HIOKI

8815 · 8830 · 8831

MEMORY Hi CORDER

9506 GP-IB INTERFACE

INSTRUCTION MANUAL

HIOKI E.E. CORPORATION

Contents

Chapter 1

Outline

The GP-IB interface was developed as an interface for programmable instruments. It provides great potential for expansion and a wide variety of powerful features.

Interfaces for programmable instruments include not only the GP-IB interface, but also the IEEE Bus, the IEC Bus, and the HP-IB interface (a proprietary standard of Hewlett Packard). All of these are basically the same, except for slight differences in connector pin numbers and signal arrangements. Please pay careful attention to these differences when using any of these interfaces.

This instruction manual discusses use of only the GP-IB interface.

For more details on the GP-IB interface, please refer to the following literature.

(1) ANSI/IEEE Standard 488-1978
IEEE Standard Digital Interface for Programmable Instructions

(2) Automatic Measuring Technology Research Association
"Report of Measuring Instruments Interface Research"
(IEC Bus Application Guide Book)
June, 1979

Chapter 2

GP-IB Specifications

2-1 Standards Conformance

The GP-IB interface described in this manual conforms to IEEE Standard 488-1978.

2-2 Interface Functions

Function	Contents
SH1	All SH (source handshake) functions
AH1	All AH (acceptor handshake) functions
T6	Basic talker function, serial polling function MLA (My Listen Address) talker release function
L4	Basic listener function MTA (My Talk Address) listener release function
SR1	All SR (Service Request) functions
RL1	All RL (Remote Local) functions
PP0	No PP (Parallel polling) function
DC1	All DC (Device Clear) functions
DT0	No DT (Device Trigger) function
C0	No C (Control) function

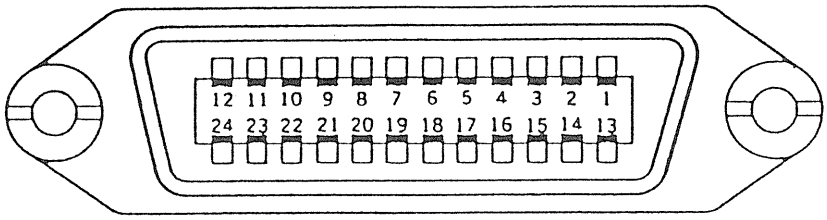
2-3 GP-IB Bus Signal Lines

Bus Structure		Signal Line Note	
Data Bus	DIO1 (Data INput Output 1) 2 (" 2) 3 (" 3) 4 (" 4) 5 (" 5) 6 (" 6) 7 (" 7) 8 (" 8)	Used for data I/O, and for interface and device message I/O.	
Transfer bus	DAV (Data Valid)	Signal indicating information data validity on data bus	Performs acceptor and source handshake.
	NRFD (Not Ready For Data)	Reception preparation ready signal	
	NDAC (Not Data Accepted)	Reception preparation ready signal	
Control bus	ATN (Attention)	Signal indicating that information data on data bus is interface message or device message.	
	IFC (Interface Clear)	Signal to initialize interface bus system.	
	SRQ (Service Request)	Signal to request asynchronous service.	
	REN (Remote Enable)	Signal to switch control remote/local.	
	EOI (End or Identify)	Signal to indicate last data byte.	

2-4 Connectors Used

On interface: 57LE-20240 (made by DDK) or its equivalent

On cable: 57-10240 (made by DDK) or its equivalent



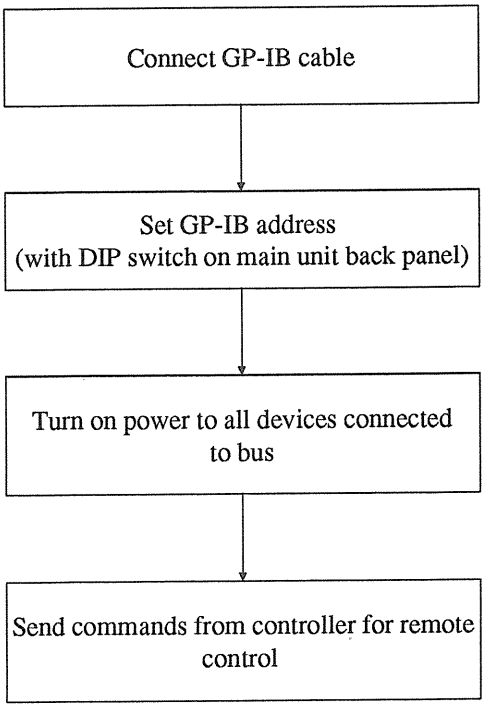
GP-IB Interface Connector Pin Assignments (Interface Connector)

Pin No.	Signal Name	Pin No.	Signal Name
1	DIO1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI	17	REN
6	DAV	18	GND
7	NRFD	19	GND
8	NDAC	20	GND
9	IFC	21	GND
10	SRQ	22	GND
11	ATN	23	GND
12	SHIELD	24	LOGIC GND

Chapter 3

GP-IB Operation Instructions

3-1 Basic Operation

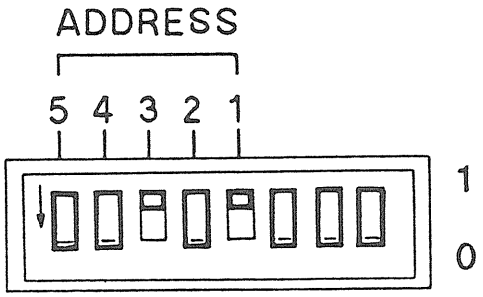


⚠ Caution

The GP-IB unit is not isolated from main unit of 8815 and 8830. Please note that GND of input unit and input terminal and GND of GP-IB are common.

3-1-1 Setting the GP-IB address

Set the GP-IP address with the DIP switch on the back panel.



The address can be set between 0 and 30.

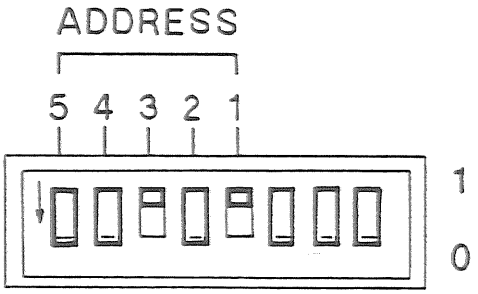
Please ensure that addresses do not overlap with those of the controller or other devices.

Setting example

Example: Setting the address to 5.

$5 = (0\ 0\ 1\ 0\ 1)_2$

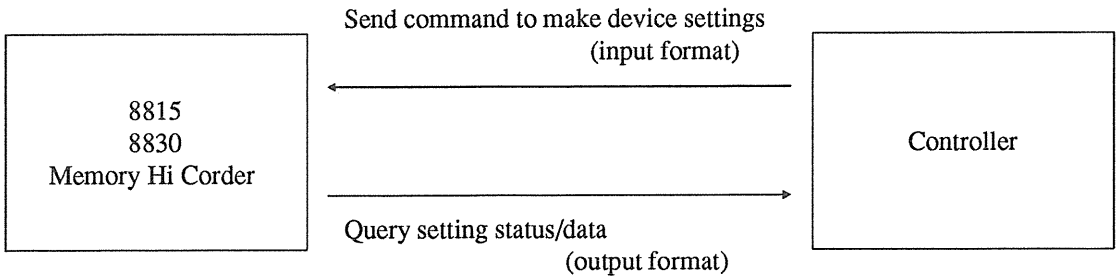
SW	5	4	3	2	1
	0	0	1	0	1



⚠ Caution

Address 31 (SW 1 - 5, all 1) is reserved and cannot be set.

3-2 I/O Format



3-2-1 Input format

The command input format is as follows:

Command	Parameter	Terminator

[Command]..... Letters indicating the type of command as follows.

For set commands (command to change settings of the 8815 and 8830), two letters indicating the command.

(Example) FN

For read commands (commands causing the 8815/8830 to output the setup status or data during the next talker action), three letters, the first of which is always Q.

(Example) QFN

[Parameter]..... Numerics specifying the settings

- These are ASCII format numerics. Codes to be applied are limited to 0 - 9 (30H - 39H), + (2BH), - (2DH).
- When using multiple parameters, separate them with a space (Δ) or comma(,).

(Example) AA1, 2, 50, 2, 0

AA1Δ2Δ50Δ2Δ5D0

[Terminator]..... Code indicating the end of instruction

- Colon (:, ASCII Code 3AH) is used as the terminator.
- If another instruction follows, the terminator can be omitted. However, for the CM and NA commands the terminator cannot be omitted.

3-2-2 Output format

The output data format is either of the following two formats. For the QRB and QDB commands, however, it should always be in the format without header.

With header ON:

GP-IB header	Parameter	GP-IB delimiter

With header OFF: (QRB, QDB)

Parameter	GP-IB delimiter

[GP-IB Header]... Indicating the meaning of output data.

- Made up of the last two letters of a read command and the read command parameters.

  (Example) The GP-IB header of the "QDR1" command is "DR1".

  (Note) The GP-IB header of the "QDAn" command is only "DA".

[Parameter]..... Number indicating settings, character string or data

- Always ASCII format numbers or character strings unless output data is the response to the QRB or QDB command. Multiple parameters are delimited with commas (,).

Parameter 1	,	Parameter 2	,		Parameter n

- The response to the QRB/QDB command is in binary format, in which one byte represents one data item.

Data 1	Data 2	Data 3	Data 4		Data n

1 byte 1 byte

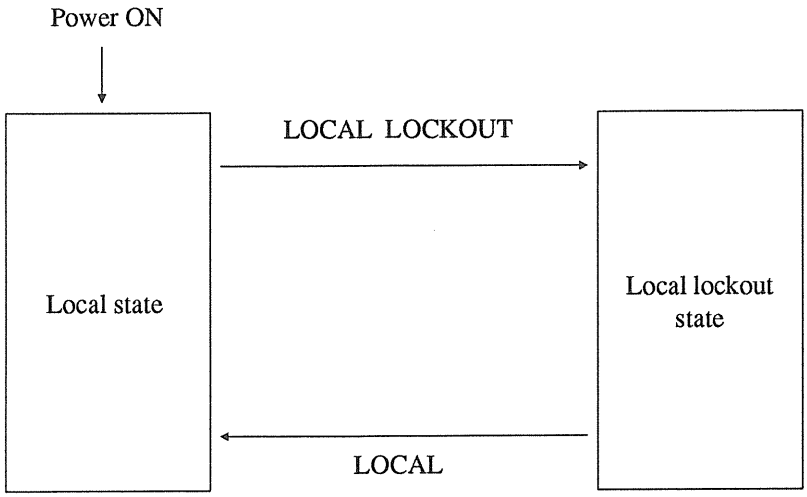
[GP-IB delimiter]... Delimiting code in data string. There are four types of delimiters as follows.

One of these can be selected with the GD command.

CRLF (E01)	0DH	0AH
CR (E01)	0DH	
LF (E01)	0AH	
(EO1).....	None	

3-3 Local State and Local Lockout State

- The GP-IB interface unit is in the local state immediately after power on.
- The interface unit enters the local lockout state when a LOCAL LOCKOUT command (LLO) is received. It returns to the local state when a LOCAL command is received.



[Local state]: State in which external control is possible both through the GP- IB interface and from the control panel.

[Local lock out state]: State in which external control is possible only through the GP-IB interface.

(Program sample 1)... HP9816 (Made by HP)

Local lockout	LOCAL LOCKOUT 7
Local	LOCAL 7

(Program sample 2)... PC9801 (Made by NEC)

Local lockout	ISET REN WBYTE &H11;
Local	IRESET REN

3-4 Device Clear and Buffer Memory

- General instructions are first stored in the 256-byte buffer, then executed in FIFO (first-in-first-out) order. However, the device clear instruction is executed immediately regardless of the buffer memory state.
- If a device clear (DCL) or select device clear (SDC) command is received, the following operation takes place:

① START/PRINT/COPY processing is aborted

② Buffer memory is cleared

③ Errors are cancelled and status byte is cleared

④ Serial polling is cancelled

⑤ The following settings are initialized

- SRQ response mask value (MS0) of the MS command
- I/O point (OD1,0) of the OD command

(Program sample 1)...HP9816 (Hewlett-Packard)

```
CLEAR 7
```

(Program sample 2)...PC9801 (NEC)

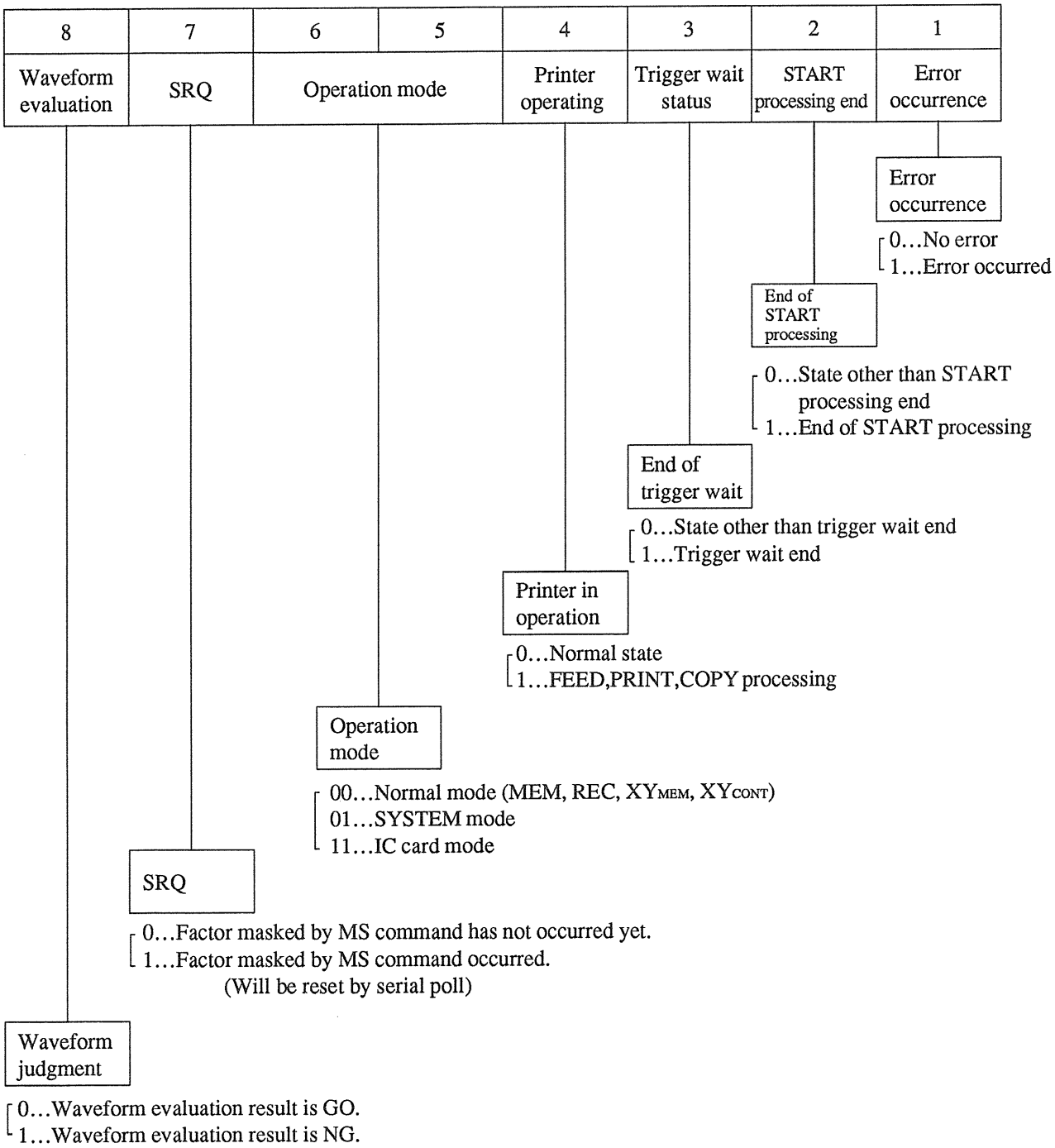
```
WBYTE &H14;
```

(Note) **Wait is needed after processing.**

3-5 Status Byte and Service Request

3-5-1 Status byte

- Bits of the status byte output in response to serial polling by the controller is as follows:



- The above also applies to the status byte output by the QUS command.
- All bits are "0" in the initial state.

3-5-2 Service request

- Conditions causing an emergency signal (service request) to be sent to the controller can be set with the MS command.

8~3	2	Bit 1
	START processing end	Error occurrence

"MS0" ... No service request

"MS1" ... Makes service request in case of error occurrence.

"MS2" ... Makes service request at end of START processing.

"MS3" ... Makes service request upon error occurrence or at end of START processing.

3-5-3 Serial polling program example

1. For the HP9816 (Hewlett-Packard)

```
100 ON INTR 7 GOSUB 500
110 ENABLE INTR 7 ; 2

500 S=SPOLL (705)

550 ENABLE INTR 7;2
560 RETURN
```

Set SRQ interrupt processing routine and enable interrupt.

Serial poll from address five.
Enable interrupt.

2. For the PC9801 (NEC)

```
100 ON SRQ GOSUB 500
110 SRQ ON

500 POLL 5,S

550 SRQ ON
560 RETURN
```

3-6 GP-IB Errors

- Errors are categorized as general errors, warnings, and GP-IB special errors.

Group	Error number	Name	Description
General errors	1~20		
Warnings	31~37		
GP-IB errors	51	Command error	• Undefined command has been entered.
	52	Parameter error	• Input instruction parameter (number) format is erroneous. • Parameter value is inappropriate.
	53	Inappropriate command	• System is in a state in which command cannot be input.
	54	Output request error	• Output request (talker designation) is inappropriate.

- Error numbers output by the QER command are as above.
- If error #54, output request error, occurs, the following data will be output:

NG999, 999

Chapter 4

GP-IB Commands

4-1 Using Set Commands

- When the conditions specified in the command list are met, send set commands in accordance with the <SET COMMAND> format.

Program example for HP9816

```
100 ! ---------------------------------- !
110 !   8830     Set Command  HP9816     !
120 ! ---------------------------------- !
130 !
140 Adr=705
150   OUTPUT Adr;"FN1"              !Function MEM
160   OUTPUT Adr;"TD2"              !Time/Div 500us
170   OUTPUT Adr;"SH0"              !Shot     20DIV
180   OUTPUT Adr;"ST"               !< START >
190 END
```

Program example for PC9801

```
100 ' ---------------------------------- '
110 '   8830     Set Command  PC9801     '
120 ' ---------------------------------- '
130 '
140 ADR=5
150 ISET IFC
160 ISET REN
170  PRINT@ ADR;"FN1"              'Function MEM
180  PRINT@ ADR;"TD2"              'Time/Div 500us
190  PRINT@ ADR;"SH0"              'Shot     20DIV
200  PRINT@ ADR;"ST"               '< START >
210 IRESET REN
220 END
```

4-2 Using Read Commands

- When the conditions specified in the command list are satisfied, send read commands in accordance with the <READ COMMAND> format to make the 8815/8830 stand by for output. Then, designate the 8815/8830 as the talker and receive data output from the talker.
- Data prepared for output by the <READ COMMAND> will be in the format described in the command list. <READ COMMAND> without SET COMMAND will be in the format shown in parentheses in the command list.

Program sample for HP9816

```
100 ! ---------------------------------- !
110 !   8830    Read Command  HP9816     !
120 ! ---------------------------------- !
130 !
140 DIM Ti$[20]
150 Adr=705
160   OUTPUT Adr;"GH1"            !Header ON
170   OUTPUT Adr;"QFN"            !Read Function
180    ENTER Adr;Ans$
190   OUTPUT Adr;"QRT"            !Read Date & Time
200    ENTER Adr;Ti$
210   PRINT Ans$,Ti$
220 END
```

Program sample for PC9801

```
100 ' ---------------------------------- '
110 '   8830     Read Command  PC9801    '
120 ' ---------------------------------- '
130 '
140 ADR=5
150 ISET IFC
160 ISET REN
170  PRINT@ ADR;"GH1"            'Header ON
180  PRINT@ ADR;"QFN"            'Read Function
190   INPUT@ ADR;ANS$
200  PRINT@ ADR;"QRT"            'Read Date & Time
210   INPUT@ ADR;DA$,TI$
220  PRINT ANS$,DA$,TI$
230 WBYTE &H5F;
240 IRESET REN
250 END
```

Caution for the PC9801:

Do not end the program with the 8815/8830 left specified as the talker.

Be sure to reset the talker state before ending processing.

4-3 Using Service Requests

(1) Set the 8815/8830 SRQ response mask value with the MS command, set the SRQ interrupt jump destination on the controller side, then enable SRQ interrupts.

(2) In the SRQ interrupt routine, do serial polling, read the 8815/8830 status byte, and perform processing according to values read, before re-enabling SRQ interrupts and returning.

Program sample for HP9816.

```
100 ! ---------------------------------- !
110 !   8830   Service Request HP9816    !
120 ! ---------------------------------- !
130 !
140 Adr=705
150 ON INTR 7 GOTO Srq_sub
160 OUTPUT Adr;"MS1"                    !SRQ mask
170 ENABLE INTR 7;2                     !Intr enable
180 !
190   Fn=0
200   OUTPUT Adr;"FN";Fn                !Read Date & Time
210    Fn=Fn+1
220    GOTO 200
230 !
240 Srq_sub:                            !SRQ Intr
250   S=SPOLL(Adr)
260   CLEAR 7                           !Buff Clear
270    PRINT " ",SRQ=";S
280   OUTPUT Adr;"MS1"
290   ENABLE INTR 7;2
300 END
```

```
100 ' ---------------------------------- '
110 '   8830   Service Request PC9801    '
120 ' ---------------------------------- '
130 '
140 ADR=5
150 ISET IFC
160 ISET REN
170 ON SRQ GOSUB *SUB
180 PRINT@ ADR;"MS1"                        'SRQ mask
190 SRQ ON
200 '
210 I=0
220  PRINT@ ADR;"FN"+STR$(I)                'Function Set
230 I=I+1 : GOTO 220
240 '
250 *SUB                                    'SRQ Intr
260    POLL ADR,S
270    IF (S AND &H40)<>0 THEN 320          'SRQ Check
280      DEF SEG=&H60 : A%=PEEK(&H9F3)
290      A%=A% AND &HBF : POKE &H9F3,A%     'SRQ Bit Clear
300      GOTO 340
310
320    WBYTE &H14;                          'Buffer Clear
330      PRINT "SRQ=";S
340    PRINT@ ADR;"MS1"                     'SRQ mask
350    SRQ ON
360 IRESET REN
370 END
```

Note for using PC9801

When a PC9801 is used, a SRQ interrupt may occur even if a service request is not made. In this case, it is necessary to forcibly clear the PC9801's SRQ bit as shown in lines 280 to 290 above.

(Excerpt from "PC Note" published by Personal Computers Sales Promotion Headquarters of NEC Corp.)

4-4 Data Input and Output

4-4-1 Output of character string data

- Data output by the cursor read-out output (QVO) or voltage conversion (QVL) command is a character string, including a unit of time or voltage.
- Data output by the trigger detection time output (QTJ) or time output (QRT) is a character string including "-" and ":".

(Output sample)

"QVO" ——→ VO236us

"QVL" ——→ VL1, 100, 25.2mV

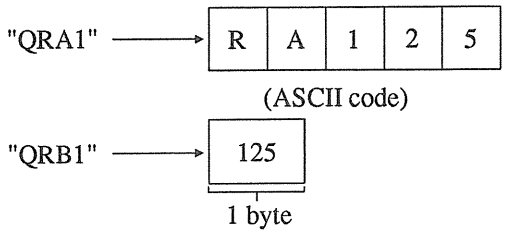
"QTJ" ——→ TJ90-03-15, 15:14:27

"QRT" ——→ RT89-11-30, 09:48:35

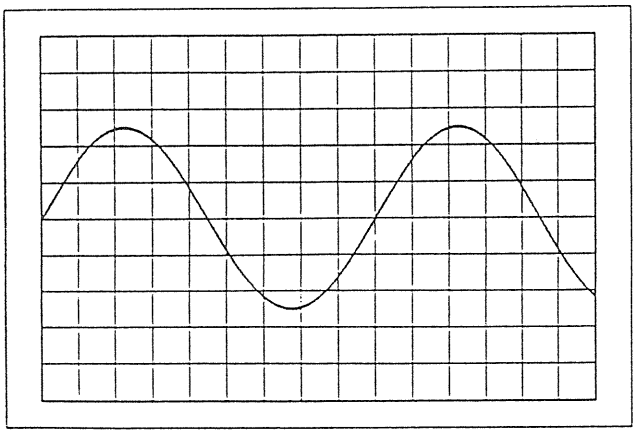
4-4-2 Output of realtime data

- Data measured is output when a QRA or QRB command is received.
- For the QRA command, output data is in ASCII format; for the QRB command, output data is in binary format.

(Output sample)



- Analog unit data is in the range from -3 to 252. The relationship between numeric values and chart output is as follows:



(Note) Binary data output format of 253, 254 or 255 indicates -3, -2 or -1, respectively.

$253=(FD)_{16} = -3$
$254=(FE)_{16} = -2$
$255=(FF)_{16} = -1$

- In the logic unit data, each channel corresponds to a bit.

8	7	6	5	4	3	2	1
A1	A2	A3	A4	B1	B2	B3	B4

0.....Low
1.....Hi

(Example) For data 129, $129 = (10000001)_2$

A1	A2	A3	A4	B1	B2	B3	B4
Hi	Low	Low	Low	Low	Low	Low	Hi

4-4-3 Storage data output method

(1) Use the QMX command to check whether or not storage data I/O is possible. If data is not stored, output is not possible because the value output by QMX becomes "0".

(2) Specify the data channel and point to be output using the OD command. The point shifts automatically as data I/O progresses. If you want to obtain data in sequence, specification is only necessary once.

(3) If you want to obtain data in ASCII format, use the QDA command. If you want to obtain data in binary format, use the QDB command. Data which can be output in one batch is from 1 to 50 for QDA or 1 to 250 for QDB.

(Note) • Total processing time is reduced by outputting more data in each batch.
• With binary output, ASCII control codes are also output. If the data string includes a string that is the same as a delimiter, data will not be output correctly.

Program sample..... Obtaining channel 1 data (2000 pcs) stored with a SHOT length of 40 DIV
(Sample 1: ASCII output with HP9816)

```
100 ! ---------------------------------- !
110 !   8830  Data Out (ASCII) HP9816    !
120 ! ---------------------------------- !
130 !
140 DIM Ch1(2000),Da(49)
150   Adr=705
160     OUTPUT Adr;"GH0,QMX"
170     ENTER Adr;Mx
180     IF Mx<>2000 THEN 310      !Enable Check
190 !
200 OUTPUT Adr;"OD1,0"            !Output Point CH1,No.0
210 FOR I=0 TO 39
220   OUTPUT Adr;"QDA50"
230     ENTER Adr;Da(*)
240     FOR J=0 TO 49
250       Ch1(50*I+J)=Da(J)
260     NEXT J
270 NEXT I
280   OUTPUT Adr;"QDA1"
290    ENTER Adr;Ch1(2000)        !Last Data
300 !
310 END
```

(Sample 2: Binary output with HP9816)

```
100 ! ---------------------------------- !
110 !   8830  Data Out (BINARY) HP9816   !
120 ! ---------------------------------- !
130 !
140 DIM Ch1(2000),Da(249)
150   Adr=705
160     OUTPUT Adr;"GH0,QMX"
170     ENTER Adr;Mx
180     IF Mx<>2000 THEN 310      !Enable Check
190 !
200 OUTPUT Adr;"OD1,0"            !Output Point CH1,No.0
210 FOR I=0 TO 7
220   OUTPUT Adr;"QDB250"
230     ENTER Adr USING "B":Da(*)
240     FOR J=0 TO 249
250       Ch1(250*I+J)=Da(J)
260     NEXT J
270 NEXT I
280   OUTPUT Adr;"QDB1"             !LAST DATA
290     ENTER Adr USING "B";Ch1(2000)
300 !
310 END
```

(Sample 3: ASCII output with PC9801)

```
100 '-------------------------------------'
110 '  8830   Data Out (ASCII) PC9801     '
120 '-------------------------------------'
140 DEFINT D : DIM D(2000)
150 ADR=5
160 ISET IFC : ISET REN
170 '
180 PRINT@ ADR;"FN1,SH1,ST"       'MEM,40DIV,<START>
190 PRINT@ ADR;"GH0,QMX"          'HEADER OFF
200 INPUT@ ADR;MX
210 IF MX<>2000 THEN 310
220 '
230 PRINT@ ADR;"OD1,0"            'Output Point CH1,No.0
240   FOR I=0 TO 1990 STEP 10
250     PRINT@ ADR;"QDA10"
260     INPUT@ ADR;D(I),D(I+1),D(I+2),D(I+3),D(I+4)
                  ,D(I+5),D(I+6),D(I+7),D(I+8),D(I+9)
270     NEXT I
280     PRINT@ ADR;"QDA1"         'Last Data
290     INPUT@ ADR;D(2000)
300 '
310 WBYTE &H5F;
320 IRESET REN
330 END
```

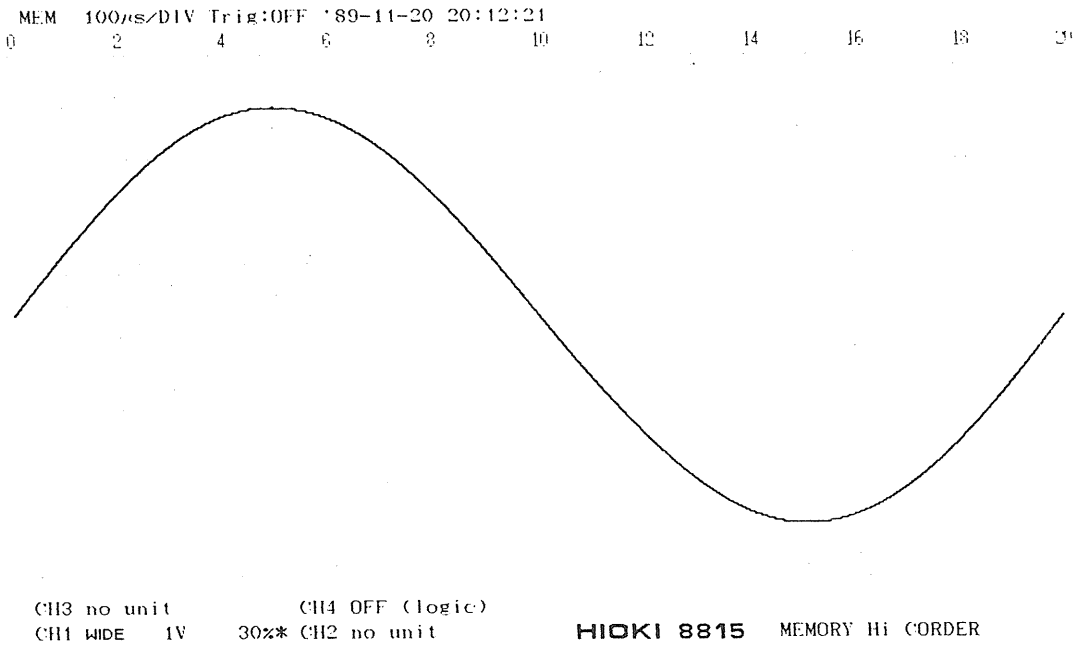
4-4-4 Storing data input

(1) Use thee QMX command to check whether or not data I/O is possible. If the value output by QMX is "0", data I/O is not possible.

(2) Specify the input data channel and point using the OD command, then issue the DA command.

(Note) As in the case of storage data output, processing time is reduced by inputting as much data as possible in each batch.

Program sample..... When data is stored with a SHOT length of 20DIV, the following program sets a SIN waveform in CH 1.



(Waveform after program execution)

(Sample for HP 9816)

```
100 ! ---------------------------------- !
110 !   8830   Data Input       HP9816   !
120 ! ---------------------------------- !
130 !
140 Adr=705
150   OUTPUT Adr;"GH0,QMX"
160     ENTER Adr;Mx
170     IF Mx<>1000 THEN 250
180 !
190   DEG
200   OUTPUT Adr;"OD1,0"
210   FOR I=0 TO 1000
220     OUTPUT Adr;"DA";INT(100*SIN(36*I/100)+125.5)
230   NEXT I
240 !
250 END
```

(Sample for PC 9801)

```
100 '-------------------------------------'
110 '  8830   Data Input       PC9801    '
120 '-------------------------------------'
130 ADR=5
140 ISET IFC : ISET REN
150 '
160 PRINT@ ADR;"GH0,QMX"          'HEADER OFF
170 INPUT@ ADR;MX
180 IF MX<>1000 THEN 250
190 '
200 PRINT@ ADR;"OD1,0"            'Input Point CH1,No.0
210   FOR I=0 TO 1000
220     PRINT@ ADR;"DA"+STR$(INT(100*SIN(3.14*I/500)+125))
230   NEXT I
240 '
250 WBYTE &H5F;
260 IRESET REN
270 END
```

4-5 Using Special Functions

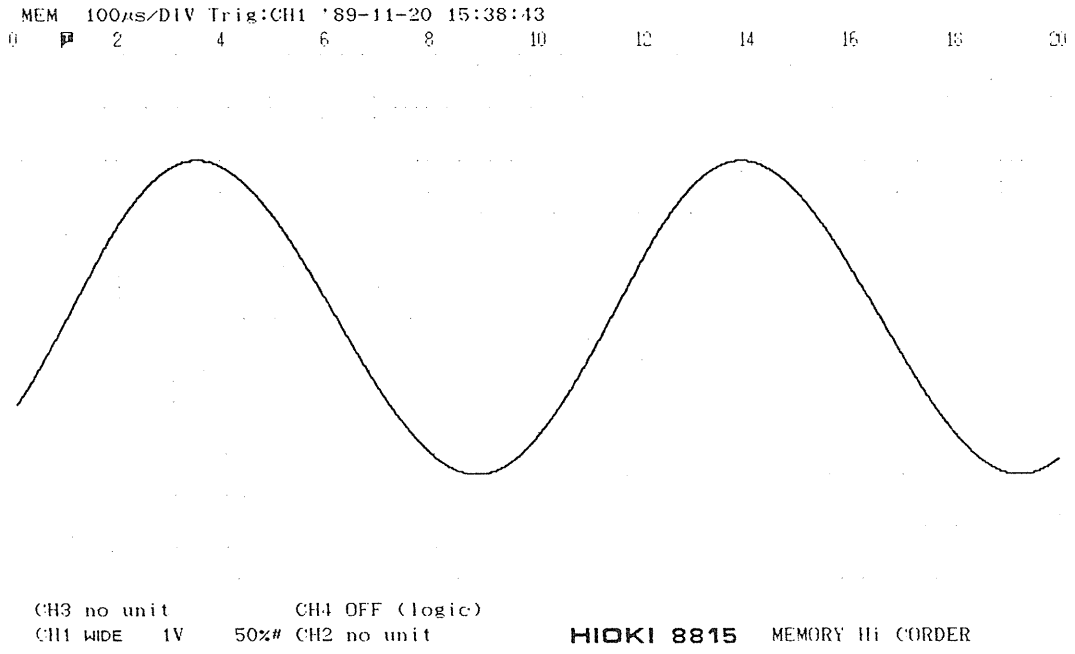
4-5-1 PEAK value computation (QPK)

- When analog units are used, minimum and maximum values of stored data can be computed.
- Calculation of minimum and maximum values is performed on all stored data. Both numeric and converted voltage values are output.
- The output format is as follows:

Minimum value	,	Maximum value	,	Minimum voltage	,	Maximum voltage

(Output sample)

50, 200, − 3 V, 3 V



4-5-2 Average value computation (QME)

- When analog units are used, the average and variance of stored data can be computed.
- The following formula is used:

$$\text{Average value } \bar{d} = \frac{1}{n+1} \sum_{i=0}^{n} d_i$$

d_i: i-th datum

$$\text{Variance value } V = \frac{1}{n+1} \sum_{i=0}^{n} (d_i - \bar{d})^2$$

d_i : i-th datum

$\bar{d}_i$: Average value

(Note) Standard deviation is the square root of the variance.

4-5-3 Area computation

- The area between data from two analog units can be computed.
- The following formula is used, where the unit are $(DIV)^2$.

(Note) If the same channel is specified for both analog units, the area will be computed for that channel against reference zero.

$$\text{Area } A = \frac{1}{25 \times 50} \left\{ \frac{|d_{10} - d_{20}|}{2} + \sum_{i=1}^{n-1} |d_{1i} - d_{2i}| + \frac{|d_{1n} - d_{2n}|}{2} \right\}$$

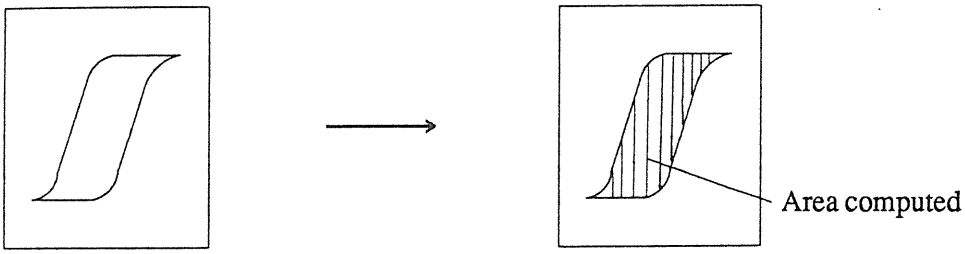
d_{1i} : i-th datum of channel 1

d_{2i} : i-th datum of channel 2

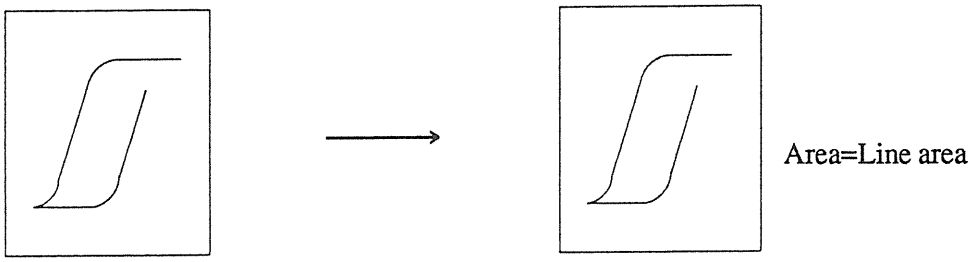
- Areas of XY waveforms can be calculated.
- The XY waveform is drawn by PRINT TYPE LINE and the area enclosed by the line is calculated, including the line itself.

Computed area

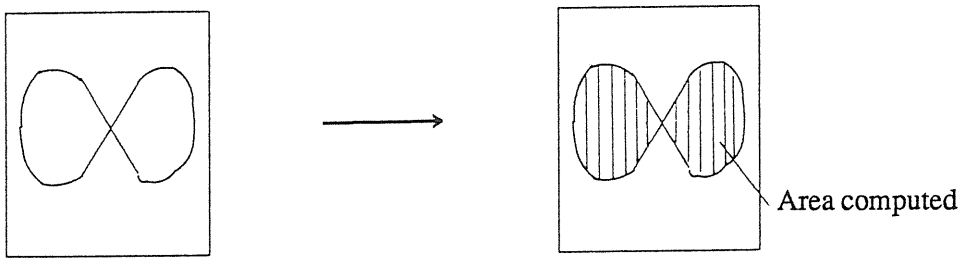
XY waveform



XY waveform (if no encircled area)



XY waveform



4-5-4 Differential and integral

- When analog units are used, differentials and integrals of stored data can be computed.
- For differentials, the source channel must be different from channel in which the computed result is stored. With integrals, both channels can be the same.
- For both differentials and integrals, the coefficient K (1 - 50) must be specified. For differentiation is the interval between points where the difference is obtained;For integration, it is the divisor of added result.
- The computation assumes that the 50% position (125 in data) is the 0 position.
- The following expression is used:

Differential $b_i = (d_{i+K2} - d_{i-K2}) + 125 \quad (i = 0, 1, \ldots\ldots, n)$

b_i : i-th computed result datum

d_i : i-th datum of source channel data

Integral $b_i = \left\{ \frac{1}{K} \sum_{t=0}^{i} (d_t - 125) \right\} + 125 \quad (i = 0, 1, \cdots\cdots, n)$

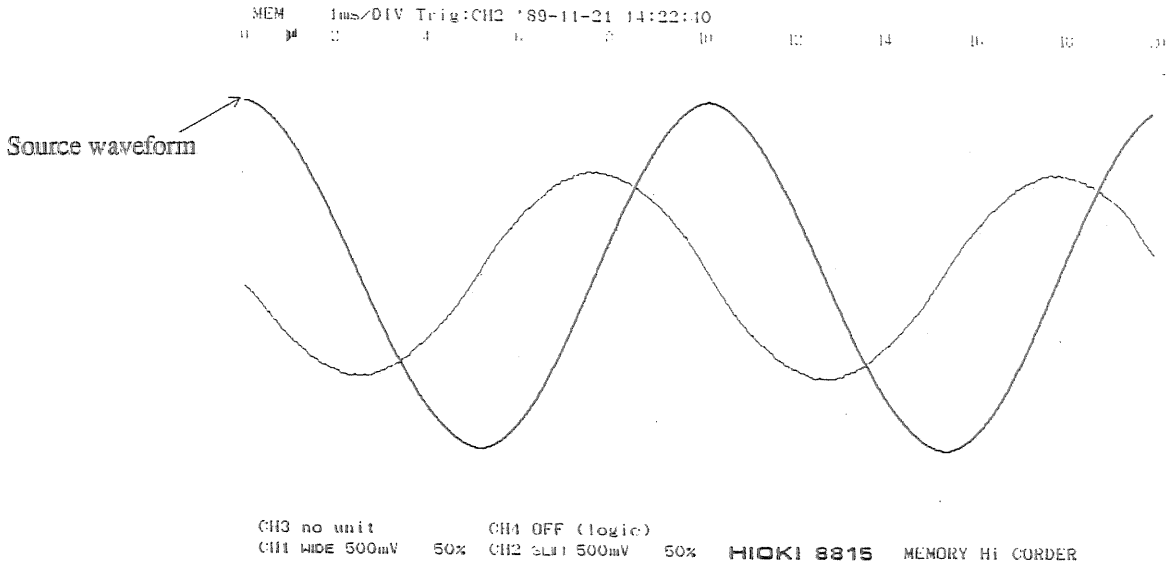
b_i : i-th computed result datum

d_i : i-th source channel datum

(Computation sample 1)

Differentiation of CH1 waveform (SIN wave) and input of result to CH2.

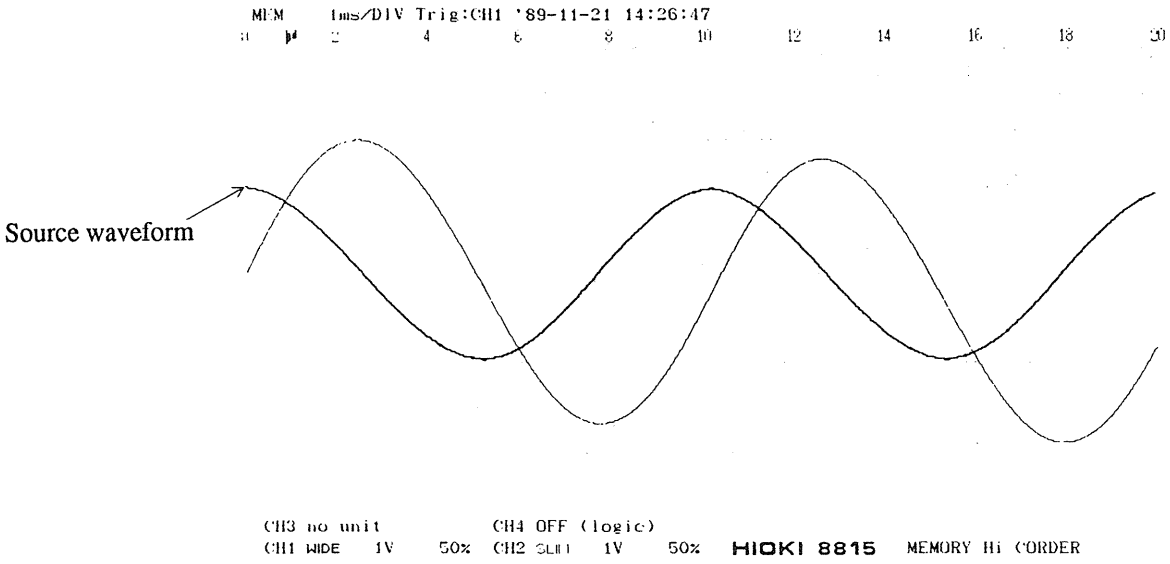
"D I 1, 2, 50"



(Computation sample 2)

Differentiation of CH1 waveform (SIN wave) and input of result to CH2.

"I N 1, 2, 50"



4-5-5 SWAP Function

- Stored data can be swapped between channels. This is illustrated below.

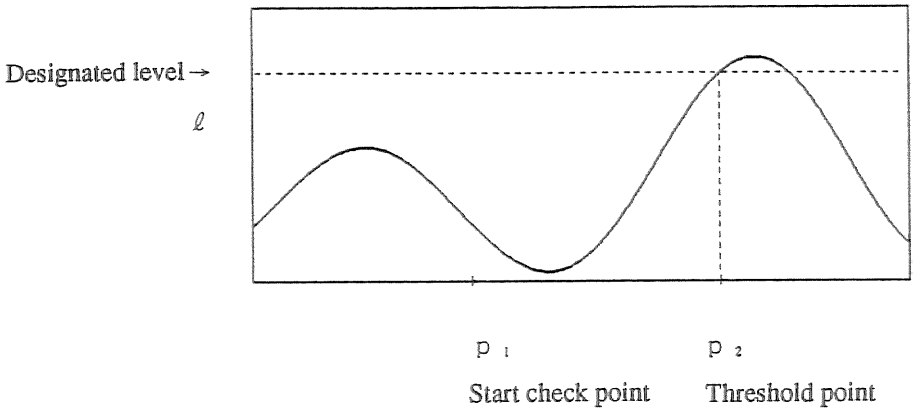
$d_{1i} \rightleftarrows d_{2i}$ $(i = 0, 1, \ldots\ldots, n)$

d_{1i}: Channel 1's i-th datum

d_{2i}: Channel 2's i-th datum

4-5-6 Computation of the point of threshold passage

- The point of passage through a specified threshold (threshold point) can be calculated for stored data, such as the internal trigger for the analog unit.



- Starting from a specified start check point P_1 (0-125000), search for the point of passage through the threshold level (-3 - 252) and slope (up or down) at the point of passage. The first point P_2 located will be output.

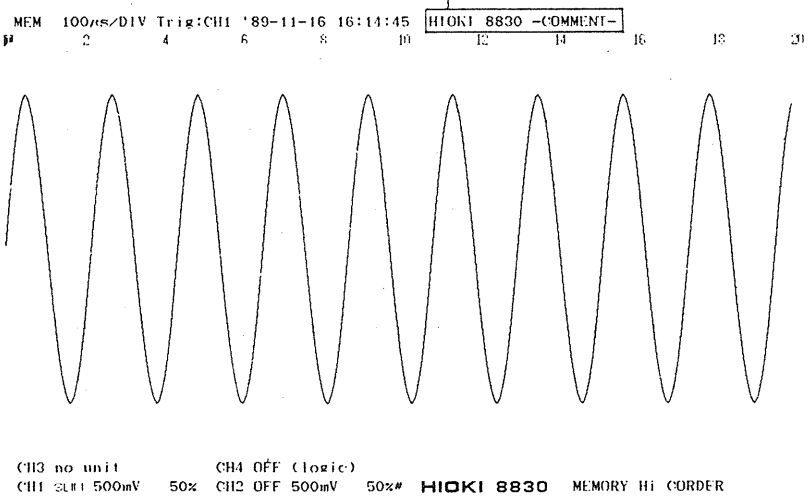
(Note) If the threshold is not passed, "-1" is output.

4-5-7 Comment printing

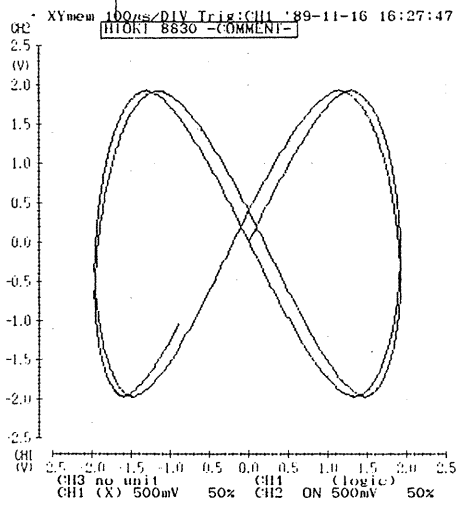
- A comment of up to 20 characters can be printed on the chart.
- The comment is printed in the upper part of the waveform display area.
- Characters which can be printed are:
  8815... ASCII code 20H - 39H, 3BH - 7FH
  8830... Letters (uppercase only), numbers (0 - 9), -, space

(Note) Characters other than the above are replaced by spaces.

Comment printing area



Comment printing area



- The command format is as follows. The command must end with a terminator.

C	M	Comment characters	Terminator

- In order to clear the comment, use:

C	M	Terminator

Chapter 5

Command List

5-1 Command List

- The [DCL] command is not an ASCII code command. It is a device clear or select device clear command to the GP-IB.
- If a command is given when essential conditions are not satisfied, a command error occurs (error 53).
- In the "Conditions" column, "Storage data I/O possible" means that the function is used when MEM or XY$_{MEM}$ data is present.
- All parameters without explanation are ASCII values.

5-2 8815 Command List

- 8815 Execution processing

Item	Set command	Read command	Conditions	Explanation
START processing	ST	--		Same as [START] key at time of waveform fetching
STOP processing	[DCL]	--		Same as [STOP] key (Note) Wait is needed after processing.
Print processing	PR	--	MEM XY_{MEM} XY_{CONT}	Same as [PRINT] key
LIST Processing	LS	--		Same as [FEED]+[COPY] keys. *1
FEED processing	FD ℓ	--		ℓ ...Paper feed length (in mm) $6 \leqq \ell \leqq 255$
Partial print start position	SS s	QSS	MEM	s...Partial print start position (0-99)
Partial print processing	PP	--	MEM	Execute partial print
Auto TIME/DIV	AT	--	MEM XY_{MEM} Other than trigger source OFF	Execute time axis automatic setting Same as [←]+[→] keys. *1
GAUGE processing	GA	--		Same as [FEED]+[PRINT] keys. *1
Memory clear	MC	--	XY_{CONT}	Same as [CLR] key
System reset	SR	--		Initialize 8815 Same as power on while pressing [STOP] key.

*1 "+" means pressing the keys at the same time.

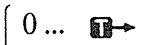
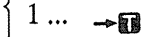
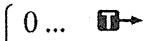
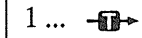
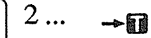
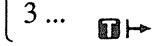
• 8815 Measuring condition setting

Item	Set command	Read command	Conditions	Explanation
Function	FN f	QFN		f...Function (0-3) 0 ...REC 2....XY_{MEM} 1 ...MEM 3.... XY_{CONT}
TIME/DIV	TD t_1	QTD	REC	t_1....TIME/DIV (0-11) 0 ...1s 6....1min 1 ... 2s 7....2min 2 ...5s 8.... 5min 3 ...10s 9.... 10min 4 ...20s 10....20min 5 ...50s 11....50min
	TD t_2	QTD	MEM XY_{MEM}	t_2.... TIME/DIV(0-14) 0 ...100µs 8....50ms 1 ... 200µs 9....100ms 2 ...500µs 10....200ms 3 ...1ms 11....500ms 4 ...2ms 12....1s 5 ... 5ms 13....2s 6 ...10ms 14....5s 7 ...20ms
SHOT	SH s_1	QSH	REC	s_1 ...SHOT length (0-6) 0 ...20DIV 4....300DIV 1 ...40DIV 5.... 600DIV 2 ...80DIV 6....CONT 3 ... 160DIV
	SH s_2	QSH	MEM XY_{MEM}	s_2 ...SHOT length (0-7) 0 ...20DIV 4....300DIV 1 ... 40DIV 5....600DIV 2 ...80DIV 6.... 1200DIV 3 ...160DIV 7....2500DIV
Compression rate	MG m	QMG	MEM	m ...Compression rate (0-1) 0 ... ×1 1....1/10

• 8815 trigger setting

Item	Set command	Read command	Conditions	Explanation
Trigger mode	--	QTM		c ....Trigger mode (0-1) 0 ...Single 1 ...Repeat
Trigger source	TS s	QTS		s.....Trigger source (0-3) 0 ...OFF 1 ...EXT 2 ...MENU 3 ...INT
Trigger channel	TC c	QTC	Trigger source INT	c .... Trigger channel (1-4) 1 ...CH1 2 ...CH2 3 ...CH3 4 ...CH4
Trigger level	TL ℓ	QTL	Analog unit	ℓ...Trigger level (in %) $0 \leqq \ell \leqq 99$
Trigger slope	SL s	QSL	Trigger source INT	S....Trigger slope (0-1) 0 ...UP (↑) 1 ...DOWN (↓)
Trigger filter	TFf (Only logic unit channel)	QTF	MEM XY_{MEM}	f.....Trigger filter (0-6) 0 ...OFF 4.... 0.6DIV 1 ...0.1DIV 5.... 1.3DIV 2 ...0.2DIV 6.... 2.6DIV 3 ...0.3DIV
	TFf (Only logic unit channel)	QTF	REC XY_{CONT}	f.....Trigger filter (0-1) 0 ...OFF 1 ...ON

- 8815 Trigger setting

Item	Set command	Read command	Conditions	Explanation
Trigger timing	PT t	QPT	REC XY CONT	t.....Trigger timing (0-1) 0 ...  1 ... 
Pre-trigger p	PT p	QPT	MEM XY MEM	p .... Pre-trigger (0-3) 0 ...  1 ...  2 ...  3 ... 
Trigger waitless	--	QTW (TW w)	MEM XY MEM	w ...Waitless (0-1) 0 ...OFF 1 ...ON

• 8815 System parameters

Item	Set command	Read command	Conditions	Explanation
Start key backup	--	QBT (BT t)		t.....Backup (0-1) 0 ...OFF 1 ...ON
Grid type	--	QGR (GR g)		g ....Grid type (0-2) 0 ...OFF 1 ... NORMAL 2 ...FINE
Auto list and gauge	--	QLT (LT ℓ)		ℓ ...Auto list and gage (0-1) 0 ... OFF 1 ...ON
Execute self-checking	SF t	--		t.....Type of self-checking (1-4) 1 ...ROM/RAM check 2 ...LED check 3 ... Printer check 4 ...Key check
Clock set	RT yy-mm-dd, HH:MM	--		yy ..... Year (00-99) mm... Month (01-12) dd..... Date (01-31) HH ... Hour (00-23) MM.. Minute (00-59) (Note) Each to be set using two digits.
Clock output	--	QRT (RT t$)		t$ ...Clock (Character string) (Example) "90-03-15, 15:14:27"

• 8815 Interface control

<table>
<tr><th>Item</th><th>Set command</th><th>Read command</th><th>Conditions</th><th>Explanation</th></tr>
<tr><td>GP-IB delimiter</td><td>GD d</td><td>--</td><td></td><td>d....GP-IB output delimiter (0-3)
0 ...CRLF (EOI)
1 ...CR (EOI)
2 ...LF (EOI)
3 ... (EOI)</td></tr>
<tr><td>GP-IB header</td><td>GH h</td><td>--</td><td></td><td>h....GP-IB header (0-1)
0 ...OFF
1 ...ON</td></tr>
<tr><td>Error number output</td><td>--</td><td>QER
(ER e)</td><td></td><td>e ....Error number (0-54)
0 ...No error
1 ...No amplifier on CH1
2 ...No storage data on CH1
3 ...Lift head
4 ...Paper end
51-54...GP-IB error (Refer to 3-6.)</td></tr>
<tr><td>Machine type and model number output</td><td>--</td><td>QID
(ID i)</td><td></td><td>i...Machine's type and model number
(8815)</td></tr>
<tr><td>SRQ response masking</td><td>MS m</td><td>QMS</td><td></td><td>m... SRQ response masking value (0-3)
<table><tr><td>8-3</td><td>2</td><td>1</td></tr><tr><td></td><td>START end</td><td>Error</td></tr></table>• SRQ clear (Refer to 3-5-2.)</td></tr>
<tr><td>Status byte output</td><td>--</td><td>QUS
(US s)</td><td></td><td>s.....Status byte
<table><tr><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr><tr><td>Waveform judgment</td><td>SRQ</td><td colspan="2">Operating mode</td><td>Printer</td><td>Wait for trigger</td><td>START</td><td>Error</td></tr></table>(Refer to 3-5-1.)</td></tr>
<tr><td>Initialization</td><td>[DCL]</td><td>--</td><td></td><td>• GP-IB initialization (Refer to 3-4.)
(Note) Wait is needed after processing.</td></tr>
</table>

• 8815 Input unit

Item	Set command	Read command	Conditions	Explanation
Type of input unit	--	QAM c (AMc,n)		c ....Channel (1-4) n ....Type of input unit (0-15) 9 ...8932 Analog unit 14 .8933 Logic unit 15. Unloaded
Analog unit range	--	QAA c (AA c, n_1, n_2, n_3, n_4)	Analog unit	c ....Channel (1-4) n_1 ... Input voltage range (numerics part) (–1-13) 0 ... 0.1 8.... 50 1 ... 0.2 9.... 100 2 ... 0.5 10.... 200 3 ... 1 11.... 500 4 ... 2 12....1000 5 ... 5 13....2000 6 ...10 7 ...20 -1....Undefined range n_2 ...Input voltage range (unit part) (-1-4) 0 ...mV/DIV 3....Vrms/DIV 1 ...V/DIV 4.... °C/DIV 2 ...mVrms/DIV -1....No unit n_3 ...Position (-10-10) -10... -100% -9 .. -90% | | 0... 0% | | 9... 90% 10... 100% n_4 ...Type of filter (0-2) 0 ...OFF 1 ... 5Hz 2 ...500Hz

• 8815 Input unit

Item	Set command	Read command	Conditions	Explanation
Logic unit	--	QLA c (LA c, n_1, n_2, n_3, n_4)	Logic unit	c ....Channel (1-4) n_1 ...Trigger pattern (Low) 1...Low n_2 ...Trigger pattern (Hi)1...Hi Each corresponds with 8-ch bit. (0 - 255) n_3 ...AND/OR (0-1) 0... AND 1...OR n_4 ...(To be used in the future.)

• 8815 Printing

Item	Set command	Read command	Conditions	Explanation
DOT, LINE	--	QDL (DL d)		d....DOT/LINE (0-2) 0 ...DOT 1 ... LINE 2 ...SMOOTH
DRAWING	--	QDR c (DRc,d)		c ....Channel (1-4) d....Draw type (0-7) Analog / Logic 0...off / 4....Off 1...Line / 5.... Ach 2...Bold line / 6....A and Bch
Print format	--	QFM (FM m)	REC MEM	m ...Print format (0-2) 0 ...NORMAL 1 ...DUAL 2 ...QUAD

• 8815 Realtime data

Item	Set command	Read command	Conditions	Explanation
Output of realtime data (ASCII format)	--	QRA c (RAc,d)		c .... Channel (1-4) d ....Data (ASCII Format) { Analog ... -3 - 252 { Logic ... 0-255 (Refer to 4-4-2.)
Output of realtime data (binary format)	--	QRB c (d$)		c .... Channel (1-4) d$ ..Data (binary format) (0-255) (Note) With the analog unit, 255, 254 and 253 are -1, -2 and -3 respectively. (Refer to 4-4-2.)

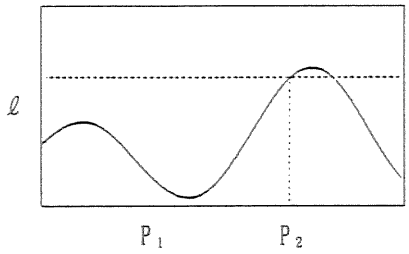
• 8815 Stored data I/O

Item	Set command	Read command	Conditions	Explanation
Stored data I/O state information	--	QMX (MX n)	MEM XY_{MEM}	n ....Number of I/O possible data 0... I/O not possible 1000... 20DIV 2000... 40DIV 4000... 80DIV 8000... 160DIV 15000... 300DIV 30000... 600DIV 60000..1200DIV 125000..2500DIV
I/O point designation	OD c,p	QOD	Stored data I/O possible	c .... Channel (1-4) p ....Point (0-125000)
Stored data output (ASCII)	--	QDA n (DA $d_1, d_2, d_3 ..., d_n$)	Stored data I/O possible	n.....Number of output data units (1-50) d_i ...i-th data (ASCII format) Analog...-3-252 Logic... 0-255 (Refer to 4-4.)
Stored data output	--	QDB n (d$)	Stored data I/O possible	n ....Number of output data units (1-250) d$ ..n-byte data (binary format) d_1 d_2 d_3 d_4 ... d_{n-1} d_n (Note) No GP-IB header (Refer to 4-4.)
Stored data input (ASCII)	DA $d_1, d_2, d_3, d_4, ..., d_n$	--	Stored data I/O possible	d_i ...Data (ASCII format) Analog...-3-252 Logic...0-255 (Refer to 4-4.)

• 8815 Computation functions

Item	Set command	Read command	Conditions	Explanation
Voltage conversion	--	QVL, c,p (VL c,p, d$)	MEM Stored data I/O possible Analog unit	c ....Channel (1-4) p ....Point (0-125000) d$ ..Voltage (Character string) (Example) "-43.2mV"
Peak computation	--	QPK c (PK c,M_1, M_2, $P_1$$, $P_2$$)	MEM Stored data I/O possible Analog unit	c...Channel (1-4) M_1...Minimum data M_2...Maximum data $P_1$$...Minimum voltage (character string) $P_2$$...Maximum voltage (character string)
Average/ variance computation	--	QME c (ME c,m,v)	MEM Stored data I/O possible Analog unit	c ....Channel (1-4) m ...Average v ....Variance (Note) Standard deviation is ($\sqrt{v}$)
Area computation	--	QAR c_1, c_2 (AR c_1, c_2, a)	XY mem Stored data I/O possible analog unit	c_1 ...Channel1 (1-4) c_2 ...Channel2 (1-4) a ....Area value (In DIV^2) (Note) Where $c_1 = c_2$, 1 channel area is calculated against zero position.
XY area computation	--	QFX c (FX c,a)	XY_{MEM} Stored data I/O possible Analog unit	c ....Y axis channel (2-4) a ....XY area value (In DIV^2) (Example) "48.686"
Differentiation	DI c_1, c_2, k	--	MEM Stored data I/O possible Analog unit	c_1 ... Source channel (1-4) c_2. ..Destination channel (1-4) k .... Interval (1-50) (Note) c_1 not same as c_2
Integration	IN c_1, c_2, k	--	MEM Stored data I/O possible Analog unit	c_1 ...Source channel (1-4) c_2 ...Destination channel (1-4) k .... Divider (1-50) (Note) ($c_1 = c_2$) is possible.

• 8815 Computation functions

Item	Set command	Read command	Conditions	Explanation
Point of threshold passage computation	--	QCP C, ℓ, s, P_1 (CPc,ℓ s,P_1, P_2)	MEM Stored data I/O possible Analog unit	c ....Channel (1-4) ℓ ... Threshold level (-3-252) s.....Threshold slope (0-1) {0...UP (↑) 1...DOWN (↓) p_1 ...Start check point (0-125000) p_2 ...Threshold point -1 ...Point non-existing 0-125000...Point existing  (Refer to 4-5-6.)
Swap computation	SW c_1, c_2	--	Stored data I/O possible	c_1 ...Channel (1-4) c_2 ... Channel (1-4) (Note) c_1 not same as c_2

• 8815 Special functions

Item	Set command	Read command	Conditions	Explanation
Trigger detection clock output	--	QTJ (TJ t$)		t$ ... Trigger detection time (character string) (Example) "90-03-15, 15:14:27"
PRINT processing optional comment	CO c	QCO		c ....Arbitrary comment ON/OFF (0-1) { 0 ... OFF { 1 ...ON
PRINT processing optional comment character	CM m$	--		m$ ... Comment string (up to 20 characters) (Note) Terminator (:) is required (Refer to 4-5-7.)

5-3 8830 Command list

- 8830 Execution processing

Item	Set command	Read command	Conditions	Explanation
START processing	ST	--	other then SYSTEM screen IC card screen.	Same as [START] key at time of waveform fetching
STOP processing	[DCL]	--		Same as [STOP] key. (Note) Wait is needed after processing.
PRINT processing	PR	--	MEM XY_{MEM} XY_{CONT}	Same as [PRINT] key.
LIST processing	LS	--		Same as [FEED]+[COPY] keys. *1
COPY processing	HC	--		Same as [COPY] key.
FEED processing	FD ℓ	--		ℓ ...Paper feed length (in mm) $6 \leqq \ell \leqq 255$
Auto TIME/DIV	AT	--	MEM XY_{MEM} other than trigger source OFF	Execute time axis automatic setting. Same as [←]+[→] keys. *1
GAUGE processing	GA	--		Same as [FEED]+[PRINT] keys. *1
Back light ON/OFF	EBe	--		Same as [BACK LIGHT] key. e ....ON/OFF (0-1) { 0...OFF { 1...ON
System reset	SR	--		Initialize 8830. Same as power entry simultaneously pressing [STOP] key.

*1 "+" means pressing the keys at the same time.

- 8830 Display mode

Item	Set command	Read command	Conditions	Explanation
Screen mode	MW m	QMW	REC MEM XY MEM XY CONT	m...Screen mode (0-1) 0...WAVE screen 1...MENU screen
Screen size	WS w	QWS	REC MEM XY MEM XY CONT	w ...Screen size (0-1) 0...Standard 1...Reduction (1/2)
Function	FN f	QFN		f.....Function(0-4) 0 ...REC 2.... XY MEM 1 ...MEM 3.... XY CONT 4....SYSTEM

• 8830 WAVE screen

Item	Set command	Read command	Conditions	Explanation
Cursor ON	AB c,t	QAB	REC MEM XY MEM XY CONT	c ....ON/OFF of cursor (0-3) { 0 – OFF 1 – A 2 – A or B 3 – A & B t.....Type of cursor (0-2) { 0 – ↔ Δ t 1 – ↔ Δ f 2 – ↕
A cursor position	MA p	QMA	--	p ....A cursor position • Horizontal movement [↔] REC, MEM } ...(0-503) 0 503 XY MEM, XY CONT } ...(0-255) 0 255 •Vertical movement [↕] REC, XY MEM, XY CONT } ...(0-255) 255 / 0
B cursor position	MB p	QMB	--	p ....B cursor position (same as A cursor)
Cursor read output	--	QVA (VO d$)	REC MEM XY MEM XY CONT	d$ ..Cursor read output character string (Example) d$="100.01mV, 10.01ms"

- 8830 WAVE screen

Item	Set command	Read command	Conditions	Explanation
Waveform evaluation	WJ	--	MEM Judgment area should exist Judgment mode should exist Stored data should exist	For judgment refer to status byte.
Area generation	WM	--	MEM	Judged area generation
Channel review	CV c	QCV	--	c ....ON/OFF (0-1) { 0 ...OFF 1 ...ON
A cursor channel	AC c	QAC	MEM Drawing is other than OFF	c ....Channel (1 - 4)
B cursor channel	BC c	QAC	MEM Drawing is other than OFF	c ....Channel (1 - 4)

• 8830 STATUS unit

Item	Set command	Read command	Conditions	Explanation
TIME/DIV	TD t_1	QTD	REC	t_1....TIME/DIV (0-11) 0 ...1s 6....1min 1 ... 2s 7....2min 2 ...5s 8.... 5min 3 ...10s 9.... 10min 4 ...20s 10....20min 5 ...50s 11....50min
	TD t_2	QTD	MEM XY_{MEM}	t_2.... TIME/DIV(0-14) 0 ...100µs 8....50ms 1 ...200µs 9....100ms 2 ...500µs 10....200ms 3 ...1ms 11....500ms 4 ...2ms 12....1s 5 ... 5ms 13....2s 6 ...10ms 14....5s 7 ...20ms
Shot length	SH s_1	QSH	REC	s_1 ... SHOT length (0-6) 0 ...20DIV 4....300DIV 1 ...40DIV 5.... 600DIV 2 ...80DIV 6....CONT 3 ... 160DIV
	SH s_2	QSH	MEM XY_{MEM}	s_2 ...Shot length (0-7) 0 ...20DIV 4....300DIV 1 ... 40DIV 5....600DIV 2 ...80DIV 6.... 1200DIV 3 ...160DIV 7....2500DIV
Compression/ enlargement rate	MG m	QMG	MEM	m ...Compression/enlargement rate (0-9) 0 ... × 1/100 5....× 1/2 1 ... × 1/50 6....× 1 2 ... × 1/20 7....× 2 3 ... × 1/10 8....× 4 4 ... × 1/5 9....× 8

• 8830 STATUS unit

Item	Set command	Read command	Conditions	Explanation
LCD Clear	DC d	QDC	XY$_{CONT}$	d ....Display clear (0-1) { 0 ...OFF 1 ... ON
Printer output	PO p	QPO	REC	p ....Printer (0-1) { 0 ...OFF 1 ...ON
Auto print	PO p	QPO	MEM XY$_{MEM}$	p ....Printer (0-1) { 0 ... OFF 1 ...ON

• 8830 Trigger unit

Item	Set command	Read command	Conditions	Explanation
Trigger mode	TM c	QTM	MEM XY_{MEM}	c ....Trigger mode (0-2) 0 ...Single 1 ...Repeat 2 ...AUTO
	TM c	QMT	At REC Shot LENGTH is other than CONT.	c ....trigger mode (0-1) 0 ...Single 1 ...Repeat
Trigger source	TS s	QTS		s.....Trigger source (0-6) 0 ...OFF 4....CH4 1 ...CH1 5....EXT 2 ...CH2 6.... MANU 3 ...CH3
Trigger level	TL ℓ	QTL	Analog unit	ℓ ...Trigger level (In %) $0 \leqq \ell \leqq 100$
Trigger slope	SL s	QSL	Trigger source (CH1-CH4)	s.....Trigger slope (0-1) 0 ...UP (↑) 1 ...DOWN (↓)
Trigger filter	TF f	QTF	MEM XY_{MEM}	f..... Trigger filter (0-6) 0 ...OFF 4....0.6DIV 1 ...0.1DIV 5.... 1.3DIV 2 ...0.2DIV 6....2.6DIV 3 ... 0.3DIV
	TF f	QTF	REC XY_{CONT}	f.....Trigger filter (0-1) 0 ...OFF 1 ...ON

- 8830 Trigger unit

Item	Set command	Read command	Conditions	Explanation
Trigger timing	TT t	QTT	REC XY$_{CONT}$	t.....Trigger timing (0-1) { 0 ...START 1 ...STOP
Pre-trigger	PT p	QPT	MEM XY$_{MEM}$	p .... Pre-trigger (0-7) { 0 ...0% 4....75% 1 ...5% 5.... 95% 2 ...25% 6....100% 3 ...50% 7....-95%
Trigger waitless	TW w	QTW	MEM XY$_{MEM}$	w ...Waitless (0-1) { 0 ...OFF 1 ...ON

- 8830 Print unit

Item	Set command	Read command	Conditions	Explanation
DOT, LINE	DL d	QDL	REC XY_{MEM} XY_{CONT}	d....DOT/LINE (0-1) 0 ...DOT 1 ...LINE
	DL d	QDL	MEM	d....DOT/LINE (0-2) 0 ...DOT 1 ...LINE 2 ... SMOOTH
DRAWING	DR c,d	QDR c	REC MEM	c ....Channel (1-4) d ....Draw type (0-7) Analog / Logic 0 ...OFF / 4....OFF 1 ...SLIM / 5.... Ach 2 ...WIDE / 6....Bch 7....A&Bch
Print format	FM m	QFM	REC MEM	m ...Print format (0-2) 0 ...NORMAL 1 ...DUAL 2 ...QUAD
Partial print enlargement	PM f	QPM	MEM	f.....Format (0-9) 0 ...× 1/100 1 ... × 1/50 2 ...× 1/20 3 ...× 1/10 4 ...× 1/5 5 ...× 1/2 6 ... × 1 7 ...× 2 8 ...× 4 9 ...× 8

• 8830 SPECIAL unit

Item	Set command	Read command	Conditions	Explanation
RAM card auto save	IA t	QIA	MEM XY$_{MEM}$	t.....Auto save (0-1) { 0 .. OFF 1 .. ON
Waveform evaluation	WC m, u, d, r, l, s	QWC	MEM	m ... Judgment mode (0-4) { 0 .. OFF 3....MODE3 1 .. MODE1 4.... MODE4 2 .. MODE2 u.....Judgment area top (0-255) d.....Judgment area bottom (0-255) r.....Judgment area right (0-255) l.....Judgment area left (0-255) s....Stop mode (0-2) { 0 .. GO 1 .. NG 2 .. GO&NG

• 8830 SPECIAL unit

Item	Set command	Read command	Conditions	Explanation
START key back up	BT t	QBT		t.....Back up (0-1) 0 ...OFF 1 ...ON
Grid type	GR g	QGR		g ....Grid type (0-2) 0 ...OFF 1 ... NORMAL 2 ...FINE
Auto list	LT ℓ	QLT		ℓ ...Auto list (0-1) 0 ...OFF 1 ...ON
Auto gage	GG g	QGG		g ....Auto gage (0-1) 0 ...OFF 1 ...ON
EL backlight auto off	EL e	QEL		e ....Auto off (0-1) 0 ...OFF 1 ...ON
Self-checking execution	SF t	--	SYSTEM	t.....type of self-check (1-5) 1 ...ROM/RAM check 2 ... LED check 3 ...Printer check 4 ...Key check 5 ...LCD check
Clock setting	RT yy-mm-dd, HH:MM:SS	--	SYSTEM	yy... Year (00-99) mm ... Month (01-12) dd ... Date (00-59) HH ... Hour (00-23) MM ...Minute (00-59) SS ... Second (00-59) (Note) Each to be set using two digits.
Clock output	--	QRT (RT t$)		t$ ...Clock (character string) (Example): "90--3-15, 15:24:17"

• 8830 Interface control

<table>
<tr><th>Item</th><th>Set command</th><th>Read command</th><th>Conditions</th><th>Explanation</th></tr>
<tr><td>GP-IB delimiter</td><td>GD d</td><td>--</td><td></td><td>d....GP-IB output delimiter (0-3)
0 ...CRLF (EOI)
1 ...CR (EOI)
2 ...LF (EOI)
3 ... (EOI)</td></tr>
<tr><td>GP-IB header</td><td>GH h</td><td>--</td><td></td><td>h....GP-IB header (0-1)
0 ...OFF
1 ...ON</td></tr>
<tr><td>Error number output</td><td>--</td><td>QER
(ER e)</td><td></td><td>e ....Error number (0-54)
0-20...General error
31-36...WARNING
51-54...GP-IB error
(Refer to 3-6.)</td></tr>
<tr><td>Machine type and model number output</td><td>--</td><td>QID
(ID i)</td><td></td><td>i.....Machine's type and model number
(8830)</td></tr>
<tr><td>SRQ response masking</td><td>MS m</td><td>QMS</td><td></td><td>m ...SRQ response masking value (0-3)
<table><tr><td>8-3</td><td>2</td><td>1</td></tr><tr><td></td><td>START end</td><td>Error occurrence</td></tr></table>•SRQ clear
(Refer to 3-5-2.)</td></tr>
<tr><td>Status byte output</td><td>--</td><td>QUS
(US s)</td><td></td><td>s.....Status byte
<table><tr><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr><tr><td>Waveform judgemnt</td><td>SRQ</td><td>Operating mode</td><td></td><td>Printer</td><td>WAIT for Trigger</td><td>START</td><td>Error</td></tr></table>(Refer to 3-5-1.)</td></tr>
<tr><td>Initialization</td><td>[DCL]</td><td>--</td><td></td><td>•GB-IB initialization (Refer to 3-4.)
(Note) Wait is needed after processing.</td></tr>
</table>

• 8830 input unit

Item	Set command	Read command	Conditions	Explanation
Type of input unit	--	QAM c (AMc,n)		c ....Channel (1-4) n ....Type of input unit (0-15) { 9...8932 Analog amp 14...8933 Logic amp 15...Unloaded
Range of analog unit	--	QAA c (AA c, n_1, n_2, n_3, n_4)	Analog unit	c ....Channel (1 - 4) n_1 ...Input voltage range (numeric part) (-1 - 13) { 0 ...0.1 8.... 50 1 ...1.2 9....100 2 ...0.5 10....200 3 ...1 11....500 4 ...2 12....1000 5 ...5 13....2000 6 ... 10 7 ...20 -1....Undefined range n_2 ...Input voltage range (unit part) (-1-4) { 0 ...mV/DIV 3 ... Vrms/DIV 1 ...V/DIV 4 ... °C/DIV 2 ...mVrms/DIV -1 ... No unit n_3 ...Position (-10-10) { -10... -100% -9... -90% | | 0... 0% | | 9... 90% 10... 100% n_4 ...Type of filter (0-2) { 0 ...OFF 1 ... 5Hz 2 ...500Hz

• 8830 Input unit

Item	Set command	Read command	Conditions	Explanation
Logic unit	--	QLA c (LA, c, n_1, n_2, n_3, n_4)		c ....Channel (1-4) n_1 ... Trigger pattern (low) 1...Low n_2 ...Trigger pattern (Hi) 1...Hi Each corresponds in 8-ch bit (0-255) n_3 ...AND/OR (0-1) 0 ...AND 1....OR n_4 ...(To be used in the future.)

• 8830 IC Card

Item	Set command	Read command	Conditions	Explanation
IC card mode start	IC	--		Same as [IC CARD] key
IC card mode end	IE	--	IC card mode	Return to normal mode
INIT processing	II	--	IC card screen	
KILL processing	IK n	--	IC card screen	n....File number (1-65535)
LOAD	LD n		IC card screen	n....File number (1-65535)
Save file name	NA n$	--	IC card screen	n$..File name (Up to 10 characters) (Note) Terminator required (:)
IC card test	--	QIT (IT t)	IC card screen	t.....Test result { 0 ... OK -1 ..NG
SAVE processing	IS t, ch, n	--	IC card screen	t..... Type (0-2) { 0 ...FUNC 1 ...WAVE 2 ...AREA ch ..Channel (1-5) { 1 ...CH1 4....CH4 2 ... CH2 5....ALL (CH1-CH4) 3 ...CH3 n....File name (0-1) { 0 ...Skipped 1 ...ON *"ch" is valid for WAVE only.

• 8830 Realtime data

Item	Set command	Read command	Conditions	Explanation
Realtime data output (ASCII format)	--	QRA c (RAc,d)		c .... Channel (1 - 4) d....Data (ASCII format) Analog ...-3 - 252 Logic... 0 - 255 (Refer to 4-4-2.)
Output of realtime data (Binary format)	--	QRB c (d$)		c ... Channel (1 -4) d$.. Data (binary format) (0 - 255) (Note) In case of analog unit, 255, 254, and 253 are -1,-2,and -3 respectively (Refer to 4-4-2.)

• 8830 IC Card

Item	Set command	Read command	Conditions	Explanation
IC card setting	--	QIC (IC i, p, n)		i ...IC card { 0 ...No set / 1 ...set p ...Protection { 0 ...Non protection / 1 ...protection n ...File number { 0~65535 / -1 ...IC card defective

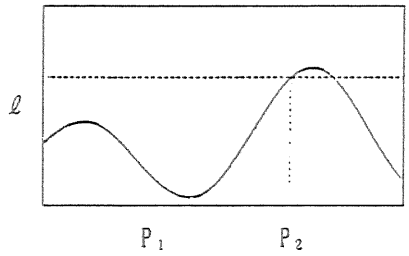
• 8830 Stored data I/O

Item	Set command	Read command	Conditions	Explanation
Informs whether stored data I/O possible	--	QMX (MX n)	MEM XY_{MEM}	n ....Number of I/O possible data { 0....I/O prohibited 1000....20DIV 2000....40DIV 4000.... 80DIV 8000....160DIV 15000....300DIV 30000....600DIV 60000....1200DIV 125000....2500DIV
I/O point designation	OD c,p	QOD	Stored data I/O possible	c ....Channel (1-4) p ....Point (0-125000)
Stored data output (ASCII)	--	QDA n (DA $d_1, d_2, d_3 ..., d_n$)	Stored data I/O is possible	n ....Number of output data unit (1-50) d_i ...i-th data (ASCII format) { Analog...-3 - 252 Logic... 0 - 255 (Refer to 4-4.)
Stored data output (Binary)	--	QDB n (d$)	Stored data I/O is possible	n ....Number of output data unit (1 - 250) d$ ..n-byte data (binary format) d_1 d_2 d_3 d_4 ... d_{n-1} d_n No GP-IB header (Refer to 4-4.)
Stored data input (ASCII)	DA $d_1, d_2, d_3, d_4, ..., d_n$	--	Stored data I/O is possible	d_i ...Data (ASCII format) { Analog... -3 - 252 Logic... 0 - 255 (Refer to 4-4.)

• 8830 Computation functions

Item	Set command	Read command	Conditions	Explanation
Voltage conversion	--	QVL, c,p (VL c,p d$)	MEM Stored data I/O possible Analog unit	c ....Channel (1 -4) p .... Point (0-125000) d$ ...Voltage (character string) (Example) "-43.2mV"
PEAK value computation	--	QPK c (PK c,M_1, M_2, $P_1$$, $P_2$$)	MEM Stored data I/O possible Analog unit	c....Channel (1-4) M_1....Minimum data M_2....Maximum data $P_1$$....Minimum voltage (character string) $P_2$$....Maximum voltage (character string)
Average value / variance computation	--	QME c (ME c,m,v)	MEM Stored data I/O possible Analog unit	c ....Channel (1 - 4) m ...Average v ....Variance (Note) Standard deviation = $\sqrt{v}$
Area value computation	--	QAR c_1, c_2 (AR c_1, c_2, a)	MEM Stored data I/O possible Analog unit	c_1 ...Channel 1 (1-4) c_2 ...Channel 2 (1-4) a ....Area value (In: DIV^2) (Note) Where $c_1 = c_2$, 1 channel area is calculated against zero position.
XY area value computation	--	QFX c (FX c,a)	XY mem Stored data I/O possible Analog unit	c ....Y-axis channel (2 - 4) a ....XY area value (In: DIV^2) (Example) "48.686"
Differential computation	DI c_1, c_2, k	--	MEM Stored data I/O possible Analog unit	c_1 ...Source channel (1 -4) c_2 ...Destination channel (1 - 4) k .... Interval (1 - 50) (Note) c_1 not same as c_2
Integral computation	IN c_1, c_2, k	--	MEM Stored data I/O possible Analog unit	c_1 ... Source channel (1 - 4) c_2 ...Destination channel (1 - 4) k ....Divider (1 - 50) (Note) c_1=c_2 is possible.

• 8830 Computation function

Item	Set command	Read command	Conditions	Explanation
Threshold point computation	--	QCP C, ℓ, s, p_1 (CPc, ℓ, s, p_1, p_2)	MEM Stored data I/O possible Analog unit	c ....Channel (1 -4) ℓ ...Threshold level (-3 - 252) s.....Threshold slope (0 - 1) {0...UP (↑) 1...DOWN (↓) p_1 ...Start check point (0 - 125000) p_2 ...Threshold point {-1 ... Point non-existing 0 - 125000 ... Point existing  (Refer to 4-5-6.)
SWAP computation	SW c_1, c_2	--	Stored data I/O possible	c_1 ...Channel (1 - 4) c_2 ...Channel (1 - 4) (Note) c_1 not same as c_2

• 8830 Special function

Item	Set command	Read command	Conditions	Explanation
Trigger detection time output	--	QTJ (TJ t$)		t$ ... Trigger detection time (character string) (Example) "90-03-15, 15:14:27"
PRINT processing optional comment	CO c	QCO		c ....optional comment ON/OFF (0 - 1) { 0 ... OFF { 1 ...ON
PRINT processing optional comment character	CM m$	--		m$...Comment character (Up to 20 characters) (Note) Terminator (:) is required (Refer to 4-5-7.)

Chapter 6

Sample Program

Programs samples in this chapter are made by setting address of 8815 and 8830 to 5, and use PC 9801 GP-IB (made by NEC) in MASTER MODE, address number 0.

(Sample 1) Set conditions of stored processing, and run.

(Explanation)

Line 140 ... Set 8815 and 8830 address (number 5) to variables ADR.

Lines 160-170 ... Send interface clear instruction, set system to remote mode.

Lines 190-260 ... Set 8815's and 8830's function, TRIG condition and PRINT condition.

Line 280 ... Run START processing under set conditions.

```
100 ' ---------------------------------- '
110 '   8830     SAMPLE PROGRAM NO.1     '
120 ' ---------------------------------- '
130 '
140 ADR=5                                 'GP-IB Address=5
150 '
160 ISET IFC                              'Interface Clear
170 ISET REN                              'Remote Enable
180 '
190 PRINT@ ADR;"FN1"                      'Function MEM
200 PRINT@ ADR;"TD3"                      'TIME/DIV 1ms
210 PRINT@ ADR;"SH0"                      'SHOT     20DIV
220 '
230 PRINT@ ADR;"TS1"                      'TRIG Source CH1
240 PRINT@ ADR;"PT1"                      'Pre-TRIG    5%
250 PRINT@ ADR;"TL60"                     'TRIG Level  60%
260 PRINT@ ADR;"SL0"                      'TRIG Slope  UP
270 '
280 PRINT@ ADR;"ST"                       '< START >
290 '
300 WBYTE &H5F;                           'UN TALK
310 IRESET REN
320 END
```

- Modifications to be made if used in 8815:

```
230 PRINT@ ADR;"TS3"                      'TRIG Source INT
235 PRINT@ ADR;"TC1"                      'TRIG CH     CH1
240 PRINT@ ADR;"PT0"                      'Pre-TRIG    5%
```

(Sample 2) **Perform START processing. If trigger is not detected, perform STOP processing.**

(Explanation)

Lines 210-230 ... Run START processing after clearing status byte.

Lines 250-260 ... Read status byte and ensure start of START processing.

Lines 280-310 ... Continue to check whether or not trigger is detected during a set duration of time.

Lines 320-350 ... If trigger not detected, perform STOP processing (SELECT DEVICE clear).

```
100 ' ---------------------------------- '
110 '   8830     SAMPLE PROGRAM NO.2     '
120 ' ---------------------------------- '
130 '
140 ADR=5                                 'GP-IB Address=5
150 '
160 ISET IFC                              'Interface Clear
170 ISET REN                              'Remote Enable
180 '
190 PRINT@ ADR;"FN1,TD3,SH0"              'MEM,1ms/DIV,20DIV
200 PRINT@ ADR;"TS1,TL60,SL0"             'TRIG CH1,60%,UP
210 PRINT@ ADR;"MS0"                      'Non SRQ
220 '
230 PRINT@ ADR;"ST"                       '< START >
240 '
250     POLL ADR,S                        'START ?
260     IF (S AND &H2)<>0 THEN 250
270 '
280   FOR W=1 TO 100
290     POLL ADR,S                        'TRIG Wait ?
300     IF (S AND &H4)<>0 THEN 370
310   NEXT W
320     PRINT "Not Trigger"
330     LA=&H20+ADR                       'ADR 5
340     WBYTE &H3F,LA,&H4;                '< STOP >
350     GOTO 410
360 '
370     POLL ADR,S                        'END ?
380     IF (S AND &H2)=0 THEN 370
390     PRINT "Storage End"
400 '
410 WBYTE &H5F;                           'UN TALK
420 IRESET REN
430 END
```

- Modifications to be made if used in 8815.

```
200 PRINT@ ADR;"TS3,TC1,TL60,SL0"         'TRIG CH1,60%,UP
```

(Sample 3) Display I/O level of analog unit on CRT for monitoring.

(Explanation)

Lines 1190-1340 ... Read existence and category type of CH1 - CH4 unit, and set results as variables.

Lines 1420-1570 ... Read data to become starting point only for analog unit.

Lines 1590-1840 ... Read and plot input level until right margin of screen is reached.

```
1000 ' ---------------------------------
1010 '   8830     SAMPLE PROGRAM NO.3
1020 ' ---------------------------------
1030 '
1040 ADR=5                                    'GP-IB Address=5
1050 SP=2                                     'Set CONST
1060 ISET IFC                                 'Interface Clear
1070 ISET REN                                 'Remote Enable
1080 ON STOP GOSUB *ENDP : STOP ON            'STOP key ON
1090 SCREEN 3,0:CONSOLE 0,25,0,1:CLS 3        'Clear Display
1100 PRINT@ ADR;"GH0GD0"                      'Header OFF
1110 '
1120 LOCATE 5,0:PRINT "< Level Monitor >"
1130 LOCATE 50,0:PRINT "CH1 :          CH2 :          ";
1140 LOCATE 50,1:PRINT "CH3 :          CH4 :          ";
1150 LOCATE 0,3:PRINT "100"
1160 LOCATE 1,11:PRINT "50"
1170 LOCATE 2,19:PRINT "0"
1180 '
1190 PRINT@ ADR;"QAM1"
1200 INPUT@ ADR;CH1
1210 IF CH1=14 THEN LOCATE 55,0:PRINT "Logic"
1220 IF CH1=15 THEN LOCATE 55,0:PRINT "Nothing"
1230 PRINT@ ADR;"QAM2"
1240 INPUT@ ADR;CH2
1250 IF CH2=14 THEN LOCATE 70,0:PRINT "Logic"
1260 IF CH2=15 THEN LOCATE 70,0:PRINT "Nothing"
1270 PRINT@ ADR;"QAM3"
1280 INPUT@ ADR;CH3
1290 IF CH3=13 THEN LOCATE 55,1:PRINT "Logic"
1300 IF CH3=15 THEN LOCATE 55,1:PRINT "Nothing"
1310 PRINT@ ADR;"QAM4"
1320 INPUT@ ADR;CH4
1330 IF CH4=14 THEN LOCATE 70,1:PRINT "Logic"
1340 IF CH4=15 THEN LOCATE 70,1:PRINT "Nothing"
1350 '
1360 CLS 2
1370 LINE (30,57)-(620,307),7,B,&HCCCC    'Frame
1380 FOR Y=82 TO 282 STEP 25
1390   LINE(30,Y)-(620,Y),7,,&H1010
1400 NEXT Y
```

```
1410 '
1420 IF CH1<>9 THEN 1460                    'CH1 not Analog ?
1430 LINE(440,8)-(490,10),6,B
1440 PRINT@ ADR;"QRA1"
1450 INPUT@ ADR;Y10
1460 IF CH2<>9 THEN 1500                    'CH2 not Analog ?
1470 LINE(560,8)-(610,10),5,B
1480 PRINT@ ADR;"QRA2"
1490 INPUT@ ADR;Y20
1500 IF CH3<>9 THEN 1540                    'CH3 not Analog ?
1510 LINE(440,24)-(490,26),4,B
1520 PRINT@ ADR;"QRA3"
1530 INPUT@ ADR;Y30
1540 IF CH4<>9 THEN 1580                    'CH4 not Analog ?
1550 LINE(560,24)-(610,26),3,B
1560 PRINT@ ADR;"QRA4"
1570 INPUT@ ADR;Y40
1580 '
1590 FOR X=30 TO 620-SP STEP SP
1600 *CH1
1610  IF CH1<>9 THEN *CH2
1620 PRINT@ ADR;"QRA1"
1630 INPUT@ ADR;Y11
1640 LINE(X,307-Y10)-(X+SP,307-Y11),6      'CH1 Line
1650 Y10=Y11
1660 *CH2
1670 IF CH2<>9 THEN *CH3
1680 PRINT@ ADR;"QRA2"
1690 INPUT@ ADR;Y21
1700 LINE(X,307-Y20)-(X+SP,307-Y21),5      'CH2 Line
1710 Y20=Y21
1720 *CH3
1730 IF CH3<>9 THEN *CH4
1740 PRINT@ ADR;"QRA3"
1750 INPUT@ ADR;Y31
1760 LINE(X,307-Y30)-(X+SP,307-Y31),4      'CH3 Line
1770 Y30=Y31
1780 *CH4
1790  IF CH4<>9 THEN 1840
1800 PRINT@ ADR;"QRA4"
1810 INPUT@ ADR;Y41
1820 LINE(X,307-Y40)-(X+SP,307-Y41),3      'CH4 Line
1830 Y40=Y41
1840 NEXT X
1850 GOTO 1360
1860 '
1870 *ENDP
1880 WBYTE &H5F;
1890 IRESET REN
1900 STOP OFF
1910 CLS 3
1920 END
```

(Sample 4) Save stored data to Disk #2 (sequential file)

(Explanation)

Lines 180-190 ... Set destinations for jump when STOP key is pressed or when an error occurs, so system does not end with file open.

Lines 300-320 ... Input channel and file name to be saved.

Lines 400 ... Record data number to be saved into start of file.

Lines 410-450 ... Read stored data from 8815, 8830, and save the results sequentially.

```
100 ' ---------------------------------- '
110 '   8830     SAMPLE PROGRAM NO.4     '
120 ' ---------------------------------- '
130 '
140 ADR=5                                  'GP-IB Address=5
150 DR$="2:"                               'FDD No.2
160 ISET IFC                               'Interface Clear
170 ISET REN                               'Remote Enable
180 ON ERROR GOTO *EXIT0                   'If ERROR Then *EXIT0
190 ON STOP GOSUB *EXIT1 : STOP ON         'If STOP  Then *EXIT1
200 '
210 CLS 3:LOCATE 3,3
220 PRINT "< Storage Data SAVE >"
230 PRINT :PRINT
240 PRINT@ ADR;"GH0,QMX"                   'Header OFF
250 INPUT@ ADR;MX                          'Read Max Point
260 IF MX<>0 THEN 290                      'Output OK ?
270   PRINT "No Strage Data !!"
280   GOTO *EXIT2
290 '
300 PRINT "     Max Point=";MX : PRINT
310 INPUT "   Channel(1-4)";CH             'Input Channel
320 INPUT "      File Name";NA$            'Input File Name
330 PRINT :PRINT
340 '
350 DD$=DR$+NA$
360 OPEN DD$ FOR OUTPUT AS #1              'File Open
370 '
380 PRINT@ ADR;"OD"+STR$(CH)+",0"          'Set Output Point
390 '
400 PRINT #1,MX                            'Save Max Point
410 FOR I=0 TO MX
420   PRINT@ ADR;"QDA1"
430   INPUT@ ADR;DT
440   PRINT #1,DT                          'Save Data
450 NEXT I
460 PRINT "     Complete."
470 GOTO *EXIT2
480 '
490 *EXIT0
500 PRINT "        ERROR !!" : GOTO *EXIT2
510 *EXIT1
520 PRINT "        STOP !!"
530 *EXIT2
540 CLOSE #1                               'File Close
550 WBYTE &H5F;                            'UN TALK
560 IRESET REN
570 END
```

(Sample 5) Fetch data which was saved in (SAMPLE 4) and set to 8815, 8830.

(Explanation)

Lines 240-250 ... Specify channel and file.

Lines 320-400 ... Load data and set to 8815, 8830.

```
100 ' ---------------------------------- '
110 '   8830     SAMPLE PROGRAM NO.5     '
120 ' ---------------------------------- '
130 '
140 ADR=5                                 'GP-IB Address=5
150 DR$="2:"                              'FDD No.2
160 ISET IFC                              'Interface Clear
170 ISET REN                              'Remote Enable
180 ON ERROR GOTO *EXIT0                  'If ERROR Then *EXIT0
190 ON STOP GOSUB *EXIT1 : STOP ON        'If STOP  Then *EXIT1
200 '
210 CLS 3:LOCATE 3,3
220 PRINT "< Storage Data LOAD >"
230 PRINT :PRINT
240 INPUT "      File Name";NA$           'Input File Name
250 INPUT "   Channel(1-4)";CH            'Input Channel
260 '
270 DD$=DR$+NA$
280 OPEN DD$ FOR INPUT AS #1              'File Open
290 '
300 PRINT@ ADR;"OD"+STR$(CH)+",0"         'Set Input Point
310 '
320 INPUT #1,MX                           'Load Max Point
330 PRINT@ ADR;"GH0,QMX"
340 INPUT@ ADR;MM                         'Read Max Point
350 IF MX<>MM THEN *EXIT0
360 '
370 FOR I=0 TO MX
380   INPUT #1,DT                         'Load Data
390   PRINT@ ADR;"DA"+STR$(DT)
400 NEXT I
410 PRINT "     Complete."
420 GOTO *EXIT2
430 '
440 *EXIT0
450 PRINT "        ERROR !!" : GOTO *EXIT2
460 *EXIT1
470 PRINT "        STOP !!"
480 *EXIT2
490 CLOSE #1                              'File Close
500 WBYTE &H5F;                           'UN TALK
510 IRESET REN
520 END
```

Appendices
GB-IB Command List

GP-IB Command List

	Processing	Format
Execution Processing	START processing	ST
	STOP processing	[DCL]
	PRINT processing	PR
	LIST processing	LS
	COPY processing	HC (8830 only)
	FEED processing	FD ℓ
	Partial print start position	SSs / QSS (8815 only)
	Partial print	PP (8815 ony)
	Auto TIME/DIVE	AT
	GAUGE processing	GA
	Backlight ON/OFF	EBe (8830 only)
	Memory clear	MC (8815 only)
	System reset	SR
Measuring condition setting	Screen mode	MWm / QMW (8830 only)
	Screen size	WSw / QWS (8830 only)
	Function	FNf QFN

	Processing	Format
Measuring condition setting	TIME/DIV	TDt QTD
	SHOT length	SHs QSH
	Compression rate	MGm QMG
	LCD clear	DCd / QDC (8815 only)
	Printer output	POp / QPO (8830 only)
	Auto print	POp / QPO (8830 only)
Trigger	Trigger mode	TMc (8830 only) QTM
	Trigger source	TSs QTS
	Trigger level	TL ℓ QTL
	Trigger slope	SLs QSL
	Trigger filter	TFf QTF
	Trigger channel	TCc / QTC (8815 only)

	Processing	Format
TRIGGR	Trigger timing	PTt, QPT (8815 only)
		TTt, QTT (8830 only)
	Pre-trigger	PTp QPT
	Trigger waitless	TWw QTW (8830 only)
Print	DOT, LINE	DL d (8830 only) QDL
	DRAWING	DC c, d (8830 only) QDRc
	Print format	FMm (8830 only) QFM
	Partial print enlargement rate	PMf, QPM (8830 only)
System item	START key backup	BTt (8830 only) QBT
	Grid type	GRg (8830 only) QGR
	Self-check execution	SFt
	Clock set	RT t$
	Clock output	QRT (RTt$)

	Processing	Format
System item	Auto list and gage	QLT, (LTt) (8815 only)
	Auto list	LT, QLT (8830 only)
	Auto gauge	GGg, QGG (8830 only)
	RAM card auto save	IAt, QIA (8830 only)
	Waveform evaluation	WCm, u, d, r, l, s QWC (8830 only)
	EL backlight auto off	ELe, QEL (8830 only)
Interface control	GP-IB delimiter	GDd
	GP-IB header	GHh
	Error number output	QER (ERe)
	Type and model number output	QID (IDi)
	SRQ response masking	MSm QMS
	Status byte output	QUS (USs)
	GP-IB initialization	[DCL]

	Processing	Format
Input unit	Type of input unit	QAMc (AM c,n)
	Range of analog unit	QAAc (AA c, n_1, n_2, n_3, n_4)
	Logic unit	QLA (LAc, n_1, n_2, n_3, n_4)
IC card (8830)	Start IC card monitor	IC
	End IC card monitor	IE
	INIT processing	II
	KILL processing	IKn
	LOAD	LDn
	SAVE file name	NAn$
	SAVE processing	ISt, ch, n
Realtime data	Realtime data output (ASCII)	QRAc (RAc, d)
	Realtime data output (BINARY)	QRB c (d$)

	Processing	Format
Stored data I/O	Stored data	QMX (MXn)
	I/O enable information	ODc,p QOC
	I/O point designation Stored data output (ASCII)	QDAn (DA d_1, ,d_2, d_3, ..., d_n)
	Stored data output (BINARY)	QDBn (d$)
	Stored data input (ASCII)	DA d_1, d_2, ..., d_n
Computation function	Voltage conversion	QVL c,p (VL c, p, d)
	PEAK value computation	QPK c (PKc, M_1, M_2, P_1, P_2)
	Average value computation	QMEC (MEc, m, v)
	Area value computation	QAR c_1, c_2 (AR c_1, c_2, a)
	XY area computation	QFX c (FX c,a)
	Threshold point computation	QCP c, ℓ, s, p_1 (CP c, ℓ, s, p_1, p_2)
	Differential computation	DI c_1, c_2, k

	Processing	Format
Computation function	Integral computation	INc$_1$, c$_2$, k
	SWAP computation	SW c$_1$, c$_2$
Special function	Trigger detection time output	QTJ (TJt$)
	PRINT processing optional comment	COc QCO
	PRINT processing optional comment character	CMm$
WAVE screen (8830)	Cursor ON	ABc, t QAB
	A cursor position	MAp QMA
	B cursor position	MBp QMB
	A cursor channel	ACc QAC
	B cursor channel	BCc QBC
	Voltage between cursor	QVO (VOd$)
	Waveform evaluation	WJ
	Area creation	WM
	Channel view	CVc

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