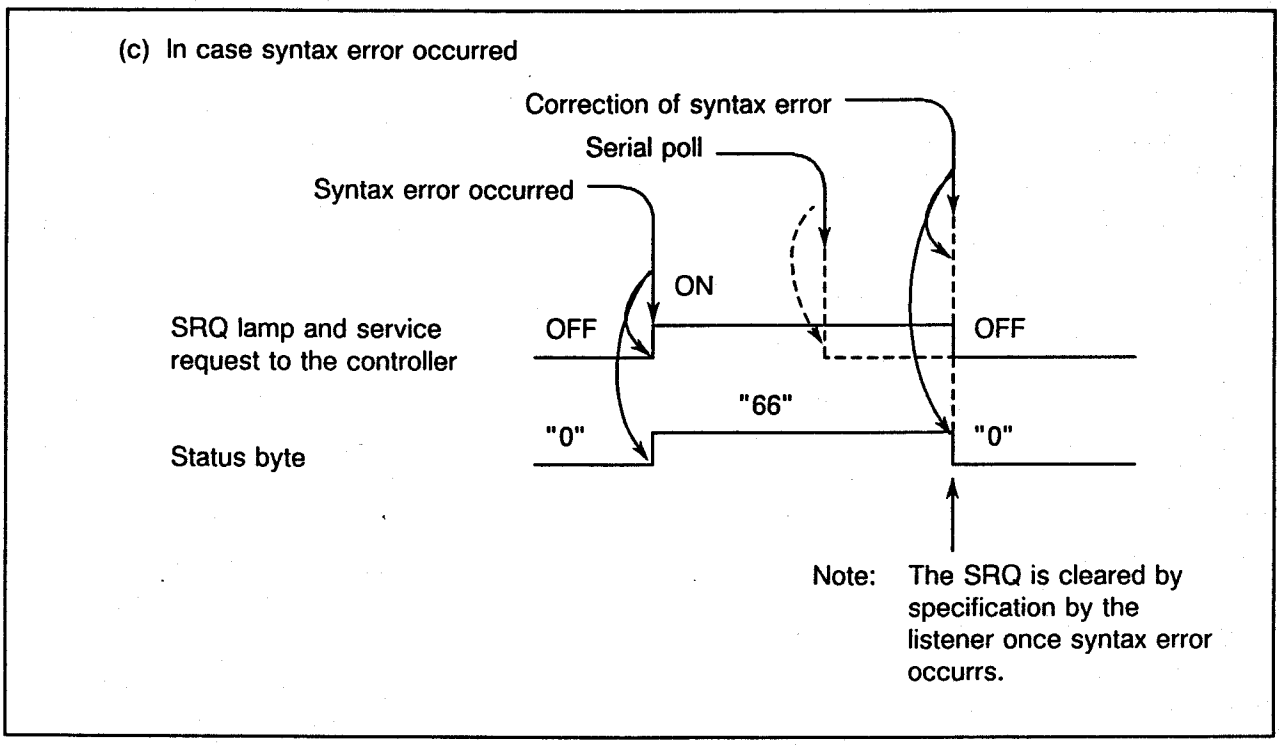


Figure 5-6 Operation Timing on Service Request (cont'd)

5.10 Program Examples

The following are some program examples using Hewlet Paccard's HP200 series and NEC's PC9801.

Example 1 : External start is commanded to start the direct current voltage measurement, 20V-range, SIGNLE sampling.

(1) Example of program using the HP200 series

```
10    !
20    !
30    !
40    DIM A$ [20]
50    R6871E=701
60    !
70    CLEAR R6871E
80    OUTPUT R6871E; "F1,R5,M1"
90    OUTPUT R6871E; "IT4,DL0,S1"
100   TRIGGER R6871E
110   ENTER R6871E;A$
120   PRINT A$
130   GOTO 100
140   !
150   END
```

	Description
40	Data area is defined.
50	The R6871E address is set at variable "R6871E".
70	The GPIB interface device is initialized.
80 to 90	The R6871E parameter is set. "F1" . . . Direct current voltage measurement function "R5" . . Measurement range 20V "M1" . . . Sampling mode : SINGLE "IT4" . . Integral time : 5PLC "DL0" . Block delimiter : CR LF EOI "S1" . . SRQ transmission OFF
100	External start is commanded.
110	Data is received.
120	Display
130	It branches to line number 100.
150	End of program

(2) Example of program using the PC9801 series

```
10    '
20    '
30    '
40    ISET IFC
50    ISET REN
60    CMD DELIM=0
70    PRINT @1;"C"
80    PRINT @1;"F1,R5,M1"
90    PRINT @1;"IT4,DL0,S1"
100   PRINT @1;"E"
110   INPUT @1;A$
120   PRINT A$
130   GOTO 100
140   END
```

	Description
40	Interface clear
50	Remote enable
60	The delimiter is CR + LF.
70	Initializing the setting for the GPIB of R6871E. ("SDC")
80	Sets the R6871E parameter. "F1" . . . Direct current voltage measurement function "R5" . . . Measurement range 20V "M1" . . . Sampling mode : SINGLE
90	"IT4" . . Integral time : 5PLC "DL0" . Block delimiter : CR LF EOI "S1" . . . SRQ transmission OFF
100	External start is commanded.
110	Data reception
120	Display
130	It branches to line number 100.
140	End of program

Example 2 : The measurement parameter is set externally. Measurement is started by external start, and data is read using the SRQ.

(1) Example of program using the HP200 series

```
10    !
20    !
30    !
40    DIM A$ [20]
50    R6871E=701
60    ON INTR 7 GOSUB Srq
70    !
80    CLEAR R6871E
90    OUTPUT R6871E; "F4,R5,M1"
100   OUTPUT R6871E; "IT3,DL0,S0"
110   ENABLE INTR 7;2
120   TRIGGER R6871E
130   Wait_f=0
140   IF Wait_f=1 THEN 120
150   GOTO 140
160   !
170 Srq: STATUS 7,1;X
180   S=SPOLL(R6871E)
190   IF S<>65 THEN 230
200   ENTER R6871E;A$
210   PRINT A$
220   Wait_f=1
230   ENABLE INTR 7;2
240   RETURN
250   !
260   END
```

	Description
40	Data area is defined.
50	The R6871E address is set at a "R6871E" variable.
60	The interruption processing routine is defined.
80	The GPIB interface device is initialized.
90	The R6871E parameter is set. "F4" . . . 4-line resistance measurement function "R5" . . . Measurement range 10KΩ "M1" . . . Sampling mode : SINGLE
100	"IT3" . . Integral time : 1PLC "DL0" . Block delimiter : CR LF EOI "S0" . . . SRQ transmission ON
110	Allows interruption by SRQ.
120	External start is commanded.
130 to 150	Interruption and interruption-wait to processing loop
170 to 180	Interruption processing routine name :R6871E is polled and the status is read.
190	When interrupting from other than the R6871E, it branches to line number 230.
200	Data reception
210	Display
220	Interruption processing end flag (Wai__ f) is set.
230	Interruption by SRQ is allowed.
240	Return to main routine
260	End of program

(2) Example of program using the PC9801 series

```
10   '
20   '
30   '
40   ISET IFC
50   ISET REN
60   CMD DELIM=0
70   DEF SEG=&H60
80   A%=PEEK(&H9F3)
90   A%=A% AND &HBF
100  POKE &H9F3,A%
110  ON SRQ GOSUB 210
120  '
130  PRINT @1;"C"
140  PRINT @1;"F4,R5,M1"
150  PRINT @1;"IT3,DL0,S0,CS"
160  SRQ ON
170  PRINT @1;"E"
180  WAITF=0
190  IF WAITF=1 THEN 170
200  GOTO 190
210  POLL 1,S
220  IF S<>65 THEN 260
230  INPUT @1;A$
240  PRINT ;A$
250  WAITF=1
260  SRQ ON
270  RETURN
280  END
```

	Description
40	Interface clear
50	Remote enable
60	The delimiter is CR + LF
70	The SRQ signal in the PC9801 GPIB is cleared (70-100). Declaration of segment base address.
80	Reading address
90	AND is removed (to clear interruption bit)
100	Write data to the specified address on the memory.
110	The head address of the SRQ subroutine is specified.
130	Initializes the setting for the GPIB of R6871E. ("SDC")
140	Sets the R6871E parameter. "F4" . . . 4-line resistance measurement function "R5" . . . measurement range 10KΩ "M1" . . . Sampling mode : SINGLE
150	"IT3" . . Integral time : 1PLC "DL0" . Block delimiter : CR LF EOI "S0" . . . SRQ transmission ON "CS" . . . Clears status byte
160	Allows interruption by SRQ.
170	External start is commanded.
180	Substitute 0 to the flag (WAITF)
190	Branches to 170 if the flag (WAITF) is 0.
200	Branches to 190.
210	Serial poll is performed.
220	Branches to 260 if the interruption from other than R6871E.
230	Data reception
240	Display
250	1 is substituted to the flag (WAITF)
260	SRQ reception is allowed.
270	RETURN
280	End of program

Example 3 : Example of program using the data memory function

```
10    !*******************************************************
20    !        DATA-MEMORY PROGRAM
30    !
40    !        MULTI SAMPLING, NS=50
50    !*******************************************************
60    !
70    DIM  M_data$ [30]
80    R6871E=701
90    Ns_end=0
100   CLEAR R6871E
110   ON INTR 7 GOSUB Srq
120   GOSUB Set_para
130   OUTPUT R6871E;"ST1"
140   TRIGGER R6871E
150   ENABLE INTR 7;2
160 Wait_srq:  IF Ns_end=0 THEN Wait_srq
170         OUTPUT R6871E;"RO0"
180         STOP
190         !
200         !
210   !*******************************************************
220   !      INTERRUPT !!
230   !*******************************************************
240   !
250 Srq:    STATUS 7,1;X
260         S=SPOLL(R6871E)
270         IF BIT(S,4)=0 THEN Rtn
280         OUTPUT R6871E;"RO1"
290         OUTPUT R6871E;"NO1"
300         OUTPUT R6871E;"RD0"
310         GOSUB Rec_data
320         FOR N=1 TO 49
330             OUTPUT R6871E;"RN"
340             GOSUB Rec_data
350         NEXT N
360         Ns_end=1
370 Rtn:    ENABLE INTR 7;2
380         RETURN
390         !
400         !
```

(cont'd)

```
410   !*******************************************************
420   !      SET R6871E PARAMETER!!
430   !*******************************************************
440            OUTPUT R6871E;"F1,R4,M2,IT1,SI0,TD0,AZ0,NS50"
450            OUTPUT R6871E;"H1,S0,SL2,DL0,CS,MS175"
460            RETURN
470            !
480            !
490   !*******************************************************
500   !        READ DATA-MEMORY DATA !!
510   !*******************************************************
520   !
530 Rec data:    ENTER R6871E;M_data$
540              PRINT M_data$
550              RETURN
560              !
570  END
```

	Description
70	The data area is defined.
80	The address of R6871E is set in the "R6871E" variable.
90	The end of recall output flag is cleared.
100	The device of GPIB interface is initialized.
110	The interruption processing routine is defined.
120	The subroutine "Set_para" that sets the parameters of the R6871E is executed.
130	The data memory storage function is enabled.
140	External start is commanded
150	SRQ interruption is allowed.
160	Interruption wait loop (looped here till 50 samplings end).
170	The data memory recall function is turned off.
250 to 260	The interruption processing routine name: R6871E is polled and the status read.
270	The status byte bit 4 (service request by end of specified counts) is tested.
280	The data memory recall function is set on.

	Description
300	Dat number "0" is read.
300	Dat number "0" is read.
310	Subroutine "Rec_data" to receive data from the R6871E is executed.
320 to 350	Process to read data numbers "1" to "49" is executed. Each data is read under step output mode by the "RN" code.
360	Recall output end flag is set.
370	Interruption by SRQ is allowed.
380	Returns to the main routine.
440 to 460	Each parameter of subroutine name : R7681E is set. "F1" ..... Measurement function : VDC "R4" ..... Measurement range : 2000mV "M2" ..... Sampling mode : MULTI "IT1" ..... Integral time : 1ms "SI0" ..... Sampling interval : 0ms "TD0" ..... Trigger delay time : 0ms "AZ0" ..... Auto-zero calibration : OFF "NS50" ..... Count of samples : 50 counts "H1" ..... Header output : ON "S0" ..... SRQ mode : ON "SL2" ..... String delimiter : "CR/LF" "DL0" ..... Block delimiter : "CR/LF (EOI)" "CS" ..... Clear status byte "MS175" ..... Mask status byte except bits 4 and 6.
530 to 550	Receive recall data from subroutine name : R6871E.
570	End of program

(Output data)

```
NO+0000,DV  +1000.05E-03
NO+0001,DV  +1000.05E-03
NO+0002,DV  +1000.03E-03
NO+0003,DV  +1000.02E-03
NO+0004,DV  +1000.06E-03
NO+0005,DV  +1000.05E-03
NO+0006,DV  +1000.04E-03
NO+0007,DV  +1000.06E-03
NO+0008,DV  +1000.07E-03
NO+0009,DV  +1000.05E-03
NO+0010,DV  +1000.05E-03
NO+0011,DV  +1000.07E-03
NO+0012,DV  +1000.06E-03
NO+0013,DV  +1000.03E-03
NO+0014,DV  +1000.06E-03
NO+0015,DV  +1000.07E-03
NO+0016,DV  +1000.06E-03
NO+0017,DV  +1000.05E-03
NO+0018,DV  +1000.07E-03
NO+0019,DV  +1000.03E-03
NO+0020,DV  +1000.02E-03
NO+0021,DV  +1000.06E-03
NO+0022,DV  +1000.05E-03
NO+0023,DV  +1000.05E-03
NO+0024,DV  +1000.05E-03
NO+0025,DV  +1000.05E-03
NO+0026,DV  +1000.04E-03
NO+0027,DV  +1000.02E-03
NO+0028,DV  +1000.06E-03
NO+0029,DV  +1000.04E-03
NO+0030,DV  +1000.03E-03
NO+0031,DV  +1000.06E-03
NO+0032,DV  +1000.06E-03
NO+0033,DV  +1000.04E-03
NO+0034,DV  +1000.03E-03
NO+0035,DV  +1000.06E-03
NO+0036,DV  +1000.03E-03
NO+0037,DV  +1000.04E-03
NO+0038,DV  +1000.06E-03
NO+0039,DV  +1000.06E-03
NO+0040,DV  +1000.06E-03
NO+0041,DV  +1000.05E-03
NO+0042,DV  +1000.07E-03
NO+0043,DV  +1000.04E-03
NO+0044,DV  +1000.03E-03
NO+0045,DV  +1000.06E-03
NO+0046,DV  +1000.06E-03
NO+0047,DV  +1000.05E-03
NO+0048,DV  +1000.07E-03
NO+0049,DV  +1000.07E-03
```

Example 4 : Example of program using the data memory function

Unlike (Example 3), the recall is done by specifying "," as the string delimiter, to reach the recall data as a character string.

When the "BO" code is sent to the R6871E, the number of data stored in the data memory is output.

```
10    !*******************************************************
20    !          DATA-MEMORY PROGRAM
30    !
40    !        MULTI SAMPLING, NS=200
50    !*******************************************************
60    !
70    DIM  M_data$ [2500]
80    R6871E=701
90    Ns_end=0
100   CLEAR R6871E
110   ON INTR 7 GOSUB Srq
120   GOSUB Set_para
130   TRIGGER R6871E
140   ENABLE INTR 7;2
150 Wait_srq:   IF Ns_end=0 THEN Wait_srq
160         OUTPUT R6871E;"RO0"
170         STOP
180         !
190         !
200   !*******************************************************
210   !         INTERRUPT !!
220   !*******************************************************
230   !
240 Srq:      STATUS 7,1;X
250           S=SPOLL(R6871E)
260           IF BIT(S,4)=0 THEN Rtn
270           OUTPUT R6871E;"RO1"
280           OUTPUT R6871E;"NO0"
290           OUTPUT R6871E;"BO"
300           ENTER R6871E;Count
310           PRINT "SAMPLE = ";Count
320           ENTER R6871E;M_data$
330           PRINT M_data$
340           Ns_end=1
350 Rtn:      ENABLE INTR 7;2
360           RETURN
370           !
380           !
```

(cont'd)

```
390   !*******************************************************
400   !       SET R6871E PARAMETER !!
410   !*******************************************************
420             OUTPUT R6871E;"F1,R3,M2,IT0,SI0,TD0,AZ0,NS200"
430             OUTPUT R6871E;"H0,S0,SL0,DL0,CS,MS175"
440             OUTPUT R6871E;"ST1"
450             RETURN
460             !
470   END
```

(Output data)

```
SAMPLE =  200
-099.94E-03,-099.86E-03,-099.79E-03,-099.88E-03.-099.61E-03,-100.03E-03,-099.95E
-03,-099.85E-03,-100.07E-03,-099.79E-03,-100.02E-03,-099.80E-03,-099.72E-03,-099
,91E-03,-099.65E-03,-100.15E-03,-099.74E-03,-099.84E-03,-099.89E-03,-099.72E-03,
-100.12E-03,-099.69E-03,-099.81E-03,-100.08E-03,-099.69E-03,-099.99E-03,-099.25E
-03,-099.79E-03,-099.87E-03,-099.65E-03,-099.86E-03,-099.46E-03,-100.11E-03,-099
.93E-03,-099.97E-03,-100.09E-03,-099.42E-03,-100.00E-03,-099.83E-03,-099.66E-03,
-099.91E-03,-099.56E-03,-100.23E-03,-099.87E-03,-099.83E-03,-100.14E-03,-099.60E
-03,-100.16E-03,-099.46E-03,-099.81E-03,-099.84E-03,-099.66E-03,-100.18E-03,-099
.56E-03,-099.79E-03,-100.06E-03,-099.59E-03,-100.05E-03,-099.64E-03,-099.91E-03,
-099.80E-03,-099.57E-03,-099.86E-03,-099.35E-03,-100.51E-03,-099.93E-03,-099.90E
-03,-100.09E-03,-099.38E-03,-100.00E-03,-099.73E-03,-099.61E-03,-099.89E-03,-099
.57E-03,-100.22E-03,-099.90E-03,-099.84E-03,-100.15E-03,-099.65E-03,-100.12E-03,
-099.61E-03,-099.84E-03,-099.89E-03,-099.63E-03,-100.05E-03,-099.37E-03,-099.69E
-03,-099.96E-03,-099.70E-03,-100.04E-03,-099.61E-03,-100.01E-03,-100.06E-03,-099
.89E-03,-100.17E-03,-099.63E-03,-099.95E-03,-099.80E-03,-099.78E-03,-099.92E-03,
-099.64E-03,-100.09E-03,-099.93E-03,-099.86E-03,-100.08E-03,-099.84E-03,-100.02E
-03,-099.01E-03,-099.65E-03,-099.93E-03,-099.64E-03,-100.09E-03,-099.67E-03,-099
.84E-03,-099.86E-03,-099.72E-03,-099.98E-03,-099.61E-03,-099.84E-03,-100.03E-03,
-099.88E-03,-100.02E-03,-099.40E-03,-099.88E-03,-099.88E-03,-099.68E-03,-099.90E
-03,-099.57E-03,-100.14E-03,-099.90E-03,-099.89E-03,-100.07E-03,-099.67E-03,-100
.03E-03,-099.97E-03,-099.85E-03,-099.93E-03,-099.70E-03,-100.11E-03,-099.76E-03,
-099.82E-03,-100.11E-03,-099.73E-03,-100.07E-03,-099.67E-03,-099.87E-03,-100.03E
-03,-099.92E-03,-100.08E-03,-099.49E-03,-099.94E-03,-099.86E-03,-099.79E-03,-099
.92E-03,-099.69E-03,-099.87E-03,-099.88E-03,-099.70E-03,-099.91E-03,-099.56E-03,
-099.95E-03,-099.91E-03,-099.90E-03,-100.07E-03,-099.82E-03,-100.04E-03,-099.81E
-03,-099.79E-03,-099.94E-03,-099.76E-03,-100.06E-03,-099.74E-03,-099.85E-03,-100
.09E-03,-099.74E-03,-100.06E-03,-099.68E-03,-099.91E-03,-100.05E-03,-099.94E-03,
-100.10E-03,-099.49E-03,-099.83E-03,-099.85E-03,-099.77E-03,-099.90E-03,-099.62E
-03,-100.00E-03,-099.97E-03,-099.89E-03,-100.11E-03,-099.81E-03,-099.97E-03,-099
.82E-03,-099.75E-03,-099.93E-03,-099.67E-03,-100.10E-03,-099.79E-03,-099.87E-03
```

Description
Setting status of each R6871E parameters
"F1" ..... Measurement function : VDC
"R3" .... Measurement range : 200mV
"M2" .... Sampling mode : MULTI
"IT0" ..... Integral time : 100μs
"SI0" ..... Sampling interval : 0ms
"TD0" .... Trigger delay time : 0ms
"AZ0" .... Auto-zero calibration : OFF
"NS200" .. Count of samples : 200 counts
"H0" .... Header output : OFF
"S0" .... SRQ mode : ON
"SL0" .... String delimiter : ","
"DL0" .... Block delimiter : "CR/LF (EOI)"
"CS" .... Clear status byte.
"MS175" .. Mask status byte except bits 4 and 6.
"ST1" .... Set data memory store function ON.

Example 5 : Example of a program where sampling is executed under the highest-speed mode using the data memory function

```
10    !*********************************************************
20    !         DATA-MEMORY PROGRAM (FAST SAMPLING)
30    !
40    !         SAMPLING MODE :RUN,   NS:  1000
50    !*********************************************************
60    !
70    DIM Rec_data$(10000) [20]
80    INTEGER Data_count,N
90    R6871E=701
100   Ns_end=0
110   CLEAR R6871E
120   ON INTR 7 GOSUB Srq
130   GOSUB Set_para
140   TRIGGER R6871E
150   ENABLE INTR 7;2
160 Wait_srq:   IF Ns_end=0 THEN Wait_srq
170         OUTPUT R6871E;"RO0"
180         STOP
190         !
200   !*********************************************************
210   !       INTERRUPT !!
220   !*********************************************************
230   !
240 Srq:    STATUS 7,1;X
250         S=SPOLL (R6871E)
260         IF BIT(S,4)=0 THEN Rtn
270         OUTPUT R6871E;"R01"
280         OUTPUT R6871E;"NO0"
290         GOSUB Rec_data
300         Ns_end=1
310 Rtn:    ENABLE INTR 7;2
320         RETURN
330         !
340   !*********************************************************
350   !      SET R6871E PARAMETER !!
360   !*********************************************************
370 Set_para:  OUTPUT R6871E,"F1,R3,TD0,NS1000"
380            OUTPUT R6871E;"H0,S0,SL2,DL0,CS,MS175"
390            OUTPUT R6871E;"DO3"
400            RETURN
410            !
420            !
```

(cont'd)

```
430   !*********************************************
440   !       GET DATA-MEMORY DATA !!
450   !*********************************************
460 Rec_data:     OUTPUT R6871E,"BO"
470               ENTER R6871E;Data_count
480               FOR N=1 TO Data_count
490                   ENTER R6871E;Rec_data$(N)
500               NEXT N
510               PRINT "DATA COUNT= ";Data_count
520               PRINT
530               FOR N=1 TO Data_count
540                   PRINT Rec_data$(N)
550               NEXT N
560               RETURN
570               !
580   END
```

(Output data)

```
DATA COUNT=   1575
+000.04E-03
+000.04E-03
+000.07E-03
+000.03E-03
+000.06E-03
+000.04E-03
+000.03E-03
+000.06E-03
+000.04E-03
+000.05E-03
+000.05E-03
+000.04E-03
+000.05E-03
+000.02E-03
+000.02E-03
+000.03E-03
+000.02E-03
+000.05E-03
+000.05E-03
+000.02E-03
+000.04E-03
+000.03E-03
+000.02E-03
+000.02E-03
+000.00E-03
-000.01E-03
+000.01E-03
-000.01E-03
+000.00E-03
+000.03E-03
+000.02E-03
+000.01E-03
+000.04E-03
+000.02E-03
+000.02E-03
```

	Description
70 to 80	Defines the data area.
90	The address of R6871E is set in the "R6871E" variable.
100	The end of recall output flag is cleared.
110	The device of GPIB interface is initialized.
120	The interruption processing routine is defined.
130	The subroutine "Set_para" that sets the parameters of the R6871E parameters is executed.
140	External start is commanded
150	SRQ interruption is allowed.
160	Interruption wait loop (looped here till 1000 samplings end after external start is commanded)
170	The data memory recall function is turned off.
180	The program is stopped.
240 to 250	The interruption processing routine name : R6871E is polled and to the status is read.
260	The status byte bit 4 (service request by end of specified counts) is tested.
270	The data memory recall function is set on.
280	It is set so that the recall data is output without data number.
290	Subroutine "Rec_data" to receive data from the R6871E is executed.
300	Recall output end flag is set.
310	Interruption by SRQ is allowed.
320	Returns to the main routine.

(Cont'd to the next page)

	Description
370 to 400	Each parameter of subroutine name : R6871E is set. "F1" . . . . . Measurement function : VDC "R3" . . . . . Measurement range : 200mV "TD0" . . . . . Trigger delay time : 0ms "NS1000" . . . Count of samples : 1000 counts "H0" . . . . . Header output : OFF "S0" . . . . . SRQ mode : ON "SL2" . . . . . String delimiter : "CR/LF" "DL0" . . . . . Block delimiter : "CR/LF (EOI)" "CS" . . . . . Clear status byte. "MS175" . . . . Mask status byte except bits 4 and 6. "DO3" . . . . . Data output mode : 3 (Highest-speed mode)
460	Batch output from data memory by subroutine name : "BO"
470	Reads number of data stored in the data memory.
480 to 500	Reads data from the data memory, to save the data to the to Rec_data buffer.
510	Displays number of data.
520 to 550	Displays all recalled data.
560	Return to the main routine.
580	End of program

Example 6 : Example of a program that executes the statistical operation of the operation function

```
10    !*******************************************************
20    !         COMPUTING FUNCTION : STATISTICS
30    !
40    !         20V range.SAMPLE : 10
50    !*******************************************************
60    !
70    DIM M_data$ [30]
80    R6871E=701
90    Ns_end=0
100   CLEAR R6871E
110   ON INTR 7 GOSUB Srq
120   GOSUB Set_para
130   TRIGGER R6871E
140   ENABLE INTR 7;2
150 Wait_srq:   IF Ns_end=0 THEN Wait_srq
160         OUTPUT R6871E;"CO0"
170         STOP
180         !
190         !
200   !*************************************************
210   !      INTERRUPT !!
220   !*************************************************
230   !
240 Srq:    STATUS 7,1;X
250         S=SPOLL(R6871E)
260         IF BIT(S,4)=0 THEN Rtn
270         OUTPUT R6871E;"SH0"
280         GOSUB Comp_data
290         FOR N=1 TO 7
300             OUTPUT R6871E;"RN"
310             GOSUB Comp_data
320         NEXT N
330         Ns_end=1
340 Rtn:    ENABLE INTR 7;2
350         RETURN
360         !
370         !
380   !*************************************************
390   !     SET R6871E PARAMETER !!
400   !*************************************************
410 Set_para: OUTPUT R6871E;"F1,R5,M2,IT5,RE7,SI0,TD1000,NS10,CF0,3,KN10"
420           OUTPUT R6871E;"H1,S0,SL2,DL0,CS,MS175"
430           OUTPUT R6871E;"CO1"
440           RETURN
450           !
460           !
```

(cont'd)

```
470   !*****************************************************
480   !       READ COMPUTING DATA !!
490   !*****************************************************
500   !
510 Comp_data:  ENTER R6871E;M_data$
520             PRINT M_data$
530             RETURN
540             !
550  End
```

(Output data)

```
DV C00010
DV X+11.234576E+00
DV N+11.234569E+00
DV A+11.234573E+00
DV K+00.000007E+00
DV S+1.9340000E-06
DV Y+11.234579E+00
DV Z+11.234567E+00
```

	Description
70	Defines the data area
80	The address of R6871E is set in the "R6871E" variable.
90	The end of statistical operation result output flag is cleared.
100	The device of GPIB interface is initialized.
110	The interruption processing routine is defined.
120	The subroutine "Set_para" that sets the parameters of the R6871E parameters is executed.
130	External start is commanded.
140	SRQ interruption is allowed.
150	Interruption wait loop (looped here till 10 samplings end)
160	The operation function is turned off.
170	The program is stopped.
240 to 250	The interruption processing routine name : R6871E is polled and to the status is read.
260	The status byte bit 4 (service request by end of specified counts) is tested.
270	Specify 'step' as the statistical operation result output mode.
280	Subroutine "Comp_data" that receives data from the R6871E is executed. (As many data as sampled is received.)
290 to 320	Process to receive the MAX, MIN, AVE, P-P,σ, UCL, LCL to data of the statistical operation result
330	End of operation result output flag is set.
340	Interruption by SRQ is allowed.
350	Returns to the main routine.

(Cont'd to the next page)

	Description
410 to 440	Each parameter of subroutine name : R6871E is set. "F1" . . . . . Measurement function : VDC "R5" . . . . . Measurement range : 20V "M2" . . . . . Sampling mode : MULTI "IT5" . . . . . Integral time : 10PLC "RE7" . . . . . Displayed digits : 7 1/2 digit mode "SI0" . . . . . Sampling interval : 0ms "TD1000" . . . Trigger delay time : 1000ms "NS10" . . . . Count of samples : 10 counts "CF0, 3" . . . . Operation function : Statistical process is set for 2-dimensional operation "KN10" . . . . Number of statistical operation object samples : 10 samples "H1" . . . . . Header output : ON "S0" . . . . . SRQ mode : ON "SL2" . . . . . String delimiter : "CR/LF" "DL0" . . . . . Block delimiter : "CR/LF (EOI)" "CS" . . . . . Clear status byte. "MS175" . . . Mask status byte except bits 4 and 6. "CO1" . . . . . Set operation function ON.
510 to 530	Result of operation is received from subroutine name : R6871E
550	End of program

5.11 Output of Comparator Calculation Results (for R6871E-OHM only)

In this section, the function of comparator results output is explained.

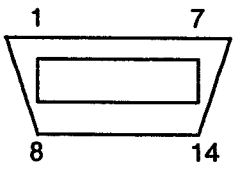
5.11.1 Outline

The R6871E-OHM is equipped with an output of comparator calculation result function as a standard attachment.

5.11.2 The Function

The results of comparator calculation is output to HIGH2, HIGH1, PASS, LOW1, LOW2, and FAIL by open collector. Dealing with pin number of connector and the signal is as follows.

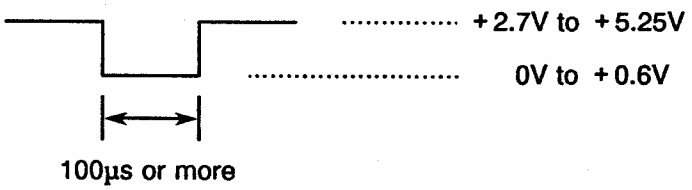
- Output Connector 57-40140 (produced by DDK)



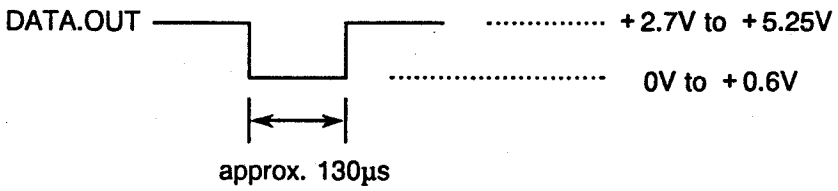
Pin No.	Signal name	Pin No.	Signal name
1	GND	8	GND
2	*EXT.TRIGGER	9	*DATA.OUT
3	HIGH2	10	LOW1
4	HIGH1	11	LOW2
5	PASS	12	FAIL
6	NC	13	NC
7	NC	14	NC

NC : No-connect

- External Start Signal
  EXT.TRIGGER : TTL level negative pulse

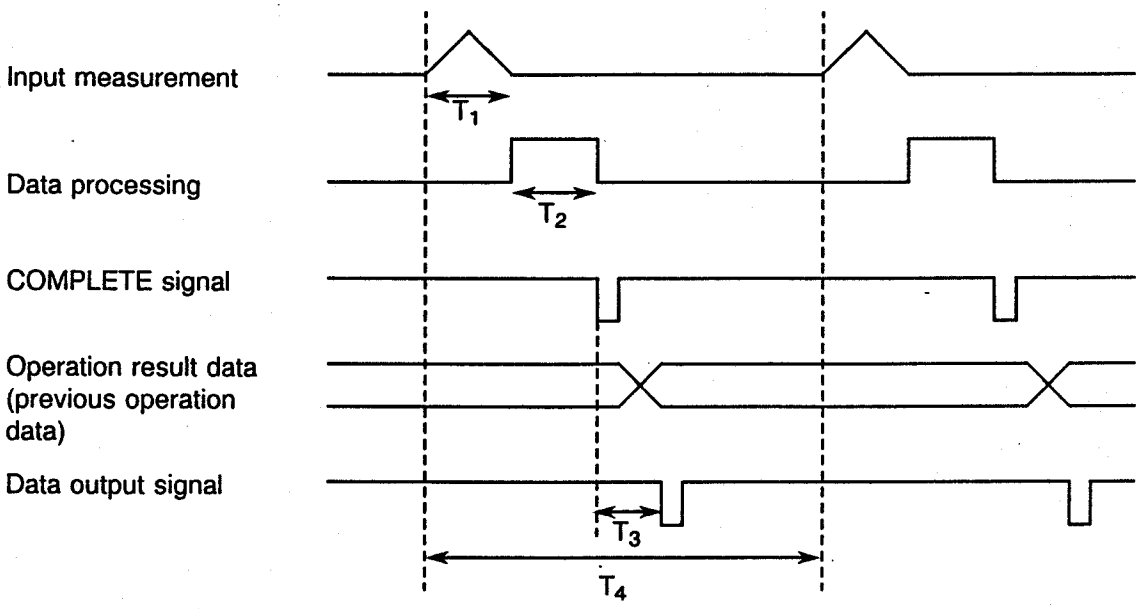


- Data Output Signal
  DATA.OUT : TTL level negative pulse



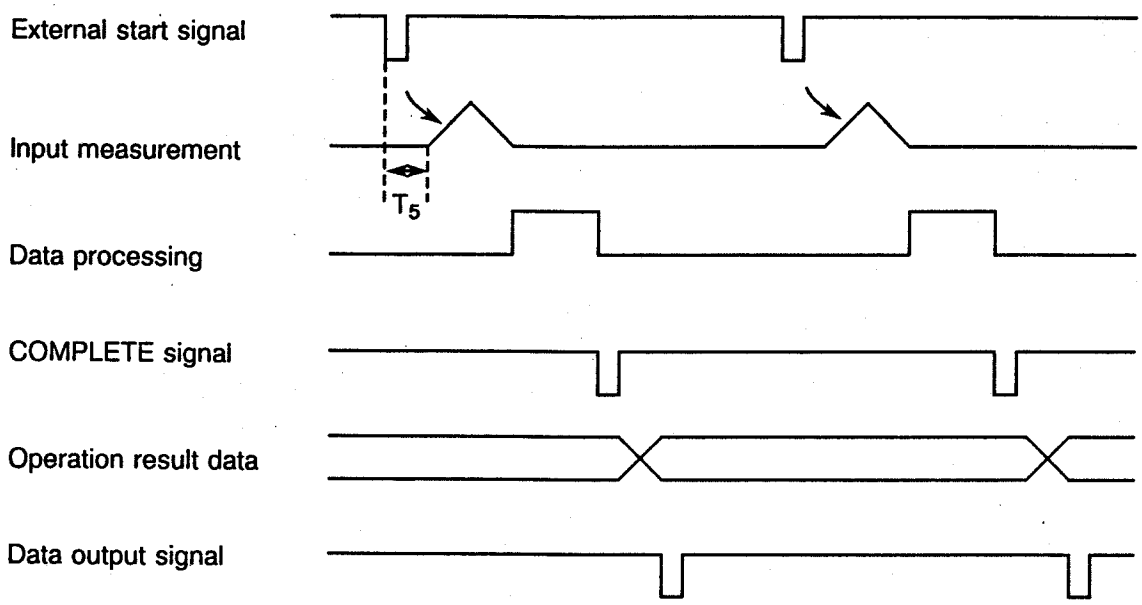
5.11.3 Output Timing

(1) Sampling mode : RUN



T_1 : Depends on the measurement function and the integration time (IT).
T_2 : True value enumeration, operation execution time
T_3 : 450µs to 600µs (DOUT mode: 0 when outputting only to display)
T_4 : Depends on sampling interval (SI).

(2) Sampling mode : SINGLE



T_5 : When trigger delay is "TD" > 0ms, depends on "TD". When the trigger delay is 0ms, the time is approximately 200µsec.

Note : An external start during the measurement operation (from external start to data output) is effective only once.