



**Advanced Test Equipment Rentals**  
**www.atecorp.com 800-404-ATEC (2832)**

**User's  
Manual**

**AR1100A/AR1200  
Analyzing Recorder**

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# INTRODUCTION

Thank you for purchasing the AR1100A/AR1200 Analyzing Recorder.

This manual describes the functions, operating procedures, and precautions for use of the AR1100A/AR1200.

Please read this manual thoroughly before using the AR1100A / AR1200 to ensure correct operation.

For details of the GP-IB / RS-232-C interface, see the separate GP-IB / RS-232-C interface manual, and for details of the FFT Analysis Function (optional), see the separate FFT Analysis Function User's Manual.

If you have purchased an optional DC12V Drive model/DC24V Drive model (only for AR1100A), please read the separate AR1600/AR1100A DC12V/DC24V Drive User's Manual before reading this User's Manual.

## ■ Notice

- The contents of this manual are subject to change without notice.
- All reasonable efforts have been made to ensure the accuracy of the contents of this manual. However, if you find any errors, please inform YOKOGAWA.
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# SAFETY PRECAUTIONS

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. The YOKOGAWA Electric Corporation assumes no liability for the customer's failure to comply with these requirements.

## General definitions of safety symbols used on equipment and in manuals.



Explanation: To avoid injury, death of personnel or damage to the instrument, the operator must refer to an explanation in the instruction manual.



High voltage terminal: Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked). Never touch it!



Protective grounding terminal: To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment.



Laser radiation: This calls attention to a procedure, practice, condition or the like, which—if not correctly performed or adhered to—could result in loss of eyesight or injury to eyes of personnel.

(CLASS 3A)

Do not stare into this beam or VIEW directly with optical instruments.

(CLASS 3B)

Avoid exposure to this beam.

**WARNING**

A WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death of personnel.

**CAUTION**

A CAUTION sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or the product.

## WARNING

- **Power Supply**

Ensure the source voltage matches the voltage of the power supply before turning ON the power.

- **Protective Grounding**

Make sure to connect the protective grounding to prevent an electric shock before turning on the power.

- **Power Cord and Plug**

To prevent an electric shock or fire, be sure to use the power supply cord and the 3 pin to 2 pin adapter supplied by YOKOGAWA. Main power plug must be plugged in an outlet with protective grounding terminal only. Do not use an extension cord without protective grounding and invalidate protection.

- **Necessity of Protective Grounding**

Never cut off the internal or external protective grounding wire or disconnect the wiring of protective grounding terminal. Doing so poses a potential shock hazard.

- **Fuse**

To prevent a fire, make sure to use the fuse with specified standard (current, voltage, type). Before replacing the fuse, turn off the power and unplug the power cord. Do not use a different fuse or short-circuit the fuse holder.

- **Do not Operate in an Explosive Atmosphere**

Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.

- **Do not Remove any Covers**

There are some areas with high voltage. Do not remove the cover if the power supply is connected. The cover should be removed by qualified personnel only.

- **External Connection**

To ground securely, insert the main power plug before connecting to measurement or control unit.

- **Never Touch the Interior of the Instrument**

Inside this instrument there are areas of high voltage, therefore never touch the interior if the power supply is connected. This instrument has an internal changeable system, however internal inspection and adjustments should be done by YOKOGAWA or other qualified personnel only.

- **Handling the CRT**

This CRT is in conformity with the requirements specified in CSA and TÜV standards. However please avoid rough handling or jarring of the instrument to prevent possible CRT implosion. Breakage of the CRT may cause a high velocity scattering of glass fragments.

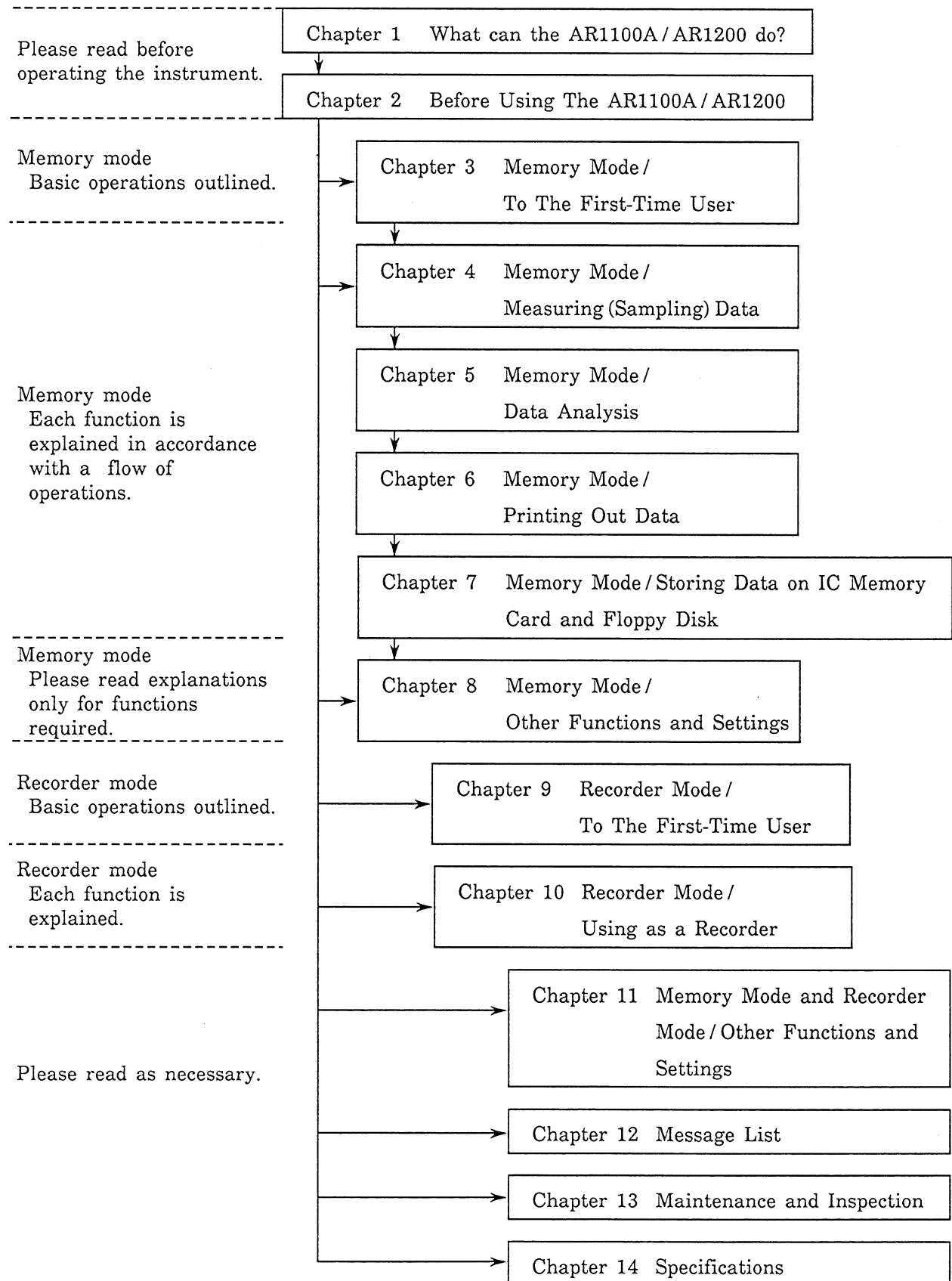
- **In Case of Malfunction**

Never continue to use the instrument if there are any symptoms of malfunction such as unusual sounds, smell, or smoke coming from the instrument. Immediately disconnect the power supply and stop further use of the instrument. If such abnormal symptoms occur, contact your sales representative or the nearest YOKOGAWA center.







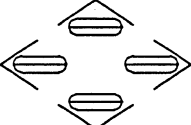




# CONFIGURATION OF MANUAL AND GUIDELINES FOR USE



# HOW TO READ THIS MANUAL

Key operations are indicated using the following symbols.

Function Keys	(Example)	
Soft Keys	(Example)	 (A label is displayed at the foot of the CRT screen for each of the eight soft keys.)
Alphanumeric Keypad	(Example)	
ENTRY Key		
Cursor Keys		
Rotary Knob		
Channel Select Keys		

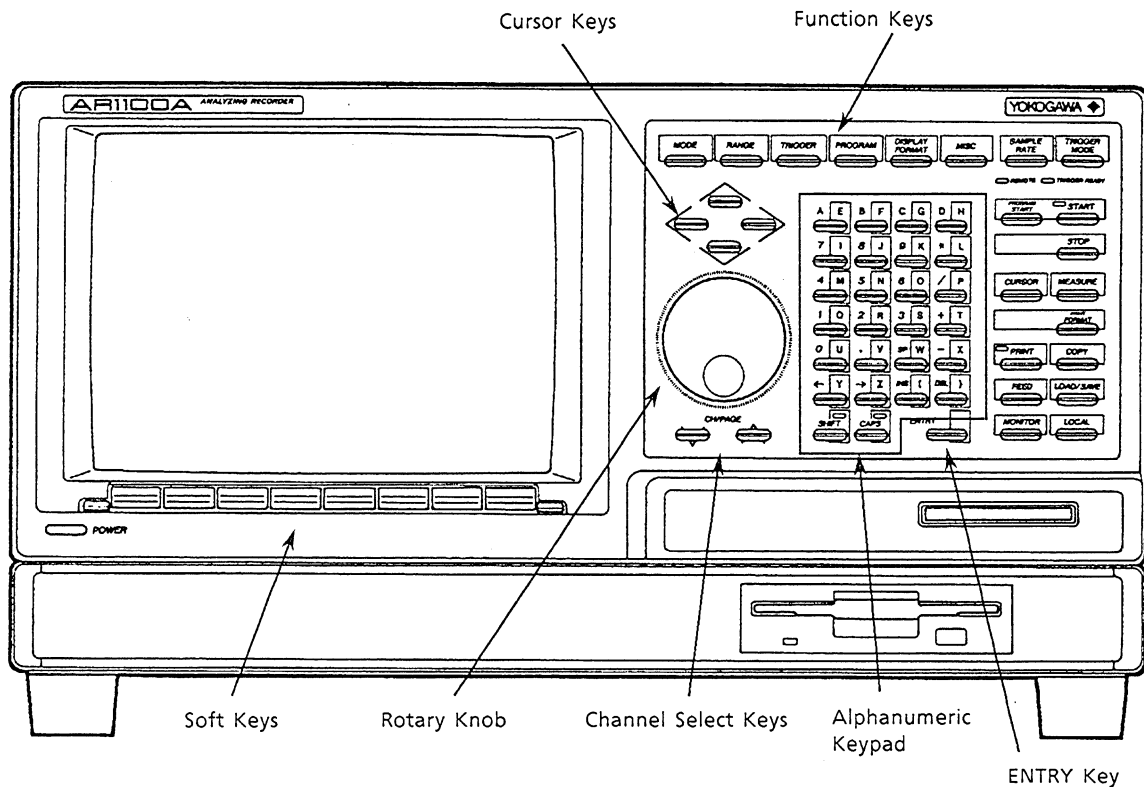


Figure 1 Front Panel (AR1100A)

The AR1200 differs from the AR1100A in the design of the floppy disk drive on the front panel.

In this manual, the following format is used to describe functions and operations.

- |                              |  |
|------------------------------|--|
| <b>Function</b>              | : Describes a function.  |
| <b>Procedure</b>             | : Describes an operating procedure.  |
| <b>Procedure<br/>Example</b> | : Describes an example of an operating procedure.  |
| <b>Setting<br/>Example</b>   | : Describes an example of a setting.   |
| <b>Notes</b>                 | : Describes any constraints or notes for an operation or function.   |
| <b>Cautions</b>              | : Describes cautions to prevent any deterioration in functioning or damage to the main unit or to any instrument connected to the main unit. |
| <b>Remarks</b>               | : Describes general terminology or information which it is useful to know.   |

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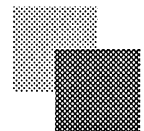
# Chapter 1

## What can the AR1100A / AR1200 do?

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Here we explain the features, main functions and part names of the AR1100A / AR1200.

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## 1.1 Features of the AR1100A / AR1200

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The AR1100A/AR1200 is an easy-to-use waveform measuring instrument which incorporates in a single unit capabilities ranging from measurement, analysis, computation, display and memory through to print-out. It is equipped with 8 isolated analog input channels and a 14-bit A/D converter (maximum sampling rate of 100kS/s) which enable you to carry out high-speed, high-resolution simultaneous measurements. The main unit also has temperature measurement (Thermocouple input: K, E, J, T, R, S, B, U, L, N, W) capability. There are also models of the main unit provided with 2 channel 8-bit logic input.

With its large memory capacity of either 64kwords/channel or 512kwords/channel the main unit shows its strengths particularly when measuring single shot phenomena over long time periods.

The main unit has 3 modes of use: Memory Mode, Recorder Mode and FFT Mode (optional). The mode you select will depend on how you wish to use the main unit.

### ■ Memory Mode

Memory Mode can be used to capture single shot high-speed phenomena, transient phenomena and low frequency (DC) to high frequency phenomena; there is a large memory capacity to enable storage of these phenomena; you can freely observe waveforms on the CRT screen and carry out various kinds of analysis; waveforms which you would like to preserve can be printed out using the main unit's built-in printer in A4 format or as a continuous chart.

### ■ Recorder Mode

Recorder Mode allows you to carry out chart recording with the feel of a conventional recorder. You can observe a waveform on the CRT screen in roll mode and print out only those phenomena which you would like to preserve.

### ■ FFT Mode

You can also use the main unit as a 2 channel FFT Analyzer. The FFT analysis can be carried out even on waveforms captured in Memory Mode, either directly or through use of the IC Memory Card (sold separately as an accessory).

# 1.2 System Configuration

The AR1100A / AR1200 System Configuration is shown in Figure 1.1. Broadly speaking it is comprised of an Input Module, Acquisition and Waveform Processing Section and Man / Machine Interface Section. The Input Module contains Acquisition Memory and circuitry for preamplification, A/D conversion, trigger detection and data compression.

The Acquisition and Waveform Processing Section is made up of a Main Sequencer, Display Section and Printer Section.

The Man / Machine Interface Section is made up of the CPU, Keyboard and Communications Interface.

The digital circuitry, adopting ASIC (Application Specific Integrated Circuit) technology, contains 8 kinds of gate array ; this has contributed to a compact, multi-channel design capable of high-speed data processing.

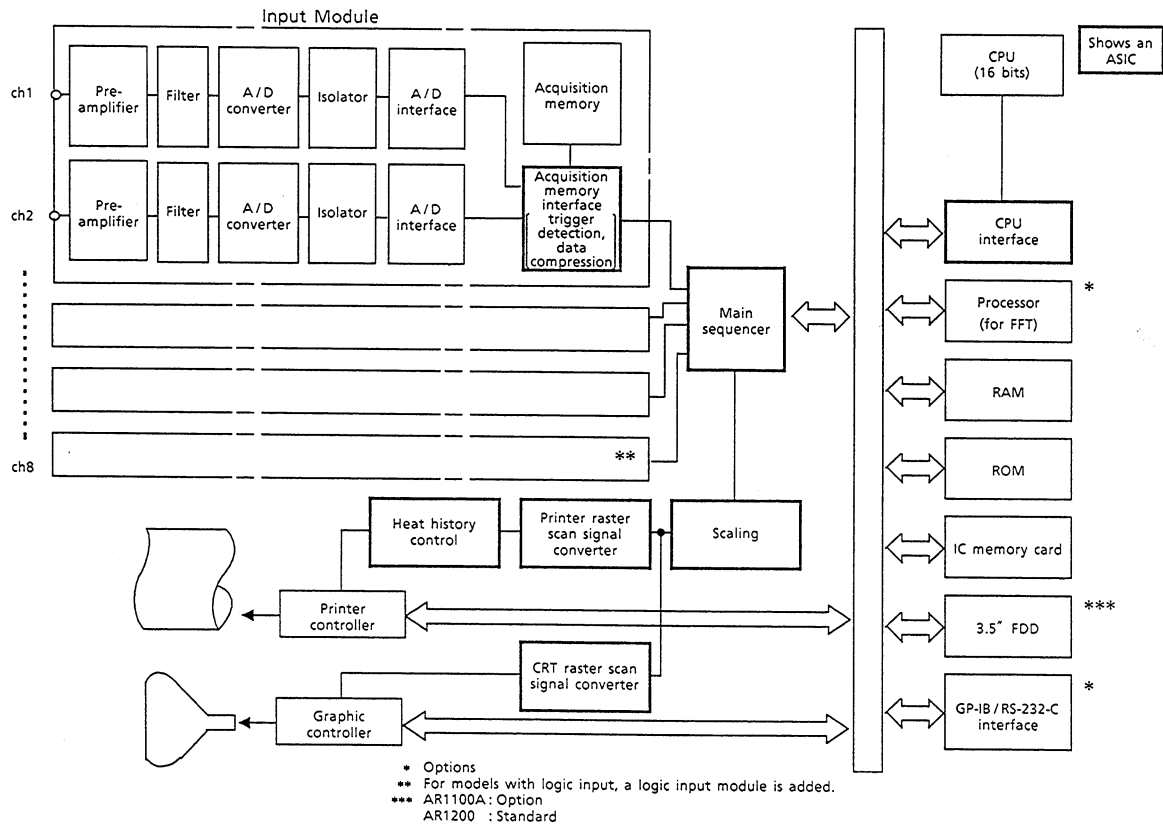


Figure 1.1 AR1100A/AR1200 System Configuration

## 1.3 Functions Available on the AR1100A / AR1200

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### ■ Measurement (Sampling) Functions

- **The Main Unit has up to 8 Analog Input Channels (Isolated).**  
2 channel 8-bit Logic Input versions (with 12 Analog Input Channels) are also available.
- **Temperature Measurement (Thermocouple Input)**  
Maximum 8 channel. Corresponding thermocouple types are K, E, J, T, R, S, B, U, L, N, and W.
- The large memory capacity of either 64kwords/channel or 512kwords/channel enables measurement of single shot phenomena over long time periods.
- You can store either 64 or 128 separate waveforms for 1 channel in memory using the memory partitioning function.
- With high-resolution the main unit can carry out 14-bit sampling for each channel up to a maximum sampling rate of 100kS/s by A/D Converter.
- You can measure signals with frequencies from DC up to 40kHz.
- **The Main Unit has Powerful Trigger Functions.**  
You can set combinations (in AND or OR form) of up to 4 analog or temperature trigger conditions and 2 logic trigger conditions; the logic trigger conditions are in the form of an 8-bit code.

### ■ Display Functions

- You can display up to 8 waveforms simultaneously. You may also display in X-Y format.
- You can read off waveform values using the cursor function.
- If a section of waveform is of particular interest you can enlarge it using the zoom function and scroll function.
- The main unit has an Accumulate function, allowing the overwriting of waveforms on the screen without deletion of previously measured waveforms.

### ■ Analysis Functions

- The main unit possesses a wide variety of computational functions. These include the 4 basic arithmetic operations but also calculus and trigonometric functions and the optional FFT analysis capabilities.
- The main unit can perform zone statistical computations; you can specify a section of the waveform and obtain values for the maximum, minimum, peak to peak span, average, RMS, standard deviation and area within that chosen zone.

**■ Print-Out Functions**

- The main unit has a built-in thermal printer for print-out. You can choose the kind of print-out you require from among the following : hard copy of the screen ; higher resolution plot print-out ; analog print-out ; digital value print-out.
- You can also print-out using an external X-Y plotter. (GP-IB / RS-232-C interface option is required.)
- The main unit can be used as a real-time recorder with a chart speed settable up to 50mm/s.  
A sampling frequency of 100kS/s means that even rapid variations in signal can be accurately reproduced.

**■ Memory Functions**

- You can store waveform data and setup information using the IC Memory Card and the optional (for AR1100A) 3.5 inch Floppy Disk.

**■ Other Functions**

- The main unit has an Auto Sequence function ; by programming a sequence of operations beforehand you can carry out data processing automatically.
- You can exercise remote control from a personal computer using either a GP-IB or RS-232-C interface (whichever option has been selected for the main unit). It is also possible to transmit data from the main unit to a personal computer.

## 1.4 Names and Functions of Parts

### ■ Front Panel (AR1100A)

The AR1200 differs from the AR1100A in the design of the floppy disk drive on the front panel.

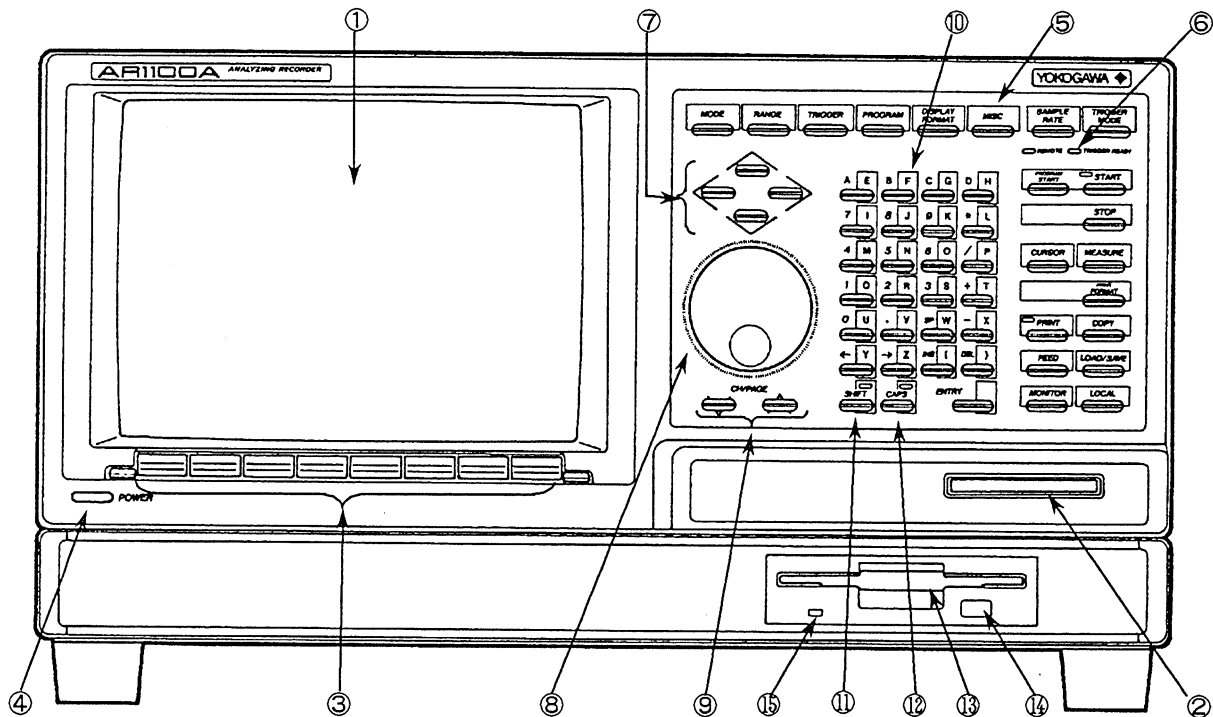


Figure 1.2 Front Panel

- |                       |   |   |
|-----------------------|---|---|
| ① CRT                 | : | 9 inch amber phosphor CRT.  |
| ② IC Card Slot        | : | Insertion slot for IC Memory Card.  |
| ③ Softkeys            | : | You can select various input parameter settings from menu items displayed on the CRT screen above the softkeys. |
| ④ Power Switch        | : | Switch for turning the power to the instrument ON and OFF.  |
| ⑤ Function Keys       | : |   |
| <b>MODE</b>           | ; | To select the Mode (Memory Mode, Recorder Mode or optional FFT Mode).   |
| <b>RANGE</b>          | ; | To set the Ranges for the input signals.  |
| <b>TRIGGER</b>        | ; | To set the trigger conditions.  |
| <b>PROGRAM</b>        | ; | To program any computations you wish to perform.  |
| <b>DISPLAY FORMAT</b> | ; | To set the format for display of data.  |
| <b>MISC</b>           | ; | To set many miscellaneous items including date / time, linear scaling, etc.                                     |
| <b>SAMPLE RATE</b>    | ; | To set the sampling rate when in Memory Mode and the chart speed when in Recorder Mode.                         |
| <b>TRIGGER MODE</b>   | ; | To select the Trigger Mode (Free, Single or Repeat).  |
| <b>PROGRAM START</b>  | ; | To repeat computations on or repeat display of data currently held in the main unit's memory.                   |
| <b>START</b>          | ; | To begin measurement. The LAMP to the upper left of the START key remains lit while measurement is in progress. |
| <b>STOP</b>           | ; | To stop measurement.  |
| <b>CURSOR</b>         | ; | To display a cursor and to display numerical values corresponding to the cursor position on the CRT screen.     |

- MEASURE** ; To carry out zone statistical computations.  
**PRINT FORMAT** ; To set the format for print-out.  
**PRINT** ; To begin print-out using the main unit's built-in printer. The LAMP to the upper left of the PRINT key remains lit while measurement is in progress.  
**COPY** ; To make a hard copy of the CRT screen.  
**FEED** ; To feed the chart paper in the built-in printer.  
**LOAD/SAVE** ; To SAVE and LOAD setup information and measured data to and from the IC Memory Card or optional Floppy Disk.  
**MONITOR** ; To monitor the input signals.  
**LOCAL** ; To switch the AR1100A from remote status to local status when using the GP-IB interface. The REMOTE LAMP to the upper right of the front panel remains lit while in remote status.
- ⑥ **TRIGGER READY LAMP** : This lights up while a trigger is being awaited.
- ⑦ **Cursor Keys** : To move the cursors on the CRT screen, etc.
- ⑧ **Rotary Knob** : To move the cursors on the CRT screen, to alter the sampling rate, etc.
- ⑨ **CH/PAGE Keys** : To select the active waveform on the CRT screen.
- ⑩ **Alphanumeric Keypad** : This keypad is used to enter numerical values and characters by direct key input; a particular entry is confirmed by pressing the ENTRY key. File names and numerical values are entered in this way.
- ⑪ **SHIFT Key** : To input characters printed in blue on the alphanumeric keypad. The SHIFT key LAMP remains lit while the SHIFT key is in effect.
- The SHIFT key can be used in combination with the following function keys.
- |                  |  |
|------------------|--|
| SHIFT + START    | To operate the Auto Sequence function.   |
| + STOP           | To forcibly stop measurement.  |
| + MEASURE        | To perform the Go/No-go waveform tests.  |
| + COPY           | To print-out a listing of setup information.   |
| + PROGRAM START  | To return the zoom multipliers to their initial values.  |
| + SAMPLE RATE    | To set the range for display of waveforms on the CRT screen when using Recorder Mode.                                    |
| + DISPLAY FORMAT | To operate the Swap function; substitutes one group of settings for display of waveforms with another group of settings. |
| + CURSOR         | To operate the Swap function; permits display of the waveforms according to the substituted group of setup conditions.   |
| + MONITOR        | To erase the display on the CRT screen.  |
- ⑫ **CAPS Key** : To enter characters on the alphanumeric keypad as capital letters. The CAPS key LAMP remains lit while the CAPS key is in effect.
- ⑬ **Floppy Disk Slot (optional)** : Insertion slot for Floppy Disk.
- ⑭ **Eject Button** : For removal of the Floppy Disk.
- ⑮ **Floppy Disk Drive Access Lamp** : This is lit when the Floppy Disk Drive is in operation.



## ■ Rear Panel (AR1100A)

The rear panel of the AR1200 differs slightly from that of the AR1100A.

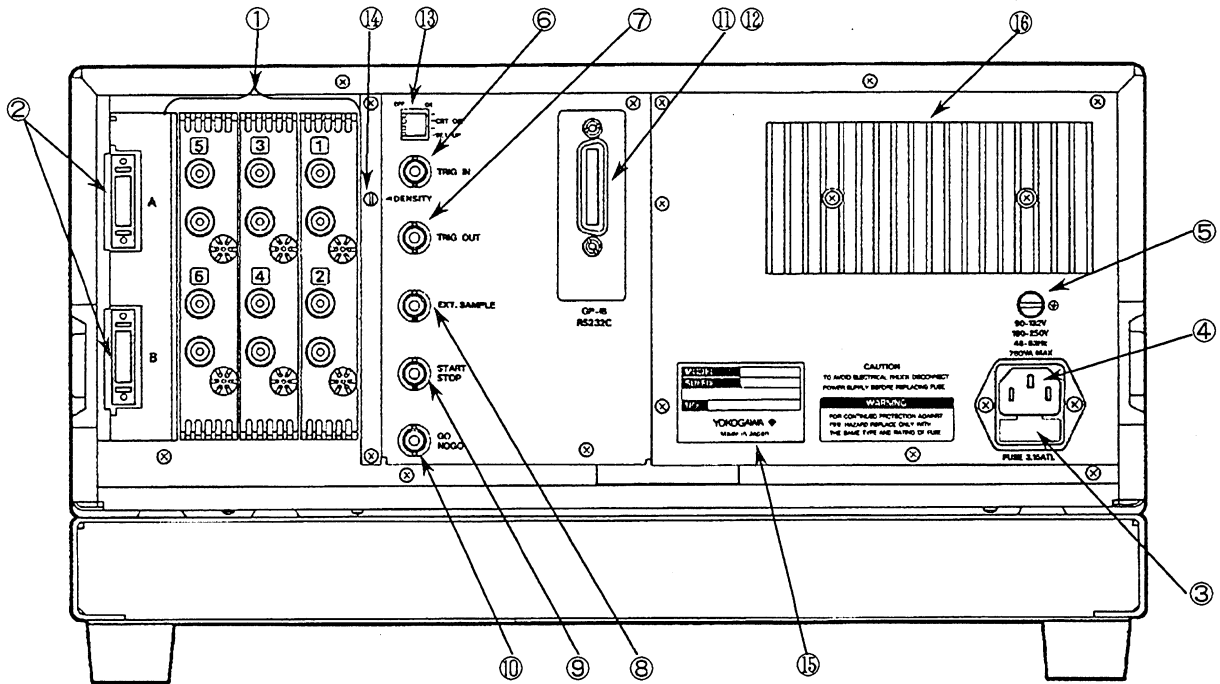
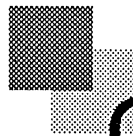


Figure 1.3 Rear Panel

- ① **Analog Input Connectors** : For connection of analog input signals to input voltage or thermocouple.
  - ② **Logic Input Connectors** : For connection of logic input signals via the Logic Signal Probe (AR1100A accessory).
  - ③ **Power Fuse** : A 3.15A time-lag fuse (A1113EF) is used in the AR1100A/AR1200. A spare fuse is included.
  - ④ **Power Connector** : For connection of the power cord supplied with the AR1100A/AR1200.
  - ⑤ **Earth Terminal** : For grounding of the AR1100A/AR1200.
  - ⑥ **TRIG IN Connector** : For connection of external trigger signal (TTL level) input.
  - ⑦ **TRIG OUT Connector** : For connection of trigger pulse (TTL level) output. If this output is connected to the TRIG IN Connector of other AR1100A / AR1200 units it is possible to carry out parallel synchronous operation with these other units.
  - ⑧ **EXT. SAMPLE Connector** : For connection of external sampling signal (TTL level) input.
  - ⑨ **START/STOP Connector** : For connection of a signal (TTL level) controlling the start/stop of measurement or print-out.
  - ⑩ **GO/NO-GO Connector** : For connection of the output (TTL level) from the Go / No-go determination.
  - ⑪ **GP-IB Connector \*** : For 24-pin connection of GP-IB Interface (in conformance with IEEE Standard 488-1978).
  - ⑫ **RS-232-C Connector \*** : For 25-pin connection of RS-232-C Interface (in conformance with EIA RS-232-C).
- \* Both GP-IB and RS-232-C are optional and either one is loaded.
- ⑬ **Dip Switch** : Allows the CRT screen to be switched off.
  - ⑭ **DENSITY** : For adjustment of the print density in the main unit's built-in printer.
  - ⑮ **Name Plate** : Displays the Model Name and Production Number.
  - ⑯ **Radiator Plate** : Allows dissipation of heat generated internally in the AR1100A/AR1200.



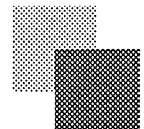
# Chapter 2

## Before Using The AR1100A / AR1200

This chapter describes preparations and cautions for the AR1100A / AR1200.

Before using the AR1100A / AR1200 please read this manual.

2.1	Checking the Enclosed Accessories .....	2-2
2.2	Optional Accessories .....	2-4
2.3	Precautions for Use .....	2-6
2.4	Precautions for Installation Location .....	2-8
2.5	Connecting to the Power Supply .....	2-10
2.6	Power Switch ON/OFF .....	2-11
2.7	Connecting Input Signals .....	2-12
2.8	Loading Chart Paper .....	2-16
2.9	Date and Time Setting .....	2-21



## 2.1 Checking the Enclosed Accessories

This instrument was thoroughly inspected before it was shipped from the factory. However, when you receive the instrument, check the specification and external appearance to confirm that all accessories are present in the correct quantities and that no damage has occurred.

If any defect is found in this instrument, contact YOKOGAWA's sales representative from when you purchased the instrument or YOKOGAWA sales division.

### ■ Checks of Models and Specifications

This instrument lists models and production numbers on the rear panel nameplate as shown in Table 2.1. Check whether this instrument is what you have ordered.

Table 2.1 List of AR1100A/AR1200 Models

Model		Suffix Code	Description	
AR1100A	AR1200			
7021A 31	7022 31		Analog 4 channel 64kW/ch	
7021A 34	7022 34		Analog 4 channel 512kW/ch	
7021A 38	---		Analog 4 channel 512kW/ch SRAM	
7021A 41	7022 41		Analog 4 channel Logic 16 channel 64kW/ch	
7021A 44	7022 44		Analog 4 channel Logic 16 channel 512kW/ch	
7021A 48	---		Analog 4 channel Logic 16 channel 512kW/ch SRAM	
7021A 51	7022 51		Analog 6 channel 64kW/ch	
7021A 54	7022 54		Analog 6 channel 512kW/ch	
7021A 58	---		Analog 6 channel 512kW/ch SRAM	
7021A 61	7022 61		Analog 6 channel Logic 16 channel 64kW/ch	
7021A 64	7022 64		Analog 6 channel Logic 16 channel 512kW/ch	
7021A 68	---		Analog 6 channel Logic 16 channel 512kW/ch SRAM	
7021A 71	7022 71		Analog 8 channel 64kW/ch	
7021A 74	7022 74		Analog 8 channel 512kW/ch	
7021A 78	---		Analog 8 channel 512kW/ch SRAM	
Power Voltage			-0	100 to 120/200 to 240VAC (automatic switching)
Power Cord			/D	UL Standard
			/F	VDE Standard
		/H	SAA Standard	
		/J	BS Standard	
		/M	JIS Standard	
Optional feature		/FFT	FFT analysis function	
		/GP-IB	GP-IB interface	
		/RS232C	RS-232-C interface	
		/FDD	3.5-inch FDD (only for AR1100A)	
		/DC12V	DC12V Drive, including FDD (only for AR1100A)	
		/DC24V	DC24V Drive, including FDD (only for AR1100A)	

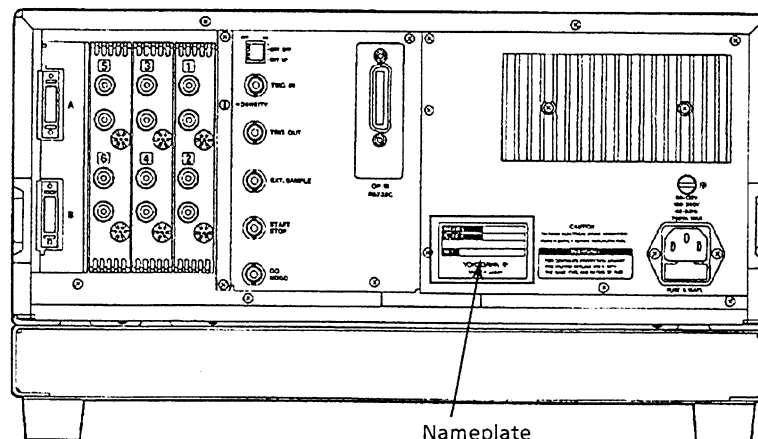


Figure 2.1 Nameplate

**Enclosed Accessories**

This instrument should be accompanied by the accessories indicated in Figure 2.2 and Table 2.2. Check that all are present in the correct quantities.

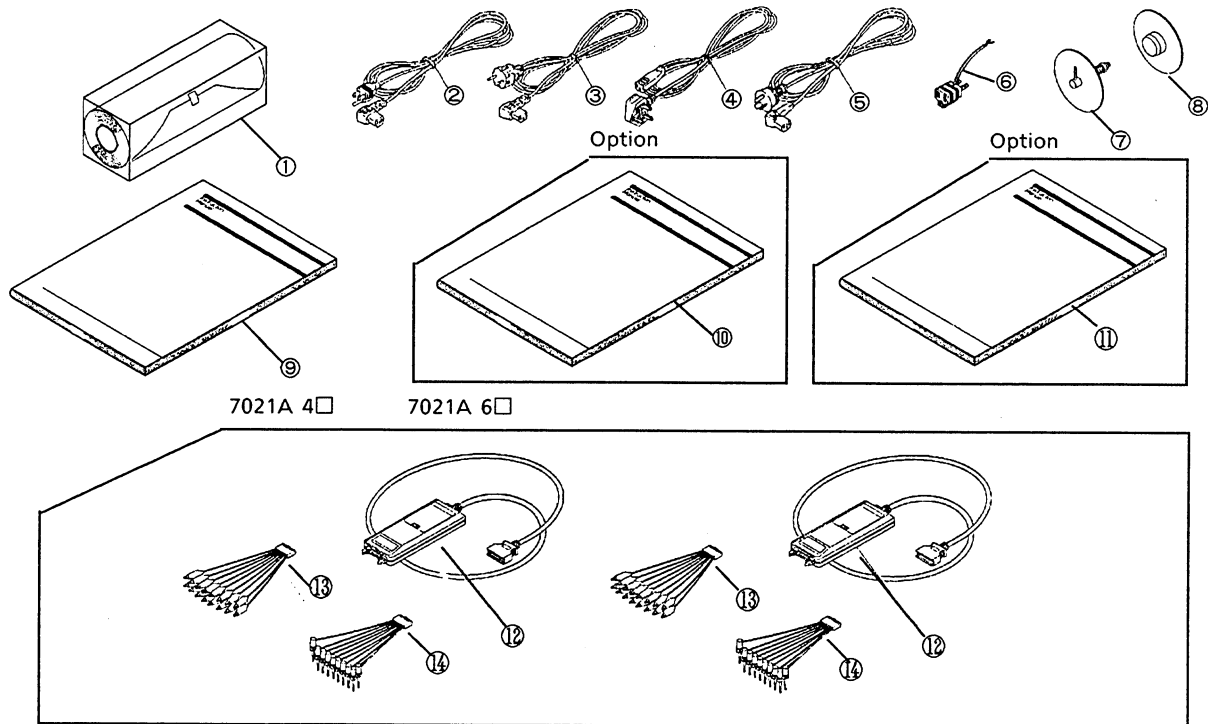


Figure 2.2 Accessories

Table 2.2 Accessories

Number	Item	Part Number	Quantity	Remarks
1	Roll paper	B9879AJ	1 roll	50m
2	Power cord	A1006WD	1 piece	UL standard } Specified one VDE standard } BS standard } SAA standard }
3		A1009WD		
4		A1023WD		
5		A1024WD		
6	3-pin → 2-pin conversion adapter	A1253JZ	1 piece	
7	Chart holders	B9887EY B9887EZ	1 piece	See Section 2.8, "Loading Chart Paper."
8	Left flange		1 piece	
	Fuse	A1113EF	1 piece	3.15 A time-lag (built into a fuse holder)
9	User's Manual	IM 7021-31E	1 volume	This manual
10	GP-IB/RS-232-C Interface User's Manual	IM 7021-41E	1 volume	Optional
11	FFT Analysis Function User's Manual	IM 7021-51E	1 volume	Optional FFT analysis function
12	Logic probe	7029 11	2 pieces	For models with logic input only
13	Connection lead (alligator clip)	B9879PX	2 pieces	
14	Connection lead (IC clip)	B9879KX	2 pieces	

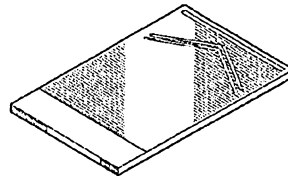
Note: If JIS standard grounded cable was specified, UL standard power code ② with 3-pin to 2-pin conversion adapter ⑥ will be supplied.

## 2.2 Optional Accessories

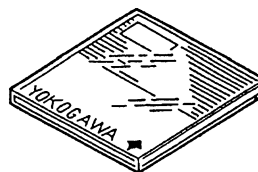
This section describes optional accessories such as input connection cables. Parenthesized numbers are type names.

### ■ IC Memory Cards

64Kbytes	(3789 03)
256Kbytes	(3789 04)
512Kbytes	(3789 05)
1Mbytes	(3789 06)

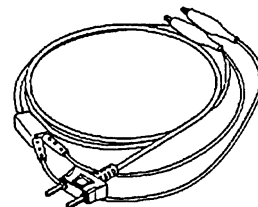


### ■ 3.5-Inch Floppy Disk 2HD (7059 00)

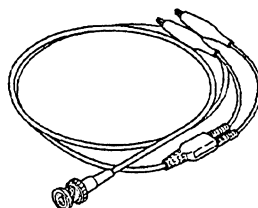


### ■ Input Connection Cables

Measurement cable with shield (3669 61)

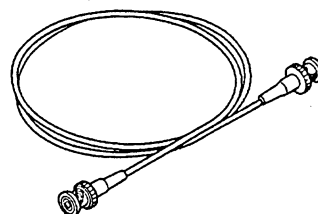


BNC to alligator-clip cable (3669 26) 1m



BNC cable (3669 24) 1m

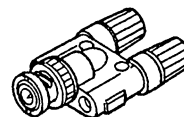
BNC cable (3669 25) 2m



### ■ Adapters

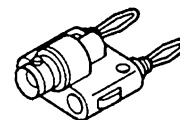
Conversion adapter (3669 21)

Converts BNC to banana terminals (female).



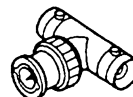
Conversion adapter (3669 22)

Converts banana terminals (male) to BNC.



T-type connector adapter (3669 23)

Used to branch TRIG OUT signals, etc., to other connections.



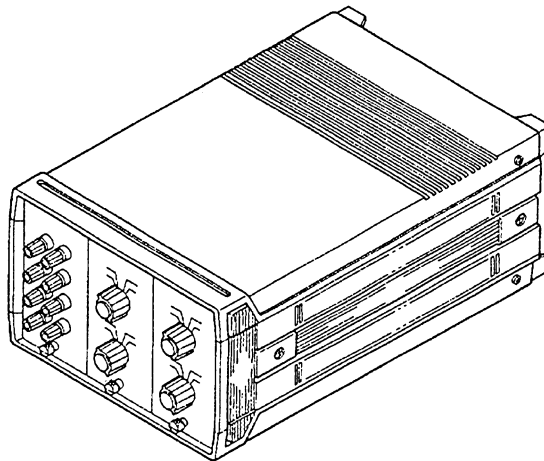
### ■ Power Unit (3659 61)

The AR1100A/AR1200 can measure up to  $\pm 60V$  FS, but cannot measure signals of more than 60V such as residential or motor power supply circuits of 100V, 200V, and 400V, etc. directly. A power converter unit (Model 3659 61) can be used to enable capture of such signals.

The output signals are electrically isolated, since the input signals are received via a potential transformer (PT) and current transformer (CT).

### ● Specifications

	Voltage	Current
Input Type	Potential transformer (PT) isolation	Current transformer (CT) isolation
Input Ranges	100/150/300/600V	1/2/5/10A
Number of Channels	2	2
Usable Frequency Range	50 to 60Hz Up to 2kHz for high frequency component (Amplitude flatness up to 2kHz, $\pm 0.5\%$ or better)	
Output Voltage	1.0V at rated input	
Accuracy	0.2% of range	
Measurement Loss	100V range Approx. 50k $\Omega$ (50Hz) 150V range Approx. 100k $\Omega$ (50Hz) 300V range Approx. 400k $\Omega$ (50Hz) 600V range Approx. 1.5M $\Omega$ (50Hz)	1A range 0.1VA (50Hz) 2A range 0.15VA (50Hz) 5A range 0.6VA (50Hz) 10A range 1.5VA (50Hz)
Withstanding Voltage between Channels	1000V rms	
Input Terminals	Binding post	
Output Terminals	$\varnothing 6$ binding post	
Connecting Cables	Approx. 1.5m for connection between this instrument and AR1100A	
External Dimensions	Approx. 149 $\times$ 228 $\times$ 365mm (not including protruded portions)	
Weight	Approx. 10kg	



## 2.3 Precautions for Use

---

To use this instrument correctly and safely, please observe the following precautions.

### ■ Operating Precautions

#### ● Top of Instrument

Do not place containers of any liquid on or above this instrument. If by any chance liquid does get into the instrument, immediately disconnect the power cord plug from the power outlet and contact your sales representative or the nearest YOKOGAWA service center. (See the back cover of this manual.) Do not place any large or heavy equipment on top of this instrument.

#### ● Moving the Instrument

Before moving this instrument, make sure that the power cord has been unplugged from the wall outlet and that all external connecting wires have been disconnected.

#### ● Transporting the Instrument

To transport this instrument, use at least as much of the packing material as that used for the first-time delivery.

Make sure a floppy disk is not in the slot. If the floppy disk has been inserted, the floppy disk or the head might be damaged.

#### ● Cleaning

Plastic is used extensively in the case and operating panels of this instrument. Never wipe with light naphtha or mineral spirits, thinner or chemically impregnated cleaning cloths. This causes the instrument to be deformed, discolored and damaged.

If the case or panel becomes dirty, wipe gently with a soft cloth.

If the case is heavily soiled, wring out a cloth soaked in a dilute solution of mild detergent, wipe off the dirt and wipe the instrument dry with a dry cloth.

#### ● Static Electricity

Do not bring any item carrying an electrical charge near to the input connectors. This may cause the destruction of the internal circuit.

#### ● Contact with Insecticides, Etc.

Do not allow volatile materials such as insecticides, etc. to come in contact with the case or panel. Do not leave rubber or vinyl materials in contact with the case for long periods. This may cause the instrument to become deformed, discolored or to break down.

#### ● Finishing Use

Press the power switch to OFF.

#### ● Discontinuing Use for a Long Period

Disconnect the plug from the power outlet.

#### ● Protective Film for CRT Filter

At the time of shipment, protective filter is attached to the surface of CRT filter. Take it off before using this instrument.

**■ For Safety of Use****● The Inside of the Instrument**

Do not remove the case of the instrument since there are areas of high voltage inside. Touching one of these areas may result in serious injury and may also cause instrument failure. For internal inspection and adjustments, contact your sales representative or the nearest YOKOGAWA service center. (See the back cover of this manual.)

**● In Case of Malfunction**

Never continue to use the instrument if there are any symptoms of malfunction such as unusual sounds, smell or smoke coming from the instrument. Immediately remove the power plug from the power outlet and stop further use of the instrument.

If such abnormal symptoms are present, contact your sales representative or the nearest YOKOGAWA service center.

**● Ground**

Always ground this instrument during use to avoid electrical shock.

**● Power Cord**

Be careful not to place heavy items on the power cord or to let the cord touch any heater or high-temperature equipment.

If the cord is damaged, contact your product sales representative.

When disconnecting the power cord from the power outlet, always grasp the plug itself. Never pull or jerk the cord.



## 2.4 Precautions for Installation Location

To use this instrument correctly and safely, please install the instrument in locations with the following characteristics.

### ■ Installation Location

- **Place the Instrument where there is Good Ventilation**

To prevent a rise in internal temperature, there are ventilation holes in the instrument case. If the instrument must be placed in a restricted space with poor ventilation, be careful to leave space on the left and right so that these ventilation holes are not blocked.

Also, never block the top cover ventilation holes.

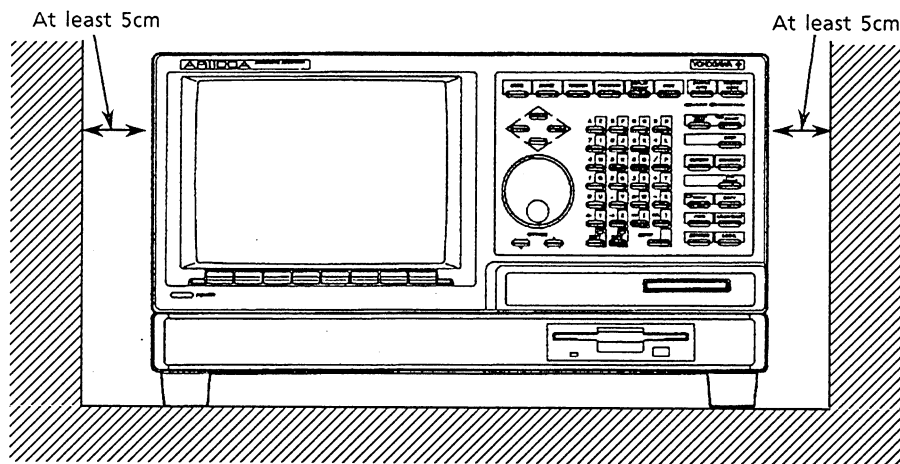


Figure 2.3

- **Avoid Flammable Materials**

The instrument is designed to dissipate internal heat from the ventilation holes and heat sink at the rear.

Do not place any flammable materials such as paper, etc. near the instrument.

- **Avoid Direct Sunlight or a Heat Source**

Placing this instrument in direct sunlight or near a heat source may deform the case or cause malfunction or instrument failure. Select a location in which the temperature is near normal room temperature (23°C) with minimal fluctuation.

- **Seek Low Levels of Soot, Steam, Humidity, Dust or Corrosive Gases**

Soot, steam, humidity, dust, or corrosive gases may cause malfunction or instrument failure.

- **Avoid Placing near an Electromagnetic Field Source**

If this instrument is used near an electromagnetic field source, the CRT screen may be distorted by the electromagnetic effects, resulting in the destruction of data in a floppy disk and malfunction. Do not place this instrument near magnets or devices that generate a magnetic field.

- **Select a Location with Limited Mechanical Vibration**

Locations with significant levels of mechanical vibration may not only have bad effects on the mechanical construction of the instrument, but also may prevent the printer from recording normally. For installation of this instrument select a location with limited mechanical vibration.

- **Select a Stable Location**

Place the instrument on a stable, leveled surface. If the instrument is used while tilted at an angle, or on a shaky, unstable surface, recording performance may be adversely affected.

## 2.5 Connecting to the Power Supply

After determining where the instrument is to be located, connect the power cord supplied with the instrument to the power connector on the instrument rear panel.

---

### WARNING

- Before connecting the instrument to the power supply, ensure that the supply voltage suits the specified operating voltage of the instrument (100 to 120VAC / 200 to 240VAC).
- Make sure to use the power cord supplied by YOKOGAWA.
- Make sure to use the specified fuse (current, voltage and type). See **Section 13.7, "Replacing Power Supply Fuse"** for fuse replacement.

To connect the power supply, proceed as follows :

1. Make sure the power switch of the main unit is OFF.
2. Connect the plug to the power connector of the main unit.
3. Then plug into the main outlet.

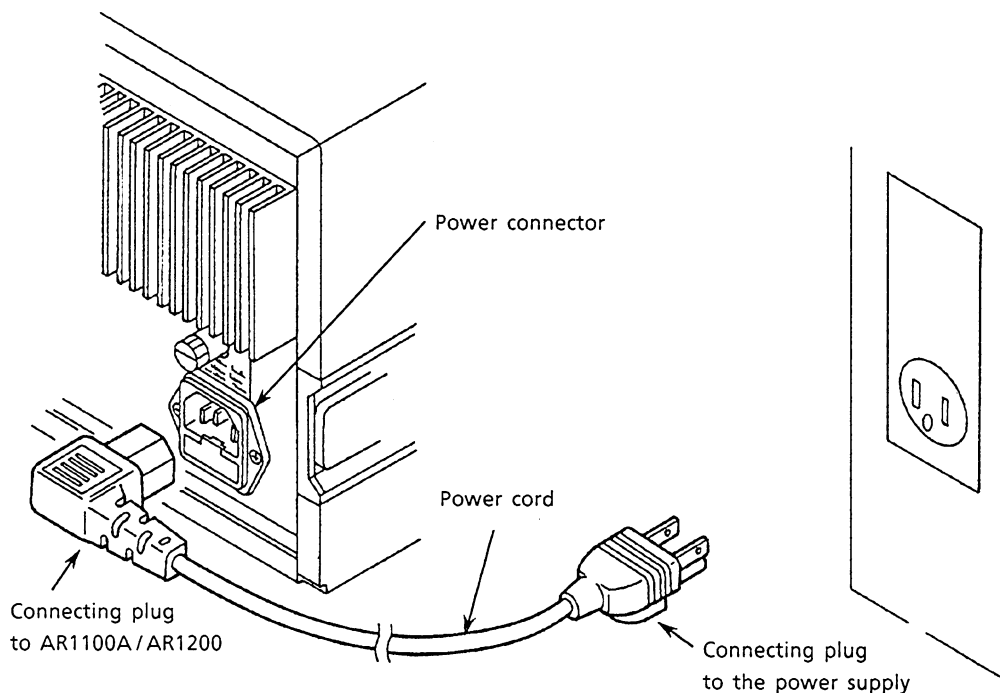


Figure 2.4 Connecting to the Power Supply

## 2.6 Power Switch ON/OFF

The power switch is located at the lower left of the front panel of this instrument. Press this switch firmly once to turn power ON; press it again to turn power OFF.

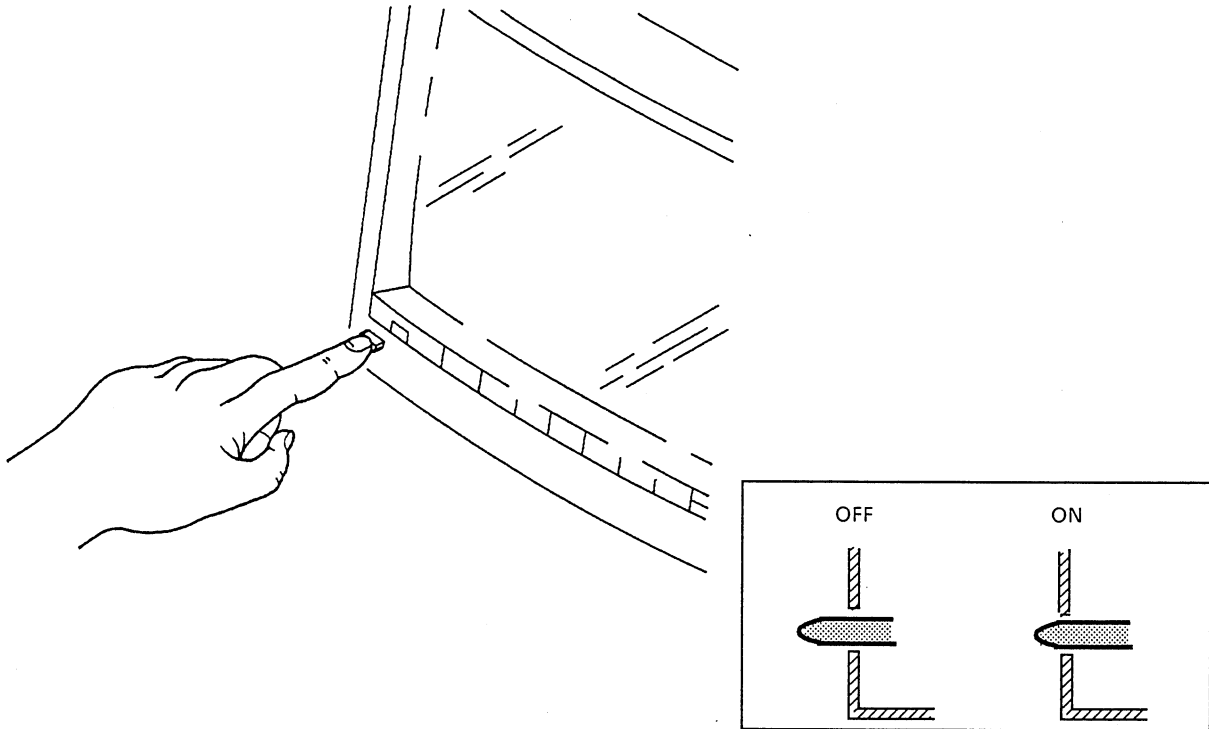


Figure 2.5 Power Switch ON/OFF

### Notes

- Measurement data and computation data in the memory are lost when power is turned OFF.
- After pressing the power switch, wait at least 10 seconds before pressing the switch again.
- When power is turned OFF, the battery backup function stores the following setting conditions immediately prior to power OFF in the main memory:
  - Panel setting conditions
  - Clock
 When power is turned ON again, this instrument recovers the settings made immediately prior to power being turned OFF.
- Battery backup is supplied by a lithium battery installed in this instrument. Battery life is approx. 10 years (at ambient temperature 23°C). If battery voltage falls below the rated value, the message "Battery exhausted" is displayed. When the message is displayed, the battery backup function doesn't work. When power is turned ON again after power is turned to OFF, panel setting condition and internal clock turns to initial setting. The other function like measurement can be executed normally. Since the lithium battery is internally installed in the instrument, it must be replaced by YOKOGAWA. Contact your sales representative or the nearest YOKOGAWA service center. (See the back cover of this manual.)

## 2.7 Connecting Input Signals

### ■ Analog Input

The analog input terminals are located on the instrument rear panel. The analog input terminals are for channels 1 to 8 on the 8-channel model, channels 1 to 6 on the 6-channel model and channels 1 to 4 on the 4-channel model.

All channels are isolated each other, and are also isolated from the instrument case. Input impedance is approx.  $1\text{M}\Omega$  (in parallel with approx.  $22\text{pF}$ ).

### ■ Logic Input (Relevant Models Only)

Logic input has channels A and B. One channel consists of 8 points, i.e., a total of 16 points can be input.

The supplied logic probe is used for connection with measurement points. The alligator-clip cable and IC-clip cable can be selected for connection between measurement points and logic probe.

TTL level input or contact input is selectable using the switch on the logic probe.

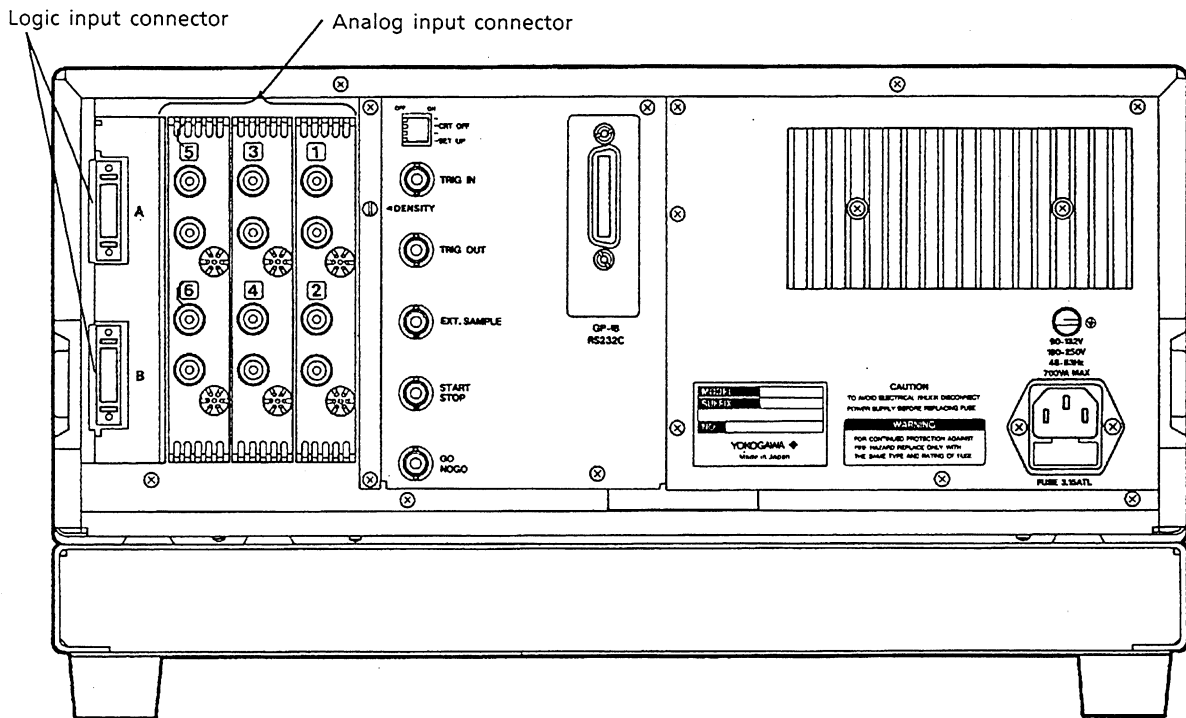
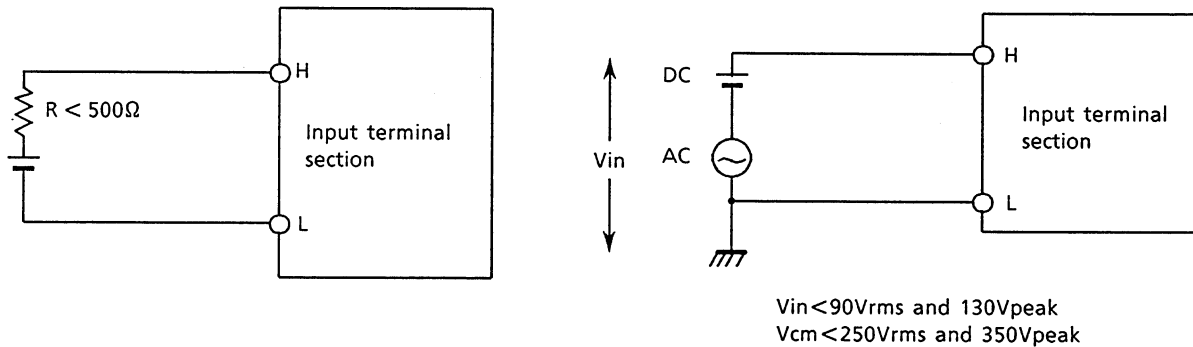


Figure 2.6

Notes
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- Analog input impedance is approximately  $1M\Omega$  (in parallel with approx.  $22pF$ ). Use a signal source whose resistance “R” (including the connecting lead-wire resistance) is less than  $500\Omega$ . If the signal line resistance is  $500\Omega$  or greater, the  $2nA$  bias current must be taken into account.
- Do not use inputs with the analog input signal voltage “ $V_{in}$ ” higher than  $90V_{rms}$  and  $130V_{peak}$ . The input circuits may be damaged if the input signal voltage exceeds  $90V_{rms}$  or  $130V_{peak}$ .
- Do not use inputs with a common mode voltage “ $V_{cm}$ ” higher than  $250V_{rms}$  and  $350V_{peak}$ . The input circuits may be damaged if the common mode voltage exceeds  $250V_{rms}$  and  $350V_{peak}$ .
- In the case of temperature measurement, use of terminals with high thermal capacity (clip, tip-type) may cause fluctuations in the terminal temperature, introducing reference junction compensation errors. Therefore, connect thermocouple element wires directly to the input terminals.




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## WARNING

- Take care to avoid electrical shock when using signals which have different common mode voltages. Also, to avoid electrical shock, make sure to ground before using this instrument.
-

### ■ Logic Probe (Model: 7029 11)

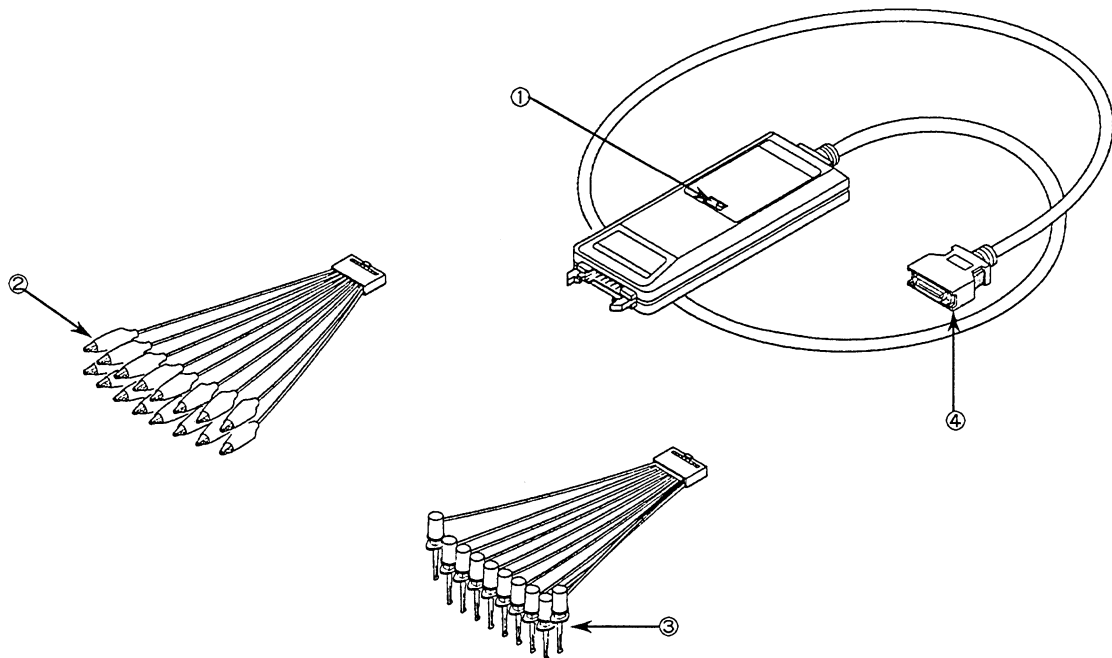
#### 1. Overview

Logic probes are connected to the main unit logic input connectors.

Since each probe has a TTL level input / Contact input selector switch, wide-ranging measurement is available from electronic circuit to relay operation timing.

#### 2. Component Names

- |                                    |   |  |
|------------------------------------|---|--|
| ① Input Selector Switch            | : | Used to select input type of either TTL level input (TTL) or contact input (CONT).                               |
| ② Connection Lead (Alligator clip) | : | Connected mainly to the contact circuit and consisting of eight signal lines (red) and eight GND lines (black).  |
| ③ Connection Lead (IC clip)        | : | Connected mainly to the electronic circuit and consisting of eight signal lines (red) and two GND lines (black). |
| ④ 26-pin Connector                 | : | Connected with the main unit logic input connector.  |



**3. How to Use**

- (1) Connect the connection lead (IC-clip or alligator-clip) to the logic probe main unit.
- (2) Set the input selector switch. For TTL level input, a voltage higher than the threshold level of approx. 1.4V sets logic "1". For Contact input, shorting signal lines and GND lines set logic "1".
- (3) Turn the main unit power switch OFF.
- (4) Connect the 26-pin connector to the main unit logic input connector.
- (5) Turn the main unit power switch ON.
- (6) Connect individual lead clips to the measurement points.

**4. Specifications (When Connected to AR1100A / AR1200)**

Input type	:	Common GND within the same probe Floating between recorder and probe
Number of Input Points	:	8
Allowable Input Range	:	$\pm 35V$
Input Impedance	:	10k $\Omega$ or more
Threshold Level	:	Approx. +1.4V
Input Method	:	TTL level or contact input (switching type)
Withstanding Voltage	:	Between logic probe and case ; 500VDC for 1 minute
Insulation Resistance	:	Between logic probe and case ; 10M $\Omega$ or more at 500VDC

**Notes**

- If the logic probe is not connected to main unit, waveform becomes "1" (High).

**Cautions**

- Do not fail to confirm the selector switch setting before connection.
- Eight input lines are grounded in common within one probe. Therefore, to avoid damaging the logic probe or any connected appliances never use contact inputs which have different common voltages.
- When the 26-pin connector is connected to or removed from the main unit logic input connector, the main unit power switch must be turned OFF.
- Never attempt to modify (extension, etc.) the connection lead.

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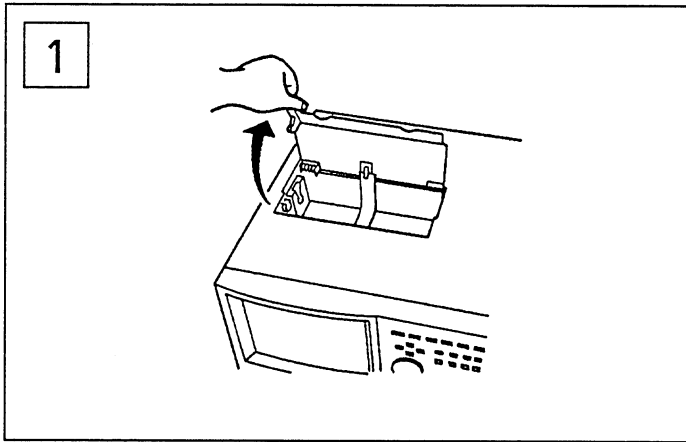
## WARNING

- The allowable input range ( $\pm 35V$ , including common voltage) must be strictly observed. Otherwise, the logic probe and main unit may be damaged. Also note that applying a voltage which exceeds  $\pm 500V$  may cause electrical shock.
-

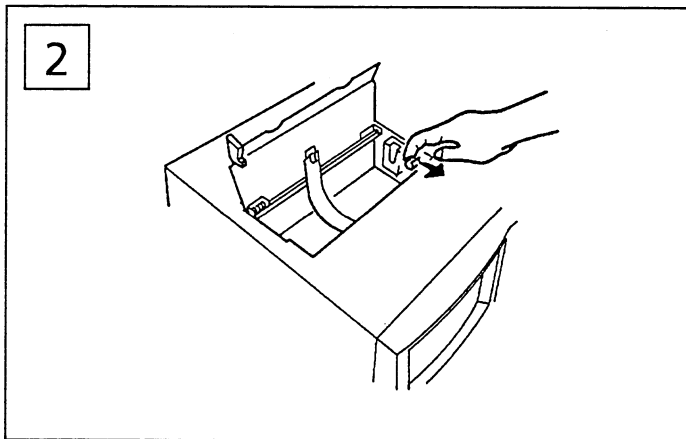


## 2.8 Loading Chart Paper

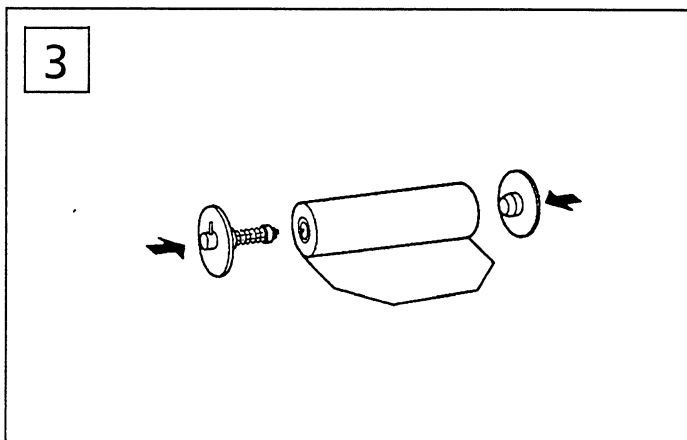
### ■ Loading Chart Paper



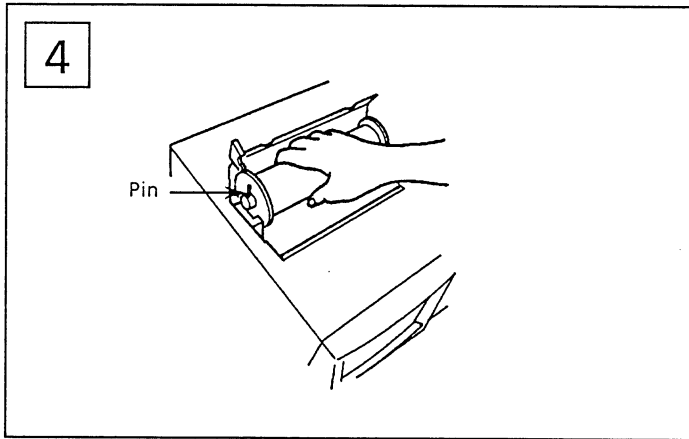
Lift the printer cover on the top of the instrument by pulling the knob.



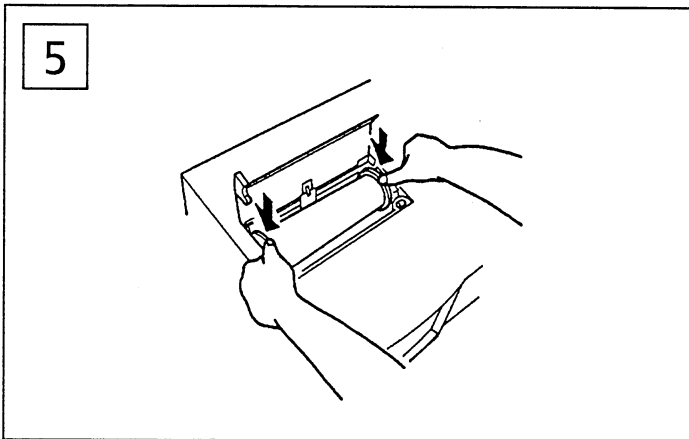
Move the release lever in the direction of the arrow.



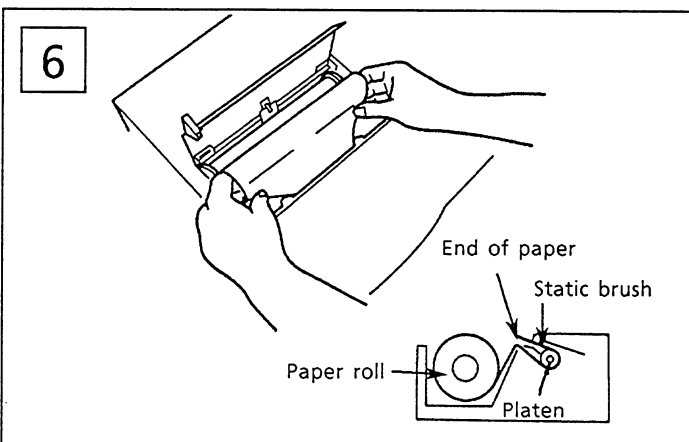
Pull the end of the roll of paper out toward you, mate the projection on the left flange with the slot on the roll and push the left and right flanges into the roll.



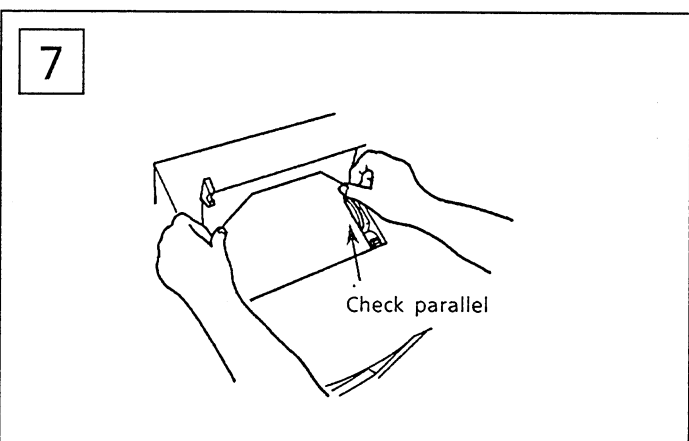
Orient the roll with the left flange pin on top and insert the roll into the holder.



Press the flanges on both sides until you hear a click.

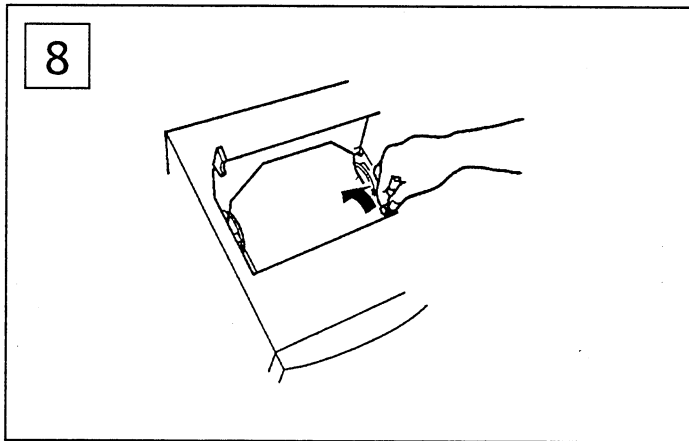


Insert the paper under the platen, and push it through until 2cm comes out of the top.

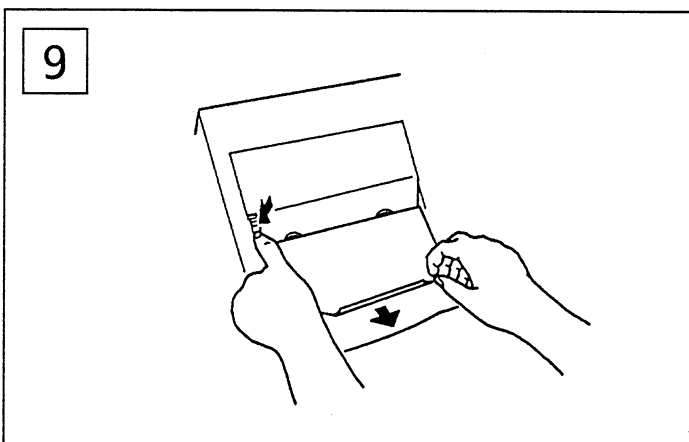


Pull the paper out so that the sides of the paper are parallel to the flanges.

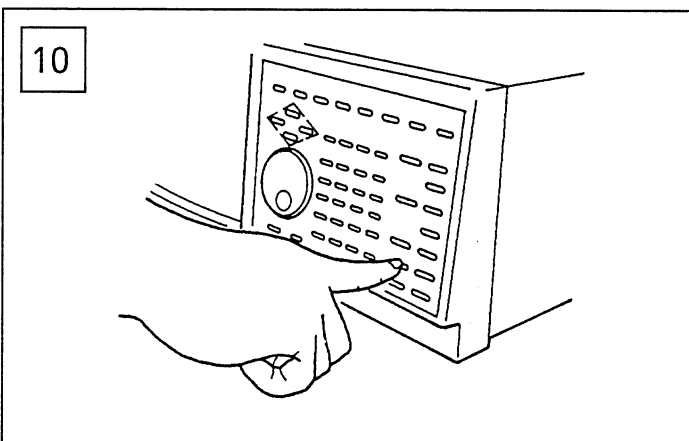
## 2.8 Loading Chart Paper




Move the release lever in the direction of the arrow.

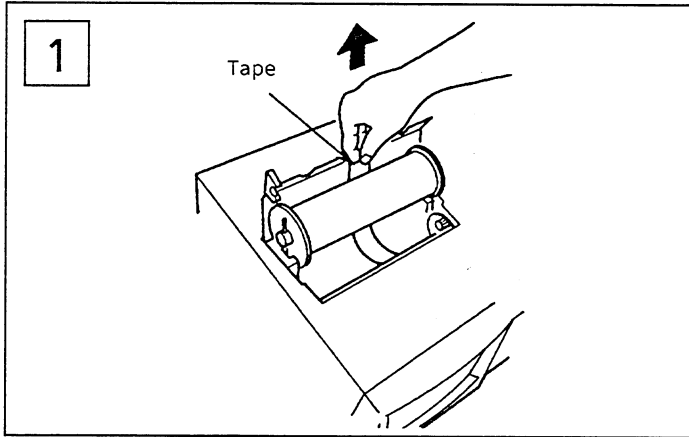


Pull the paper toward the front and close the cover. Press the knob to lock.

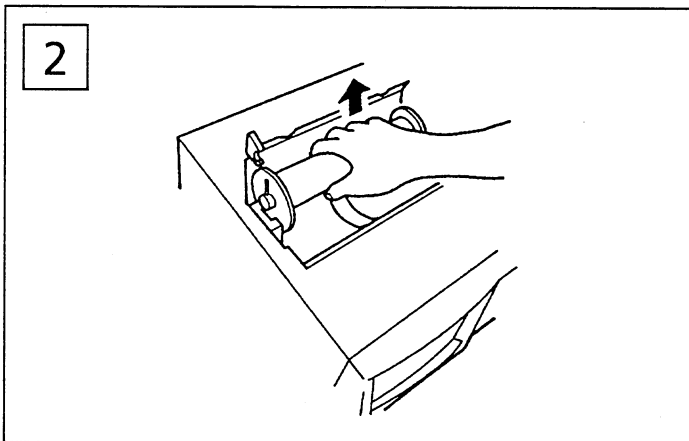


Turn the power ON and press the  to verify that paper feeds correctly.

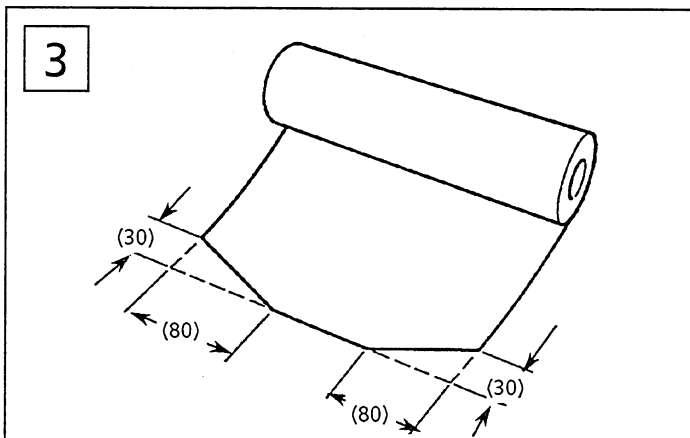
## ■ Replacing Chart Paper



To remove the paper roll, pull the roll removal tape.



If a small amount of paper remains on the roll, the roll can be grasped directly to remove it.



If you wish to use a roll of paper that has been used before, cut the ends of the roll paper as shown in the diagram to facilitate insertion into the printer.

Notes
-------

■ **When Storing Unused Chart Paper**

- Chart paper stored in the rolled state under normal conditions should not be affected by external conditions.  
The temperature at which chart paper begins to discolor is approximately 60°C. For long-term storage, store the paper in a cool, dark, dry location.
- If exposed to bright light for a long period, the outer surfaces of the paper tend to become discolored.  
Be careful not to expose the paper to bright light if the packaging has been removed.

■ **When Using New Chart Paper**

- Recording may be uneven on the area of the paper where the tape has been attached. Avoid using this area.

■ **When Storing Chart Paper Used in Recording**

- Chart paper that has been used in recording has a tendency to fade if exposed to high temperature, high humidity or bright light.  
Store the recorded chart paper in a cool, dark, dry location, or make a copy and store the copy.
- Avoid leaving the recorded chart paper exposed to direct sunlight for a long period.
- The paper surface can become discolored by the frictional heat if it is rubbed vigorously with a hard object.

- As for chart paper, our roll paper (No. B9879AJ) should be used.




## 2.9 Date and Time Setting








### Function

Sets date and time of the internal clock.








The procedure below sets date and time to 13:20, March 25, 1992.


### Procedure

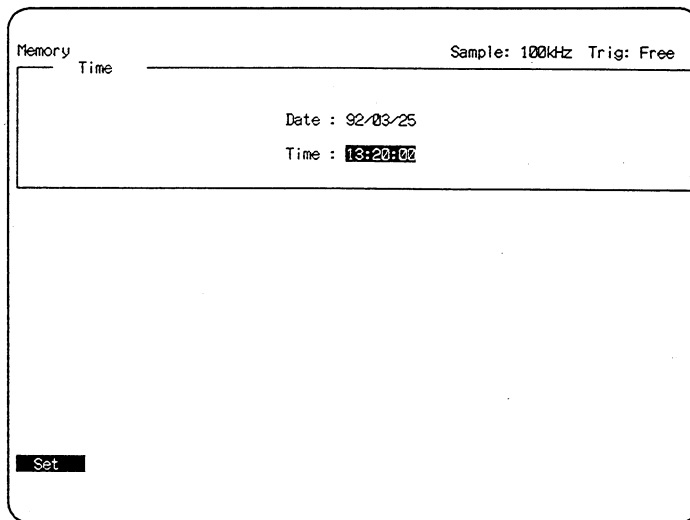
1.  The MISC panel appears.
2.  The soft key menu changes.
3.  The date and time setting panel appears.
4. Key in the following on the alphanumeric keypad.

5. Then key in the following on the alphanumeric keypad.

6.  Pressing this key sets the values entered.



### Notes

- The internal clock is backed up by lithium battery installed in the instrument. Battery life is approx. 10 years (at ambient temperature 23°C). When battery voltage falls below the rated value, the message "Battery exhausted" is displayed. When the message is displayed, the battery must be replaced. Since the lithium battery is internally installed in the instrument, it must be replaced by YOKOGAWA. Contact your sales representative or the nearest YOKOGAWA service center. (See the back cover of this manual.) Even though the message "Battery exhausted" is displayed, functions like measurement or recording works except the backup function of internal clock and setting value.





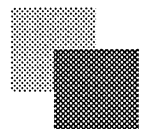
# Chapter 3

## Memory Mode / To The First-Time User

Chapter  
**3**

Here we explain the basic procedure of the memory mode.

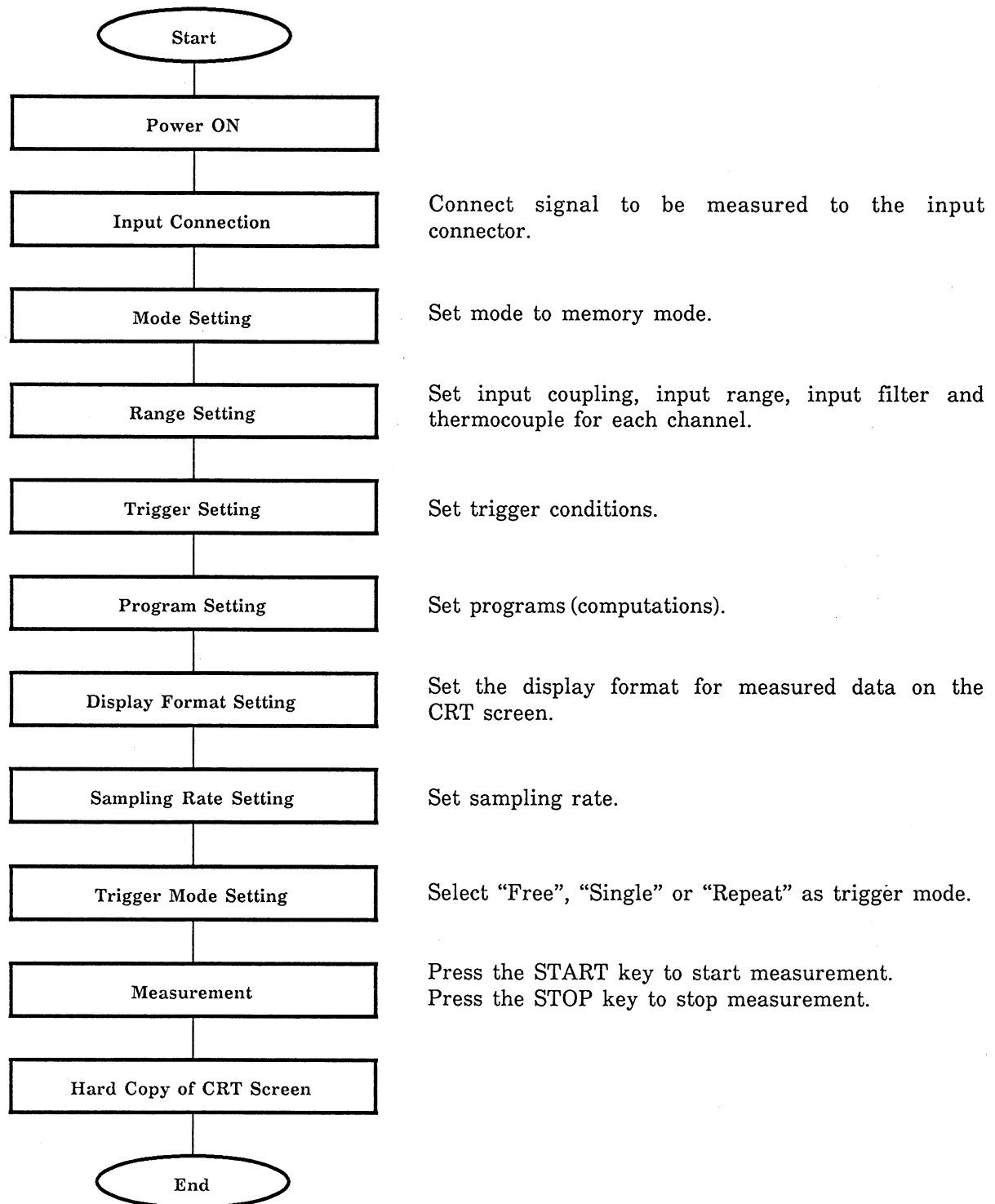
3.1 Operation Flow .....	3-2
3.2 Basic Operations .....	3-3





## 3.1 Operation Flow

The following chart outlines the flow of operations.



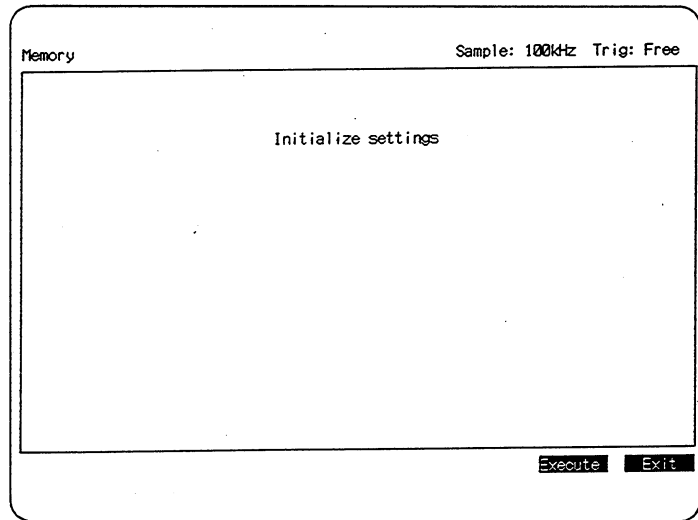
## 3.2 Basic Operations

This section describes basic operations in the memory mode in an example that follows through the procedure to measure a 2Vp-p, 200Hz sine wave from a function generator. The explanation covers model 7021A 61 (64kW / ch) provided with logic input in addition to 6-channel analog input.

### (1) Initializing Settings and Acquisition Memory

Return settings and Acquisition Memory to the initial values.

1. Press **MISC**.
2. Select **Next**.  
The menu changes.
3. Select **Next**.  
The menu changes.
4. Select **Init.**.  
The panel as shown to the right appears.
5. Select **Execute**.  
Settings are initialized.



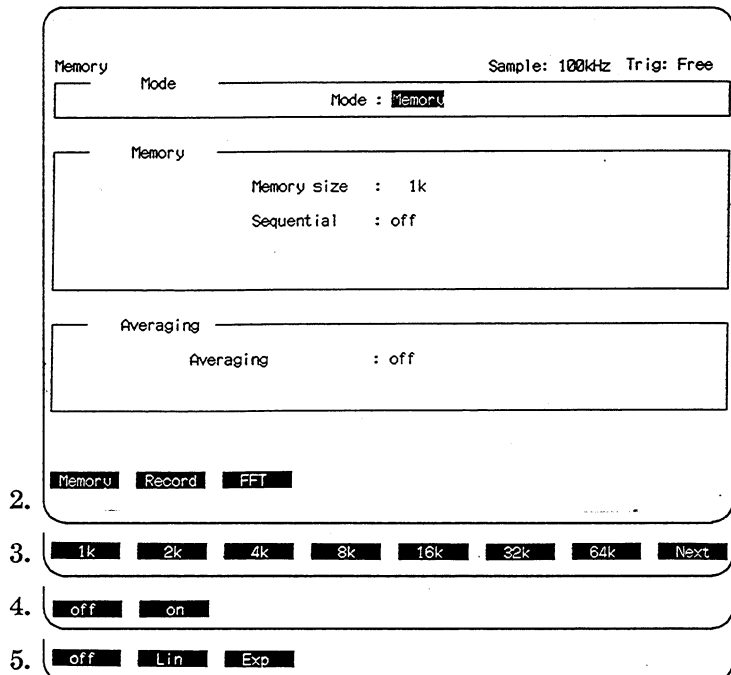
### (2) Input Connection

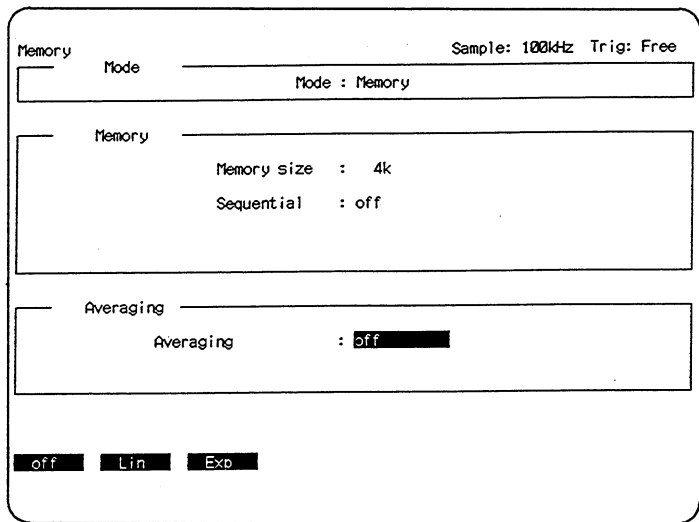
Connect the function generator output to channel 1 of the main unit analog input connector.  
Input a 2Vp-p, 50Hz sine wave.

### (3) Mode Setting

Set Mode to "Memory", set memory size to 4kW and averaging to "off".

1. Press **MODE**.
2. Select **Memory**.
3. Select **4k**.
4. Select **off**.
5. Select **off**.





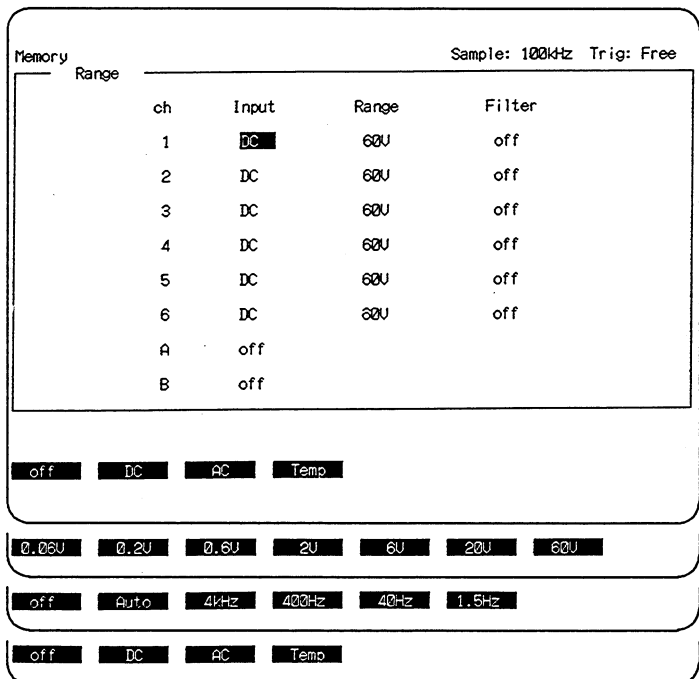
Panel After Completing Setting

(4) Range Setting

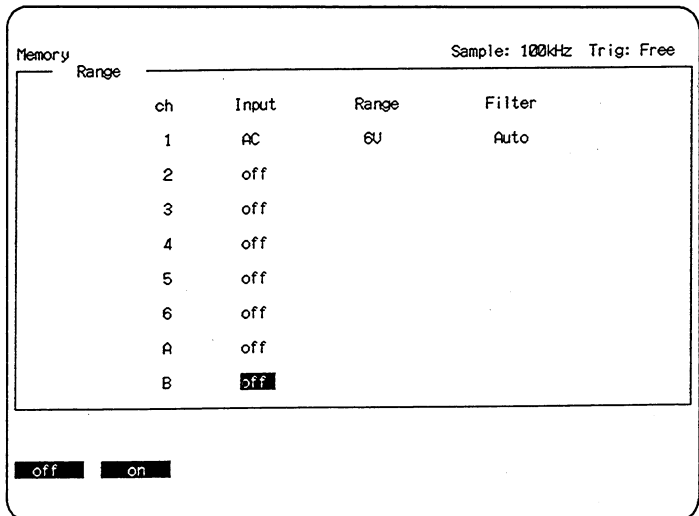
Set channel 1 Input to "AC", Range to "6V" and Filter to "Auto".

Set Input for channels 2 to 6 and channels A and B to "off".

1. Press **RANGE**.
2. Set channel 1 as follows.
  - ① Select **AC**.
  - ② Select **6V**.
  - ③ Select **Auto**.
3. Select **off** for channels 2 to 6 and channels A and B.



- 2.①
- 2.②
- 2.③
- 3.



Panel After Completing Setting

(5) Trigger Setting

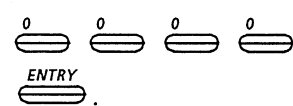
Set the trigger mode Trigger source to "Int", Pretrigger to "0%" and Trigger AND / OR to "AND".

Set analog trigger 1 to "on", set the trigger 1 Source channel to "1", the Slope to "Rise", and the trigger Level to "0%". Set triggers 2 to 6 to "off".

1. Press **TRIGGER**.
2. Select **Int**.
3. Select **0**.
4. Select **AND**.
5. Set trigger 1 as follows.

- ① Select **on**.
- ② Select **1**.
- ③ Select **Rise**.

Use the alphanumeric keypad to key in



6. Select **off** for triggers 2 to 6.

Memory Sample: 100kHz Trig: Free

Trigger mode Trigger source : **Int**  
Pre trigger : 0%  
Trigger AND/OR : OR

Analog trigger		on/off	Source ch	Slope	Level
Trig no.	1	on	1	Rise	0%
	2	off			
	3	off			
	4	off			

Logic trigger Trig no. on/off Source ch 8 7 6 5 4 3 2 1

5 off

6 off

**Int** Ext rise Ext fall

0 10 20 30 40 50 60 Next

AND OR

off on

1 2 3 4 5 6

Rise Fall High Low

off on

Memory Sample: 100kHz Trig: Free

Trigger mode Trigger source : Int  
Pre trigger : 0%  
Trigger AND/OR : AND

Analog trigger		on/off	Source ch	Slope	Level
Trig no.	1	on	1	Rise	0%
	2	off			
	3	off			
	4	off			

Logic trigger Trig no. on/off Source ch 8 7 6 5 4 3 2 1

5 off

6 off

off on

Panel After Completing Setting

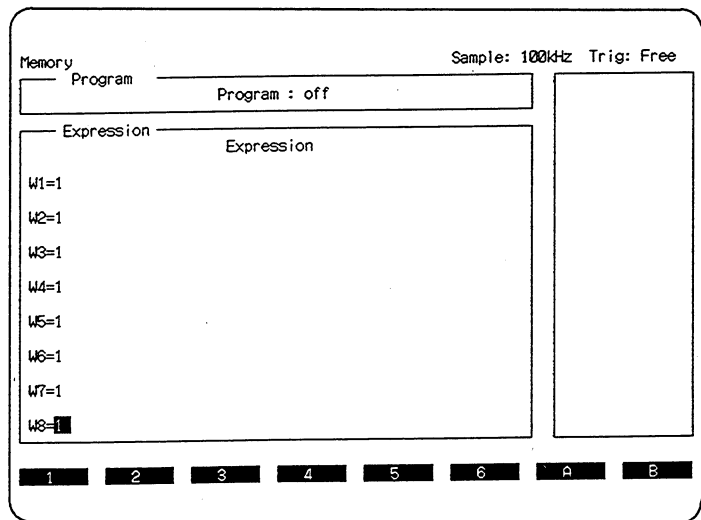
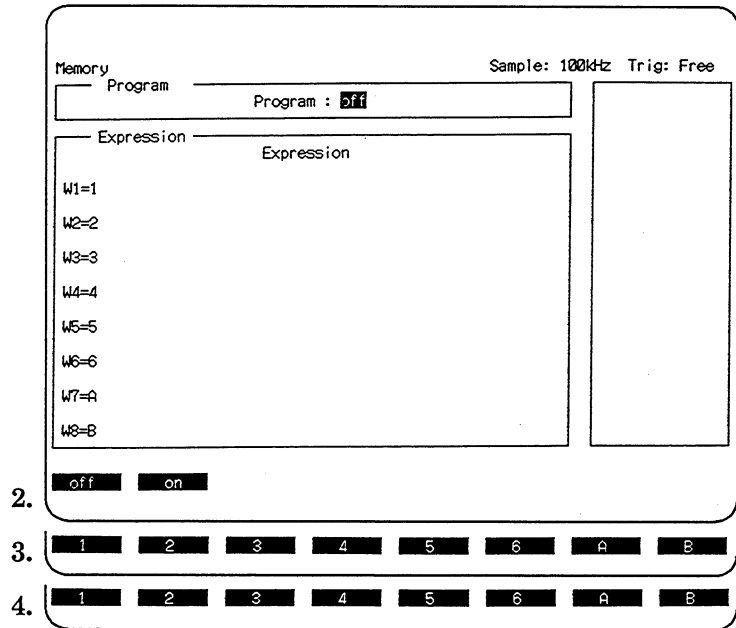
### 3.2 Basic Operations

#### (6) Program Setting

Set the program mode to "off" and W1 to W8\* to "channel 1".

1. Press **PROGRAM**.
2. Select **off**.
3. Select **1**.
4. Select **1** in the same way for W2 to W8.






- \* For 4-channel model:  
W1 to W4
- For 6-channel model  
(including logic input):  
W1 to W6

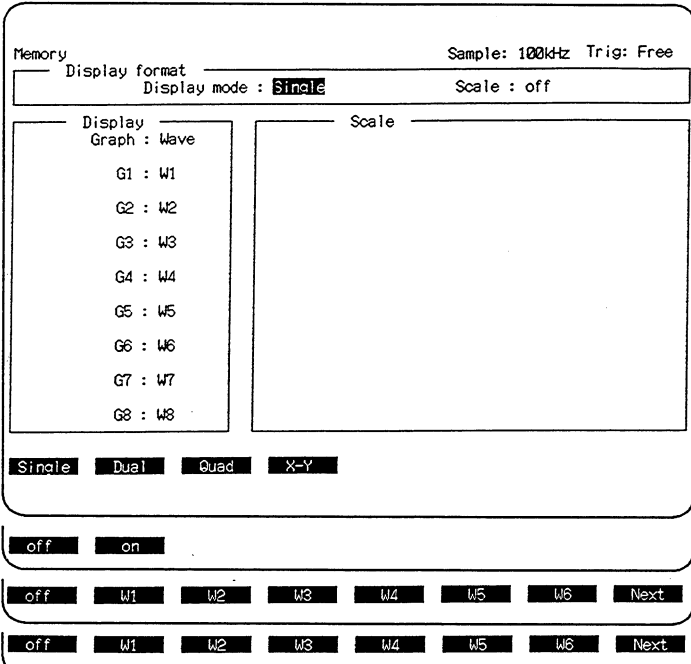


Panel After Completing Setting

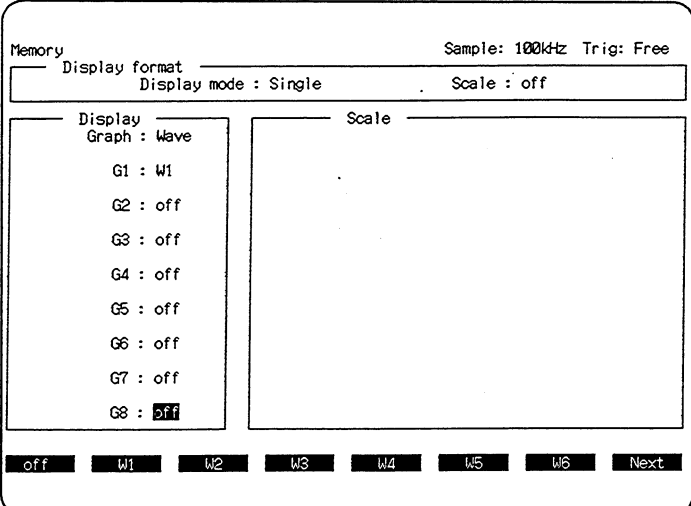
**(7) Display Format Setting**

Set the display format Mode to "Single", Scale to "off", Display G1 to "W1" and G2 to G8 to "off".

1. Press .
2. Select .
3. Select .
4. Select  for G1.
5. Select  for G2 to G8.




- 2.
- 3.
- 4.
- 5.

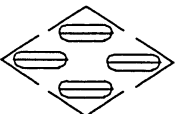



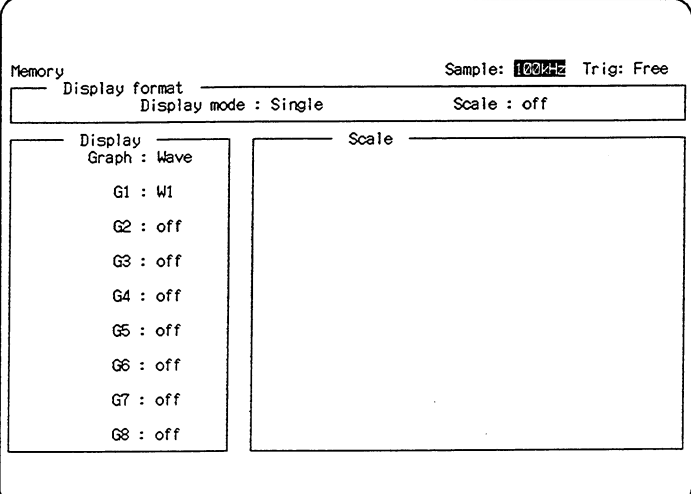
Panel After Completing Setting

**(8) Sampling Rate Setting**

Use the cursor keys or rotary knob to set the sampling rate to "10kHz".

1. Press .
2. Set the sampling rate to "10kHz" using the cursor



keys  or rotary knob .

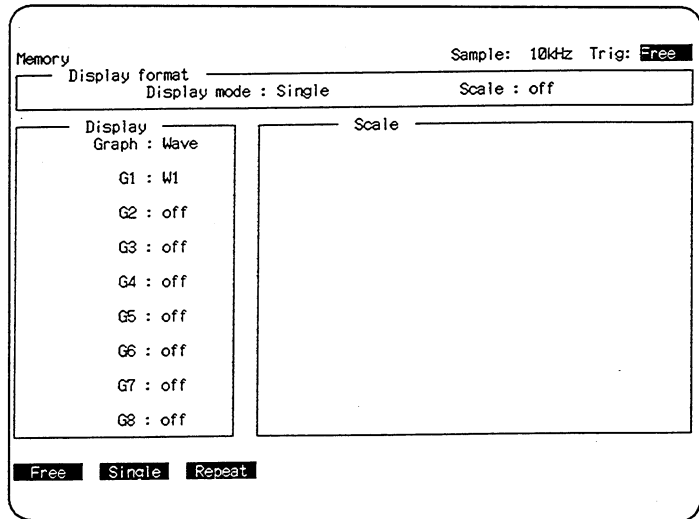


### 3.2 Basic Operations


#### (9) Trigger Mode Setting


Set the trigger mode to "Single"

1. Press .
2. Select .





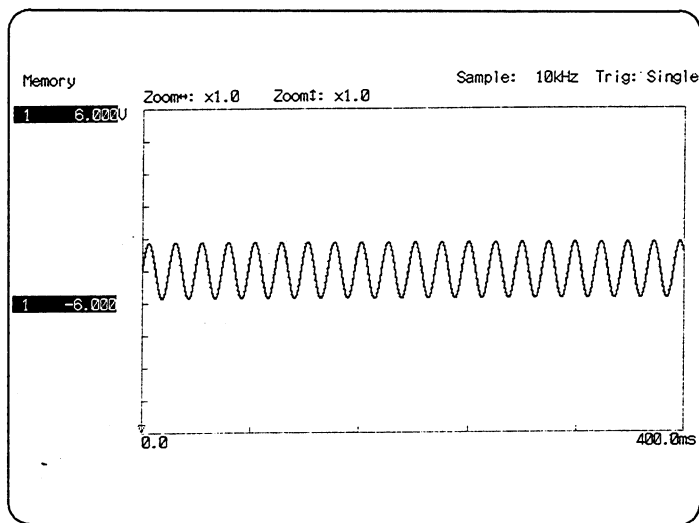
#### (10) Measurement Start

Use  to start measurement. Here, the waveform is captured only once to 4kW memory at a sampling rate of 10kHz.

1. Press . The lamp lights.


Since the input is already connected, the trigger is tripped immediately. After data is captured to memory, the lamp switches off, the instrument changes to STOP status and the waveform appears on the CRT screen.

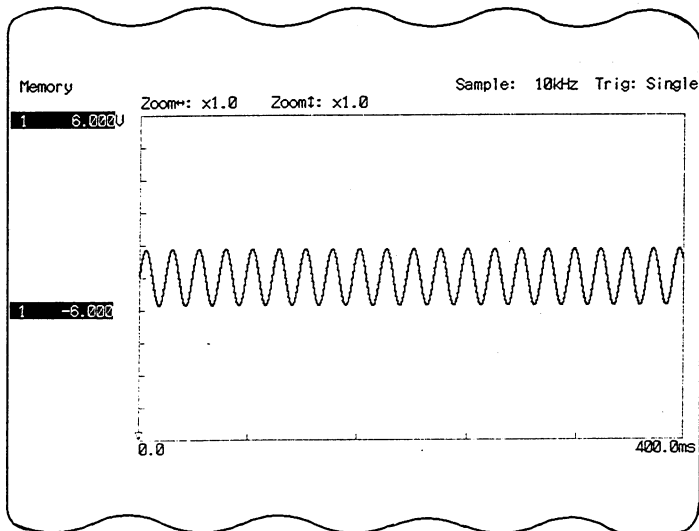
If the trigger is not tripped, press  and then  to forcibly stop measurement (see Section 4.15, "Forcible Stop of Measurement").



#### (11) Hard Copy of CRT Screen

Use the COPY key to make a copy of the CRT screen.

1. Press . This outputs a copy of the panel displayed on the CRT screen to the built-in printer.





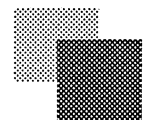
# Chapter 4

## Memory Mode / Measuring (Sampling) Data

---

Here we explain the procedure for capturing data to memory.

4.1	Measuring (Sampling) Procedure Outline .....	4-2
4.2	Mode Setting .....	4-3
4.3	Memory Size Setting .....	4-4
4.4	Setting of Memory Partitioning .....	4-8
4.5	Setting of Averaging .....	4-10
	4.5.1 Setting of Linear Averaging .....	4-12
	4.5.2 Setting of Exponential Averaging .....	4-13
4.6	Setting of Input Coupling, Input Range, Input Filter and Thermocouple .....	4-14
4.7	Trigger Setting .....	4-18
4.8	Setting PROGRAM (Computations) to OFF .....	4-26
4.9	Setting PROGRAM (Computations) to ON .....	4-27
4.10	Setting of Display Format .....	4-34
4.11	Setting of Display Scale .....	4-38
4.12	Setting of Sampling Rate .....	4-42
4.13	Setting of Trigger Mode .....	4-44
4.14	Measurement Start and Stop .....	4-46
4.15	Forcible Stop of Measurement .....	4-48





## 4.1 Measuring (Sampling) Procedure Outline

---

This section describes the memory mode procedures from conversion of the input signal to a digital signal by the A/D converter through to data capture using memory (memory sampling).

### ■ Setting Related to use of Memory

By setting memory size and dividing the memory into blocks, data can be captured each time the trigger is tripped.

### ■ Setting Averaging

Linear averaging and exponential averaging are provided. Averaging is effective for eliminating random noise when periodic signals are measured.

### ■ Setting Input Conditions

Select DC input coupling, AC input coupling or thermocouple input coupling. Also select input voltage range type of thermocouple to be used, and low-pass filter for each analog input channel.

### ■ Setting Trigger

Specify trigger conditions. For analog input, a combination trigger (AND/OR) of up to four channels (two more channels for logic input) is usable.

### ■ Setting PROGRAM (Computation)

Expressions for various computations such as the four basic arithmetic operations, differentiation, etc. can be programmed.

### ■ Setting Waveform Display Format



The waveform display format can be selected from Single, Dual, Quad, and X-Y.

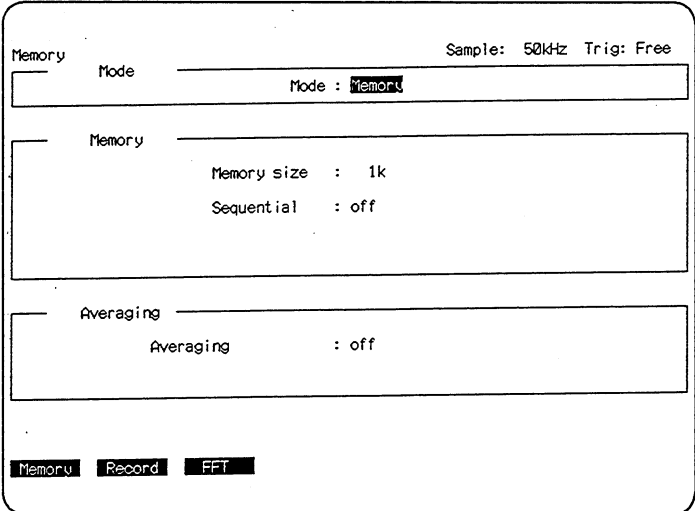
## 4.2 Mode Setting

### Function

The first step is to select memory mode or recorder mode.  
Here, select memory mode.

### Procedure

1.  The mode setting panel appears.
2.  Memory mode is selected.



The screenshot shows a mode setting panel with the following elements:

- Top right: Sample: 50kHz Trig: Free
- Section 1: Mode. A dropdown menu is open, showing "Memory" selected.
- Section 2: Memory.
  - Memory size : 1k
  - Sequential : off
- Section 3: Averaging.
  - Averaging : off
- Bottom: Three buttons labeled "Memory", "Record", and "FFT". The "Memory" button is highlighted.

## 4.3 Memory Size Setting

### Function

Select the memory size for waveform data capture for each channel.

#### ■ Memory Linkage

This instrument allows the odd- and even-numbered channel memories to be linked together to double the even-numbered channel's memory size. In this case, the even-numbered channels cannot be used.

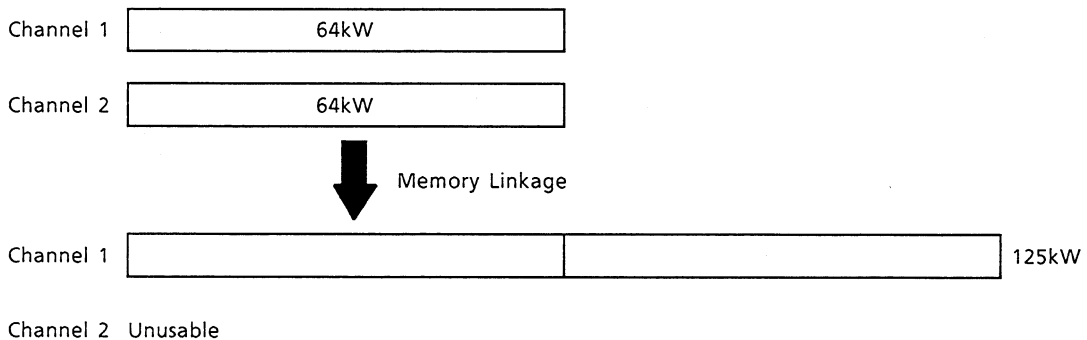
For example, if this instrument is a 8-channel, 64kW/ch model, then a memory size of 125kW can be used for channels 1, 3, 5 and 7. However, channels 2, 4, 6 and 8 cannot be used during that time.

This function can be automatically set when a "Memory size" value of 125kW (for the 64kW/ch model) or of 1MW (for the 512kW/ch model) is selected.



#### ■ Logic Input Memory Linkage (For Relevant Model Only)

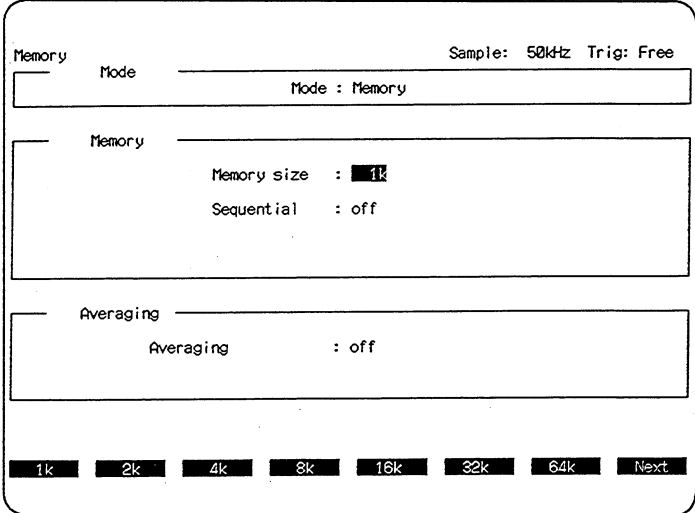
If memory linkage is set, channel A memory size is doubled and channel B cannot be used.

Example for a 64kW/ch model:



### Procedure

1.  The mode setting panel appears.
2. Move the menu cursor to "Memory size" using cursor keys .
3. Select the memory size for each channel using soft keys.  
For 64kW/ch model:  
(1k / 2k / 4k / 8k / 16k / 32k / 64k / 125k)  
For 512kW/ch model:  
(1k / 2k / 4k / 8k / 16k / 32k / 64k / 125k / 250k / 500k / 1M)



### Notes

#### ■ Memory Capacity Limitations According to Use

This instrument is available in two models with memory capacity of 64kW / ch and 512kW / ch. The memory capacity is however reduced when using the memory partitioning function, the averaging function, or the computational processing function.

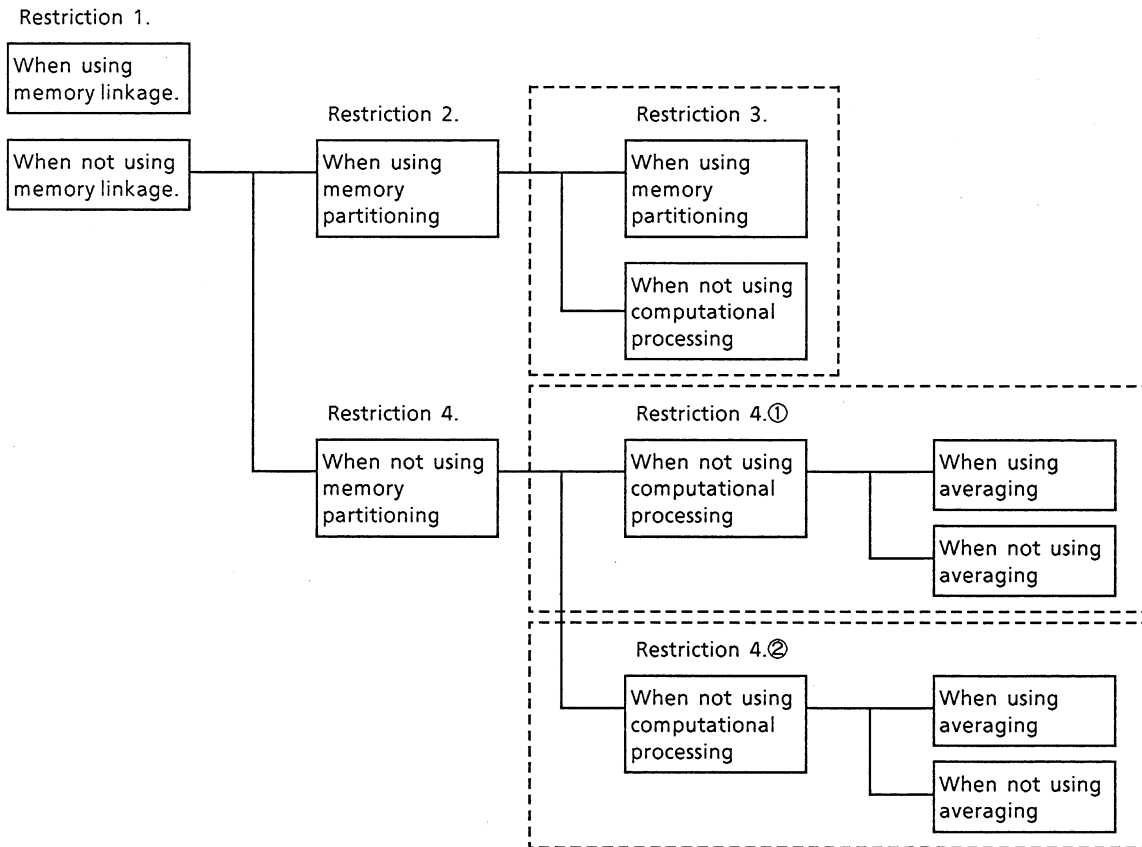
Basically, using the averaging function or the computation processing function reduces memory capacity to one-fourth. Using both the averaging function and the computational processing function together reduces memory capacity to one-eighth.

Restrictions related to the use of memory capacity are given on the next page. Priority order is as follows : 1. Memory linkage, 2. Memory partitioning, 3. Computational processing, and 4. Averaging functions.

For example, even if you attempt to carry out computational processing and averaging at the same time there will be occasions when it is not possible to use the averaging function due to memory capacity limitations.

- If the memory size and the number of blocks are changed, earlier measured data is reset.
- If the current measured data must be preserved, save the data on IC memory card or floppy disk (option), or set block protect mode (see Section 8.12, "Protecting Data in Blocks") to "on".

### 4.3 Memory Size Setting



- Restriction 1.: If memory linkage is in use, then the memory partitioning, averaging, and computational processing functions cannot be used.
- Restriction 2.: If memory partitioning is in use, then the averaging function cannot be used.
- Restriction 3.: If memory partitioning is in use, then whether or not the computational processing function can be used depends on the instrument's memory capacity, specified memory size, and number of blocks. The following shows the relationship between these.

Memory Capacity 512kW/ch Model

Selected Memory Size	No. of Sequentially Saved Blocks					
	4	8	16	32	64	128
1k	○	○	○	○	○	○
2k	○	○	○	○	○	×
4k	○	○	○	○	×	×
8k	○	○	○	×	×	—
16k	○	○	×	×	—	—
32k	○	×	×	—	—	—
64k	×	×	—	—	—	—
125k	×	—	—	—	—	—
250k	—	—	—	—	—	—
500k	—	—	—	—	—	—

64W/ch Model

Selected Memory Size	No. of Sequentially Saved Blocks					
	4	8	16	32	64	128
1k	○	○	○	×	×	—
2k	○	○	×	×	—	—
4k	○	×	×	—	—	—
8k	×	×	—	—	—	—
16k	×	—	—	—	—	—
32k	—	—	—	—	—	—
64k	—	—	—	—	—	—

- : Computations can be processed
- ×
- : Setting not possible

Restriction 4.: If the memory partitioning function is used

- ① If the computational processing function is used, then whether or not the averaging function can be used is determined by the instrument's memory capacity and selected memory size.

Memory Capacity 512kW/ch Model

Selected Memory Size	Averaging
1k	○
2k	○
4k	○
8k	○
16k	○
32k	○
64k	○
125k	×
250k	×
500k	×

64 kW/ch Model

Selected Memory Size	Averaging
1k	○
2k	○
4k	○
8k	○
16k	×
32k	×
64k	×

- : Averaging can be used
- × : Averaging cannot be used

- ② If the computational processing function is not used, then whether or not the averaging function can be used is determined by the instrument's memory capacity and specified memory size. The following shows the relationship between these.

Memory Capacity 512kW/ch Model

Selected Memory Size	Averaging
1k	○
2k	○
4k	○
8k	○
16k	○
32k	○
64k	○
125k	○
250k	×
500k	×

64kW/ch Model

Selected Memory Size	Averaging
1k	○
2k	○
4k	○
8k	○
16k	○
32k	×
64k	×

- : Averaging can be used
- × : Averaging cannot be used

## 4.4 Setting of Memory Partitioning

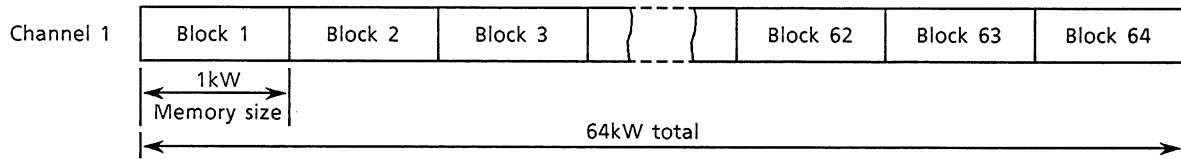
### Function

Partitions the memory into a specified number of blocks, and captures a block of waveform data into each block, in sequence, each time that a trigger is generated.

The number of blocks can be selected from among 4, 8, 16, 32, 64, and 128. Note that the number of partition blocks available will differ according to the model.

For example, for the 64kW/ch model, if the memory size is 1kW for each block, a maximum of 64 blocks can be measured.

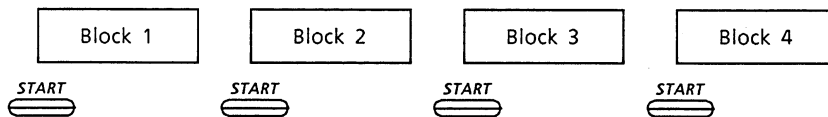
Example for 64kW/ch model : Memory size=1kW, No. of blocks=64



### ■ Differences in Data Capture According to Trigger Mode

#### ● When Trigger Mode is Free

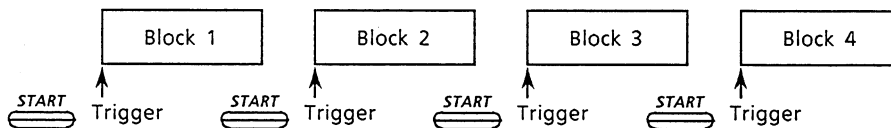
Data is captured to the blocks one at a time, each time START is pressed.



#### ● When Trigger Mode is Single

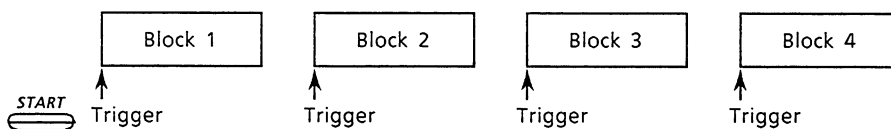
After START is pressed, data is captured to block 1 when the trigger conditions are satisfied.

If START is pressed again, data is captured to block 2 when the trigger conditions are satisfied. Data is captured to the blocks one at a time in this way.



#### ● When Trigger Mode is Repeat



After START is pressed, data is captured to the blocks sequentially, one at a time, each time the trigger conditions are satisfied. This stops when data for the last block is captured.

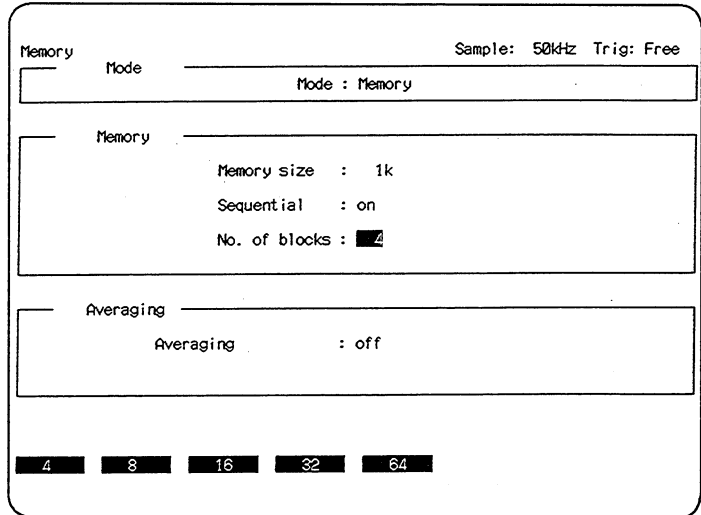


Note : If START is pressed again after data has been captured to the last block, data for all blocks is automatically reset, and data is again captured beginning from block 1.

If block protect mode is "on", data is not automatically reset and no data can be captured (see Section 8.12, "Protecting Data in Blocks").

### Procedure

1.  The mode setting panel appears.
2. Move the menu cursor to "Sequential" using the cursor keys .
3. **Sequential**  
Select whether or not to partition memory (off/on).  
Select  on .
4. **No. of blocks**  
Select the number of blocks into which to divide the memory (4/8/16/32/64/128).



Memory Mode Sample: 50kHz Trig: Free

Mode : Memory

---

Memory

Memory size : 1k  
Sequential : on  
No. of blocks : 4

---

Averaging

Averaging : off

---

4 8 16 32 64

### Notes

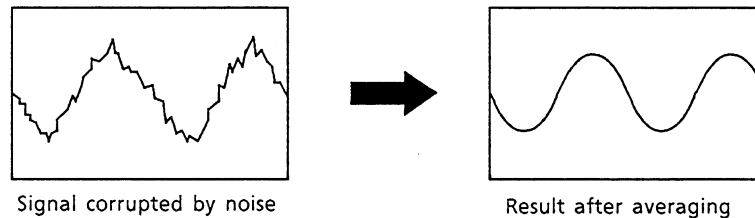
- **Relationship Between Instrument Model, Memory Size, and Number of Blocks**  
See Section 4.3, "Memory Size Setting", concerning the relationship between instrument model, memory size, and number of blocks.
  - Memory partitioning cannot be used when memory linkage is in use (see Section 4.3, "Memory Size Setting").
  - If any of the following setting items is changed while data is being captured to a particular block or while waiting for a trigger, the next data capture is performed beginning from block 1 after earlier captured data has been reset.
    - Memory size
    - No. of blocks
    - Input range
    - Sampling rate
- If the current measured data must be preserved, save the data on IC memory card or floppy disk (option), or set block protect mode (see Section 8.12, "Protecting Data in Blocks") to "on".



## 4.5 Setting of Averaging

Noise will be present to a greater or lesser extent in the measurement of actual signals. Therefore, the signal to be measured is sometimes hidden in the noise. In the case of random noise, the noise components can be decreased almost to zero through averaging with only the periodic waveform signals being extracted. This function is called averaging (averaging computations).

The main unit provides linear averaging and exponential averaging.



### ■ Linear Averaging

This is also called serial addition averaging. Since signals are continuously averaged, even if the averaging is aborted, averaging performed up to that time is effective.

The number of cycles for averaging can be selected from 4, 8, 16, 32, 64, 128, and 256.

Linear averaging is carried out according to the following formula.

$$A_n = \{(n-1) * A_{n-1} + Z_n\} / n$$

$n$  : Number of averaging cycles

$A_n$  : Measured value averaged over  $n$  cycles

$Z_n$  :  $n$ 'th measured data

### ■ Exponential Averaging

Exponential averaging gives greater weight to the most recent data, reducing the weight of each previous data measurement exponentially.

The value of weight depends on the attenuation coefficient.

The coefficient can be selected from 4, 8, 16, 32, 64, 128, and 256.

Exponential averaging is carried out according to the following formula.

$$A_n = \{(N-1) * A_{n-1} + Z_n\} / N$$

$N$  : Attenuation coefficient

$n$  : Number of averaging cycle

$A_n$  : Measured value averaged over  $n$  cycles

$Z_n$  :  $n$ 'th measured data sample

Notes
-------

- Averaging cannot be performed if memory is partitioned.
- Averaging cannot be performed if memory linkage is performed.
- There are instances in which averaging cannot be performed, this depending on memory capacity, specified memory size, and whether or not computational processing is performed. For details, see restrictions described in **Section 4.3, "Memory Size Setting"**.

## 4.5.1 Setting of Linear Averaging

### Function

#### Linear Averaging

This is also called serial addition averaging. Since signals are continuously averaged, even if the averaging is aborted, averaging performed up to that time is effective.

The number of cycles for the averaging can be selected from 4, 8, 16, 32, 64, 128, and 256. Linear averaging is carried out according to the following formula.




$$A_n = \{(n-1) * A_{n-1} + Z_n\} /$$

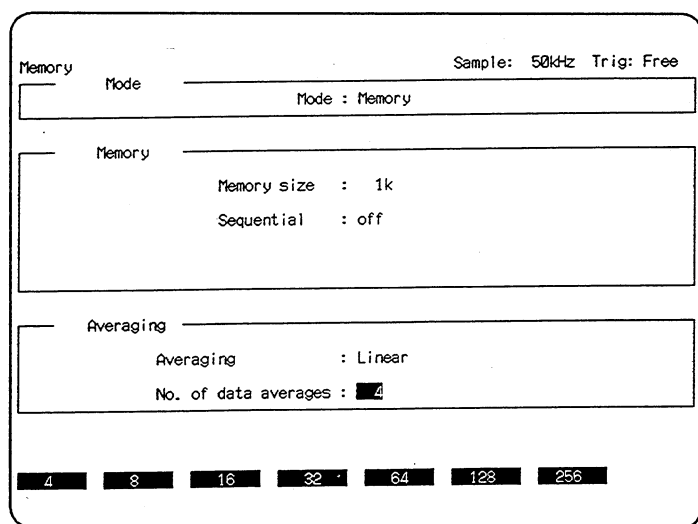
n : Number of averaging cycles

A<sub>n</sub> : Measured value averaged over n cycles

Z<sub>n</sub> : n'th measured data sample

### Procedure

1.  The mode setting panel appears.
2. Move the menu cursor to "Averaging" using the cursor keys .
3. Select .
4. No. of data averages  
Select the number of averaging cycles.



Memory Sample: 50kHz Trig: Free

Mode Mode: Memory

---

Memory

Memory size : 1k

Sequential : off

---

Averaging

Averaging : Linear


No. of data averages : 4




---


4 8 16 32 64 128 256

### Notes

- When linear averaging is performed, select a trigger mode of either Single or Repeat. If the waveform is not of a nature such that this results in averaging a signal that is synchronized to the trigger conditions, meaningless data will be produced.
  - When Trigger Mode is Single
 

After  has been pressed, data capture begins when the trigger conditions have been satisfied. Data capture continues for the specified number of averaging cycles and measurement ends. Averaging is performed each time data is captured.
  - When Trigger Mode is Repeat
 

After  has been pressed, data capture begins when the trigger conditions have been satisfied. If data is captured for the specified number of averaging cycles, averaging results are reset when the next trigger conditions have been satisfied. This is repeated until  is pressed.
- Pressing  while averaging is in progress stops measurement even if the specified number of averaging cycles has not been completed.
 

For example, if four averaging cycles are specified, and  is pressed during the third cycle, the third averaging is performed and then measurement ends.
- For those cases in which averaging cannot be performed, please read the Notes on page 4-11.

## 4.5.2 Setting of Exponential Averaging

### Function

#### ■ Exponential Averaging

Exponential averaging gives greater weight to the most recent data, reducing the weight of each previous data measurement exponentially.

The value of weight depends on the attenuation coefficient.

The coefficient can be selected from 4, 8, 16, 32, 64, 128, and 256.

Exponential averaging is computed by the following formula.

$$A_n = \{(N-1) * A_{n-1} + Z_n\} / N$$




N : Attenuation coefficient

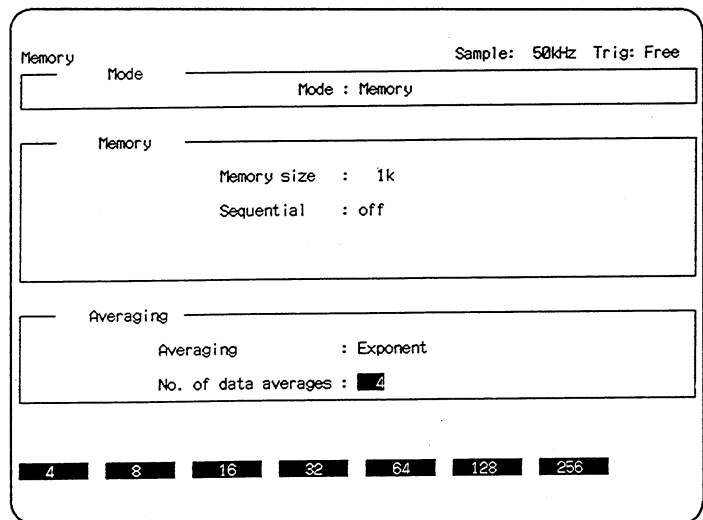
n : Number of averaging cycles

A<sub>n</sub> : Measured value averaged over n cycles

Z<sub>n</sub> : n'th measured data

### Procedure

1.  The mode setting panel appears.
2. Move the menu cursor to "Averaging" using the cursor keys .
3. Select .
4. No. of data averages  
Select the attenuation coefficient.



Memory Mode Sample: 50kHz Trig: Free

Mode : Memory

---

Memory

Memory size : 1k  
Sequential : off

---



Averaging

Averaging : Exponent  
No. of data averages : 4

4 8 16 32 64 128 256

### Notes

- When exponential averaging is performed, set the trigger mode to Repeat.
  - When Trigger Mode is Repeat
 

After  has been pressed, data capture begins when the trigger conditions have been satisfied. Data capture and averaging continue each time the trigger conditions are satisfied according to the specified attenuation coefficient. This continues until  is pressed.
  - When Trigger Mode is Single
 

Since data is captured only once, it is meaningless to use a trigger mode of Single when exponential averaging is selected.
  - When Trigger Mode is Free
 

Since a signal which is not synchronized to the trigger conditions is averaged, meaningless data will be produced.
- For those cases in which averaging cannot be performed, please read the Notes on page 4-11.

## 4.6 Setting of Input Coupling, Input Range, Input Filter and Thermocouple

### Function

This function is used to select the voltage input or thermocouple input for each channel. For voltage input, select the combination of input coupling, input range and input filter. For thermocouple input, select the type of thermocouple. These settings can be changed while measurement is in progress.

#### ■ Input Coupling

Select DC or AC input coupling.

#### ■ Input Range

Select the input range from 0.06, 0.2, 0.6, 2, 6, 20 and 60V.

#### ■ Input Filter

Select the cutoff frequency of the input low-pass filter from off, Auto, 4kHz, 400Hz, 40Hz, and 1.5Hz.

4kHz, 400Hz, and 40Hz correspond to a filtering of  $-24\text{dB/oct.}$  low-pass filter.

1.5Hz corresponds to  $-50\text{dB}$  (50Hz or 60Hz) line filter.

No filtering will be carried out if "off" is selected.

If Auto is selected, a filtering of  $-72\text{dB}/1.5\text{fc}$  is automatically set according to the sample rate as shown below.

Sampling rate	100kHz	50kHz	20kHz	10kHz	5kHz	2kHz	1kHz	500Hz	200Hz	100Hz
Cutoff frequency (fc)	40kHz	20kHz	8kHz	4kHz	2kHz	800Hz	400Hz	200Hz	80Hz	40Hz
Sampling rate	50Hz	20Hz	10Hz	5Hz	2Hz	1Hz	0.5Hz	0.2Hz	0.1Hz	
Cutoff frequency (fc)	40Hz	40Hz	40Hz	40Hz	1.5Hz	1.5Hz	1.5Hz	1.5Hz	1.5Hz	

Note: Filter is off when external sampling is carried out.

- For logic input channel A and channel B, only on/off setting is provided.

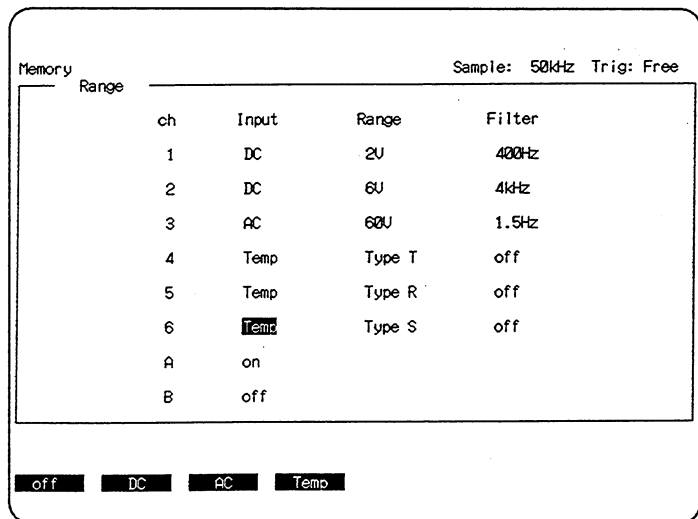
■ **Type of Thermocouple**

Following thermocouple can be used.

Selected Range	Thermocouple Type	Measurement Range	Remarks
R	Type R	0.0 to 1760.0°C	
S	Type S	0.0 to 1760.0°C	
B	Type B	0.0 to 1820.0°C	
K	Type K	-200.0 to 1370.0°C	Old CA
E	Type E	-200.0 to 800.0°C	Old CRC
J	Type J	-200.0 to 1100.0°C	Old IC
T	Type T	-200.0 to 400.0°C	Old CC
N	Type N	0.0 to 1300.0°C	NBS
W	Type W	0.0 to 2315.0°C	OMEGA
L	Type L (Fe-CuNi)	-200.0 to 900.0°C	DIN 43710
U	Type U (Cu-CuNi)	-200.0 to 400.0°C	DIN 43710

**Procedure**

- RANGE**  
The input coupling / range / filter / thermocouple setting panel appears.
- ch**  
Channel is displayed.
- Input**  
Select DC or AC input coupling of voltage measurement, or temperature measurement (Temp). If a given channel is not to be used, select "off" (off / DC / AC / Temp).
- Range**  
Set the input range of voltage measurement or thermocouple type used at temperature measurement.  
For voltage measurement (0.06 / 0.2 / 0.6 / 2 / 6 / 20 / 60V)  
For temperature measurement (K / J / E / T / R / S / B / N / W / L / U)
- Filter**  
Select the frequency of the low-pass filter from among the frequencies given below. Note that if "Auto" is selected, the frequency of the low-pass filter (-72dB / 1.5fc) is determined according to the sampling rate.  
For voltage measurement (off / Auto / 4kHz / 400Hz / 40Hz / 1.5Hz)  
For temperature measurement (off / 1.5Hz)





## 4.6 Setting of Input Coupling, Input Range, Input Filter and Thermocouple

### Procedure ··· Using the Soft Key Menu to Change Settings while Measurement is in Progress

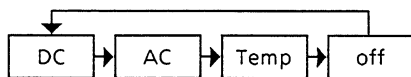
1. Press **RANGE** while measurement is in progress.

2. **ch**

Pressing the channel select key  or  changes the channel no. display.

3. **Input**

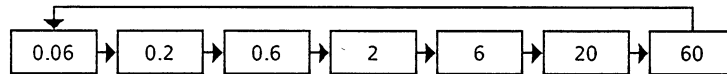
Each time the soft key is pressed, the Input display changes as follows.



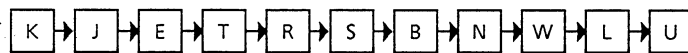
4. **Range**

Each time the soft key is pressed, the Range display changes as follows.

When input=DC or AC



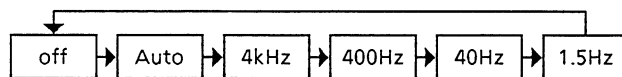
When input=Temp



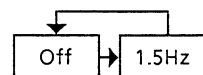
5. **Filter**

Each time the soft key is pressed, the Filter display changes as follows.

When input=DC or AC

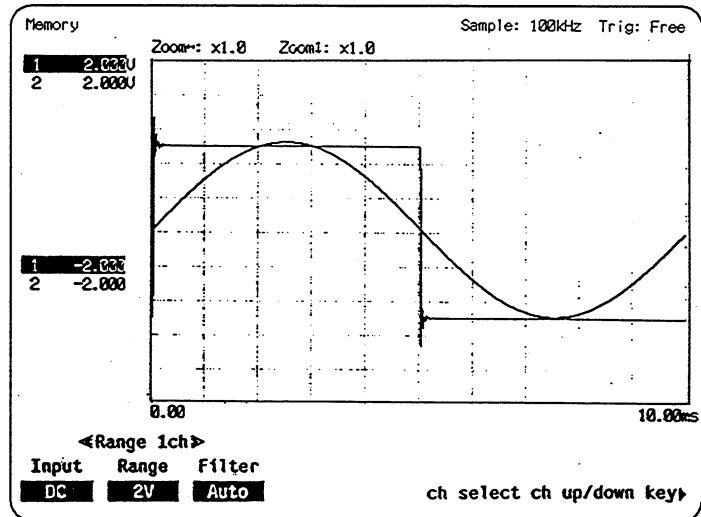


When input=Temp



6. **ENTRY**

Changes are executed.



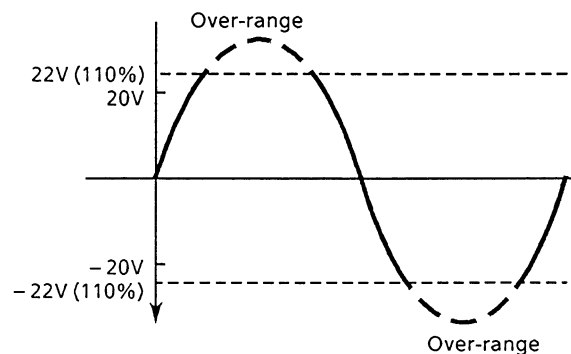
### Notes

#### ■ Over-Range

In the case of voltage input, an input greater than 110% of the input range is treated as over-range.

For example, if the input range is 20V, a voltage of 22V or more or -22 V or less is treated as over-range.

In the case of temperature measurement, the range exceeded the measurement range is treated as over-range.



■ **Setting of Even-Numbered Channels When Memory Linkage is being used**

Although it is possible to set values for the input coupling, range, filter and thermocouple for even-numbered channels, this has no effect in practice.

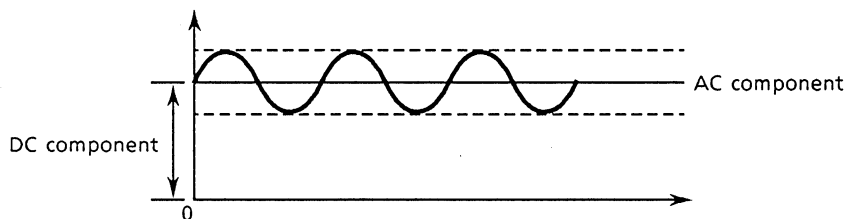
■ **Changing Settings While Measurement is in Progress with Memory Partitioned**

If the input range is changed while measurement is in progress, all data captured to blocks up to that point is reset after current data capture to a block has been completed and data is again captured beginning from block 1 (when block protect mode is "off"). (For block protect mode, see Section 8.12, "Protecting Data in Blocks.")

**Remarks**

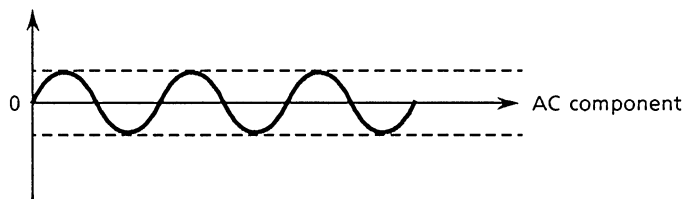
■ **DC Coupling**

Measures the DC component + the AC component of the input signal.



■ **AC Coupling**

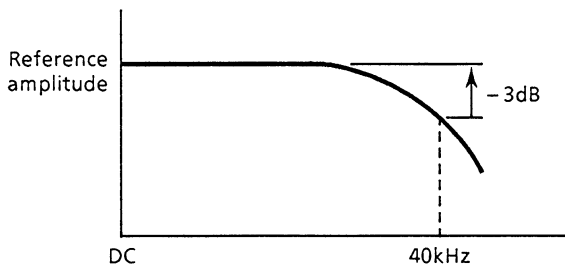
Cuts the DC component of the input signal, and measures the AC component only.



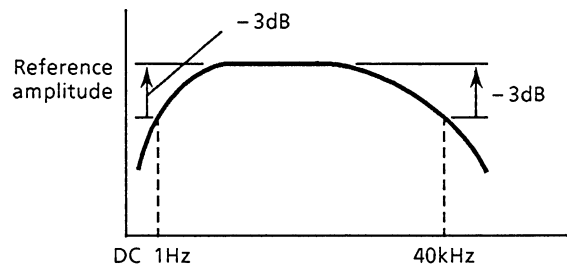
● Input characteristics of DC coupling and of AC coupling are shown in the figures below.

<Input coupling frequency characteristics (with filter OFF)>

● For DC coupling



● For AC coupling



■ **Reference Junction Compensation of Temperature Measurement**

A thermocouple is measured by the difference in temperature between the metal junctions at the instrument input terminal and the thermocouple junction at the measurement point. This is called reference junction compensation.

AR1100A / AR1200 always executes the reference junction compensation, and displays or records the actual temperature at the measurement point.



## 4.7 Trigger Setting

---

### Function

Sets trigger conditions. Data can be captured after the conditions have been satisfied.

#### ■ Internal/External Trigger Selection

Selects whether the trigger signal source is an input signal, or a separate external input, with triggering on rising edges or on falling edges. If an external trigger is used, see Section 8.20, "Using External Trigger".

#### ■ Pretrigger Setting

Sets the pretrigger area as a % of the memory size.

#### ■ Trigger Condition AND/OR

For analog input, up to four trigger conditions (for the model with logic input, two more conditions) can be set, and the AND or OR of these individual trigger conditions can be used to trip the trigger.

##### ● AND triggering

A trigger to be tripped when all the trigger conditions are satisfied.

##### ● OR triggering

A trigger to be tripped when any one of the trigger conditions is satisfied.

#### ■ Trigger Conditions for Analog Input (Include Thermocouple Input)

Up to four trigger conditions can be set.

A trigger source channel, trigger slope (rising edge / falling edge, or High / Low), and trigger level are set for each trigger condition.

#### ■ Trigger Conditions for Logic Input (For the Logic Input Models Only)

For either channel A or channel B, each bit can be set to "0", "1", "0" to "1" transition (up: ↑), "1" to "0" transition (down: ↓), or Don't care (X).

#### ■ Window Triggering

The window trigger, which can be applied with AND or OR triggering, is tripped when the waveform enters/exits the set window.

#### ■ Bi-Slope Triggering

The bi-slope trigger, which can be applied with OR triggering, is tripped by either the rising edge or the falling edge of a particular signal.

**Procedure**

1. **TRIGGER**  
Call up the trigger setting panel.
2. **Trigger mode/Trigger source**  
Select whether to use internal or external trigger signal source (Int/Ext rise/Ext fall).
3. **Trigger mode/Pre trigger**  
Select the length of signal preceding the trigger to be retained as a % of the memory size (0/10/20/30/40/50/60/70/80/90/100).
4. **Trigger mode/Trigger AND/OR**  
Select whether to take the AND or OR of the trigger conditions (AND/OR).
5. **Analog trigger/Trig no.**  
Up to four trigger conditions can be set. Numbers 1 through 4 are displayed.
6. **Analog trigger/on/off**  
Select whether each trigger condition is to be disabled or enabled (off/on).
7. **Analog trigger/Source ch**  
Select to which channel the trigger source is set.
8. **Analog trigger/Slope**  
Select whether the trigger is to be tripped on the rising edge or falling edge, or by a High or Low state versus the specified trigger level (Rise/Fall/High/Low).
9. **Analog trigger/Level**  
Set the trigger level as a percentage of the input range. Input from the alphanumeric keypad in 1-percent increments from -100 to 100 and then press **ENTRY**.
10. **Logic Trigger/Trig no.**  
Up to two trigger conditions can be set. Numbers 5 and 6 are displayed.
11. **Logic Trigger/on/off**  
Select whether each trigger condition is to be disabled or enabled (off/on).
12. **Logic Trigger/Source ch**  
Select channel A or channel B as the trigger source.
13. **Logic Trigger/1 to 8**  
Set 0, 1, up (↑:0→1), down (↓:1→0), or X (don't care) for each bit.

Memory		Sample: 50kHz Trig: Repeat								
Trigger mode		Trigger source : Int								
		Pre trigger : 0%								
		Trigger AND/OR : OR								
Analog trigger										
Trig no.	on/off	Source ch	Slope	Level						
1	on	1	Rise	0%						
2	off									
3	off									
4	off									
Logic trigger										
Trig no.	on/off	Source ch	8	7	6	5	4	3	2	1
5	off									
6	off									
Int Ext rise Ext fall										

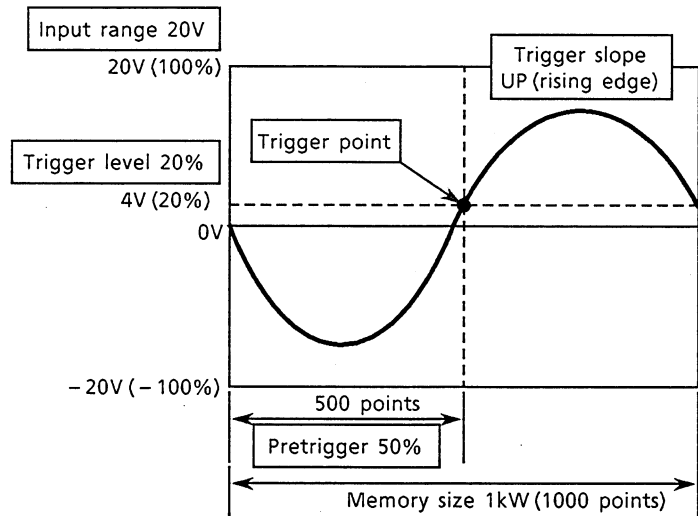
Note: Items 10 to 13 above apply to models with logic input only.

## 4.7 Trigger Setting

### Example of Setting ... Analog Trigger

Set the trigger to be tripped on the rising edge of channel 1 at a level of 20%, with a pretrigger of 50%. Also set the input range to 20V, and the memory size to 1kW.

Trigger source : Int  
 Pre trigger : 50%  
 Trigger AND/OR : AND  
 Trig no.1  
 on/off : on  
 Source ch : 1  
 Slope : Rise  
 Level : 20%

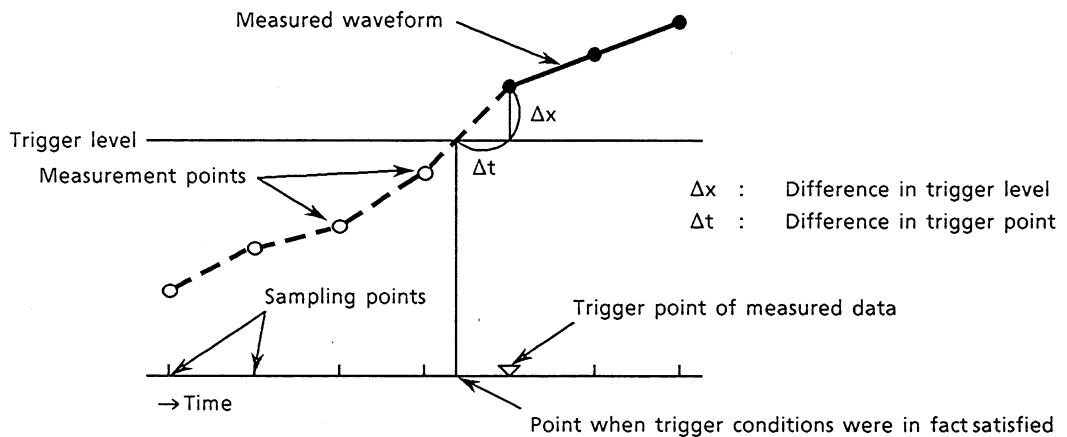


### Notes

#### ■ Trigger Point Discrepancy

The instrument determines at each sampling point whether or not the trigger conditions are satisfied.

There will usually be some discrepancy between the level and time at the sampling point where the measured data satisfies the trigger conditions, and the actual level and time at which trigger conditions were in fact satisfied.



When Trigger Condition is "Rise"

#### ■ Constraints when AND/OR Trigger is Set to AND

If more than one trigger condition is set, only one of those conditions can be a Rise or Fall Slope trigger.

### ■ Trigger Level for Temperature Measurement


The following table shows the trigger level, according to the type of thermocouple, when temperature measurement is performed by the trigger source. For example, when a Type K thermocouple is used, the measurement range is from 1370°C to -200°C. In this case, 1370°C can be thought of as 100%, and -1370°C can be thought of as -100%. Therefore, the measurement range on the minus side is -200°C, the setting limit is approximately -15%.

Type of Thermocouple	Measurement Range	Trigger Level Setting Range	Degrees per 1%
K	1370°C -200°C	100% Approx. -15%	13.7°C
J	1100°C -200°C	100% Approx. -18%	11°C
E	800°C -200°C	100% Approx. -25%	8°C
T	400°C -200°C	100% Approx. -50%	4°C
R	1760°C 0°C	100% 0%	17.6°C
S	1760°C 0°C	100% 0%	17.6°C
B	1820°C 0°C	100% 0%	18.2°C
N	1300°C 0°C	100% 0%	13°C
W	2315°C 0°C	100% 0%	23.2°C
L	900°C -200°C	100% Approx. -22%	9°C
U	400°C -200°C	100% Approx. -50%	4°C

There may be some difference between the temperature value (which is calculated by the % of the trigger multiplied by the temperature for each 1%) and the temperature value of the actual trigger.

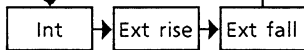
## 4.7 Trigger Setting

### Procedure ... Changing Trigger Conditions while Measurement is in Progress

1. Press  while measurement is in progress.

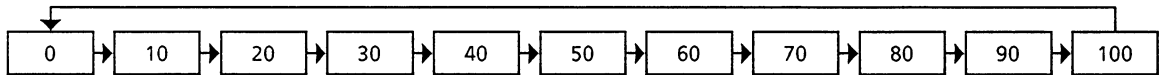
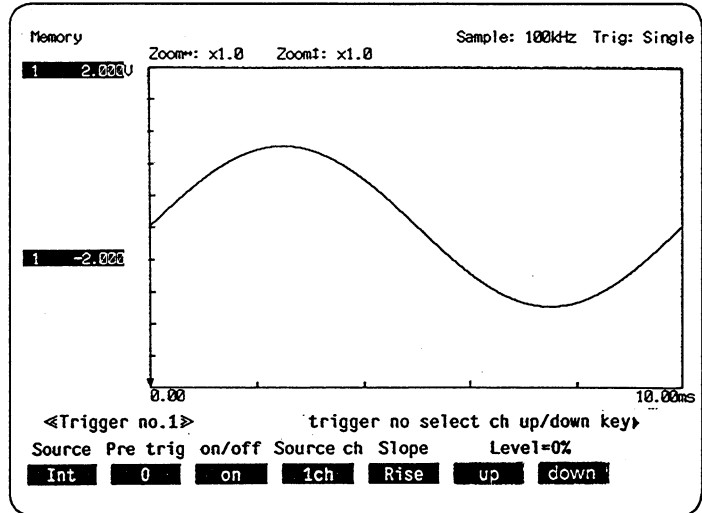
2. **Trigger source**

Each time the soft key is pressed, the Trigger source display changes as follows.



3. **Pre trigger**

Each time the soft key is pressed, the Pre trigger display changes as follows.



The following items appear on the panel only when “Trigger source=Int”.

4. **Trig no.**

Each time channel select key  or  is pressed, the Trig no. display changes.

5. **on / off**

Each time the soft key is pressed, the on / off display changes as follows.

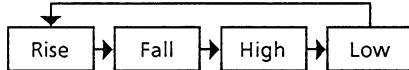


6. **Source ch**

Each time the soft key is pressed, the Source ch display changes.


7. **Slope**


Each time the soft key is pressed, the Slope display changes as follows.




8. **Level**



Pressing the  soft key once raises the Level 1%.

Pressing the  soft key once lowers the Level 1%.

9. Pressing  changes the settings.

Note: Menus 6 to 8 are displayed only when menu 5 is set to “on”.

Menus 7 and 8 are not displayed when Trig no.=5 or 6 (logic trigger). (models with logic input only)

**Example of Setting** ... Window Triggering (Application of AND triggering)

The trigger conditions are set in such a way as to create a window, so that the trigger is tripped if and when the waveform enters that window.

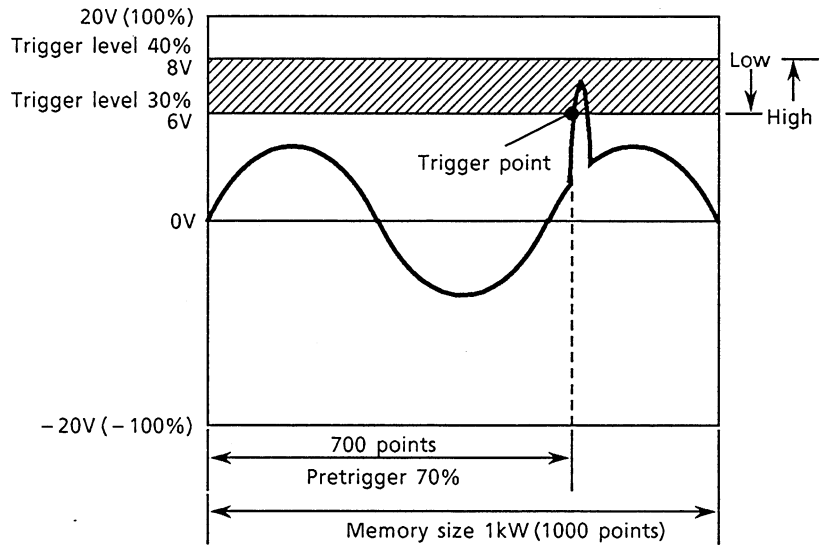
This technique is useful to activate triggers and observe a signal when some abnormality occurs.

Set measurement range to 20V and memory size to 1kW.

Trigger source : Int  
 Pre trigger : 70%  
 Trigger AND/OR : AND

Trig no. 1	
on/off	: on
Source ch	: 1
Slope	: High
Level	: 30%

Trig no. 2	
on/off	: on
Source ch	: 1
Slope	: Low
Level	: 40%



## 4.7 Trigger Setting

### Example of Setting ··· Window Triggering (Application of OR Triggering)

The trigger conditions are set in such a way as to create a window, so that the trigger is tripped if and when the waveform exits that window.

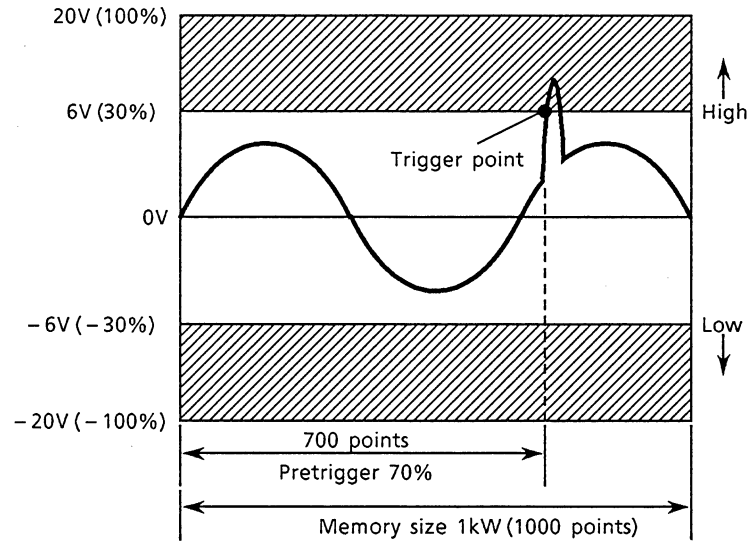
This technique is useful to activate triggers and observe a signal when some abnormality occurs.

Set measurement range to 20V and memory size to 1kW.

Trigger source : Int  
 Pre trigger : 70%  
 Trigger AND/OR : OR

Trig no. 1	
on/off	: on
Source ch	: 1
Slope	: High
Level	: 30%

Trig no. 2	
on/off	: on
Source ch	: 1
Slope	: Low
Level	: -30%



**Example of Setting** ... Bi-Slope Triggering (Application of OR Triggering)

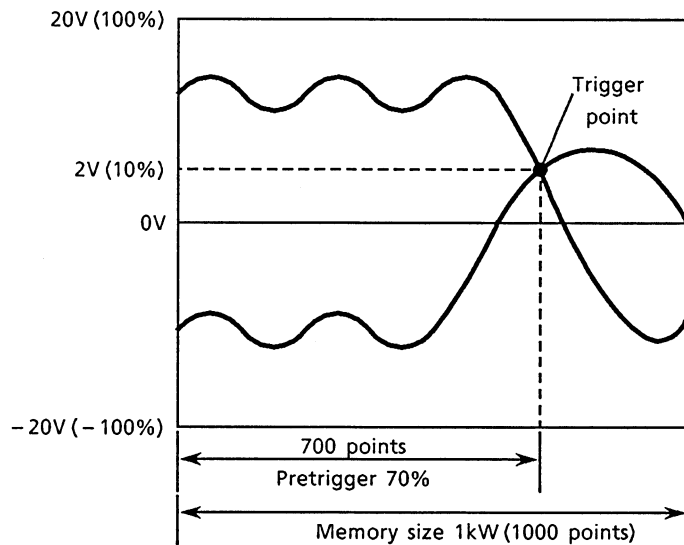
When setting triggers for measurement in "Single" trigger mode for a transient phenomenon, there are cases where it is not known whether to trigger on a rising edge or falling edge. Bi-slope triggering is particularly effective in such cases.

Set measurement range to 20V and memory size to 1kW.

Trigger source : Int  
 Pre trigger : 70%  
 Trigger AND/OR : OR

Trig no. 1	
on/off	: on
Source ch	: 1
Slope	: Rise
Level	: 10%

Trig no. 2	
on/off	: on
Source ch	: 1
Slope	: Fall
Level	: 10%

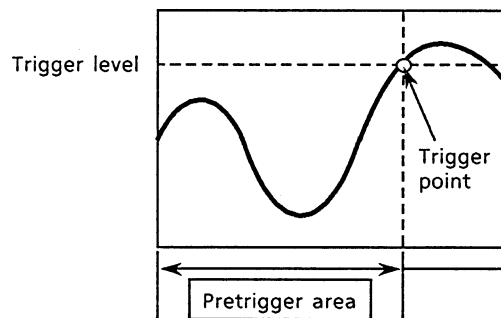


**Remarks**

■ **Pretrigger Function**

In a waveform measuring instrument using A/D converters and memories, the signal ahead of the trigger can be observed.

The function that allows observation of the signal ahead of the trigger is called the pretrigger function; the area before the trigger is called the pretrigger area.



■ **AND Triggering**

A trigger to be tripped when all set trigger conditions are satisfied.

■ **OR Triggering**

A trigger to be tripped when any one of the set trigger conditions is satisfied.



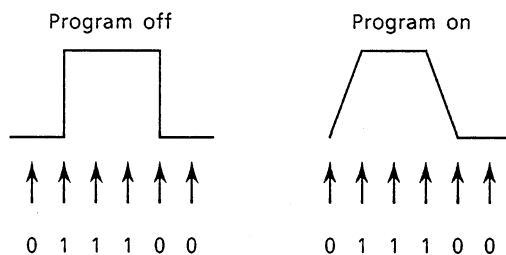
## 4.8 Setting PROGRAM (Computations) to OFF

### Function

Displays sampled waveforms without executing PROGRAM (computations).

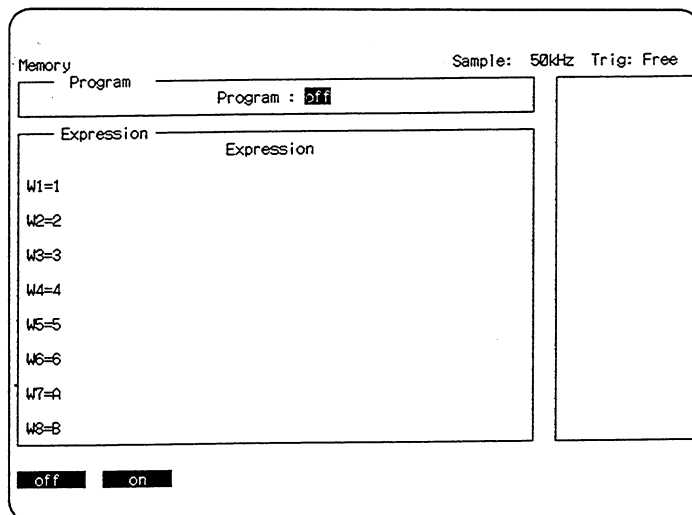
Assigns a channel number to each waveform number.

Logic waveforms are displayed differently according to whether PROGRAM is “off” or “on” (logic input models only).



### Procedure

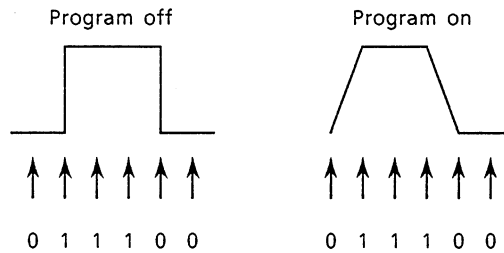
1. **PROGRAM**  
 Program setting panel appears.
2. **Program**  
 Select  off .
3. **W1 to W8\***  
 Assign channel numbers to waveform numbers (W1 to W8\*) using the soft keys.  
 \* For 4-channel model:  
     W1 to W4  
 For 6-channel model  
 (including logic input):  
     W1 to W6



# 4.9 Setting PROGRAM (Computations) to ON



## Function

- Allows computations to be performed on sampled measured data. The following table shows the functions and operators available. SIN, COS, and TAN are specified in radians. Assign a computational expression to each waveform number. The number of moving average points can be set from 10 to 128 (see Section 8.15, "Computation Related Setting").
- Up to four IC memory card data files can be subject to computation. In this case, it is necessary to register IC memory card file names to M1, M2, M3, and M4 (see Section 8.15, "Computation Related Setting"). However, this does not apply to logic input data.
- **For Models with Logic Input**  
 For logic input data, bit-by-bit (point-by-point) computation (Enter A1 to A8, B1 to B8 to the computational expression, each value is 0 or 1.) or channel-by-channel computation using eight-digit binary numbers (Enter A or B to the computational expression and value is decimal numbers 0 to 255) can be performed for channels A and B respectively. The display of logic input waveforms differs according to whether Program is "on" or "off" as shown below.

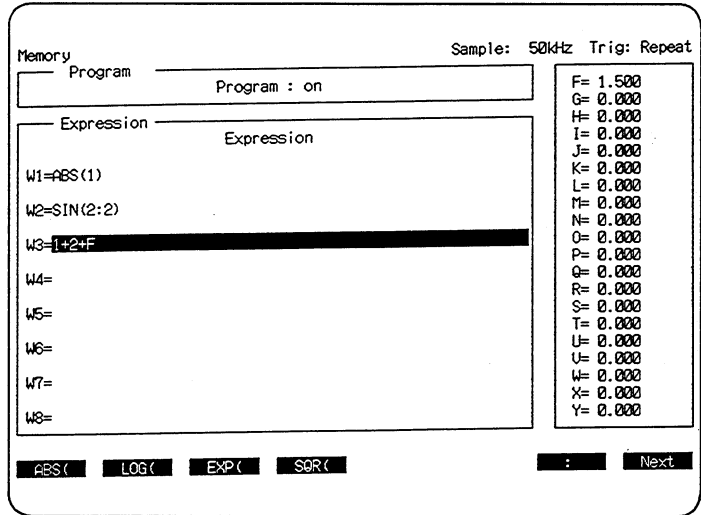


Type of computation	Operator	Example
Arithmetic computation (addition)	+	1+2
Arithmetic computation (subtraction)	-	1-2
Arithmetic computation (multiplication)	*	1*2
Arithmetic computation (division)	/	1/2
Note: The precedence of the four arithmetic operators is $\otimes$ *, / $\otimes$ +, -		
Square root	SQR()	SQR(1)
Common logarithm	LOG()	LOG(1)
Exponential	EXP()	EXP(1)
Absolute value	ABS()	ABS(1)
Mean	MEAN()	MEAN(1)
Differentiation	DIF()	DIF(1)
Double differentiation	DDIF()	DDIF(1)
Integration	INTG()	INTG(1)
Double integration	IINTG()	IINTG(1)
Sine	SIN()	SIN(1)
Inverse sine	ASIN()	ASIN(1)
Cosine	COS()	COS(1)
Inverse cosine	ACOS()	ACOS(1)
Tangent	TAN()	TAN(1)
Inverse tangent	ATAN()	ATAN(1)


**Procedure**

1. **PROGRAM**  
  
 Program setting panel appears.
2. **Program**  
 Select .
3. **W1 to W8\***  
 Input computational expressions.  
 The following computational functions and symbols can be input using the soft keys.


				ABS (	LOG (	EXP (			
SQR (	SIN (	COS (	TAN (						
ASIN (	ACOS (	ATAN (	MEAN (						
DIF (	DDIF (	INTG (	IINTG (						
				:					



Use the alphanumeric keypad to input the “+”, “-”, “\*”, “/”, and “)” symbols.

Press  to set the values.

- \* For 4-channel input model: W1 to W4
- For 6-channel model (including logic model): W1 to W6

4. **F to Y**  
 Enter constants using the alphanumeric keypad.  
 Press  to set the values.

**Notes**

■ **Computational Expressions**

● **Limitations on Number of Characters**

Computational expressions can be entered up to 55 characters in length. If nothing is entered for a computational expression, that waveform number is treated as having been set to “off”.

● **Entering Constants**

Numeric values should be assigned to the letters F to Y using the alphanumeric keypad and then these letters F to Y entered in the computational expressions. Numeric values cannot be entered directly into computational expressions.

The valid setting range for a constant, where “F” is the constant, is  $F=0.0$ ,  $-1.00E-30 \leq F \leq -1.00E30$ ,  $1.00E-30 \leq F \leq 1.00E30$ . The number of significant digits for entry of constants is nine.

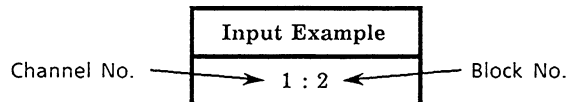
Example of Correct Input	Example of Incorrect Input
W1=1*F    F=1.600	W1=1*1.6

● **Entering a Channel No. or Block No. (If Memory is Partitioned)**

Enter channel numbers using the alphanumeric keypad.

For example, for channel 1, enter “1” and for channel 2, enter “2”, using the alphanumeric keypad.

If memory is partitioned, enter block numbers as follows.



If a channel number alone is entered when memory is partitioned, then the data from the last previous measurement block captured before the computational expression was entered will be used as the input.

For example, to sum the second block of channel 1 and the third block of channel 2, set as follows:

W1=1:2+2:3

### ● Computing Data on IC Memory Card

Up to four data files M1, M2, M3, and M4 on an IC memory card can be subject to computations.

For registration of file names assigned to M1, M2, M3, and M4, see Section 8.15, "Computation Related Setting".

### ● Notes on Use of Functions

Inside a computational expression, the functions DIF, DDIF, INTG, IINTG, and MEAN must be the outermost elements. Also, these functions cannot be used more than once.

Example of Correct Input	Example of Incorrect Input	
W1=DIF(2+3*F)	W1=DIF(2)+3*F	W1=DIF(MEAN(2))

In the case of SIN, COS and TAN the contents of the brackets ( ) should be specified in radians.

### ● Moving Average

When moving average is used, you can set the number of points in the moving average.

The number of moving average points can be set from 10 to 128 (see Section 8.15, "Computation Related Setting").

Until data reaches the set number of points in the moving average, the average of the values acquired up to that point is displayed.

If, for example, the number of moving average points is set to "10", the data displayed for the ninth point is the average of data points one through nine.

### ● Treatment of logic input data in computational expressions (For Models with Logic Input Only)

When logic input data is treated bit-by-bit, i.e., point-by-point, computational expressions should be entered using bit numbers A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7 and B8. Each data is computed as the value of 0 or 1.

When the data is treated channel-by-channel (i.e., in eight bit units), expressions should be entered using channel numbers A and B. In this case, since a decimal number is assigned to each bit as shown in the table below, the data is computed treating A and B in the expressions as decimal numbers between 0 and 255.

Bit Numbers	A8	A7	A6	A5	A4	A3	A2	A1
	B8	B7	B6	B5	B5	B3	B2	B1
When set to "0"	0	0	0	0	0	0	0	0
When set to "1"	128	64	32	16	8	4	2	1

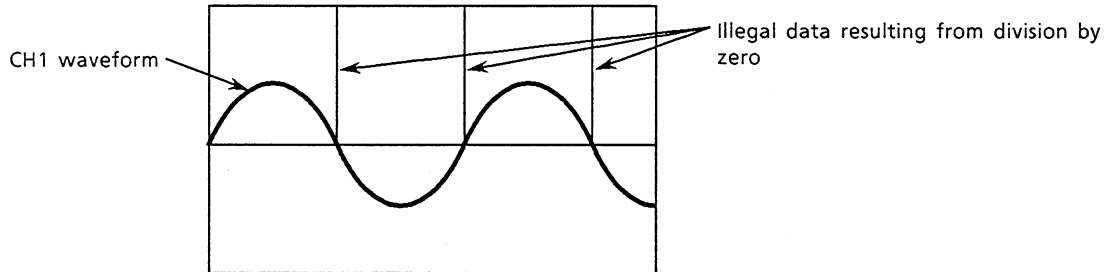
● **Erroneous Computation Data (Illegal Data)**

● **Overflow when carrying out computations**

When a computation is executed, computed values less than about  $-3.4 \times 10^{38}$  or greater than about  $3.4 \times 10^{38}$  are treated as illegal data.

● **Values divided by zero**

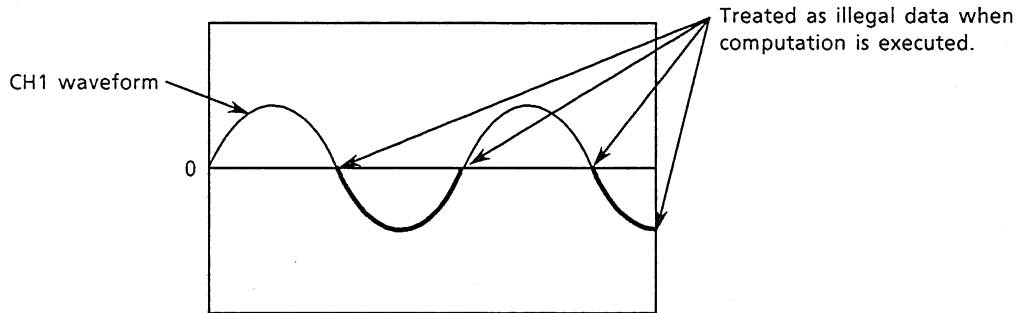
If, for example, a sine wave is input on channel 1, and another sine wave is input on channel 2, and division is performed between them, those points that result in division by 0V are treated as illegal data.



● **Square root of negative data**

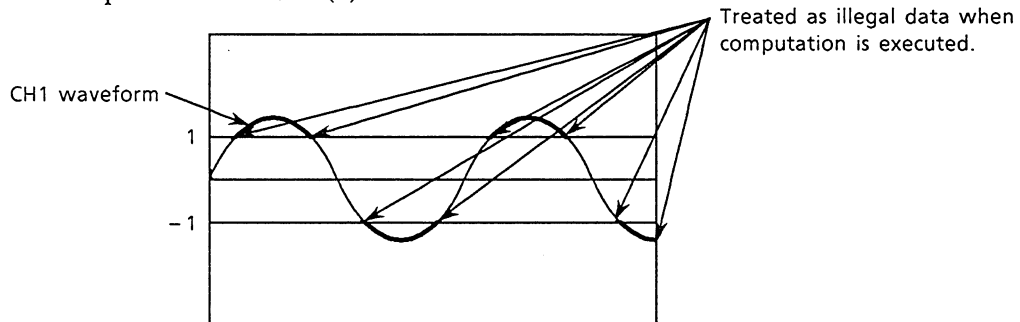
If a square root is computed on the data from channel 1, then the results of computations carried out on negative values will be treated as illegal data.

Example:  $W1 = \text{SQR}(1)$



● **Arguments of inverse trigonometric functions (ASIN, ACOS and ATAN) with an absolute value exceeding unity.** If an inverse trigonometric function is computed on data from channel 1, then values exceeding 1.0 are treated as illegal values when the computation is executed (see the figure below).

Example:  $W1 = \text{ASIN}(1)$



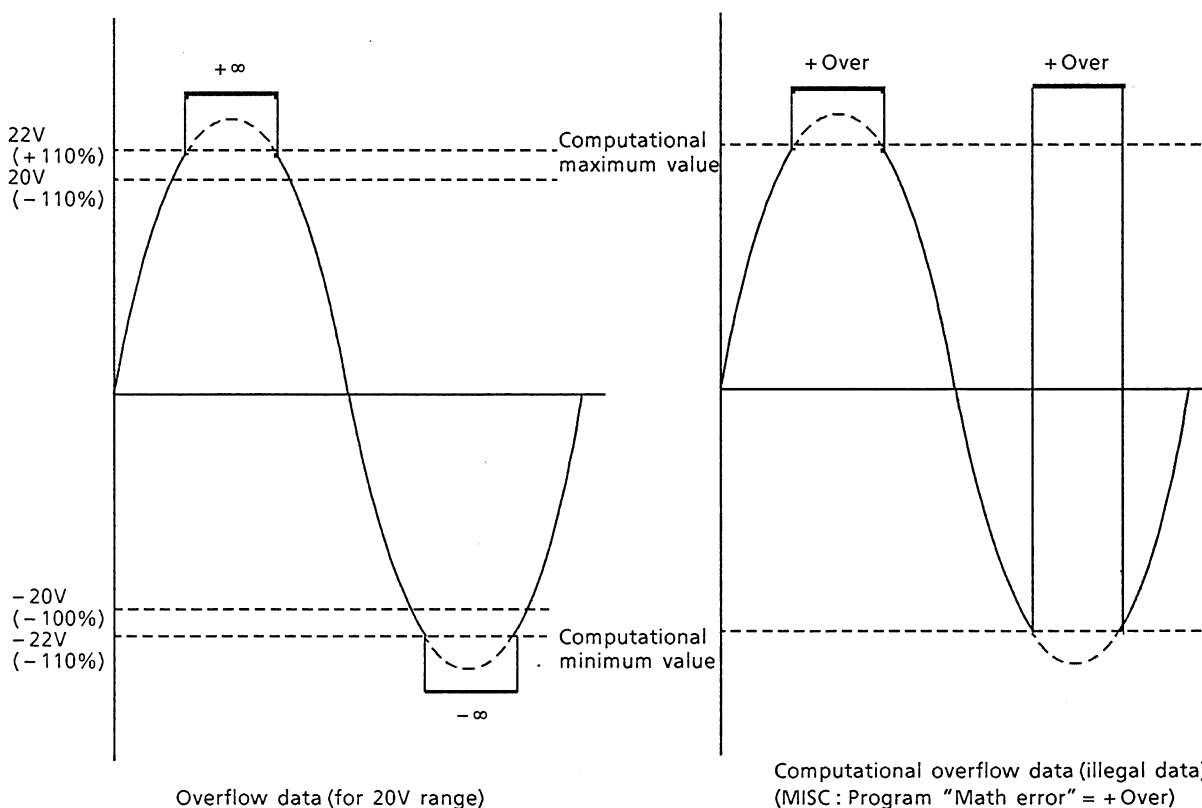
Note: It is possible to make a setting such that data which has been computed as illegal data is in fact taken as the maximum value or minimum value (see Section 8.15, "Computation Related Setting").

## ■ Overflow Data and Erroneous Computation Data (Illegal Data)

- When PROGRAM is not in use (Program=off), an input voltage greater than 110% of the specified input range is treated as overrange. In this case, data is treated as overflow data. Overflow to the +side will have a value of +infinity; overflow to the -side will have a value of -infinity.
- When PROGRAM (computations) is in use (Program=on), computed values outside the range which can be internally handled (less than about  $-3.4 \times 10^{38}$  or greater than about  $3.4 \times 10^{38}$ ) are treated as illegal data. In this case, that data value will be the value of "Math error" specified for the MISC : Program function (the maximum or minimum value). For MISC : Program "Math error" setting, see Section 8.15, "Computation Related Setting".

## ■ FFT Option Related Examples

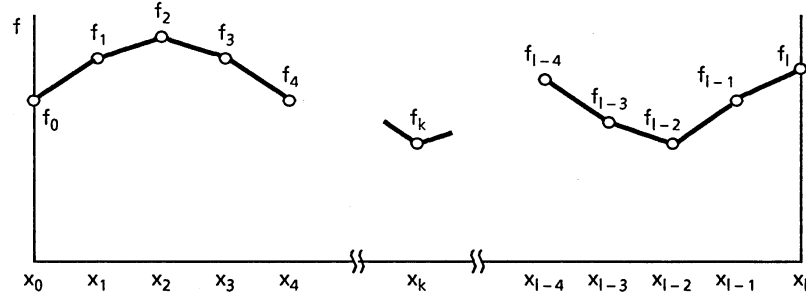
- **When the provision of an FFT option makes no difference to processing**  
When Program=on, setting W1 to "1" (i.e., no computation) displays the same waveform as when Program=off if display scale has been set. Input voltage greater than 110% of the specified input range is treated as overflow data in the same way as when Program=off.
- **When Processing Differs Depending on Whether or not FFT Option is Provided**  
When Program=on and settings are W1=1\*F, F=1.00 (coefficient), processing of an input voltage exceeding 110% of the specified input range differs depending on whether or not FFT option is provided. An AR1100A with FFT option treats such data as overflow data in the same way as above. An AR1100A without FFT treats that data as illegal data since the instrument judges that an ordinary computation has been performed, and as a result the data takes the value (maximum or minimum value) specified for MISC : Program "Math error".



■ **Differentiation**

Computation of single and double differential values is carried out using the fifth-order lagrange formula for polynomial interpolation, computing each point of data from the five points of data around that point.

The figure shows data points  $f_0$  to  $f_1$  for sampling times  $x_0$  to  $x_1$ . The integral and differential values for these data points are computed as shown below.



**Computational Expressions for First Derivative Values**

Point  $x_0$   $f_0' = \frac{1}{12h} [-25f_0 + 48f_1 - 36f_2 + 16f_3 - 3f_4]$

Point  $x_1$   $f_1' = \frac{1}{12h} [-3f_0 - 10f_1 + 18f_2 - 6f_3 + f_4]$

Point  $x_2$   $f_2' = \frac{1}{12h} [f_0 - 8f_1 + 8f_3 - f_4]$

Point  $x_k$   $f_k' = \frac{1}{12h} [f_{k-2} - 8f_{k-1} + 8f_{k+1} - f_{k+2}]$

Point  $x_{i-2}$   $f_{i-2}' = \frac{1}{12h} [f_{i-4} - 8f_{i-3} + 8f_{i-1} - f_i]$

Point  $x_{i-1}$   $f_{i-1}' = \frac{1}{12h} [-f_{i-4} + 6f_{i-3} - 18f_{i-2} + 10f_{i-1} + 3f_i]$

Point  $x_i$   $f_i' = \frac{1}{12h} [3f_{i-4} - 16f_{i-3} + 36f_{i-2} - 48f_{i-1} + 25f_i]$

$h = \Delta x \dots$  Sampling rate (sec) (Example: For 5kHz,  $\frac{1}{5000} = 200 \times 10^{-6}$  sec)  
 However,  $h=1$  when external sampling is used.

**Computational Expressions for Second Derivative Values**

Point  $x_0$   $f_0'' = \frac{1}{12h^2} [35f_0 - 104f_1 + 114f_2 - 56f_3 + 11f_4]$

Point  $x_1$   $f_1'' = \frac{1}{12h^2} [11f_0 - 20f_1 + 6f_2 + 4f_3 - f_4]$

Point  $x_2$   $f_2'' = \frac{1}{12h^2} [-f_0 + 16f_1 - 30f_2 + 16f_3 - f_4]$

⋮

Point  $x_k$   $f_k'' = \frac{1}{12h^2} [-f_{k-2} + 16f_{k-1} - 30f_k + 16f_{k+1} - f_{k+2}]$

⋮

Point  $x_{i-2}$   $f_{i-2}'' = \frac{1}{12h^2} [-f_{i-4} + 16f_{i-3} - 30f_{i-2} + 16f_{i-1} - f_i]$

Point  $x_{i-1}$   $f_{i-1}'' = \frac{1}{12h^2} [-f_{i-4} + 4f_{i-3} + 6f_{i-2} - 20f_{i-1} + 11f_i]$

Point  $x_i$   $f_i'' = \frac{1}{12h^2} [11f_{i-4} - 56f_{i-3} + 114f_{i-2} - 104f_{i-1} + 35f_i]$

### ■ Integration

Computation of single and double integral values is determined using trapezoidal formulas.

#### Computational Expressions for Single Integral Values

$$\text{Point } x_0 \quad I_0 = 0$$

$$\text{Point } x_1 \quad I_1 = \frac{1}{2} (f_0 + f_1) h$$

$$\text{Point } x_2 \quad I_2 = \frac{1}{2} (f_0 + f_1) h + \frac{1}{2} (f_1 + f_2) h = I_1 + \frac{1}{2} (f_1 + f_2) h$$

$$\text{Point } x_i \quad I_i = I_{i-1} + \frac{1}{2} (f_{i-1} + f_i) h$$

#### Computational Expressions for Double Integral Values

$$\text{Point } x_0 \quad \Pi_0 = 0$$

$$\text{Point } x_1 \quad \Pi_1 = \frac{1}{2} (I_0 + I_1) h$$

$$\text{Point } x_2 \quad \Pi_2 = \frac{1}{2} (I_0 + I_1) h + \frac{1}{2} (I_1 + I_2) h = \Pi_1 + \frac{1}{2} (I_1 + I_2) h$$

$$\text{Point } x_i \quad \Pi_i = \Pi_{i-1} + \frac{1}{2} (I_{i-1} + I_i) h$$

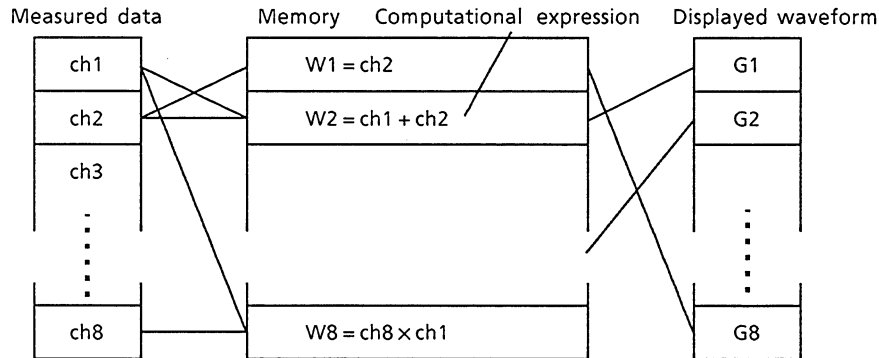


# 4.10 Setting of Display Format

## Function

Selects whether the display format for measured data on the CRT screen is to be Single display, Dual display, Quad display, or X-Y display.

This function is used to assign the waveform numbers W1 to W8 specified on the program setting panel to the graph numbers G1 to G8 (for program setting, see Section 4.8, "Setting PROGRAM (Computations) to OFF" and Section 4.9, "Setting PROGRAM (Computations) to ON").



Concept of Display Format

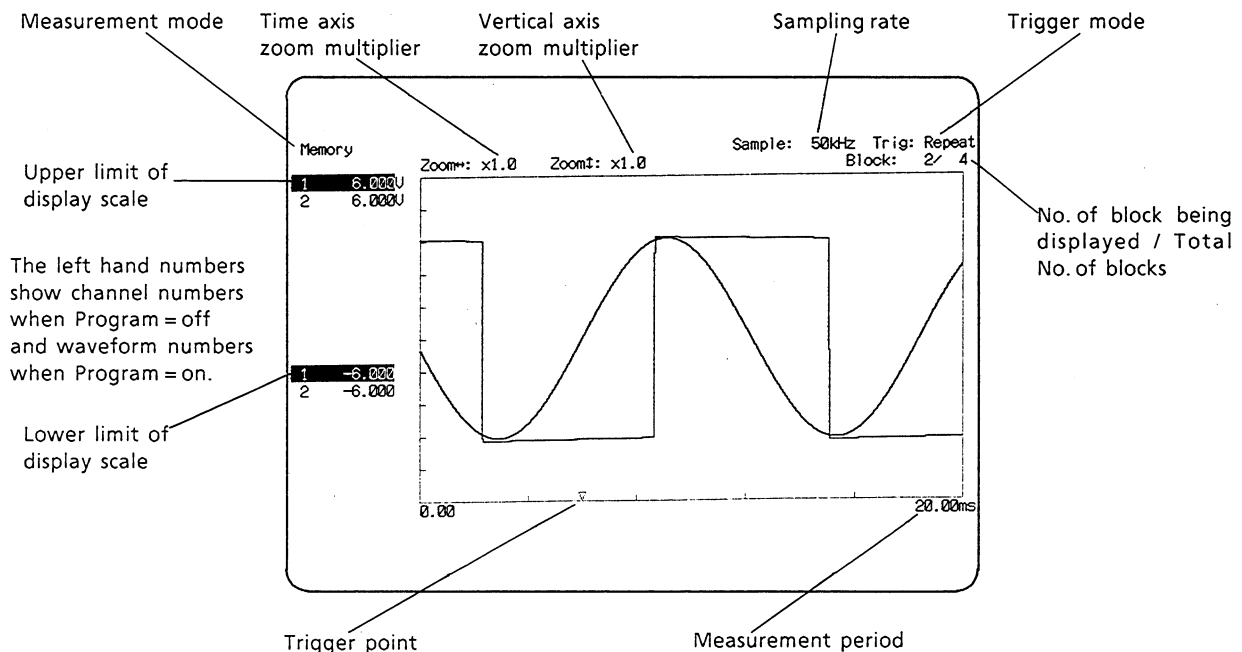
The display position of the waveforms and the display scale are fixed for each graph number. Waveform display can be easily switched using the swap function; the swap function enables two sets of display format settings to be held.

For display of logic input data, only Single display is available. Also, in this case the display position is fixed.

Each setting can be changed while measurement is in progress.

### Single Display (For Analog Waveforms)

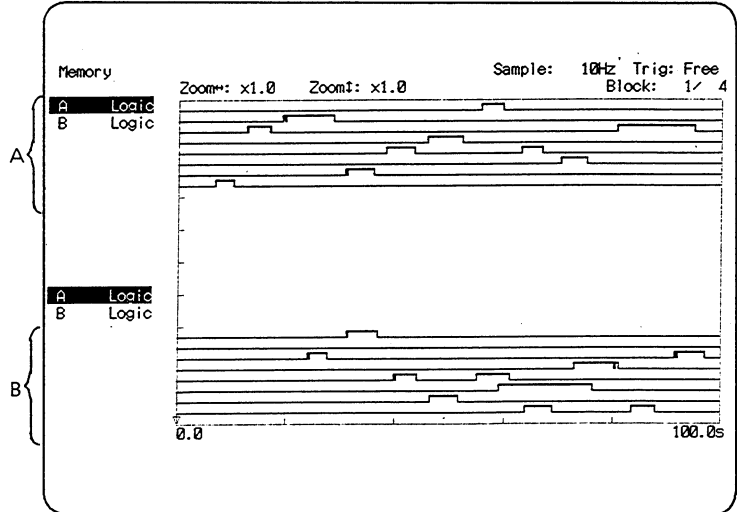
Displays the waveforms along a single time axis on the CRT screen. Up to eight waveforms can be displayed.



■ Single Display (For Logic Waveforms)

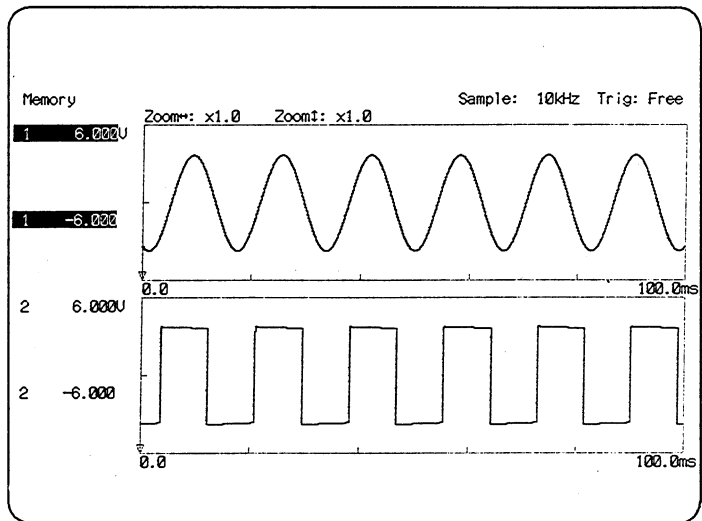
Channel A is displayed on the upper side, and channel B on the lower side.

Starting from the top waveforms are in the following order: A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7, B8.



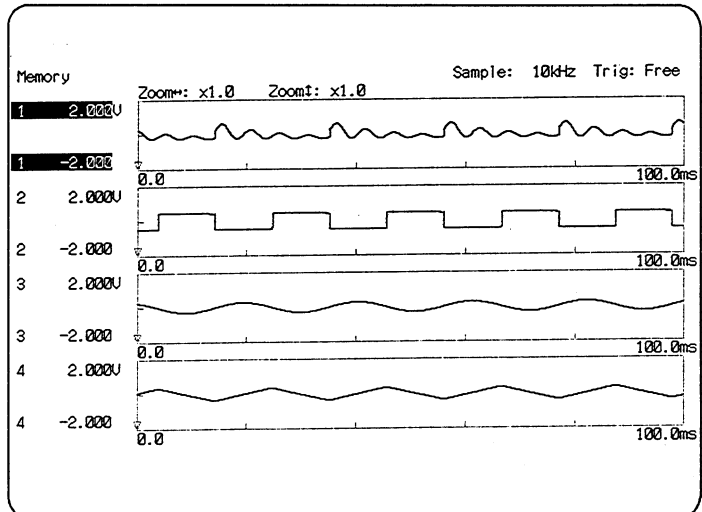
■ Dual Display

Displays the waveforms along two time axes on the CRT screen which is split into two panels, an upper and lower panel. Up to four waveforms each can be displayed on the upper and lower panels.



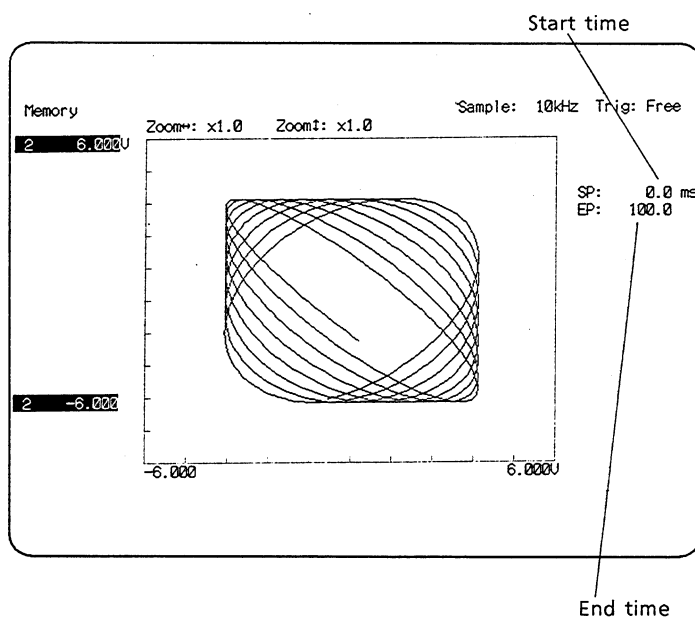
■ Quad Display

Displays the waveforms along four time axes on the CRT screen split into four panels. Only one waveform can be displayed on each panel.



### ■ X-Y Display

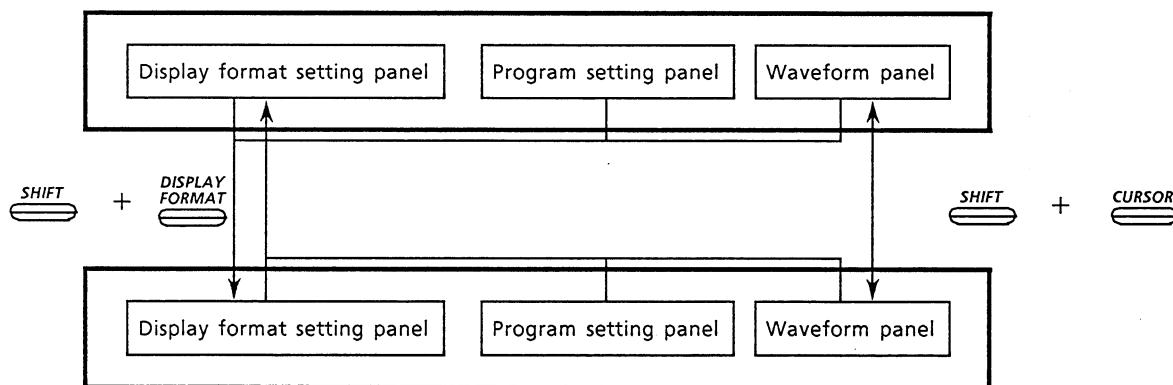
Displays data in X-Y format on the CRT screen. One waveform can be specified as the horizontal axis, and up to four waveforms corresponding to that waveform can be assigned to the vertical axis for X-Y display.



### ■ Swap Function

The swap function enables two sets of display format settings to be held. Two corresponding sets of program settings may also be held. Which of the two sets of settings is to be effective is simply selectable by pressing  $\text{SHIFT} + \text{DISPLAY FORMAT}$ . Press  $\text{SHIFT} + \text{CURSOR}$  to switch from one waveform panel to the other waveform panel directly.

Note that the settings for "Program" (off/on) on the program setting panel, and "Display mode" (Single, Dual, Quad, X-Y) and "Scale" (off/on) on the display format setting panel are common to both the major and complementary settings.




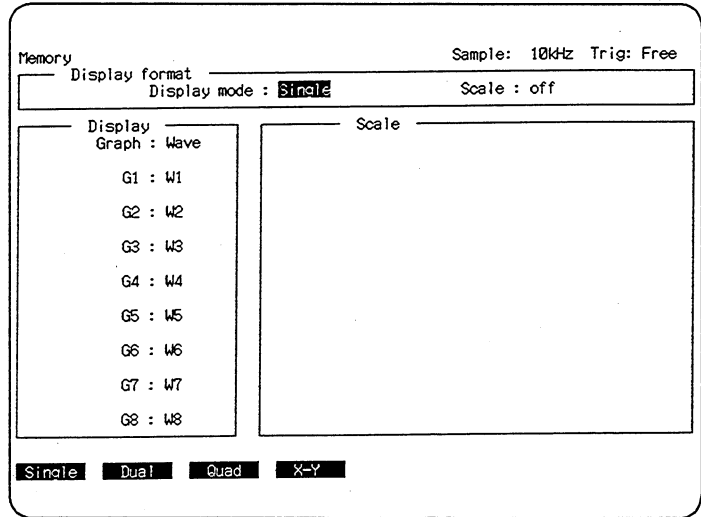
Note: Whichever setting panel is on display, pressing  $\text{SHIFT} + \text{DISPLAY FORMAT}$  changes the panel to the display format setting panel of the other (complementary) setting.

$\text{SHIFT} + \text{CURSOR}$  is only effective for switching between waveform display panels.

See Section 11.2, "Exchanging Display / Computation Settings (SWAP)."


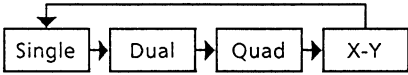


**Procedure**

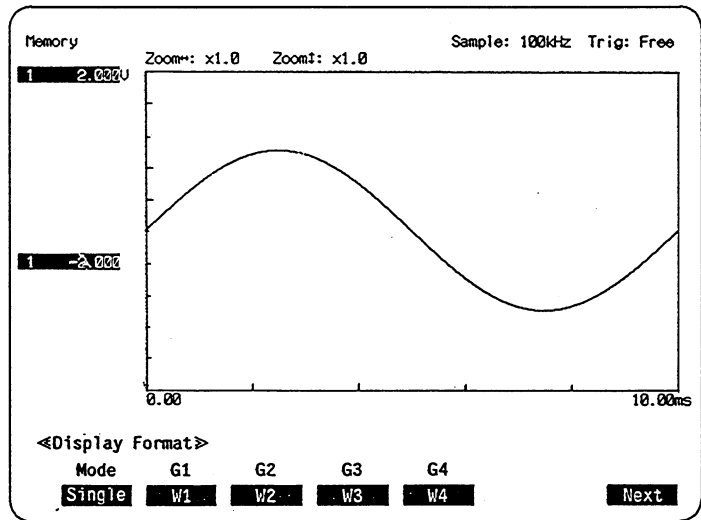
1.  Display format setting panel appears.
2. **Display mode**  
Select the display format (Single / Dual / Quad / X-Y).
3. **Scale (displayed only when Program = off)**  
Select whether or not to use display scaling (off/on).  
(See Section 4.11, "Setting of Display Scale".)
4. **Display**  
Assign the waveform numbers W1 to W8\* to be displayed to the graph numbers G1 to G8 using the soft keys.  
Assign "off" to the number of a graph on which no waveform is to be displayed.  
\* For 4-channel model: W1 to W4  
For 6-channel model (including logic input): W1 to W6



For Single display

**Procedure** ... Changing Display Format while Measurement is in Progress

1. Press  while measurement is in progress.
2. **Display mode**  
Each time the soft key is pressed, the Display mode display changes as follows.  

3. **G1 to G8**  
Each time the soft key for G1 to G8 is pressed, waveform No. changes.
  - Pressing  changes "G1 to G4" to "G5 to G8" and vice versa (for Single or Dual display).
4. Pressing  executes changes.



**Note**

■ This instrument adds a zero point correction to the input for waveform display on the CRT screen. Depending on the zero correction tolerance, the image on the display panel may be off by 1 dot. This has no effect on the measured value itself.

# 4.11 Setting of Display Scale

## Function

Sets the upper and lower limits of the vertical axis for the displayed waveform.

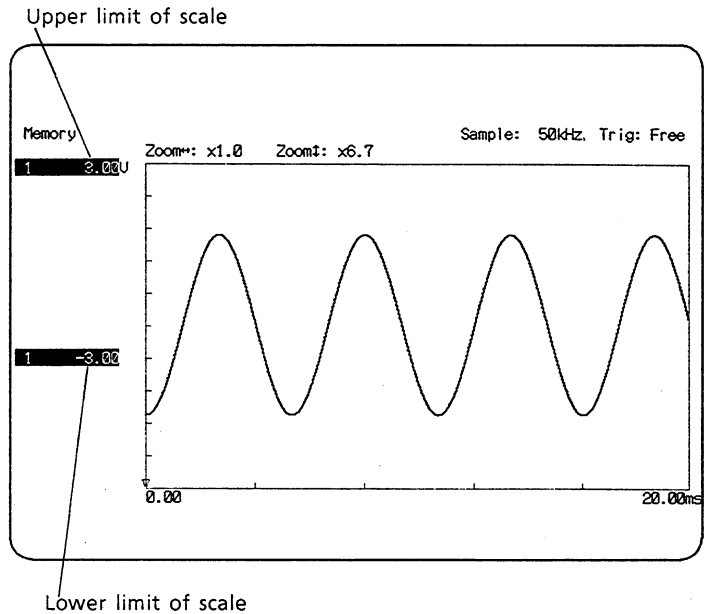
### When Computational Processing is not Used (Program = off)

It is possible to specify whether or not to set the display scale. If the display scale is not set, the upper and lower limits will take the maximum and minimum values of the input range.

### When Computational Processing is Used (Program = on)

Set the upper and lower limits of the scale for each waveform number (W1 to W8\*).

The setting ranges differ according to whether computational processing is in use (Program=on) or not in use (Program=off). The setting range also depends on the input range.



## Procedure

1. **DISPLAY FORMAT**  
The display format setting panel is called up.
2. Move the menu cursor to the "Scale" area using the cursor key
3. **Scale (displayed only when Program = off)**  
Select whether or not to use display scaling (off/on). Here, select  on .

Memory		Sample: 50kHz Trig: Free	
Display format			
Display mode: Single		Scale: on	
Display Graph: Wave	Wave	Scale Upper	Scale Lower
G1: W1	W1	3.000	-3.000
G2: W2	W2	5.000	1.000
G3: W3	W3	0.5000	0.000
G4: W4	W4	1.000	-1.000
G5: W5	W5	1.000	0.000
G6: W6	W6	1.000	0.000
G7: W7	W7	1.000	0.000
G8: W8	W8	1.000	0.000

4. **Scale**  
Set the scale of the vertical axis for each waveform number (W1 to W8\*).

Upper: Set the upper limit of the vertical axis.

Lower: Set the lower limit of the vertical axis.

5. **Unit (displayed only when Program = on)**

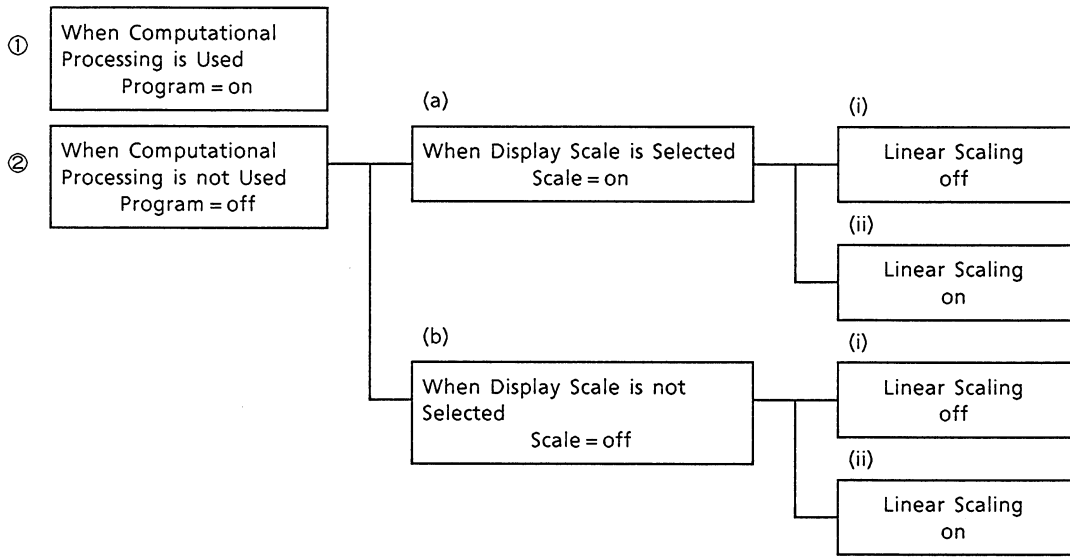
Units consisting of up to six characters each can be entered using the soft keys or the alphanumeric keypad.

However, only the first two characters can be displayed on the panel and printed out when taking a hard copy of the CRT screen.

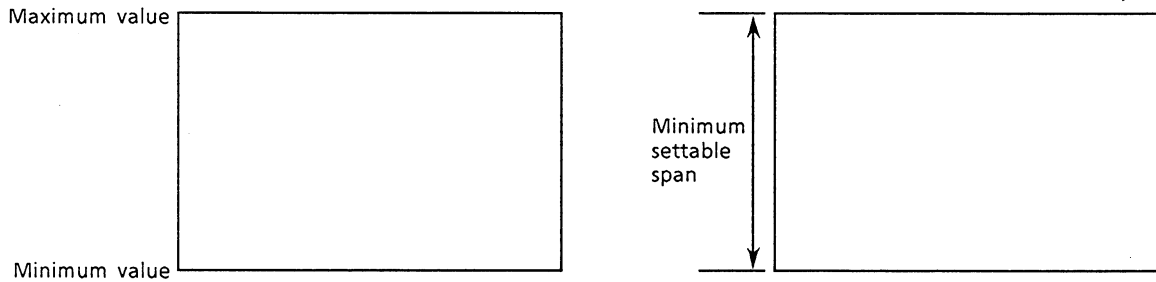
\* For 4-channel model: W1 to W4  
For 6-channel model (including logic input): W1 to W6

**Notes**

■ The maximum value, minimum value, and minimum settable span for each setting range differ according to five conditions. For linear scaling, see Section 8.6, "Setting Linear Scaling".



Note: Meanings of maximum value, minimum value, and minimum settable span for the setting range



- Maximum value : Upper limit of value that can be set
- Minimum value : Lower limit of value that can be set
- Minimum settable span : Smallest value of (Upper value – Lower value)

■ When computational processing is not used (Program=off), it is ineffective to make display scale settings for logic input waveforms. (Values can be input but invalid.)

## ① When Computational Processing is Used (Program = on)

Maximum Value of Setting Range	$10^{30}$
Minimum Value of Setting Range	$-10^{30}$
Minimum Settable Span	$10^{-30}$

## ② When Computational Processing is not Used (Program = off)

## (a) When Display Scale is Selected (Scale = on)

## (i) When Linear Scaling = off

The table below shows the relationship between the display scale setting range and input range.

Range	Maximum Value	Minimum Value	Minimum Settable Span
60V	120.0	-120.0	6.0
20V	40.0	-40.0	2.0
6V	12.0	-12.0	0.6
2V	4.0	-4.0	0.2
0.6V	1.20	-1.20	0.06
0.2V	0.40	-0.40	0.02
0.06V	0.12	-0.12	0.006
K	2500.0	-1500.0	100.0
J	2500.0	-1500.0	100.0
E	1750.0	-1250.0	75.0
T	1000.0	-1000.0	50.0
R	3250.0	-1750.0	125.0
S	3250.0	-1750.0	125.0
B	3250.0	-1750.0	125.0
N	2500.0	-1500.0	100.0
W	4500.0	-1500.0	150.0
L	1750.0	-1250.0	75.0
U	1000.0	-1000.0	50.0

## (ii) When Linear Scaling = on

If linear scaling has been selected, the display scale values on the waveform panel are the values obtained by linear scaling.

The setting range and minimum settable span are the same as described in (a) (i) for the case when linear scaling is "off".

**(b) When Display Scale is not Selected (Scale=off)**

**(i) When Linear Scaling=off**

Display scale values are determined by the input range.

**(ii) When Linear Scaling=on**

If linear scaling has been selected, the display scale values on the waveform panel are the values obtained by linear scaling.

- When computational processing is not used (Program=off), it is ineffective to make display scale settings for logic input waveforms.




## 4.12 Setting of Sampling Rate

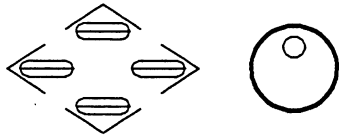
### Function

The speed at which measured data is written to memory is called the "Sampling Rate". This must be set to a suitable value, according to the rate of change and frequency of the input signal. If using external sampling, see Section 8.21, "Using External Sampling".

### Procedure

The sampling rate is always displayed at the top right hand of the CRT screen.

1.  Instrument enters the mode that allows setting of the sampling rate.
2. **Cursor Keys or Rotary Knob**

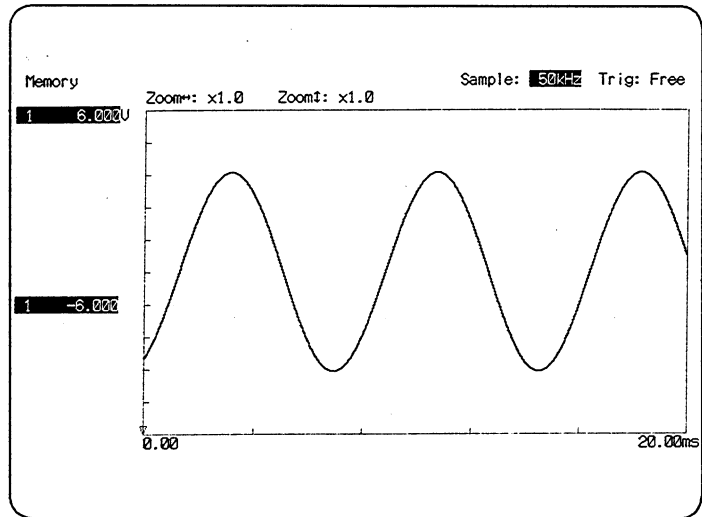


Setting changes as follows.

100kHz / 50kHz / 20kHz / 10kHz /  
5kHz / 2kHz / 1kHz / 500Hz / 200Hz  
/ 100Hz / 50Hz / 20Hz / 10Hz / 5Hz /  
2Hz / 1Hz / 0.5Hz / 0.2Hz / 0.1Hz /

Ext

If "Ext" is selected, sampling will be controlled by an external signal.



### Notes

#### ■ Changing the Sampling Rate Setting while Measurement is in Progress

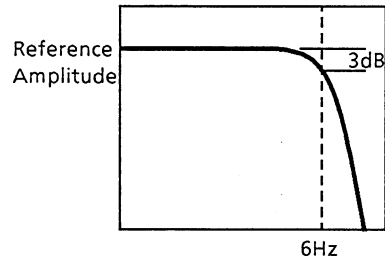
The sampling rate can be changed even while measurement is in progress with the new setting becoming effective at the start of the next data capture.

If the sampling rate is changed while measurement is in progress and memory partitioning is being used, the instrument clears all data in blocks up to and including the block to which data is currently being captured and begins measurement again from block 1 at the changed sampling rate (when the block protect mode is set to "off"). (For details of the block protect mode, see Section 8.12, "Protecting Data in Blocks".)

■ **Temperature Measurement**

Temperature measurement is always performed at a sampling rate of 135Hz (renewal of the temperature data, not writing into memory).

Frequency characteristics when performing temperature measurement are as shown in the figure to the right.



■ **Aliasing Phenomenon**

According to the Nyquist sampling theorem, if sampling is performed at a frequency that is at least two times the highest frequency component of the input signal, then in theory the source waveform can be reproduced.

If the sampling rate is less than two times this frequency, then a phenomenon occurs in which the frequencies above the Nyquist frequency appear as phantom components at lower frequencies than the original components in the source waveform. This is known as “aliasing”. To avoid aliasing it is necessary to measure at a sampling rate that is at least two times the frequencies in the input signal.

- When sampling rate is sufficiently high



Input signal



- Aliasing occurs when sampling rate is too low

Aliasing signal    Input signal    Sampling point



Aliasing phenomenon

- The sampling rate cannot be changed from the MISC setting panel.

# 4.13 Setting of Trigger Mode

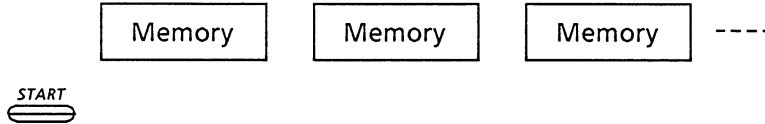
## Function

The main unit is equipped with the following 3 trigger modes.

### Free Mode

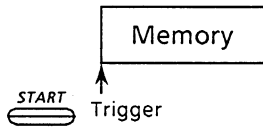
In Free mode, if **START** is pressed waveforms are captured but this capture is unrelated to any trigger signal.

The data in memory is re-written each time data of the specified memory size is captured.



### Single Mode

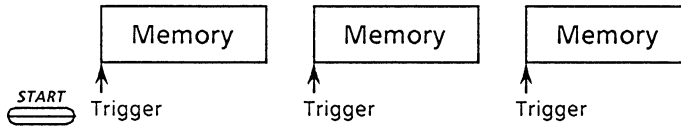
In Single mode, after **START** is pressed, a waveform is captured only once when the trigger conditions are satisfied.



### Repeat Mode

After **START** is pressed, a waveform is captured each time the trigger conditions are satisfied.

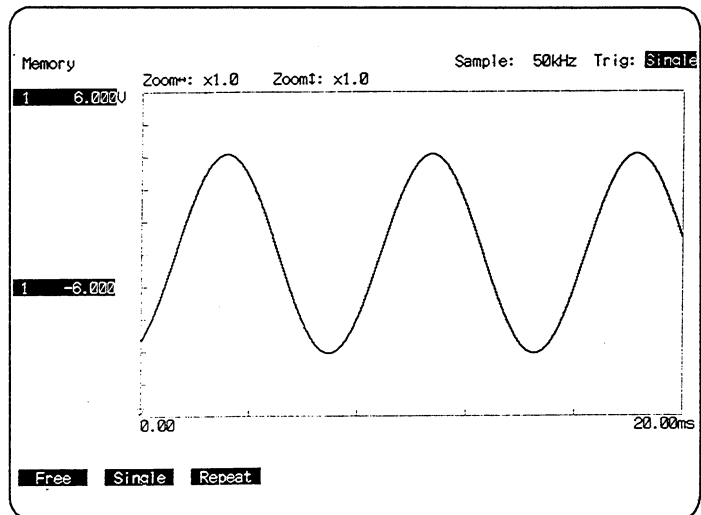
The data in memory is re-written each time the trigger is tripped.



Note: The above is true if memory partitioning is not performed. If memory is partitioned, see Section 4.4, "Setting of Memory Partitioning".

## Procedure

1. **TRIGGER MODE**  
The trigger mode soft key menu appears.
2. Select trigger mode by pressing the corresponding soft key (Free / Single / Repeat).




Notes
-------

■ Display of “Waiting for trigger (s)”



If the trigger mode is set at Repeat or Single, “Waiting for trigger (s)” is displayed until the trigger condition is satisfied and the trigger signal is received.

■ Trigger Ready Lamp



● When Setting Pretrigger

When the TRIGGER READY lamp lights up, a trigger signal is being received. And then the lamp goes off. In low-speed sampling (for example, 10 Hz and 1 Hz), it takes some time before the lamp lights up after the  key is pressed.

(For example, approximately 50 seconds at a memory length of 1 k, a pretrigger of 50% and a sampling speed of 10 Hz)

If you want to stop measurement while a trigger signal is not being received, pressing the  key followed by the  key causes forced stopping.

● When no Setting Pretrigger (Pretrigger of 0%)

The TRIGGER READY lamp stays lit until a trigger signal is received. Upon receiving a trigger signal, the lamp goes off. If you want to stop measurement while a trigger signal is not being received, pressing the  key followed by the  key causes forced stopping.

## 4.14 Measurement Start and Stop

### Function

The START key is used to start measurement (sampling); the STOP key is used to stop measurement.


Display of waveforms on the CRT screen is simultaneous with measurement.

The lamp at the upper left of the START key is lit during measurement.

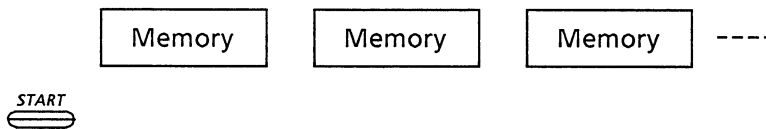
When the instrument is waiting for a trigger, the TRIGGER READY lamp is lit.

### Measurement Start


#### ● When Trigger Mode is Free

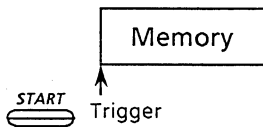
Pressing  causes waveform capture that is unrelated to any trigger signal.

The data in memory is re-written each time data of the specified memory size is captured.




#### ● When Trigger Mode is Single

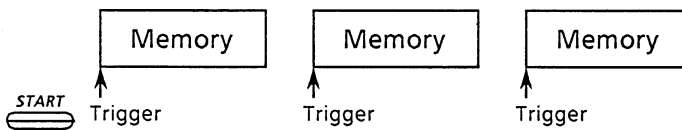
After  is pressed, a waveform is captured only once when the trigger conditions are satisfied.



#### ● When Trigger Mode is Repeat

After  is pressed, a waveform is captured each time the trigger conditions are satisfied.

The data in memory is re-written each time the trigger is tripped.



Note: The above is true if memory partitioning is not performed. If memory is partitioned, see Section 4.4, "Setting of Memory Partitioning".

## ■ Measurement Stop

### ● When Trigger Mode is Free

Pressing **STOP** stops measurement after data of the specified memory size has been captured.

### ● When Trigger Mode is Single

When the trigger is tripped, the instrument automatically stops measurement after data of the specified memory size has been captured.

If you wish to stop measurement when the instrument is waiting for a trigger, press **SHIFT** and then **STOP** (see Section 4.15, "Forcible Stop of Measurement").

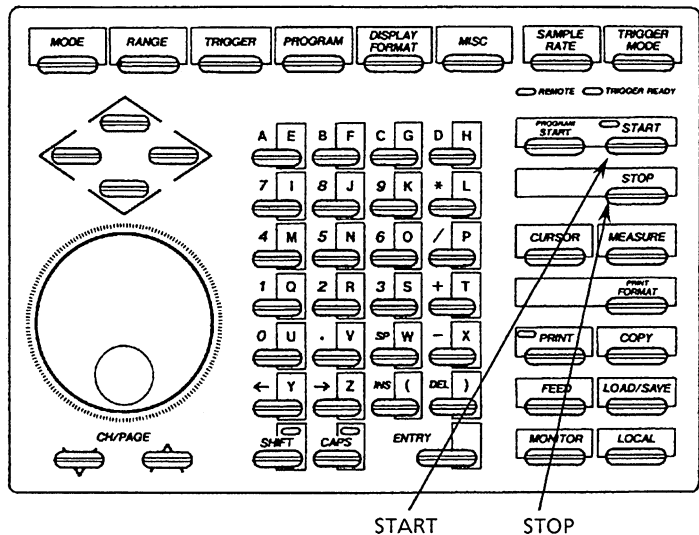
### ● When Trigger Mode is Repeat

If **STOP** is pressed while data is being captured, the instrument stops measurement after capturing data of the specified memory size.

If you wish to stop measurement when the instrument is waiting for a trigger, press **SHIFT** and then **STOP** (see Section 4.15, "Forcible Stop of Measurement").

## Procedure

1. **START**  
Measurement starts.
2. **STOP**  
Instrument terminates measurement after data of the specified memory size has been captured.



## Notes

- In the following circumstances, measurement will not start even if **START** is pressed.
  - When print-out is in progress via the built-in printer or external plotter.
  - When the PROGRAM START key has been pressed and data is still in the process of being redisplayed.
  - In block protect mode when memory has been partitioned (see Section 8.12, "Protecting Data in Blocks").
  - When the lamp at the upper left of the START key is lit.

# 4.15 Forcible Stop of Measurement

## Function

Forcibly stops a measurement operation.

A forcible STOP should be performed if the user wishes to stop measurement while the main unit is waiting for a trigger.

## Procedure

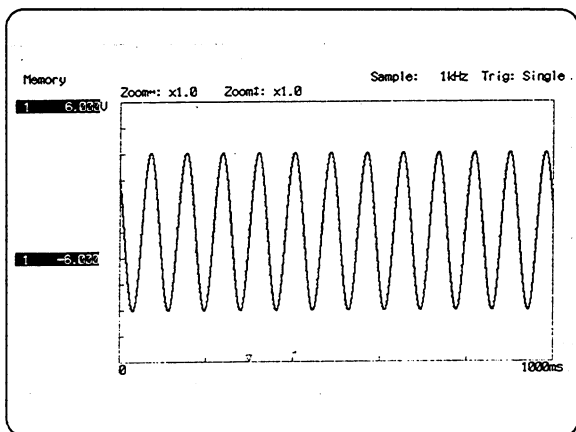
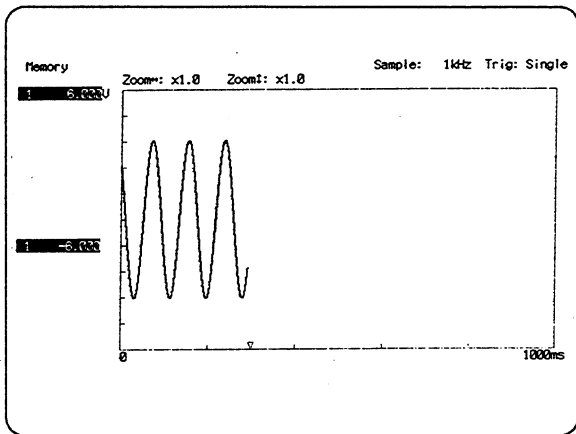
Press **SHIFT** and then **STOP** while measurement is in progress.

## Note

### ■ Difference between Measurement STOP and Forcible STOP

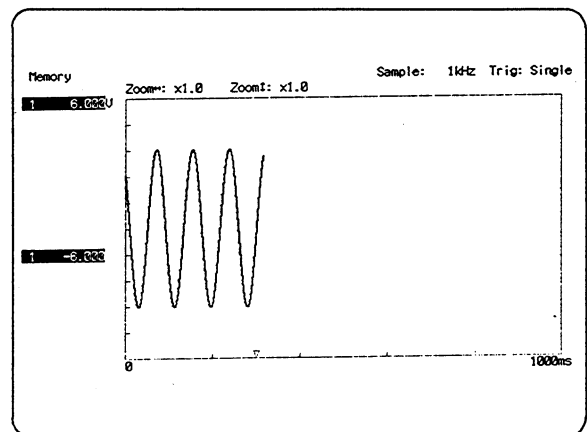
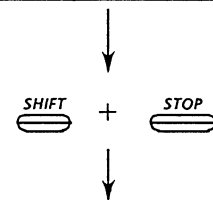
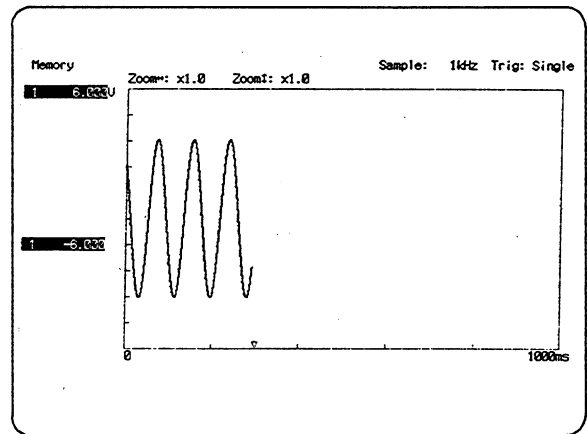
Pressing the STOP key while measurement is in progress will cause measurement to stop at the moment that data capture of the specified memory size has been completed; pressing the SHIFT key and then the STOP key will cause measurement to stop even if data of the specified memory size has not been captured.

Measurement STOP

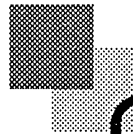


Measurement completed

Forcible STOP



Measurement completed



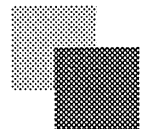
# Chapter 5

## Memory Mode / Data Analysis

---

This chapter describes the various analytical processing that can be carried out on data captured to memory.

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## 5.1 Summary of Analytical Functions

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This section explains the analysis that can be carried out on the CRT screen of measured data captured in the memory in Memory Mode. The main unit is provided with the following analytical functions.

- Can redisplay measured and computed data captured in the memory on the CRT with the display scale or display format changed and perform computations using newly set expressions.
- Can read out data using the cursor. The difference in data value and time can also be read out.
- Waveform enlargement (zoom) or shift (scroll)
- **Zone Statistical Computations**  
The maximum value, minimum value, peak-to-peak amplitude, average, root-mean-square, standard deviation, or area can be computed by specifying a zone on the waveform using a pair of cursors.


## 5.2 Redisplay and Recomputation of Measured / Computed Data

---



### Function

- When a panel other than the waveform display panel is being displayed on the CRT, the instrument can call up the waveform display panel to display the measured / computed data captured in the memory.
- Displays the measured / computed data in the memory after changes have been made to the display scale and display format.
- Displays the results of computational processing carried out on measured data stored in memory.

### Procedure

1. Change the display scale, display format, PROGRAM (computations) on / off setting, or computational expressions if necessary.
2.  Waveform is displayed.

### Notes

- In the following circumstances, pressing  is ineffective.
  - When measurement is being performed
  - When a waveform is being printed out via the built-in printer or external plotter
- When memory partitioning is in use, pressing  is effective for data in the most up-to-date block.

## 5.3 Reading Out of Data Values (CURSOR)

---

The cursor function is used to read out data values. It can be divided into the following three types.

### ■ Single-Point Cursor Function

Reads out the data values for only one waveform at a time.

For logic input waveforms, reads out values channel-by-channel (i.e., in units of eight bits).

### ■ Multi-Point Cursor Function

Reads out the data values for up to four waveforms simultaneously when Single display is selected as the display format.

To use this function, the cursor mode should be set in advance to multi-point cursor using the MISC panel.

### ■ Reference Cursor Function

Allows the use of two cursors to find differences in data values and times.



For logic input waveforms, this function reads out differences in bit value.

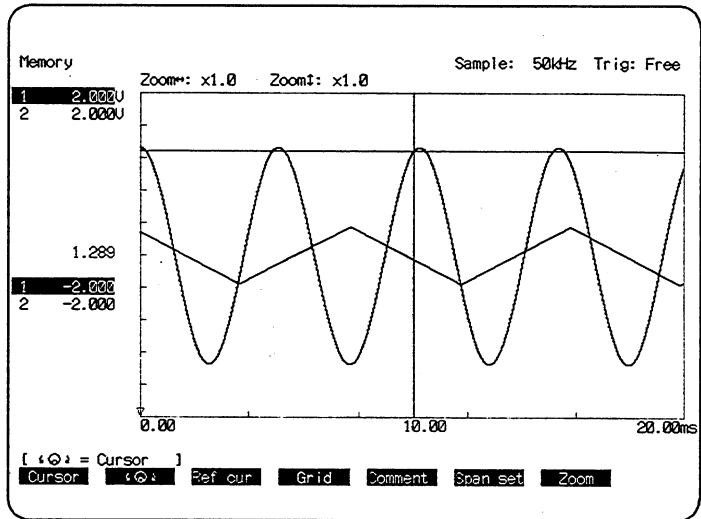
### 5.3.1 Reading Out of Single Data Values (Single-Point Cursor)

**Function**

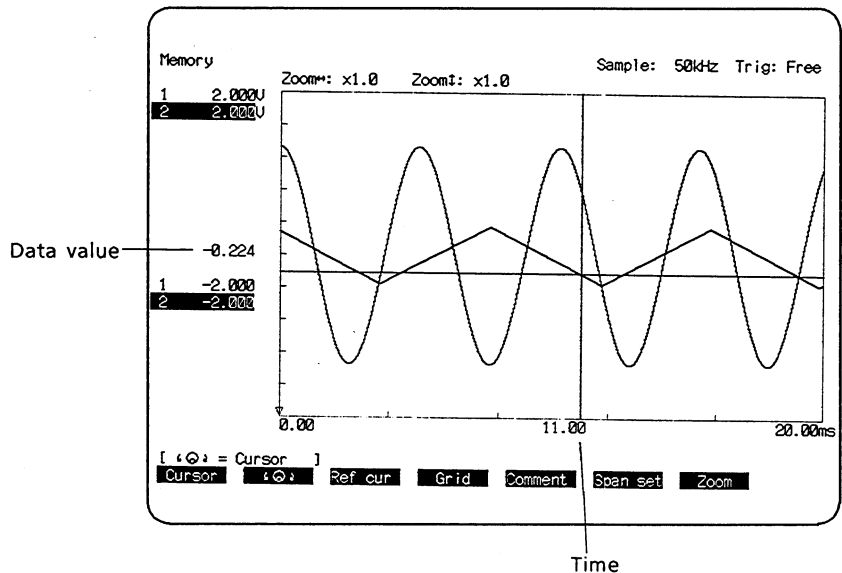
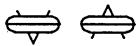
Reads out data values for only one waveform.  
 For logic input waveforms, reads out data channel-by-channel (i.e., in units of eight bits).

**Procedure**

1.  Instrument enters cursor mode.
2.  Cursor is displayed on the panel.

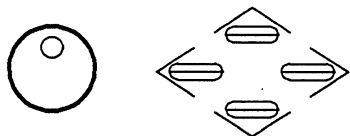


3. The waveform on which the cursor is positioned is displayed with intensified brightness. The scale values are inverse video displayed. To move the waveform on which the cursor is to be positioned, use the channel select keys.







### 5.3 Reading Out of Data Values (CURSOR)



4. Use the rotary knob or cursor keys to change the cursor position.







The cursor position can also be moved as shown below.




 +  Automatically moves the cursor to the left with a continuous motion (auto-cursor).



 +  Automatically moves the cursor to the right with a continuous motion (auto-cursor).

 +  Moves the cursor to the center of the panel.

 +  Moves the cursor to the trigger point.


 +  Moves the cursor to the left extremity of the panel.


 +  to  Moves the cursor to the position corresponding to n/10 of the panel.

 +  Moves the cursor to the right extremity of the panel.

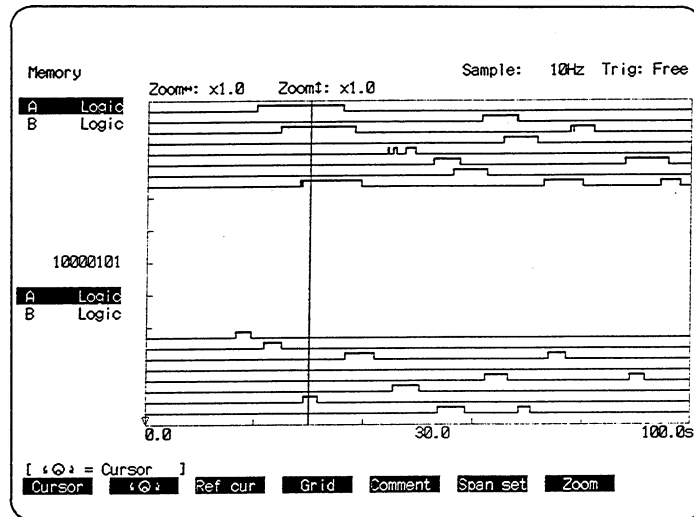
- To stop the auto-cursor, press any cursor key or turn the rotary knob.

The cursor movement can be selected from among nine types using the keys 1 to 9 of the alphanumeric keypad while the cursor is being displayed (and also while the auto-cursor is being executed).



Selecting  moves the cursor data point by data point (minimum movement).

Selecting  moves the cursor 1/10 of the panel at a time (maximum movement).

● For Logic Input Waveforms



Values for A8, A7, A6, A5, A4, A3, A2, and A1 read using the cursor function are displayed from the left.

If channel B is selected using the channel select keys  and  values for B8, B7, B6, B5, B4, B3, B2, and B1 are displayed from the left.

**Notes**

- This cursor function can be used only after measurement has been completed.
- This cursor function cannot be used while the waveform test function is in use and a test area is being created.




## 5.3.2 Simultaneous Reading Out of Multiple Data Values (Multi-Point Cursor)

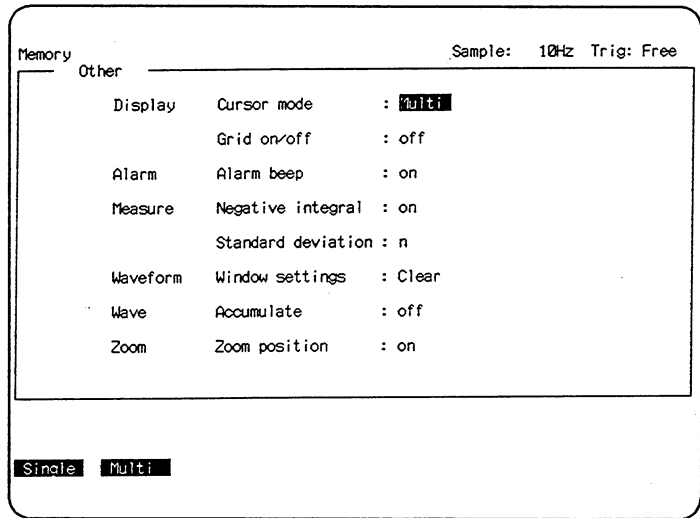
### Function


Simultaneously reads out data for up to four waveforms obtained at the same point of time when Single display is selected as the display format. To use this function, the cursor mode should be set in advance to multi-point cursor using the MISC panel.

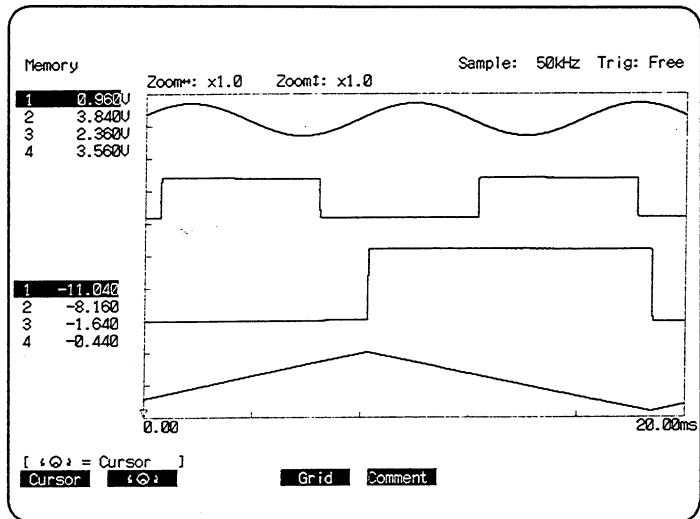
### Procedure

Set the cursor mode to multi-point as follows.

1.  MISC panel appears.
2. Select .
3. **Cursor mode**  
Either single-point or multi-point can be selected (Single/Multi).  
Select .

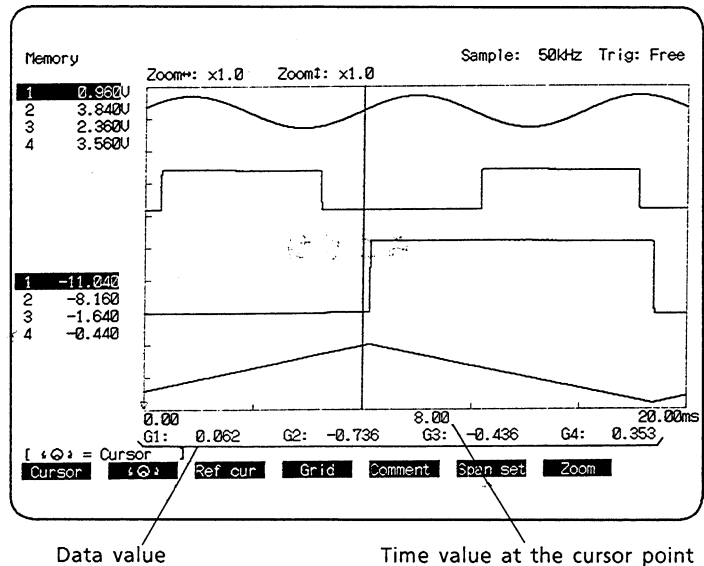




4. Set the display format to Single display (see Section 4.10, "Setting of Display Format").
5.  CURSOR  
Instrument enters cursor mode.

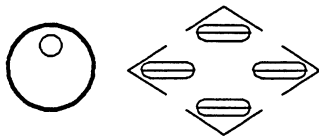


6. **Cursor**

A cursor is displayed on the panel.



- The cursor is positioned on the four waveforms including one waveform displayed with intensified brightness. Data values are displayed for graph numbers G1 to G8. Simultaneous data value read out is available only in the following combinations of waveforms: G1 to G4 and G5 to G8. Use the channel select keys  and  to select the waveform to be displayed with intensified brightness.
- Use the rotary knob or cursor keys to change the cursor position.



Cursor shift functions and procedures are the same as for the single-point cursor function (see Section 5.3.1, "Reading Out of Single Data Values (Single-Point Cursor)").

**Notes**

- This cursor function can be used only after measurement has been completed.
- This cursor function cannot be used while the waveform test function is in use and a test area is being created.
- This cursor function can also be used for logic input waveforms. Eight bit channel A or channel B values are displayed in the same order as for the single-point cursor function.





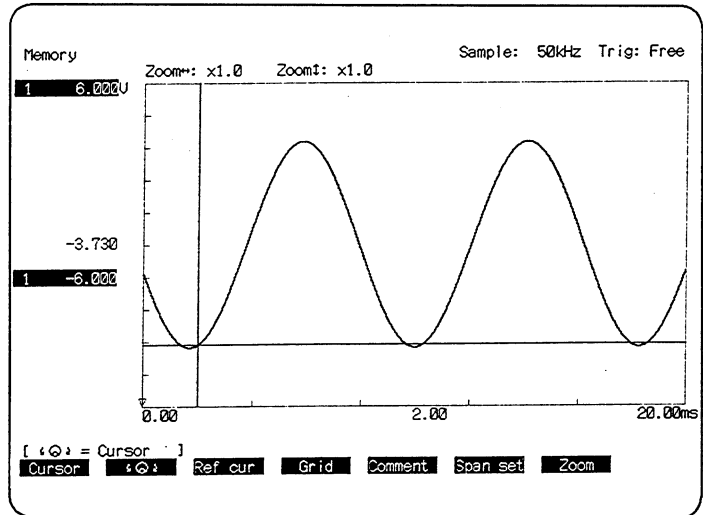
### 5.3.3 Reading Out Differences in Data Values and Times (Reference Cursor)

**Function**

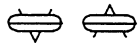
Allows the use of two cursors to find differences in data values and times.

**Procedure**

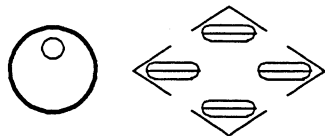
1.  Instrument enters cursor mode.
2.  Cursor is displayed on the panel.





3. The waveform on which the cursor is positioned is displayed with intensified brightness. The scale values are inverse video displayed. To select the waveform on which the cursor is to be positioned, use the channel select keys.

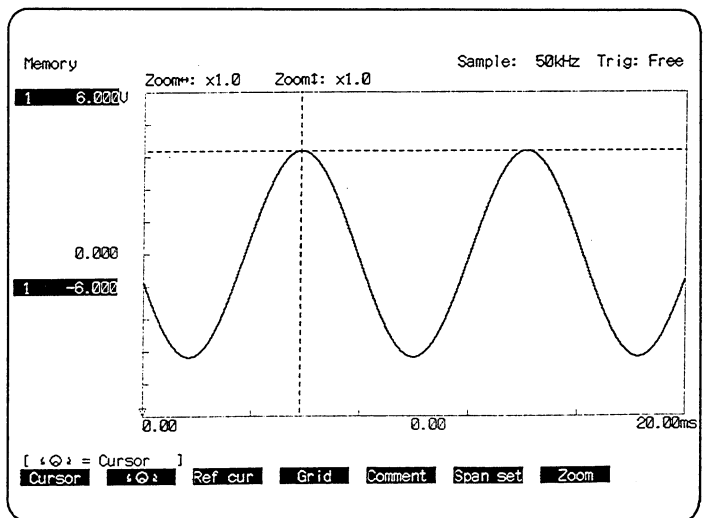


4. Use the rotary knob or cursor keys to move the cursor to the position to be set as a reference point.

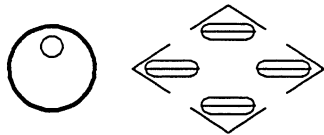


5.  The cursor position is set as a reference. The reference point is indicated by a dashed-line cursor.

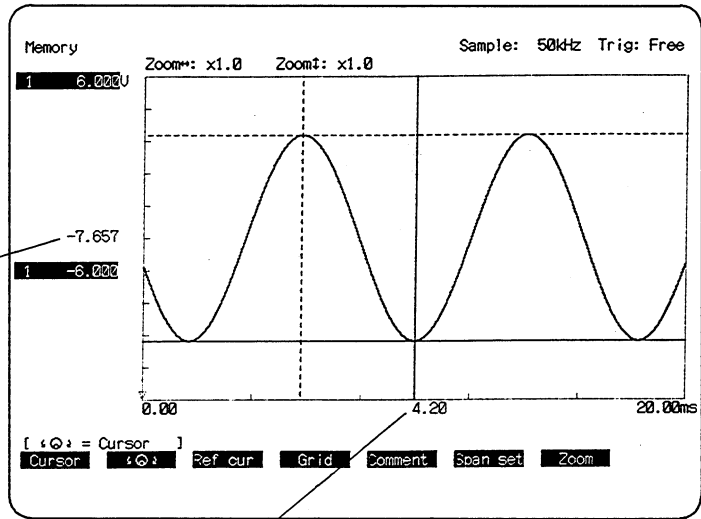
Pressing  again erases the reference point cursor.



6. Use the rotary knob or cursor keys to change the cursor position.



Difference in data value

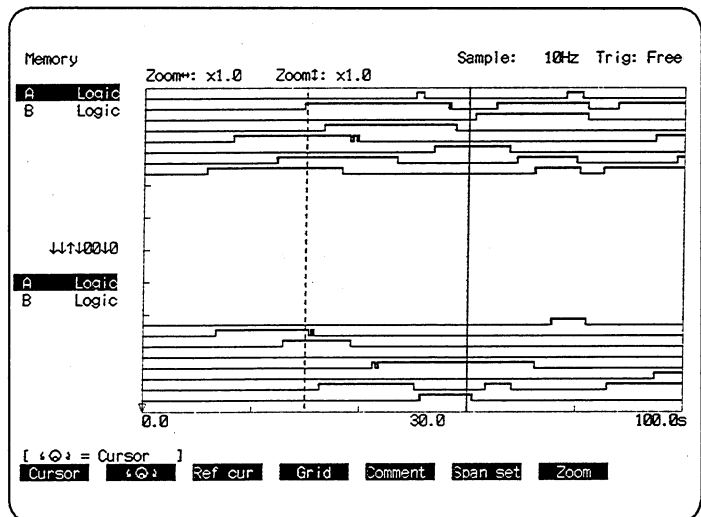


Time difference

Cursor shift functions and procedures are the same as for the single-point cursor function (see Section 5.3.1, "Reading Out of Single Data Values (Single-Point Cursor)").

● For Logic Input Waveforms

Data values are displayed using "0", "1", "↑", or "↓".  
 "0" or "1" shows that there was no change in data value.  
 "↑" shows that a value changed from "0" to "1"; "↓" shows that a value changed from "1" to "0".



Notes

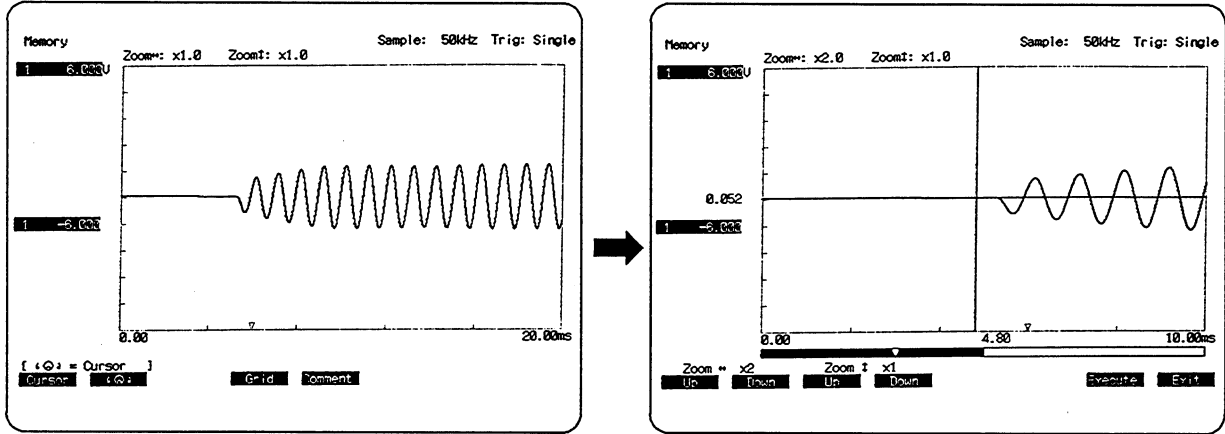
- This cursor function can be used only after measurement has been completed.
- This cursor function cannot be used while the waveform test function is in use and a test area is being created.
- This reference cursor can also be used while the multi-point cursor is in use. However in this case the horizontal cursor line is not displayed.

# 5.4 Enlarging Waveforms (ZOOM)

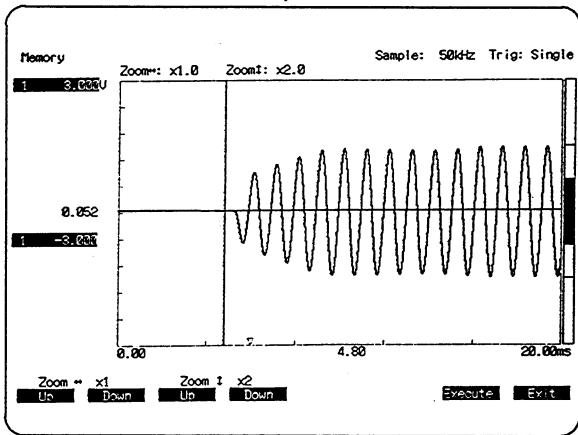
## Function

- Expands waveform data in the time axis direction for observation.
- Expands waveform data in the vertical axis direction for observation.

Time axis zooming



Vertical axis zooming



- For logic input waveforms (when Program=off), only time axis zooming is available.

### Zoom Position Display


When the zoom function is in use, the time axis displays the zoom position to show which portion of the memory corresponds to the displayed (zoomed) waveform. The time axis zoom position display also shows any trigger point.

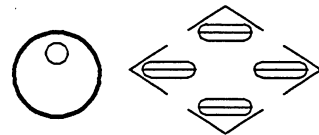
The vertical axis displays the zoom position to show which portion of 2 times of input range (possible maximum value of waveform movement).





However, at the channel executing temperature measurement there is no vertical axis zoom position.

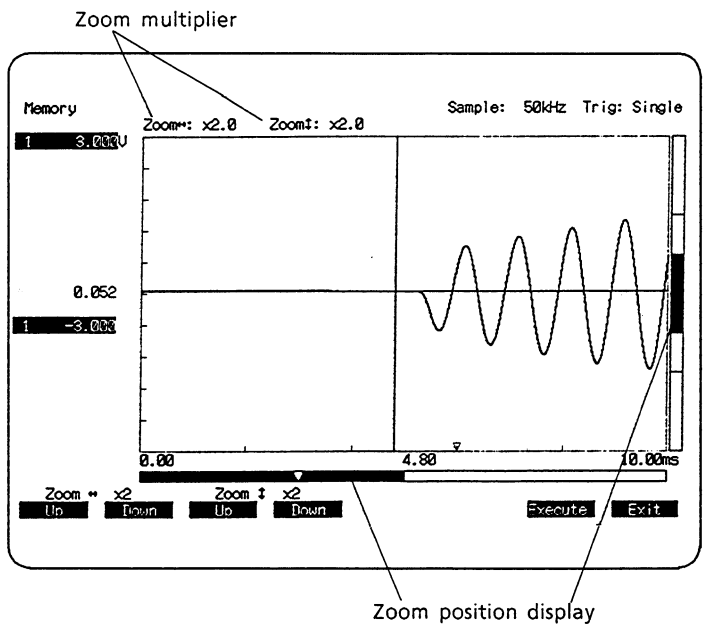
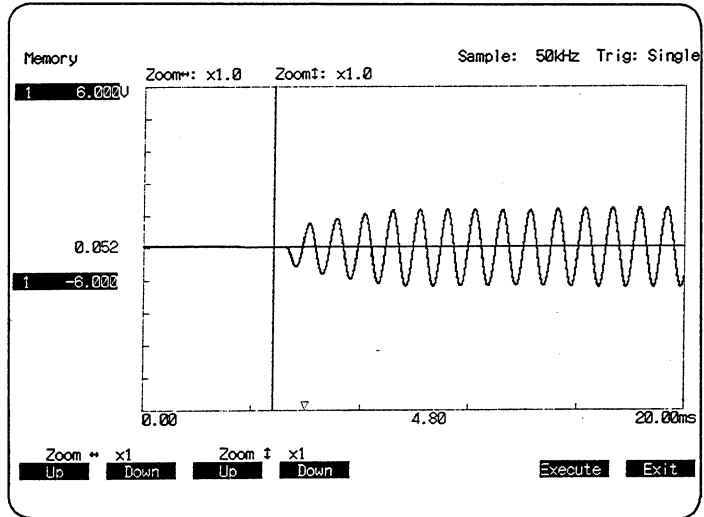
It is possible to disable zoom position display (see Section 8.19, "Disabling Zoom Position Display").

**Procedure** ... Display format=Single, Dual, or Quad

1. **CURSOR**  
  
 Instrument enters cursor mode.
2. **Cursor**  
 Cursor is displayed.
3. **Zoom**  
 Mode changes to zoom mode.
4. Select waveform to be zoomed in the vertical axis direction using the channel select keys.  
 The selected waveform is displayed with intensified brightness and the scale values are inverse video displayed.
5. Use the rotary knob or cursor keys to move the cursor to the center of the portion of the waveform to be zoomed.



- **Zoom** ↔  
   
 Set the zoom multiplier for the time axis direction.  
 The zoom multiplier display differs according to the specified memory size (see "Notes").
- **Zoom** ↑↓  
   
 Set the zoom multiplier for the vertical axis direction (x1/x2/x5/x10/x20).
- 6. **Execute**  
 The waveform to which the cursor applies is zoomed according to the specified zoom multiplier; the zooming is centred around the cursor position.



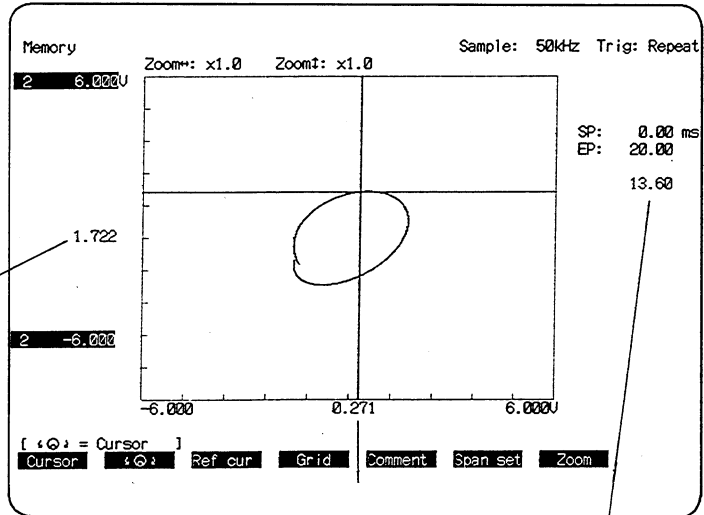
Note: Time axis zooming is effective for all the waveforms on display.

## 5.4 Enlarging Waveforms (ZOOM)

**Procedure** ... Display format = X-Y

1. **CURSOR**  
Instrument enters cursor mode.
2. **Cursor**  
Cursor is displayed.

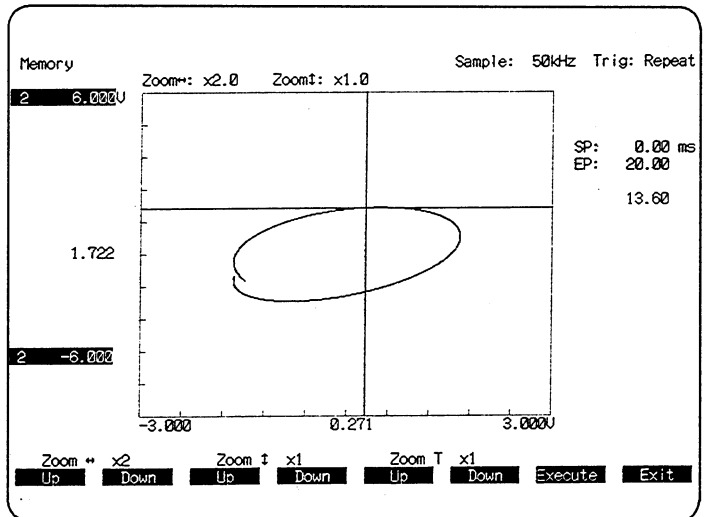
Y axis measurement value at the cursor point



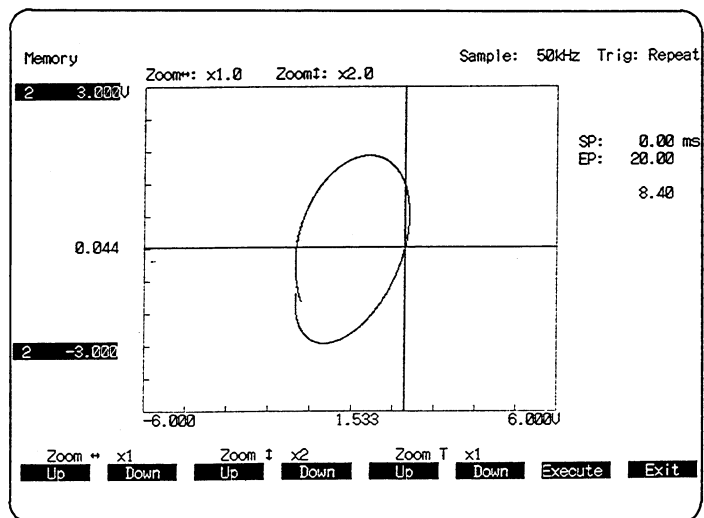
X axis measurement value at the cursor point

Time at the cursor point

3. **Zoom**  
The mode changes to zoom mode.
4. Select the waveform to be zoomed using the channel select keys.  
**Zoom** ↔
5. **Zoom** ↔  
up down  
Set the zoom multiplier for the X direction (x2 / x5 / x10 / x20).
6. **Zoom** ↑  
up down  
Set the zoom multiplier for the Y direction (x2 / x5 / x10 / x20).



7. **Zoom T**  
up down  
Time axis zooming is possible in X-Y display mode.
8. **Execute**  
The waveform is zoomed according to the specified zoom multiplier.



## Notes

### ■ Restrictions on Time Axis Direction Multipliers Related to the Specified Memory Size

The table below shows the multipliers in the time axis direction versus specified memory size.

Memory Size	Multiplier					
1k	2	4	10	20		
2k	2	4	8	20		
4k	2	4	8	16	40	
8k	2	4	8	16	32	
16k	2	4	8	16	32	64
32k	1.6	3.2	8	16	32	64
64k	1.6	3.2	6.4	16	32	64
125k	2.5	5	12.5	25	50	125
250k	5	10	25	50	100	250
500k	10	20	50	100	200	500
1M	10	40	100	200	400	1000

### ■ Display of Vertical Zoom Multiplier

When a display scale has been set (see Section 4.11, "Setting of Display Scale") the vertical axis multiplier represents the number of times that the range is greater than the display scale.

For example, if a 2 V range display scale is set to -1 V to +1 V, Zoom:  $\updownarrow$  2.0 is displayed.

$$\frac{4 \text{ (for a 2 V range, } -2 \text{ to } +2)}{2 \text{ (-1V to } +1\text{V)}} = 2.0$$

### ■ Preserving the Zoom Multipliers

When performing program start after the zoom function has been set, the user can specify whether to keep the zoom multipliers or to return to the initial conditions (see Section 8.18, "Preservation of Zoom Multipliers at Remeasurement or Redisplay").

### ■ Zooming of Logic Input Waveforms

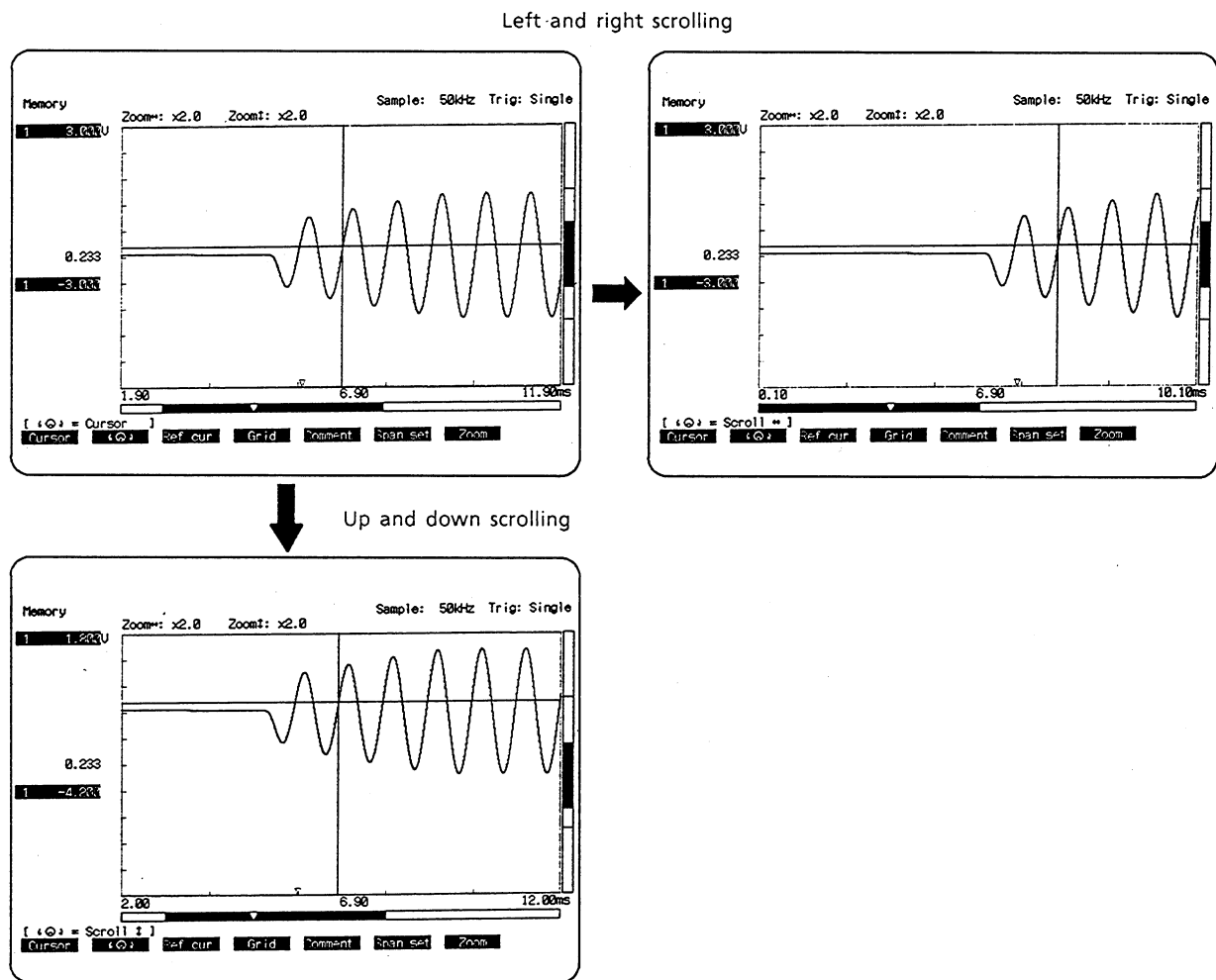
Zooming of logic input waveforms can only be carried out in the time axis direction. It is not possible to zoom in the vertical axis direction.

- For functions useful for cursor movement, see Section 5.3.1, "Reading Out of Single Data Values (Single-Point Cursor)".

## 5.5 Shifting Waveforms (SCROLL)

### Function

- Moves a zoomed waveform up and down, and to left and right.
- Up and down scrolling can be used even if the waveform is not zoomed.



- For logic input waveforms (when Program=off), only left and right scrolling can be used.

### Zoom Position Display

When the zoom function is in use, the time axis displays the zoom position to show which portion of the memory corresponds to the displayed (zoomed) waveform. The time axis zoom position display also shows any trigger point.

The vertical axis displays the zoom position to show which portion of 2 times of input range (possible maximum value of waveform movement).

However, at the channel executing temperature measurement there is no vertical axis zoom position.

It is possible to disable zoom position display (see Section 8.19, "Disabling Zoom Position Display").

**Procedure**

Scrolling is used when a waveform is in a zoomed state (see Section 5.4, "Enlarging Waveforms (ZOOM)").

Up and down scrolling can be used even if the waveform is not zoomed.

1. **CURSOR**  
Instrument enters cursor mode.
2. **Cursor**  
Cursor is displayed on the panel.
3. Select the waveform to be scrolled using the channel select keys.  
The selected waveform is displayed with intensified brightness and the scale values are inverse video displayed.

4. **(↺)**  
Each time the soft key is pressed, the display above the soft key changes between "Cursor", "Scroll↔", and "Scroll↕".  
[ (↺) = Cursor]

The cursor is moved using the cursor keys or rotary knob.

When the cursor reaches either the left or right panel extremity the waveform is scrolled.

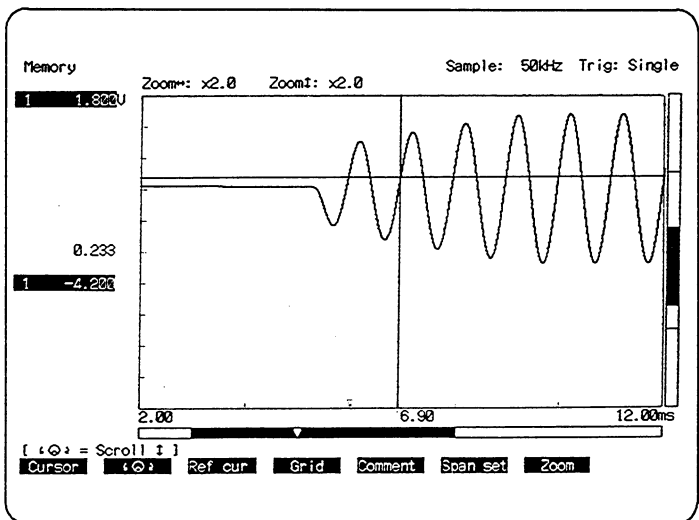
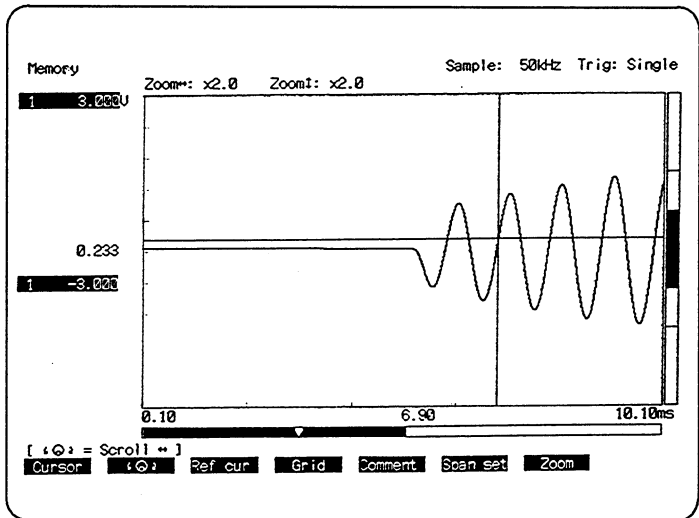
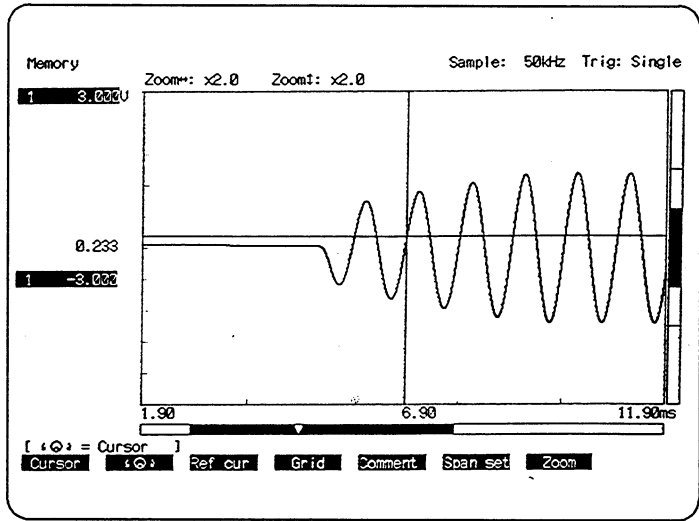
[ (↺) = Scroll ↔ ]

The waveform is moved to left and right using the cursor keys or rotary knob.

[ (↺) = Scroll ↕ ]

The waveform is moved up and down using the cursor keys or rotary knob.

- For functions useful for cursor movement, see Section 5.3.1, "Reading Out of Single Data Values (Single-Point Cursor)".






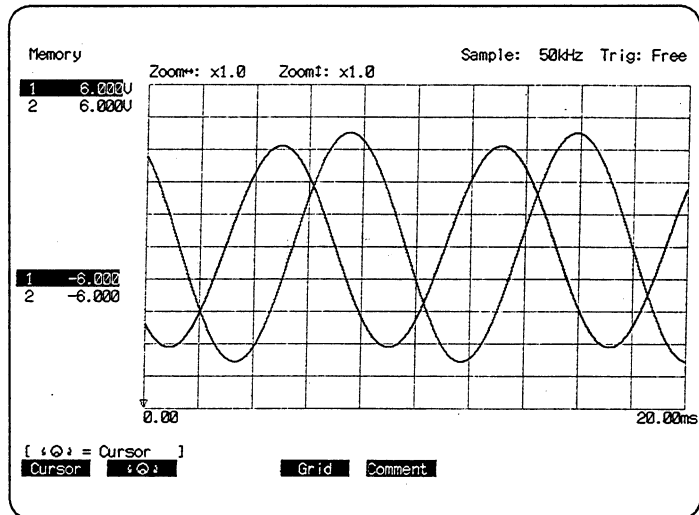
## 5.6 Inserting a Grid


### Function

Displays a grid on the waveform display panel to make it easier to compare the time relationships and data values of multiple waveforms.

### Procedure

1.  Instrument enters cursor mode.



2. 

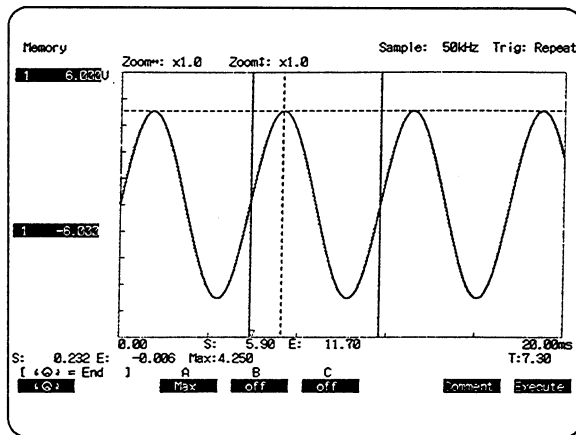
Pressing the soft key once displays a grid.  
 Pressing the key a second time clears the grid.  
 The number of grid lines is as follows,  
 For Single display: 10 horizontal, 10 vertical  
 For Dual display : 4 horizontal, 10 vertical  
 For Quad display : 2 horizontal, 10 vertical  
 For X-Y display : 10 horizontal, 10 vertical

# 5.7 Zone Statistical Computations

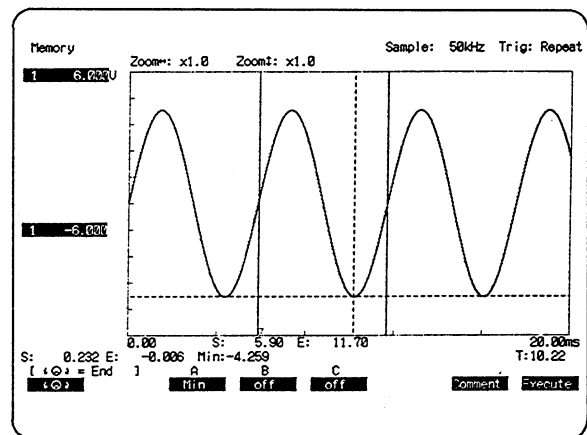
## Function

- The zone statistical computation function uses a pair of cursors to specify a zone on the waveform display panel over which to compute the maximum value, minimum value, P-P (peak-to-peak) amplitude, average, root-mean-square, standard deviation, or area.
- Up to three zone statistical computations can be simultaneously performed for one data sample in the same zone.
- When determining the standard deviation, the population can be specified as “n” or “n-1” (see Section 8.17, “Selecting Population for Standard Deviation Computation”).
- There are two methods (Negative integral=on and Negative integral=off) by which area may be computed.  
For the selection procedure, see Section 8.16, “Integral Computation Type Selection.”
- In the case of X-Y display, only area can be computed, but using either method (Integ 1 or Integ 2).

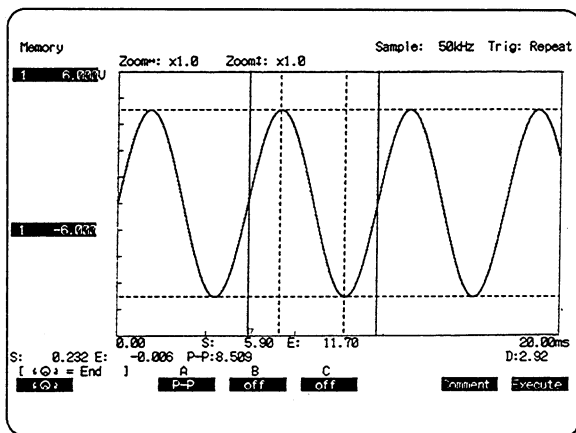
Maximum value (Max)



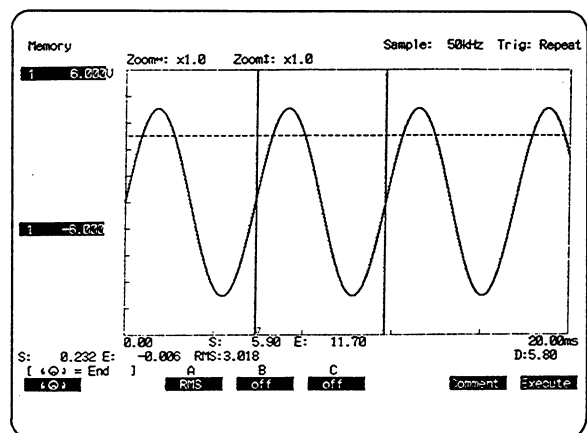
Minimum value (Min)



Peak to Peak (P-P)

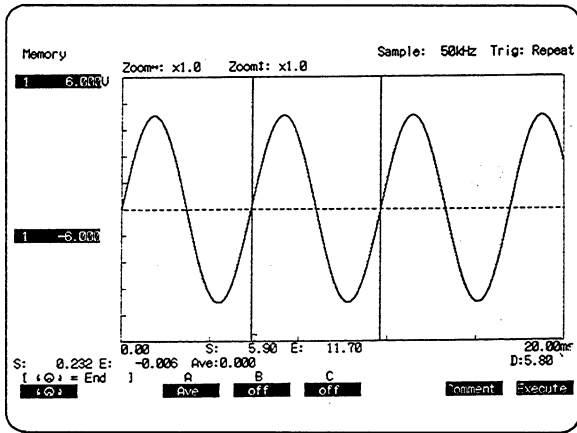


Root-mean-square (RMS)

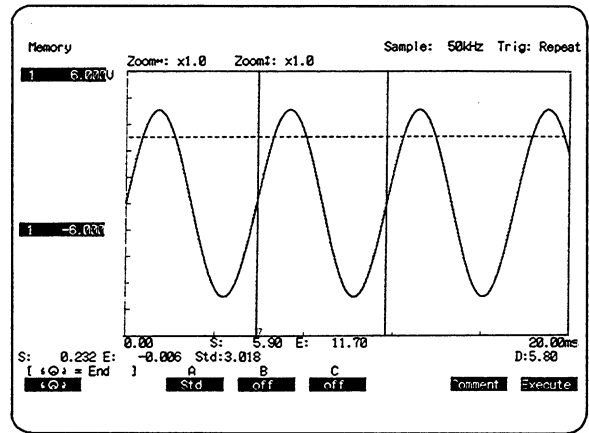


## 5.7 Zone Statistical Computations

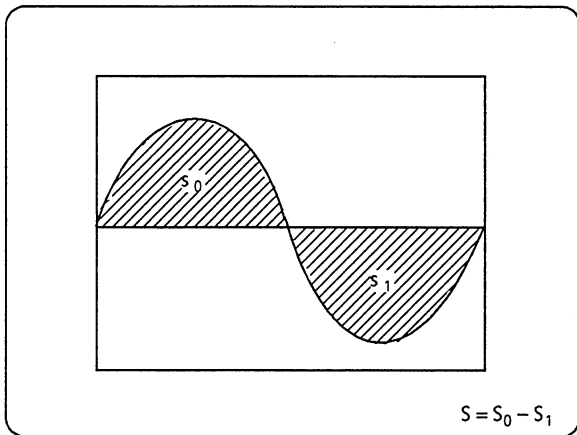
Average (Ave)



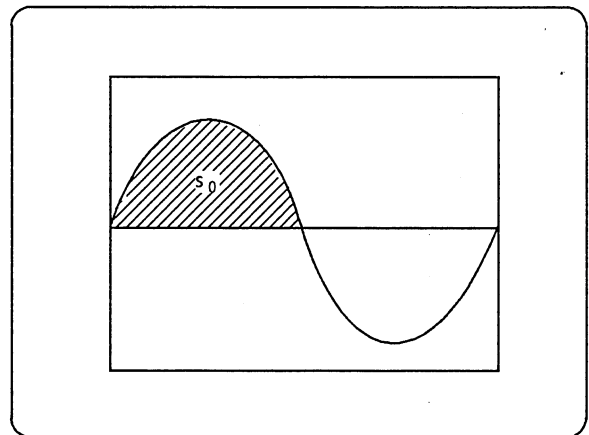
Standard deviation (Std)



Area (Negative integral = on)

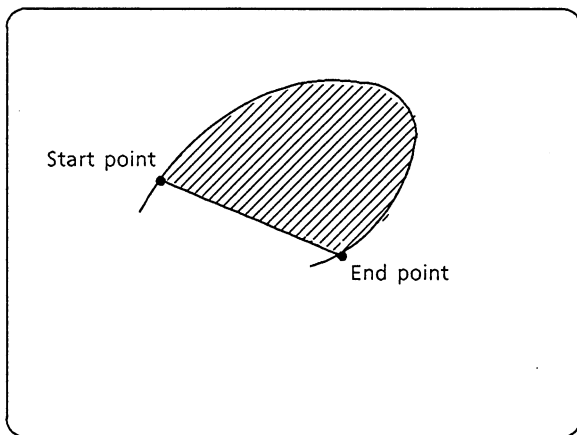


Area (Negative integral = off)

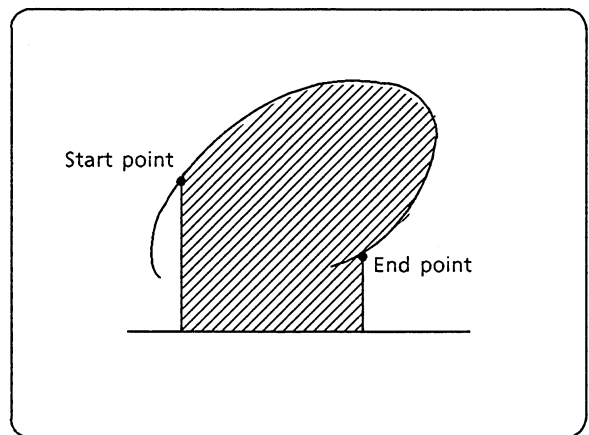


X-Y Display


Area (Integ1)

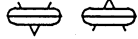


Area (Integ2)






**Procedure** ... When waveform panel is in Single Display, Dual Display, or Quad Display formats

1. **MEASURE**  
  
 Instrument enters the mode for zone statistical computations.
2. Select the waveform on which zone statistical computations are to be performed using the channel select keys.

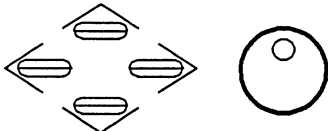


The selected waveform is displayed with intensified brightness and the scale values are inverse video displayed.

3.   
 The relevant display changes between [  ] = Start], [  ] = End].

Use the cursor keys or rotary knob to adjust the start cursor position and end cursor position ;

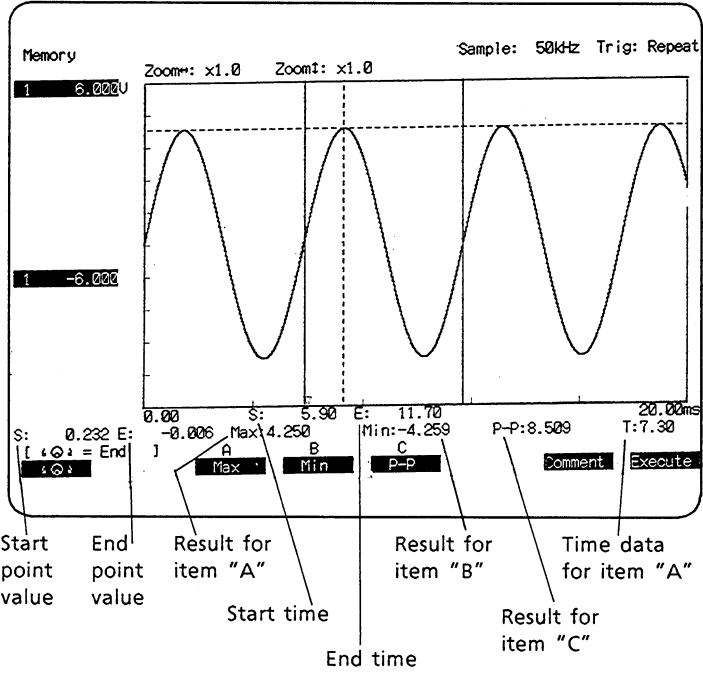
the start cursor position and end cursor position specify the zone for computation.



4. **A, B, C**  
 Each time the "A" soft key is pressed, the type of computation displayed on the soft key label changes in the sequence shown in parentheses below. The same is true for the "B" and "C" soft keys (Max/Min/P-P/Ave/RMS/Integ/Std/off).

5. **Execute**  
 Computation is executed.

■ For the computation function selected on soft key menu item "A", the display also gives the digital value for either the time along the time axis or the data value, and indicates the point or area of interest with a dashed-line cursor or cursors.



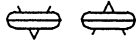
Computation for "A"	Digital Display	Dashed-Line Cursor (s)
Maximum value (max)	T: (Time of maximum value)	Maximum value
Minimum value (Min)	T: (Time of minimum value)	Minimum value
P-P value (P-P)	D: (Time difference between maximum value and minimum value)	Maximum value and minimum value
Average (Ave)	D: (Time difference between start point and end point)	Average value
Root-mean-square (RMS)	D: (Time difference between start point and end point)	Root-mean-square
Area (Integ)	D: (Time difference between start point and end point)	Dashed-line cursor not visible due to superimposition on solid-line cursor
Standard deviation (Std)	D: (Time difference between start point and end point)	Standard deviation

**Procedure** ... When waveform panel is in X-Y display format

1. **MEASURE**

Instrument enters the mode for zone statistical computations.

2. Select the waveform on which zone statistical computations are to be performed using the channel select keys.

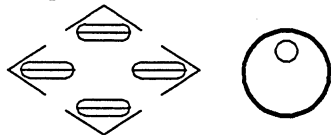


The selected waveform is displayed with intensified brightness and the scale values are inverse video displayed.

3.

The relevant display changes between [ = Start ], and [ = End ].

Use the cursor keys or rotary knob to adjust the start cursor position and end cursor position ; the start cursor position and end cursor position specify the zone for computation.

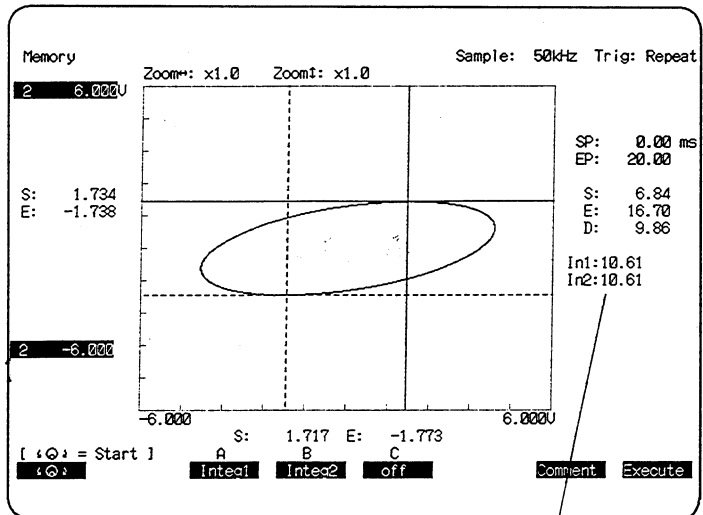


4. **A, B, C**

Each time the "A" soft key is pressed, the type of computation displayed on the soft key label changes in the sequence shown in parentheses below. The same is true for the "B", and "C" soft keys (Integ 1 / Integ 2 / off).

5. **Execute**

Computation is executed.



Result of computation

**Notes**

- Zone statistical computations cannot be performed when the cursor function is in use. To perform zone statistical computations on a waveform that has been zoomed or scrolled, the user must first clear the cursor from the waveform panel before beginning the operations.
- If there is illegal data within the specified zone, zone statistical computations cannot be performed.  
The following constitute illegal data :
  - Overrange data
  - Erroneous computation data generated in computations (see "Notes" in Section 4.9, "Setting PROGRAM (Computations) to ON").
- Zone statistical computations cannot be performed for logic input waveforms.
- For functions useful for cursor movement, see Section 5.3.1, "Reading Out of Single Data Values (Single-Point Cursor)".

**Remarks**

■ **Methods for Computing Root-Mean-Square, Average, Standard Deviation, and Area**

Ave : Average 
$$\left( = \frac{\sum_{i=m}^n D(i)}{n - m + 1} \right)$$

RMS : Root-mean-square 
$$\left( = \sqrt{\frac{\sum_{i=m}^n D^2(i)}{n - m + 1}} \right)$$

Std : Standard deviation within the cursor-defined zone 
$$\left( = \sqrt{\frac{\sum_{i=m}^n (D(i) - \text{AVE})^2}{\text{Note } n - m + 1}} \right)$$

Note : User can specify "n-1" instead of "n" (see Section 8.17, "Selecting Population for Standard Deviation Computation").

AVE : Average within the cursor-defined zone 
$$\left( = \frac{\sum_{i=m}^n (D(i))}{n - m + 1} \right)$$

Where

- D(i) is a Data Value.
- m is the Start point data number.
- n is the End point data number.

Integ : Area 
$$\left\{ = \left( \sum_{i=m+1}^{n-1} D(i) + \frac{D(m) + D(n)}{2} \right) \times \Delta t \right\}$$

Here

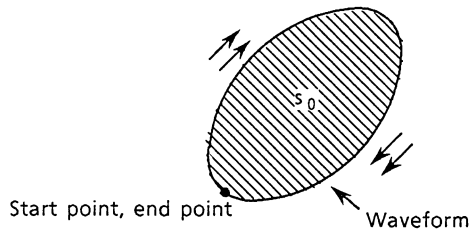
- D(i) is a Data Value.
- m is the Start point data number.
- n is the End point data number.
- Δt is the Sampling time.

■ **Calculating the Area on an X-Y Display**

The difference between “Integ 1” and “Integ 2”, when calculating the area on an X-Y display, is as follows.

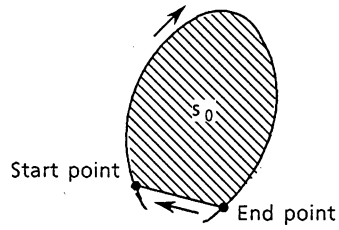
① **When Integ 1 is Selected**

(i) For multiple loop



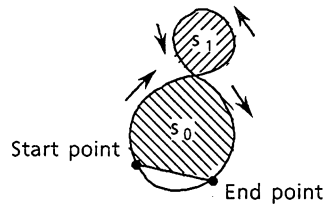
Area  $S = n \times s_0$   
 $N$  : No. of loops

(ii) For open curve



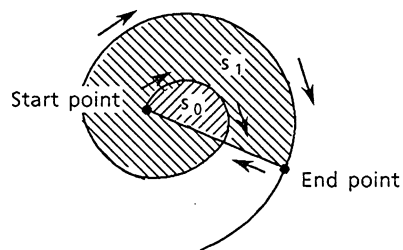
Area  $S = s_0$   
 Area enclosed by curve with start point and end point connected by straight line

(iii) For figure-8 loop



Area  $S = |s_0 - s_1|$

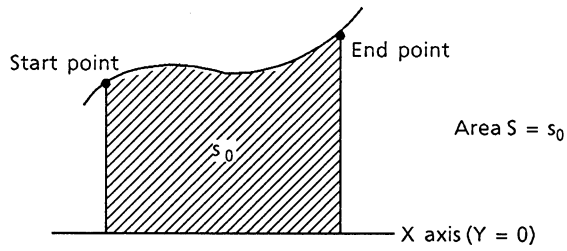
(iv) For spiral loop



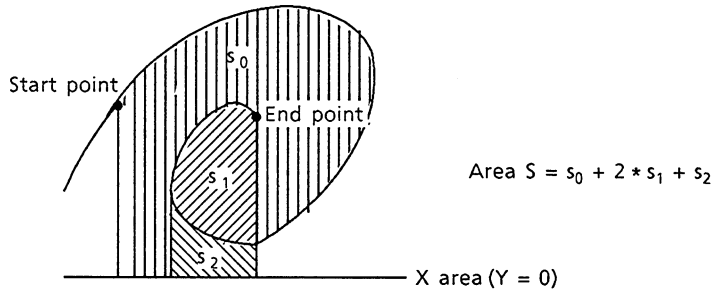
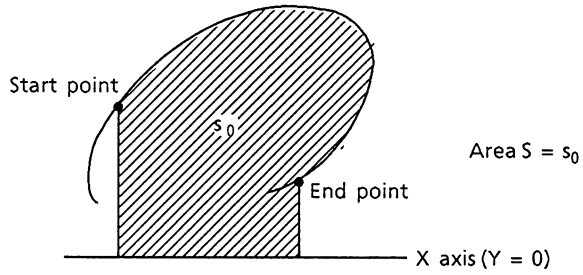
Area  $S = s_0 \times 2 + s_1$   
 As the number of loops increases, the number of overlapping areas also changes.

② When Integ 2 is Selected

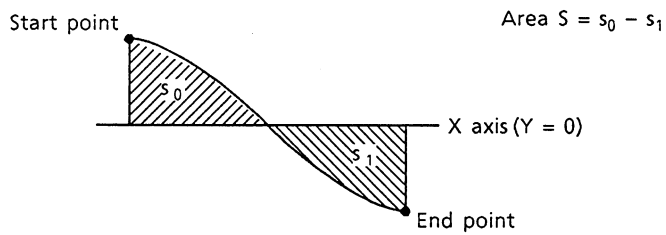
(i) When there is only one Y data point for each X data point



(ii) When there are several Y data points for each X data point

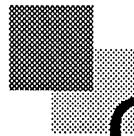


(iii) For waveform with negative (minus) amplitude









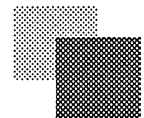
# Chapter 6

## Memory Mode / Printing out Data

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Here we explain the various ways of printing out waveform data contained in the main unit's memory.

6.1 Summary of Print-out Functions .....	6-2
6.2 Taking a Hard Copy of the CRT Screen .....	6-3
6.3 Setting up for a High Resolution Print-out of the Displayed Waveform .....	6-4
6.4 Setting up for an Analog Print-out .....	6-6
6.5 Setting up for a Digital Print-out .....	6-8
6.6 Setting up to print out using an External Plotter .....	6-10
6.7 Print-out and Paper Feed .....	6-15
6.8 Printing out a Setup List .....	6-16



## 6.1 Summary of Print-out Functions

When measurement (sampling) has been carried out in Memory Mode and data stored in the main unit's memory, that data may be printed out using the main unit's built-in thermal printer or using an external plotter (if the plotter is HP-GL compatible). Setup Information may also be printed out.

### ■ Printing out Using the Built-in Printer

#### ● Copy

This function allows an A4 size or A5 size hard copy of the CRT screen to be printed out. Print-out can be quickly and simply carried out with a resolution identical to that of the CRT screen.

It is possible to print out not only waveforms but also panels showing setup information.

#### ● Plot

This function allows an A4 size print-out of the waveform displayed on the CRT screen but with a higher resolution than Copy.

Such items as the soft key menu are not included in the print-out but it is possible to enter a title.

#### ● Analog

This function allows an analog print-out of measured data or computed data, either in full or for a specified section of the data only; the time-axis resolution for the print-out may be specified by the user, allowing an expanded or contracted version of the waveform to be produced.

A title may also be entered.

#### ● Digital

This function allows a digital print-out (discrete numerical values) of measured data, either in full or for a specified section of the data only.

A title may be added to the print-out.

### ■ Printing out Using an External Plotter (for Models with GP-IB or RS-232-C option only)

Print-out to an external plotter is possible via GP-IB or RS-232-C interface; however the plotter must be HP-GL compatible.

Pen colours may be specified for particular waveforms and a title may be added to the print-out.

### ■ Printing out a Setup Listing

A listing of the various kinds of setup information such as Input Range, Trigger Conditions and Display Format can be printed out on Chart Paper.

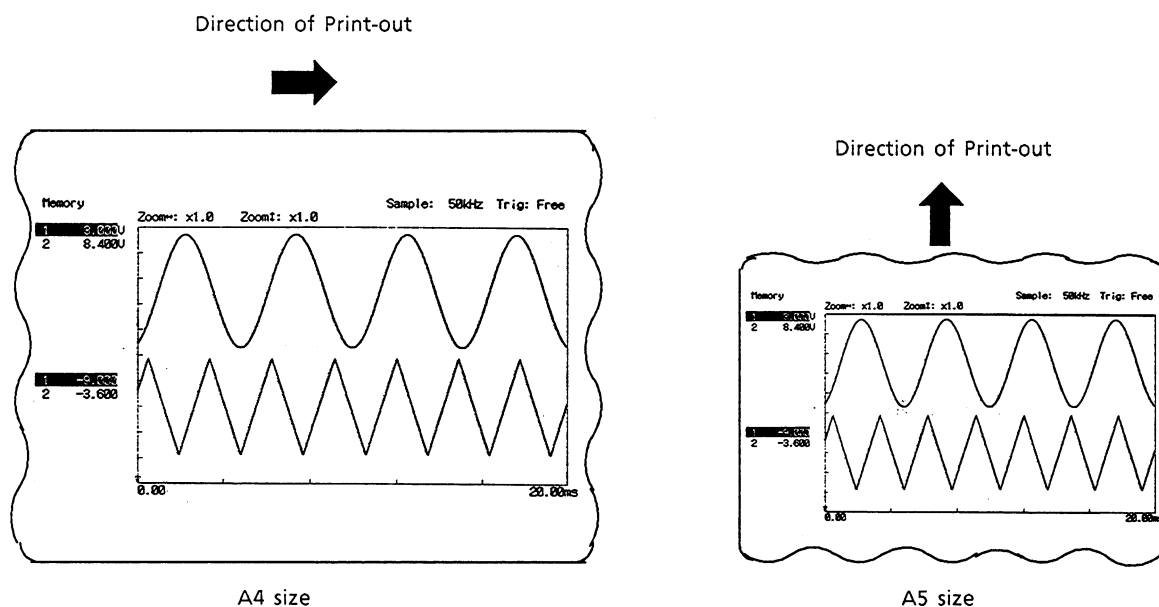
## 6.2 Taking a Hard Copy of the CRT Screen

### Function


This function allows an A4 size or A5 size hard copy of the CRT screen to be printed out. In the case of an A4 size hard copy you may further specify the length of the print-out as either 297mm or 279mm (letter size).

Print-out can be quickly and simply carried out with a resolution identical to that of the CRT screen.

It is possible to print out not only waveforms but also panels showing setup information.






### Procedure

1. 

Pressing the COPY key commences print-out of the CRT screen hard copy.

- The hard copy size can be set using the MISC panel. For details of the procedure please refer to Section 11.4 "Recording Related Settings".

### Notes

- The  key is rendered ineffective in the following cases.
  - When print-out is already being performed by the main unit's built-in printer or by an external plotter.
  - When the  key has been pressed and measurement is still in progress.
  - When the  key has been pressed and data is in the process of redisplay.
- If there is no Chart Paper in the main unit's built-in printer or if the Chart Paper runs out, "Chart empty" or "Chart exhausted" will be displayed on the CRT screen. In such cases Chart Paper should be inserted in the printer.

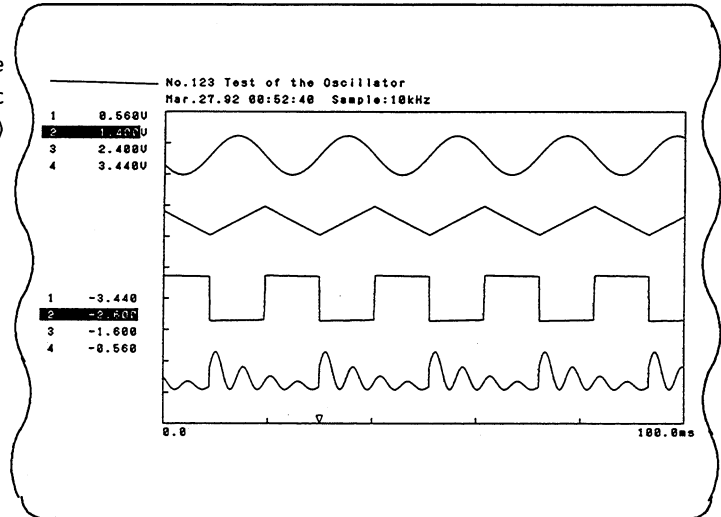
## 6.3 Setting up for a High Resolution Print-out of the Displayed Waveform

### Function

This function allows an A4 size print-out of the waveform displayed on the CRT screen but with a higher resolution than "Hard Copy".

Items such as the soft key menu are not included in the print-out but it is possible to enter a title up to 40 characters in length.

Title  
(the title entered using the Alphanumeric Keypad is printed out)



### Procedure

- PRINT FORMAT**

Pressing the PRINT FORMAT key calls up the Print Format settings panel.
- Output device**

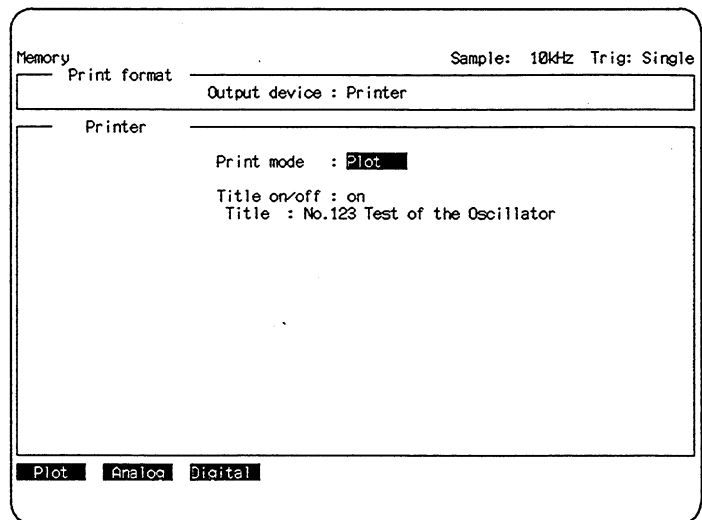
This allows selection of either the main unit's built-in printer (Printer) or an external plotter (Plotter).

Select Printer by pressing the **Printer** soft key.
- Print mode**

Select Plot by pressing the **Plot** soft key.
- Title on/off**

This allows you to select whether or not to insert a title.
- Title**

If you have chosen to insert a title, it can be entered using the Alphanumeric Keypad or the soft keys. The title may be up to a maximum of 40 characters in length. Once the title has been decided, it is confirmed by pressing the **ENTRY** key.
- Press the **START** or **PROGRAM START** keys to display the waveform on the CRT screen; then press the **PRINT** key to produce a high resolution print-out of the displayed waveform.



**Note**

■ When Print mode=Plot, the data is processed internally; "Image processing..." is displayed on the CRT screen while the internal data processing is taking place.

**Memo**

The following table can be used as a reference for the time required for print-out. The exact print-out time will vary somewhat according to the nature of the waveforms being printed out. It is recommended that you select Print mode=Analog when the number of data points is 125k or more, as the time required for a Plot copy can become excessive in such cases. For further details please refer to Section 6.4 "Setting up for an Analog Print-out".

No. of Data Points \ No. of Waveforms	Print-out Time	
	4	8
1k	18 sec.	22 sec.
2k	22 sec.	29 sec.
4k	26 sec.	38 sec.
8k	35 sec.	54 sec.
16k	50 sec.	1 min. 25 sec.
32k	1 min. 21 sec.	2 min. 28 sec.
64k	2 min. 23 sec.	4 min. 32 sec.

These results were produced under the following conditions :

- Input Signal            200Hz, 1V<sub>P-P</sub> Sine Wave
- Sampling Rate        50kHz
- Measurement Range   DC, 6V, Filter "off", Computational Processing "off".

## 6.4 Setting up for an Analog Print-out

### Function

This function allows an analog print-out of measured data or computed data, either in full or for a specified section of the data only; the time-axis resolution for the print-out may be specified by the user, allowing an expanded or contracted version of the waveform to be produced.

A title up to 40 characters in length may also be entered.

You can specify whether to insert a grid; if a grid is to be inserted, it may be specified as either Fine or Coarse.

Graph Nos. may also be printed out.

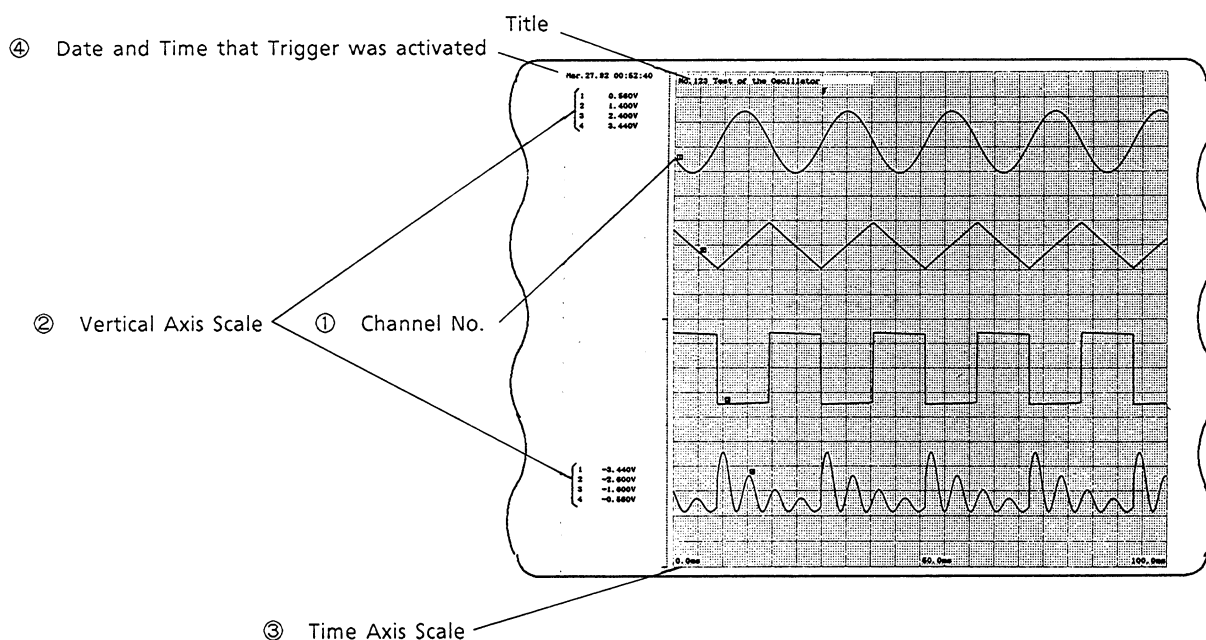
Analog print-out is always carried out in Single display format, irrespective of the Display Format selected for display on the CRT screen (Single, Dual, Quad, X-Y). However, the Graph Nos. specified using the Display Format panel are effective.

The width of the print-out is 200mm.

You can select whether or not to print out each of the following items:

- ① Channel No.
- ② Vertical Axis Scale
- ③ Time Axis Scale
- ④ Date and Time that Trigger was activated

For details of the procedure please refer to Section 11.4 "Recording Related Settings".

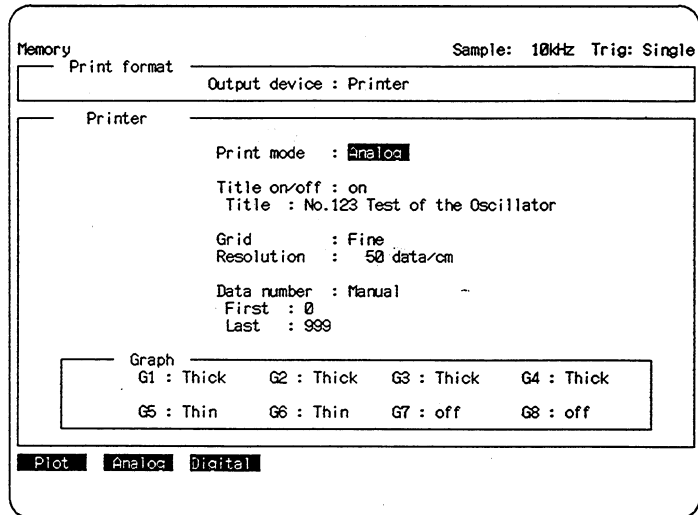


### Notes

- When data has been loaded into the main unit's memory from an IC Memory Card or Floppy Disk, first display the data in Single format on the CRT screen and then carry out the Analog print-out.
- The print-out range may also be specified using a waveform displayed on the CRT screen. For full details of this procedure please read Section 8.11 "Setting Recording Range and Saving Range on the Waveform Panel".

## Procedure

1. **PRINT FORMAT**  
 Pressing the PRINT FORMAT key calls up the Print Format settings panel.
2. **Output device**  
 This allows selection of either the main unit's built-in printer (Printer) or an external plotter (Plotter).  
 Select Printer by pressing the **Printer** soft key.
3. **Print mode**  
 Select Analog by pressing the **Analog** soft key.
4. **Title on / off**  
 This allows you to select whether or not to insert a title.
5. **Title**  
 If you have chosen to insert a title, it can be entered using the Alphanumeric Keypad or the soft keys. The title may be up to a maximum of 40 characters in length.  
 Once the title has been decided, it is confirmed by pressing the **ENTRY** key.
6. **Grid**  
 You can select whether or not to insert a grid on the print-out ("off" indicates that a grid is not desired); if a grid is to be inserted, it may be specified as a fine grid ("Fine") or more coarse grid ("Normal").  
 (Fine / Normal / off)
7. **Resolution**  
 The time axis resolution can be specified in terms of the number of data points per 1cm of the time axis.  
 (100/25/50/200/400/1000)
8. **Data number**  
 This allows you to select whether to print out all the data for the entire span of the memory size ("Auto") or to print out only a specified region within that entire span ("Manual").
9. **First**  
 Use the Alphanumeric Keypad to input the data number from which you wish to begin analog print-out.  
 Once decided, it is confirmed by pressing the **ENTRY** key.
10. **Last**  
 Use the Alphanumeric Keypad to input the data number at which you wish to end analog print-out.  
 Once decided, it is confirmed by pressing the **ENTRY** key.
11. **Graph**  
 This allows you to select whether or not to print out the waveforms for the Graph numbers specified using the Display Format settings panel. If you do not wish to print out the waveform for a particular Graph number, select "off". If you do wish to print out the waveform for a particular Graph number, it should be specified as either a thick trace ("Thick") or a thin trace ("Thin").
12. Press the **START** or **PROGRAM START** keys to display the waveform on the CRT screen; then press the **PRINT** key to produce an analog print-out of the displayed waveform.





## 6.5 Setting up for a Digital Print-out

### Function

This function allows a digital print-out (discrete numerical values) of measured data or computed data, either in full or for a specified section of the data only.











It is possible to specify the interval between the data to be printed out.

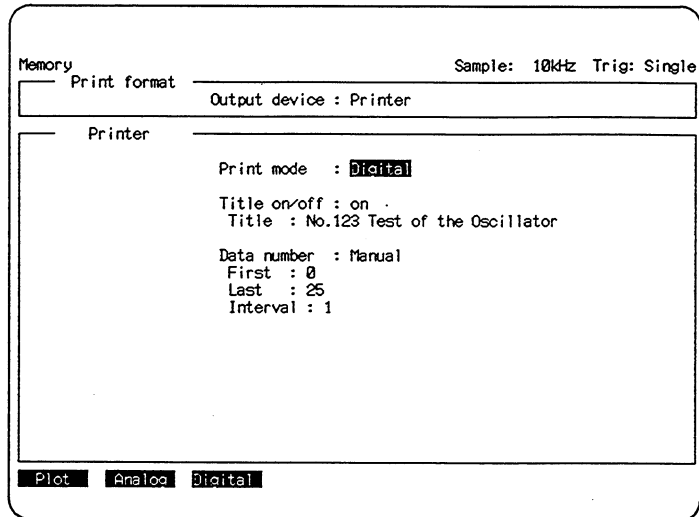
A title up to 40 characters in length may be entered.

No.123 Test of the Oscillator Mar. 27.92 00:52:40 Sample:10kHz

Data No	[V 1]	[V 2]	[V 3]	[V 4]
0	-0.123	0.126	0.289	0.034
1	-0.129	0.122	0.290	0.028
2	-0.136	0.119	0.288	0.021
3	-0.142	0.114	0.288	0.013
4	-0.148	0.111	0.288	0.004
5	-0.154	0.107	0.288	-0.004
6	-0.159	0.104	0.288	-0.014
7	-0.165	0.101	0.289	-0.024
8	-0.171	0.097	0.288	-0.035
9	-0.176	0.094	0.288	-0.043
10	-0.181	0.089	0.288	-0.053
11	-0.186	0.084	0.287	-0.063
12	-0.191	0.081	0.288	-0.072
13	-0.196	0.077	0.288	-0.082
14	-0.200	0.074	0.288	-0.090
15	-0.205	0.071	0.288	-0.098
16	-0.209	0.067	0.288	-0.104
17	-0.212	0.064	0.288	-0.110
18	-0.216	0.060	0.287	-0.115
19	-0.220	0.056	0.288	-0.119
20	-0.224	0.053	0.287	-0.123
21	-0.227	0.049	0.285	-0.125
22	-0.231	0.045	0.287	-0.125
23	-0.233	0.042	0.285	-0.125
24	-0.235	0.039	0.287	-0.125
25	-0.237	0.036	0.288	-0.124

## Procedure

1.  Pressing the PRINT FORMAT key calls up the Print Format settings panel.
2. **Output device**  
This allows selection of either the AR1100A's built-in printer (Printer) or an external plotter (Plotter).  
Select Printer by pressing the  soft key.
3. **Print mode**  
Select Digital by pressing the  soft key.
4. **Title on/off**  
This allows you to select whether or not to insert a title.
5. **Title**  
If you have chosen to insert a title, it can be entered using the Alphanumeric Keypad or the soft keys. The title may be up to a maximum of 40 characters in length.  
Once the title has been decided, it is confirmed by pressing the  key.
6. **Data number**  
This allows you to select whether to print out all the data for the entire span of the memory size ("Auto") or to print out only a specified region within that entire span ("Manual").
7. **First**  
Use the Alphanumeric Keypad to input the data number from which you wish to begin digital print-out.  
Once decided, it is confirmed by pressing the  key.
8. **Last**  
Use the Alphanumeric Keypad to input the data number at which you wish to end digital print-out.  
Once decided, it is confirmed by pressing the  key.
9. **Interval**  
Use the Alphanumeric Keypad to enter the spacing (number of data points) between the numerical values which are to be printed out.  
Once decided, it is confirmed by pressing the  key.
10. Press the  or  keys to display the waveform on the CRT screen; then press the  key to produce a digital print-out of the waveform.



## Note

- The print-out range may also be specified using a waveform displayed on the CRT screen. For full details of this procedure please read Section 8.11 "Setting Recording Range and Saving Range on the Waveform Panel".

## 6.6 Setting up to print out using an External Plotter

### Function

Print-out to an external plotter is possible via GP-IB or RS-232-C interface ; however the plotter must be HP-GL compatible.

A title up to 40 characters in length may be entered.

It is possible to specify an A4 size plot, an A3 size plot or two A5 size plots (upper and lower) on an A4 sheet.

The pen speed may be altered.

It is possible to select whether to plot waveforms with or without a surrounding border. When comparing a second waveform with an earlier waveform, it is more convenient to plot the second waveform without a surrounding border.

The plotter pen number can be changed for each waveform so that colour coding of waveforms is possible.

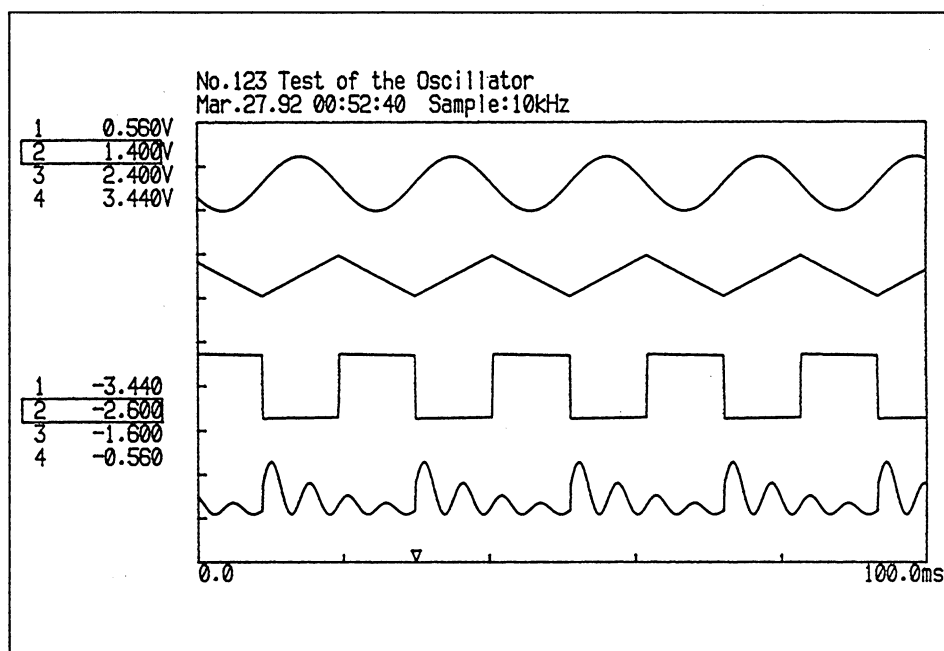
AR1100As fitted with the GP-IB Interface option must be used with a GP-IB compatible plotter.

Similarly, main units fitted with the RS-232-C Interface must be used with an RS-232-C compatible plotter.

(Note) This function is for the models with GP-IB or RS-232-C interface option only.

The following plotters are recommended by YOKOGAWA.

Paper Size Manufacturer and Model	A3	A4	A5 Upper	A5 Lower
HP 7475A, 7550A	○	○	○	○
Roland DXY-990 (RS-232-C)	○	○	○	○



### ■ Setting of the AR1100A / AR1200 (GP-IB Interface Model)

Generally speaking, the main unit is set to “Talk only” and the plotter to “Listen only” when using the GP-IB Interface.

Please read Section 11.10 “Communication Related Settings” and set the GP-IB mode to “Talk only”.

### ■ How to connect the AR1100A / AR1200 (GP-IB Interface Model) and Plotter

1. Before connecting the main unit and Plotter please make sure you have carried out the above communications related setup procedures for an main unit fitted with GP-IB Interface.
2. Carry out any necessary setup procedures for the Plotter.
3. Set the main unit’s power switch to off.
4. Switch off the power to the Plotter.
5. Connect the GP-IB Connector on the Rear Panel of the main unit to the Plotter’s GP-IB Connector using GP-IB Cable. The Cable should be securely fixed using the attached screws.

(Note) Generally speaking, a one-to-one connection should be made between Plotter and AR1100A / AR1200.

6. Set the main unit’s power switch to on.
7. Switch on the power to the Plotter.

### ■ Setting of the AR1100A / AR1200 (RS-232-C Interface Model)

Generally speaking, communications are carried out using the Handshake system. Please read Section 11.10 “Communication Related Settings” and be sure to enter all settings correctly. All of the items must be set correctly to assure normal Plotter operation.

Pay particular attention that “Set & Out” is entered as the 232C mode and that the Handshake setting matches the Plotter.

### ■ How to connect the AR1100A / AR1200 (RS-232-C Interface Model) and Plotter

1. Before connecting the main unit and Plotter please make sure you have carried out the above communications related setup procedures for an AR1100A / AR1200 fitted with RS-232-C Interface.
2. Carry out any necessary setup procedures for the Plotter.
3. Set the main unit’s power switch to off.
4. Switch off the power to the Plotter.
5. Please check the internal wiring of the RS-232-C Cable to be used for connection. RS-232-C Cables can have a number of permutations of internal pin connection in spite of an identical external appearance. Please be sure to employ a cable that is suited to the communications that are to be carried out between the main unit and the Plotter being used.
6. Connect the RS-232-C Connector on the Rear Panel of the main unit to the Plotter’s RS-232-C Connector using RS-232-C Cable. The Cable should be securely fixed using the attached screws.
7. Set the main unit’s power switch to on.
8. Switch on the power to the Plotter.

#### Notes

- Use “Talk only” for GP-IB communications.

- Use the Handshake system for RS-232-C communications.  
The Handshake must be set correctly to assure normal operation of the Plotter.

## 6.6 Setting up to print out using an External Plotter

### Procedure

The communications related settings must be carried out beforehand.

For full details of the procedures please read Section 11.10 "Communication Related Settings".

(Note) Use "Talk only" for GP-IB communications and the Handshake system for RS-232-C communications.

1. **PRINT FORMAT**  
Pressing the PRINT FORMAT key calls up the Print Format settings panel.

2. **Output device**  
This allows selection of either the main unit's built-in printer (Printer) or an external plotter (Plotter).

Select Plotter by pressing the **Plotter** soft key.

3. **Title on/off**  
This allows you to select whether or not to insert a title.

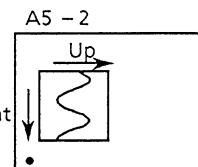
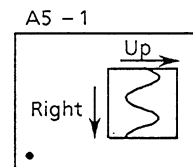
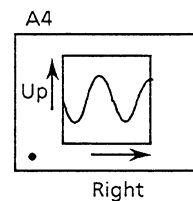
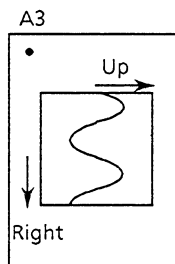
4. **Title**  
If you have chosen to insert a title, it can be entered using the Alphanumeric Keypad or the soft keys. The title may be up to a maximum of 40 characters in length. Once the title has been decided, it is confirmed by pressing the **ENTRY** key.

5. **Paper size**  
This allows you to specify the size of the paper for plotting. You can select whether to generate an A4 size plot, an A3 size plot or to generate an A5 size plot to the top of an A4 sheet or to the bottom of an A4 sheet.

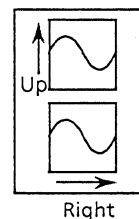
6. **Pen speed**  
This allows you to select either a fast pen speed ("Normal") or a slow pen speed ("Slow") for the external Plotter.

(Normal/Slow)  
If "Slow" is selected, the plot takes longer to complete but has better resolution.

Pen number			
Title : 1	Label : 2	Axis : 3	Cursor : 4
G1 : 5	G2 : 6	G3 : 7	G4 : 8
G5 : 9	G6 : 10	G7 : 11	G8 : 12



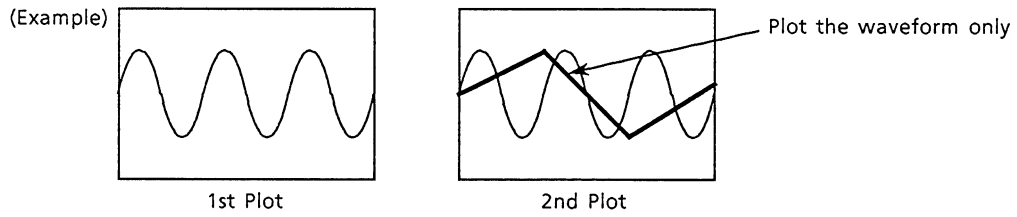
(Note) If A5-1 or A5-2 are selected, two graphs can be plotted on one A4 sheet.



**7. Draw border**

Here you can select whether to plot waveforms with or without a surrounding border (Yes/No). If "No" is selected, the waveform alone is plotted.

When comparing a second waveform with an earlier waveform, it is more convenient to plot the second waveform without a surrounding border.



**8. Pen number**

An individual pen number can be specified for the Title, Label, Axis, Cursor and Graph Numbers G1 to G8. The number of pen numbers that can be specified will differ according to the Plotter being used.

## 6.6 Setting up to print out using an External Plotter

Example of  
Setting

### ... Procedure for HP 7550A Plotter (using GP-IB Interface)

1. The GP-IB mode of the main unit should be set to "Talk only".  
It is meaningless to set an Address in this case.
2. Set the HP-IB mode of the Plotter to "LISTEN ONLY" (For details of the procedure please refer to the Instruction Manual of the Plotter).
3. Connect the GP-IB Connector of the main unit to the HP-IB Connector of the Plotter using GP-IB Cable.

Example of  
Setting

### ... Procedure for HP 7550A Plotter (using RS-232-C Interface)

1. The main unit Settings are as follows:

232C mode	:	Set & Out
Baud rate	:	9600
Data length	:	8bit
Parity	:	None
Stop bit	:	1
Handshake	:	Xon : Xon

2. The Communications mode for the Plotter should be set to the following:

SERIAL / HANDSHAKE	XON/XOFF
BAUD / BAUD RATE	9600
PARITY / 8-BITS	OFF
DATA FLOW / LOCAL	

For details of the procedure please refer to the Instruction Manual of the Plotter.

3. Use RS-232-C Cable with the following direct pin-to-pin correspondence. Please be sure to check the internal wiring of the cable.

Make connection to the "TERMINAL" Connector of the Plotter.

AR1100A / AR1200	HP 7550A
Pin No. (male type)	Pin No. (male type)

①	—————	①
②	—————	②
③	—————	③
④	—————	④
⑤	—————	⑤
⑥	—————	⑥
⑦	—————	⑦
⑩	—————	⑩

## 6.7 Print-out and Paper Feed

### Function

This allows you to start or stop the print-out being carried out by the built-in printer or the external plotter.




The print-out format is in accordance with the PRINT FORMAT settings.

Print-out can only be executed when a waveform is displayed on the CRT screen. So the START or PROGRAM START keys should be pressed to display the waveform on the CRT screen, after which print-out should be commenced.



The LAMP to the upper left of the PRINT key is lit while print-out is in progress.

Paper feed is carried out using the FEED key.

### Procedure

-  : commences print-out to the built-in printer or external plotter.
- But, if print-out is already in progress
-  : discontinues the print-out to the built-in printer or external plotter.
-  : causes feeding of Chart Paper in the built-in printer.

### Notes

- Print-out is not possible if the  key has been pressed and measurement is still in progress.
- Print-out is not possible if the  key has been pressed and data is still in the process of redisplay.
- Print-out is not possible unless there is a waveform displayed on the CRT screen.
- Other AR1100A / AR1200 operations cannot be carried out while print-out is in progress.
- For details of the various PRINT FORMAT settings please refer to the following :
  - Section 6.3 "Setting up for a High Resolution Print-out of the Displayed Waveform"
  - Section 6.4 "Setting up for an Analog Print-out"
  - Section 6.5 "Setting up for a Digital Print-out"
  - Section 6.6 "Setting up to print out using an External Plotter"
- Feeding of the Chart Paper cannot be carried out while print-out is in progress.
- If there is no Chart Paper in the main unit's built-in printer or if the Chart Paper runs out, "Chart empty" or "Chart exhausted" will be displayed on the CRT screen. In such cases Chart Paper should be inserted in the printer.



## 6.8 Printing out a Setup List

### Function

This allows a listing of setup information to be printed out by the main unit's built-in printer.

The following information is contained in the print-out listing.

<u>MODE</u>	Settings for Mode, Use of Memory and Averaging
<u>RANGE</u>	Settings for Input Coupling, Input Range, Input Filters and Thermocouple
<u>TRIGGER</u>	Trigger Conditions
<u>PROGRAM</u>	Settings for Data Computation
<u>DISPLAY FORMAT</u>	Display Format Settings
<u>MISC</u>	Date and Time Settings Display Comment Settings Print-out related Settings Computation related Settings Communications related Settings Hardware Configuration Settings, etc.
<u>SAMPLE RATE</u>	Sampling Rate
<u>TRIGGER MODE</u>	Trigger Mode
<u>PRINT FORMAT</u>	Format Settings for Print-out and Recording

### Procedure

Press the SHIFT key and then the COPY key; a listing of setup information is printed out via the AR1100A's built-in printer.

If the COPY key is pressed during print-out of the Setup List, the print-out will be discontinued.

### Notes

- It is not possible to print out a Setup List under the following circumstances :
  - when print-out is in progress via the built-in printer or external plotter.
  - when the START key has been pressed and measurement is still in progress.
  - when the PROGRAM  
START key has been pressed and data is still in the process of being redisplayed.
- If there is no Chart Paper in the main unit's built-in printer or if the Chart Paper runs out, "Chart empty" or "Chart exhausted" will be displayed on the CRT screen. In such cases Chart Paper should be inserted in the printer.



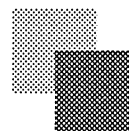
# Chapter 7

## Memory Mode / Storing Data on IC Memory Card and Floppy Disk

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Here we explain how to store waveform data and setup information on IC Memory Card and Floppy Disk and how to retrieve data stored on these media.

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## 7.1 Summary of Data Storage Functions

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Measured Data, Computed Data and Setup Information can be stored on (SAVE) and the same data retrieved from (LOAD) the IC Memory Card and the optional Floppy Disk.

The data format is MS-DOS.

The DUMP Function allows the storage of large quantities of data onto Floppy Disk ; data of a particularly large volume can be stored on a series of Floppy Disks if a single disk proves to be too small.

These functions make it easy for the user to carry out measurements with previous setup conditions and to make comparisons with previously measured data.

### ■ Saving Measured Data and Computed Data

You can select either Binary or ASCII format.

However, if you choose to save data in ASCII format, it cannot be reloaded into the main unit. Please read **Section 7.22, "ASCII File Format"**.

You can specify the Channel Number, Waveform Number and Block Number of the data you wish to save ; you can also specify the precise portion of data to be saved through Data Numbers.

### ■ Loading Measured Data and Computed Data

You can load measured data and computed data into the main unit's memory provided it has been saved in Binary format. There are two ways of loading the data : Replacement Load in which loading takes place after deletion of all data in the main unit's memory ; and Overwrite Load in which data is loaded only into a specified channel of the main unit's memory leaving data for other channels unaffected.

However, computed data cannot be overwrite loaded.

### ■ Saving and Loading of Setup Information

You can save and load setup conditions such as Input Range, Trigger Conditions and Display Format. Auto Sequence Programs may also be saved and loaded simultaneously with the setup conditions.

Standard Areas for Waveform Judgement can also be saved and loaded ; refer to **Section 8.7, "Waveform Tests (Go / No-go)"** for further details of the Waveform Judgement function.

### ■ Dumping Large Quantities of Data and Retrieving Dumped Data (Floppy Disk only)

With the normal Save and Load operations it is not possible to save all the data when the quantity of data is large.

Furthermore for normal Save and Load operations the data is stored and retrieved after a correction has been calculated.

Using the DUMP Function large quantities of measured data can be dumped onto a series of floppy disks in the form of raw, unprocessed data.

### ■ File Utilities

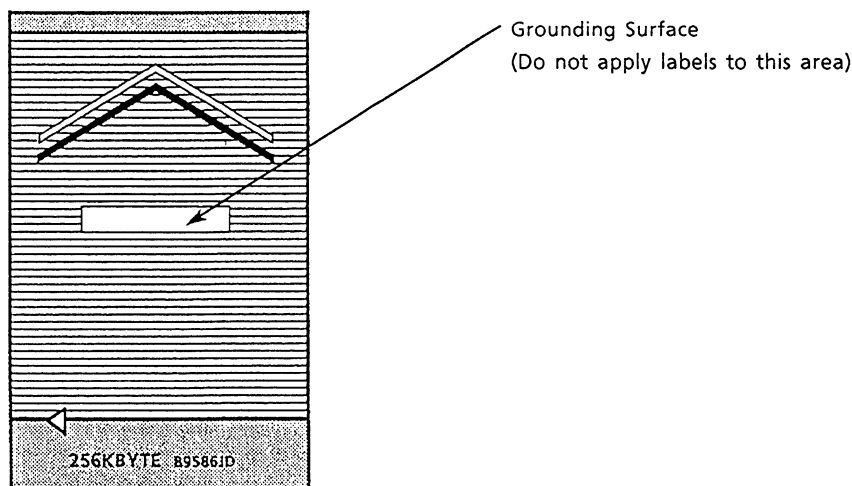
The following utilities are available for both IC Memory Card and Floppy Disk : Initialization, File Copying, File Renaming, File Deletion, Directory Creation / Deletion and Directory Print-out.

## 7.2 Precautions for Use of IC Memory Card

- Please be sure to use the following YOKOGAWA IC Memory Cards with the main unit.

Item	Memory Capacity	Model Number
IC Memory Card	64Kbytes	3789 03
IC Memory Card	256Kbytes	3789 04
IC Memory Card	512Kbytes	3789 05
IC Memory Card	1Mbytes	3789 06

- Please make sure you install the batteries supplied before using an IC Memory Card.
- Please initialize (format) a new IC Memory Card before use.
- IC Memory Card Battery Replacement should be carried out with the IC Memory Card inserted in the main unit and with the main unit's power switched on. Exercise caution as attempting any other method of battery replacement will cause the loss of data contained on the IC Memory Card.
- Do not remove an IC Memory Card from the main unit while data is being stored on it or retrieved from it. Data previously stored on the IC Memory Card may be corrupted and the section of data currently being stored will be rendered unusable.
- Do not drop or bend an IC Memory Card or otherwise subject it to any severe shocks.
- Do not allow an IC Memory Card to become wet.
- Do not allow dirt or dust to get into the connector.
- Do not leave IC Memory Cards near heaters or in places exposed to direct sunlight.
- Do not store IC Memory Cards in conditions of high temperature and humidity.
- The life of an IC Memory Card battery is about 4 years for a 64Kbyte card, 2 years for a 256Kbyte card and 512Kbyte card and 1 year for a 1Mbyte card.
- Adhesive labels are provided on which to write VOLUME and FILE names on an IC Memory Card; take extreme care not to apply these labels to the grounding surface in the centre of the card rear surface. Applying a label to this surface will nullify the card's capacity to prevent static electricity build-up and may cause loss of data stored on the card.



## 7.3 Installing the IC Memory Card Battery

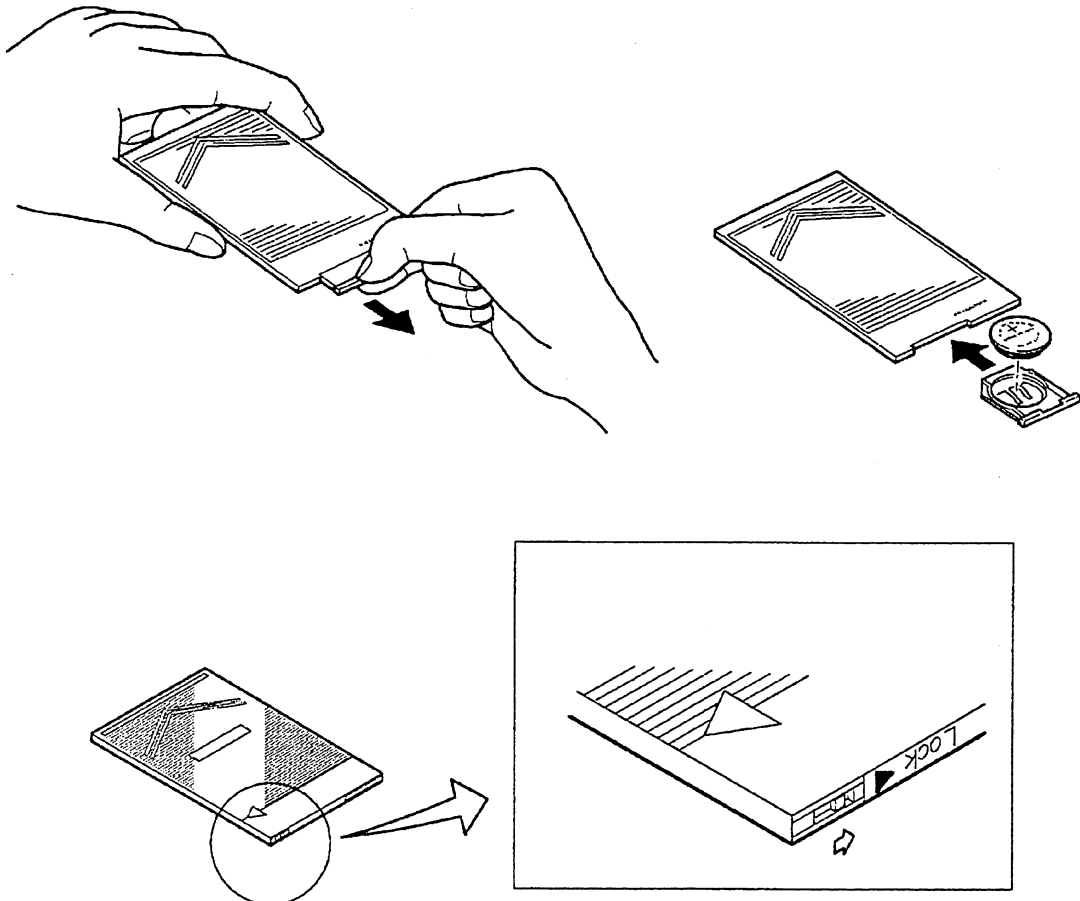
The batteries supplied are intended to preserve the data stored on the IC Memory Card; the IC Memory Card should be used after these batteries have been installed.

The battery installation procedure at the time of delivery is explained here.

Should the batteries become exhausted during use of the IC Memory Card and it is desired to replace them without losing the memory contents, please refer to **Section 7.4 "Replacing the IC Memory Card Battery"**.

1. Hold the IC Memory Card with its part number label (reverse side) uppermost.
2. Remove the battery holder by inserting your thumbnail in the gap between battery holder and IC Memory Card and pulling out.
3. Insert the supplied battery into the battery holder with its + symbol uppermost.
4. Replace the battery holder in the IC Memory Card.
5. Set the "Lock" switch on the IC Memory Card battery holder to "Lock".

The above completes the battery installation procedure for a new IC Memory Card.



## 7.4 Replacing the IC Memory Card Battery

If an IC Memory Card is in use and the "IC card battery exhausted" message is displayed at the top of the main unit's CRT screen, the IC Memory Card battery should be replaced as soon as possible.

The procedure explained here is for battery replacement without any loss of data contained in the IC Memory Card. If it is not required to preserve the data stored on the IC Memory Card, you may remove the IC Memory Card from the main unit and carry out the battery replacement according to the procedure in Section 7.3 "Installing the IC Memory Card Battery".

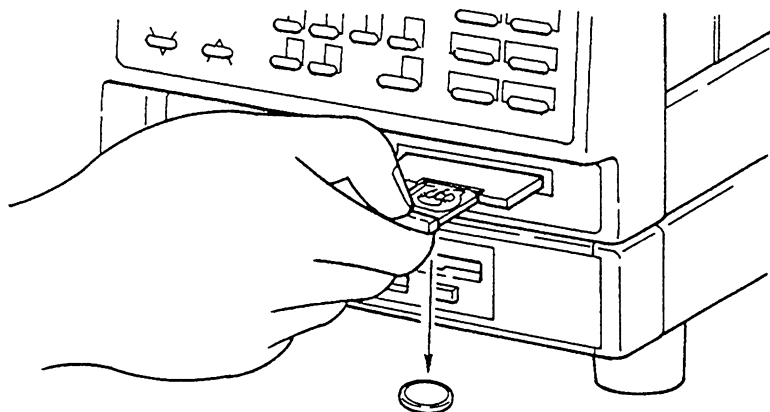
The Replacement Battery Part Numbers are as follows :

64Kbyte card .....	B9586JU
256Kbyte/512Kbyte/1Mbyte cards .....	B9586JV

1. Keep the IC Memory Card inserted in the main unit.
2. Keep the main unit's power switched on.
3. Set the battery holder "Lock" switch (on the right hand facing edge of the IC Memory Card) to its unlocked position.
4. Remove the battery holder (on the right hand facing edge of the IC Memory Card) by inserting your thumbnail in the gap between battery holder and IC Memory Card and pulling out. Exercise caution as the battery will fall out of the battery holder during this procedure.
5. Insert the new battery into the battery holder with the +symbol facing upwards. The polarity of the battery holder is negative. (Exercise caution as the IC Memory Card battery holder is flipped over when inserted in the main unit).
6. Turn the battery holder upside down and, holding the battery in place with your finger, insert the holder into the IC Memory Card.
7. Set the "Lock" switch on the right hand facing edge of the IC Memory Card to "Lock".

The above completes the battery replacement procedure for the IC Memory Card.

**Caution :** If the IC Memory Card is inadvertently removed from the main unit without its battery installed the contents of the IC Memory Card will be lost.

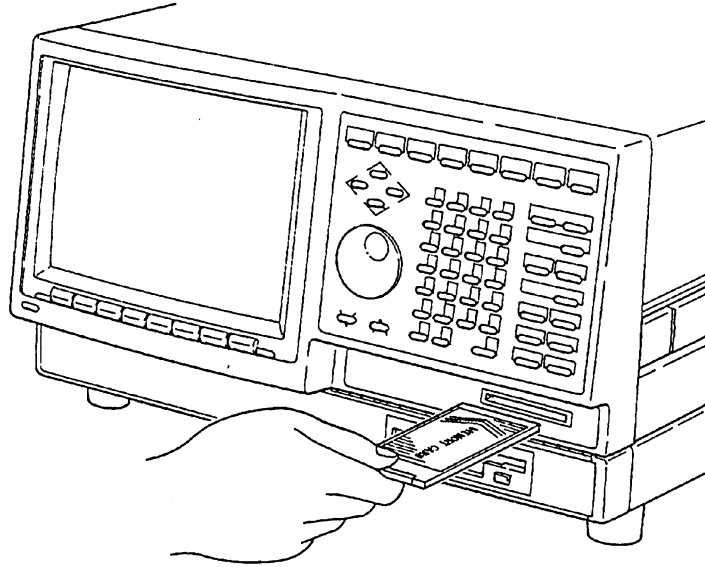


## 7.5 Inserting and Removing the IC Memory Card

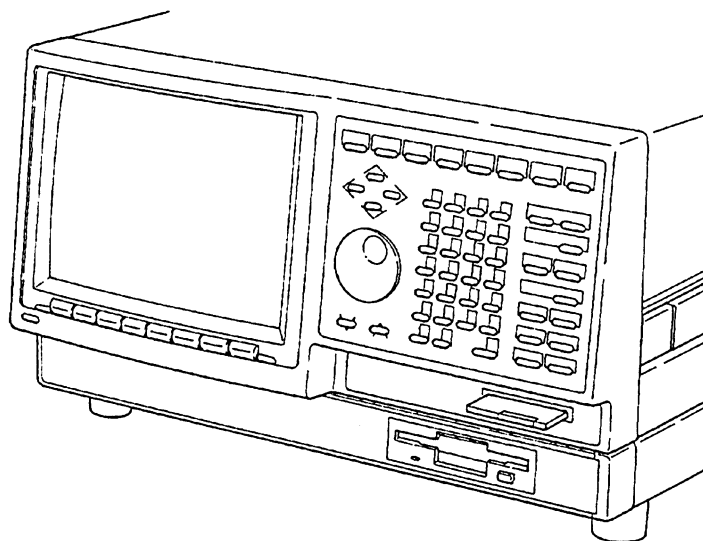
### ■ Inserting the IC Memory Card

With its MEMORY CARD symbol face upwards insert the IC Memory Card firmly and securely into the IC Memory Card Slot as shown in the Figure (The figure below is for the AR1100A which is the same as the AR1200).

With the IC Memory Card correctly inserted a small portion (about 13mm) will protrude from the main unit.



How to insert the IC Memory Card



IC Memory Card inserted in the AR1100A/AR1200

### ■ Removing the IC Memory Card




First check on the main unit's CRT screen that the main unit is not in the middle of a read or write operation using the IC Memory Card. Then remove the IC Memory Card by holding between fingers and thumb and firmly withdrawing. If the IC Memory Card is removed during a read or write operation it is possible that data contained on the card will be corrupted.

## 7.6 Initializing the IC Memory Card


### Function



To carry out the initialization (formatting) of a new IC Memory Card ; this prepares the card for use.

### Procedure


1. Having carried out the battery installation procedure, insert the IC Memory Card which you wish to initialize into the main unit's IC Memory Card Slot.
2.  Call up the Load/Save panel.
3. **Load/Save mode**  
Select Utility by pressing the  soft key.
4. **Function**  
Select Format (IC Memory Card Initialization) by pressing the  soft key.
5. **Parameter**


Press the  soft key. The IC Memory Card Drive Number is A.

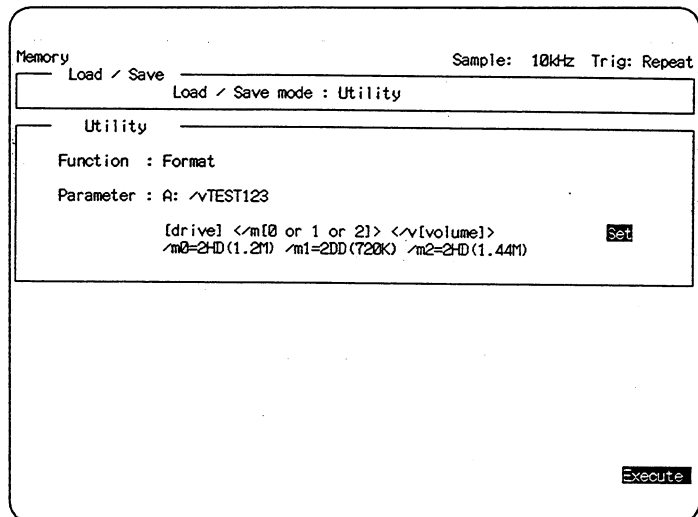
If you wish to specify a Volume label (a name for the IC Memory Card), you should use the Alphanumeric Keypad to first input “\_/v” after the “A:” and then to input a string up to a maximum of 11 characters in length ( \_ is a space). Having decided on a label, confirm it by pressing the  key.

If you do not wish to specify a Volume label, press the  key with “A:” only displayed. When the  key has been pressed, the Menu Cursor will move to the “Set” position.


6. **Set**

The Initialization is completed by pressing the  soft key.

After “Formatting...” has been displayed on the main unit's screen, it returns to the previous display panel (which was obtained by pressing the  soft key in procedure 3 above).



### Notes

- If you initialize an IC Memory Card which already contains data, all of that data will be lost.
- If the IC Memory Card battery is replaced with the IC Memory Card removed from the main unit, it will be necessary to carry out the above IC Memory Card Initialization procedure again.
- When specifying a Volume label be sure to insert a space (sp) before the “/v.”  
Use the  key when entering a space.
- Spaces and lower-case letters cannot be entered in a Volume label.



## 7.7 Precautions for Use of Floppy Disk

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The main unit (FDD Models) can be used with 3.5 inch 2HD Floppy Disks or 3.5 inch 2DD Floppy Disks.

You can use 1.2MB (MS-DOS Format) or 1.44MB (MS-DOS Format) 2HD Floppy Disks and 720KB (MS-DOS Format) 2DD Floppy Disks.

We recommend the use of YOKOGAWA 3.5 inch 2HD Floppy Disks (Model Number 7059 00) with the AR1100A/AR1200.

■ **Do not open the shutter and touch the surface of the disk.**

Finger print markings on the medium surface can lead to errors in reading and writing.

■ **Do not leave Floppy Disks in places exposed to direct sunlight and do not store Floppy Disks in conditions of high temperature and humidity.**

A deformation of the outer casing may lead to damage of the disk surface.

■ **Take care over condensation.**

Condensation can give rise to errors in reading and writing.

Such condensation may be caused by sudden changes in environmental conditions.

In cases where Floppy Disks have been sent by post or have otherwise been brought into a room from outside, do not use the disks immediately ; allow 30 to 60 minutes for the disks to adapt to the conditions in which they are to be used.

■ **Do not expose Floppy Disks to strong magnetic fields.**

The data stored on the Floppy Disks may be corrupted. Floppy Disks should not be placed near power transformers, magnets, motors, etc.

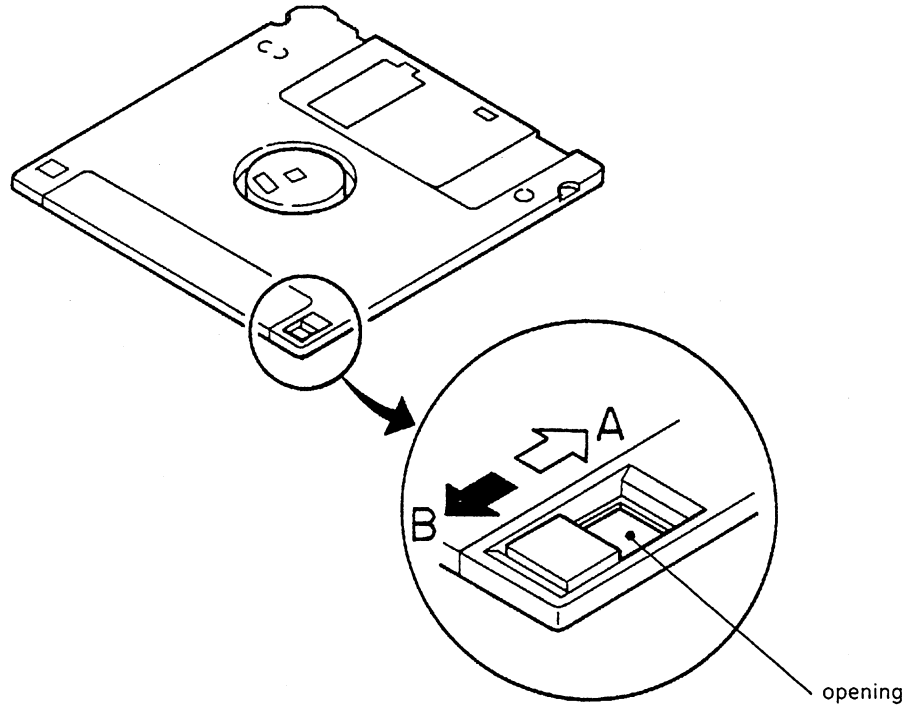
■ **Floppy Disk formats incompatible with the AR1100A / AR1200**

The following 2HD Floppy Disk formats cannot be used with the main unit : 640KB, 720KB, etc.

The following 2DD Floppy Disk formats cannot be used with the main unit : 640KB, 1.2MB, 1.44MB, etc.

**■ Preventing accidental deletion of data**

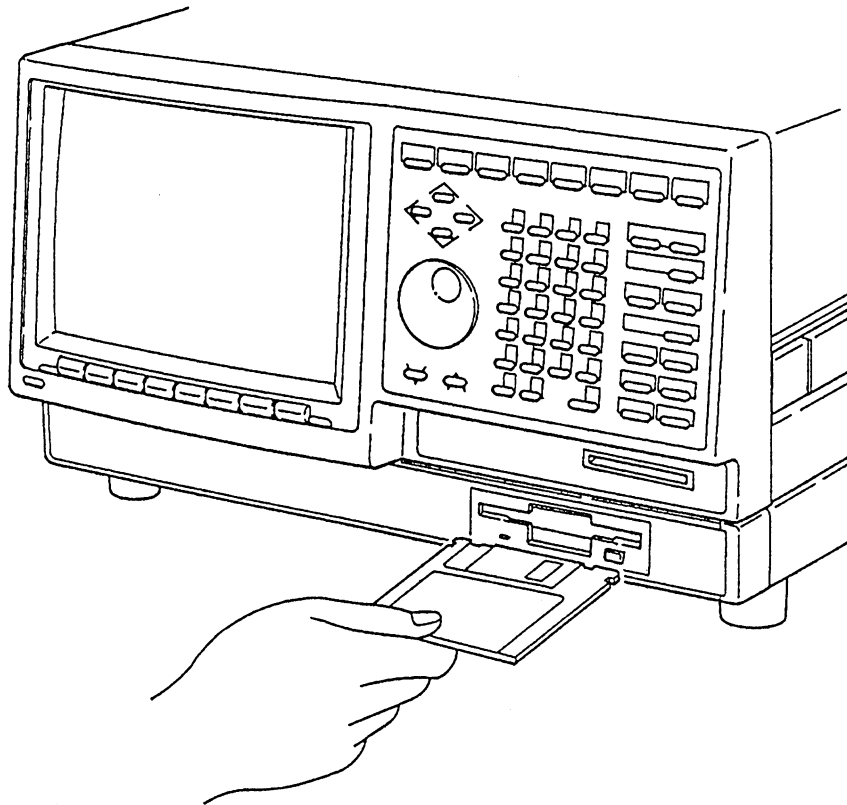
There is a write protect mechanism on the rear of the Floppy Disk. Moving the write protect tab in direction B reveals an opening in the write protect mechanism; with the Floppy Disk in this write protect status it is not possible to write any data to the disk or delete any data from the disk.



## 7.8 Inserting and Removing the Floppy Disk

### ■ Inserting the Floppy Disk

Insert the Floppy Disk face upwards into the main unit's Floppy Disk Slot as shown in the Figure below (The figure below is the AR1100A which is the same as the AR1200). If any other method of insertion is attempted, the Floppy Disk will not fit into the Slot. The Floppy Disk should be firmly pushed into the slot until the Eject Button clicks out.



### ■ Removing the Floppy Disk

First check that the Floppy Disk Drive Access Lamp is not lit; then press the Eject Button. The Floppy Disk will jump out.

Do not attempt to remove a Floppy Disk while the Floppy Disk Drive Access Lamp is lit; this may result in loss of data from the Floppy Disk.

# 7.9 Initializing the Floppy Disk

## Function

New Floppy Disks must be initialized (formatted).

Here we explain the MS-DOS Format initialization procedure for 1.2MB and 1.44MB 3.5 inch 2HD Floppy Disks and for 720KB 3.5 inch 2DD Floppy Disks.

## Procedure

1. Insert the Floppy Disk into the main unit's Floppy Disk Slot.

2. **LOAD/SAVE**

Call up the Load/Save panel.

3. **Load/Save mode**

Select Utility by pressing the **Utility** soft key.

4. **Function**

Select Format by pressing the **Format** soft key.

5. **Parameter**

Press the **B:** soft key. The Floppy Disk Drive Number is B. Then use the Alphanumeric Keypad to enter the following: first input a space and a slash “\_ /”, then input the format type (m0, m1 or m2).

Select m0 for initialization of 1.2MB 2HD disks.

Select m1 for initialization of 720KB 2DD disks.

Select m2 for initialization of 1.4MB 2HD disks.

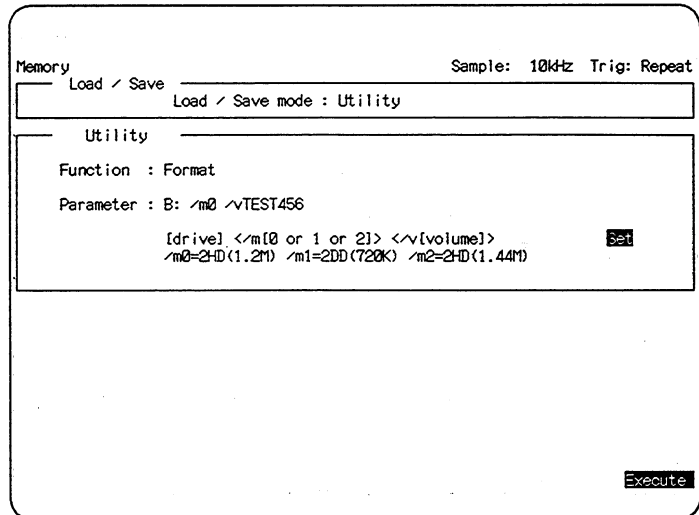
If you wish to specify a Volume label (a name for the Floppy Disk), you should use the Alphanumeric Keypad to first input “\_ / v” (space, slash, v) after the format type and then to input a string up to a maximum of 11 characters in length ( \_ is a space). Having decided on a label, confirm it by pressing the **ENTRY** key.

If you do not wish to specify a Volume label, press the **ENTRY** key after entering the format type (m0, m1 or m2).

When the **ENTRY** key has been pressed, the Menu Cursor will move to the “Set” position.

6. **Set**

The Initialization is completed by pressing the **Execute** soft key. After “Formatting...” has been displayed on the main unit's screen, it returns to the previous display panel (which was obtained by pressing the **Utility** soft key in procedure 3 above).



## Notes

- If you initialize a Floppy Disk which already contains data, all of that data will be lost.
- Be sure to insert a space (sp) before the “/” used for input of format type and the “/v” used to specify a Volume label. Use the **SP** key when entering a space.
- Spaces and lower-case letters cannot be entered in a Volume label.

## 7.10 Size and Number of Files stored on IC Memory Card and Floppy Disk

### ■ Size of Setup Information Files

The size of files containing setup information ranges from 1Kbytes up to 2Kbytes. The exact file size will differ according to the Model of main unit being used and the setup conditions to be saved.

### ■ Number of Files that can be saved on a single IC Memory Card and a single Floppy Disk.

The number of files (including both setup information files and files containing waveform data) that can be saved to a Root Directory (without creating any Sub-directories) is listed below for IC Memory Card and Floppy Disk. However, if the volume of data increases, these values will be reduced. When creating Sub-directories, the number of files is not restricted.

Medium	IC Memory Card				Floppy Disk		
	Memory Capacity	64KB	128KB	512KB	1MB	2DD (720KB)	2HD (1.2MB)
Maximum File Size in Root Directory	47	47	47	47	111	191	223

### ■ Size of Measured, Computed and FFT Computed Data Files

The formulae listed below provide a rough estimate of the size of data files. Logic data uses 1 channel at a time (channel A or channel B) and is saved in 2 bytes so the data size calculation is the same as for analog data.

#### ● For Memory Mode

Type of Data	File Header Size (bytes)	Data Size (bytes)
Measured Data (binary format)	Closest multiple of 64 $\geq 134 + 64 * X + 20 * Y + 36 * B$	$2 * D * Y * B$
Measured Data (ASCII format)	$168 + 29 * X$	$D * (8 + 10 * X)$
Computed Data (binary format)	Closest multiple of 64 $\geq 170 + 81 * W$	$4 * D * W$
Computed Data (ASCII format)	$146 + 14 * W$	$D * (8 + 10 * W)$

- (Note) X: (Number of Analog channels saved) + (Number of Logic channels saved \* 8)  
 However, if a particular channel input is OFF, that channel's data is not saved.  
 Y: (Number of Analog channels saved) + (Number of Logic channels saved)  
 B: Number of blocks saved (when memory partitioning is in use).  
 However, if memory partitioning has not been adopted, the number of blocks is assumed to be 1 for the purposes of calculation.  
 D: Size of data saved  
 W: Number of waveform numbers for which computed data has been saved.  
 However, if a computational expression has not been set for a particular waveform number, the data for that waveform number is not saved.

● For FFT Mode

Type of Data	File Header Size (bytes)	Data Size (bytes)
Measured Data (binary format)	Closest multiple of 64 $\geq 170 + 84 * Y$	$2 * D * Y$
Measured Data (ASCII format)	$168 + 29 * Y$	$D * (8 + 10 * Y)$
FFT Computed Data (binary format)	Closest multiple of 64 $\geq 225 + 81 * W$	$4 * D * 1 * W$
FFT Computed Data (ASCII format)	$145 + 14 * W$	$D * 1 * (8 + 10 * W)$

\*1 Computed Data is saved for points 0 to 400 and "0" is entered for points 401 to 999.

■ Guide to File Size

Below is a table showing how file size relates to the number of channels saved and to the memory length. (If memory partitioning is being used, the values given in the table should be multiplied by the number of blocks.)

● Without Memory Partitioning Binary Format

Unit : Kbyte

Memory size →		1k	4k	16k	64k	125k	250k	500k	1M
Number of Analog Channels	Number of Logic Channels								
1		3	9	32	126	245	489	978	—
	1	3	9	32	126	245	489	978	—
2		5	16	63	251	489	977	—	—
2	2	10	33	127	502	978	—	—	—
4		9	32	126	501	978	—	—	—
4	2	14	49	190	752	—	—	—	—
6		13	48	189	751	—	—	—	—
6	2	18	65	252	1002	—	—	—	—
8		17	64	251	1001	—	—	—	—

Note : Combinations of memory size and channels for which no value is given cannot be realized even using a 2HD (1.44MB) Floppy Disk.

7.10 Size and Number of Files stored on IC Memory Card and Floppy Disk

● Without Memory Partitioning ASCII Format

Unit: Kbyte

Memory size →		1k	4k	16k	64k	125k	250k	500k	1M
Number of Analog Channels	Number of Logic Channels								
1		18	71	282	1126	—	—	—	—
	1	87	345	1375	—	—	—	—	—
2		28	110	438	—	—	—	—	—
2	2	185	736	—	—	—	—	—	—
4		48	188	751	—	—	—	—	—
4	2	204	814	—	—	—	—	—	—
6		67	266	1063	—	—	—	—	—
6	2	224	892	—	—	—	—	—	—
8		87	345	1375	—	—	—	—	—

Note : Combinations of memory size and channels for which no value is given cannot be realized even using a 2HD (1.44MB) Floppy Disk.

■ DUMP Data (AR1200 and FDD Models of AR1100A)

File Size for DUMP data can also be estimated on the basis of 2 bytes per one point of data per single channel.

8 channels of 500k data can be saved on 8 2HD (1.2MB) Floppy Disks.

■ ASCII File Format

Please read Section 7.22, "ASCII File Format".

## 7.11 Saving Measured Data and Computed Data

### Function

Measured Data and Computed Data can be saved on IC Memory Card or Floppy Disk. You can select either Binary or ASCII format.

However, if you choose to save data in ASCII format, it cannot be reloaded into the main unit. Please read Section 7.22, "ASCII File Format".

You can specify the Channel Number, Waveform Number and Block Number of the data you wish to save; you can also specify the precise portion of data to be saved through Data Numbers.

### Procedure

#### 1. LOAD/SAVE

Call up the Load/Save panel.

#### 2. Load/Save mode

Select Data by pressing the Data soft key.

#### 3. Type

Select Save by pressing the Save soft key.

#### 4. Drive no.

Press the A soft key or the B soft key according to the Drive Number you wish to select. The IC Memory Card Drive Number is A.

The Floppy Disk Drive Number is B.

#### 5. Directory

"/" indicates a Root Directory. Sub-directories may also be specified at this point. "/" is the symbol used for subdivision of directories.

The Directory Name can be entered using the soft keys or the Alphanumeric Keypad.

Having decided the item you wish to enter, confirm it by pressing the ENTRY key.

If there are more than 8 directories, it is possible to change the soft key menu using the Channel Select Keys ← →.

Sub-directories must be created in advance; for details of the procedures involved please read Section 7.21, "Creating and Deleting Directories".

#### 6. File name

File names are entered using the Alphanumeric Keypad (with a maximum length of 8 characters).

At this point, the names of the files contained in the specified directory are displayed above the soft keys. These soft keys can be used when overwriting. If there are more than 8 directories, it is possible to change the soft key menu using the Channel Select Keys ← →.

Whichever method of file name entry is adopted, confirmation of the entry is carried out by pressing the ENTRY key.

In addition, file information for the specified directory is displayed on the lower half of the CRT screen.

For further details please read Section 7.17, "Checking Files".



## 7. Data type

To decide the format in which data is to be saved.

### ● Binary Format

Binary format should be selected if data is to be handled using the main unit.

Press the  soft key to save measured data in Binary format.

Press the  soft key to save computed data in Binary format.

### ● ASCII Format

ASCII format should be selected if data is to be handled using a personal computer, etc.

Note that a special IC Card Reader is required to read IC Memory Cards ; please contact your YOKOGAWA dealer for more information concerning IC Card Readers.

Press the  soft key to save measured data in ASCII format.

Press the  soft key to save computed data in ASCII format.

## 8. Option

Pressing the  soft key will cause storage of all data : all channels for which the input has not been set to "off", all computed waveforms and all blocks.

If you press the  soft key you will see the Option settings displayed at the foot of the CRT screen. You should check that these are as required.

### ● Block no.

This displays the numbers of the blocks to be saved.

### ● Data point

This displays the portion of data to be saved. (Data numbers are specified from 0 onwards).

### ● ch

"on" indicates that a channel is to be saved and "off" indicates that a channel is not to be saved.

Pressing the  soft key allows you to change each of the Option settings.

Pressing the  soft key causes the Option settings to be initialized (to their maximum values), followed by display of the Option setting panel.

The above Option settings can be entered using the Alphanumeric Keypad or the Soft Keys.

Once decided, the settings are confirmed by pressing the  key.

Then, after using the Cursor Keys to move the Menu Cursor to the "Set" position, you can set the Options by pressing the  soft key.

## 9. Set

Use the Cursor Keys to move the Menu Cursor to the "Set" position.

Then pressing the  soft key causes the data to be saved.

Notes
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- The Volume label within the < > brackets is the Volume label (name) of the IC Memory Card (specified by Drive Number A) or Floppy Disk (specified by Drive Number B).
- Memory indicates the remaining memory capacity on the IC Memory Card (specified by Drive Number A) or Floppy Disk (Specified by Drive Number B).
- If you save data to a directory using an existing file name, the data will overwrite the existing file.
- Characters that may be used in file names and impermissible file names are in accordance with MS-DOS.
- When memory partitioning is in operation and computed data is to be saved and when there is no Option setting for Block Number, Block 1 data only is saved.
- The setting of Options is contained within the main unit's setup procedures (as applied to AR1100A/AR1200 data).
- Files which have been saved in ASCII format cannot be reloaded into the main unit. Do not save data in ASCII format unless you intend to handle the data using a personal computer.
- When handling files with a personal computer, the file extension for Binary format is DAT and the file extension for ASCII format is ASC.
- The Option which specifies the particular range of data to be saved may also be set using a waveform that is displayed on the CRT screen.
- For further details of this, please read **Section 8.11, "Setting Recording Range and Saving Range on the Waveform Panel"**.
- For further details of ASCII format, please read **Section 7.22, "ASCII File Format"**.

## 7.12 Loading Measured Data and Computed Data

### Function

Measured Data and Computed Data which has been saved in Binary format can be loaded into the main unit.

There are 2 methods for loading such data : Replacement Load and Overwrite Load.

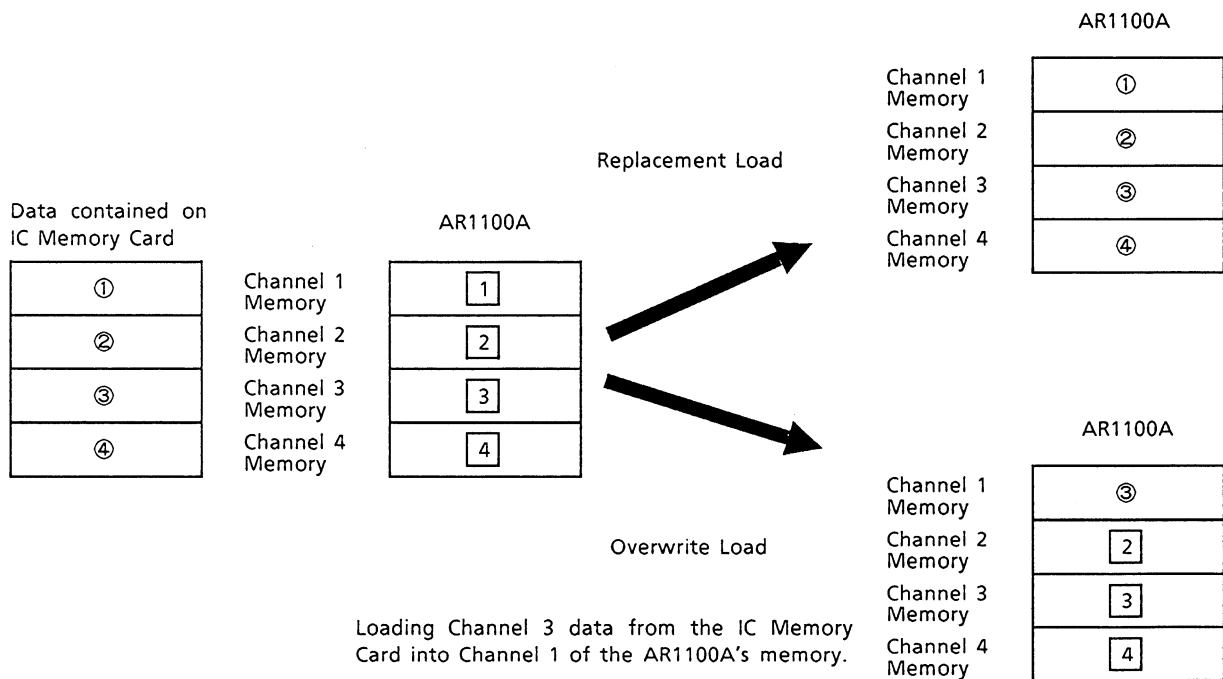
### ■ Replacement Load

With Replacement Load, data contained on IC Memory Card or Floppy Disk is loaded into the main unit's memory, deleting all of the data previously contained in the main unit's memory. It is also possible to specify the Data Point Number from which loading of data will commence.

### ■ Overwrite Load (Only Measured Data)

With Overwrite Load, a specified channel number of the data contained on IC Memory Card or Floppy Disk is loaded into a specified channel of the main unit's memory. When carrying out Overwrite Load it is essential that the setup conditions (such as sampling rate) are identical for the data being loaded and the data contained in the main unit's memory. It is also possible to specify the Data Point Number from which loading of data will commence.

### ● The Difference between Replacement Load and Overwrite Load



### Notes

### ■ Definition of "Overwrite":

Used here to mean "the loading of a particular channel of data (but with the same setup conditions as the data contained at that time in the main unit's memory) into a specified channel of the main unit's memory leaving data for other channels in the main unit's memory unaffected."

## 7.12.1 Replacement Loading of Measured Data and Computed Data

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### Function

Measured Data and Computed Data which has been saved in Binary format can be loaded into the main unit using Replacement Load.

Data contained on IC Memory Card or Floppy Disk is loaded into the main unit's memory, deleting all of the data previously contained there.

It is also possible to specify the Data Point Number from which loading of data will commence.

#### ● Conditions for Replacement Load :

- If Memory Partitioning is in operation, the Block Protect Mode should be set to "off".
- If Computed Data is being loaded, the PROGRAM Function (used for computations) should be set to "on".

#### ● Setup Information

The following setup information related to waveform display will become matched to the data contained on the IC Memory Card or Floppy Disk.

However, the setup information for waveform measurement by the main unit is unaffected.

- Range Settings (with the exception that filters are all set to "off" and channels for which no data has been loaded are also set to "off".)
- Sampling Rate
- Trigger Point

#### ● Display Scaling

- When Measured Data is loaded, the main unit's Display Scaling is set to "off" regardless of the setting prior to loading.
- When Computed Data is loaded, the main unit's Display Scaling remains at the value set prior to loading.

#### ● Linear Scaling

The main unit settings for Linear Scaling are unaffected by the loading of data. Settings for Linear Scaling are not saved.

#### ● Memory Size and Loading of Data

##### ● Data on which memory partitioning has not been performed.

Memory size is set automatically according to data size prior to saving. If the memory size is not sufficient, the maximum memory size is set and that portion of data is loaded.

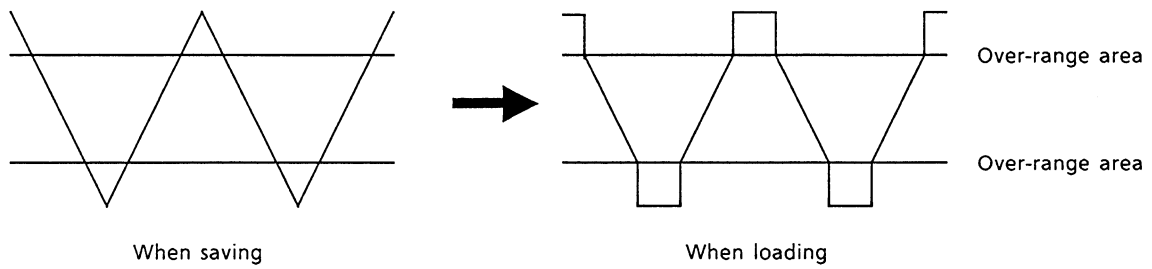
##### ● Data on which memory partitioning has been performed.

Memory size is set automatically according to data size prior to saving. The number of partitioned blocks is limited by the memory size that has been set.

## 7.12 Loading Measured Data and Computed Data

### ● Over-range Data

In cases when over-range data is saved and then reloaded into the main unit, a waveform differing from the original waveform may be generated.



### ● Loading Data when the PROGRAM Function (used for computations) is set to "on".

- If you load measured data, then all the computed data up to that point is rendered unusable.
- If you load computed data, then all the measured data up to that point is rendered unusable.
- If you load computed data, then the panel scaling value will automatically be replaced by the value that was set when the data was saved.

## Procedure

### 1. LOAD/SAVE

Pressing the LOAD / SAVE key calls up the Load/Save panel.

### 2. Load / Save mode

Select Data by pressing the  soft key.

### 3. Type

Select Load by pressing the  soft key.

#### ● Drive no.

Press the  soft key or the  soft key according to the Drive Number you wish to select.

The IC Memory Card Drive Number is A.

The Floppy Disk Drive Number is B.

#### ● Directory

“/” indicates a Root Directory. Sub-directories may also be specified at this point. “/” is the symbol used for subdivision of directories. The Directory Name can be entered using the soft keys or the Alphanumeric Keypad.

Having decided the item you wish to enter, confirm it by pressing the ENTRY key.

If there are more than 8 directories, it is possible to change the soft key menu using the Channel Select Keys  .

#### ● File name

The names of the files contained in the specified directory are displayed above the soft keys. Only 8 files can be displayed at one time. If there are more than 8 files in the directory, it is possible to change the soft key menu using the Channel Select Keys  .

You may also enter file names using the Alphanumeric Keypad.

Whichever method of file name entry is adopted, confirmation of the entry is carried out by pressing the ENTRY key.

In addition, file information for the specified directory is displayed in lots of 8 on the lower half of the CRT screen.

For further details please read Section 7.17, “Checking Files”.

Memory		Sample: 10kHz	Trig: Repeat
Load / Save		Load / Save mode : Data	Type : Load
Data			
Drive no. : A	Volume label <TEST123 >	Memory :	79KB
Directory : /MODULE1/		Option : <input checked="" type="checkbox"/> on	
File name : TEST3		<input type="button" value="Set"/>	
Start point : 499			
Over write : off			
<input type="button" value="off"/>	<input checked="" type="button" value="on"/>	<input type="button" value="Set OPT"/>	<input type="button" value="Dir OPT"/>

## 4. Option

Pressing the  soft key means that you will commence loading data from the "0" data point (the first data).

Pressing the  soft key allows you to specify the data point from which you will commence loading data. The Option Settings are then displayed in the lower half of the CRT screen.

● **Start point** This displays the data point from which data loading will take place.

● **Over write** "on" indicates Overwrite Load and "off" indicates Replacement Load.

If Overwrite is not set to "off" (for Replacement Load), it can be changed in the following way.

Pressing the  soft key will display the Option setting panel.

Pressing the  soft key causes the Option settings to be initialized (to their maximum values), followed by display of the Option setting panel.

The above Option settings can be entered using the Alphanumeric Keypad or the Soft Keys. Once decided, the settings are confirmed by pressing the  key.

Then, after using the Cursor Keys to move the Menu Cursor to the "Set" position, you can set the Options by pressing the  soft key.

## 5. Set

Use the Cursor Keys to move the Menu Cursor to the "Set" position.

Then pressing the  soft key causes the data to be loaded.

Notes

- The Volume label (name) of the IC Memory Card (specified by Drive Number A) or Floppy Disk (specified by Drive Number B) is displayed within the Volume label brackets < >.
- When carrying out Replacement Load, files which include any logic input data should be loaded using a main unit with logic option.
- When carrying out Replacement Load, if the channel configuration (the number of analog input channels and the presence or absence of any logic inputs) is different for the file and the main unit being used, then loading will be carried out only for those sections of data which can be loaded.
- Loading will not be carried out if the Start point Option setting is inappropriate to the data contained on the IC Memory Card or Floppy Disk.

## 7.12.2 Overwrite Loading of Measured Data

### Function

With Overwrite Load, a specified channel of the data contained on IC Memory Card or Floppy Disk is loaded into a specified channel of the main unit's memory. When carrying out Overwrite Load it is essential that the setup conditions (such as sampling rate) are identical for the data being loaded and the data contained in the main unit's memory. It is also possible to specify the Data Point Number from which loading of data will commence.

- **Overwrite Load cannot be carried out in the following cases :**

- When Memory Partitioning has been adopted.
- When Computed Data is being loaded.
- When Program is ON.

- **Setup Information and Overwrite Load**

The following setup information will become matched to the data contained on the IC Memory Card or Floppy Disk.

- Range Settings (with the exception that filters are all set to "off" and channels for which no data has been loaded are also set to "off".)
- Sampling Rate

Note : The Trigger Point is taken as that which is set for the main unit at the time of data loading.

Even if the sampling rates differ for the data contained in the main unit's memory and the data contained on the IC Memory Card or Floppy Disk, the loaded data will be treated as though it has been sampled at the main unit's sampling rate setting. However, in this case the loaded data will not be displayed with the correct time axis scaling.

- **Display Scaling and Overwrite Load**

The main unit's Display Scaling is set to "off" regardless of the setting prior to loading.

- **Linear Scaling**

The main unit settings for Linear Scaling are unaffected by the loading of data. (Settings for Linear Scaling are not saved.)

- **Memory Size and Loading of Data**

- **Data on which memory partitioning has not been performed.**

This data is loaded with the memory size that has been set.

- **Data on which memory partitioning has been performed.**

This data is loaded with the memory size of the first block of data on the file.

- When the memory size which has been set for the main unit is greater than the length of data for overwrite load : in this case the section of the main unit's memory for which no data has been loaded is treated as Illegal Data.

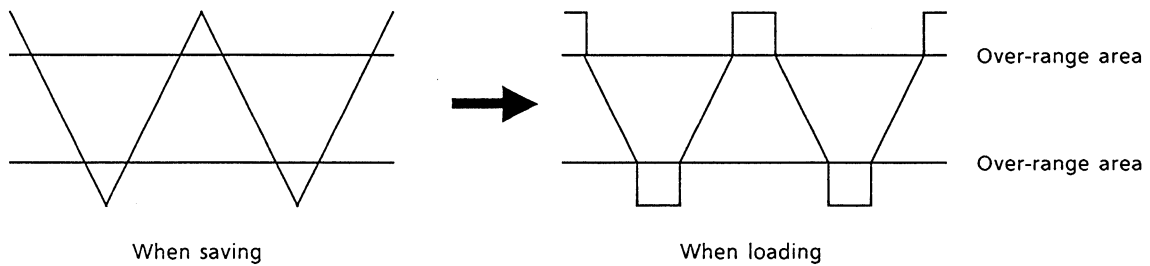
- When the memory size which has been set for the main unit is smaller than the length of data for overwrite load : in this case data is loaded only until the available memory size (currently set for the main unit) has been occupied and the remaining data is not loaded.



## 7.12 Loading Measured Data and Computed Data

### ● Over-range Data

In cases when over-range data is saved and then reloaded into the main unit, a waveform differing from the original waveform may be generated.





### ● Overwriting by Switching Program (Calculation) ON to Program (Calculation) OFF


Changing program-on to program-off allows the measured data to be overwritten.

Overwrite after first setting the program to off and then press the program start key to display the measured data.



## Procedure

1. **LOAD/SAVE**  
 Pressing the LOAD / SAVE key calls up the Load/Save panel.

2. **Load/Save mode**  
 Select Data by pressing the  soft key.

3. **Type**  
 Select Load by pressing the  soft key.

### ● Drive no.


Press the  soft key or the  soft key according to the Drive Number you wish to select.



The IC Memory Card Drive Number is A.

The Floppy Disk Drive Number is B.



### ● Directory

“/” indicates a Root Directory. Sub-directories may also be specified at this point. “/” is the symbol used for subdivision of directories. The Directory Name can be entered using the soft keys or the Alphanumeric Keypad.


Having decided the item you wish to enter, confirm it by pressing the  key.

If there are more than 8 directories, it is possible to change the soft key menu using the Channel Select Keys  .

### ● File name

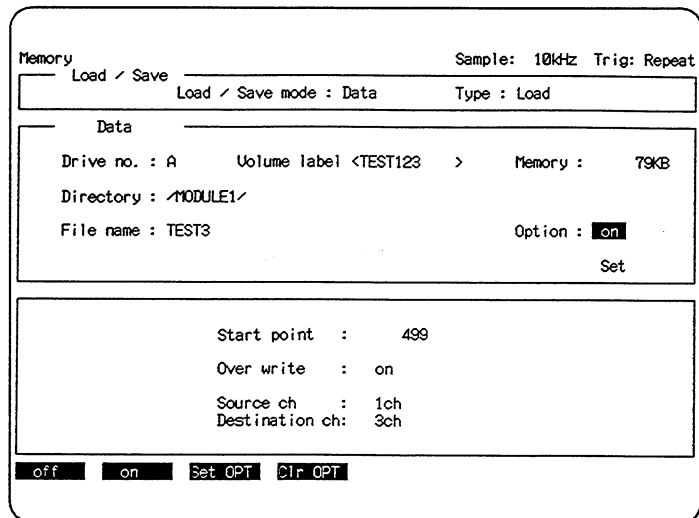
The names of the files contained in the specified directory are displayed above the soft keys. Only 8 files can be displayed at one time. If there are more than 8 files in the directory, it is possible to change the soft key menu using the Channel Select Keys  .

You may also enter file names using the Alphanumeric Keypad.

Whichever method of file name entry is adopted, confirmation of the entry is carried out by pressing the  key.

In addition, file information for the specified directory is displayed in lots of 8 on the lower half of the CRT screen.

For further details please read Section 7.17, “Checking Files”.



Memory Sample: 10kHz Trig: Repeat

Load / Save Load / Save mode : Data Type : Load

---

Data

Drive no. : A      Volume label <TEST123 >      Memory : 79KB

Directory : /MODULE1/

File name : TEST3      Option : **on**

Set

---

Start point : 499

Over write : on

Source ch : 1ch

Destination ch: 3ch

**off**   **on**   **Set OPT**   **Dir OPT**

## 4. Option

Pressing the  off soft key selects a Replacement Load commencing from the “0” data point (the first data).

Pressing the  on soft key causes display of the Start point for loading and the Overwrite Load settings on the lower half of the CRT screen.

- **Start point** This displays the data point number from which data loading will commence.
- **Over write** “on” indicates Overwrite Load and “off” indicates Replacement Load. If Overwrite is set to “on” (for Overwrite Load), the following additional settings are displayed.
- **Source ch** This displays the channel number of the IC Memory Card or Floppy Disk data which is to be loaded into the main unit.
- **Destination ch** This displays the main unit channel number into which data will be loaded.

The Option settings can be changed in the following way.

Pressing the  set OPT soft key will display the Option setting panel.

Pressing the  clr OPT soft key causes the Option settings to be initialized (to their maximum values), followed by display of the Option setting panel.

The above Option settings can be entered using the Alphanumeric Keypad or the Soft Keys. Once decided, the settings are confirmed by pressing the  ENTRY key.

Then, after using the Cursor Keys to move the Menu Cursor to the “Set” position, you can set the Options by pressing the  Execute soft key.

## 5. Set

Use the Cursor Keys to move the Menu Cursor to the “Set” space position.

Then pressing the  Execute soft key causes the data to be loaded.

Notes
-------

- The Volume label (name) of the IC Memory Card (specified by Drive Number A) or Floppy Disk (specified by Drive Number B) is displayed within the Volume label brackets < >.
- Logic input data should be loaded into the main unit’s logic channels.
- Loading will not be carried out if the Start point Option setting is inappropriate to the data contained on the IC Memory Card or Floppy Disk.

## 7.13 Deleting Measured Data Files and Computed Data Files

### Function

To delete measured data files and computed data files saved on IC Memory Card or Floppy Disk.

### Procedure

1. **LOAD/SAVE**

Pressing the LOAD / SAVE key calls up the Load/Save panel.

2. **Load / Save mode**

Select Data by pressing the **Data** soft key.

3. **Type**

Select Delete by pressing the **Delete** soft key.

● **Drive no.**

Press the **A** soft key or the **B** soft key according to the Drive Number you wish to select.

The IC Memory Card Drive Number is A.

The Floppy Disk Drive Number is B.

● **Directory**

"/" indicates a Root Directory. Sub-directories may also be specified at this point. "/" is the symbol used for subdivision of directories. The Directory Name can be entered using the soft keys or the Alphanumeric Keypad.

Having decided the item you wish to enter, confirm it by pressing the **ENTRY** key.

If there are more than 8 directories, it is possible to change the soft key menu using the Channel Select Keys **↔** **↔**.

● **File name**

The names of the files currently contained in the specified directory are displayed above the soft keys. Use the soft keys to specify the file to be deleted.

If there are more than 8 files in the directory, you may use the Channel Select Keys **↔** **↔** to change the soft key menu and view the remaining file names.

You may also enter file names using the Alphanumeric Keypad.

Whichever method of file name entry is adopted, confirmation of the entry is carried out by pressing the **ENTRY** key.

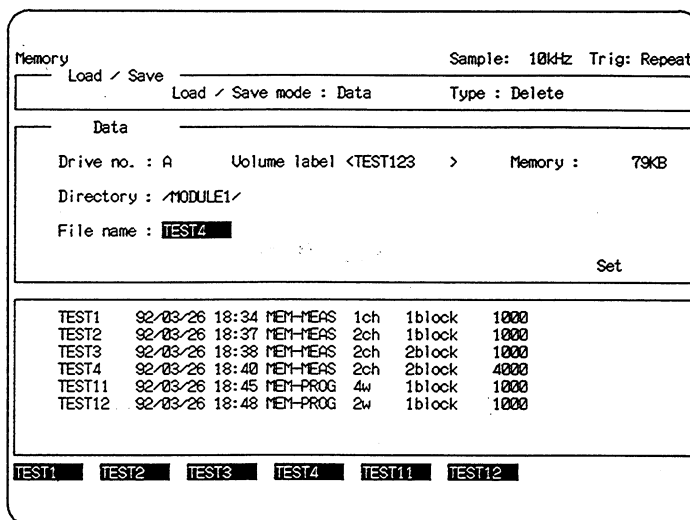
In addition, file information for the specified directory is displayed in lots of 8 on the lower half of the CRT screen.

For further details please read Section 7.17, "Checking Files".

4. **Set**

Use the Cursor Keys to move the Menu Cursor to the "Set" position.

Then pressing the **Execute** soft key causes deletion of the specified file.



### Notes

- Before carrying out any deletion, be sure to carefully check the Drive no., Directory and File name.

## 7.14 Saving, Loading and Deleting Setup Information

### Function

Setup Information (such as Input Coupling, Input Range, Input Filters, Sampling Rate and Display Format) can be saved on IC Memory Card or Floppy Disk; Setup Information Files can be loaded into the main unit and they may be deleted if required.

### Procedure

#### 1. LOAD / SAVE

Pressing the **LOAD / SAVE** key calls up the Load/Save panel.

#### 2. Load / Save mode

For handling of Setup Information files select Panel by pressing the **Panel** soft key.

#### 3. Type

Pressing the **Save** soft key allows Setup Information to be saved.

Pressing the **Load** soft key allows loading of Setup Information files.

Pressing the **Delete** soft key allows Setup Information files to be deleted.

#### ● Drive no.

Press the **A** soft key or the **B** soft key according to the Drive Number you wish to select.



The IC Memory Card Drive Number is A.

The Floppy Disk Drive Number is B.

#### ● Directory

“/” indicates a Root Directory. Sub-directories may also be specified at this point. “/” is the symbol used for subdivision of directories. Sub-directories must be created in advance; for details of the procedures involved please read **Section 7.21, “Creating and Deleting Directories”**.

#### ● File name

The names of the files contained in the specified directory are displayed above the soft keys. Only 8 files can be displayed at one time. If there are more than 8 files in the directory, you may use the Channel Select Keys   to change the soft key menu and view the remaining file names.

You may also enter file names (up to a maximum of 8 characters) using the Alphanumeric Keypad.

Whichever method of file name entry is adopted, confirmation of the entry is carried out by pressing the **ENTRY** key.

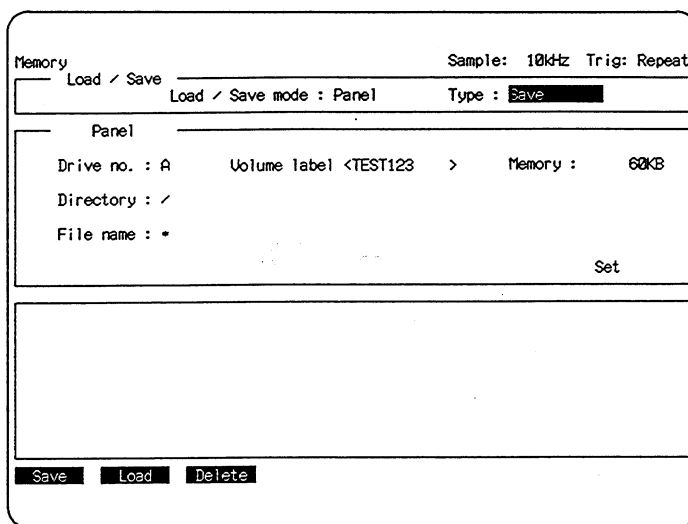
In addition, file information for the specified directory is displayed in lots of 8 on the lower half of the CRT screen.

For further details please read **Section 7.17, “Checking Files”**.

#### 4. Set

Use the Cursor Keys to move the Menu Cursor to the “Set” position.

Saving, loading or deletion are then carried out by pressing the **Execute** soft key.



Notes
-------

- If you save data using an existing file name in the specified directory, the existing file will be overwritten with the new data.
- Before saving data or carrying out any deletion, be sure to carefully check the Drive no., Directory and File name.
- The File Extension for handling Setup Information files with a personal computer is PNL.
- In the SWAP function, it is not possible to save the Complementary (currently inactive) setting.  
For further details of the SWAP function, please read **Section 11.2, "Exchanging Display / Computation Settings (SWAP)."**
- Auto Sequence Programs are also simultaneously saved. For details of the Auto Sequence Function please read **Section 8.8, "Setting Automatic Operation (AUTO SEQUENCE)."**

## 7.15 Dumping Measured Data onto Floppy Disk

### Function

Using the DUMP function large quantities of measured data contained in the AR1100A's memory can be saved onto a series of floppy disks in the form of raw, unprocessed data. This is what is meant by "dumping".

The DUMP function is only available on main unit's fitted with the FDD Option.

### Procedure

1. Prepare the required number of formatted floppy disks.  
In the case of 2HD (1.2MB) floppy disks a maximum of 8 are required (but the precise number will depend on the quantity of data being saved).  
When dumping large quantities of data requiring a series of floppy disks, try to use floppy disks containing as little data as possible.  
Insert the first floppy disk.

2. **LOAD/SAVE**

Pressing the **LOAD/SAVE** key calls up the Load/Save panel.

3. **Load/Save mode**

Select Utility by pressing the **Utility** soft key.

4. **Utility/Function**

Pressing the **Next** soft key changes the soft key menu.

5. **Utility/Function**

Select the **DUMP** function by pressing the **Dump** soft key.

6. **Utility/Parameter**

Enter the PATH. This is the name given to the dumped file.

The Drive no. for Floppy Disks is B. IC Memory Cards (with Drive no. A) cannot be used for dumping. Leave the Drive no. set to B.

"/" is the symbol used for subdivision of directories. However, the Root Directory should be used here.

The File name should be entered after "B:/" (maximum of 8 characters). The default file name is NONAME.

The file being saved will take the name <filename.AR1> for the first floppy disk with the extension changing for the second floppy disk onwards : AR2, AR3...AR9, ARA, ARB...ARZ, etc.

Once the file name is decided, it is confirmed by pressing the **ENTRY** key.

7. **Set**

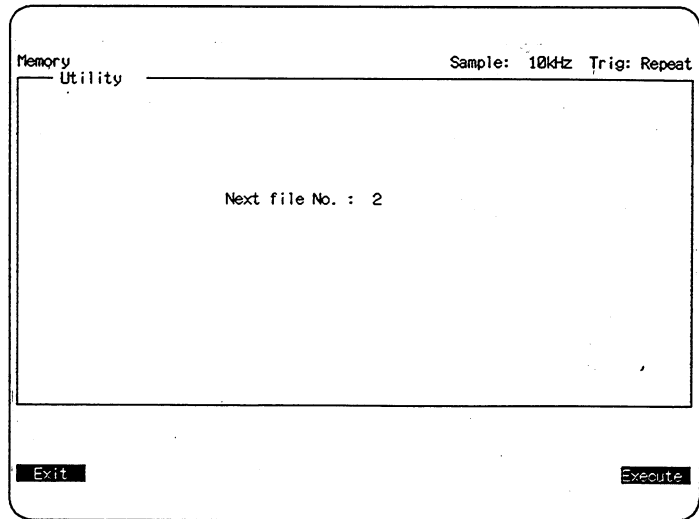
Use the Cursor Keys to move the Menu Cursor to the "Set" position. Then pressing the **Execute** soft key causes data to be dumped onto the Floppy Disk.

While data is in the process of being dumped onto floppy disk, "Utility Dump" is displayed on the CRT screen.

The screenshot shows the 'Memory' screen with the following content:

- Top right: Sample: 10kHz Trig: Repeat
- Section: Load / Save
- Sub-section: Load / Save mode : Utility
- Section: Utility
- Function : Dump
- Parameter : B:NONAME
- Field: <path> with a **Set** key to its right.
- Bottom right: **Execute** key.

8. When the first Floppy Disk becomes full, "Next file No. :2" is displayed on the CRT screen. Remove the first Floppy Disk from the main unit and insert the second Floppy Disk.
9. Pressing the  soft key commences the writing of data to the second Floppy Disk.
10. Procedures 8 and 9 should then be repeated for the third Floppy Disk, fourth Floppy Disk, etc. until all the data has been dumped. When the dumping of all data is completed, the CRT screen returns to the Utility panel.



- If for any reason you wish to abort the dump procedure mid-way, press the  soft key. However, in such a case all of the data dumped onto Floppy Disks up to that point is rendered unusable.

### Notes

- Characters that may be used in file names and impermissible file names are in accordance with MS-DOS.
- If the first Floppy Disk is already full then "Not enough space to save" will be displayed ; if the first Floppy Disk is write protected then "Write protected" will be displayed ; in both cases "Next file No. :1" will be displayed shortly afterwards. If you change to a Floppy Disk which is neither full nor write protected, the data dumping can be commenced by pressing the  soft key.
- If, in the case that "Next file No. (2~)" is displayed on the CRT screen, the Floppy Disk has been changed, the  soft key has been pressed and either "Not enough space to save" or "Write protected" appear on the CRT screen, the data dumping can be continued by changing the Floppy Disk and pressing the  soft key.
- If, while "Next file No. (1~)" is displayed on the CRT screen, you happen to press a function key then the data dumping procedure will be aborted and all of the data dumped onto Floppy Disk (s) up to that point rendered unusable.
- It is recommended that you label beforehand any Floppy Disks to be used.
- When dumping large quantities of data requiring a series of Floppy Disks, try to use Floppy Disks containing as little data as possible.
- When overwriting onto a Floppy Disk which already contains dumped data, the file name of the data being dumped must tally with the existing file name (including the extension AR? indicating the numbering of the Floppy Disk). As a data protection measure the file names must be in agreement for overwriting to take place.
- Data that has been dumped using a 512kW/ch version of the main unit cannot be read using a 64kW/ch version of the main unit.
- When using the main unit to read dumped data from a Floppy Disk, only data for those Channel Numbers present in the main unit can be read.
- Two bytes are used per data item.



## 7.16 Retrieving Measured Data Dumped onto Floppy Disk

### Function

Raw Measured Data that has been dumped onto Floppy Disk is read using the main unit and stored in the main unit's memory. This is what is meant by "retrieving". For details of the DUMP function please read Section 7.15, "Dumping Measured Data onto Floppy Disk". The retrieving of Measured Data dumped onto Floppy Disk is only possible using an AR1200 and an AR1100A fitted with the FDD Option.

### Procedure

- Sort out the Floppy Disks containing the dumped data files.  
In particular make sure to arrange the Floppy Disks in the same order in which the data dumping was carried out.  
Insert the first Floppy Disk.

- LOAD / SAVE

Pressing the LOAD / SAVE key calls up the Load / Save panel.

- Load / Save mode

Select Utility by pressing the Utility soft key.

- Utility / Function

Pressing the Next soft key changes the soft key menu.

- Utility / Function

Select retrieval of data by pressing the Retrieve soft key.

- Utility / Parameter

Enter the PATH. This is the name given to the dumped file.

The Drive no. for Floppy Disks is B. IC Memory Cards (with Drive no. A) cannot be used for dumping or retrieving. Leave the Drive no. set to B.

"/" is the symbol used for subdivision of directories. However, dumped data files are usually to be found in Root Directories so the "/" symbol can be left as it is.

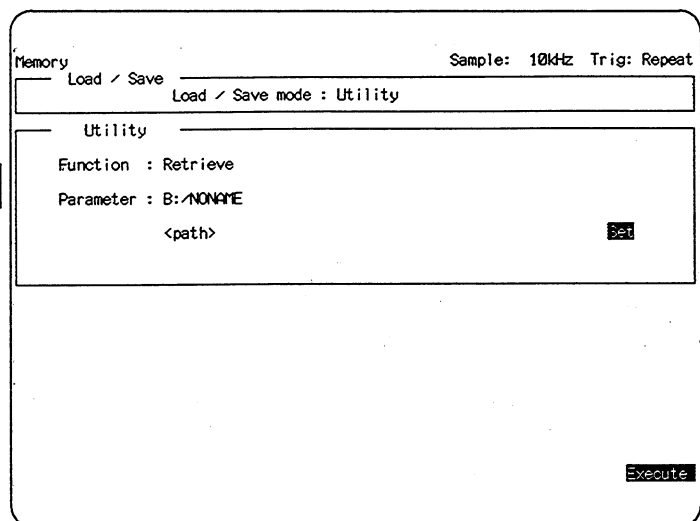
The File Name should be entered after "B:/". The default file name is NONAME.

Once the file name is decided, it is confirmed by pressing the ENTRY key.

- Set

Use the Cursor Keys to move the Menu Cursor to the "Set" position. Then pressing the Execute soft key causes data to be retrieved from the Floppy Disk.

While data is in the process of being retrieved from floppy disk, "Utility Retrieve" is displayed on the CRT screen.



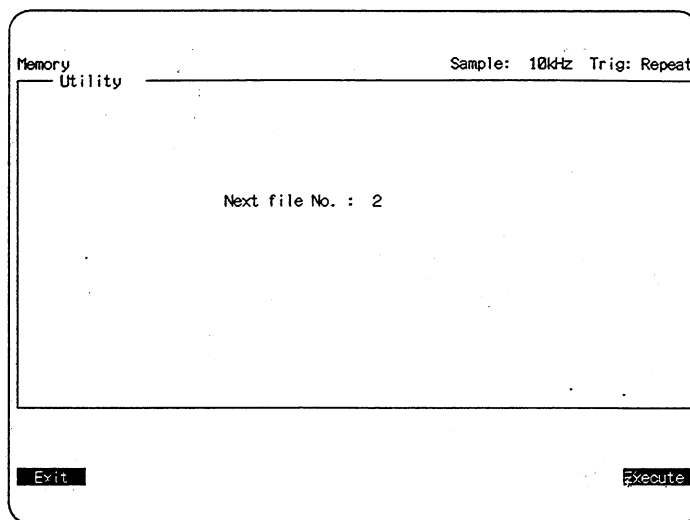
8. When data retrieval from the first Floppy Disk is complete, "Next file No. : 2" is displayed on the CRT screen.

Remove the first Floppy Disk from the main unit and insert the second Floppy Disk.

9. Pressing the  soft key commences the reading of data from the second Floppy Disk.
10. Procedures 8 and 9 should then be repeated for the third Floppy Disk, fourth Floppy Disk, etc. until all the data has been retrieved.

Upon completion of the data retrieval, the CRT screen returns to the Utility panel.

- If for any reason you wish to abort the retrieval procedure mid-way, press the  soft key. However, in such a case all of the data retrieved up to that point becomes unusable.



#### Notes

- If a mistaken ordering is adopted and the first Floppy Disk inserted happens to be the wrong one, then "No such file" will be displayed indicating that the specified file has not been found; "Next file No. : 1" will be displayed shortly afterwards. Retrieving of data can be commenced by changing to the correct Floppy Disk and pressing the  key.
- If, in the case that "Next file No. (2~)" is displayed on the CRT screen, the Floppy Disk has been changed, the  soft key has been pressed and "No such file" appears on the CRT screen (indicating that the specified file has not been found), the data retrieval can be continued by changing to the correct Floppy Disk and pressing the  key.
- If, while "Next file No. (1~)" is displayed on the CRT screen, you happen to press a function key then the data retrieval procedure will be aborted and all of the data retrieved to the main unit's memory up to that point rendered unusable.
- It is recommended that you label beforehand any Floppy Disks to be used.
- Files which have been saved using the DUMP function take the name <filename.AR1> for the first Floppy Disk with the extension changing for the second Floppy Disk onwards : AR2, AR3...AR9, ARA, ARB...ARZ, etc.
- Data that has been dumped using a 512kW/ch version of the main unit cannot be read using a 64kW/ch version of the main unit.
- When using a particular version of the main unit to read dumped data from a Floppy Disk, only data for those Channel Numbers present in the main main unit be read.

# 7.17 Checking Files

## Function

### ■ Setup Information Files

When saving, loading or deleting setup information files you can establish the file name, the time the data was saved and the mode used.

### ■ Measured Data and Computed Data Files

When saving, loading or deleting Measured Data or Computed Data files you can establish the file name, the time that the trigger was activated, the kind of data, the number of channels or number of waveform numbers employed, the number of blocks and the number of data points.

And you can check file contents in more detail using the "Information" function.

### ■ Directory Print-out

A Table listing Files and Directories can be printed out on Chart Paper in MS-DOS Directory Format.

## Procedure ... Setup Information Files

#### 1. LOAD/SAVE

Pressing the LOAD / SAVE key calls up the Load/Save panel.

#### 2. Load/Save mode

Select Panel by pressing the Panel soft key.

#### 3. Type

Select any of Load, Save or Delete using the soft keys.

##### ● Drive no.

Press the A soft key or the B soft key according to the Drive Number you wish to select.

The IC Memory Card Drive Number is A.

The Floppy Disk Drive Number is B.

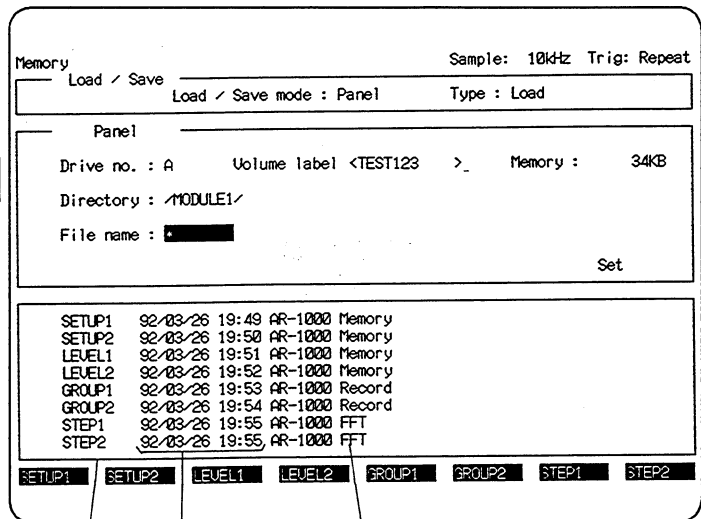
##### ● Directory

"/" indicates a Root Directory. Sub-directories may also be specified at this point. "/" is the symbol used for subdivision of directories. The Directory Name is entered using the soft keys. Once decided, it can be confirmed by pressing the ENTRY key.

If there are more than 8 directories, you may use the Channel Select Keys ← → to change the soft key menu and view the remaining directory names.

##### ● File name

If you now shift the position of the menu cursor, file information for the specified directory is displayed in lots of 8.



## Procedure ... Measured Data and Computed Data Files

### 1. LOAD/SAVE

Pressing the LOAD/SAVE key calls up the Load/Save panel.

### 2. Load/Save mode

Select Data by pressing the **Data** soft key.

### 3. Type

Select any of Load, Save or Delete using the soft keys.

#### ● Drive no.

Press the **A** soft key or the **B** soft key according to the Drive Number you wish to select.

The IC Memory Card Drive Number is A.

The Floppy Disk Drive Number is B.

#### ● Directory

"/" indicates a Root Directory. Sub-directories may also be specified at this point. "/" is the symbol used for subdivision of directories. The Directory Name is entered using the soft keys. Once decided, it can be confirmed by pressing the **ENTRY** key.

If there are more than 8 directories, you may use the Channel Select Keys **←** **→** to change the soft key menu and view the remaining directory names.

#### ● File name

If you now shift the position of the menu cursor, file information for the specified directory is displayed in lots of 8.

File Name	Date and Time that the Trigger was activated	Type of Data	Number of Channels (Measured Data) or Number of Waveform Numbers (Computed Data)	Number of Blocks
TEST1	92/03/26 20:55	MEM-MEAS	1ch	1block 2000
TEST2	92/03/26 20:39	MEM-MEAS	2ch	4block 1000
TEST3	92/03/26 20:41	MEM-PROG	2w	1block 1000
TEST4	92/03/26 20:44	MEM-PROG	1w	1block 500
STEST21	92/03/26 20:46	FFT-MEAS	2ch	1block 1000
STEST22	92/03/26 20:48	FFT-MEAS	1ch	1block 1000
STEST31	92/03/26 20:48	FFT-PROG	2w	1block 1000
STEST32	92/03/26 20:57	FFT-PROG	2w	1block 1000

## Note

■ Data files saved in ASCII Format cannot be checked in this way. A personal computer should be used to check such files.

However, using the Utility PRN Dir Function a directory listing can be printed out on Chart Paper.

**Procedure** ... Information Function

1. **LOAD / SAVE**  
Pressing the LOAD / SAVE key calls up the Load / Save panel.
2. **Load / Save mode**  
Select Data by pressing the Data soft key.
3. **Type**  
Select Information by pressing the Info. soft key.

- **Drive no.**  
Press the A soft key or the B soft key according to the Drive Number you wish to select.

The IC Memory Card Drive Number is A.  
The Floppy Disk Drive Number is B.

- **Directory**  
"/" indicates a Root Directory. Sub-directories may also be specified at this point. "/" is the symbol used for subdivision of directories. The Directory Name is entered using the soft keys. Once decided, it can be confirmed by pressing the ENTRY key.  
If there are more than 8 directories, you may use the Channel Select Keys ← → to change the soft key menu and view the remaining directory names.

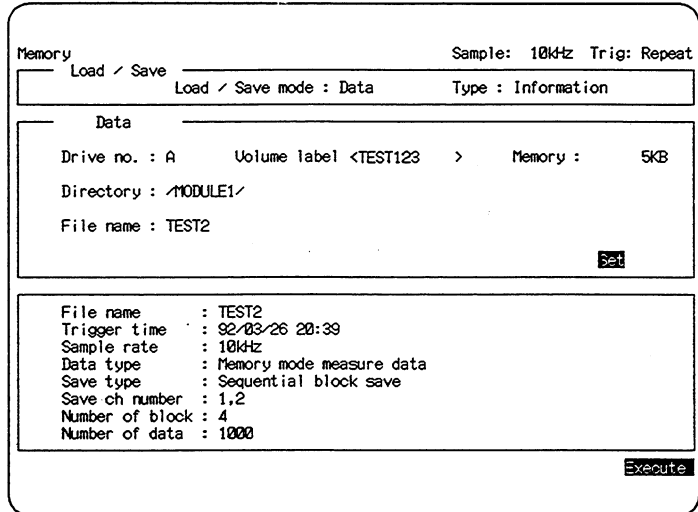
- **File name**  
The names of the files contained in the specified directory are displayed above the soft keys. Only 8 files can be displayed at one time. If there are more than 8 files in the directory, you may use the Channel Select Keys ← → to change the soft key menu and view the remaining file names. You may also enter file names using the Alphanumeric Keypad. Whichever method of file name entry is adopted, confirmation of the entry is carried out by pressing the ENTRY key.

4. **Set**  
Move the Menu Cursor to the "Set" position using the Cursor Keys.  
Then pressing the Execute soft key displays the following detailed file information.

- File name** : Name of file whose contents are being checked.
- Trigger time** : Date and time that data was measured (trigger activated).
- Sample rate** : Sampling rate during measurement.
- Data type** : Displays the mode in which data was measured (Memory, FFT) and whether data is Measured Data or Computed Data.
- Save type** : Displays whether data was saved in individual blocks or using Memory Partitioning (series of blocks).
- Save ch number** : Channel number for which data was measured.
- Number of block** : Number of blocks saved.
- Number of data** : Number of data points contained in each block.

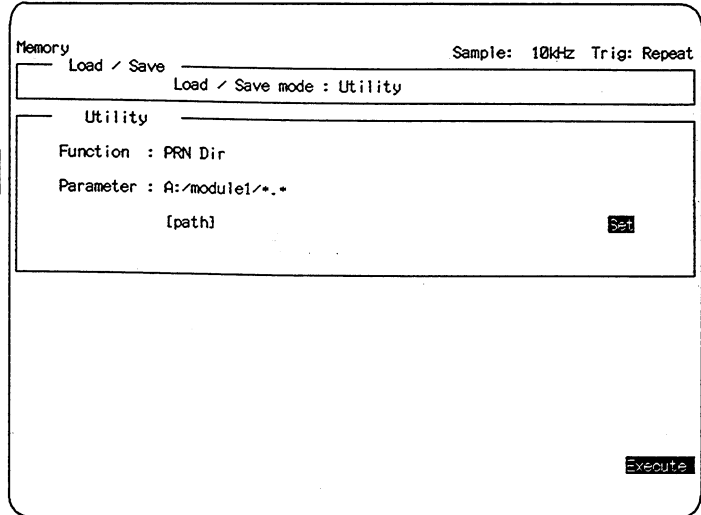
**Note**

- Data files saved in ASCII Format cannot be checked in this way.  
A personal computer should be used to check such files (a special IC Card Reader is required for IC Memory Cards).  
However, using the Utility PRN Dir Function a directory listing can be printed out on Chart Paper.



**Procedure** ... Directory Print-out on Chart Paper

1. **LOAD / SAVE**  
Pressing the LOAD / SAVE key calls up the Load / Save panel.
2. **Load / Save mode**  
Select Utility by pressing the **Utility** soft key.
3. **Utility / Function**  
Select Directory Print-out by pressing the **PRN Dir** soft key.
4. **Utility / Parameter**  
Enter the PATH.  
Press the **A:** soft key or the **B:** soft key according to the Drive Number you wish to select.



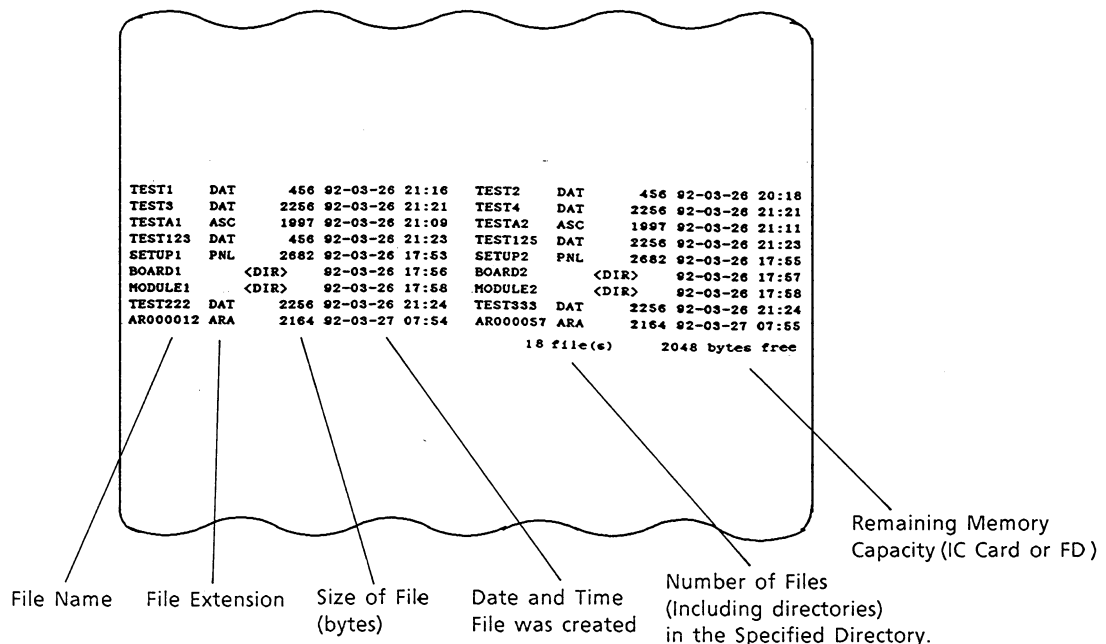
The IC Memory Card Drive Number is A.

The Floppy Disk Drive Number is B.

"/" is the symbol used for subdivision of directories. "\*" is the symbol used to indicate a wildcard. For example, if you wish to see the entire contents of a certain directory, you should write "/ \* . \*" after that directory. Having entered the file name using the Alphanumeric Keypad, it is confirmed using the **ENTRY** key.

The following file extensions are used: DAT for Binary Files of Measured Data and Computed Data; ASC for ASCII Files of Measured Data and Computed Data; PNL for Setup Information Files; AR1 to AR9, ARA to ARZ for Dumped Data Files. File names for standard area data (used in making Go / No-go judgements on waveforms) are in the following form: AR000000. ARA to AR000099. ARA.

5. **Set**  
Shifting the Menu Cursor to the "Set" position and pressing the **Execute** key causes print-out of the directory onto Chart Paper.  
While print-out is in progress, "Utility PRN Dir" is displayed on the CRT screen.



## 7.18 Copying Files

### Function

To copy Files on IC Memory Card or Floppy Disk.

### Procedure

1. **LOAD / SAVE**  
Pressing the LOAD / SAVE key calls up the Load/Save panel.
2. **Load / Save mode**  
Select Utility by pressing the Utility soft key.
3. **Utility / Function**  
Select Copy by pressing the Copy soft key.
4. **Utility / Parameter**  
Enter PATH1 and PATH2 being sure to specify both PATH names in full. PATH1 is the name of the file to be copied and PATH2 is the name of the copy that will be created.

Memory Sample: 10kHz Trig: Repeat

Load / Save Load / Save mode : Utility

---

Utility

Function : Copy

Parameter : A:/test1.\* B:/test111.\*

<path1> <path2> Set

Execute

A space (SP) should be inserted between PATH1 and PATH2. Press the A: soft key or the B: soft key according to the Drive Number you wish to select. The IC Memory Card Drive Number is A. The Floppy Disk Drive Number is B.

“/” is the symbol used for subdivision of directories. “\*” is the symbol used to indicate a wildcard. Once the PATH names have been entered using the Alphanumeric Keypad, they are confirmed by pressing the ENTRY key.

The following file extensions are used : DAT for Binary files of Measured Data and Computed Data ; ASC for ASCII Files of Measured Data and Computed Data ; PNL for Setup Information Files ; AR1 to AR9, ARA to ARZ for Dumped Data Files. File names for standard area data (used in making Go/No-go judgements on waveforms) are in the following form : AR000000. ARA to AR000099. ARA.

File names may be up to 8 and file extensions may be up to 3 characters in length.

5. **Set**  
Shifting the Menu Cursor to the “Set” position and pressing the Execute key commences copying of the file.  
“Utility Copy” is displayed on the CRT screen followed by a return to the Utility panel.

### Notes

- Characters that may be used in file names and impermissible file names are in accordance with MS-DOS.
- If an existing file in the destination (PATH2) directory has the same name as the file to be created, then that existing file will be overwritten. So, care should be taken in the naming of files.
- The “time stamp” for a newly copied file is taken as the time that the copy was made.

## 7.19 Deleting Files

### Function

To delete Files on IC Memory Card or Floppy Disk.

### Procedure

1. **LOAD / SAVE**  
Pressing the LOAD / SAVE key calls up the Load/Save panel.
2. **Load / Save mode**  
Select Utility by pressing the **Utility** soft key.
3. **Utility / Function**  
Select Deletion by pressing the **Del** soft key.
4. **Utility / Parameter**  
Enter the PATH, being sure that you specify the name in full. Press the **A:** soft key or the **B:** soft key according to the Drive Number you wish to select.

The screenshot shows a terminal-style interface. At the top, it says 'Memory' on the left and 'Sample: 10kHz Trig: Repeat' on the right. Below this is a header bar with 'Load / Save' on the left and 'Load / Save mode : Utility' on the right. The main area is titled 'Utility' and contains the following text: 'Function : Del', 'Parameter : A:/module1/test1.dat', and '<path>'. There is a 'Set' button to the right of the parameter field. At the bottom right of the panel is an 'Execute' button.

The IC Memory Card Drive Number is A. The Floppy Disk Drive Number is B.

“/” is the symbol used for subdivision of directories. “\*” is the symbol used to indicate a wildcard. Once the PATH names have been entered using the Alphanumeric Keypad, they are confirmed by pressing the **ENTRY** key.

The following file extensions are used: DAT for Binary files of Measured Data and Computed Data; ASC for ASCII Files of Measured Data and Computed Data; PNL for Setup Information Files; AR1 to AR9, ARA to ARZ for Dumped Data Files. File names for standard area data (used in making Go/No-go judgements on waveforms) are in the following form: AR000000. ARA to AR000099. ARA.

File names may be up to 8 and file extensions may be up to 3 characters in length.

5. **Set**  
Shifting the Menu Cursor to the “Set” position and pressing the **Execute** key causes deletion of the specified file.  
“Utility Delete” is displayed on the CRT screen followed by a return to the Utility panel.

### Note

- Check the file name (PATH) carefully before carrying out any deletion.



## 7.20 Renaming Files

### Function

To change the name of a file on IC Memory Card or Floppy Disk.

### Procedure

#### 1. LOAD/SAVE

Pressing the LOAD / SAVE key calls up the Load/Save panel.

#### 2. Load / Save mode

Select Utility by pressing the **Utility** soft key.

#### 3. Utility / Function

Select Renaming by pressing the **Ren** soft key.

#### 4. Utility / Parameter

Enter PATH1 and PATH2 being sure to specify both PATH names in full. PATH1 is the current name of the file and PATH2 is the new name of the file to be adopted after renaming.

A space (SP) should be inserted between PATH1 and PATH2.

Press the **A:** soft key or the **B:** soft key according to the Drive Number you wish to select. The IC Memory Card Drive Number is A. The Floppy Disk Drive Number is B.

"/" is the symbol used for subdivision of directories. Once the PATH names have been entered using the Alphanumeric Keypad, they are confirmed by pressing the **ENTRY** key.

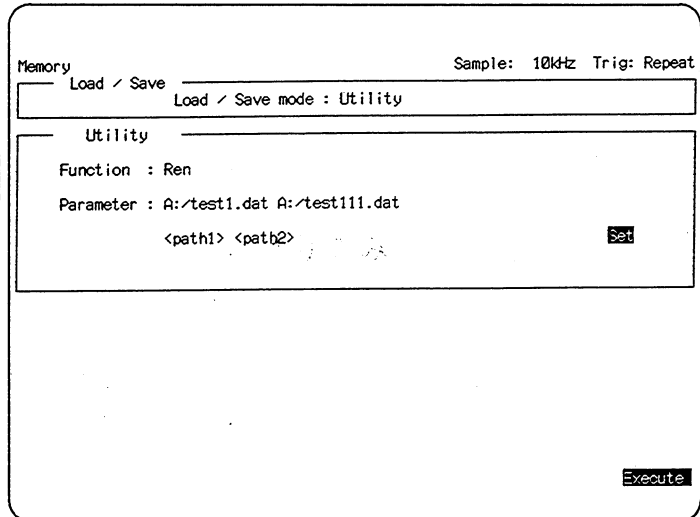
The following file extensions are used: DAT for Binary files of Measured Data and Computed Data; ASC for ASCII Files of Measured Data and Computed Data; PNL for Setup Information Files; AR1 to AR9, ARA to ARZ for Dumped Data Files. File names for standard area data (used in making Go/No-go judgements on waveforms) are in the following form: AR000000. ARA to AR000099. ARA.

File names may be up to 8 and file extensions may be up to 3 characters in length.

#### 5. Set

Shift the Menu Cursor to the "Set" position and press the **Execute** key; the file renaming procedure will be executed.

"Utility Rename" is displayed on the CRT screen followed by a return to the Utility panel.



### Notes

- Characters that may be used in file names and impermissible file names are in accordance with MS-DOS.
- The wildcard symbol "\*" cannot be used during the renaming of files. Files should be renamed on a one-by-one basis.
- If you specify the name (PATH) of an existing file as PATH2, the renaming procedure will not be carried out.
- Check the PATH names (file names) carefully before carrying out any renaming procedure.

## 7.21 Creating and Deleting Directories

### Function

To create or delete a directory on IC Memory Card or Floppy Disk.

### Procedure

#### 1. LOAD / SAVE

Pressing the LOAD / SAVE key calls up the Load/Save panel.

#### 2. Load / Save mode

Select Utility by pressing the **Utility** soft key.

#### 3. Utility / Function

Select Directory Creation by pressing the **MD** (Make Directory) soft key ; select Directory Deletion by pressing the **RD** (Remove Directory) soft key.

#### 4. Utility / Parameter

Enter the PATH, being sure to specify in full the directory you wish to create or delete. Press the **A:** soft key or the **B:** soft key according to the Drive Number you wish to select. The IC Memory Card Drive Number is A. The Floppy Disk Drive Number is B.

“/” is the symbol used for subdivision of directories. Once the PATH name has been entered using the Alphanumeric Keypad, it is confirmed by pressing the **ENTRY** key.

The directory name may be up to 8 and file extensions may be up to 3 characters in length.

#### 5. Set

Shift the Menu Cursor to the “Set” position and press the **Execute** key ; the directory creation or deletion procedure will be executed.

Utility MD” (in the case of directory creation) or “Utility RD” (in the case of directory deletion) is displayed on the CRT screen followed by a return to the Utility panel.

The screenshot shows a terminal window titled 'Memory' with 'Sample: 10kHz Trig: Repeat' in the top right. The main display area is divided into sections. The top section is labeled 'Load / Save' and shows 'Load / Save mode : Utility'. Below this is the 'Utility' section, which contains 'Function : MD' and 'Parameter : A:/module12'. There is a '<directory>' prompt followed by a 'Set' key indicator. At the bottom right of the screen is an 'Execute' key indicator.

### Notes

- Characters that may be used in directory names and impermissible directory names are in accordance with MS-DOS.
- Directories containing files or sub-directories cannot be deleted.
- The wildcard symbol “\*” cannot be used when deleting directories (RD procedure). Directories should be deleted on a one-by-one basis.

## 7.22 ASCII File Format

---

The ASCII File Format of the main unit is shown below.

①	Model Name	CR	LF		
②	Number of Data Points	CR	LF		
③	Trigger Point	CR	LF		
④	Time that Trigger was activated	CR	LF		
⑤	Sampling Rate	CR	LF		
⑥	Channel Number	CR	LF		
⑦	Input Range	CR	LF		
⑧	Unit	CR	LF		
⑨	Data Type	CR	LF		
⑩	"No."	CR	LF		
⑪	Data Number and Data  (Repeated for Number of Data)	CR	LF		

① Model Name

	1	2	3	4	5	6	7	8	9	10	11
	" A R - 1 0 0 0 "									CR	LF
Hex	22	41	52	2D	31	30	30	30	22	0D	0A

② Number of Data Points

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	" N u m b e r o f d a t a " ,																	Number of Data Points		
Hex	22	4E	75	6D	62	65	72	20	6F	66	20	64	61	74	61	22	2C			

	21	22	23	24	25	26
				CR	LF	
Hex				0D	0A	

● Example

18	19	20	21	22	23	24	
			1	0	0	0	1000 Data Points
		6	4	0	0	0	64000 Data Points
1	0	0	0	0	0	0	1000000 Data Points

③ Trigger Point

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	" T r i g g e r p o i n t " ,																Trigger Point			
Hex	22	54	72	69	67	67	65	72	20	70	6F	69	6E	74	22	2C				

	21	22	23	24
			CR	LF
Hex			0D	0A

● Example

17	18	19	20	21	22
					0
			9	9	9
9	9	9	9	9	9

Data No. 0

Data No. 999

Data No. 999999

④ Time that Trigger was activated

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	" T r i g g e r t i m e " ,																Time that Trigger was activated			
Hex	22	54	72	69	67	67	65	72	20	74	69	6D	65	22	2C					

	21	22	23	24	25	26	27	28	29	30	31	32	33
												CR	LF
Hex												0D	0A

● Example

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
"	9	2	/	0	1	/	0	1		0	0	:	0	0	"
"	9	3	/	1	2	/	3	1		2	3	:	5	9	"

⑤ Sampling Rate

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	" S a m p l e r a t e " ,														Sampling Rate		'	Unit		
Hex	22	53	61	6D	70	6C	65	20	72	61	74	65	22	2C			2C			

	21	22	23	24	25
				CR	LF
Hex				0D	0A

● Example

	15	16	17	18	19	20	21	22	23	
	1	0	0	,	"	k	H	z	"	100kHz
			1	,	"	H	z		"	1Hz
	0	.	1	,	"	H	z		"	0.1Hz
				,	"	E	x	t	"	External Clock

⑥ Channel Number

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	" T a g n a m e " ,										Channel Number				,					
Hex	22	54	61	67	20	6E	61	6D	65	22	2C					2C				

	21	22	23	24		?	?
	Channel Number				.....	CR	LF
Hex						0D	0A

● Example

	+0	+1	+2	+3	+4	+5	
	"		C	H	1	"	Analog Channel 1
	"	C	H	1	6	"	Analog Channel 16
	"			A	1	"	Logic Bit 1 of Channel A

⑦ Input Range

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	" R a n g e " ,							Input Range							,	Input Range					
Hex	22	54	61	67	20	6E	22	2C								2C					

	21	22	23
Hex			

.....

?	?
CR	LF
0D	0A

● Example

+0	+1	+2	+3	+4	+5	+6	
"			6	0	V	"	60V
"		0	.	6	V	"	0.6V
"	0	.	0	6	V	"	0.06V
"					T	"	Type T

Note : Except Logic Data.

⑧ Unit

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	" U n i t " ,							Unit					,	Unit			
Hex	22	55	6E	69	74	22	2C						2C				

.....

?	?
CR	LF
0D	0A

● Example

+0	+1	+2	+3	
"		V	"	Voltage
"	o	C	"	Temperature

Note : Except Logic Data.

⑨ Data Type

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	" D a t a t y p e " ,											Data Type									
Hex	22	44	61	74	61	20	74	79	70	65	22	2C									

	21	22	23	24	25	26	27	28	29			
	,	Data Type							.....		?	?
Hex	2C										CR	LF
											0D	0A

● Example

+0	+1	+2	+3	+4	+5	+6	+7	
"	A	n	a	l	o	g	"	Analog Data of Voltage
"			T	e	m	p	"	Analog Data of Temperature
"		L	o	g	i	c	"	Logic Data

⑩ "No."

	1	2	3	4	5	6	7
	" N o . "					CR	LF
Hex	22	44	61	74	22	0D	0A

⑪ Data Number and Data

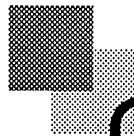
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Data Number						,	Data									,			
Hex							2C										2C			

	21	22	23	24	25	26				
	Data						.....		?	?
Hex									CR	LF
									0D	0A







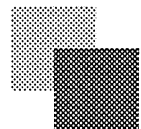
# Chapter 8

## Memory Mode /

## Other Functions and Settings

This chapter explains waveform overwrite, waveform tests, auto operations and other highly useful functions for AR1100A users.

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


## 8.1 Setting Waveform Overwrite (ACCUMULATE)



### Function

Generally, each time measurement is performed, previously displayed waveforms are erased; however, this accumulation function allows earlier waveforms to be saved. Thus, with this function, a comparison made between blocks of the same channel.

The following three modes are available for the accumulate function :

- Mode 1 Retains all waveforms on display.  
The active waveform also is retained with normal brightness.
- Mode 2 Only the active waveform is retained with intensified brightness.
- Mode 3 Retains all waveforms on display.  
The active waveform is retained with intensified brightness.

Note : An active waveform is a waveform displayed with intensified brightness ; its scale values are inverse video displayed in cursor mode. To change the active waveform, press  to put the instrument into cursor mode and select the desired waveform using the channel select keys  and  .

Accumulation start procedure differs according to whether  or  is pressed.

#### ■ Pressing









Starts accumulation after the panel has been erased. Therefore, this method is effective when the trigger mode is Repeat or Free.

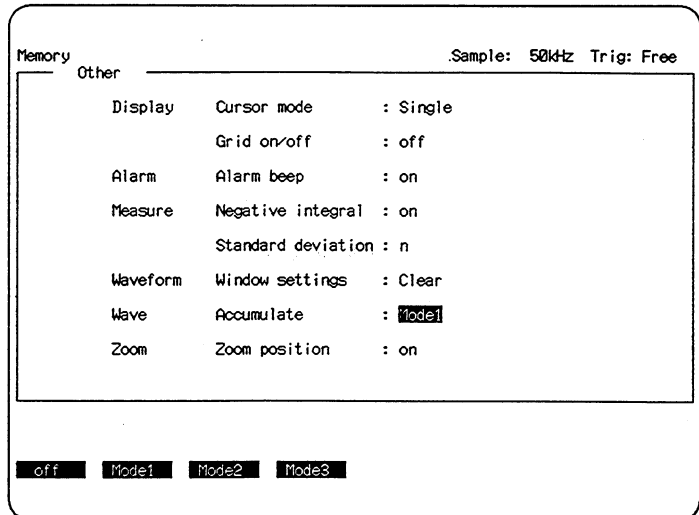
#### ■ Pressing

Displays a newly measured waveform above the waveform being displayed on the panel.

Note : If you wish to erase the waveform display, press any function key to call up a setting panel.

### Procedure

1.  MISC panel appears.
2.  Panel changes to the setting panel.
3. Move the menu cursor using the cursor key .
4. **Wave accumulation**  
 Selecting  causes no accumulation.  
 Selecting  activates Mode 1 accumulation.  
 Selecting  activates Mode 2 accumulation.  
 Selecting  activates Mode 3 accumulation.
5. Pressing any function key  terminates the MISC panel.



### Notes

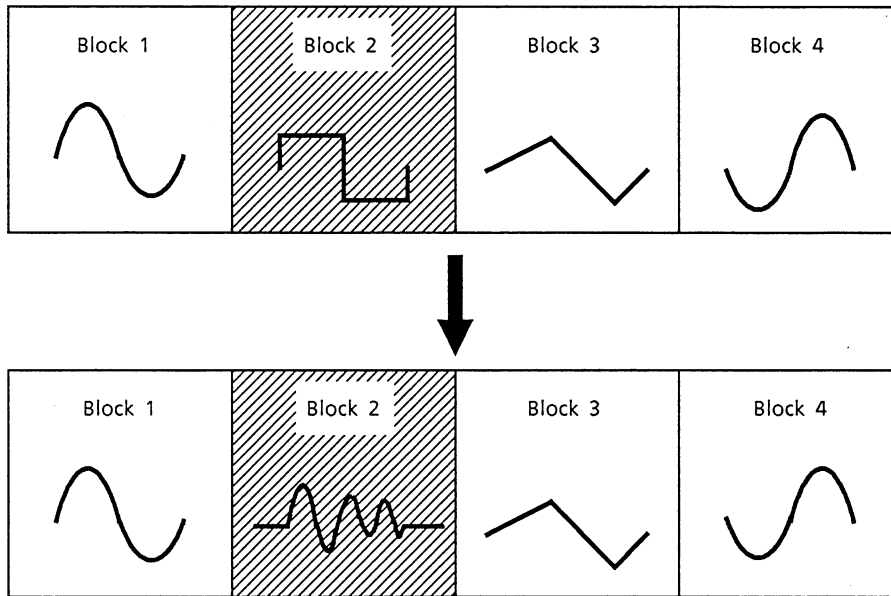
- Cursor function is effective only for the most recent data.
- If the zoom function is executed, data display of other than the most recent data is erased.

## 8.2 Remeasurement of Specific Block

### Function

If memory is partitioned, see Section 4.4, "Setting of Memory Partitioning," this function allows the user to redo the measurement for a block that has already been measured by specifying a block number.

Assume for example that four memory blocks are in use for measurement, and that measurement is completed after data has been captured to all the blocks. If block 2 is specified as the measurement block and measurement is performed in the Single trigger mode, the new data is captured to block 2.



The operation of this function differs according to whether the block protection mode is "on" or "off" (see Section 8.12, "Protecting Data in Blocks").

### ■ When Block Protection Mode is "off"

Data measurement begins with the specified block, and continues through the subsequent blocks. Assume for example that eight blocks are in use for measurement, and that measurement has proceeded as far as block 4.

Block	1	2	3	4	5	6	7	8
	○	○	○	○				

If block 3 is specified as the measurement block, then data measurement begins with block 3 and continues from there.

Block	1	2	3	4	5	6	7	8
	○	○	◎	◎	◎	◎	◎	◎

- : Data measured before the measurement block has been specified
- ◎ : Data measured after the measurement block has been specified

**■ When Block Protection Mode is “on”**

Data measurement begins with the specified block, and continues with those for which no measurement has yet been made. Assume for example that eight blocks are in use for measurement, and that measurement has proceeded as far as block 4.

Block	1	2	3	4	5	6	7	8
	○	○	○	○				

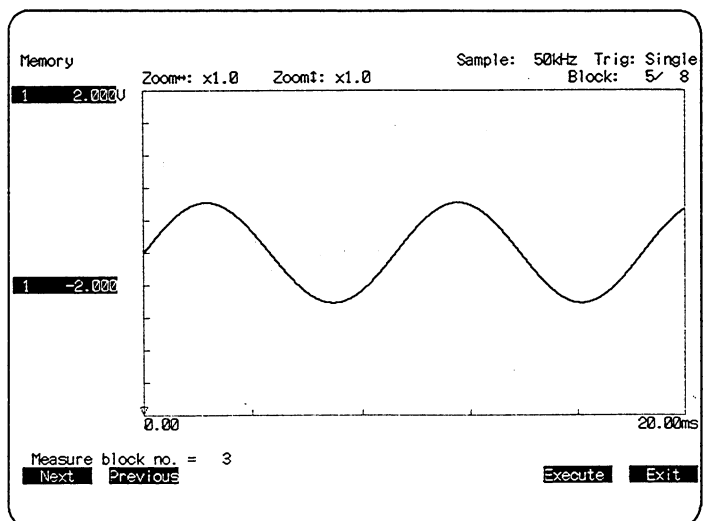
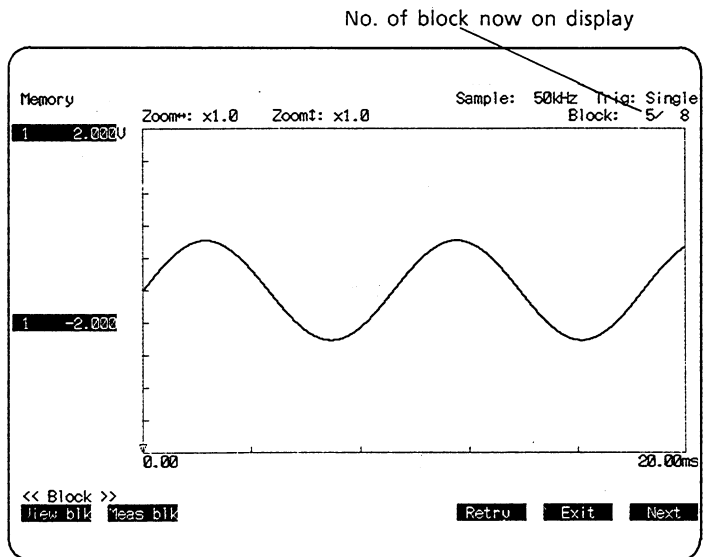
If block 3 is specified as the measurement block, then data measurement begins with block 3, after which data measurement continues with blocks 5, 6, 7, and 8.

Block	1	2	3	4	5	6	7	8
	○	○	◎	○	◎	◎	◎	◎

○ : Data measured before the measurement block has been specified  
 ◎ : Data measured after the measurement block has been specified








**Procedure** ··· When Restarting Measurement from the Waveform Panel

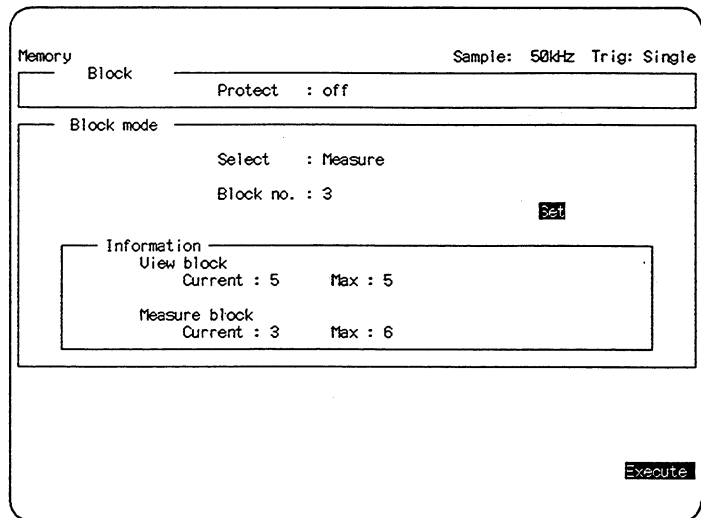
1. **CURSOR**  
Instrument enters cursor mode.
2. **Block**  
Block setting panel appears.
3. **Meas blk**  
Mode changes to the mode which permits the user to specify a measurement block.
4. **Measure block no.**  
Specify the block to be measured. Pressing **Next** or **Previous** causes “Measure block no.” to change. It is not possible to specify a block on which measurement has not yet been performed.
5. **Execute**  
The block specified in “4.” above is fixed.
6. Pressing **START** causes the measurement for the block specified by “4.” to begin.



## 8.2 Remeasurement of Specific Block

### Procedure ... When Restarting Measurement from the MISC Panel

1.  MISC panel appears.
2.  Block setting panel appears.
3. Move the menu cursor to the "Block mode Select" area using the cursor key .
4.  Remeasurement is specified.
5. **Block no.**  
Enter the number of the block from which measurement is to be restarted using the alphanumeric keypad.
6.  Block number is fixed and the menu cursor moves to Set.
7. **Set**  
 The block specified by "5." is set as the block from which measurement is restarted.
8.  Measurement starts from the block specified by "5."



The screenshot shows the MISC panel interface. At the top right, it displays "Sample: 50kHz Trig: Single". Below this, there are several sections:

- Memory Block**: A section with "Protect : off".
- Block mode**: A section with "Select : Measure" and "Block no. : 3". A "Set" button is located to the right of "Block no. : 3".
- Information**: A section containing two rows of data:
  - View block**: "Current : 5" and "Max : 5".
  - Measure block**: "Current : 3" and "Max : 6".
- An **Execute** button is located at the bottom right of the panel.

### Note

#### ■ Memory Block Usage Map Review

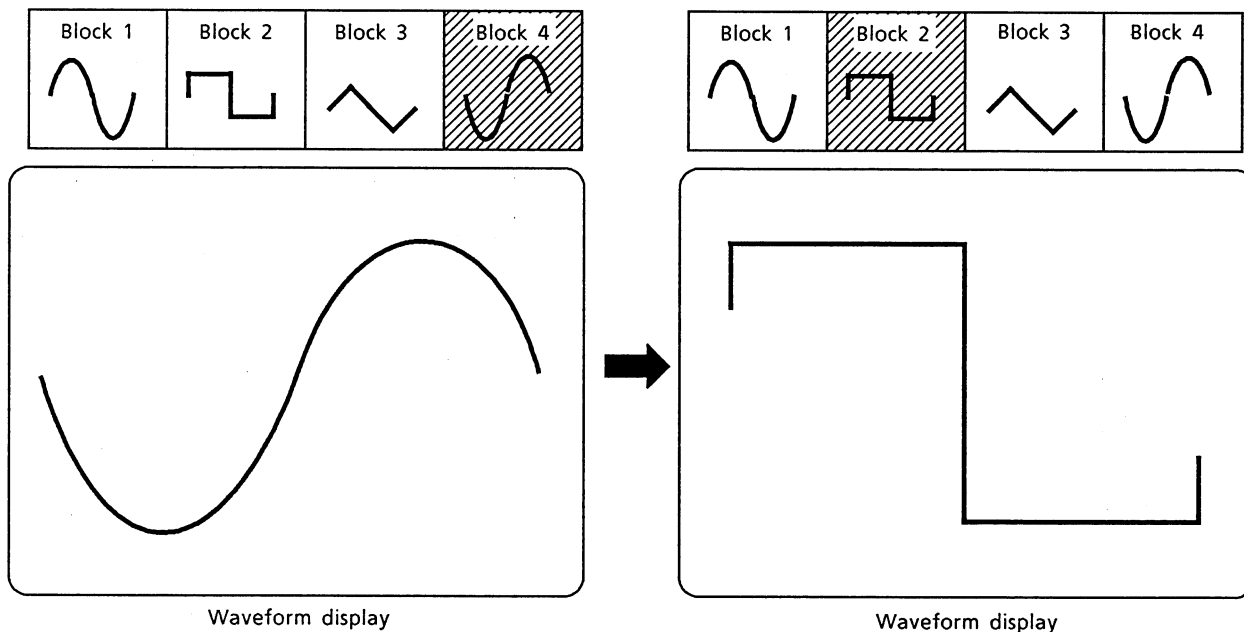
If you wish to know in which blocks data exists and when that data was captured, see Section 8.13, "Memory Block Usage Map Review."

## 8.3 Changing the Block to be Displayed

### Function

If memory is partitioned, see Section 4.4, "Setting of Memory Partitioning," this function allows the user to display the data in a block that has already been measured on the CRT screen by specifying a block number.

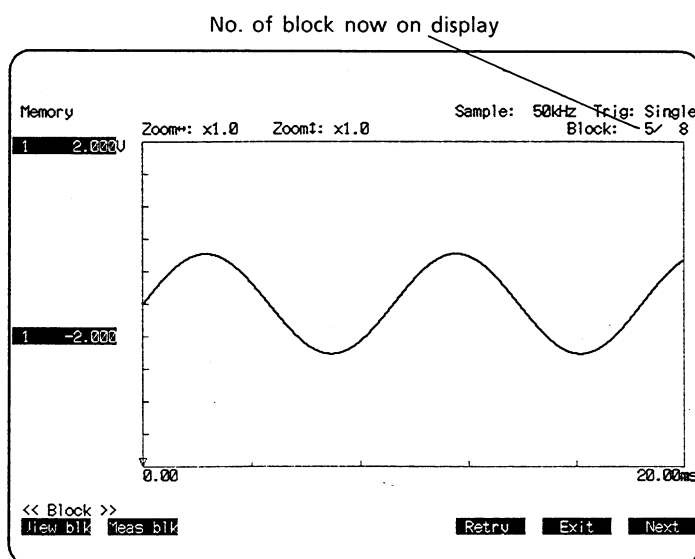
Assume for example that measurement with four memory blocks has been completed and the data for block 4 measured last is currently being displayed. If the user wishes to view the data for block 2, it is possible to display that data by specifying block 2.



### Procedure

... When Changing the Block to be Displayed from the Waveform Panel

1. **CURSOR**  
Instrument enters cursor mode.
2. **Block**  
Block setting panel appears.
3. **View Blk**  
Mode changes to the mode which permits the user to change the block to be displayed.





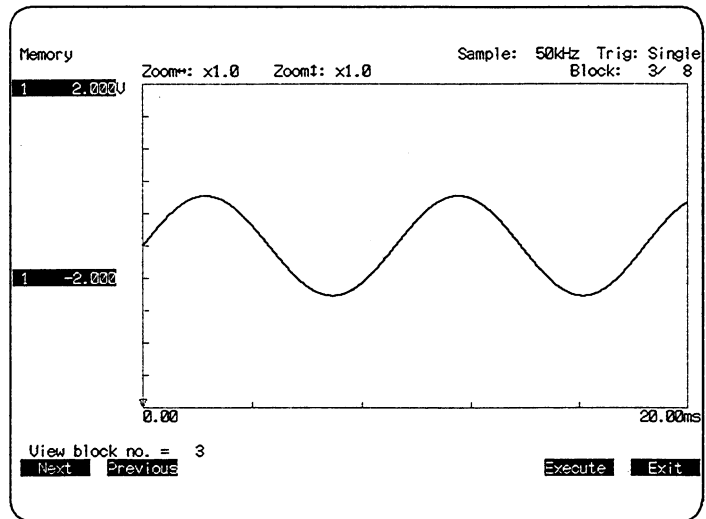
### 8.3 Changing the Block to be Displayed

#### 4. View block no.

Specify the block to be displayed.  
Pressing  or  causes "View block no." to change.

#### 5.

The data of the block specified by "4." is displayed.



### **Procedure** ...When Changing the Block to be Displayed from the MISC Panel

#### 1.

MISC panel appears.

#### 2.

Block setting panel is called up.

#### 3. Move the menu cursor to the "Block mode Select" area using the cursor key .

#### 4.

Display change is specified.

#### 5. Block no.

Enter the number of the block to be displayed using the alphanumeric keypad.

#### 6.

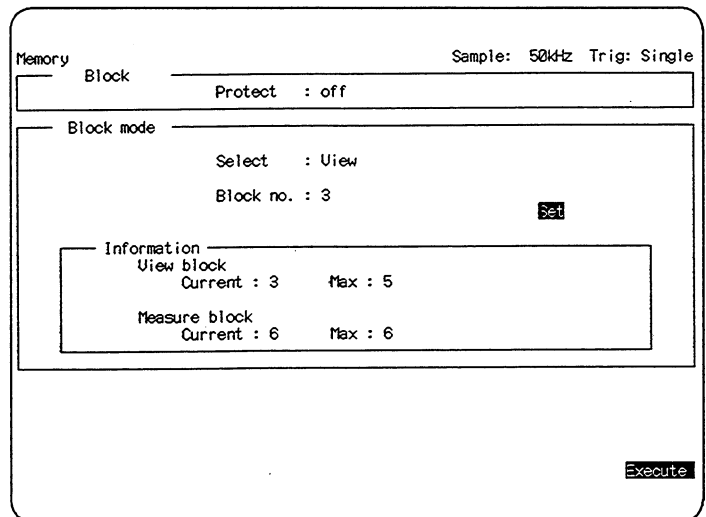
Block number is fixed and the menu cursor moves to "Set".

#### 7. Set

Block specified by "5." is set as the block to be displayed.

#### 8.

Block specified by "5." is displayed.



### **Note**

#### ■ Memory Block Usage Map Review

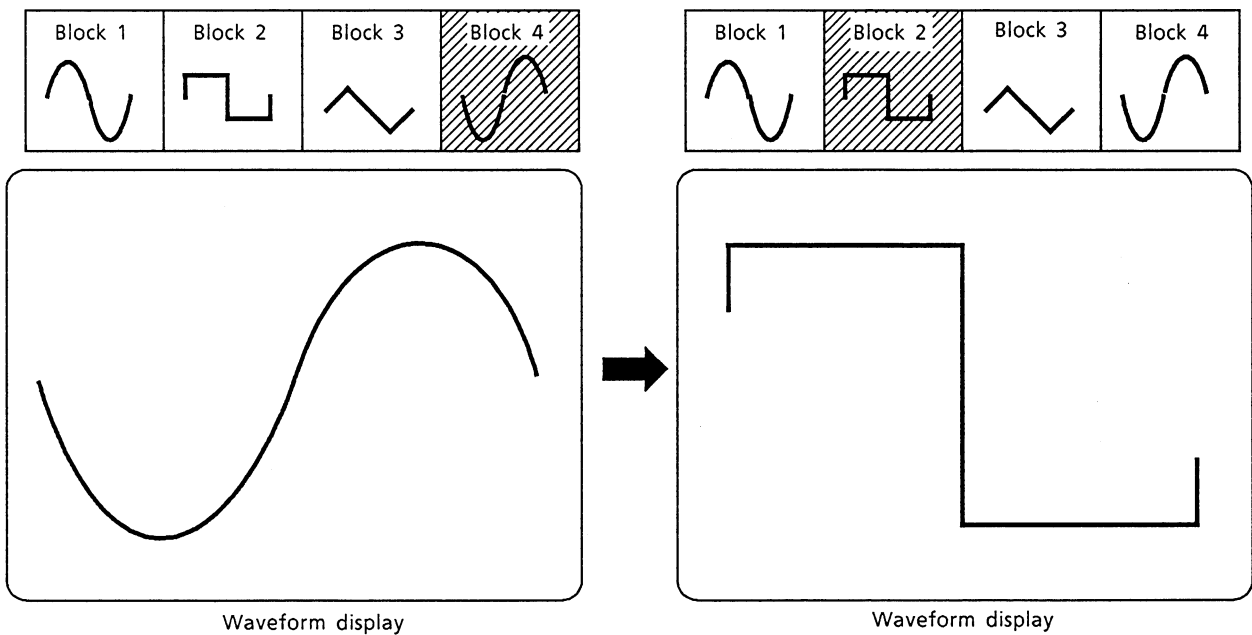
If you wish to know in which blocks data exists and when that data was captured, see Section 8.13, "Memory Block Usage Map Review."

## 8.4 When Restarting Measurement for the Specified Block from the Displaying Block

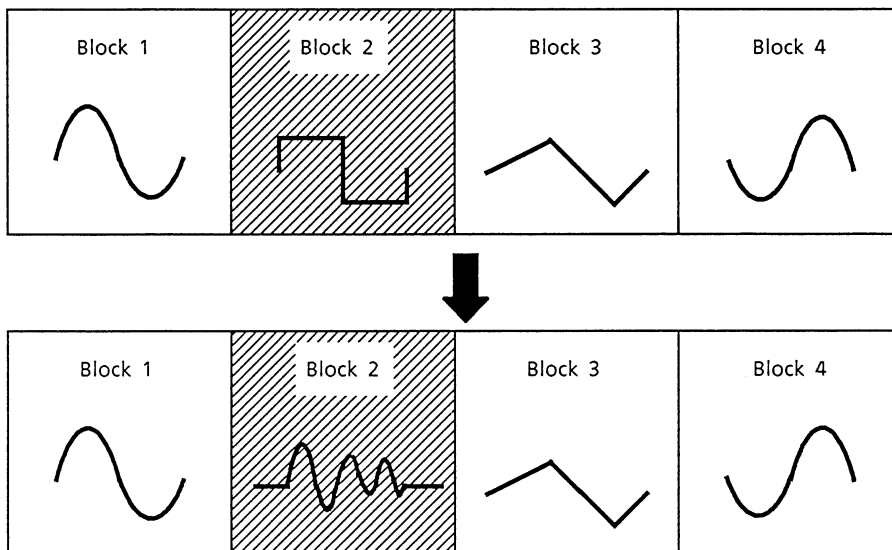
### Function

If memory is partitioned, see Section 4.4, "Setting of Memory Partitioning," this function allows the user to display the data in a block that has already been measured on the CRT screen by specifying a block number. Also, with this function, measurement can be restarted from the displaying block. Thus, it can be said that this function combines the two functions which are respectively described in Section 8.2, "Remeasurement of Specific Block" and Section 8.3, "Changing the Block to be Displayed."

Assume for example that measurement with four memory blocks has been completed and the data for block 4 measured last is currently being displayed. If the user wishes to view the data for block 2, it is possible to display that data by specifying block 2.



If measurement is performed for the currently displayed block 2 using the Single trigger mode, the new data is captured to block 2.



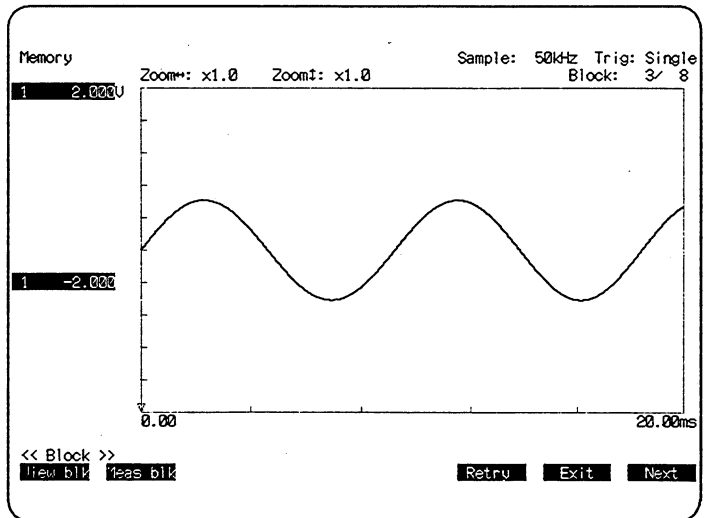
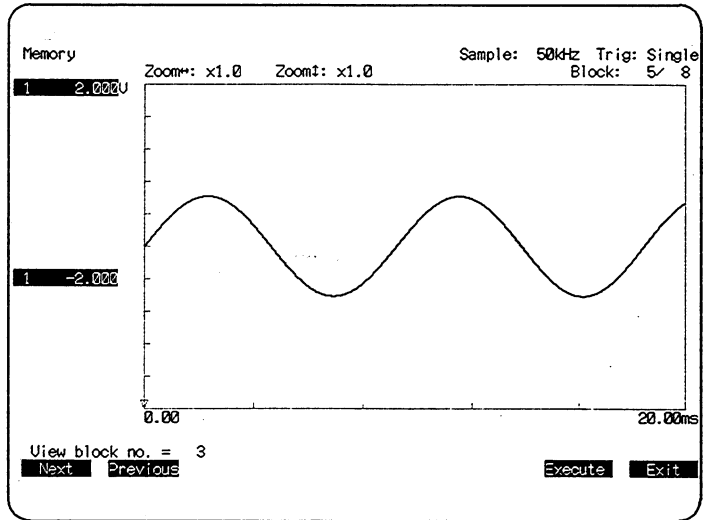
## 8.4 When Restarting Measurement for the Specified Block from the Displaying Block

The operation of this function differs according to whether the block protection mode is “on” or “off” (see Section 8.12, “Protecting Data in Blocks”). For details, see Section 8.2, “Remeasurement of Specific Block.”

### Procedure

Activating the function from the waveform panel

1. **CURSOR**  
Instrument enters cursor mode.
2. **Block**  
Block setting panel appears.
3. **View Blk**  
Mode changes to the mode which permits the user to change the block to be displayed.
4. **View block no.**  
Specify the block to be displayed.  
Pressing **Next** or **Previous** causes “View block no.” to change.
5. **Execute**  
Allows the data of the block specified by “4.” to be viewed as the waveform display.
6. **Exit**  
Previous display panel returns.
7. **Retry**  
Block for remeasurement is fixed.
8. Pressing **START** starts the measurement from the displayed block specified by “4.”.



### Note

#### ■ Memory Block Usage Map Review

If you wish to know in which blocks data exists and when that data was captured, see Section 8.13, “Memory Block Usage Map Review.”

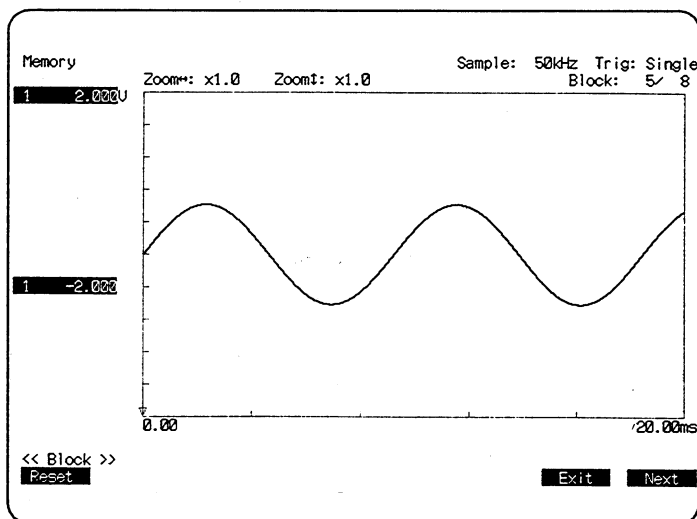
## 8.5 Resetting Data Measured Using Memory Partitioning

### Function


Resets all data measured using memory partitioning.

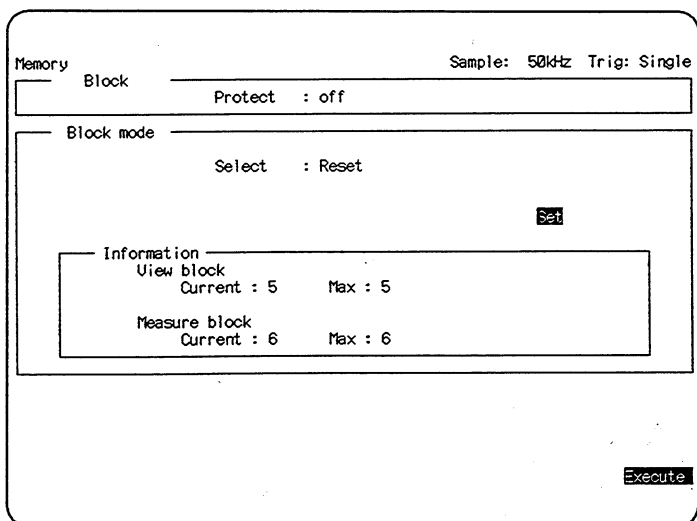
### Procedure ... On the waveform panel

1. **CURSOR**  
Instrument enters cursor mode.
2. **Block**  
The block setting panel appears.
3. **Next**  
Soft key menu changes.
4. **Reset**  
Data samples for all blocks are erased.



### Procedure ... On the MISC panel

1. **MISC**  
MISC panel appears.
2. **Block**  
Block setting panel appears.
3. Move the menu cursor to the "Block mode Select" area using the cursor key .
4. **Reset**  
Menu cursor moves to "Set".
5. **Set**  
**Execute**  
The data samples for all blocks are erased.



### Note

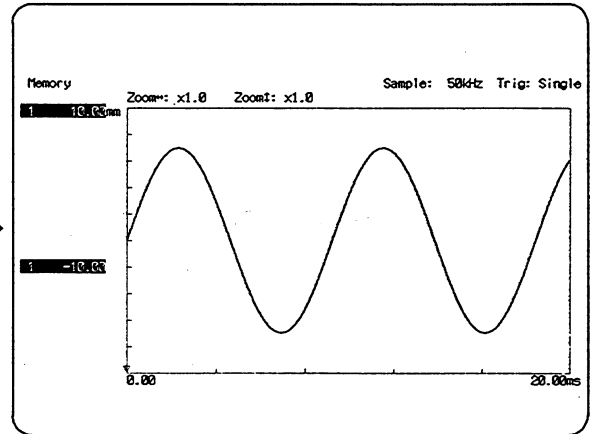
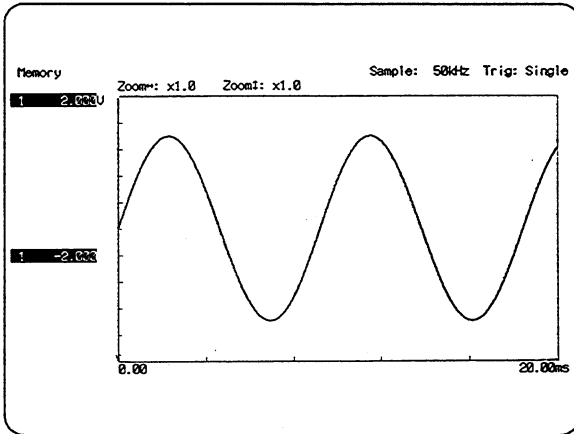
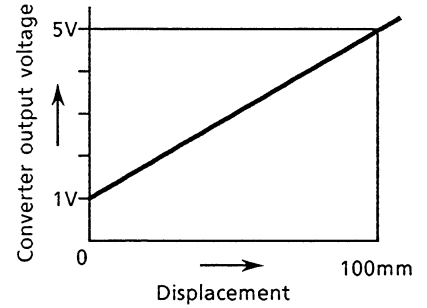
- Either of the above operations can erase all data, regardless of whether the block protection mode is "on" or "off".
- **Memory Block Usage Map Review**  
If you wish to know in which blocks data exists and when that data was captured, see Section 8.13, "Memory Block Usage Map Review".

# 8.6 Setting Linear Scaling

## Function

If external converters are being used to measure physical quantities such as strain, displacement, speed, acceleration, and pressure, the physical quantities can be read directly (in engineering units) by using the linear scaling function. For example, if a displacement gauge is used, displacement can be read directly in “mm” units.

The linear scaling function makes it possible to convert voltage to displacement units without consuming the memory capacity that would be required if the computational processing functions had to be used for this (using computational processing reduces the available memory size to one-fourth the otherwise available memory size).



## Procedure

1. **MISC**  
 MISC setting panel is called up.
2. **Scale**  
 Instrument enters mode for setting linear scaling.
3. **Linear scale**  
 Select .
4. **Coefficient**  
 Use the alphanumeric keypad to enter the constant of proportionality (slope) for the first-order (linear) function.  
 Press  to fix the constant.
5. **Offset**  
 Use the alphanumeric keypad to enter the offset value for the first-order (linear) function.  
 Press  to fix the value.
6. **Units**  
 Use the soft keys or the alphanumeric keypad to enter the units. Press  to fix the units.

Memory Sample: 50kHz Trig: Single

Linear scale mode Linear scale : on

---

Linear scale

Channel	Coefficient	Offset	Units
1ch	5.000	0.000	mm
2ch	1.000	0.000	
3ch	1.000	0.000	
4ch	1.000	0.000	
5ch	1.000	0.000	
6ch	1.000	0.000	
7ch	1.000	0.000	
8ch	1.000	0.000	

Operation Example
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To measure voltage on channel 1 using a converter giving 1V output per 5mm displacement, and convert to displacement.

Notes
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- If computational processing is used (see Section 4.9, "Setting PROGRAM (Computations) to ON"), linear scaling is disabled. However, monitor display (see Section 11.3, "Monitoring Measured Data") will show the values that would have been obtained from linear scaling.
- If computational processing is not used (Program=off), then the values displayed on the waveform panels are the values resulting from linear scaling.
- The setting range for constants of proportionality (Coefficient) and offset values (Offset) is  $-10^{30}$  to  $10^{30}$ .
- Linear scaling cannot be set for logic input.

## 8.7 Waveform Tests (Go / No-go)

### Function

The waveform test function judges whether a waveform is or is not within the preset test area, and outputs the result of the judgment at TTL level from the Go / No-go connector on the instrument rear panel. However, the test can be performed for only one waveform displayed using the Single display format (see Section 4.10, "Setting of Display Format").

When Go / No-go output is detected, the instrument can save the data to memory and then automatically terminate the measurement (auto save).

The test area can be set in either of the following ways: by using the displayed waveform itself, or by creating a horizontal area on the panel (band setting). The created test area can be saved / loaded to and from an IC memory card.

Also, auto recording command of the auto sequence function causes the waveform obtained when the Go / No-go output is generated to be automatically recorded. See Section 8.8, "Setting Automatic Operation (AUTO SEQUENCE)."

### ■ Test Area Setting

- **Setting using the displayed waveform**

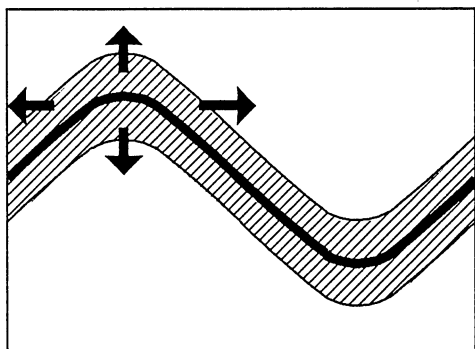
Set the area by moving the displayed waveform up, down, left and right on the panel using the cursor keys.

- **Band setting**

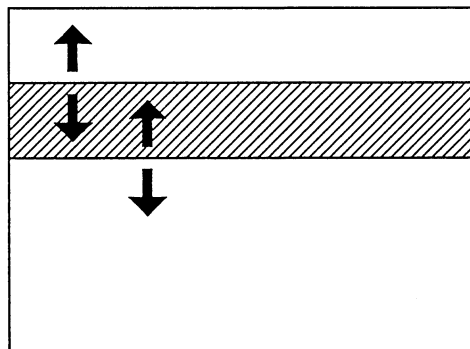
Create a horizontal band on the panel. It is possible to create multiple bands.

- **Setting by loading from IC memory card**

Load the file to which the test area created by using either of the above methods is saved.



Setting using displayed waveform



Band setting

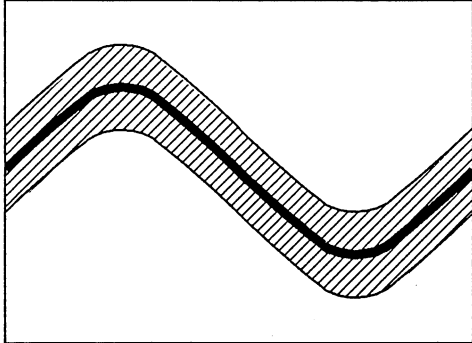
## ■ Judgment Modes

### ● In

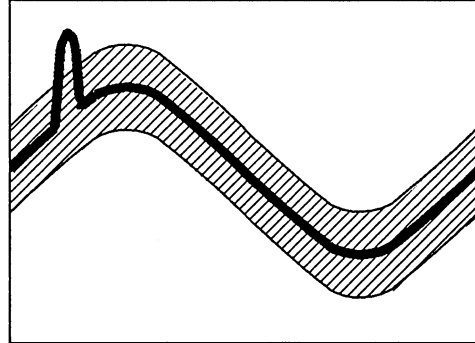
The Go/No-go output is generated when the measured waveform comes entirely within the test area.

### ● Out

The Go/No-go output is generated when any part of the measured waveform goes outside of the test area.



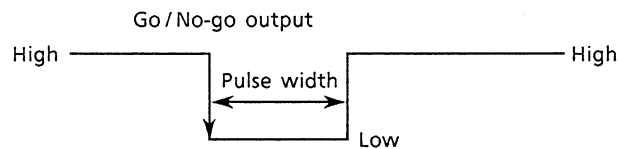
In : Go/No-go output generated  
for case shown above



Out : Go/No-go output generated  
for case shown above

## ■ Go/No-go Output

- A TTL level pulse signal is output from the Go/No-go output terminal.



$$100\text{ms} \leq \text{pulse width} \leq 150\text{ms}$$

When the Go/No-go output is generated,  
the signal level proceeds from high level to low level.

- Measurement automatically ends after data has been saved to internal memory (in auto save setting).
- If this waveform test function is used in combination with the auto sequence function, data obtained when the Go/No-go output is generated is automatically recorded by the internal printer (when the auto recording command of the auto sequence function is set).

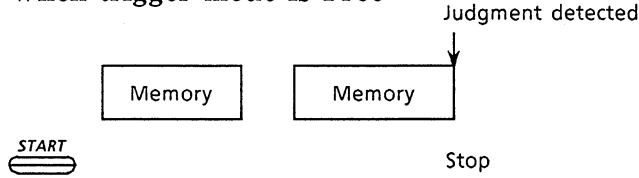


■ Data Capture to Memory When Auto Save is in Use

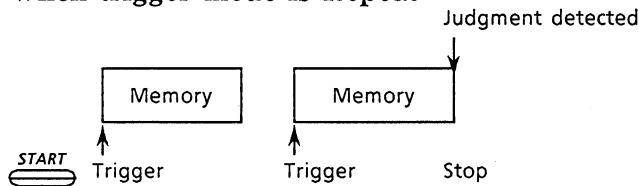
● If memory is not partitioned

When the Go / No-go output is detected, the data is saved to memory, and measurement automatically ends. Waveform test ends on the first occasion that judgment is detected. Note that if the trigger mode is Single then measurement ends after one data capture cycle, regardless of whether judgment was detected. Therefore the use of Free or Repeat trigger mode is recommended.

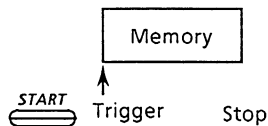
● When trigger mode is Free



● When trigger mode is Repeat



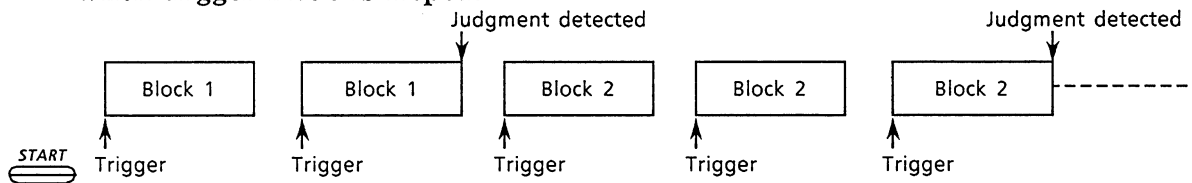
● When trigger mode is Single



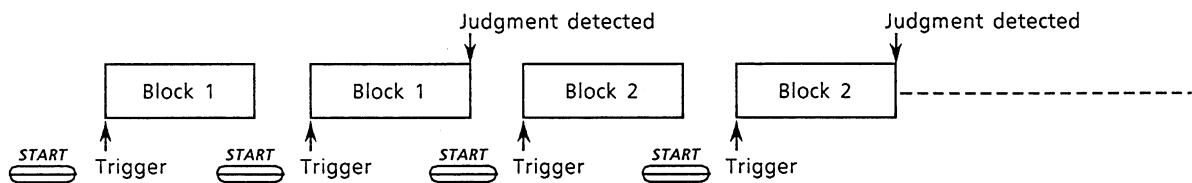
● If memory is partitioned

Each time judgment is detected, data is saved to memory, and the current block is updated to the next block. Waveform test ends when judgment has been detected for the specified number of blocks.

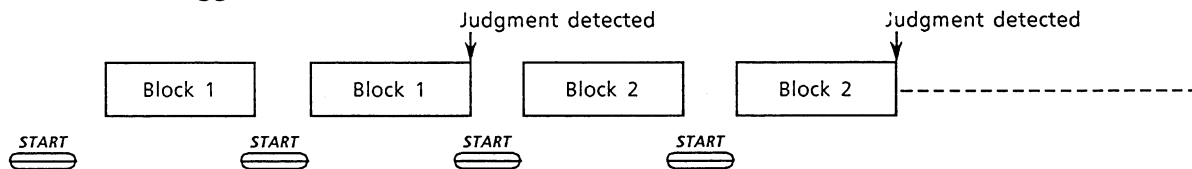
● When trigger mode is Repeat



● When trigger mode is Single





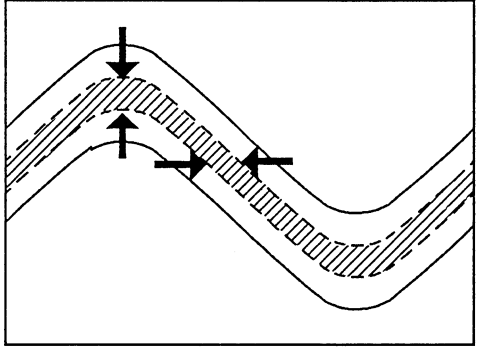
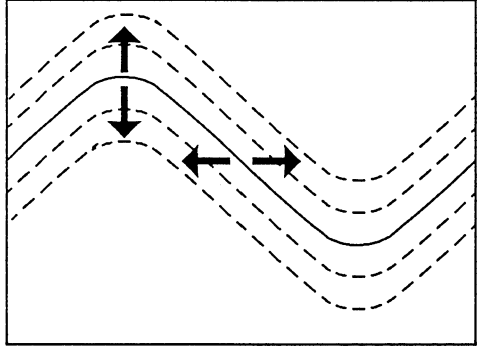
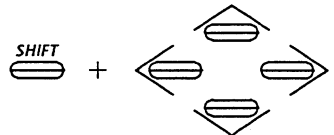
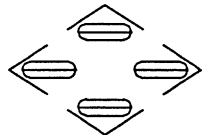
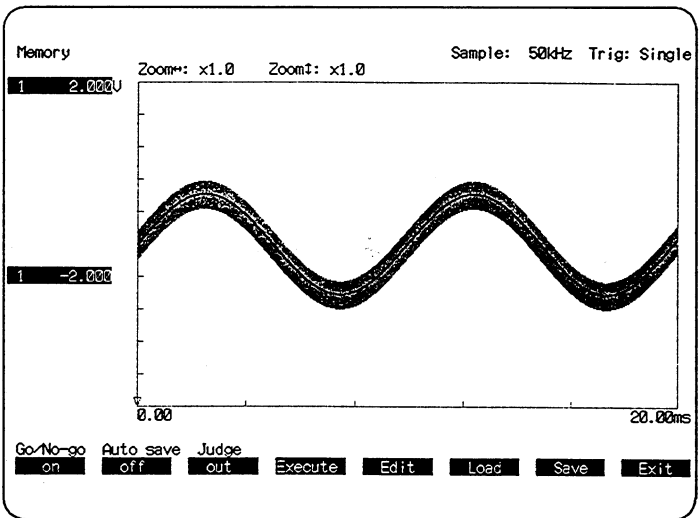
● When trigger mode is Free



● When averaging is in use, the data is saved to memory when judgment is detected even if the specified number of cycles has not been reached.

**Procedure** ... Setting the Test Area Using the Displayed Waveform

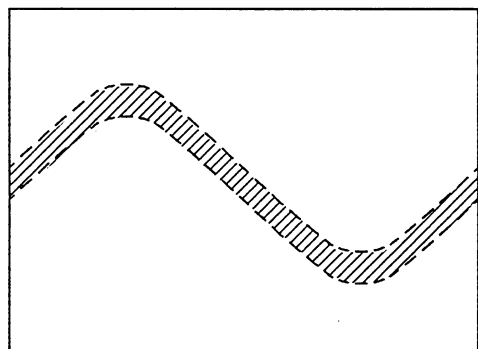
1. Display the standard waveform using **START** or **PROGRAM START** on the panel. Select "Single" as the display format.
2. **SHIFT** + **MEASURE**  
Instrument enters waveform test mode.
3. **Go/No-go**  
Select "on" using the relevant soft key.
4. Select the standard waveform using the channel select keys  and .
5. **Edit**  
The instrument enters test area creation mode.
6. **Clear**  
(Press this key only when you wish to create new standard waveforms.)
7. Create the test area using the cursor keys.



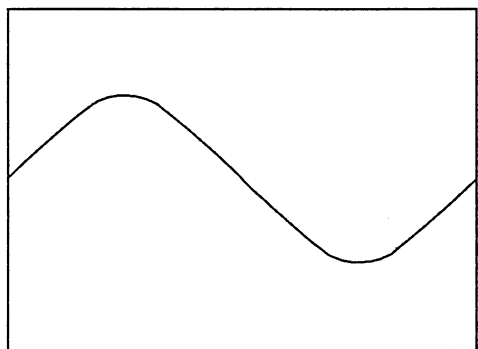
Note : It is not possible to shrink a test area loaded from an IC memory card, or a test area already created before entering the Edit mode.

Pressing **Execute** sets the test area.

Use **Clear** to change (erase) the existing test area.



**Clear**

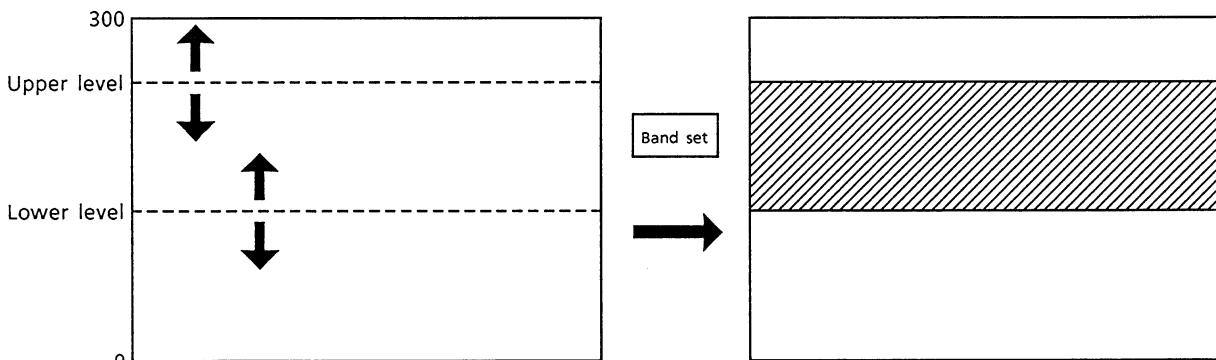
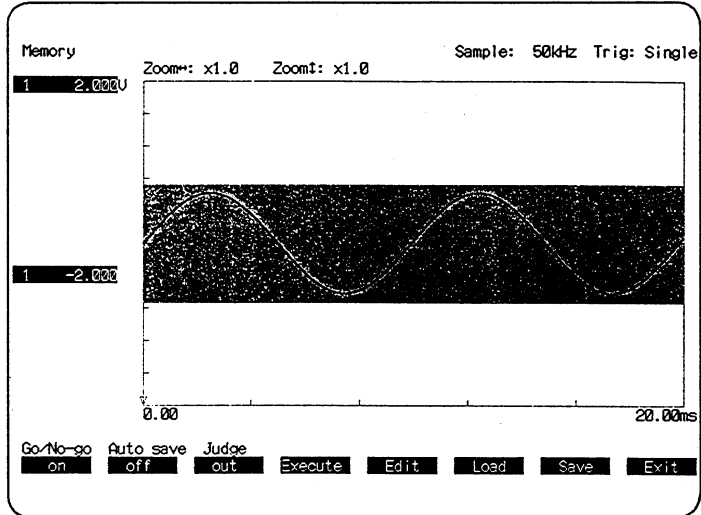


**Procedure** ... Setting a Band as a Test Area

1. **SHIFT** + **MEASURE**  
Instrument enters waveform test mode.
2. **Go/No-go**  
Select "on" using the soft key.
3. **Edit**  
Instrument enters test area creation mode.
4. **Upper level, Lower level**  
Move the upper and lower dashed lines on the panel using **Up** and **Down** to set the band position and width.

The upper end of the waveform panel has been set to value "300"; the lower end has been set to value "0".

Note : It is not possible to change a test area loaded from an IC memory card, or a test area already created before entering the Edit mode (superimposing is possible).



5. **Band set**  
Test area is set.
6. To change (erase) the setting of the band under creation, press **Band Clr**.

**Procedure** ... Saving the Test Area to an IC Card

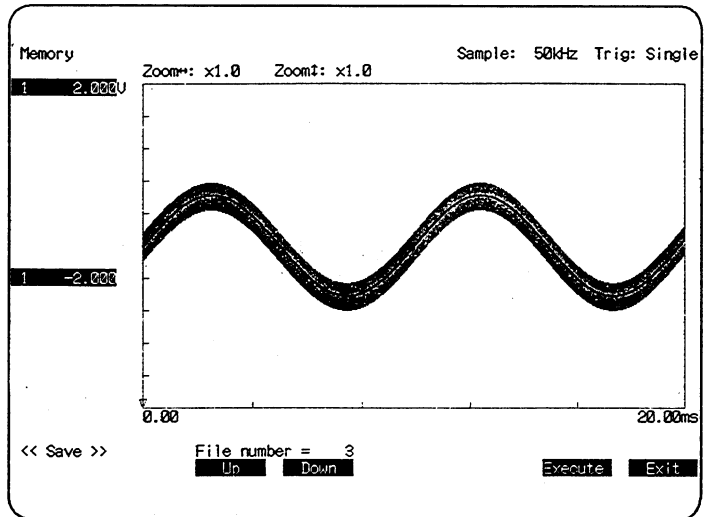
1. **SHIFT** + **MEASURE**  
Instrument enters waveform test mode.
2. **Go / No-go**  
Select "on" using the soft key.
3. When a test area has not already been created, select **Edit**.  
Use the test area creation mode to create a test area (see pages 8-17 and 8-18).

**Execute**

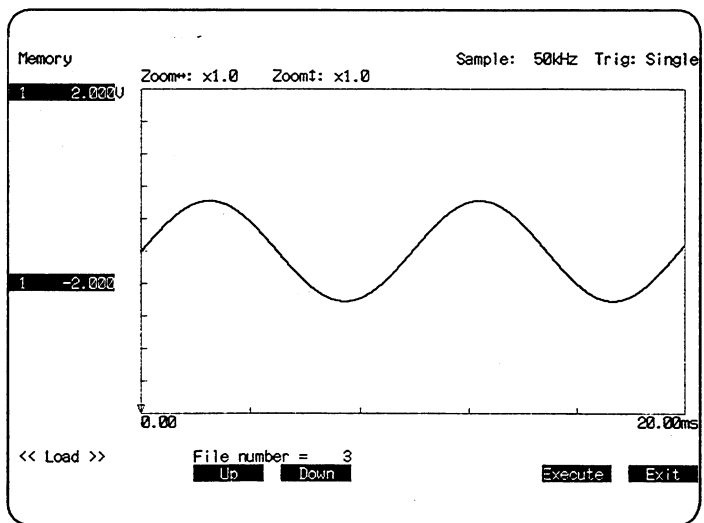
4. **Save**  
"File number" is displayed in the lower part of the panel.

Specify the file number (0 to 99) using **Up** and **Down**.

5. **Execute**  
During saving of the test area "Saving ...." is displayed in the upper part of the panel.  
When saving is completed, "Completed" is displayed.

**Procedure** ... Loading the Test Area from an IC Card

1. **SHIFT** + **MEASURE**  
Instrument enters waveform test mode.
2. **Go / No-go**  
Select "on" using the soft key.
3. **Load**  
"File number" is displayed at the lower part of the panel.  
Specify the file number (0 to 99) using **Up** and **Down**.
4. **Execute**  
During loading of the test area "Loading ...." is displayed in the upper part of the panel.  
When loading is completed, "Completed" is displayed.



**Procedure** ... Performing Waveform Test

1. Set up a test area in advance (see pages 8-17, 8-18, and 8-19).

2.  $\overline{\text{SHIFT}}$  +  $\overline{\text{MEASURE}}$

Instrument enters waveform test mode.

3. **Go/No-go**

Select "on" using the soft key.

4. **Auto save**

By using the soft keys, select whether or not to save the waveform which is obtained when Go / No-go output is generated to internal memory and automatically terminate the measurement (on/off).

5. **Judge**

Select In or Out using the soft keys.

- **In**

Go / No-go output is generated when the measured waveform is contained entirely within the test area.

- **Out**

Go / No-go output is generated when any part of the measured waveform extends beyond the test area.

6. Select the waveform on which waveform test is to be performed using the channel select keys  $\overline{\text{CH1}}$  and  $\overline{\text{CH2}}$ .

7. **Execute**

Instrument enters the mode permitting waveform test.

8.  $\overline{\text{START}}$  or  $\overline{\text{PROGRAM START}}$

Measurement or redisplay for testing is performed.

- If you wish to record data automatically using the auto sequence function, press

$\overline{\text{SHIFT}}$  +  $\overline{\text{START}}$ .

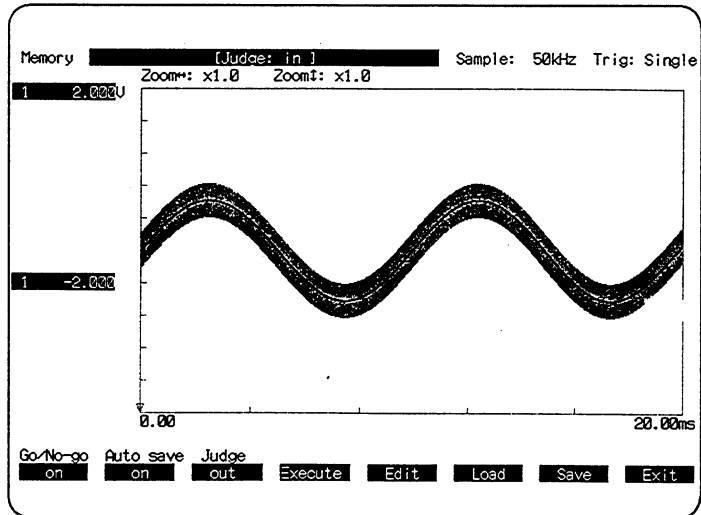
In this case, it is necessary to preset an auto recording command in the auto sequence program (initial state). For auto sequence setting, see Section 8.8, "Setting Automatic Operation (AUTO SEQUENCE)."

- While waveform test is in progress, "Judge : in" or "Judge : out" is displayed in the upper part of the panel each time measurement ends. When the condition selected in "5." above is satisfied, "Judgment detected" is momentarily displayed and the alarm beep sounds.

Note : If you wish to disable the alarm beep, see Section 11.6, "Disabling the Alarm Beep".

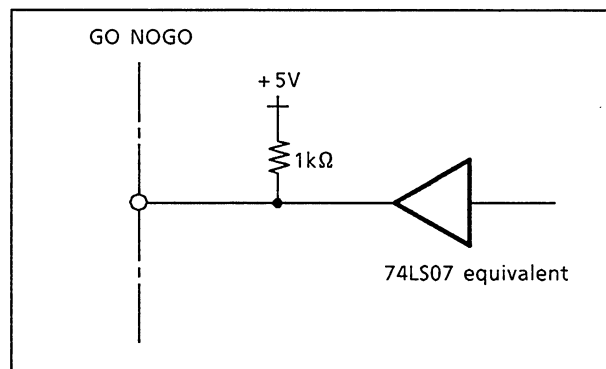
- **To stop waveform test**

When no measurement is being performed, press  $\overline{\text{SHIFT}}$  +  $\overline{\text{MEASURE}}$  so that the instrument enters waveform test mode. Set Go / No-go to "off" and then press **Exit**. The test area on the panel disappears.



**Notes**

- Waveform test is only possible when the display format is Single (see Section 4.10, "Setting of Display Format").
- Only one waveform can be tested at a time.
- The test area file is saved only to the root directory of an IC card and the file name will be AR000000. ARA to AR000099. ARA.
- Waveform test can also be performed on computed waveforms (see Section 4.9, "Setting PROGRAM (Computations) to ON", and on waveforms on which averaging has been performed (see Section 4.5, "Setting of Averaging").
- If auto recording at Go/No-go output is performed when the auto sequence function is in use, measurement is suspended until recording ends.
- The GO/NOGO output format is as shown below.





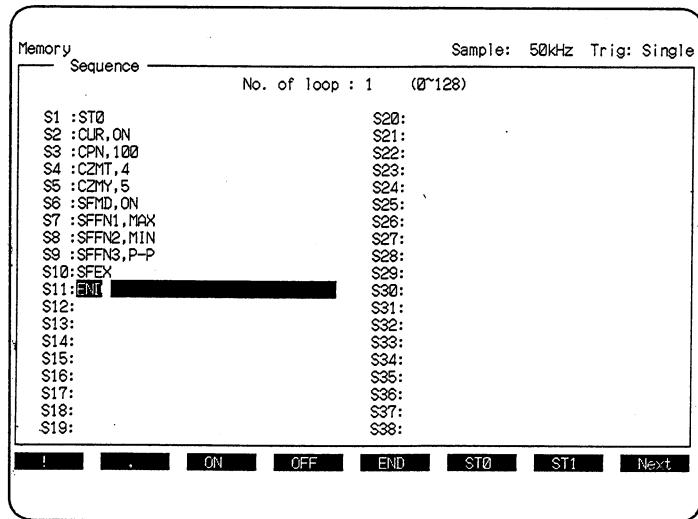
## 8.8 Setting Automatic Operation (AUTO SEQUENCE)





### Function

Allows the instrument to automatically perform a sequence of operations from measurement start to recording through data analysis (cursor, zoom, zone computation, and other functions). The procedures to be performed must be programmed in advance.

### Procedure

1.  MISC panel appears.
2.  Panel that permits auto sequence program input is called up.



3. **No. of Loop**  
Enter a number (0 to 128) to specify how many times the program currently created is to be executed using the alphanumeric keypad.  
Press  to fix the entered number.  
Note : If "0" is set, the program is infinitely executed.
4. **S1 to S38**  
Enter commands for the auto sequence function (see page 8-24).  
Use the soft keys to enter commands and the alphanumeric keypad to enter numeric values.  
Press  to fix the entries.  
Note : The initial setting is S1 : ST3 and S2 : END, which means that the auto recording function (measurement, then recording) is set.
5.  and then   
Auto sequence function is executed according to the program.

### ■ Precautions for Program Setting

- Always enter the "END" command at the end of the program ; otherwise, the auto sequence function will not work.
- Enter a comma (,) between a command and a parameter.
- Program auto sequence so that commands are executed in the correct order ; otherwise, the auto sequence function will not operate. For example, setting the cursor moving command earlier than the command for selecting cursor mode results in error.

Notes
-------

- The user can forcibly stop an auto sequence program in progress by pressing SHIFT and then STOP .
- Though commands for auto sequence are based on those for communications (GP-IB or RS-232-C interface), usable commands are limited. Also, there are parameter limits on some commands (see the command list on the next page).
- Auto sequence does not support setting of measurement conditions such as mode, memory size, input coupling, input range, trigger, etc. or setting of display format, print format, etc.
- If setup information is saved to an IC memory card or floppy disk, the auto sequence program is saved along with it (see Section 7.14, "Saving, Loading and Deleting Setup Information").
- To perform auto recording during waveform tests (see Section 8.7, "Waveform Tests (Go / No-go)"), initialize the auto sequence program as follows :
  - No. of loop = 1
  - S1 : ST3
  - S2 : END
 When designing other applications of this function, make sure to create the correct sequence and include the ST3 command.
- When the ST0, ST1, ST2 or ST3 command is entered in the auto sequence program with a Trigger Mode of "Repeat" or "Free", next step can't be done.



## 8.8 Setting Automatic Operation (AUTO SEQUENCE)

Table 8.1 Auto-Sequence Command List

Command	Description	Parameter	Remarks
!	Ignore the contents of this line.	None	<p>When the cursor mode is not set to 'on', these commands will result in errors.</p> <p>When the zone computation is not set to 'on', these commands will result in errors.</p>
END	Auto-sequence end	None	
ST0	Measurement start	None	
ST1	Program start	None	
ST2	Program start (with SHIFT)	None	
ST3	Auto recording (performs measurement, then recording)	None	
PST0	Printing start	None	
PST1	Hard copy	None	
CUR	Cursor mode	ON, OFF	
CUn	Active graph setting	None, n: 1 to 8	
CRF	Reference cursor	ON, OFF	
CPN	Cursor position setting	0 to 999999	
CZMT	T axis zoom setting	See Table 8.2	
CZMY	Y axis zoom setting	1, 2, 5, 10, 20	
CZMX	X axis zoom setting	1, 2, 5, 10, 20, In X-Y mode only	
CCM1	Comment 1 display	None	
CCM2	Comment 2 display	None	
CCM3	Comment 3 display	None	
CCM4	Comment 4 display	None	
CCM5	Print format title display	None	
CCM6	Current time display	None	
CCM7	Trigger time display	None	
SFMD	Zone statistical computation mode	ON, OFF	
SFSP	Zone statistical computation start point	0 to 999999	
SFEP	Zone statistical computation end point	0 to 999999	
SFEX	Execution of zone statistical computation	None	
SFFN <sub>n</sub>	Execution of zone statistical computational expression	See Table 8.3. n: 1 to 3	
SWP1	Execution of waveform swapping	None	
MBVB	Display block change	None (Note) See page 8-26	

Table 8.2 CZMT Parameters

Memory Size	Parameter					
1k	2	4	10	20		
2k	2	4	8	20		
4k	2	4	8	16	40	
8k	2	4	8	16	32	
16k	2	4	8	16	32	64
32k	1.6	3.2	8	16	32	64
64k	1.6	3.2	6.4	16	32	64
125k	2.5	5	12.5	25	50	125
250k	5	10	25	50	100	250
500k	10	20	50	100	200	500
1M	10	40	100	200	400	1000

Table 8.3 SFFNn Parameter

Parameter	Description
MAX	Maximum value
MIN	Minimum value
P-P	Peak-to-peak value
AVE	Average value
RMS	Root-mean-square
INTEG	Area
STD	Standard deviation
INTEG1	Area (at X-Y display, Integ1)
INTEG2	Area (at X-Y display, Integ2)
OFF	Computation off

## 8.8 Setting Automatic Operation (AUTO SEQUENCE)

Note : MBVB command :

No parameter can be specified for the MBVB (display block change) auto sequence command.

If the auto sequence function being executed comes across an MBVB command, the block currently displayed is changed to the next block.

Also, this command cannot be used when cursor mode is set to "off".

Example :

When the memory is partitioned into eight blocks and each block already contains data, to make a hard copy of each block using auto sequence, set the program as follows.

No. of loop=8

ST1

PST1

CUR, ON

MBVB

END

In this case, set "Block mode Block no." on the MISC : Block panel to "1" when "View" has been selected for "Block mode Select" (see Section 8.3, "Changing the Block to be Displayed").

When the above program is executed, error is detected at MBVB of the eighth loop even though the sequence ends normally. This is because the block number changes to "9" when MBVB is executed at the eighth loop.

Setting Example
--------------------

## ... Example of Auto-Sequence Program

Command	Description
ST0	: Measurement start
CUR, ON	: Cursor ON
CPN, 400	: Cursor position 400 points
CZMT, 4	: T axis zoom multiplier 4
CZMY, 5	: Y axis zoom multiplier 5
SFMD, ON	: Zone statistical computation mode ON
SFFN1, MAX	: Computation for A: MAX
SFFN2, MIN	: Computation for B: MIN
SFFN3, P-P	: Computation for C: P-P
CU1	: Active graph No. 1
SFEX	: Zone statistical computation execution
CCM1	: Comment 1 display
PST1	: Hard copy
CU2	: Active graph No. 2
SFEX	: Zone statistical computation execution
CCM2	: Comment 2 display
PST1	: Hard copy
CU3	: Active graph No. 3
SFEX	: Zone statistical computation execution
CCM3	: Comment 3 display
PST1	: Hard copy
CU4	: Active graph No. 4
SFEX	: Zone statistical computation execution
CCM4	: Comment 4 display
PST1	: Hard copy
END	: Auto-sequence end

## 8.9 Displaying Comments on Waveform Panel

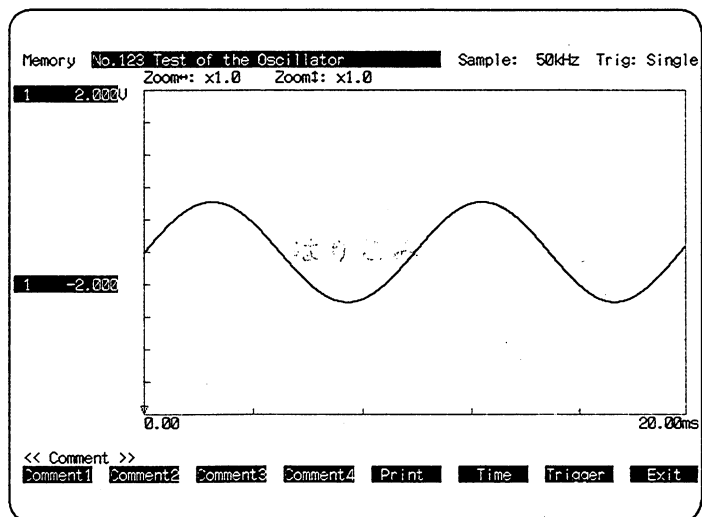
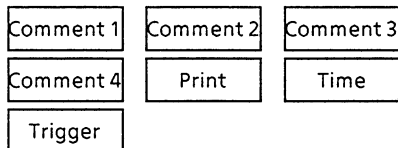
### Function

Displays comments on the waveform panel. By making a hard copy of the panel with the comments on display, the comments can be recorded onto paper along with the waveforms.

- Comment 1 to Comment 4 : Comments specified in Section 8.10, "Comment Registration"
- Print : Titles specified in Section 6.3, "Setting up for a High Resolution Print-out of the Displayed Waveform", 6.4, "Setting up for an Analog Print-out", 6.5, "Setting up for a Digital Print-out", and 6.6, "Setting up to print out using an External Plotter".
- Time : Current date and time
- Trigger : Date and time of trigger

### Procedure

1. Set comments for Comment 1 to Comment 4 and the title of the Print if necessary.
2. When the waveform panel is displayed, press **CURSOR** so that the instrument enters cursor mode.
3. **Comment**  
Instrument enters comment display mode.



Pressing one of the soft keys corresponding to the above displayed items displays the comment in the upper part of the panel.

4. Press **COPY** to make a hard copy if necessary.
5. **Exit**  
Instrument exits from the comment display mode.

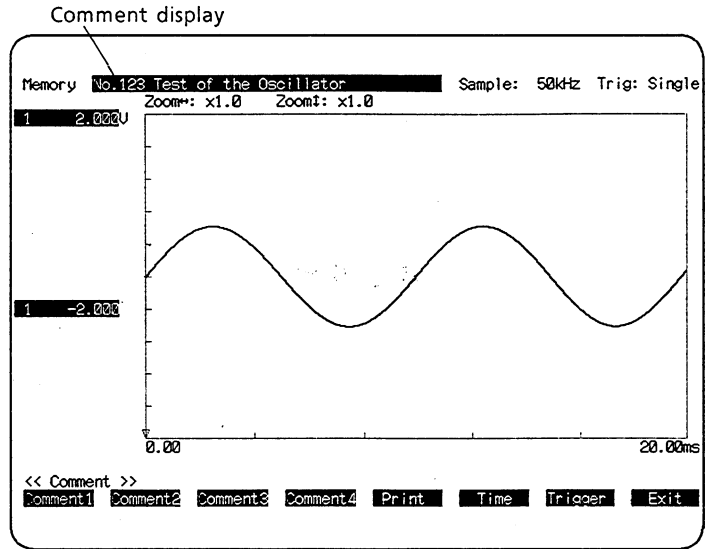
### Note

- The displayed comments are cleared if any key other than **COPY** is pressed while the comments are on display.

# 8.10 Comment Registration

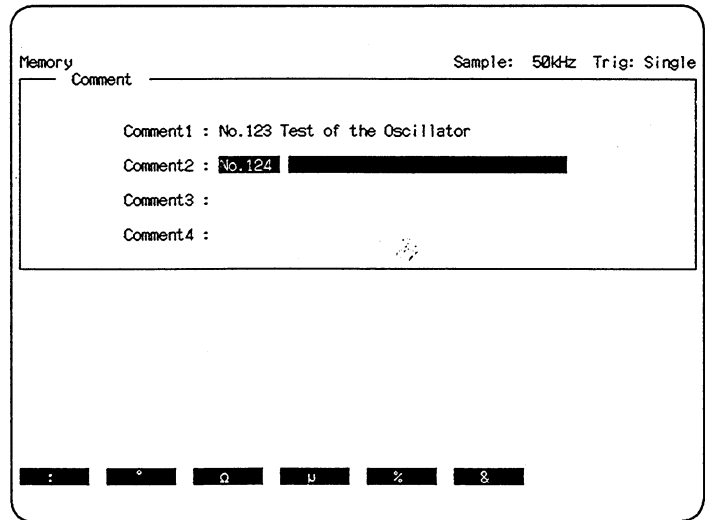
## Function

Registers comments to be displayed on the waveform panel. To display comments, see Section 8.9, "Displaying Comments on Waveform Panel."



## Procedure

1. **MISC**  
MISC panel appears.
2. **Next**  
Soft key menu changes.
3. **Comment**  
Comment registration panel is called up.
4. Up to four comments can be set. Enter each comment (up to 40 characters) using the alphanumeric keypad or soft keys and then press **ENTRY** to register the entered comments.






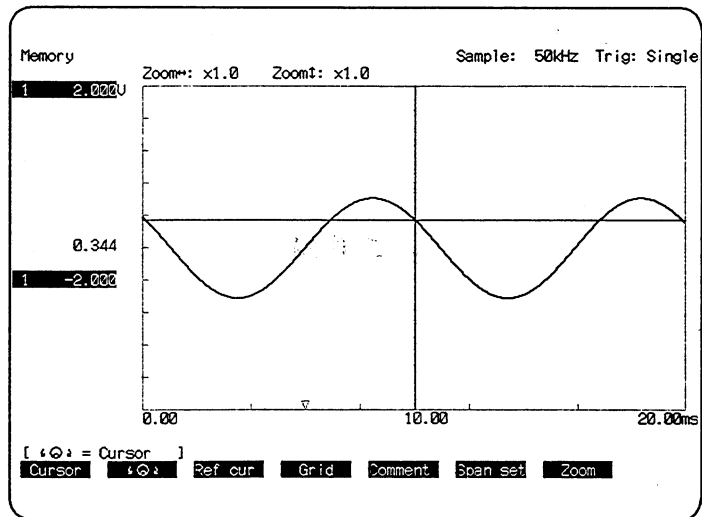
## 8.11 Setting Recording Range and Saving Range on the Waveform Panel

### Function

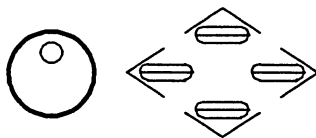
- The Range of Data Samples to be Used for Analog and Digital Recording can be Set. In Section 6.4, "Setting up for an Analog Print-out" and Section 6.5, "Setting up for a Digital Print-out", when "Manual" is selected as the Data number, the first data to be recorded (First), and the last data to be recorded (Last) are entered using the alphanumeric keypad. This function can be used to set First and Last while viewing the waveform.
- The Range of Waveform Data to be Saved to IC Memory Card or Floppy Disk can be Set from the Waveform Panel. In Section 7.11, "Saving Measured Data and Computed Data" the saving range is set for "Option" using the alphanumeric keypad. This function can be used to set the range while viewing the waveform.

**Procedure** ...The setup procedure is the same for both of the above functions.

1. With the waveform panel on display, press  so that the instrument enters cursor mode.
2.  Cursor is displayed.
3.  Span set The panel allowing setting of the recording/saving range appears.

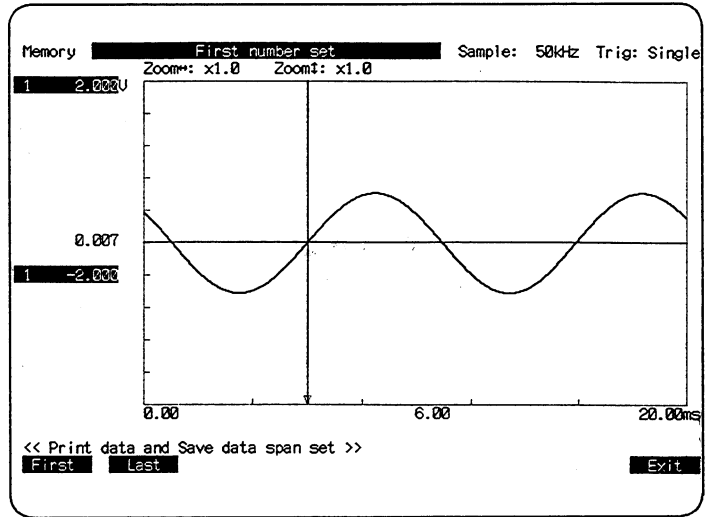


4. Use the rotary knob or cursor keys to move the cursor to the first data position to be recorded or saved. For details of cursor operation, see Section 5.3.1, "Reading Out of Single Data Values (Single-Point Cursor)".

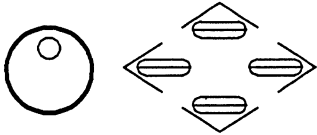


5. **First**

“First number set” is displayed at the top of the panel and the first data to be recorded or saved is set.

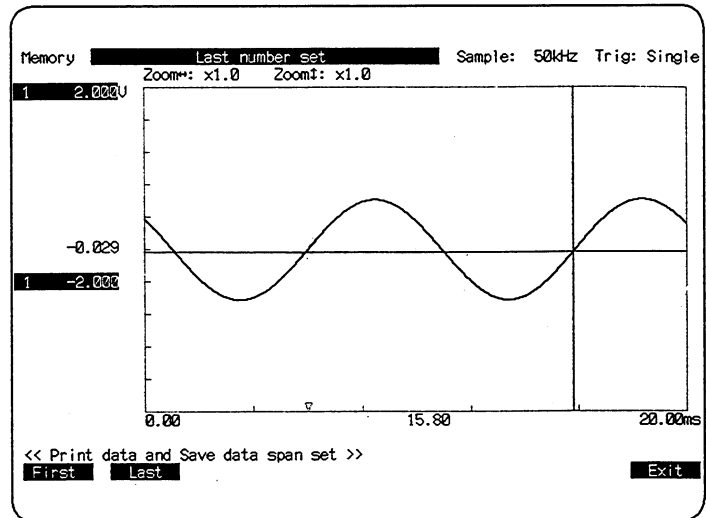


6. Use the rotary knob or cursor keys to move the cursor to the last data position to be recorded or saved.



7. **Last**

“Last number set” is displayed at the top of the panel and the last data to be recorded or saved is set.



8. **Exit**

Instrument exits from the range setting panel.

**Notes**

- The range specified using the above procedure is effective when “Manual” is selected as the Data number when setting up for analog or digital recording.
- The range specified using the above procedure is effective when “Option” for saving has been set to “on”.
- The range can be set with the waveform zoomed.
- For details of the many helpful cursor movement functions, see Section 5.3.1, “Reading Out of Single Data Values (Single-Point Cursor)”.






## 8.12 Protecting Data in Blocks

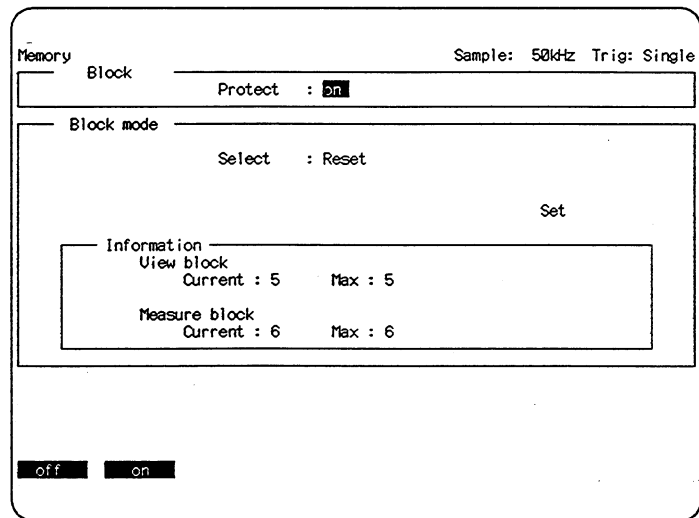
### Function

This function can be selected, when memory partitioning is in use, so that the main unit will not automatically clear already measured waveform data in each block. 'Setting the block protect mode to "on"' is the term generally used to indicate selection of this function.

However, when the user has carried out a remeasurement of a specific block (see **Section 8.2, "Remeasurement of Specific Block"**), the instrument will overwrite the specific block even if the block protect mode has been set to "on".

### Procedure

1.  MISC panel appears.
2.  Panel for block protect mode selection appears.
3.  Block protect mode is set to "on".



- The "Block mode" area is displayed only when memory already contains waveform data measured with memory partitioning. For the "Block mode" related functions and operations, see **Section 8.2, "Remeasurement of Specific Block," 8.3, "Changing the Block to be Displayed," 8.4, "When Restarting Measurement for the Specified Block from the Displaying Block," and 8.5, "Resetting Data Measured Using Memory Partitioning"**.

### Note

- To activate block protect, set block protect mode to "on" prior to data measurement. After block protect mode has been set to "on", previously measured blocks are protected after the next block measurement takes place. Note that simply setting the block protect mode to "on" does not immediately protect any blocks. For example, if three blocks are measured with the block protect mode set to "off", and then the block protect mode is set to "on", the measured blocks are not, at that point, protected. If a fourth block is then measured, all of those blocks (1 through 4) are then protected.

**■ When Block Protect is “off”**

When memory partitioning is in use, sampling rate, input coupling, input range, and input filter cannot be changed until measurement for all blocks is completed.

If the user changes such parameters while a series of block measurements is in progress and starts the next measurement, the instrument automatically clears all data in all blocks sampled up to that time, and data capture begins again from block 1.

Also, all data in all blocks is cleared when measurement is started again after measurement for all blocks is completed. Data capture begins again from block 1.

**■ When Block Protect is “on”**

If Block Protect is “on”, measured block data is protected from being cleared automatically by the change in parameters or measurement start described in ‘When Block Protect is “off”’ above.

**■ Actions Disabled When Block Protect is “on”**

- Change of sampling rate, input coupling, input range, and input filter, or move from memory mode to other mode
- Restart of measurement after capture of data for all blocks
- Loading of data from an IC memory card or floppy disk

To circumvent these restrictions, either set the block protect mode to “off”, or perform a block data reset (see Section 8.5, “Resetting Data Measured Using Memory Partitioning”).



# 8.13 Memory Block Usage Map Review

## Function

When memory has been partitioned for measurement, this function can be used to review which blocks have and have not already been measured.

For blocks which have already been measured, the trigger time of the data can also be reviewed.

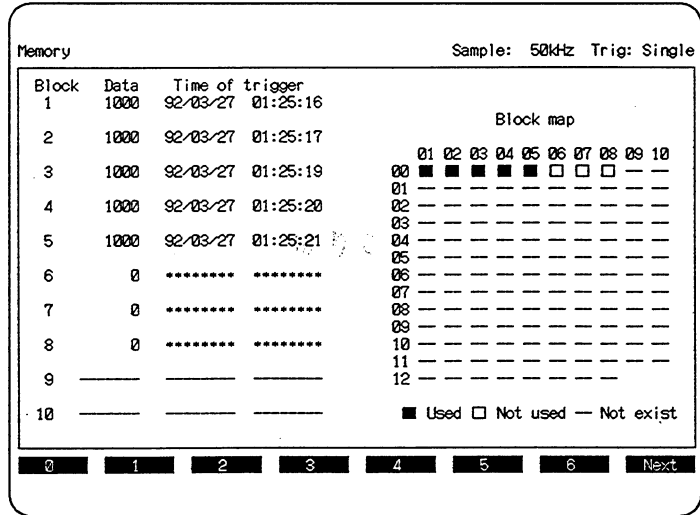
## Procedure

1.  MISC panel appears.
2.  Map Enables review of the block usage information.

- **Block**  
Block numbers  
The tens digit of the block numbers can be changed using the soft keys.
- **Data**  
Displays the number of measured data points.
- **Time of trigger**  
Displays the time at which the trigger was tripped.

- **Block map**  
A block number can be found by multiplying by ten its corresponding number in the column of two-digit numbers and adding its corresponding number in the row of two-digit numbers.

- : Blocks already measured
- : Blocks not yet measured
- : No setting (Nothing exists.)

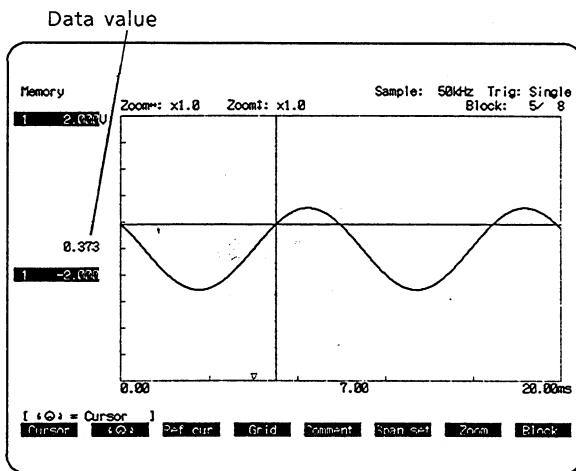


## 8.14 Cursor Setting

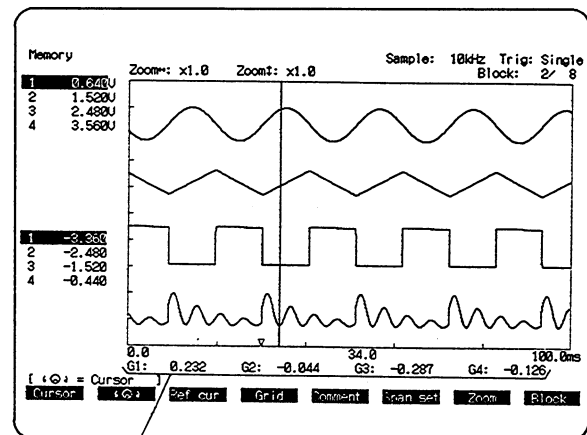
### Function

Selects whether the single-point cursor (reads out data values for one waveform) or the multi-point cursor (reads out data values for up to four waveforms simultaneously) is effective when the cursor function is used.

For details of the cursor function, see Section 5.3, "Reading Out of Data Values (CURSOR)."



Single-point cursor

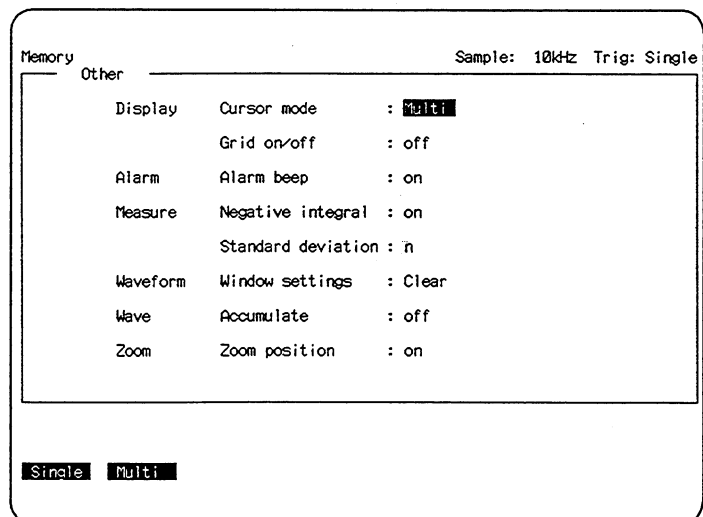


Data values

Multi-point cursor

### Procedure

1. Press **MISC**.  
MISC panel appears.
2. Press **Other**.  
The panel changes to the setting panel.
3. Display **Cursor mode**  
Select **Single** for the single-point cursor; **Multi** for the multi-point cursor.
4. Pressing any function key **ENTER** terminates the MISC panel.



## 8.15 Computation Related Setting

### Function

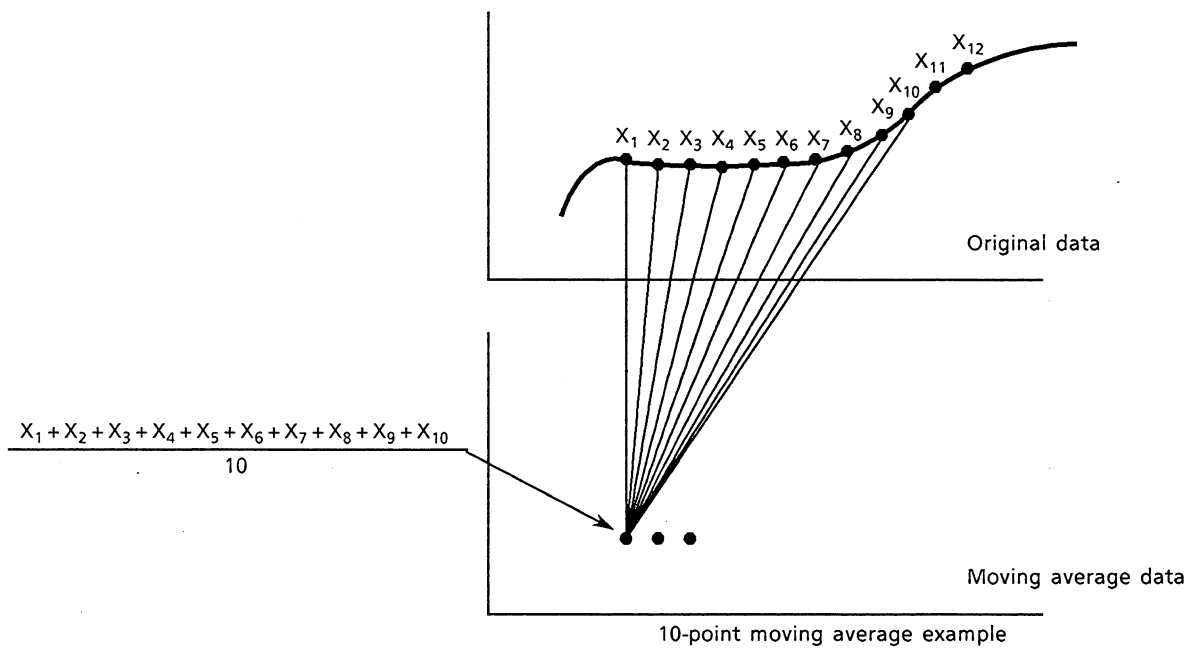
This function enables setting of the processing of overflow data generated during computations, and setting of the number of data used when computing a moving average. This function also allows the setting to be made regarding use of data in the data files during computations.

#### ■ Overflow During Computation

When a computation is performed and the result of the computation overflows the computational processing range, this selection specifies whether the computation result is to be set to the maximum value or to the minimum value of the range.

#### ■ Number of Data Points when Computing Moving Average

Select the number of data points across which to perform the moving average computation.



#### ■ Registering Reference Files for Computations

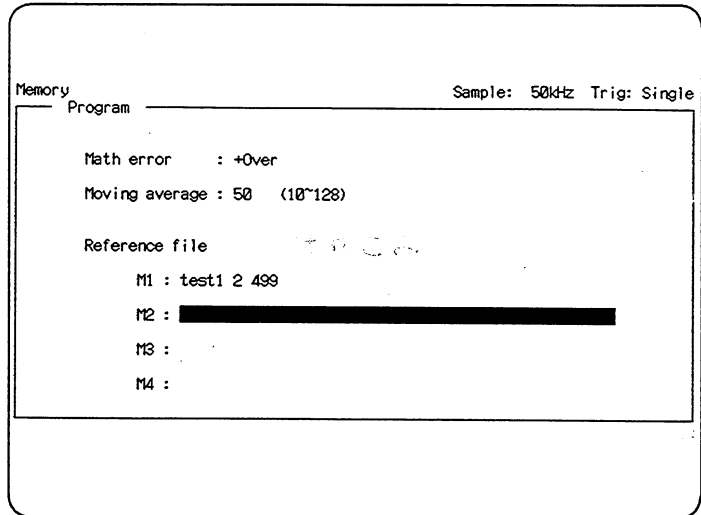
This instrument allows the user to assign the names of files on an IC memory card to the symbols M1 to M4, and then enter these symbols into computational expressions on the PROGRAM setting panel.

For details, see Section 4.9, "Setting PROGRAM (Computations) to ON".

Even if the names of logic input data files are assigned to M1 to M4, these symbols cannot be entered into computational expressions.

**Procedure**

1. **MISC**  
MISC panel appears.
2. **Next**  
The soft key menu changes.
3. **Program**  
The panel that allows computation related setting appears.
4. **Math error**  
Select whether, when the computational processing result overflows, to set the result to the maximum value **+Over** or the minimum value **-Over** of the range.



5. **Moving average**  
Use the alphanumeric keypad to enter the number of moving average points for moving average computation.  
Input range is from 10 to 128 (initial value: 100).  
Press **ENTRY** to fix.

6. **Reference file M1 to M4**  
Assign the names of the files to be used in computation to M1 to M4 using the alphanumeric keypad.  
Each item is specified as follows:  
<File Name>\_ <CH No.>\_ <Starting Data No.>  
Note : “\_” is a space (SP).

<File Name> : Designates reference file name to be used in computation.  
 <CH No.> : Designates the channel number in the file.  
 When it is left out, 1CH is adopted.  
 A logic channel number cannot be designated.  
 <Starting Data No.> : Designates the data number of the reference file data which is to be regarded as the starting data point for computation.  
 Thereafter the computed data number is added to this number, when the data in the file is referred to.  
 When it is left out, a Starting Data No. of “0” is adopted.  
 Note : When <CH No.> is left out, <Starting Data No.> cannot be designated.

Press **ENTRY** to fix.

**Note**

- Only files in the root directory of an IC card can be set as reference files.

**Note**

- Inserting spaces instead of a file name clears the setting of the item, and it is regarded as if no file has been designated.
- In computation, when the file with a designated file number (M1 to M4) is not set, or when the file does not exist even if it is set, or when no data is stored, the computed result will be the value of "Math error" (+Over or -Over). In this case "Error" or "Warning" is not displayed.

**Remarks**

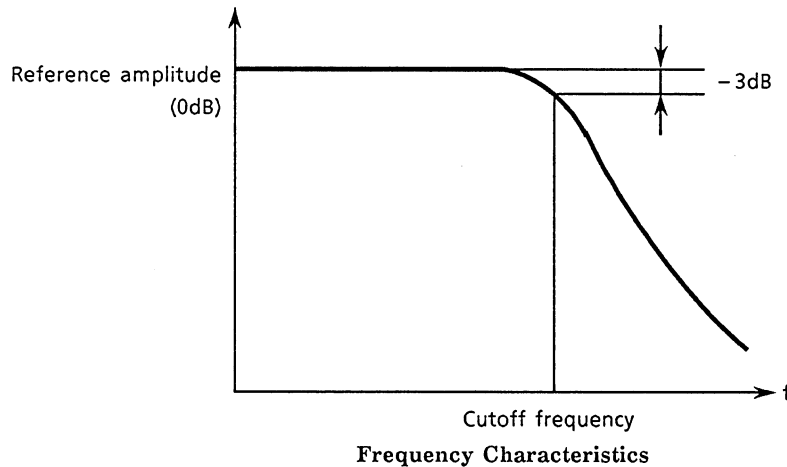
- **Number of Moving Average Points**

The moving average computation acts as a low-pass filter on the measured data. The cutoff frequency of the low-pass filter is determined by the sampling frequency and the number of moving average points. The following formula is used to compute the cutoff frequency.

$$\text{Cutoff frequency} = \frac{\text{Sampling frequency}}{\text{Number of moving average points}} \times 0.44299$$

For example, if the sampling frequency is 50kHz, and the number of moving average points is 10, the cutoff frequency is computed as follows.

$$\text{Cutoff frequency} = \frac{50\text{kHz}}{10} \times 0.44299 \doteq 2.2\text{kHz}$$



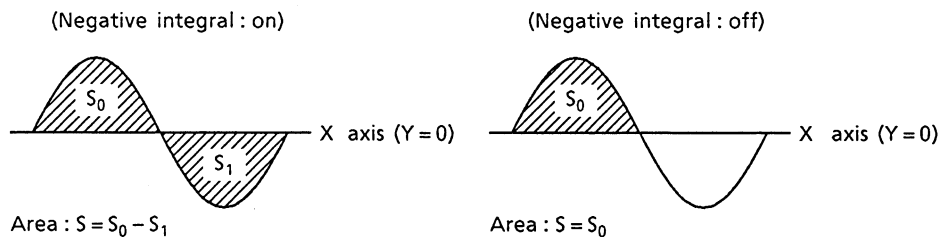
## 8.16 Integral Computation Type Selection

### Function





The following two types of integral computation are available when using zone statistical computations.

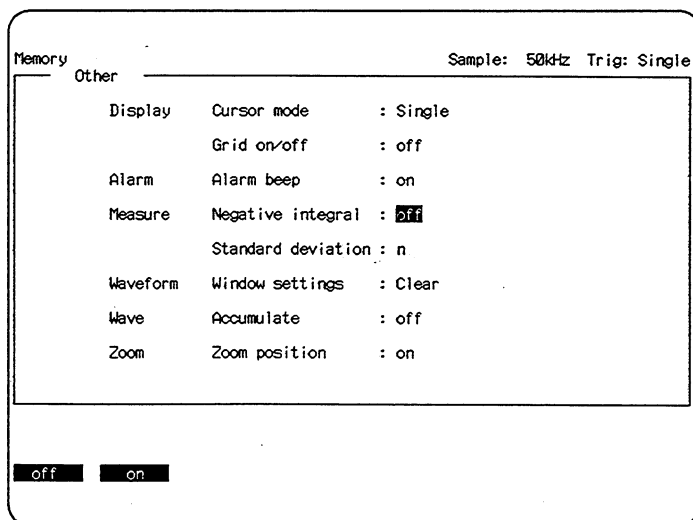
This function selects which of these is used (when the display format is Single, Dual, or Quad).

For zone statistical computations, see Section 5.7, "Zone Statistical Computations."



### Procedure

1.  MISC panel appears.
2.  Panel changes to the setting panel.
3. Move the menu cursor using the cursor key .
4. Measure Negative integral  
Select  on or  off.
5. Pressing any function key  terminates the MISC panel.





## 8.17 Selecting Population for Standard Deviation Computation

### Function

Allows selection of “n” or “n-1” as the standard deviation population during zone statistical computations.

For zone statistical computations, see Section 5.7, “Zone Statistical Computations.”

### Method for Computing Standard Deviation

$$\text{Standard deviation between cursors Std} = \sqrt{\frac{\sum_{i=m}^n (D(i) - \text{AVE})^2}{n - m + 1}}$$







Note : User can specify “n-1” instead of “n”.

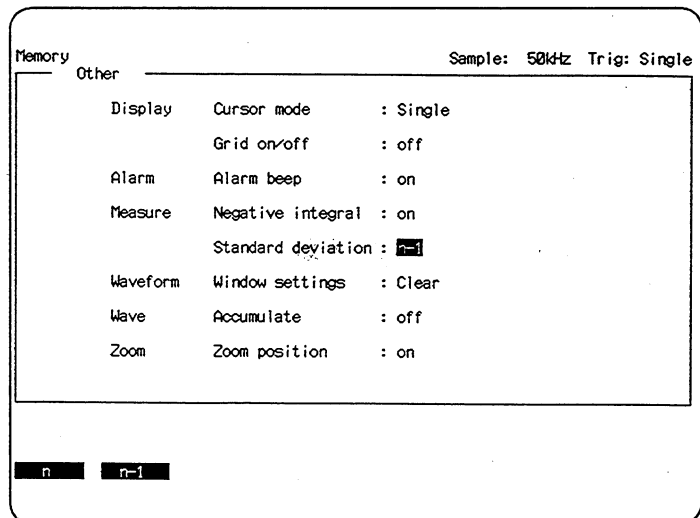
$$\text{Average between cursors} = \frac{\sum_{i=m}^n (D(i))}{n - m + 1}$$

Where

- D(i) : Data
- m : Start point data number
- n : End point data number

### Procedure

1.  MISC panel appears.
2.  Panel changes to the setting panel.
3. Move the menu cursor using the cursor key .
4. **Measure Standard deviation**  
Select  or .
5. Pressing any function key  terminates MISC panel.



## 8.18 Preservation of Zoom Multipliers at Remeasurement or Redisplay

### Function



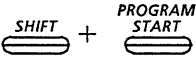
When the initial value “Clear” is set, if the next measurement is started with the waveform expanded (zoom) or shifted (scroll), this function allows the new data to be captured in memory with the zoom multiplier reset to “1” and the amount of shift reset to “0”.

When “Hold” is set under the same conditions as above, it is possible to capture the new data with the zoom multiplier and the amount of shift preserved.

### ■ Window settings

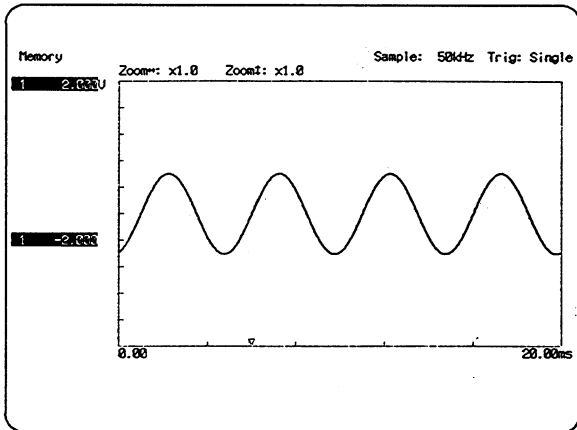
- Clear : As a general rule, this resets the zoom multiplier and amount of shift.
- Hold : As a general rule, this preserves the zoom multiplier and amount of shift.

### ■ Key Operation

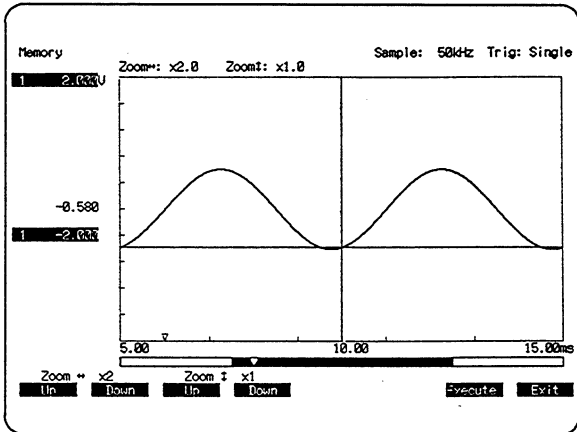
-  ... Captures the new data.
-  ... Does not capture the new data and redisplay the data in memory.
-  ... Redisplay the data in memory with the relationship between “Clear” and ”Hold” reversed.

■ Window settings = Clear

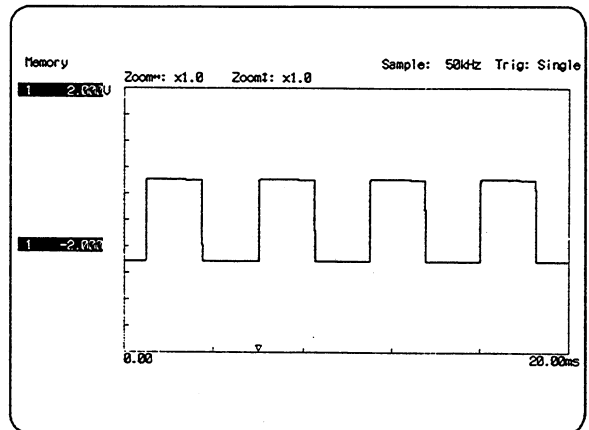
First measurement



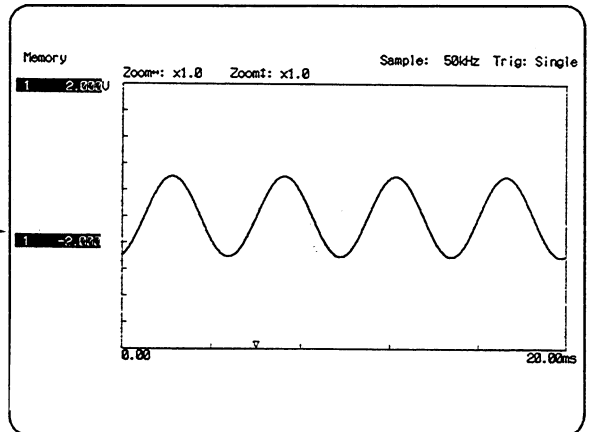
Zoom / scroll



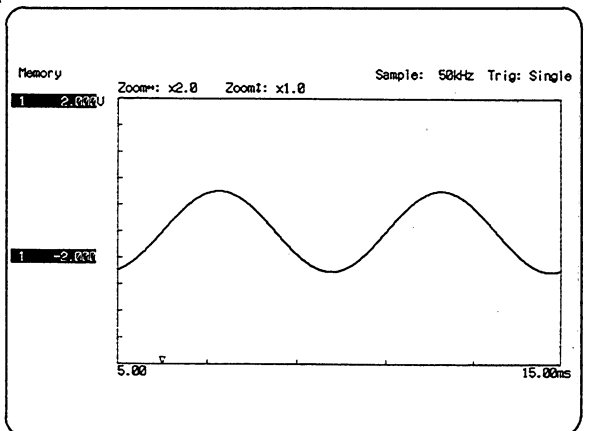
**START** Captures the new data with the zoom multiplier and amount of shift reset.



**PROGRAM START** Displays the data in memory with the zoom multiplier and amount of shift reset.

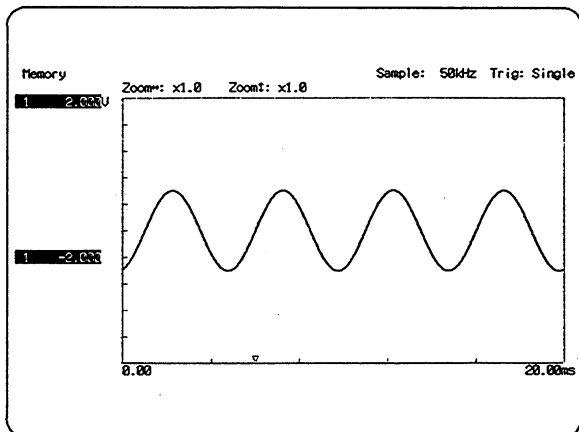


**SHIFT + PROGRAM START** Displays the data in memory with the zoom multiplier and amount of shift preserved.

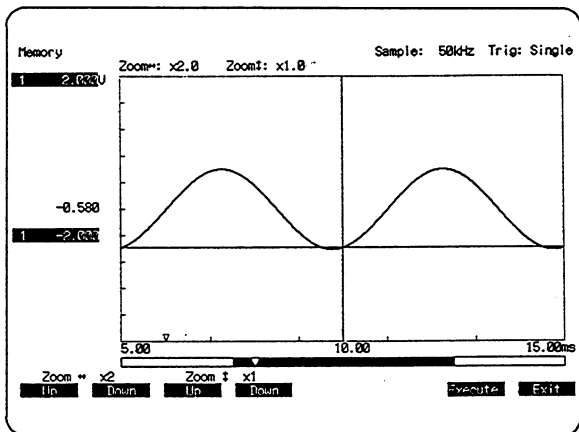


■ Window settings = Hold

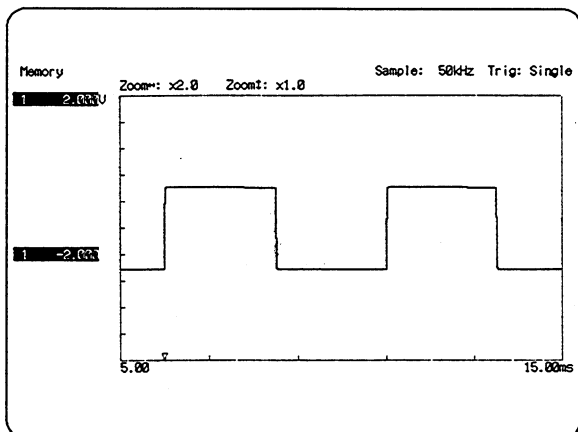
First measurement



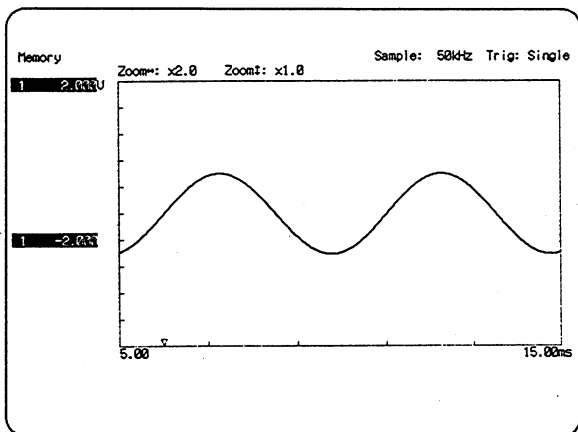
Zoom / scroll



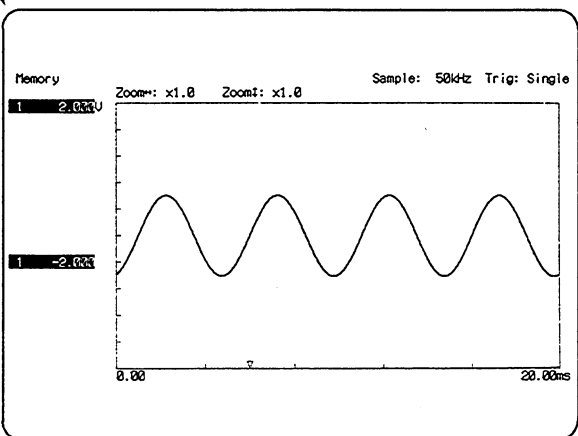
**START** Captures the new data with the zoom multiplier and amount of shift preserved.









**PROGRAM START** Displays the data in memory with the zoom multiplier and amount of shift preserved.

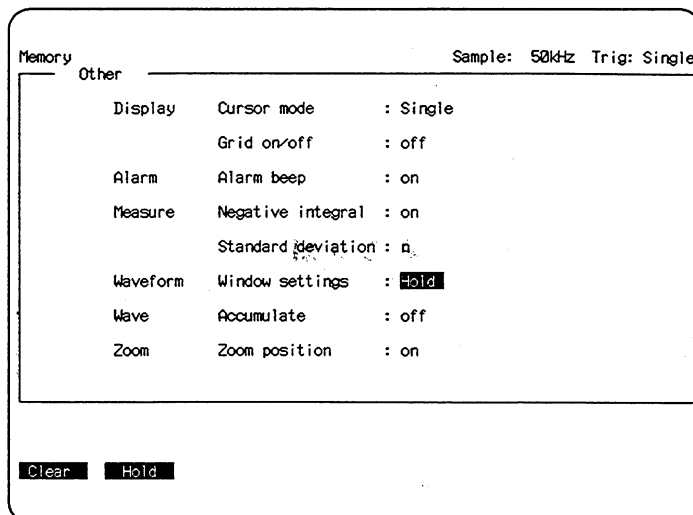


**SHIFT + PROGRAM START** Displays the data in memory with the zoom multiplier and amount of shift reset.



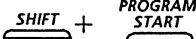


### Procedure

1.  MISC panel appears.
2.  Panel changes to the setting panel.
3. Move the menu cursor to the "Waveform Window settings" area using the cursor key .
4. Select  or .
5. Pressing any function key  terminates the MISC panel.



### Notes




- Whether the instrument is in "Hold" mode or in "Clear" mode, if any of the following parameters is changed and then , , or  is pressed, the zoom multiplier and amount of shift are reset.
  - Input range
  - Program computational expression
  - Display format
  - Memory size, memory partitioning
  - Sampling rate

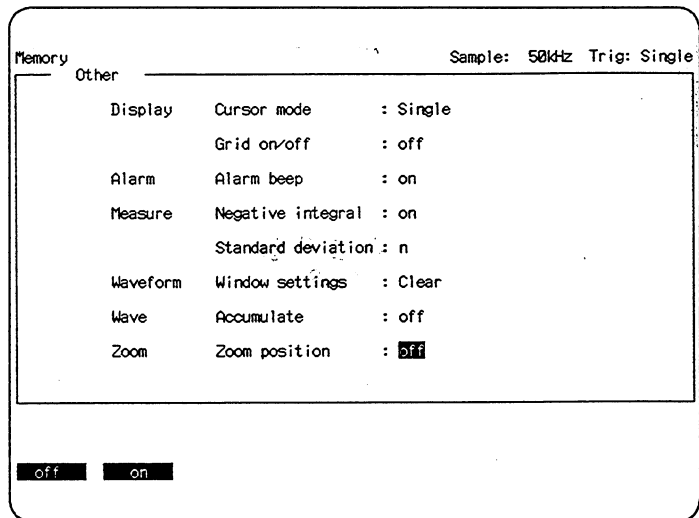
## 8.19 Disabling Zoom Position Display




### Function

In the main unit's initialized state, the zoom position is displayed when the waveform is zoomed (see Section 5.4, "Enlarging Waveforms (ZOOM)" and Section 5.5, "Shifting Waveforms (SCROLL)"). This function is used to disable the zoom position display.

### Procedure

1.  MISC panel appears.
2.  Panel changes to the setting panel.
3. Use the cursor key  to move the menu cursor.



4. **Zoom position**  
 Select  to disable zoom position display.  
 Select  to enable zoom position display.
5. Pressing any function key  terminates the MISC panel.

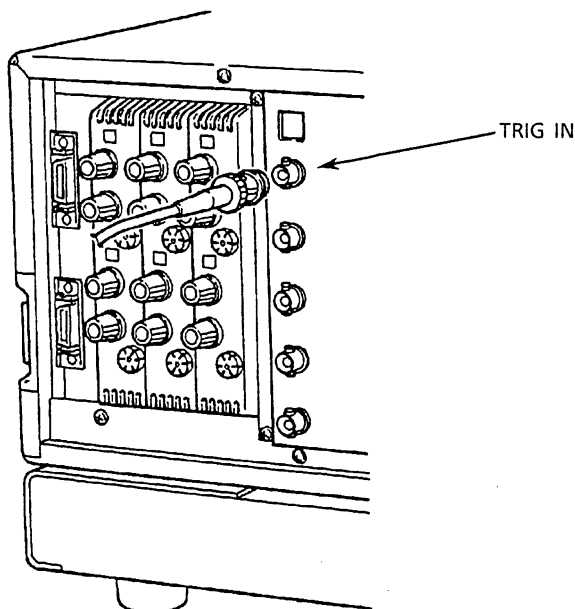
### Notes

- Even if "Zoom position" is set to "on", zoom position is not displayed unless "Display Cursor mode" is set to "Single".

## 8.20 Using External Trigger

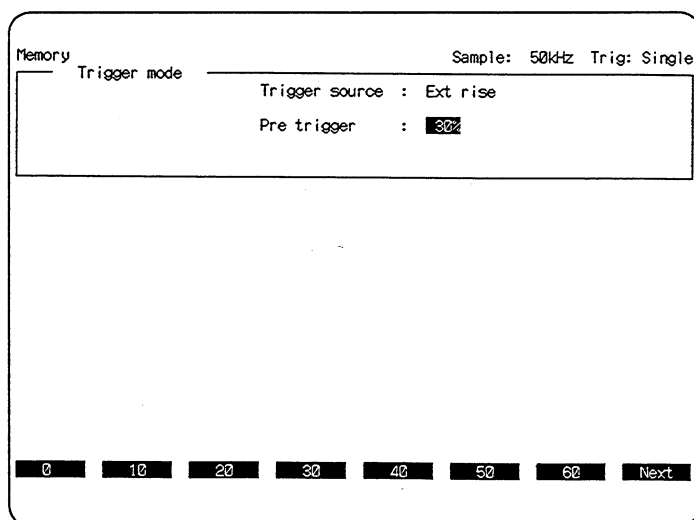
### Function

Triggering can also be applied via an external signal. The connector used for input of this external signal is as shown below.



### Procedure

1. **TRIGGER**  
The trigger setting panel is called up.
2. **Trigger source**  
Select  (external rising edge) or  (external falling edge).
3. **Pre trigger**  
Select the length of signal preceding the trigger to be retained as a percentage of the memory size (0 / 10 / 20 / 30 / 40 / 50 / 60 / 70 / 80 / 90 / 100)。

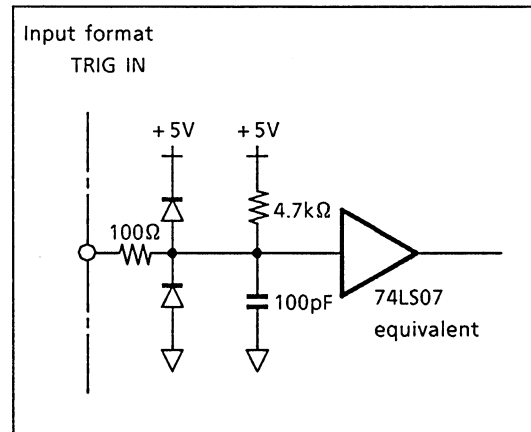


## Notes

- To avoid erroneous operation due to noise, use a cable of length not exceeding 3 m.
- When an external trigger signal (TRIG OUT) of the main unit is used in parallel synchronous operation, set the slave-side trigger slope to the rising edge ( $\uparrow$ ).

## Caution

- **External Trigger Input Signal Specifications**
  - Signal level : TTL level
  - Low input voltage :  $-0.5$  to  $+0.8\text{V}$
  - High input voltage :  $+2.0$  to  $+5.5\text{V}$
  - Pulse width :  $2\mu\text{s}$  or more
  - Allowable input voltage :  $-0.5$  to  $+5.5\text{V}$
  - Any input higher than the allowable input voltage may damage the input block of the main unit.




---

**WARNING**

The L sides of TRIG IN, EXT SAMPLE, and TRIG OUT are connected in common. Therefore, do not use signals with different common mode voltages when using two or more of these connectors as this may damage the internal circuit of the instrument. Also, if the instrument is not grounded, there is the possibility of electrical shock.

---

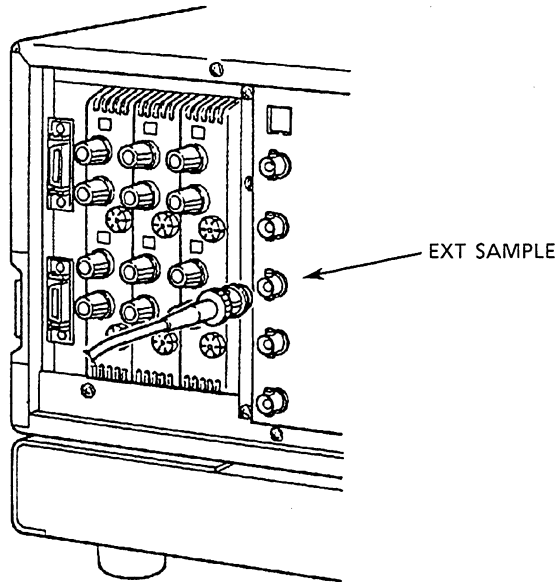


## 8.21 Using External Sampling

### Function


A/D conversion and memory sampling can be performed using an external signal as a sampling clock.

The connector used for input of this external signal is as shown below.

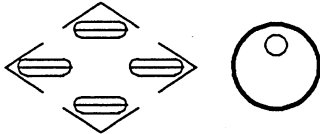


### Procedure

The sampling rate is always displayed at the upper right hand of the CRT screen.

1. **SAMPLE RATE**  


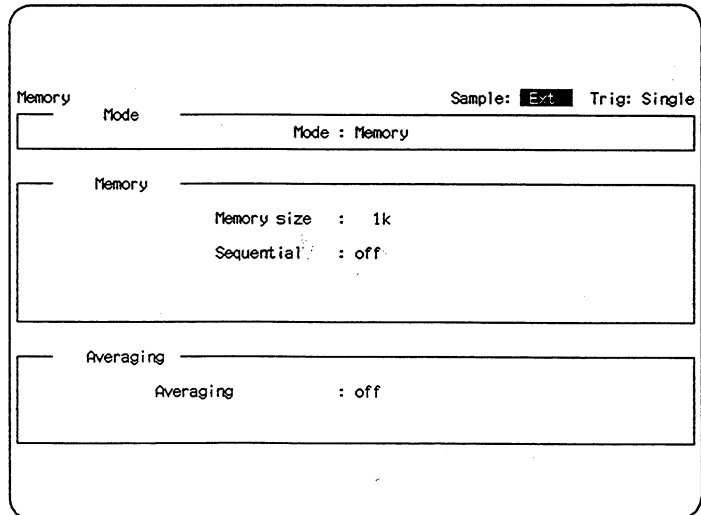
Instrument enters the mode that allows the sampling rate to be set.
2. **Cursor Keys or Rotary Knob**



Setting changes as follows as the cursor keys or rotary knob are operated.

100kHz / 50kHz / 20kHz / 10kHz / 5kHz / 2kHz / 1kHz / 500Hz / 200Hz / 100Hz / 50Hz / 20Hz / 10Hz / 5Hz / 2Hz / 1Hz / 0.5Hz / 0.2Hz / 0.1Hz / Ext

Here, select "Ext".



## Notes

### ■ Aliasing Phenomena

According to the Nyquist sampling theorem, if sampling is performed at a frequency that is at least two times the highest frequency component of the input signal, then in theory the source waveform can be reproduced.

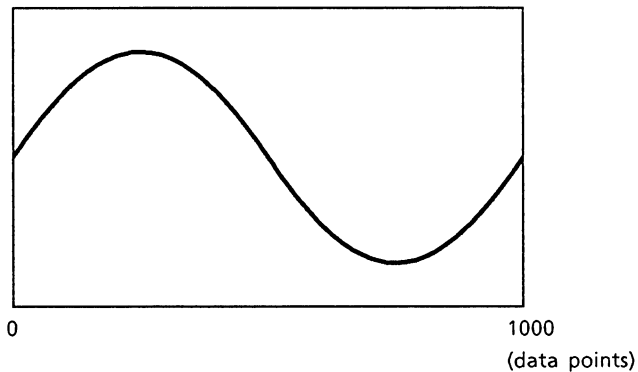
If the sampling rate is less than two times this frequency, then a phenomenon occurs in which the frequencies above the Nyquist frequency appear as phantom components at lower frequencies than original components in the source waveform. This is known as “aliasing”. To avoid aliasing it is necessary to measure at a sampling rate that is at least two times the frequencies in the input signal.

- To avoid erroneous operation due to noise, use a cable of length not exceeding 3m.

### ■ Time Axis Display

If using external sampling, the time axis displayed on the waveform panel will show the number of data points for the specified memory size.

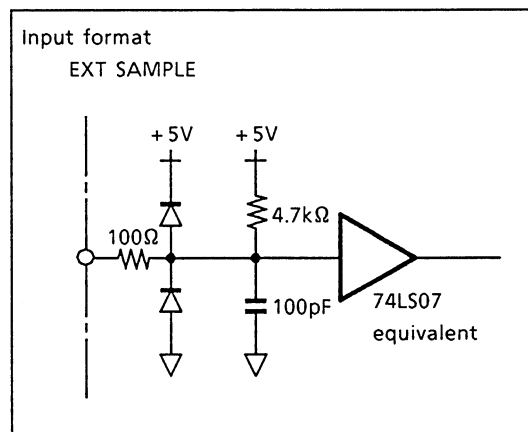
For memory size of 1kW



## Caution

### ■ External Sampling Input Signal Specifications

Signal level : TTL level  
 Low input voltage :  $-0.5$  to  $+0.8$ V  
 High input voltage :  $+2.0$  to  $+5.5$ V  
 Signal frequency : Max. 100kHz  
 Pulse width :  $2\mu$ s or more  
 Allowable input voltage :  $-0.5$  to  $+5.5$ V  
 Any input higher than the allowable input voltage may damage the input block of the main unit.



## WARNING

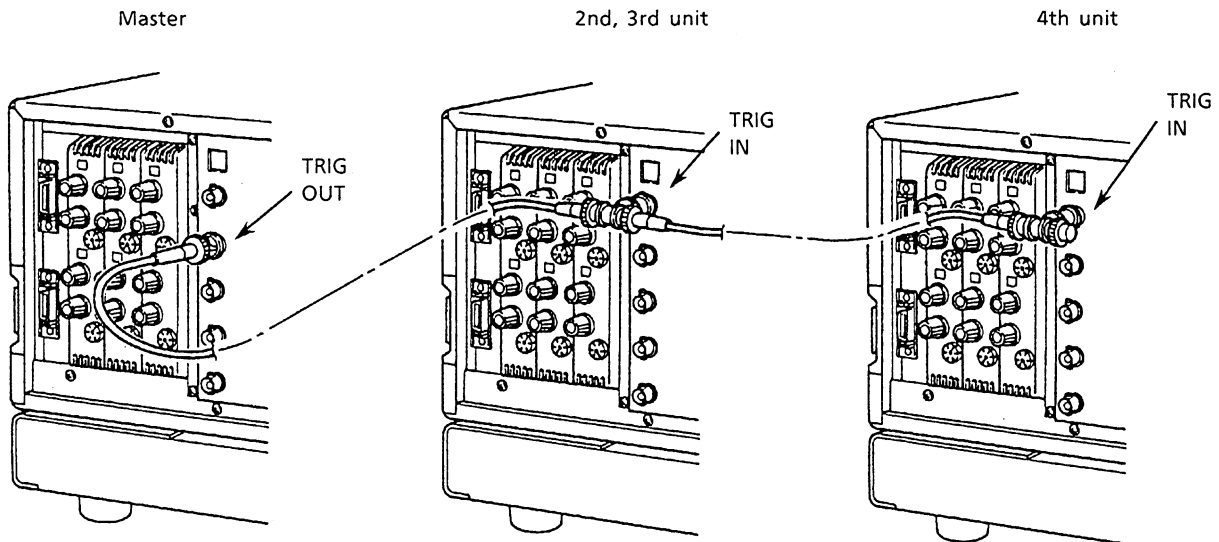
The L sides of TRIG IN, EXT SAMPLE, and TRIG OUT are connected in common. Therefore, do not use signals with different common mode voltages when using two or more of these connectors as this may damage the internal circuit of the instrument. Also, if the instrument is not grounded, there is the possibility of electrical shock.

## 8.22 Parallel Synchronous Operation

### Function

Using the external trigger functions, parallel operation of multiple AR1100A / AR1200 units can be performed.

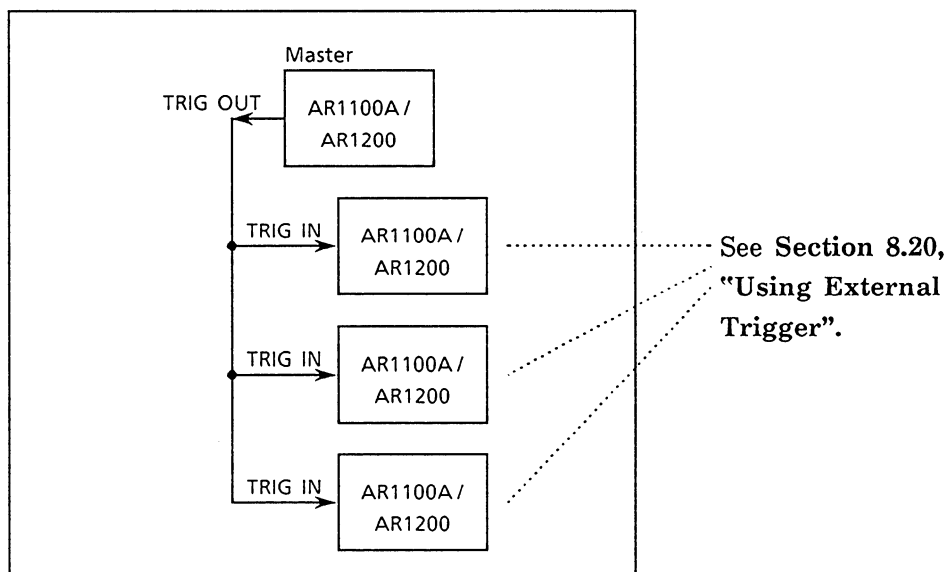
For synchronization of A/D conversion sampling, see Section 8.21, "Using External Sampling".



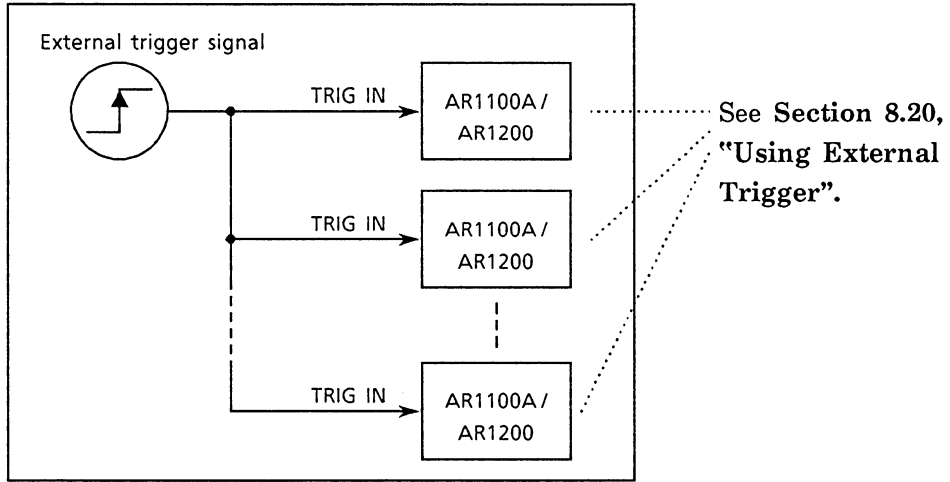
Note) When using AR1100A/AR1200 TRIG OUT signal

### Procedure

#### ■ When Using AR1100A / AR1200 TRIG OUT Signal



■ When Using External Trigger Signal



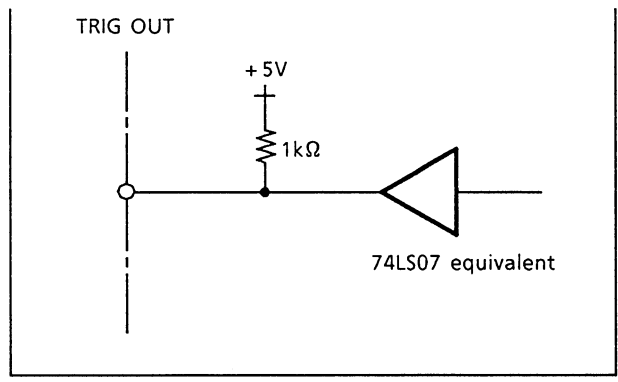
Note : An external trigger signal output from the TRIG OUT connector is tripped on the rising edge (⏏).

**Notes**

- Use Single as the trigger mode. If Repeat mode is used, synchronization may fail due to the relationship between internal processing and trigger intervals.
- To avoid erroneous operation due to noise, use a cable with a length not exceeding 3m.
- **Number of Units that can be used in parallel synchronous operation**  
When using TRIG OUT signal, up to three units not including the master can be used.
- The output of the TRIG OUT signal is delayed one sampling point.

**Caution**

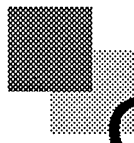
■ TRIG OUT Output Format



**WARNING**

The L sides of TRIG IN, SAMPLE IN, and TRIG OUT are connected in common. Therefore, do not use signals with different common mode voltages when using two or more of these connectors as this may damage the internal circuit of the instrument. Also, if the instrument is not grounded, there is the possibility of electrical shock.



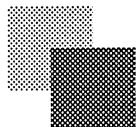


# Chapter 9

## Recorder Mode / To The First-Time User

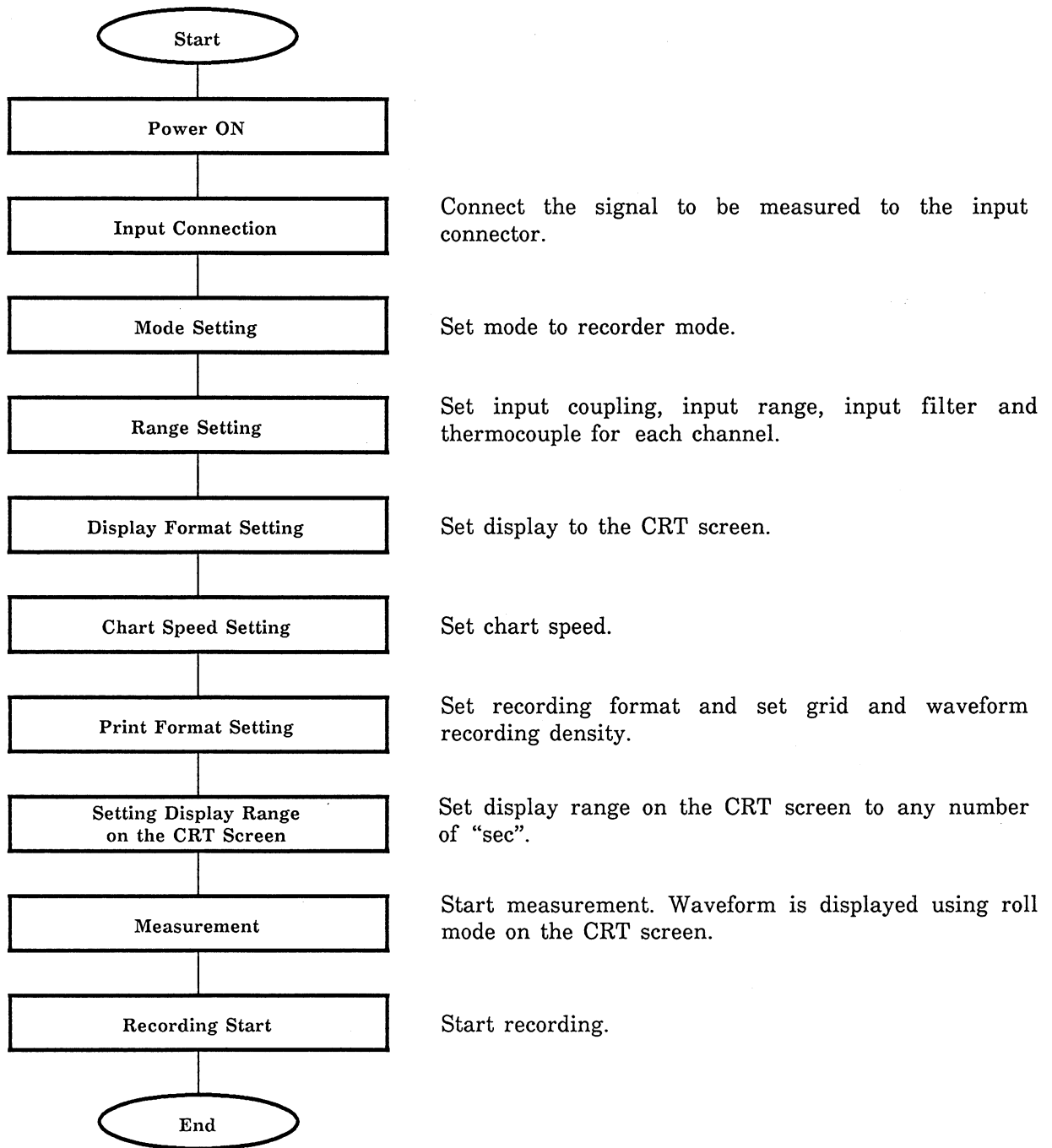
This chapter describes only the basic operations of recorder mode according to the flow of operations.

9.1 Operation Flow .....	9-2
9.2 Basic Operations .....	9-3



# 9.1 Operation Flow

The following chart outlines the flow of operations.



## 9.2 Basic Operations

### Function






This section describes basic operations in recorder mode in an example that follows through the procedure to measure a 2Vp-p, 0.5Hz sine wave from a function generator.

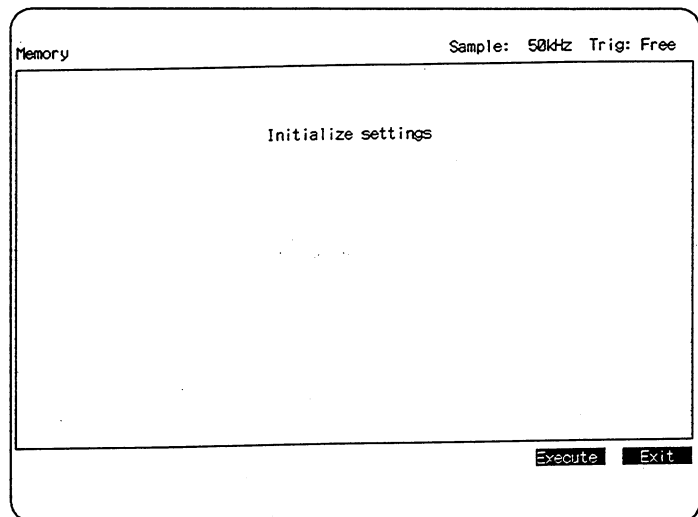
The explanation covers model 7021A 61 (64kW / ch) provided with logic input in addition to 6-channel analog input.

#### (1) Initializing Settings and Acquisition Memory

Return settings to the initial values.

Initialize Acquisition Memory.

1. Press .
2. Select . Menu changes.
3. Select . Menu changes.
4. Select . Panel as shown to the right appears.
5. Select . Settings are initialized.





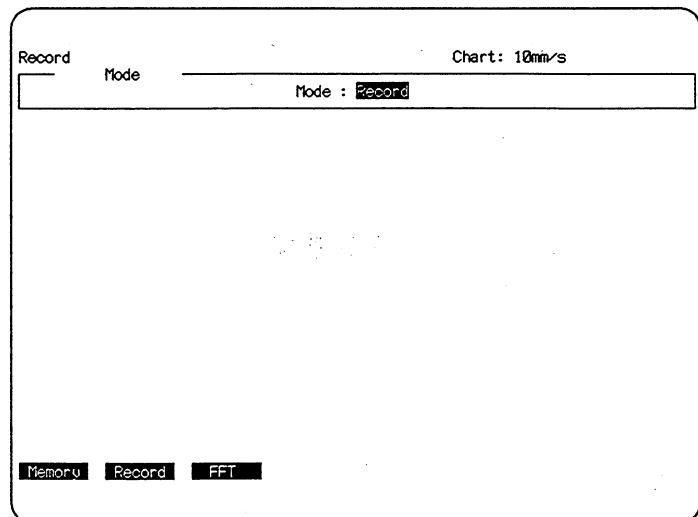
#### (2) Input Connection

Connect the function generator output to the channel 1 input connection of the main unit.  
Input a 2Vp-p, 0.5Hz sine wave.

#### (3) Mode Setting

Set Mode to "Record".

1. Press .
2. Select .





## 9.2 Basic Operations

### (4) Range Setting

Set channel 1 Input to "DC", Range to "6V", and Filter to "off".

Set Input for channels 2 to 6 and channels A and B to "off".

1. Press **RANGE**.
2. Set channel 1 as follows.
  - ① Select **DC**.
  - ③ Select **6V**.
  - ② Select **off**.
3. Set channels 2 to 6 and channels A and B as follows. Select **off**.

Record Range Chart: 10mm/s

ch	Input	Range	Filter
1	DC	60V	off
2	DC	60V	off
3	DC	60V	off
4	DC	60V	off
5	DC	60V	off
6	DC	60V	off
A	off		
B	off		

2.① off DC AC Temp

2.② 0.06V 0.2V 0.6V 2V 6V 20V 60V

2.③ off Auto 4kHz 400Hz 40Hz 1.5Hz

3. off DC AC Temp

Record Range Chart: 10mm/s





ch	Input	Range	Filter
1	DC	6V	off
2	off		
3	off		
4	off		
5	off		
6	off		
A	off		
B	off		

off on

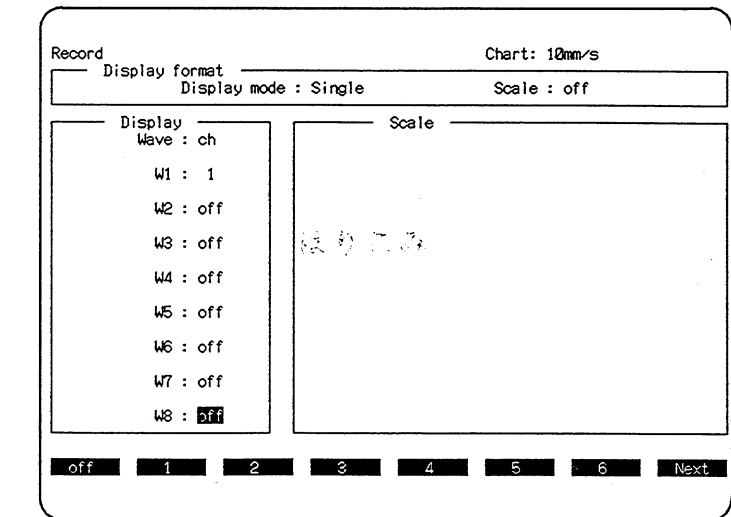
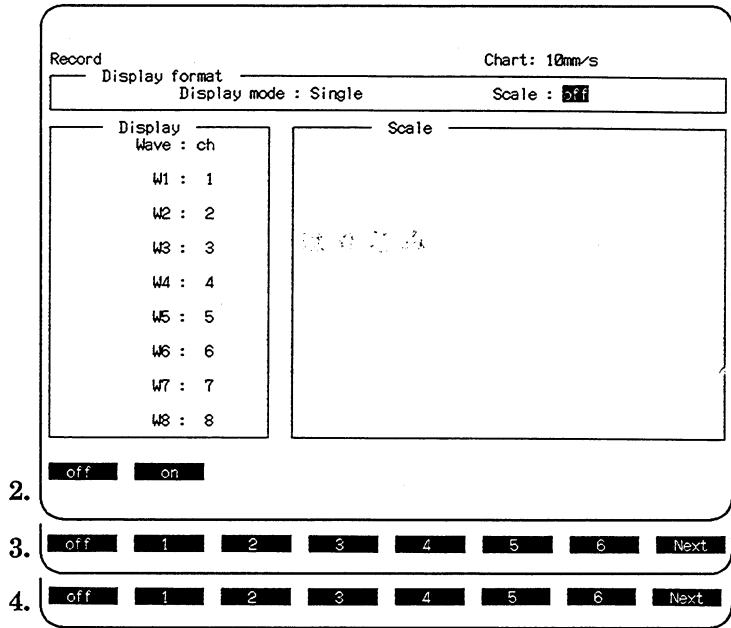
Panel After Completing Setting

**(5) Display Format Setting**

Set the Display format Display mode to "Single" (single panel display), Scale to "off", Display W1 to channel 1 and W2 to W8\* to "off".

1. Press .
2. Select  for Scale.
3. Select  for W1.
4. Select  for W2 to W8\*.


\* For 4-channel models :  
W2 to W4  
For 6-channel models  
(including logic input):  
W2 to W6

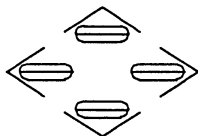



Panel After Completing Setting

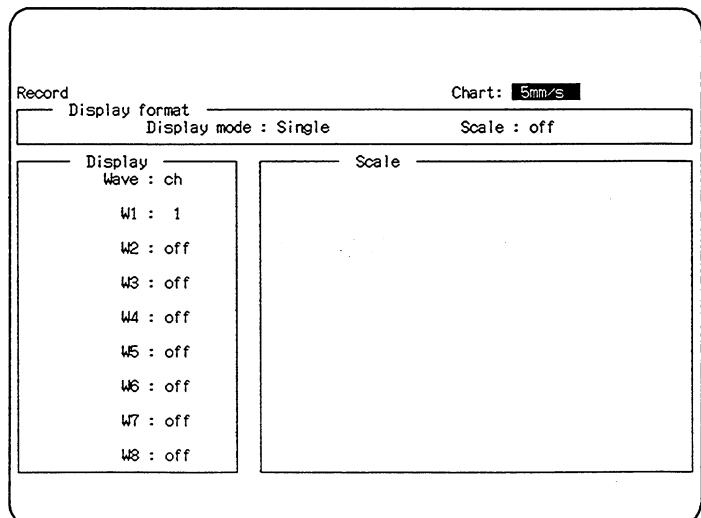
**(6) Chart Speed Setting**

Use the cursor keys or rotary knob to set the chart speed to 5mm/s.

1. Press .
2. Use the cursor keys



or rotary knob  to set the chart speed to 5mm/s.



(7) **Print Format Setting**

Set the Print format Print mode to "Analog", Title to "off", and Grid to "Normal".  
 For waveforms to be recorded, set W1 to "Thick" (thick trace), and set W2 to W8\* to "off".

1. Press **PRINT FORMAT**.
2. Select **Analog**.
3. Select **off**.
4. Select **Normal**.
5. Set W1 as follows.  
 Select **Thick**.
6. Set W2 to W8\* as follows.  
 Select **off**.

\* For 4-channel models:  
 W2 to W4  
 For 6-channel models  
 (including logic input):  
 W2 to W6

The figure shows a sequence of six screenshots illustrating the configuration of the Print Format menu. The menu is titled "Print format" and includes options for Print mode, Title on/off, Grid, and Wave settings (W1-W8). The "Record" indicator is at the top left and "Chart: 5mm/s" is at the top right.

2. **Analog** **Digital**

3. **off** **on**

4. **Fine** **Normal** **off**

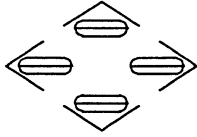
5. **off** **Thick** **Thin**


6. **off** **Thick** **Thin**

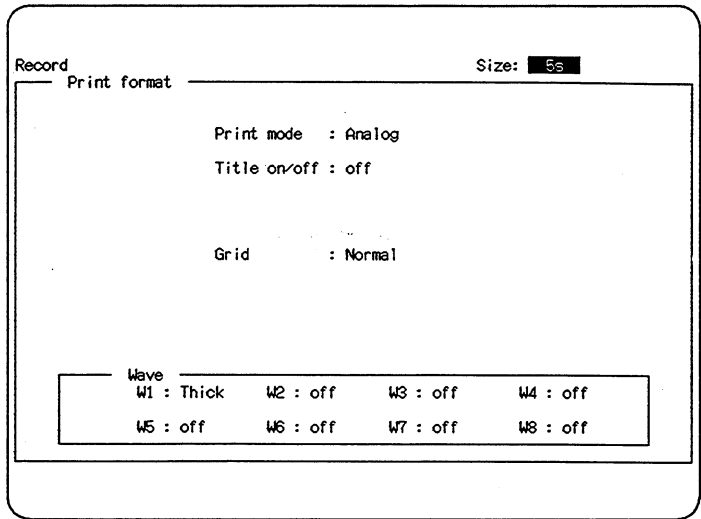
Panel After Completing Setting

(8) Setting Display Range on the CRT Screen

1. Press **SHIFT** and then **SAMPLE RATE**.
2. Use the cursor keys



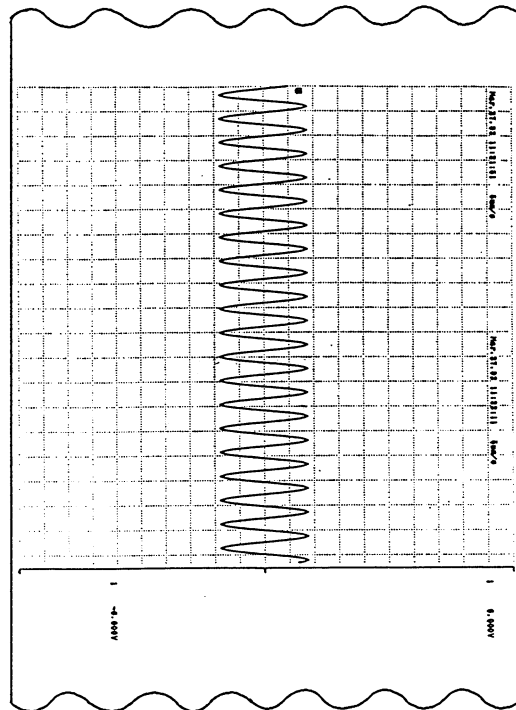
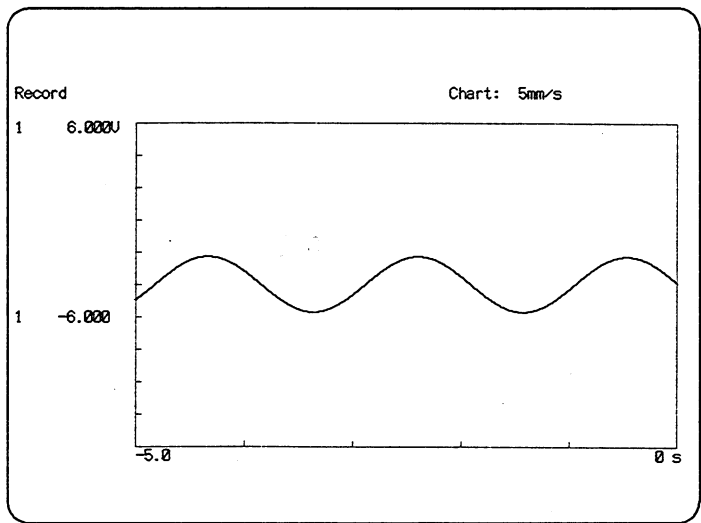
or rotary knob  to set the display range (Size) on the CRT to 5sec.



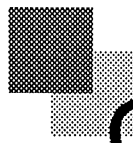
(9) Measurement Start and Recording Start

Press **START** to display the waveform on the CRT screen. Then press **PRINT** to record the waveform.

1. Press **START**. The lamp lights. The waveform appears in roll mode on the CRT.
2. Press **PRINT**. The lamp lights. The waveform is recorded to the printer.
3. Press **PRINT** again to switch off the lamp and stop recording.
4. Press **STOP** to switch off the lamp and stop measurement.







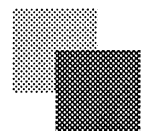
# Chapter 10

## Recorder Mode / Using as a Recorder

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This chapter describes the recorder mode function which enables real-time recording on chart paper while displaying waveforms on the panel.

10.1 Recorder Mode Function Outline .....	10-2
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10.3 Setting of Input Coupling, Input Range, Input Filter and Thermocouple .....	10-4
10.4 Setting of Time Trigger .....	10-8
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10.11 Moving Waveforms on the Panel (SCROLL) .....	10-20
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## 10.1 Recorder Mode Function Outline

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### Function

This function allows use of the main unit as a conventional recorder.

User can monitor the waveform displayed using the roll mode on the CRT screen and record only the required part of the waveform.



- 100kS/s sampling and a wide range of chart speed from 50mm/s to 10mm/h
- Start and stop recording according to internal clock time is possible.
- Can simultaneously record measured data for up to eight channels while displaying on the CRT.
- Can set the scale and display range for waveforms to be displayed on the CRT and also scroll them in the vertical axis direction.
- Setup information saving and loading to/from an IC memory card or floppy disk (option).

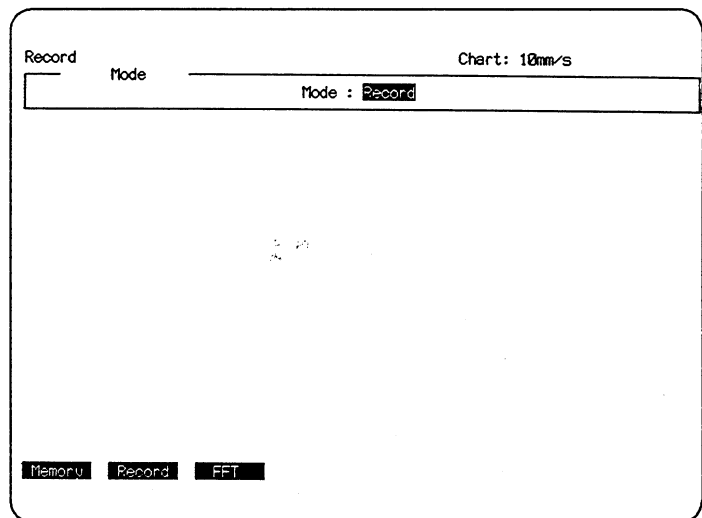
## 10.2 Mode Setting

### Function

The first step is to select the use of either memory mode or recorder mode. Here, select recorder mode.

### Procedure

1.  Mode setting panel appears.
2.  Recorder mode is selected.





## 10.3 Setting of Input Coupling, Input Range, Input Filter and Thermocouple

### Function

Used to select the voltage input or thermocouple input for each channel.

For voltage input, select the combination of input coupling, input range and input filter.

For thermocouple input, select the type of thermocouple.

#### ■ Input Coupling

Select the cutoff frequency of the input low-pass filter from off, Auto, 4kHz, 400Hz, 40Hz and 1.5Hz.

#### ■ Input Range

Select the input range from 0.06, 0.2, 0.6, 2, 6, 20 and 60V.

#### ■ Input Filter

Select the cutoff frequency of the input low-pass filter from off, Auto, 4kHz, 400Hz, 40Hz and 1.5Hz.

4kHz, 400Hz and 40Hz correspond to a filtering of  $-24\text{dB/oct.}$  low-pass filter ; 1.5Hz corresponds to  $-50\text{dB}$  (50Hz or 60Hz).

Selecting "off" causes no filtering.

In Auto, filtering is the same as if set to "off".

■ For logic input channel A and channel B, only on/off setting is provided.

#### ■ Type of Thermocouple

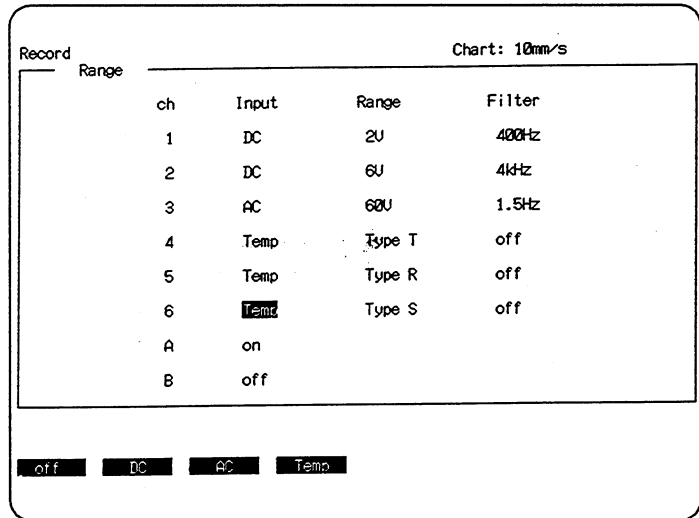
Following thermocouple can be used.

Setting Range	Type of Thermocouple	Measurement Range	Remarks
R	Type R	0.0 to 1760.0°C	
S	Type S	0.0 to 1760.0°C	
B	Type B	0.0 to 1820.0°C	
K	Type K	-200.0 to 1370.0°C	old CA
E	Type E	-200.0 to 800.0°C	old CRC
J	Type J	-200.0 to 1100.0°C	old IC
T	Type T	-200.0 to 400.0°C	old CC
N	Type N	0.0 to 1300.0°C	NBS
W	Type W	0.0 to 2315.0°C	OMEGA
L	Type L (Fe-CuNi)	-200.0 to 900.0°C	DIN 43710
U	Type U (Cu-CuNi)	-200.0 to 400.0°C	DIN 43710

■ The setting can be changed while measurement and recording are in progress.

**Procedure**



1. **RANGE**  
Input coupling / range / filter / thermocouple setting panel appears.
2. **ch**  
Channel display.
3. **Input**  
Select DC or AC input coupling of voltage measurement, or temperature measurement (Temp). If a given channel is not to be used, select "off" (off/DC/AC/Temp).
4. **Range**  
Set the input range of voltage measurement or thermocouple type used at temperature measurement.  
For voltage measurement (0.06/0.2/0.6/2/6/20/60V)  
For temperature measurement (K/J/E/T/R/S/B/N/W/L/U)
5. **Filter**  
Select the frequency of the low-pass filter from the frequencies given below. In Auto, filtering is the same as if set to "off".  
For voltage measurement (off/Auto/4kHz/400Hz/40Hz/1.5Hz)  
For temperature measurement (off/1.5Hz)

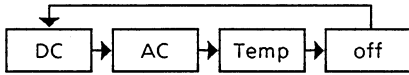


### 10.3 Setting of Input Coupling, Input Range, Input Filter and Thermocouple

#### Procedure Making Changes while Measurement and Recording are in Progress

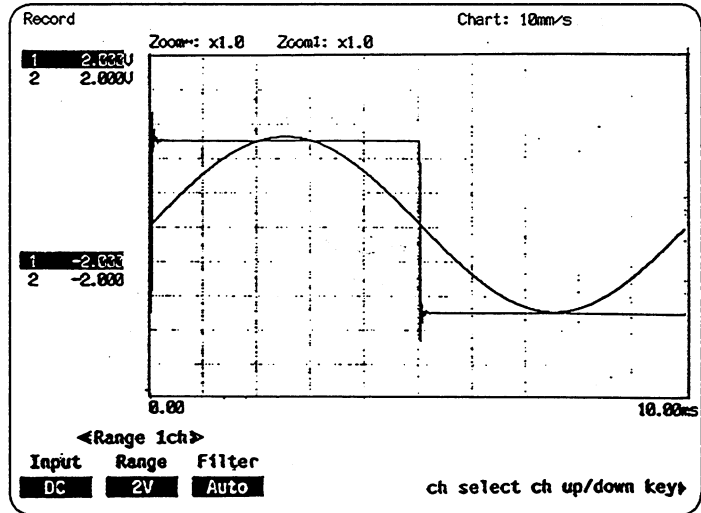
1. Press **RANGE** while measurement is in progress.

2. **ch**  
Pressing the channel select key  or  changes the channel number display.

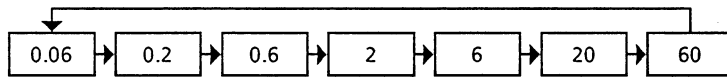


3. **Input**  
Each time the soft key is pressed, the Input display changes as follows.

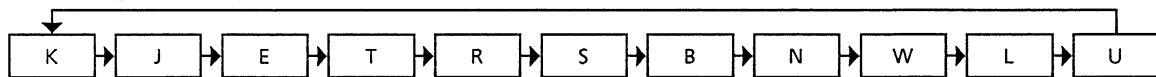
4. **Range**  
Each time the soft key is pressed, the Range display changes as follows.



When input=DC or AC

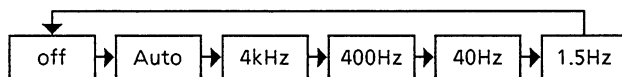


When Input=Temp

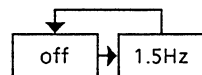


5. **Filter**  
Each time the soft key is pressed, the Filter display changes as follows.

When input=DC or AC



When Input=Temp

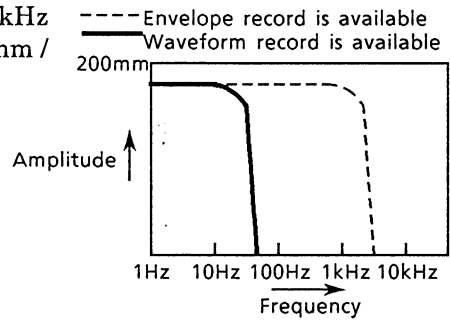


6. **ENTRY**  
Changes are executed.

**Notes**

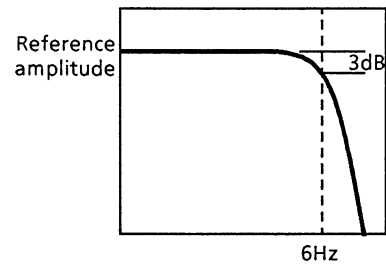
■ **Frequency Characteristics of Voltage Measurement**

Since the sampling rate is 100kS/s, approx. up to 10kHz envelope waveform can be recorded. Also at max. 50mm/sec. up to scores of 10Hz waveform can be recorded.



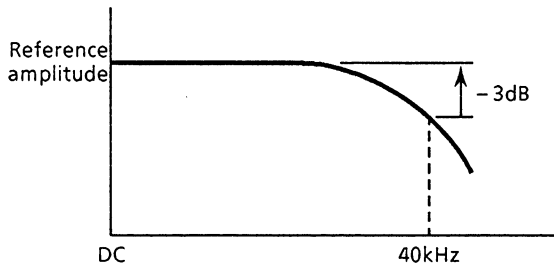
■ **Frequency Characteristics of Temperature Measurement**

The sampling rate is 135S/s. Right figure shows frequency characteristic (with filter off). Reference junction compensation and measurement are executed in parallel.

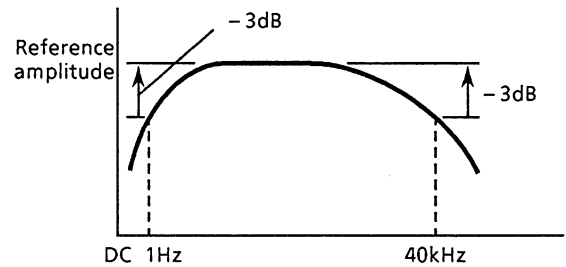


■ **Differences in Characteristics Based on Input Coupling Type (with Filter OFF)**

● **For DC Coupling**



● **For AC Coupling**

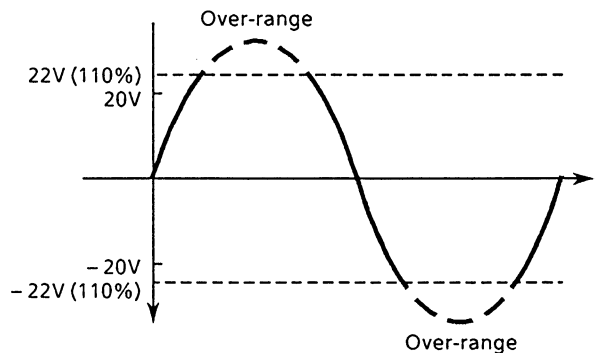


■ **Over-range**

In the case of voltage input, an input greater than 110% of the input range is treated as over-range.

For example, if the measurement range is 20V, a voltage of 22V or more or -22V or less is treated as over-range.

In the case of temperature measurement, the range exceeded the measurement range is treated as over-range.



## 10.4 Setting of Time Trigger

### Function

This function allows recording to start or stop at a preset start or stop time. Also, start and stop recording at the same time of day every month or every day is possible.

### Procedure

1. **TRIGGER**  
Trigger setting panel appears.
2. **Start**  
Select whether or not to set a recording start time (off/on).
3. **Stop**  
Select whether or not to set a recording stop time (off/on).
4. **Start date**  
Set the year, month and day to start recording. Enter using the alphanumeric keypad.  
Press **ENTRY** to fix.
5. **Time**  
Set the time of day to start recording.  
Enter using the alphanumeric keypad.  
Press **ENTRY** to fix.
6. **Stop date**  
Set the year, month and day to stop recording.  
Enter using the alphanumeric keypad.  
Press **ENTRY** to fix.
7. **time**  
Set the time of day to stop recording.  
Enter using the alphanumeric keypad.  
Press **ENTRY** to fix.
- To set items 4. to 7. to the current date and time, press **Now**.

Chart: 10mm/s

Record Trigger

---

Start : on  
Stop : on

Start date : 92/03/07  
time : 08:20

Stop date : 92/03/08  
time : 21:30

**Now**

**Operation Example**

Set the recording start time to 8:20 a.m. on March 7, 1992, and set the recording stop time to 9:30 a.m. on March 8, 1992.

TRIGGER

on

on

9 2 0 3 0 7 ENTRY  
 0 8 2 0 ENTRY  
 9 2 0 3 0 8 ENTRY  
 2 1 3 0 ENTRY

Note : Always enter year, month, day, hour and minute in two digits.  
 Press <sup>ENTRY</sup> to fix.

**Notes**

■ **Measurement Start and Time Trigger**

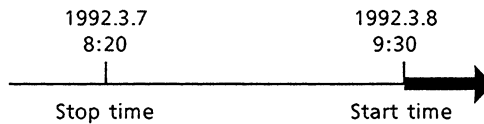
If the START key has not been pressed, recording will not start even if the recording start time is reached.

For time relationship between measurement start and time trigger, see Section 10.10, "Measurement Start and Stop."

■ **If Start Time and Stop Time are Reversed**

Even if the stop time is set earlier than the start time, the start time will take effect.

For example, even if the start date and time is set to 9:30 a.m. on March 8, 1992, and the stop date and time is set to 8:20 a.m. on March 7, 1992, recording will start at 9:30 a.m. on March 8, 1992.



## 10.4 Setting of Time Trigger

### ■ Setting Fixed Time Recording

Leaving a field such as the year, month, day or time field in the Start time or Stop time “date” or “time” blank is the same as specifying every month, every day or every time of day.

For example, if the start date and stop date are set as shown in the figure below, recording starts at 8:00 and stops at 17:00 every day of March, 1992.

Use  $\overline{SP}$  when entering a blank.

The image shows a terminal-style window titled "Record Trigger" with a "Chart: 10mm/s" indicator in the top right. The main area contains the following text:

```
Start : on
Stop  : on
Start date : 92/03/
           time : 08:00
Stop date  : 92/03/
           time : 17:00
```

Two lines from the right side of the window, labeled "Blank", point to the date fields "92/03/" in the "Start date" and "Stop date" lines. At the bottom left of the window, there is a "Now" button.

### ■ For Manual Recording

See Section 10.14, "Recording Start/Stop and Paper Feed."

## 10.5 Setting of Display Format

### Function

The display format in which measured data are displayed on the CRT screen is "Single display."

Up to eight channels can be simultaneously displayed.

This function sets the channel number to be displayed.

The setting can be changed while measurement and recording are in progress.

### Procedure

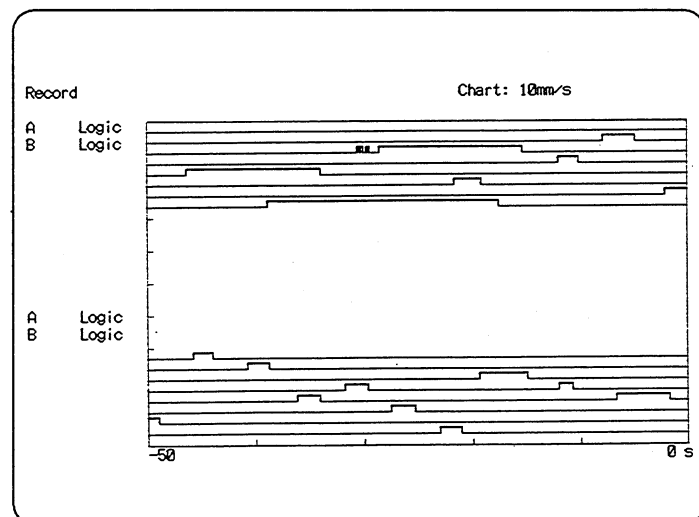
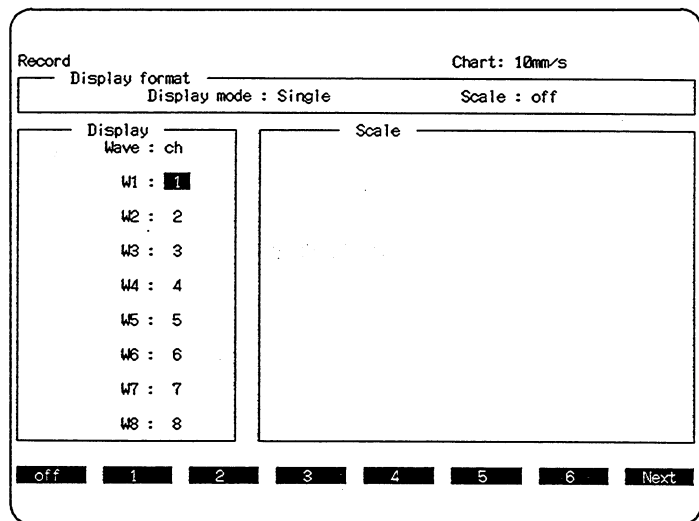
1. **DISPLAY FORMAT**  
Display format panel appears.
2. **Display mode**  
Only Single display can be specified. This display format cannot be changed.
3. **Display**  
Assign the channel numbers to be displayed on the CRT screen to the waveform numbers (W1 to W8\*).

For models with logic input, logic channel numbers A and B can also be set.

\* For 4-channel models:  
W2 to W4

For 6-channel models  
(including logic input):  
W2 to W6

- Waveforms for logic channel A are displayed on the upper side (A1 to A8 from the top) and those for logic channel B on the lower side (B1 to B8 from the top). It is impossible to change the above display order.



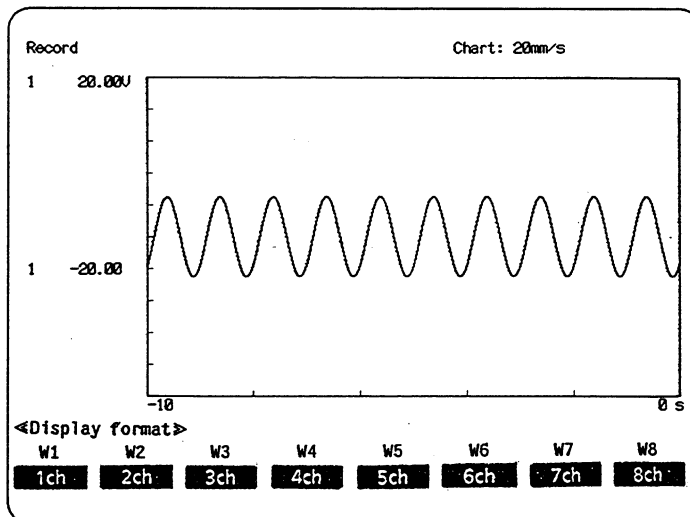
Note : For setting for Scale (display scaling) see Section 10.6, "Setting of Display Scale."



## 10.5 Setting of Display Format

### Procedure Making Changes while Measurement and Recording are in Progress

1. Press **DISPLAY FORMAT** while measurement is in progress.
2. **W1 to W8\***  
Each time the soft key is pressed, the channel number display changes.
3. **ENTRY**  
Settings are changed.  
\* For 4-channel models:  
    W2 to W4  
For 6-channel models  
(including logic input):  
    W2 to W6



## 10.6 Setting of Display Scale

### Function


This function enables the user to set the scale of the vertical axis of each waveform displayed on the CRT screen for waveform numbers W1 to W8\*.

The scale set here is also effective during recording.

\* For 4-channel models: W2 to W4

For 6-channel models (including logic input): W2 to W6

### Procedure

1.  Display format panel appears.
2. **Display mode**  
Only "Single" display can be specified. This display format cannot be changed.
3. **Scale**  
Select .
4. **Scale**  
Set the scale of the vertical axis for each waveform number (W1 to W8\*).

\* For 4-channel models:

W2 to W4


For 6-channel models

(including logic input):


W2 to W6

Display		Scale	
Wave	ch	Upper	Lower
W1	1	2.000	-2.000
W2	2	4.000	0.000
W3	3	12.00	-12.00
W4	4	1.000	0.000
W5	5	1.000	0.000
W6	6	1.000	0.000
W7	7	1.000	0.000
W8	8	1.000	0.000

**Upper**: Enter the upper limit of the vertical axis using the alphanumeric keypad.

Press  to fix the setting.

**Lower**: Enter the lower limit of the vertical axis using the alphanumeric keypad.

Press  to fix the setting.

Note: For setting of Display W1 to W8, see Section 10.5, "Setting of Display Format."

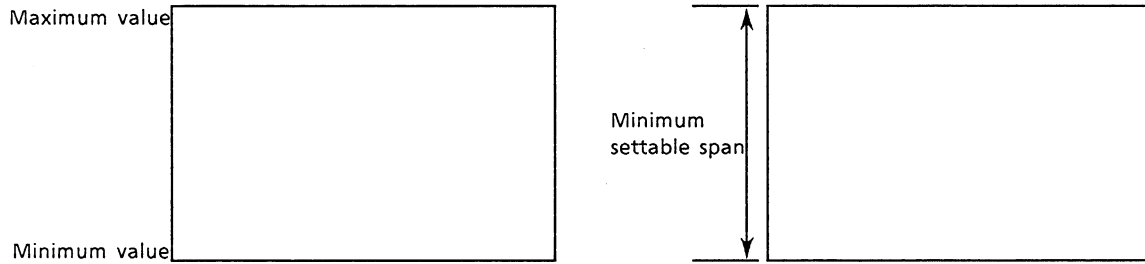
### Notes

- When computational processing is not in use (Program=off), the display scale setting for logic input waveforms is invalid.

## 10.6 Setting of Display Scale

### Notes

Meanings of maximum value, minimum value and minimum settable span for setting range are as follows:



Maximum value : Upper limit of value that can be set  
 Minimum value : Lower limit of value that can be set  
 Minimum settable span: Smallest value (Upper value – Lower value)

#### ■ When Display Scale is Selected (Scale = on)

The table below shows the relationship between the display scale setting range and the input range. The relationship is not affected by whether linear scaling is selected (on) or not (off).

Input Range	Maximum Value	Minimum Value	Minimum Settable Span
60V	120.0	-120.0	6.0
20V	40.0	-40.0	2.0
6V	12.0	-12.0	0.6
2V	4.0	-4.0	0.2
0.6V	1.20	-1.20	0.06
0.2V	0.40	-0.40	0.02
0.06V	0.12	-0.12	0.006
K	2500.0	-1500.0	100.0
J	2500.0	-1500.0	100.0
E	1750.0	-1250.0	75.0
T	1000.0	-1000.0	50.0
R	3250.0	-1750.0	125.0
S	3250.0	-1750.0	125.0
B	3250.0	-1750.0	125.0
N	2500.0	-1500.0	100.0
W	4500.0	-1500.0	150.0
L	1750.0	-1250.0	75.0
U	1000.0	-1000.0	50.0

■ If linear scaling is set to “off” when display scale has not been selected (Scale=off), the display scale values will be the input range values.

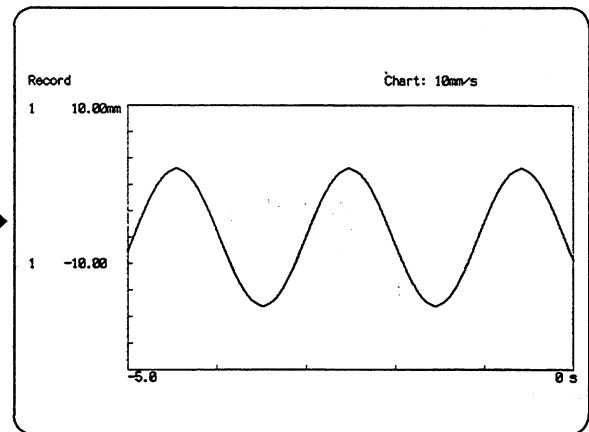
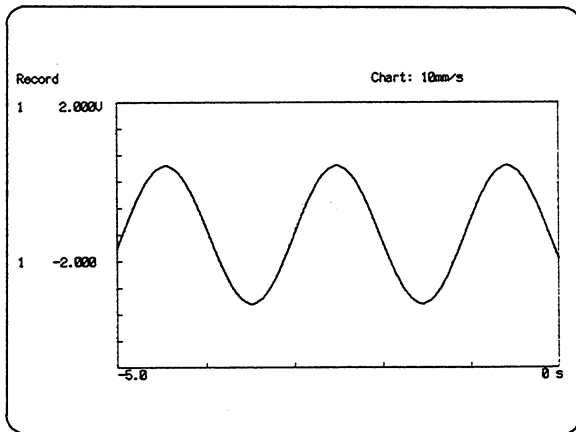
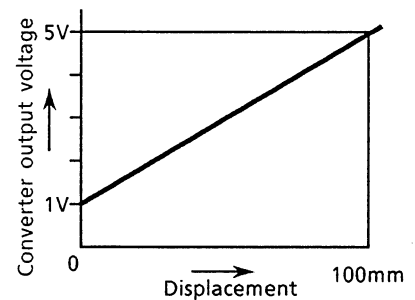
■ If linear scaling is set to “on” when display scale has not been selected (Scale=off), maximum value, minimum value and minimum settable span for setting range are the values obtained by linear scaling.

## 10.7 Setting of Linear Scale

### Function

If external converters are being used to measure physical quantities such as pressure, acceleration, speed, displacement, and strain, the physical quantities can be read directly (in engineering units) by using the linear scaling function. For example, if a displacement gauge is used, displacement can be read directly in "mm" units.

The linear scaling function makes it possible to convert voltage to displacement units without consuming the memory capacity that would be required if the computational processing functions had to be used for this. Using computational processing reduces the available memory size to one-fourth the otherwise available memory size.



### Procedure












1. **MISC**  
MISC setting panel appears.
2. **Scale**  
Instrument enters linear scaling setting mode.
3. **Linear scale**  
Select **on**.
4. **Coefficient**  
Use the alphanumeric keypad to enter the constant of proportionality (slope) for the first-order (linear) function. Press **ENTRY** to fix.
5. **Offset**  
Use the alphanumeric keypad to enter the offset value for the first-order (linear) function. Press **ENTRY** to fix.
6. **Units**  
Enter the units using the soft keys or the alphanumeric keypad. Press **ENTRY** to fix.

Linear scale	Coefficient	Offset	Units
1ch	5.000	0.000	mm
2ch	1.000	0.000	
3ch	1.000	0.000	
4ch	1.000	0.000	
5ch	1.000	0.000	
6ch	1.000	0.000	
7ch	1.000	0.000	
8ch	1.000	0.000	

## 10.7 Setting of Linear Scale

### Operation Example

To measure displacement on channel 1 use a converter giving 1V output per 5mm displacement, and read in a unit of displacement.

### Notes

- The setting range for constants of proportionality (Coefficient) and offset values (Offset) is  $-10^{30}$  to  $10^{30}$ .
- The setting of linear scaling is effective for both panel display and recording.
- Linear scaling cannot be set for logic input.

## 10.8 Setting of Chart Speed

### Function

When measured data is being recorded to chart paper, the recording speed is referred to as the "chart speed." This must be set to a suitable value, according to the rate of change and frequency of the input signal.

The chart speed can be changed while measurement and recording are in progress.

### Procedure

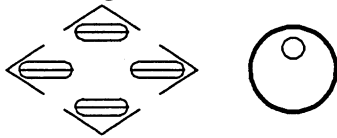
The chart speed is always displayed at the upper right hand of the CRT screen.

1.  **SAMPLE RATE**

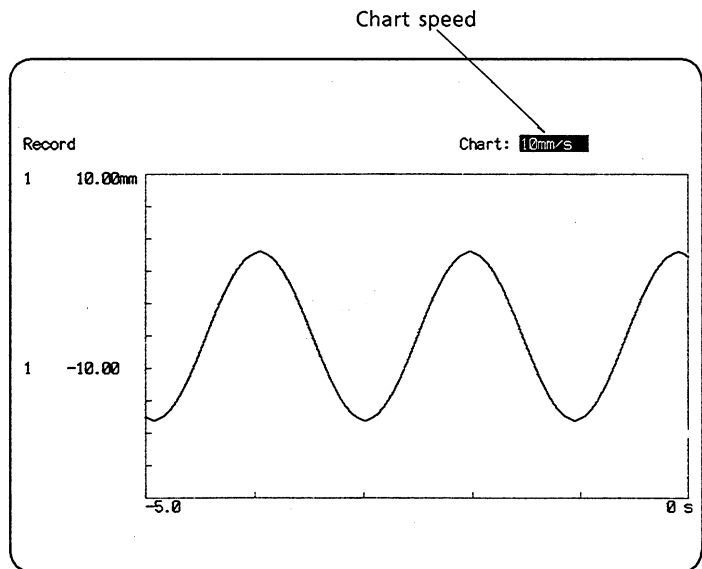
Instrument enters the mode that allows the chart speed to be set.

2. The setting changes as the cursor keys or rotary knob is operated.

The chart speed is selected from the following fifteen.



50,20,10,5,2,1 mm/s  
 50,20,10,5,2,1 mm/min  
 50,20,10 mm/h



### Note

- Input signal sampling (A/D conversion) rate is 100kS/s and this value is always uniform. However, the conversion rate from voltage data to temperature data is 135S/s at temperature measurement.

# 10.9 Setting of Display Range

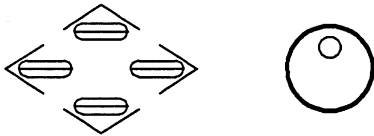
## Function

In recorder mode, waveforms are displayed on the CRT screen using roll mode. The display range can be set in terms of time.

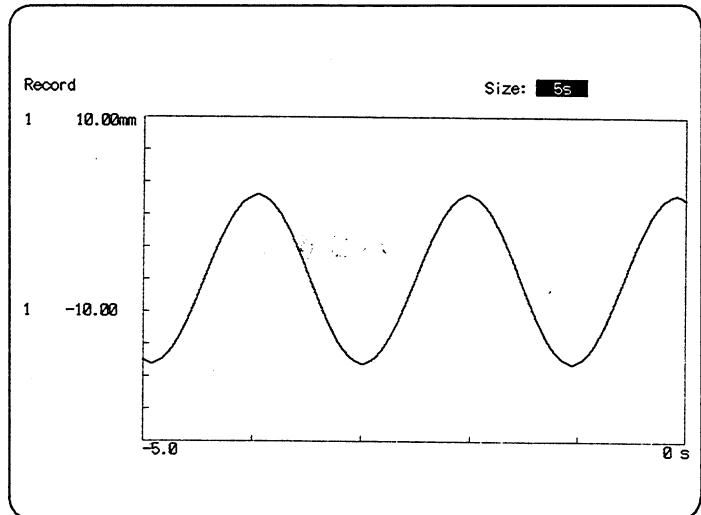
The setting can be changed while measurement and recording are in progress.

## Procedure

1. Press **SHIFT** and then **SAMPLE RATE**.  
Instrument enters the mode used to set the display range.
2. The setting changes as the cursor keys or rotary knob is operated.



Select the display range from the following:  
250s, 100s, 50s, 25s, 10s, 5s, 2.5s,  
1.0s, 0.5s.



## Notes

- The table below shows the relationship between the specified display range and the time axis scale.



Display Range	Display Time Axis Scale	
250sec	-250	0
100sec	-100	0
50sec	-50	0
25sec	-25	0
10sec	-10	0
5sec	-5	0
2.5sec	-2.5	0
1.0sec	-1.0	0
0.5sec	-0.5	0

# 10.10 Measurement Start and Stop

## Function

The START key is used to start measurement; the STOP key is used to stop measurement. If measurement has been started, the lamp at the upper left of the START key switches ON. When measurement is terminated, using the STOP key, this lamp switches OFF. Pressing the STOP key while recording is in progress also terminates recording.

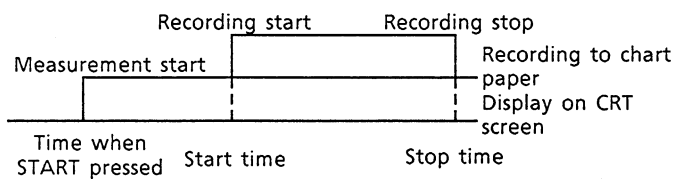
## Procedure

1.  Measurement starts.
2.  Measurement stops.

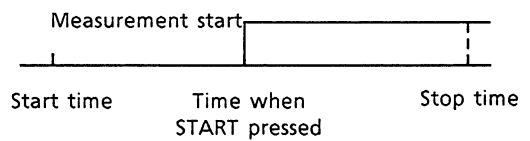
## Notes

### ■ Relationship between Measurement Start and Time Trigger

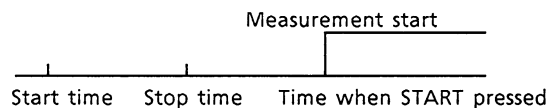
① Example of basic use :



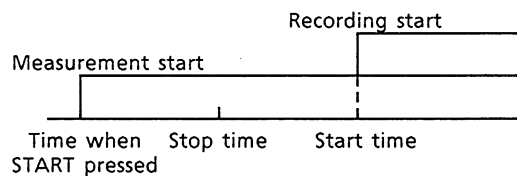
② When START key pressed after start time (no recording) :



③ When START key pressed after start time and after stop time (no recording) :



④ When stop time set before start time :



### ■ Relationship between Measurement Stop and Time Trigger

If the time for which the measurement STOP key is set is earlier than the recording stop time set using the time trigger (see Section 10.4, "Setting of Time Trigger"), recording ends at the time that the measurement STOP key is pressed.



## 10.11 Moving Waveforms on the Panel (SCROLL)

### Function

Waveform on the panel can be scrolled in the voltage axis direction while measurement is in progress. This operation is also reflected in recording.

This function is enabled when the AR1100A is set for display scaling via the display format panel (Scale: on). See Section 10.6, "Setting of Display Scale."

### Procedure

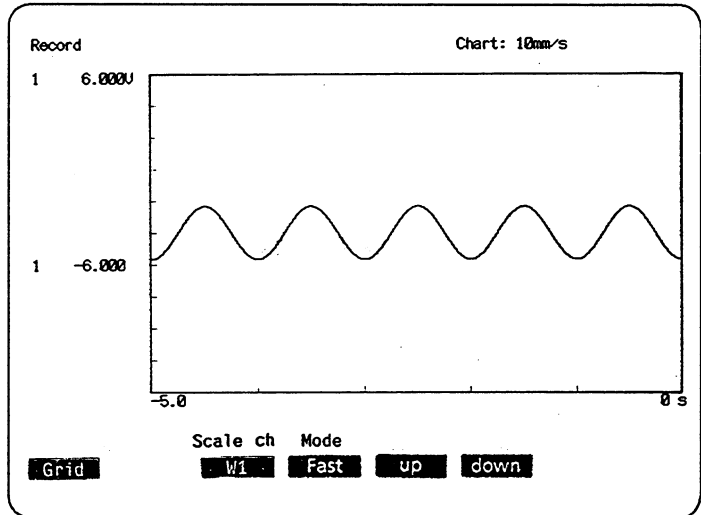
1. Pressing **CURSOR** while measurement is in progress changes the soft key menu.
  - **Scale ch**  
Select the number of the waveform to be scrolled. Each time the soft key is pressed the display changes.
  - **Mode**  
Select the scrolling speed. Pressing the soft key toggles the display between **Fast** and **Slow**.  

Fast

→

Slow

↑
  - **Execute scrolling.**  
Use the **up** key to scroll up.  
Use the **down** key to scroll down.



Notes
-------

■ **Scrolling range**

The possible scrolling extent depends on the input range.

Range	Maximum Value	Minimum Value
60V	120.0	-120.0
20V	40.0	-40.0
6V	12.0	-12.0
2V	4.0	-4.0
0.6V	1.20	-1.20
0.2V	0.40	-0.40
0.06V	0.12	-0.12
K	2500.0	-1500.0
J	2500.0	-1500.0
E	1750.0	-1250.0
T	1000.0	-1000.0
R	3250.0	-1750.0
S	3250.0	-1750.0
B	3250.0	-1750.0
N	2500.0	-1500.0
W	4500.0	-1500.0
L	1750.0	-1250.0
U	1000.0	-1000.0



- Waveforms can be scrolled only during measurement operations (including recording).
- Scrolling cannot be performed if display scaling is set to "off."
- Logic input waveforms cannot be scrolled.

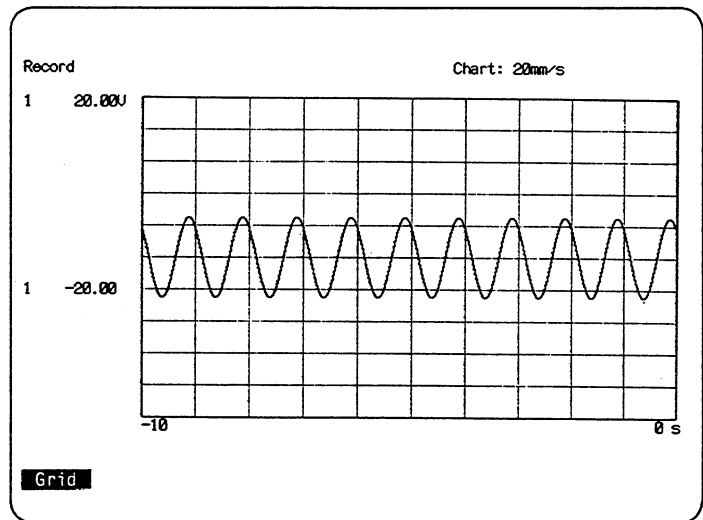
## 10.12 Inserting a Grid

### Function

This function presents a grid on the panel display frame. It is convenient for comparison of multiple waveforms.

### Procedure

1. Press  during measurement operations.  
Soft key menu changes.
2.   
Press this key once to display a grid.  
Press the key a second time to erase the grid.



### Notes

- Grid display can be used only during measurement operations.
- For grid setting for the chart paper see Section 10.13, "Setting of Print Format (Recording Format)."

## 10.13 Setting of Print Format (Recording Format)

### Function

Select whether to perform analog recording or digital recording.

### ■ Analog Recording

Provides analog recording of the waveform in real time at the specified chart speed.

For chart speed setting see Section 10.8, "Setting of Chart Speed."

The number of the waveform to be recorded and the waveform recording density can be specified.

Grid can also be specified.

### ■ Digital Recording

Provides digital printout recording of the waveform in real time at the specified time intervals.

### Procedure ... Progress Analog Recording

1. **PRINT FORMAT**  
Print format setting panel appears.
2. **Print mode**  
Select **Analog**.
3. **Title on/off**  
Select whether or not to print a title (on/off).
4. **Title**  
If a title is to be printed, enter the title using the alphanumeric keypad (up to 40 characters). Press **ENTRY** to fix.
5. **Grid**  
Select whether or not to print a grid on the chart paper and whether to print the grid in fine or normal width (Fine/Normal/off).
6. **Wave**  
Specify whether or not (off) to record the waveforms for the waveform numbers (W1 to W8\*) assigned from the display format setting panel.  
If recording is selected, select whether the recording trace is to be thick (Thick) or thin (Thin).  
\* For 4-channel models:  
    W2 to W4  
For 6-channel models  
(including logic input):  
    W2 to W6

Record Chart: 10mm/s

Print format

Print mode : **Analog**

Title on/off : off

Grid : Fine

Wave	W1 : Thick	W2 : Thick	W3 : Thick	W4 : Thick
	W5 : Thick	W6 : Thick	W7 : Thick	W8 : Thick

**Analog** **Digital**

Record Chart: 10mm/s

Print format

Print mode : Analog

Title on/off : on

Title : No.123 Test of the Oscillator

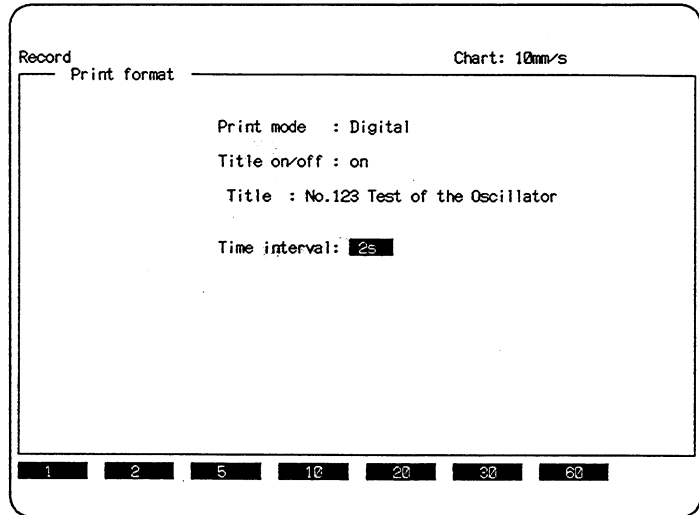
Grid : Fine

Wave	W1 : Thick	W2 : Thick	W3 : Thick	W4 : Thick
	W5 : Thin	W6 : Thin	W7 : off	W8 : off

**off** **Thick** **Thin**

**Procedure** Digital Recording

1. **PRINT FORMAT**  
Print format setting panel appears.
2. **Print mode**  
Select **Digital**.
3. **Title on/off**  
Select whether or not to print a title (on/off).
4. **Title**  
If a title is to be printed enter the title using the alphanumeric keypad (up to 40 characters).
5. **Time interval**  
Set the spacing between data points to be printed (1/2/5/10/20/30/60).



**Procedure** Making Changes while Measurement (Recording) is in Progress (Analog Recording Only)

1. Pressing **PRINT FORMAT** while measurement is in progress changes the panel as follows. It is necessary to set Print mode to "Analog" in advance.
2. **W1 to W8**

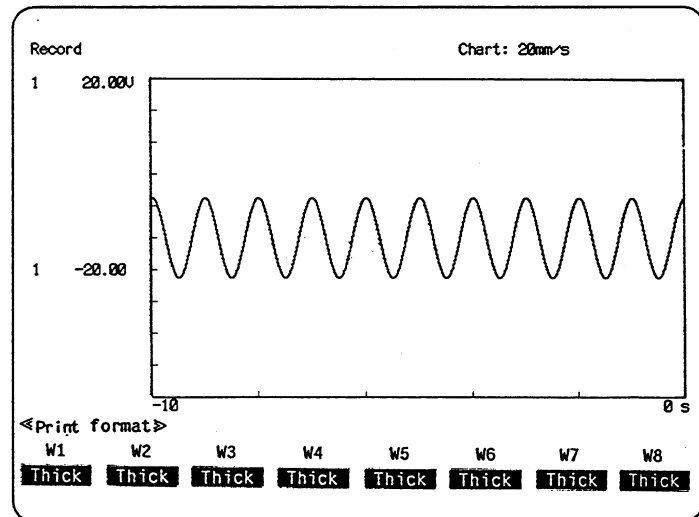
Each time a soft key W1 to W8\* is pressed, both the display and setting simultaneously change as follows:

```

    graph LR
      off[off] --> Thick[Thick]
      Thick --> Thin[Thin]
      Thin --> off
  
```

Note : The setting changes even if **ENTRY** is not pressed.

- \* For 4-channel models : W2 to W4
- For 6-channel models (including logic input) : W2 to W6



## 10.14 Recording Start/Stop and Paper Feed

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



### Function

Starts (print start) or stops (print stop) recording to the internal printer.


The recording format is the same as the print format. See Section 10.13, "Setting of Print Format (Recording Format)."

Use the FEED key to feed paper.

### Procedure

1.   
Measurement starts.
2.   
Recording starts.
3. Press  while recording is in progress.
  -   
Chart paper is fed.

### Notes

- If measurement has not been started, recording cannot begin even if  is pressed.
- Paper cannot be fed while recording is in progress.
- If the waveform being recorded results in the trace "painting" the paper solidly across a broad range, then a recording head overtemperature condition may result. When this condition is detected the current to the head is automatically cut off to protect the head. Chart paper feed, however, will continue. Although the recording trace will become more faint, this is not a malfunction.
- If no chart paper is present, "Chart exhausted" is displayed on the panel and recording stops. Refill the printer with chart paper.












## 10.15 Saving / Loading / Deleting Setup Information

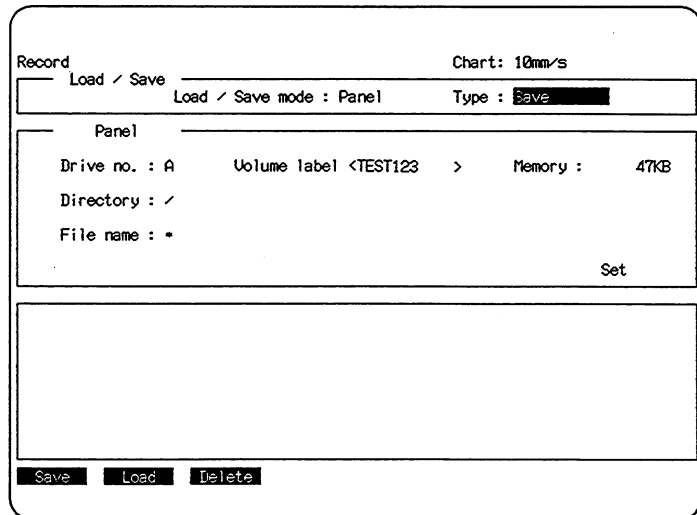
### Function

Setup information such as input coupling, input range, input filter, chart speed, display format, print format, etc. can be saved to and loaded from the IC memory card or floppy disk (option).

Also the setup information file can be deleted.

### Procedure

1. **LOAD / SAVE**  
  
 Load/Save panel is called up.
2. **Load / Save mode**  
 Press  .
3. **Type**  
 Pressing  saves setup information.  
 Pressing  loads setup information.  
 Pressing  deletes setup information.
- **Drive no.**  
 Press  to specify IC card.  
 Press  to specify floppy disk.
- **Directory**  
 "/" shows the root directory. User can specify the subdirectory in this area. Use "/" as a partition of the directory. When setup information is saved in the subdirectory, the subdirectory must be created in advance (see Section 7.21, "Creating and Deleting Directories").
- **File name**  
 The file names that exist in the currently specified directory are displayed in the soft key menu area. Up to eight file names can be displayed at a time. If there are more than eight files, the channel select key  or  can be used to display subsequent file names. User can also enter the file name (up to eight characters) using the alphanumeric keypad.  
 In either case, press  to fix.  
 Eight information items of the file in the specified directory can be displayed at the lower part of the panel. For details see Section 7.17, "Checking Files."
4. **Set**  
 With the cursor at the Set position, press the  to save, load or delete the file.



Record Chart: 10mm/s

Load / Save Load / Save mode : Panel    Type : Save

---

Panel




Drive no. : A      Volume label <TEST123 >      Memory : 47KB

Directory : /

File name : \*

Set

---

Notes
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- If the user uses an IC memory card, carefully read sections from 7.2, "Precautions for Use of IC Memory Card" to 7.6, "Initializing the IC Memory Card."
- If the user uses a floppy disk, carefully read sections from 7.7, "Precautions for Use of Floppy Disk" to 7.9, "Initializing the Floppy Disk."
- If data is saved using the file name already existing in the specified directory, the file is overwritten.
- Confirm Drive no., Directory and File name carefully before saving or deleting the file.
- When the setup information files are treated using a personal computer, the file extension is PNL.
- Definition concerning which characters can or cannot be used for file names conforms to MS-DOS.
- It is not possible to save the Complementary Setting (presently inactive setting) of the Swap Function. For details of the Swap Function please read Section 11.2, "Exchanging Display / Computation Settings (SWAP)."










## 10.16 Printing out a Setup List



### Function

Records setup parameter listings by the internal printer.


The following shows the information in the listings that can be recorded.

<i>MODE</i> 	Mode setting
<i>RANGE</i> 	Setting of input coupling, input range, input filter and thermocouple
<i>TRIGGER</i> 	Time trigger setting
<i>DISPLAY FORMAT</i> 	Display format setting
<i>MISC</i> 	Comment setting Printout related setting Communications related setting Hardware configuration, etc.
<i>SAMPLE RATE</i> 	Chart speed
<i>PRINT FORMAT</i> 	Print format (recording format) setting information

### Procedure

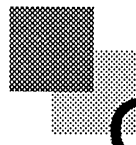
Press  and then press .

A setup information listing is recorded by the internal printer.

Pressing  during recording stops recording.

### Notes

- While measurement is in progress, the setup list cannot be recorded.
- If no chart paper is present, "Chart empty" or "Chart exhausted" is displayed. Refill the printer with chart paper.



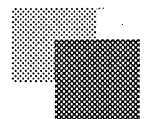
# Chapter 11

## Memory Mode and Recorder Mode / Other Functions and Settings

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This chapter describes miscellaneous functions which are common to memory mode, recorder mode and FFT mode are also useful for understanding.

11.1	Initializing Setting and Memory Contents .....	11-2
11.2	Exchanging Display/Computation Settings (SWAP) .....	11-3
11.3	Monitoring Measured Data .....	11-4
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## 11.1 Initializing Setting and Memory Contents

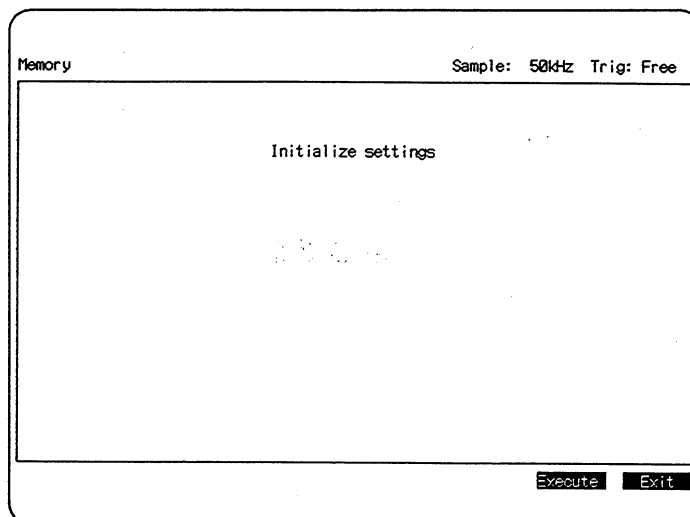
### Function

This function resets the setup information to its initial state. It also initializes waveform data in the memory.

See APPENDIX 3, "Menu Hierarchy Structure" for initial value data.

### Procedure

1. MISC  
MISC panel appears.
2. Next  
Soft key menu changes.
3. Next  
Soft key menu changes.
4. Init.  
The panel which initializes setup information appears.
5. Execute  
Initialization is executed.
- Exit  
Use this key to abort initialization and return to the MISC panel.



## 11.2 Exchanging Display / Computation Settings (SWAP)

### Function

The main unit can simultaneously display waveforms for up to eight channels. Thus, display related settings must be changed each time waveform other than the currently displayed waveform is displayed. This swap function simplifies the setting change.

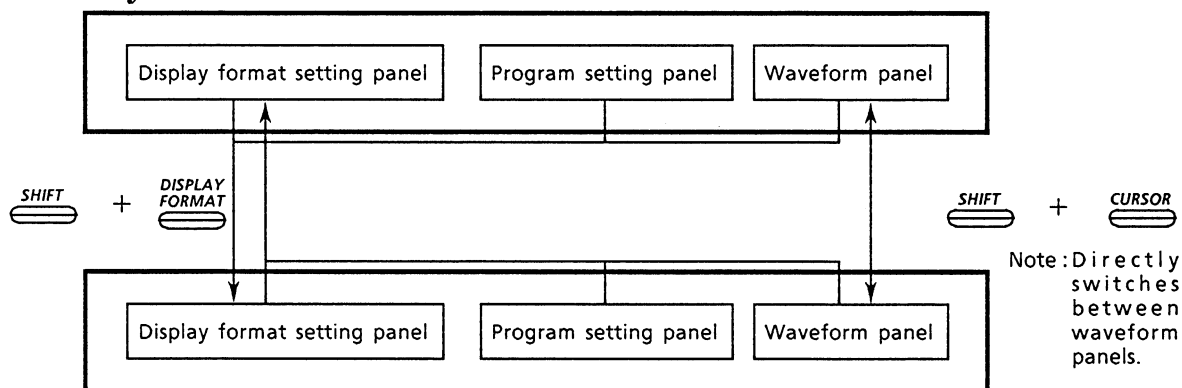
The swap function enables two contents to be set and also exchanged by simple key operation.

This swap function is active for the following setting contents :

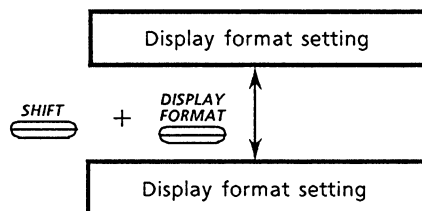
Memory mode : Program, Display format  
 Recorder mode : Display format  
 FFT mode : None

### Procedure

#### ■ Memory Mode



#### ■ Recorder Mode



### Notes

- A message, "Setting changed," displayed on the upper part of the panel notifies the operator that the setting changes when the swap function is activated.
- Note that "Program" (off / on) on the program setting panel and "Display mode" (Single, Dual, Quad, X-Y) and "Scale" (off / on) on the display format setting panel are set in common to both major and complementary settings.
- The major and complementary settings do not have any distinguishing identifier themselves. That is to say, the setting which is currently active is regarded as the major setting and the other is regarded as the complementary setting.
- It is not possible to print out a Setup List for the complementary setting or save setup information for the complementary setting.
- Pressing  $\overline{\text{SHIFT}} + \overline{\text{CURSOR}}$  allows switching between the waveform display panels in memory mode only.

## 11.3 Monitoring Measured Data

### Function

The measured data for each channel is displayed as a digital value on the panel every half second.

This feature is useful for zero-point adjustments when using an external amplifier.

Memory		Sample: 50kHz Trig: Free	
Monitor			
ch	Data		
01	-0.04 U		
02	0.03 U		
03	-0.26 U		
04	0.26 U		
05	1.32 U		
06	-0.02 U		
ch	Data	ch	Data
A	0101 1001	B	0011 1001

### Procedure

1. **MONITOR**  
Monitor mode panel appears.
2. **STOP**  
Monitor mode ends.

### Notes

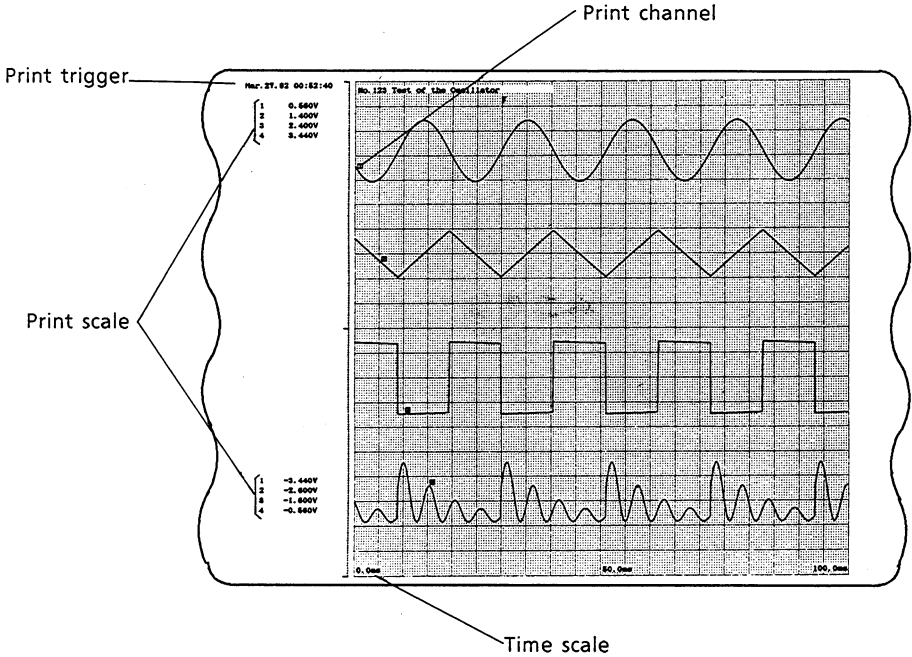
- **Values when Linear Scaling is in Use**  
The values are displayed after linear scaling has been performed. For linear scaling see Section 8.6, "Setting Linear Scaling".
- **Circumstances under which Monitor Mode cannot be Used**
  - While measurement by **START** is in progress
  - When **PROGRAM START** is used for redisplay
- **Displaying Overage Data**  
Overrange data is displayed as follows :  
\*\*\*\*\*

# 11.4 Recording Related Settings

## Function

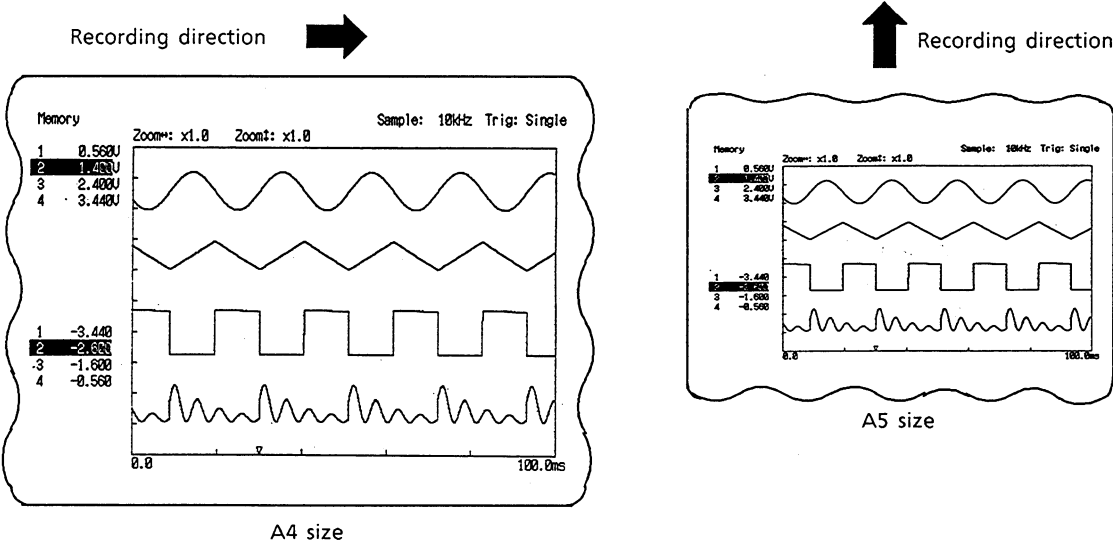
This selects whether or not the channel numbers, vertical axis values, etc. are recorded when performing analog recording in memory mode or when recording in recorder mode. It also sets the size used when making a hard copy of the panel.

### ■ Analog Recording in Memory Mode

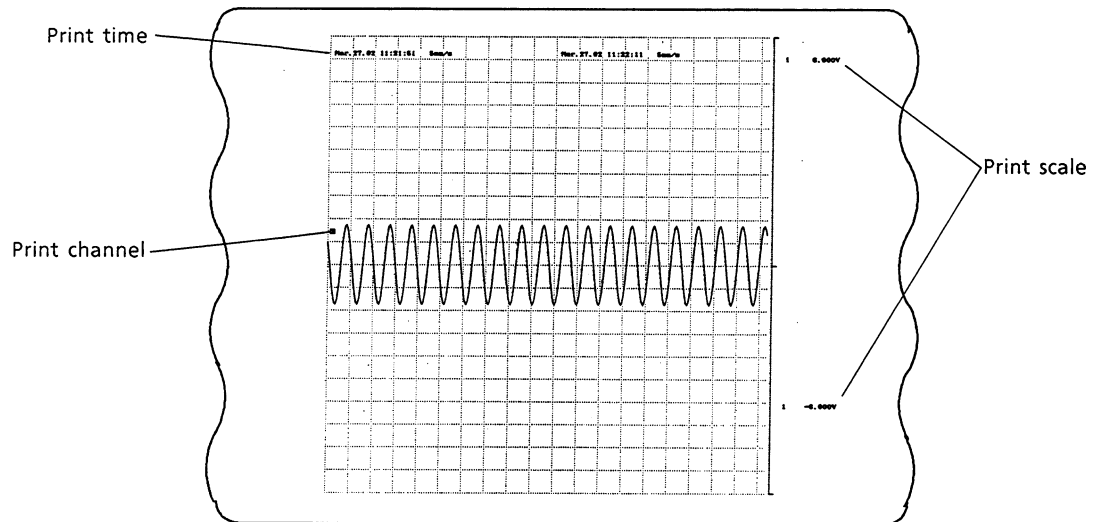


### ■ Hard Copy Size

A4 or A5 can be selected.




### ■ Recording in Recorder Mode





### ■ Chart Paper Length

A4 (297mm) or letter size (279mm=11inches) can be selected.

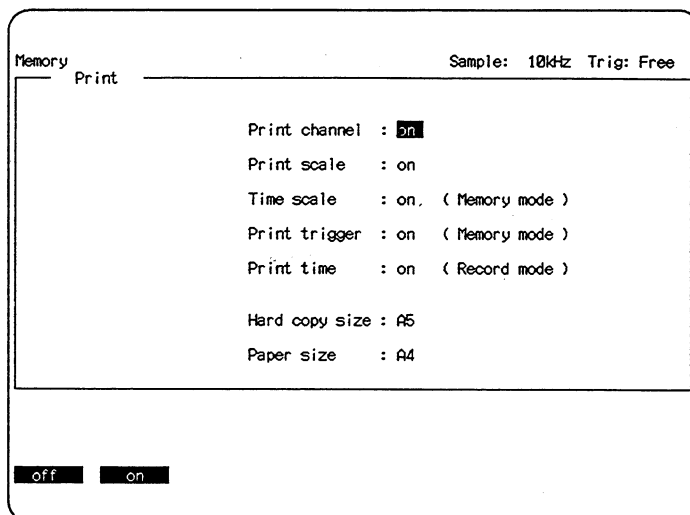
### Procedure

1.  MISC panel appears.

2.  Soft key menu changes.

3.  Calls up the panel on which the printout related settings are performed. Menu cursor can be moved using the cursor keys. The following items can be selected by the soft keys:

- **Print channel**  
Select whether or not to print channel numbers (on/off).
- **Print scale**  
Select whether or not to print vertical axis values (on/off).
- **Time scale**  
Select whether or not to print time axis values. Can be set for analog recording in memory mode only (on/off).
- **Print trigger**  
Select whether or not to print the time at which the trigger was tripped (on/off). Can be set for analog recording in memory mode only.
- **Print time**  
Select whether or not to print the recording start time (on/off). Can be set for recorder mode only.
- **Hard copy size**  
Select whether recording size for hard copy is set to A4 or A5 (A4/A5).
- **Paper size**  
Select whether the chart length is A4 size (297mm) or letter size (279mm=11inches) (A4/Letter).  
Normally set to A4 size.










## 11.5 Inserting a Grid Immediately after Power-ON

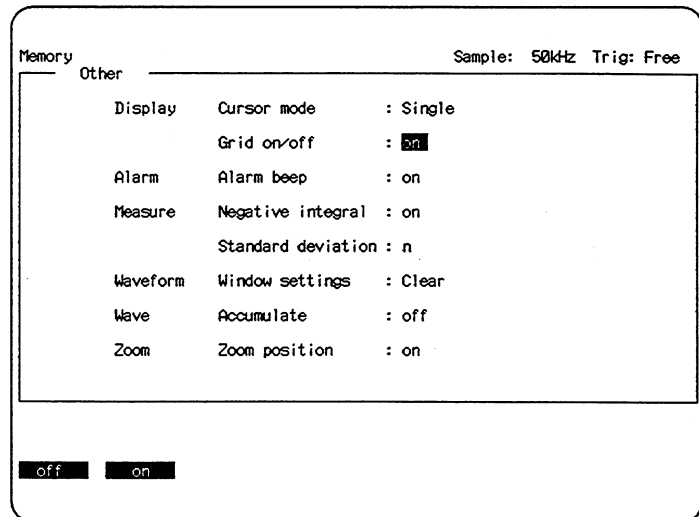
### Function

Selects whether or not a grid is displayed on the waveform panel immediately after power-ON.

For operation of erasing the displaying grid after power-ON or displaying a grid during measurement, see Section 5.6, "Inserting a Grid" and Section 10.12, "Inserting a Grid".

### Procedure

1.  MISC panel appears.
2.  Other Setting panel appears.
3. Move the menu cursor using the cursor key .
4. **Display Grid on/off**  
Press  to enter a grid after power-ON.
5. Pressing any of the function keys  ends the MISC panel.









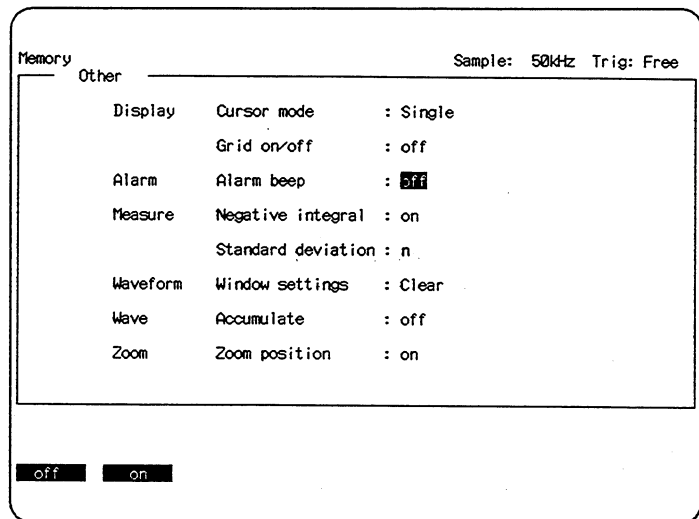
## 11.6 Disabling the Alarm Beep

### Function

In initial status the alarm beep sounds when key input is not accepted because of incorrect operation or when waveform judgment is detected. This function disables an alarm beep.

### Procedure

1.   
MISC panel appears.
2.   
Setting panel appears.
3. Move the menu cursor using the cursor key .
4. **Alarm beep**  
Pressing  disables an alarm beep.  
Pressing  enables an alarm beep.
5. Pressing any of the function keys  ends the MISC panel.





## 11.7 Checking Setup Information

### Function

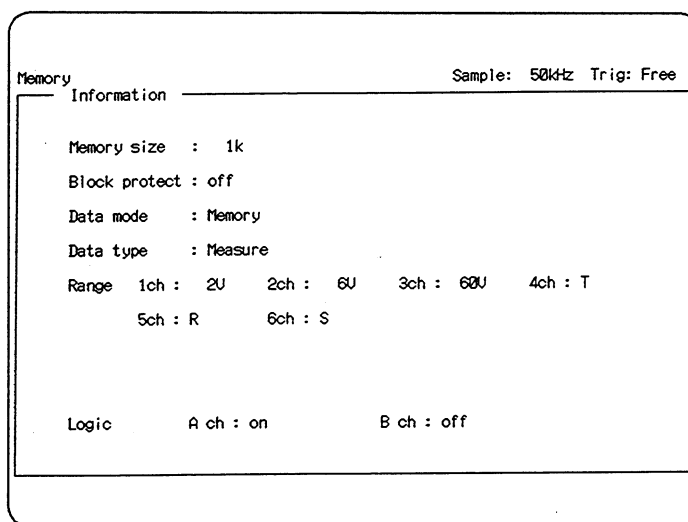
This function is used to check the setup information used for the latest data measurement. When data is loaded from an IC memory card or floppy disk (option), the setup information in effect when that data was measured can be examined.

### Procedure

1.  MISC panel appears.
2.  The setup information check panel appears.

Information items are as follows:

- **Memory size**  
Displays the currently set memory size (see Section 4.3, "Memory Size Setting").
- **Block protect**  
Displays whether the block protect mode is set to "on" or "off" (see Section 8.12, "Protecting Data in Blocks").
- **Data mode**  
Displays in what mode data was measured.
- **Data type**  
Displays whether data is measured data (Measure) or computed data (Program).
- **Range**  
Displays the range information for each channel (analog).
- **Logic**  
Displays whether the logic channels are set to "on" or "off".






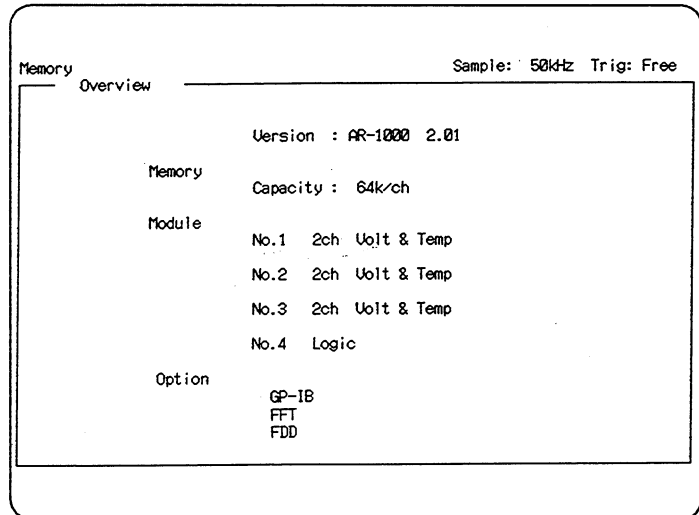
## 11.8 Checking Hardware Configuration

### Function

This function is used to check the hardware configuration of the instrument.

### Procedure

1.  MISC panel appears.
2.  Soft key menu changes.
3.  The instrument hardware configuration check panel appears.
  - **Version**  
Displays the version number.
  - **Memory/Capacity**  
Displays the memory capacity for each channel.
  - **Module**  
Displays the number and type of input modules incorporated in the instrument.  
The numbers show the input module slot numbers indicated at the rear of the instrument.
  - **Option**  
Displays options added to this instrument.





Note: Though "AR-1000" is displayed for "Version", this does not mean the Product Name.

## 11.9 Reviewing Functions Activated by SHIFT + Function Keys

### Function

















This instrument has functions to be activated by combinations of function keys with the SHIFT key. This function enables brief explanation for frequently employed functions to be displayed on the panel.

### Procedure

1.  MISC panel appears.
2.  Explanation is displayed.

Memory	Help	Sample: 50kHz Trig: Single
	Guide	
	SHIFT+START	Start Auto Sequence Start Auto Print (FFT mode)
	SHIFT+STOP	Abort
	SHIFT+COPY	List Setup Conditions
	SHIFT+SAMPLE RATE	Viewing Range (Recorder mode)
	SHIFT+MEASURE	Go/No-go Judgement
	SHIFT+▲	Jump to Center
	SHIFT+▼	Jump to Trigger Point
	SHIFT+→	Auto Cursor to Right
	SHIFT+←	Auto Cursor to Left

### Notes

- The following briefly describes key operations which appear on the Help panel:
  -  +  : Auto sequence starts.  
See Section 8.8, "Setting Automatic Operation (AUTO SEQUENCE)".
  -  +  : Forcibly ends measurement.  
See Section 4.15, "Forcible Stop of Measurement".
  -  +  : Records setup list using built-in printer.  
See Sections 6.8, "Printing out a Setup List" and Section 10.16, "Printing Out a Setup List".
  -  +  : Specifies panel displaying range in recorder mode.  
See Section 10.9, "Setting of Display Range".
  -  +  : Moves the cursor to the center of the panel.
  -  +  : Moves the cursor to the trigger point.
  -  +  : Automatically moves the cursor to the right (auto cursor).
  -  +  : Automatically moves the cursor to the left (auto cursor).

■ The following functions do not appear on the Help panel:

- $\overline{\text{SHIFT}} + \overline{0}$  to  $\overline{9}$ ,  $\overline{A}$  : Moves the cursor to the position corresponding to  $n/10$  of the panel ( $A=10$ ).  
For details see Section 5.3.1, "Reading Out of Single Data Values (Single-Point Cursor)".
- $\overline{\text{SHIFT}} + \overline{\text{PROGRAM START}}$  : Protects the zoom multiplier at redisplay (in clear mode).  
See Section 8.18, "Preservation of Zoom Multipliers at Remeasurement or Redisplay".
- $\overline{\text{SHIFT}} + \overline{\text{DISPLAY FORMAT}}$  : Changes the current setting to the complementary setting (swap function).  
See Sections 11.2, "Exchanging Display / Computation Settings (SWAP)" and Section 4.10, "Setting of Display Format."
- $\overline{\text{SHIFT}} + \overline{\text{CORSOR}}$  : Executes swap and redisplay the panel.  
See Sections 11.2, "Exchanging Display / Computation Settings (SWAP)" and Section 4.10, "Setting of Display Format."
- $\overline{\text{SHIFT}} + \overline{\text{MONITOR}}$  : Turns off the CRT screen.  
See Section 11.11, "CRT Screen OFF".

## 11.10 Communication Related Settings

### Function

This function is used to set either GP-IB or RS-232-C in the AR1100A / AR1200 when recording is made using an external plotter. The main unit is controlled by the computer or data is sent from the main unit to the computer.

The main unit incorporates as standard either the GP-IB or RS-232-C interface.

### ■ GP-IB

Select either "Talk only" or "Addressable".







Generally, select "Talk only" when an external plotter is connected to the main unit; select "Addressable" when the main unit is controlled by the GP-IB controller and then set the address of the main unit.

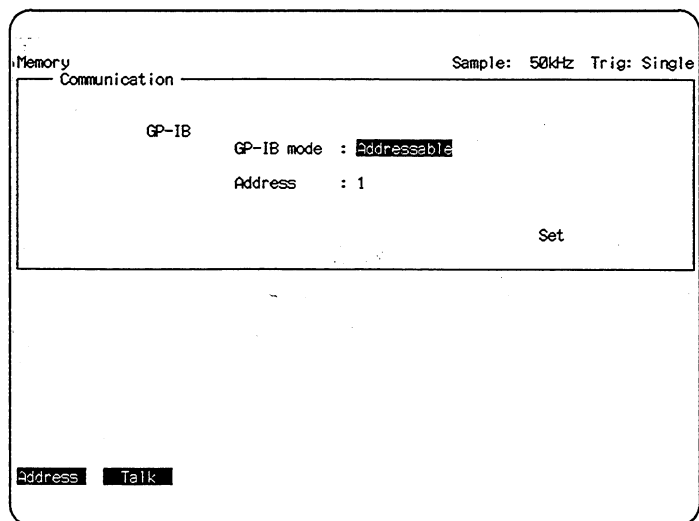
### ■ RS-232-C

Set the following items:







- Mode
- Transmission rate
- Data length
- Parity
- Stop bit
- Handshake

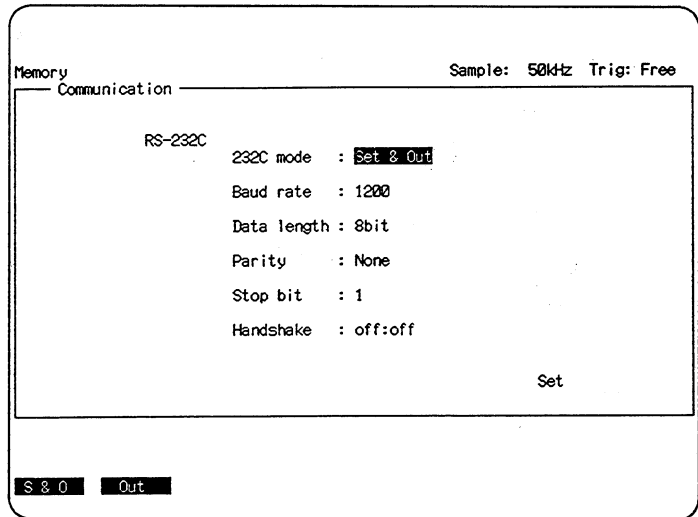
### Procedure GP-IB

1.  MISC panel appears.
2.  Soft key menu changes.
3.  Communication related setting panel appears.
  - **GP-IB mode**  
Press  to enter "Talk only" and  to enter "Addressable".
  - **Address**  
Enter the address of the main unit when "Addressable" has been selected. Any value between 0 and 15 should be entered using the soft keys. The address is backed up by the lithium battery installed in the instrument.
4. **Set**  
Press  to execute settings when the menu cursor is at "Set".



**Procedure** RS-232-C

1.  MISC panel appears.
2.  Soft key menu changes.
3.  Communication related setting panel appears.
  - **232C mode**  
When the main unit performs both input and output, for example such as handshaking, press  to select "Set & Out". To select "Out" press .
  - **Baud rate**  
(75 / 150 / 300 / 600 / 1200 / 2400 / 4800 / 9600)
  - **Data length**  
(7/8)
  - **Parity**  
(Even / Odd / None)
  - **Stop bit**  
(1/2)
  - **Handshake**  
(off : off / XON : XON / XON : ER / XON : RS / CS : ER / CS : RS / DR : ER / DR : RS)
4. **Set**  
Press  to execute settings when the menu cursor is at "Set".

**Note**

-  forcibly switches GP-IB remote status to local.



## 11.11 CRT Screen OFF

### Function

This function can be used to turn OFF the CRT screen. This should be done to avoid CRT burn out when the instrument is used for a long period in automatic mode without human attention.

The following two methods can be used to turn off the screen.

### Procedure Using the Keys on the Front Panel

- Press **SHIFT** and then **MONITOR**.

This causes the CRT to be turned OFF. However, processing up to that time continues after the CRT has been turned OFF.

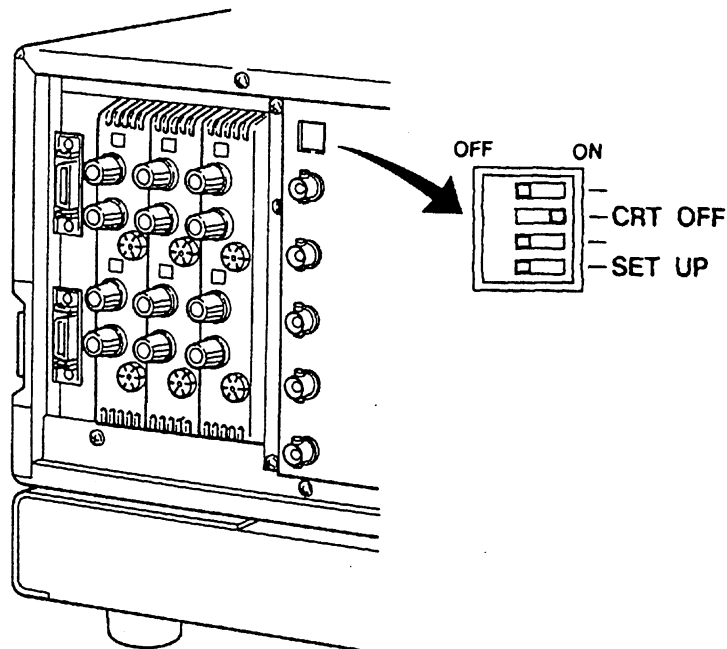
The SHIFT lamp lights while the CRT is turned OFF.

- Pressing any key or turning the rotary knob releases the operation.
- Operation is disabled when the CRT is in OFF status.

### Procedure Setting the Switch on the Rear Panel

- Set the CRT OFF switch on the instrument rear panel (second switch from the top) from OFF to ON (see the figure below).

This turns OFF the CRT. Using this method, general operations can be performed from the front panel even if the CRT is in OFF status.



### Note

- Do not touch any switches on the rear panel except the CRT OFF switch. If the switches are turned ON by mistake, always return to OFF.

## 11.12 Measurement and Recording Start/Stop Using External Signal

### Function

#### ■ In Memory Mode

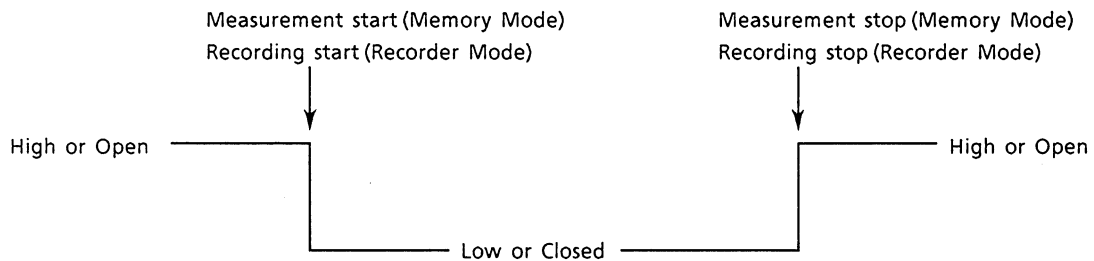
Performs the same operation as Section 4.14, "Measurement Start and Stop" using external signal.

#### ■ In Recorder Mode

Performs the same operation as Section 10.14, "Recording Start/Stop and Paper Feed" using external signal. (However, paper cannot be fed.)


### Procedure

Input a Voltage Signal or Contact Signal to the START/STOP connector on the rear panel. The relationship between input signal and START/STOP operation is as shown below.



"Low" input voltage :  $-0.5$  to  $+0.8V$   
 "High" input voltage :  $+3.0$  to  $+5.5V$   
 Contact current : Approx.  $5mA$

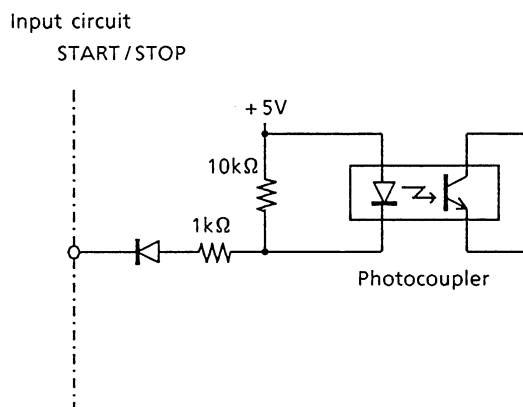
### Note

■ In recorder mode, recording can be started after measurement has been started by pressing .

### Cautions

The START/STOP input format is as shown below.

Allowable input voltage is  $-0.5$  to  $+5.5V$ . If input exceeds this range, the main unit internal circuit may be damaged.







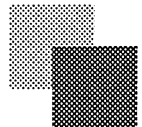
# Chapter 12

## Message List

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This chapter describes error messages, warning messages, and status messages.

12.1	Error Messages .....	12-2
12.2	Warning Messages .....	12-7
12.3	Status Messages .....	12-8



## 12.1 Error Messages

This section describes error messages and their contents. If the instrument requires service, contact your sales representative or the nearest YOKOGAWA service center (see the back cover of this manual). Only the final four digits of each error number are displayed on the panel.

Error No.	Error Message	Operation	*(Note)
00001	Decision error [Communications only]	Cannot process requested setting or operation because measurement, recording, communications data output, or other operation is currently in progress. →Instrument requires service.	8
00012	Command does not exist. [Communications only]	Did not recognize command received. →Check that correct command was transmitted. Also check that delimiters were correctly transmitted.	4
00013	Channel does not exist. [Communications only]	Although using 12 channel model, command specifying channel 13, such as "RI13, DC", for example is being used.	4
00014	Mode error [Communications only]	Command is correct, but command is valid only in certain modes (Memory / Recorder / FFT), and cannot be used in the current mode. →Change mode.	8
00120	No effective triggers	Attempted to use other than Free mode triggering, but no effective triggers because all triggers are "OFF", or source channel input activating the trigger is set to "OFF". →Correct trigger setting, and perform measurement.	8
00160	Block full	Attempted to perform additional measurements although data has already been stored to all blocks, with block protect mode "ON". →Turn block protect mode "OFF", or clear data from current block, and perform measurement.	8
00161	Block not changeable	Attempted to display or re-measure block not yet measured. →Change block designation.	8
00162	Beyond empty block	There is a block before the specified block which is empty.	8
00163	Block protected, cannot set	Block protect mode is set to "ON". Mode and range settings cannot be changed at this time. →Reset all data in block, or turn block protect mode "OFF".	8
00200	Beyond boundary	Numeric value setting exceeds specified range. Specified numeric value is unacceptable. →Correct setting to be within specified range.	8
00201	Syntax/lexical error	Item used in syntax of computational expression, etc. syntactically or lexically incorrect. →Conform to syntax.	8
00202	String too long [Communications only]	Character string longer than permitted by specifications was used when entering expression or text. →Shorten character string to within the length permitted by specifications.	8
00210	Improper parameter [Communications only]	Parameters specified for communication command not included among those that can currently be set. →Correct parameters.	8
00300	Cursor is off	Attempted to move cursor when cursor setting is not "ON". →First set cursor to "ON".	8
00301	Cursor already on	Attempted to set cursor to "ON" when the cursor is already displayed.	8

\*(Note) Value at right hand edge indicates the status byte. This is used in communications.  
For details, see the "GP-IB/RS-232-C Interface User's Manual".

Error No.	Error Message	Operation	*(Note)
00302	Not zoomed	Cannot scroll waveform because not zoomed. →First zoom waveform.	8
00303	No graphs	No displayed graphs exist.	8
00304	No channels measuring	Measurement not possible because inputs of all channels are "OFF". →Set any one of channels to "ON".	8
00305	No effective channels	Frequency analysis cannot be performed because input for channel that is to be the object of FFT analysis is "OFF".	8
00306	Single block only available	Attempted to perform analysis in FFT mode on a waveform that has been measured in memory mode with memory partitioned. →Only single-block data can be processed using FFT.	8
00310	Cannot scroll	Cannot scroll X-Y display.	8
00320	Outside measure mode [Communications only]	Not in zone statistical computation mode, but specified setting or executable command used in that mode. →Go to zone statistical computation mode to specify such commands.	8
00321	Currently in measure mode	Attempted to perform other settings in zone statistical computation mode.	8
00322	Illegal data present	Illegal data among data for zone statistical computation ; cannot perform the specified computation.	8
00330	Program not available	Program was set to "ON" and attempt made to start program after data already sampled with currently set memory size, but program computations not possible with current memory size. →Program computations can be done by using START to perform measurement.	8
00331	Ineffective scale settings	Because upper / lower scale span with waveform display scale set with program=ON is "0", valid waveform display not possible. →Set scale correctly.	8
00370	Not single display mode	To use waveform test, display format must be SINGLE. Attempted to use waveform test with different display format. →Set display format to SINGLE.	8
00371	Outside judgement mode [Communications only]	Waveform test such as test area editing, load / save, etc. cannot be performed before entering waveform test mode. →First set mode to waveform test mode.	8
00372	Editing ref. wave	Cannot change to other setting panel while creating test area. →Exit from the editing panel.	8
00373	Save failed	Any of the following factors related to IC memory card disables test area from being saved correctly: 1) IC memory card not correctly installed. 2) IC memory card not correctly initialized. 3) Capacity or directory full. →Clear the above factors.	8
00374	Load failed	Any of the following factors related to IC memory card disables test area from being loaded correctly: 1) IC memory card not correctly installed. 2) IC memory card not correctly initialized. 3) No data to save. →Clear the above factors.	8
00375	No ref. wave	Cannot perform waveform test because no test area is created. →First create test area.	8
00376	Currently in judgement mode	Waveform test is in progress.	8

## 12.1 Error Messages

Error No.	Error Message	Operation	*(Note)
00378	Editing ref. wave	Waveform test area editing in progress; cannot execute specified command. →First exit from editing mode.	8
00379	Cannot edit ref. wave [Communications only]	Attempted edit, although not in waveform test standard waveform editing mode. →First set mode to editing mode.	8
00500	Chart empty	No chart paper at start of recording. →Refill chart paper.	8
00501	Printhead raised	Printer head not loaded at start of recording. →Put down the release lever of the printer.	8
00502	Printhead disabled	Printer abnormality detected at start of recording. If DC Power Supply is being used on DC Drive models, the abnormality may be caused by a drop in the DC Power Supply voltage, in which case the DC Power Supply should be returned to normal. In other cases the instrument requires servicing.	8
00520	Invalid data number	Data number specified for analog recording or digital recording does not exist in acquisition memory. →Correctly specify data number.	8
00521	Print not available	Cannot perform digital printout. Digital printout cannot be performed from FFT Nyquist or Array display.	8
00600	Data transferring	Communications data output is in progress.	—
00690	Communication not available	No communications card. Communications card required to output to external plotter.	8
00700	Media not ready	File media not inserted in slot. →Insert IC memory card or floppy disk.	8
00701	Media unformatted	File media not initialized. →Initialize IC memory card or floppy disk.	8
00710	No such file	Cannot find specified file. →Correctly specify file.	8
00715	Invalid file name	Invalid file name (e.g. file name too long, invalid characters in file name). →Change to a valid file name.	8
00720	No data to save	No data to save exists in the memory.	8
00721	No data for specified ch.	Specified channel to be loaded not in file.	8
00722	No such ch.	Load destination channel does not exist.	8
00723	Not enough space to save	Insufficient media capacity →Erase unnecessary files or save to another medium.	8
00724	Directory full	Number of files that can be registered to the rule directory has been exceeded. →Erase unnecessary files or save to another medium.	8
00725	Load while program is off	Attempted to load program with program OFF. →Load data with program ON.	8
00726	Cannot specify OVW	Attempted overwrite load with blocks partitioned. Overwrite cannot be specified with blocks partitioned.	8
00727	Block protected	Cannot load because block protect mode is set to "ON". →Set block protect mode to "OFF".	8
00728	Invalid file format	Cannot load because file is not in a loadable format. →Change file to a loadable format.	8
00729	Format version mismatch	Cannot load because version of file is different.	8
00730	Cannot specify OVW	Attempted overwrite load with computed data.	8

Error No.	Error Message	Operation	*(Note)
00731	Invalid drive specified	Invalid media drive specified, or drive does not exist. →IC memory card drive is A, and floppy disk drive is B.	8
00732	Cannot accept this type	Cannot load because data file is from another instrument, and the type of data is not supported by this instrument.	8
00733	Cannot find specified data	Data with data number to be loaded does not exist.	8
00734	Write protected	Write protected file. (Media is in write protect status. Specified file has a read-only file attribute that was set by other measuring instrument, personal computer, etc.)	8
00735	Cannot load in memory mode	FFT computed data cannot be loaded except in FFT. →Set mode to FFT mode.	8
00736	Cannot load in FFT mode	Memory mode computed data cannot be loaded except in memory mode. →Set mode to memory mode.	8
00737	Cannot save Array data	Array data cannot be saved with FFT computed data save.	8
00738	FFT not available	Attempted to load FFT panel setting values to a model not equipped with the FFT option.	8
00739	Actual data length 0	Attempted overwrite load, but no data present in memory.	8
00740	Utility error	Indicates utility Error. Execution not possible due to incorrect Parameter input or input of non-existent file. →Make sure input is correct.	8
00741	Cannot read	When file utilities are in use, reading cannot be carried out due to media abnormality, etc.	8
00742	Cannot write	When file utilities are in use, writing cannot be carried out due to media abnormality, etc.	8
00743	Cannot create	When file utilities are in use, file cannot be created due to media abnormality, etc.	8
00744	Memory size error	Dumped data cannot be retrieved (read) due to a different Memory size when data was dumped.	8
00745	Load/Save error	Loading or saving cannot be carried out due to incorrect insertion of the media or due to some physical abnormality in the media.	8
00900	RAM error	Error detected in internal memory. →Instrument requires service.	8
00901	Aqc. memory error	Error detected in waveform memory. →Instrument requires service.	8
00950	Commu. card error	Error detected in communications card. →Instrument requires service.	8
00960	Printer card error	Error detected in printer card. →Instrument requires service.	8
11001 }	Sequence Error Step 1	Error occurred in Step (1 to 38) while executing auto sequence. Operation is aborted. →Check auto sequence program.	—
11038	Sequence Error Step 38		
29000	Main NV-RAM error	Main RAM failure →Instrument requires service.	—
29010	A/D NV-RAM 1 error	Input module 1 failure →Instrument requires service.	—
29011	A/D NV-RAM 2 error	Input module 2 failure →Instrument requires service.	—

\*(Note) Value at right hand edge indicates the status byte. This is used in communications.  
For details, see the "GP-IB/RS-232-C Interface User's Manual".



## 12.1 Error Messages

Error No.	Error Message	Operation	*(Note)
29012	A/D NV-RAM 3 error	Input module 3 failure →Instrument requires service.	—
29013	A/D NV-RAM 4 error	Input module 4 failure →Instrument requires service.	—
29020	Commu. card removed	Communications card failure →Instrument requires service.	—
29021	Commu. card error	Communications card hardware failure →Instrument requires service.	—
29022	Commu. parameter error	Communications card software failure →Instrument requires service.	—

\*(Note) Value at right hand edge indicates the status byte. This is used in communications.  
For details, see the "GP-IB/RS-232-C Interface User's Manual".

## 12.2 Warning Messages

This section describes warning messages and their contents. If instrument requires service, contact your sales representative or the nearest YOKOGAWA service center (see the back cover of this manual). Only the final four digits of each error number are displayed on the panel.

No.	Warning Message	Operation	*(Note)
10000	No sample data	No measured data present.	—
10001	Not sequential save mode	Memory not block-partitioned.	—
10002	No graphs to display	Setting of display format is not made to enable waveform to be displayed, or valid waveform No. or channel No. is not specified. However, measurement (capture of data to memory) has been correctly performed.	—
10003	No data on X axis	X-axis waveform not selected for X-Y display.	—
10010	No ref. wave	No area for waveform test.	—
10200	Chart exhausted	No chart paper remaining. Recording is suspended. →Feed chart paper.	2
10201	Printhead raised	Printer head raised. →Push the release lever backward to carry out recording again.	—
10202	Printhead inactive	Abnormality detected in print head printing voltage. If DC Power Supply is being used on DC Drive models, the abnormality may be caused by a drop in the DC Power Supply voltage, in which case the DC Power Supply should be returned to normal. In other cases the instrument requires servicing.	2
10203	Printhead overload	Excessive load on printer head; temperature of printer head exceeds limit. Because head is protected, printing continues at reduced head load. Recording may become faint, but no error results. When printer head temperature decreases, recording is performed as before. This may occur as a result of continuous "painting" of chart in recorder mode, etc.	—
10500	Acq. memory initialized	Waveform memory initialized.	—
10510	Battery exhausted	Indicates exhaustion of AR1600 battery for clock and backup of settings. Replace with new battery. →Instrument requires service.	—
10511	IC card battery exhausted	IC memory card battery dead. →Replace with new battery.	—
10520	Setting initialized	Setup information lost. Settings Initialized.	—
10521	Calendar clock reset	Internal calendar clock reset.	—
10522	Equipment changed	Change detected in acquisition memory capacity, FFT option, number of channels, etc. →If there has been such a change, previously entered setup information is initialized. →If the above occurs when there has been no change, instrument requires service.	—
10523	Setting changed	Notifies operator that complementary setting is selected by swap function.	—

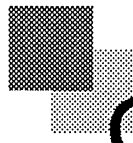
\*(Note) Value at right hand edge indicates the status byte. This is used in communications.  
For details, see the "GP-IB/RS-232-C Interface User's Manual".

## 12.3 Status Messages

This section describes messages that indicate the status of the AR1600.

No.	Status Message	Operation	*(Note)
20000	Waiting for trigger (s)	Waiting for trigger (s). To stop measurement, "SHIFT + STOP" must be used to forcibly end measurement.	—
20001	Calculating...	Execution of a computation is in progress.	—
20002	Sampling...	Data sampling (measurement) in progress.	—
20003	Auto cursor (1-9 Speed key)	Auto cursor (auto scroll) operation is in progress. Cursor speed can be changed by using numeric keypad (1 to 9).	—
20004	First number set	Recording / save start data number has been set.	—
20005	Last number set	Recording / save end data number has been set.	—
20040	Judgement detected	Specified criteria satisfied.	32
20041	[Judge : in]	All within standard area.	—
20042	[Judge : out]	Outside standard area.	—
20050	Execution aborted	Execution was aborted.	—
20200	Image processing...	Internal processing in progress by plotter recording using built-in printer. Image print-out in progress.	—
20300	Loading...	Load in progress.	—
20301	Completed	Load satisfactorily completed.	—
20302	Saving...	Save in progress.	—
20303	Completed	Save satisfactorily completed.	—

\*(Note) Value at right hand edge indicates the status byte. This is used in communications.  
For details, see the "GP-IB/RS-232-C Interface User's Manual".



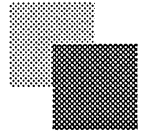
# Chapter 13

## Maintenance and Inspection

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This chapter describes daily maintenance, self-test and power fuse replacement that can be carried out by the user.

13.1	CRT Screen Brightness Adjustment .....	13-2
13.2	Key Test .....	13-3
13.3	ROM/RAM Test .....	13-4
13.4	Printer Test and Printer Head Cleaning .....	13-5
13.5	Linearize Test .....	13-6
13.6	Cleaning CRT Filter .....	13-7
13.7	Replacing Power Supply Fuse .....	13-8









## 13.1 CRT Screen Brightness Adjustment

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### Function

This function adjusts the CRT screen brightness level. Brightness can be adjusted from 0% to 100%.

### Procedure








1.  : MISC panel appears.
2.  : Soft key menu changes.
3.  : Self-test panel appears.
4.  : Adjusts the brightness level of the CRT.  
Use the rotary knob to adjust brightness from 0% to 100%.
5.  : Ends brightness adjustment to return to the self-test panel.
6.  : Instrument exits from self-test panel. (Any other function key can also be used.)

## 13.2 Key Test

### Function

This checks the keys and the rotary knob on the front panel.

### Procedure

1.  : MISC panel appears.
  2.  : Soft key menu changes.
  3.  : Self-test panel appears.
  4.  : Key check panel appears.  
When each key is pressed, the corresponding  key imaged on the CRT turns to . That means the key is functioning correctly. When the rotary knob is turned, the numeric value displayed on the rotary knob image varies depending on the turning speed. That means the knob is functioning correctly.
  5.  : Pressing the  key twice returns the panel to self-test panel.
  6.  : The instrument exits from self-test panel. (Any other function key can also be used.)
- If any key is found defective, contact your sales representative or the nearest YOKOGAWA service center (see the back cover of this manual).




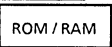

## 13.3 ROM / RAM Test

---

### Function

This checks the ROM / RAM on the internal printed circuit board.

### Procedure

1.  : MISC panel appears.
2.  : Soft key menu changes.
3.  : Self-test panel appears.
4.  : Checks ROM / RAM.  
Displays "OK" if normal and automatically returns the panel to self-test panel. The test takes several minutes to complete.
5.  : Instrument exits from self-test panel. (Any other function key can also be used.)






- If there is any abnormality, contact your sales representative or the nearest YOKOGAWA service center (see the back cover of this manual).

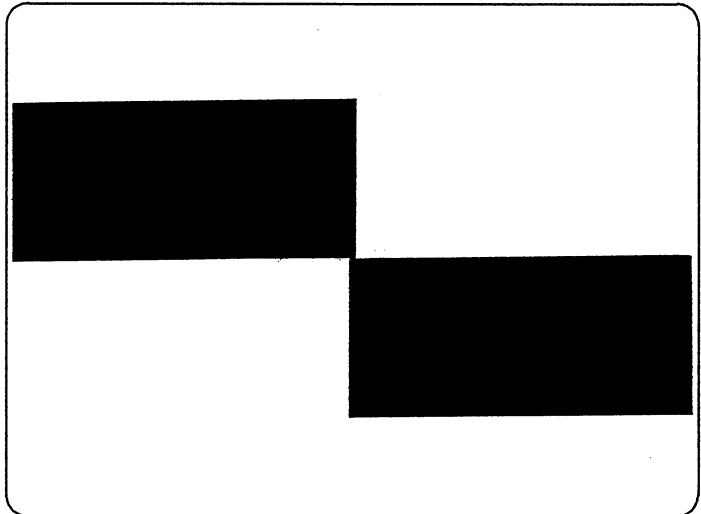
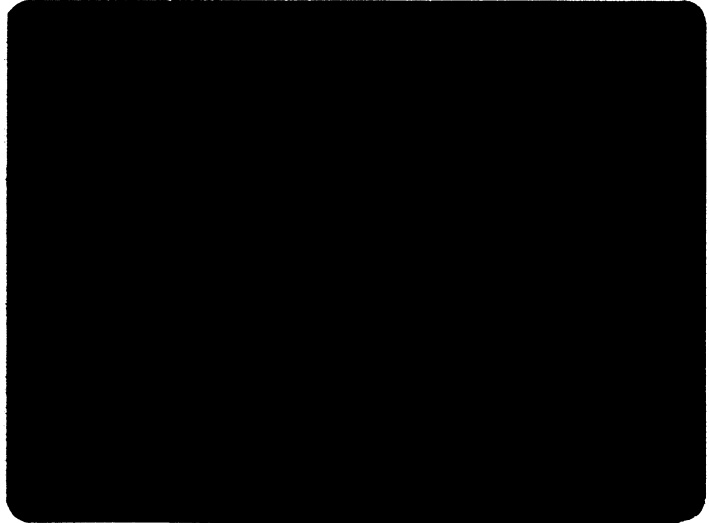
## 13.4 Printer Test and Printer Head Cleaning

### Function

This is used to check the internal printer or to clean the printer head.

### Procedure

1.  MISC panel appears.
2.  Soft key menu changes.
3.  Self-test panel appears.
  - To check the internal printer  
 Checks the printer.
  - To clean internal printer head  
 Executes head cleaning. Clean head after using each roll of chart paper, or if print-out is uneven. Recording is performed as shown at right.



- If there is any abnormality, contact your sales representative or the nearest YOKOGAWA service center (see the back cover of this manual).



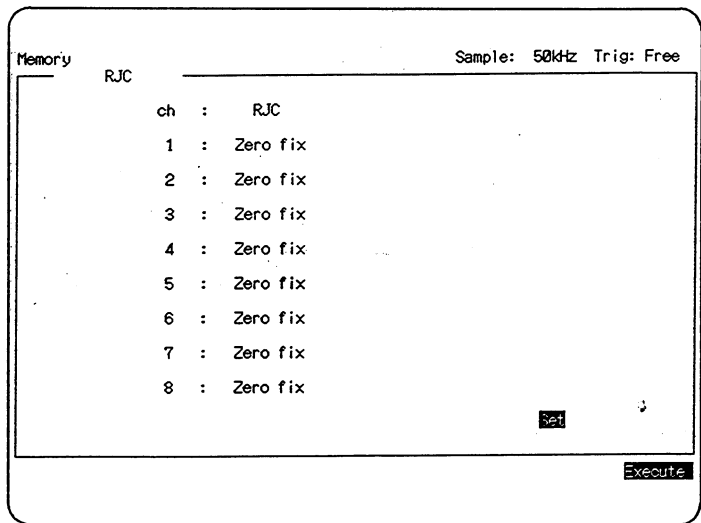
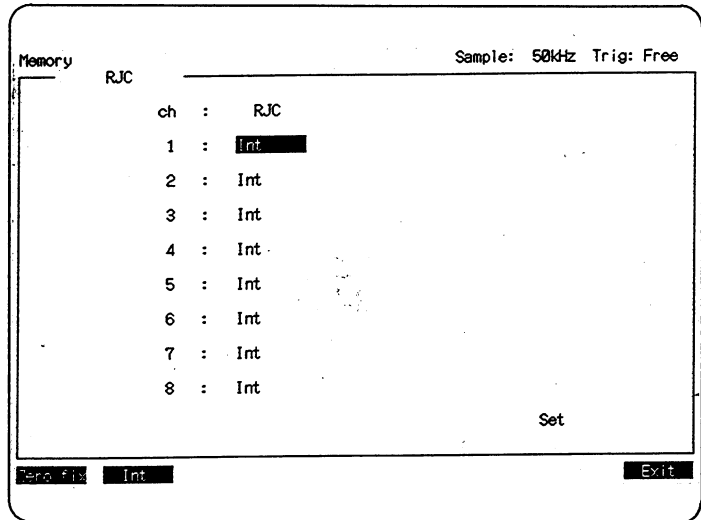
# 13.5 Linearize Test

## Function

This test is available to make reference junction compensation ineffective, and check whether or not the indicated temperature corresponds properly to a standard input voltage for linearize (convert input voltage to temperature) function.

## Procedure

1. MISC  
Call up the MISC panel.
2. Test  
Call up the self-test panel.
3. RJC  
Call up the linearize check panel.
4. Zero fix  
Make reference junction compensation ineffective and set the input terminal temperature to 0°C.
5. **Set**  
Press Exetute with the cursor in this position.
6. Inputting the standard voltage using such as voltage generator executes the linearize check.

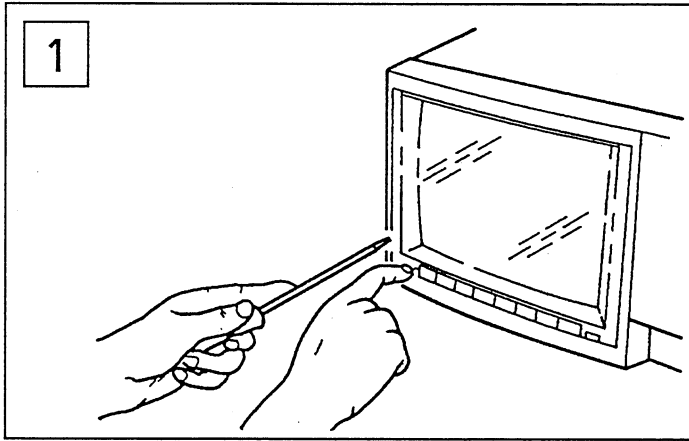


## Notes

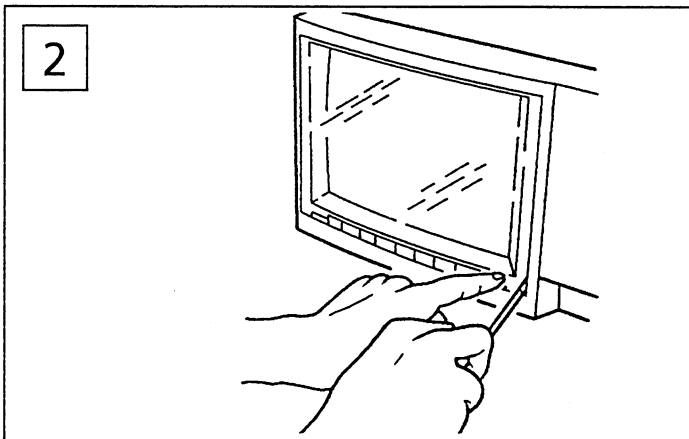
- For analog 4-channel model, this test will be ineffective when channel 5 to 8 is set.
- For analog 6-channel model, this test will be ineffective when channel 7 to 8 is set.
- After performing this check, turn power OFF and then ON again. That makes return to the measurement executes reference junction compensation.
- If reference junction compensation is not operating normally after this check has been performed, check whether or not the bottom fan is operating.  
If the fan is not operating, contact your sales representative or the nearest YOKOGAWA service center (listed on the back cover).

## 13.6 Cleaning CRT Filter

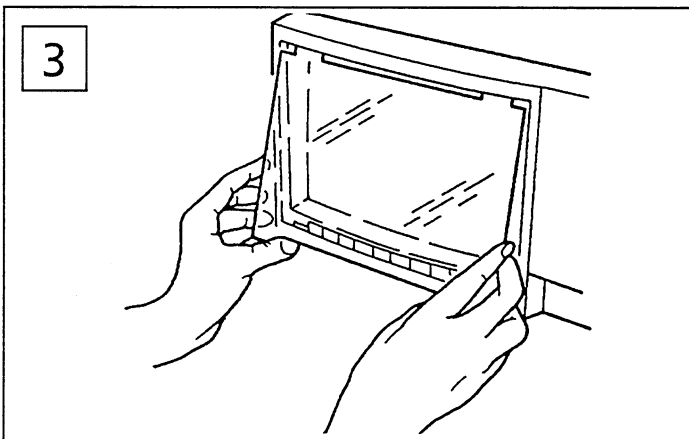
If the CRT filter becomes dirty, follow the steps below to take off the filter and remove any dirt, etc. Use the filter cleaner in the cleaning kit (Model: 7009 21).



Insert your fingernail in the filter holder at the edge of the soft keys at one side of the bottom of the CRT, and press down firmly while using a flat-blade screwdriver to pull the filter out toward you.



In the same way, press down on the filter holder on the opposite side of the filter and pull the filter out toward you.



Remove the filter by pulling it down and out.

## 13.7 Replacing Power Supply Fuse

The following describes how to replace the power supply fuse installed in the rear panel of the main unit.

1. Turn the power switch OFF and remove the power cord.
  2. Use a screwdriver to take out the fuse holder carrier. Then remove the fuse from the carrier.
  3. Replace with a new fuse, and press the carrier back into place.
    - Fuse : 3.15A time-lag
    - (Part number : A1113EF)
- A spare fuse is stored in the spare section of the carrier.

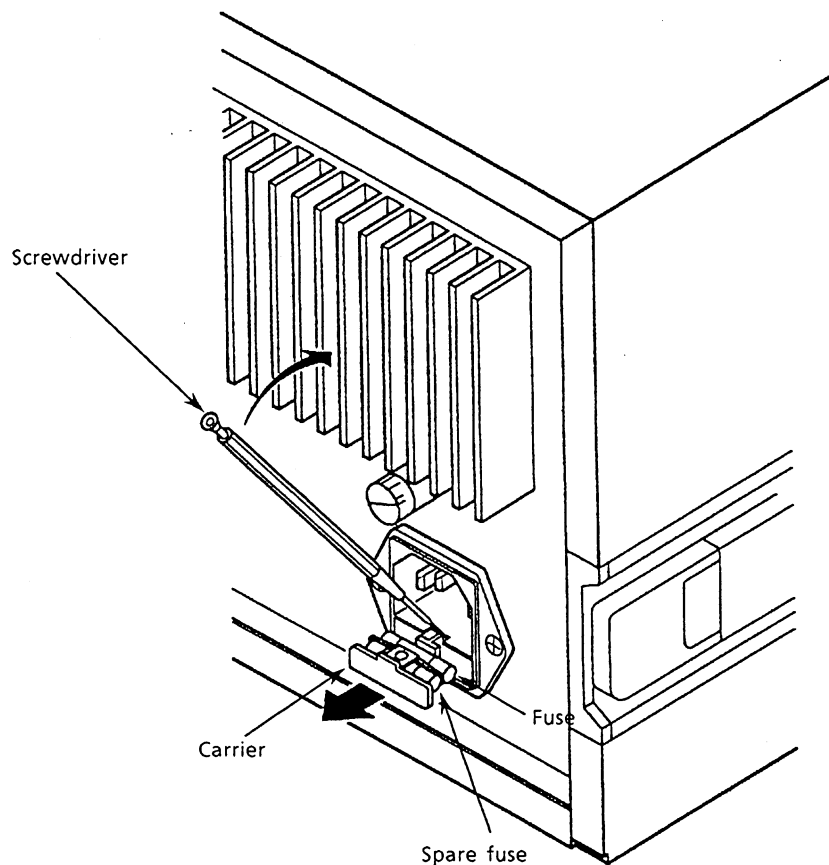


Figure 13.1 Power Supply Fuse Replacement

### WARNING

- To avoid fire, use only a fuse with the rating (current, voltage, type) specified for this instrument. Before replacing the fuse, turn the power switch to OFF and remove the power cord. Never use non-specified fuses or short the fuse holder.
- If the instrument appears defective in its protective functions such as protective ground, fuse, etc., it should not be operated. Inadvertent operation of the instrument in a defective state is dangerous; the user must exercise care to avoid any such operation.



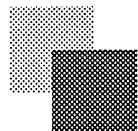
# Chapter 14

## Specifications

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This chapter describes AR1100A specifications (function, performance, external dimensions) and optional specifications.

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14.2	Logic Input Section .....	14 - 5
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## 14.1 Analog Input Section

### ■ Analog Input Section

#### ● Common Specification of Voltage Input and thermocouple input

Number of input points	:	4 (7021A/7022 3□) (7021A/7022 4□) 6 (7021A/7022 5□) (7021A/7022 6□) 8 (7021A/7022 7□)
Input type	:	Each channel Isolated, floating unbalanced input
Maximum input voltage	:	90Vrms and 130Vpeak
Maximum common mode voltage	:	250Vrms and 350Vpeak
Temperature coefficients		
Zero point	:	Auto-calibration before measurement start
	After	$\left\{ \begin{array}{l} 0.02\% \text{ of F.S./}^\circ\text{C} \\ \text{(anti-aliasing filter off)} \\ 0.04\% \text{ of F.S./}^\circ\text{C} \\ \text{(anti-aliasing filter on)} \end{array} \right.$
Gain	:	0.01%/°C (immediately after auto-calibration)
	After	$\left\{ \begin{array}{l} 0.01\% / ^\circ\text{C} \\ \text{(anti-aliasing filter off)} \\ 0.05\% / ^\circ\text{C} \\ \text{(anti-aliasing filter on)} \end{array} \right.$
Allowable signal source resistance	:	500Ω or less

#### ● Voltage Input

Measurement range	:	±60, 200, 600mV, 2, 6, 20, 60V FS
Input impedance	:	Approx. 1MΩ (in parallel with approx. 22pF)
Input Bias current	:	2nA (Typical)
Frequency bandwidth	:	DC to 40kHz ( $_{-3}^{+1}$ dB Typical DC coupled)
(with filter OFF)		1Hz to 40kHz ( $_{-3}^{+1}$ dB Typical AC coupled)
Input coupling	:	DC or AC
Accuracy	:	±(0.25% of F.S. + 50μV), (With filter OFF, DC, 23±3°C)
Noise	:	120μVp-p (Typical), (at 60mV range, input shorted)
Common mode rejection ratio (Typical):		-114dB (for 60mV, 200mV, 600mV,
(when line filter is OFF)		2V ranges)
(at 50 or 60Hz)		-74dB (for 6V, 20V, 60V ranges)

#### ● Temperature Input (excludes FFT mode)

Frequency bandwidth	:	DC to 6Hz ( $_{-3}^{+1}$ dB, Typical)
(with filter OFF)		

● **Measurement Range and Accuracy (with line filter ON, excludes reference junction compensation accuracy)**

Range	Measurement Range	Accuracy (at 23 ±3°C)
K	-200 to 1370°C	± (0.2% of rdg + 1.5°C)
E	-200 to 800°C	Except -200 to 0°C: ±(0.5% of rdg+1.5°C)
J	-200 to 1100°C	
T	-200 to 400°C	
U	-200 to 400°C	
L	-200 to 900°C	
N	0 to 1300°C	
R	0 to 1760°C	
S	0 to 1760°C	Except 0 to 200°C : ±6°C 200 to 800°C : ±4°C
B	0 to 1820°C*	± (0.2% of rdg + 4°C) Except 400 to 700°C: ±8°C
W	0 to 2315°C	± (0.2% of rdg + 3°C)

\* Effective measurement range is 400 to 1820°C.

Reference junction compensation accuracy  
(with input terminal temperature at equilibrium):

±0.8°C (K, E, J, T, U, L, N, W)

±1.5°C (R, S, B)

● **Filter**

Filter Selection : Line filter (LINE), Low-pass filter (LPF), Anti-aliasing filter (AUTO), OFF  
(However, when thermocouple input is being used, only OFF or line filter is selectable.)

Cutoff frequency (Typical, -3dB)

Line filter : 1.5Hz

Low-pass filter : 40, 400Hz, 4kHz, OFF

Anti-aliasing filter : 40, 80, 200, 400, 800Hz, 2k, 4k, 8k, 20k, 40kHz

Cutoff characteristics (Typical)

Line filter : Normal mode rejection ratio

; -50dB (at 50 or 60Hz)

Common mode rejection ratio (at 50 or 60Hz)

; -140dB (for 60mV, 200mV, 600mV, 2V ranges)

-100dB (for 6V, 20V, 60V ranges)

Low-pass filter : -24dB/octave

Anti-aliasing filter : -72dB/1.5fc (fc is cutoff frequency.)

Passband characteristics (Typical) :

For anti-aliasing filter : ±50dB (DC to 1/2 fc)

However, when cutoff frequency is 40, 400Hz, 4k or 40kHz:  $\begin{matrix} +0 \\ -1.5 \end{matrix}$ dB (1/4 fc to 1/2 fc)

## 14.1 Analog Input Section

### Mode and available filter selection

Filter Selection	Memory Mode	Recorder Mode	FFT Mode
Line filter	○	○	—
Low pass filter	○	○	—
Anti-aliasing filter	○	—	○
Filter off	○	○	○

Filter auto-selection : (Memory mode...When Auto is selected)  
(FFT mode...When On is selected)  
Anti-aliasing filter (cut-off frequency=Sample rate 12.5) is automatically selected. However, when sampling rate is 50, 20, 10 or 5Hz in memory mode, cut-off frequency is 40Hz. When sampling rate is less than 2Hz, line filter with cut-off frequency 1.5Hz is selected. In FFT mode, when analysis frequency range is 4, 8 or 20Hz, cut-off frequency is 40Hz.

### ● A/D Conversion (Independent for Each Channel)

Resolution : 14bits  
Conversion speed : 10 $\mu$ s (100kS/s)  
Measurement method : Simultaneous measurement on all channels

## 14.2 Logic Input Section

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### ■ Logic Input (7021A 4□, 7021A 6□, 7022 4□, 7022 6□)

Input type	:	Common GND within the same probe Floating between recorder and probe
Number of input points	:	16
Maximum input voltage range	:	$\pm 35\text{V}$
Input impedance	:	10k $\Omega$ or more
Threshold level	:	Approx. +1.4V
Input method	:	TTL level or contact input (selectable using switch)



## 14.3 Memory Mode

### Memory Mode



#### Memory Section

- Maximum memory capacity : 64kwords / channel (7021A □1, 7022 □1)  
512kwords / channel (7021A □4, 7022 □4)
- Memory element : DRAM (Volatile Memory)
- Memory formula selection : Selects from standard, memory combination, memory partitioning.
- Standard : Writes up to 64kwords (7021A □1, 7022 □1) or 500kwords (7021A □4, 7022 □4) for each channel.
- Memory combination : Combines odd-numbered channels and even-numbered channel sequentially and writes. However, only odd-numbered channels are then available. Also, program computation, averaging and memory partitioning cannot be designated.
- Memory partitioning : Partitions each channel memory into blocks and writes each block for every trigger. However, averaging cannot be designated.
- Number of memory blocks : 4, 8, 16, 32, 64, or 128 blocks (selectable) However, maximum block number is restricted by the combination of maximum memory capacity and whether program computation is designated or not.
- Maximum data capacity for each channel (k=1,000 data / channel)
- Standard : without averaging and program computation  
64k (7021A □1, 7022 □1), 500k (7021A □4, 7022 □4)  
without averaging but with program computation  
16k (7021A □1, 7022 □1), 125k (7021A □4, 7022 □4)  
with averaging but without program computation  
16k (7021A □1, 7022 □1), 125k (7021A □4, 7022 □4)  
with averaging and program computation  
8k (7021A □1, 7022 □1), 64k (7021A □4, 7022 □4)
- Memory combination : 125k (7021A □1, 7022 □1)  
1,000k (7021A □4, 7022 □4)
- Memory partitioning :

Maximum Memory Capacity	Program Computation Designation	Number of Memory Blocks					
		4	8	16	32	64	128
Maximum data capacity for each channel (k data / ch)							
64k (7021A □1 7022 □1)	without	16	8	4	2	1	×
	with	4	2	1	×	×	×
512k (7021A □4 7022 □4)	without	125	64	32	16	8	4
	with	32	16	8	4	2	1

Data write interval	:	20, 50, 100, 200, 500 $\mu$ s, 1, 2, 5, 10, 20, 50, 100, 200, 500ms, 1, 2, 5, 10s / data and external sampling clock (EXT SAMPLE, Max. 100kHz) However temperature measurement data update interval: approx. 7.4ms
Time axis accuracy	:	$\pm 0.02\%$
SRAM model		
Acquisition memory (SRAM) Backup time	:	After operation of at least 30 minutes Approx. 48 hours (at 25°C) Approx. 24 hours (at 35°C)
Message in case the acquisition: memory was initialized	:	In case a power voltage decline is detected during the power is ON, the acquisition memory will be initialized and the message 'Acq. Memory initialized' will appear.

### ● Triggering

Start/Stop	:	Measurement start and stop can be controlled in the following 3 ways: <ul style="list-style-type: none"> <li>Using START/STOP key of the operation panel</li> <li>External START/STOP signal Voltage input  START,  STOP Low input voltage : -0.5 to +0.8V High input voltage : +3.0 to +5.5V Contact input Start caused by contact input Open→Close, stop caused by contact input Close→Open</li> <li>Command via GP-IB or RS-232-C (Optional)</li> </ul>
Trigger mode selection	:	Selects from FREE, REPEAT, or SINGLE.
FREE	:	"Start" executes and "stop" ends measurement. (Executes measurement regardless of whether trigger conditions are satisfied.)
REPEAT	:	Entry into Trigger Wait status by pressing "Start". Thereafter, data is written to memory every time trigger conditions are satisfied and trigger wait status is released by "stop". However, while executing memory partitioning, writes data every triggering and advances block number, and after the last block has been written, releases trigger waiting status.
SINGLE	:	Entry into Trigger Wait status by pressing "start". As soon as the data is written to memory the first time trigger conditions are satisfied, the trigger wait status is released. When memory partitioning is executed, advances block number and stops after data has been written to memory.
Trigger source selection	:	Selects from internal (INT) or external (EXT).
Internal trigger	:	Combination trigger
Analog input		
Trigger formula	:	Digital trigger of the measurement data for each channel
Trigger source	:	4 source channel designations are available.
Trigger combination selection:		Selects from AND or OR for all sources. Bi-slope and window triggering are available by designating the same channel into 2 trigger sources.
Trigger ON/OFF	:	ON/OFF designation for each source OFF disables the trigger condition.
Trigger level	:	-100% to +100% (setting resolution 1%)
Trigger slope	:	Selects from rising or falling edge.

Trigger status	:	Selects from High or Low. "High" makes triggering available above trigger level. "Low" makes triggering available below trigger level.
Logic input (7021A 4□, 7021A 6□, 7022 4□, 7022 6□)		
Trigger formula	:	for each measured data point
Trigger source	:	8 points×2
Trigger combination selection:		Selects from AND or OR. Triggering at AND or OR in all sources
Trigger ON/OFF	:	ON/OFF designation for each source OFF disables the trigger condition.
Trigger slope	:	Rising edge (0→1), Falling edge (1→0)
Trigger status	:	High (1), Low (0), Don't care (X)
External trigger	:	Triggering by TRIG IN signal (TTL level)
External trigger slope designation		
	:	Selects from rising or falling edge.
Pretrigger (negative delay)	:	Setting is available for internal and external triggers.
Setting range	:	0 to 100% (10% increments)

### ● Analysis Processing Section

Linear scaling	:	Sets offset value and scaling factor for the setting value of each channel. Scaling is executed for every acquisition and this value becomes the measured data value.
Averaging	:	Selects from OFF, linear averaging, or exponential averaging.
Number of cycles (attenuation factor)	:	Selects from 4, 8, 16, 32, 64, 128, 256
Program computation	:	Definition of computational expressions is possible using combinations of functions.
Number of computation expressions	:	Maximum 8 (7021A 6□, 7021A 7□, 7022 6□, 7022 7□) Maximum 6 (7021A 4□, 7021A 5□, 7022 4□, 7022 5□) Maximum 4 (7021A 3□, 7022 3□)
Computation text length	:	Maximum 55 characters
Computation numerator	:	The four basic arithmetic operators [+ , - , × , ÷ ], parenthesis [( , )]
Variable	:	Measured data for each channel. IC memory card data or floppy disk (option) data (maximum 4 channels)
Constants	:	Maximum 20
Types of function	:	SQR (square root), LOG (logarithm), EXP (exponential), ABS (absolute value), DIF (differentiation), DDIF (double differentiation), INTG (integration), IINTG (double integration), MEAN (10 to 128 point moving average), SIN, COS, TAN, ASIN, ACOS, ATAN (Average, differentiation and integration can only be used once in an expression).
Zone statistical computation	:	Pair of crosshair cursors used to define a zone on displayed waveform ; computations carried out on this zone and results displayed on CRT screen.

- Zone statistical computation type : Area (range bounded by waveform and cursor, or by waveform and waveform, T-Y waveform, X-Y waveform)  
Maximum value, minimum value, P-P value, average value, RMS value, standard deviation (between cursors)
- Waveform go/no-go testing : Testing of one arbitrary channel
- Test area creation : Creates test area by moving displayed waveform up, down, left, and right, or by moving two lines parallel to time axis.  
Averaging and program computation waveforms can also be used.
- Test actions : Can select auto-save or automatic recording.
- Auto-save : Waveform captured at Go/No-go judgment only is saved in memory.
- Automatic print-out : Waveform captured at Go/No-go judgment only is recorded.
- Go/No-go output : Outputs Go/No-go signal (TTL level). (Low level when judgment takes place.)

### ● CRT Display

- Display format : SINGLE display ; 1 to 8 Analog channels or 16 logic channels + 1 to 6 analog channels displayed on one panel  
DUAL display ; 1 to 4 channels displayed on each of two panels  
QUAD display ; 1 channel displayed on each of four panels  
X-Y display ; Displays four channels.
- Cursor : Digital display of data at the selected point
- Reference cursor : Displays difference in value between cursor and reference cursor.
- Scroll
- Vertical direction : Scrolls only waveform specified by cursor.
- Horizontal direction : Scrolls all waveforms on the same panel.
- Zoom
- Vertical direction : Expands waveform specified by cursor.  
In X-Y display mode, vertical axis multiplier applies to both X and Y directions.
- Horizontal direction : Expands all waveforms on the same panel.
- Grid display : ON/OFF available
- Display scaling : Scales display along vertical axis (upper limit, lower limit)
- Overlap display : Calls up a waveform already stored in memory and superimposes it on the CRT screen.
- Accumulate display : While measurement is in progress, displays a newly measured waveform on the previously measured waveform on display without erasing the previous one.
- Specified block display : Displays a specified block of the data already stored in memory.
- Program start : Displays the result of computations carried out using data already stored in memory.

## 14.3 Memory Mode

### ● Recording

- Size : A5 (for CRT hard copy), A4, or length required according to data length (analog, digital recording)
- Mode : (1) Hard copy of CRT screen  
Recording resolution range ;  
640×400 (same as CRT display)
- (2) Plot recording of CRT screen  
Recording density ; 8 dots/mm
- (3) Analog recording in a specified range  
Recording density ; 8 dots/mm  
Time axis waveform recording resolution ;  
20 dots/mm
- (4) Digital recording within a specified range
- (5) Setup list recording ;  
Records setup information.
- Title : Title can be inserted above recording (up to 40 characters)  
Types of characters ;  
Alphanumerics, parentheses, four rules of arithmetic
- Automatic recording start function : Starts recording at trigger (specified by auto-sequence, however, no designation necessary in FFT mode) or at Go/No-go determination.

### ● Others

- Auto sequence function : The AR1100A / AR1200 operates automatically according to a sequence that is set in advance (maximum of 38 steps).

Note: "logic" written in this specification applies to model 7021A 4□, 7021A 6□, 7022 4□ and 7022 6□ only.

## 14.4 Recorder Mode

### ■ Recorder Mode

#### ● Recording

Recording format selection	:	Selects from analog trend or digital trend.
Analog trend	:	Waveform recording on continuous chart
Recording subject	:	Measured data for each channel
Number of recording channels	:	Maximum 8 (analog) or 6 (analog) + 16 (logic) However, less than the number of input channels
Recording channel selection	:	Any input channel is selectable for each recording channel.
Scaling	:	Linear scaling is available for each channel (analog).
Sampling interval	:	Voltage measurement 10 $\mu$ s (100kS/s) Temperature measurement approx. 7.4ms (135S/s)
Recording method	:	Records by painting out between maximum and minimum values.
Valid recording width	:	200mm
Chart length	:	50m
Recording paper feed rate	:	10, 20, 50mm/h, 1, 2, 5, 10, 20, 50mm/min, 1, 2, 5, 10, 20, 50mm/s
Recording color	:	Black
Recording density	:	8 dots/mm
Time axis waveform recording resolution	:	32 dots/mm
Recording accuracy	:	Measurement accuracy +0.125mm (1 dot)
Digital trend	:	A list print-out of waveform data as digital values. Interval can be selected from 1, 2, 5, 10, 20, 30, 60s.

#### ● Trigger

Time-of-day triggering	:	Designates date, hour, and minute for start and stop of recording.
Scheduled recording	:	Starts and stops at the time specified every day or month.

#### ● CRT Display

Display format	:	Roll mode table
Number of display waveforms	:	Maximum 8 (analog) or 6 (analog) + 16 (logic) However, less than the number of input channels
Display time range setting	:	0.5, 1, 2.5, 5, 10, 25, 50, 100, 250s (selectable)
Display update period	:	1/500 of display time range

Note: "Logic" written in this specification applies to model 7021A 4□, 7021A 6□, 7022 4□ and 7022 6□ only.

## 14.5 FFT Mode






### ■ FFT Mode (Optional)

- **Trigger** : Trigger function is the same as for memory mode.
- **Analysis Display**
  - Number of channels : 2
  - Channel selection : Waveform data for an arbitrary input channel or waveform data captured in Memory Mode and written to an IC Memory Card or Floppy Disk (option).
  - Engineering unit function : Converts external converter input voltage to engineering unit.
  - Analysis function : Linear spectrum, power spectrum, power spectrum density, overall, RMS spectrum, cross spectrum, transmission function, coherence function
  - Analysis frequency range : 4, 8, 20, 40, 80, 200, 400, 800Hz, 2k, 4k, 8k, 20, 40kHz
  - Frequency resolution : 1/400 of the analysis frequency range
  - Window : Selects from hanning or rectangular.
  - Dynamic range : 72dB (Typical)
  - Sampling
    - Sampling frequency : 2.5 times analysis frequency range
    - Frequency accuracy :  $\pm 0.02\%$
    - Number of sampling points : 1,000
  - Averaging
    - Time axis averaging : OFF, linear averaging, exponential averaging
    - Frequency axis averaging : OFF, linear averaging, exponential averaging, peak hold  
Peak hold executes repeated frequency analysis and displays the maximum value.
  - Number of cycles (attenuation factor):  
Selects from 4, 8, 16, 32, 64, 128, or 256.
  - Display format : 1 panel (single) ; Displays 1 analysis result.  
2 panel (dual) ; Displays 2 analysis results.  
Available to display time axis waveform simultaneously.  
Nyquist display  
Array display ; Displays 16 time related analysis results.
  - Cursor : Reads frequency and analysis value.
  - Reference cursor : Reads difference of frequency and analysis value between 2 points.
- **Recording**
  - Size : A5 (for hard copy), A4
  - Mode : (1) Hard copy of CRT screen  
Recording resolution range ;  
640×400 (same as CRT display)  
(2) Plot recording of CRT screen  
Recording density ; 8 dots/mm  
(3) Setup list printout
  - Title : Same as memory mode



## 14.6 External Input / Output

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### ■ External Input

- EXT SAMPLE : TTL level , 100kHz Max. (pulse amplitude 2μsec minimum)  
 “Low” input voltage ; -0.5 to +0.8V  
 “High” input voltage ; +2.0 to +5.5V
- TRIG IN : TTL level  or  (pulse amplitude 2μsec minimum)  
 “Low” input voltage ; -0.5 to +0.8V  
 “High” input voltage ; +2.0 to +5.5V
- START/STOP : Voltage Input ;  START,  STOP  
 “Low” input voltage ; -0.5 to +0.8V  
 “High” input voltage ; +3.0 to +5.5V  
 Contact signal ; Start when Open →Close  
 Stop when Close →Open  
 Contact current; approx. 5mA.

### ■ External Output

- TRIG OUT : TTL level  (pulse width 3μsec minimum, for parallel operation)
- GO/NOGO : TTL level  (100ms ≤ pulse width ≤ 150ms)



## 14.7 General Specifications

### ■ General Specifications

- **CRT Display Section** : 9-inch CRT (display color: amber)  
640×400 dots, 4 levels
  
- **Recording Section**
  - Recording form : Thermal printer
  - Valid recording width : 200mm
  - Recording density : 8 dots/mm
  - Time axis waveform recording resolution :  
20 dots/mm (memory mode, analog recording)  
32 dots/mm (recorder mode, analog trend)
  - Recording speed : 50mm/s Max. (recorder mode)  
20mm/s (hard copy, etc.)
  
- **Others**
  - Clock accuracy : ±50ppm (Typical)
  - Setting value memory : Memorizes a type of panel setting condition.
  - Battery backup : Life of clock backup lithium battery, approx. 10 years (at ambient temperature of 23°C).
  - Operating environment : 0 to 40°C, 30 to 80% R.H. (non-condensing)  
Except 5 to 35°C for printer operation
  - Withstand voltage : Between power supply and case ;  
1,500VAC for 1 minute  
: Between input terminal and case  
1,500VAC for 1 minute  
: Between logic probe and case ;  
500VDC for 1 minute (7021A 4□, 7021A 6□)
  - Insulation resistance : Between power supply and case ;  
10MΩ Min. at 500VDC  
: Between input terminal and case  
10MΩ Min. at 500VDC  
: Between logic probe and case ;  
10MΩ Min. at 500VDC (7021A 4□, 7021A 6□)
  - Power supply : Rated power supply voltage range ;  
100 to 120VAC/200 to 240VAC  
(automatic switching)  
Power supply voltage tolerance ;  
90 to 132VAC/180 to 250VAC  
Rated power supply frequency ; 50/60Hz  
Power supply frequency tolerance ; 48 to 63Hz
  - Power consumption
    - With printer not operating : Power supply voltage 100 to 120VAC during operation ;  
Approx. 120VA (7021A 3□, 7022 3□)  
Approx. 135VA (7021A 4□, 7022 4□)  
Approx. 135VA (7021A 5□, 7022 5□)  
Approx. 150VA (7021A 6□, 7022 6□)  
Approx. 150VA (7021A 7□, 7022 7□)  
Power supply voltage 200 to 240VAC during operation ;  
Approx. 200VA (7021A 3□, 7022 3□)  
Approx. 225VA (7021A 4□, 7022 4□)  
Approx. 225VA (7021A 5□, 7022 5□)  
Approx. 250VA (7021A 6□, 7022 6□)  
Approx. 250VA (7021A 7□, 7022 7□)

With printer operating	:	Power supply voltage 100 to 120VAC during operation ; Approx. 500VA Max. Power supply voltage 200 to 240VAC during operation ; Approx. 700VA Max.
External dimensions	:	Approx. 198 (H) × 426 (W) × 433 (D) mm (7021A□□, 7022□□) For details, see drawings of external dimensions. Approx. 243 (H) × 426 (W) × 433 (D) mm (7021A□□ / DC12 / DC24) For details, see drawings of external dimensions. Approx. 288 (H) × 426 (W) × 433 (D) mm (7021A) For details, see drawings of external dimensions.
Weight	:	Approx. 13.5kg (7021A 3□) Approx. 14kg (7021A 4□) (7021A 5□) Approx. 14.5kg (7021A 6□) (7021A 7□) Approx. 15.5kg (7021A 3□ / FDD) Approx. 16kg (7021A 4□ / FDD) (7021A 5□ / FDD) Approx. 16.5kg (7021A 6□ / FDD) (7021A 7□ / FDD)  Approx. 14kg (7022 3□) Approx. 14.5kg (7022 4□) (7022 5□) Approx. 15kg (7022 6□) (7022 7□)

## 14.8 Additional Specifications and Accessories

### ■ Additional Specification and Accessories

#### ● GP-IB Interface (Additional Specification / GP-IB)

- Standard : Conforms to IEEE St'd 488-1978.
- Function specification : SH 1, AH 1, T5, L4, SR 1, RL 1, PP0, DC 1, DT0, C0
- GP-IB function : Setting value input / output, Measurement value output and control.  
(However, setting and control except Power ON / OFF)  
HP-GL plotter output

#### ● RS-232-C Interface (Additional Specification / RS232C)

- Standard : Conforms to EIA RS-232-C.
- Transmission speed : 75, 150, 300, 600, 1200, 2400, 4800, 9600 bps
- RS-232-C function : Setting value input / output, Measurement value output and control.  
(However, setting and control except Power ON / OFF)  
HP-GL plotter output

#### ● HP-GL Plotter Output (In Common with GP-IB / RS-232-C Interface)

- Applicable plotter : HP ; 7475A, 7550A  
ROLAND ; DXY - 990
- Plot output : Plot recording of memory mode and FFT mode

#### ● IC Memory Card (Sold Separately)

- Card slot : One slot standard equipment
- Memory capacity : 1MB, 512KB, 256KB, 64KB  
2bytes / data (measurement data)
- Memory data : Specifies and memorizes arbitrary section of waveform memory.
- Panel setup information : File size of 1 setting-Approx. 1 to 2Kbytes
- Data readout display : Waveform can be displayed on CRT screen by readout of data from IC memory card to waveform memory.
- Battery backup : Lithium battery [Life 64Kbytes (Approx. 4 years), 256Kbytes (Approx. 2 years), 512Kbytes (Approx. 2 year), 1Mbytes (Approx. 1 year)]

#### ● Floppy Disk Drive (for AR1100A : Additional Specification / FDD)

- Slot : 1 slot 3.5-inch FDD Corresponds to the following formats.  
2HD (1.44MB MS-DOS format)  
2HD (1.2MB MS-DOS format)  
2DD (720KB MS-DOS format)
- Memory data : Specifies and memorizes arbitrary section of waveform memory.
- Panel setup information : File size of 1 setting-Approx. 1 to 2Kbytes
- Data readout display : Waveform can be displayed on CRT screen by readout of data from IC memory card to waveform memory.

● **DC Supply Drive (Optional Specifications / DC12, /DC24, for AR1100A only)**

- Input voltage : 12 V DC (/DC12)  
 24 V DC (/DC24)
- Allowable input voltage ranges : 10 to 20 V DC (/DC12)  
 21 to 30 V DC (/DC24)
- Power consumption : when printer is not operating - approximately 80 VA  
 when printer is operating - 250 VA maximum
- Insulation resistance : 10 M $\Omega$  or more at 500 V DC
- Withstanding voltage : 500 V DC for 1 minute  
 (between the DC supply input terminal and case)
- Switching between AC and DC supplies :  
 The AC supply has priority over the DC supply;  
 however, if switched, the recorder must be restarted.

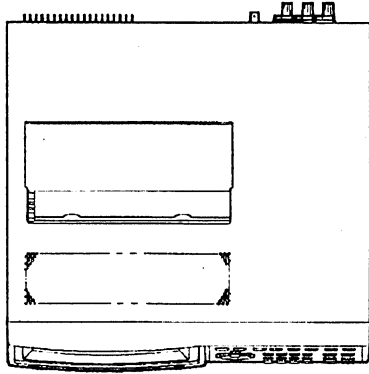
● **Others**

- Input type : Front face - BNC connector input  
 Provided with 3.5-inch FDD (/FDD) functions
- Accessory : DC supply connector

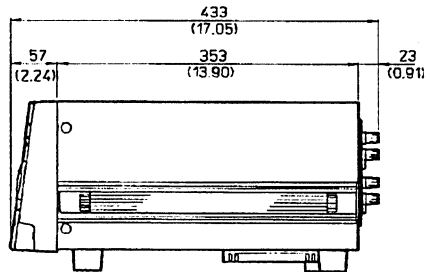
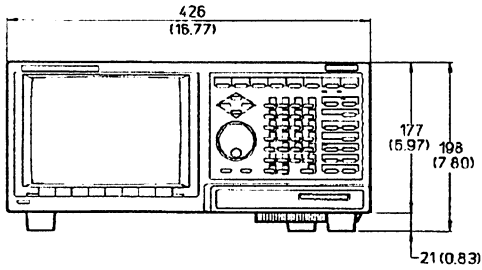
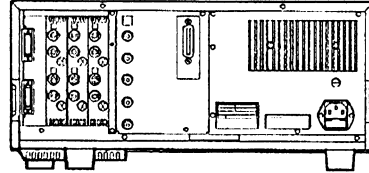
# 14.9 External Dimensions

## ■ AR1100A Standard Models

Unit : mm  
(Approx. inch)



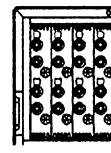
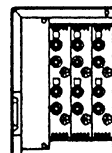
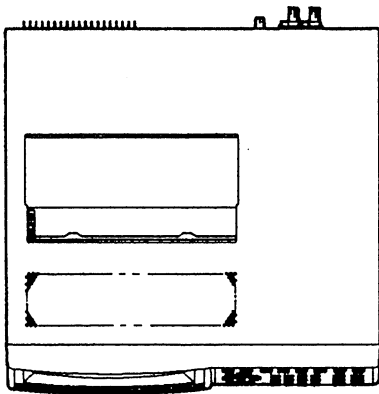
Rear



## ■ AR1200

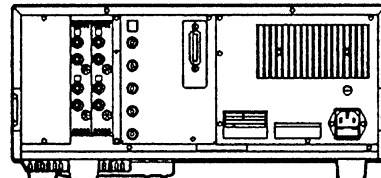
Unit : mm  
(approx. inch)

Rear View

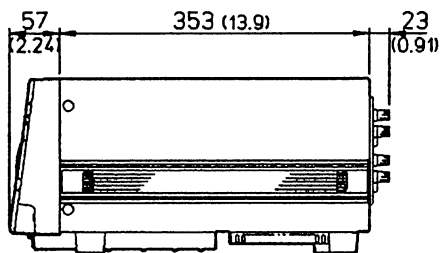
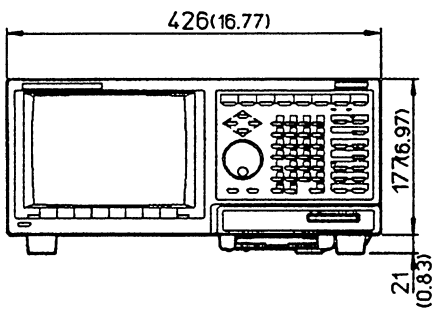


Model 7022 5□

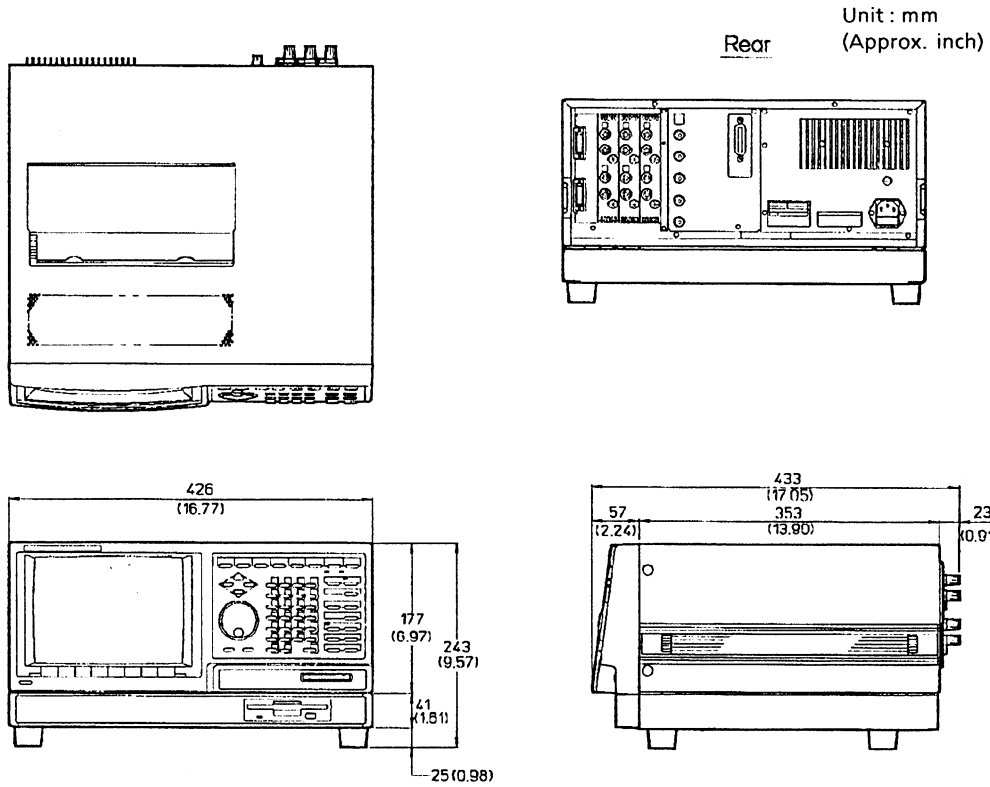
Model 7022 7□



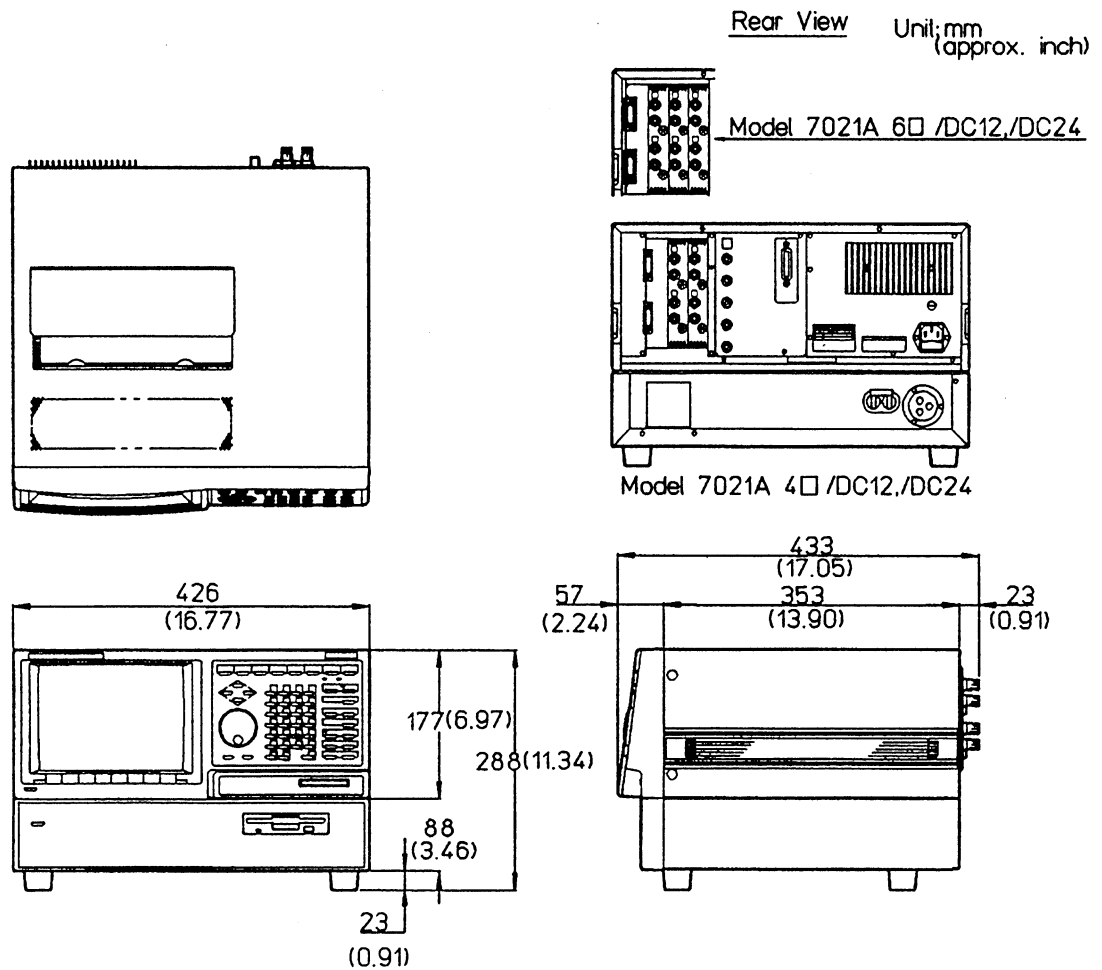
Model 7022 3□



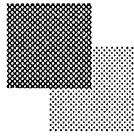
■ AR1100A Models with FDD



■ AR1100A Models with DC12 or DC24



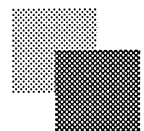




# APPENDICES










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





Appendix 1. Key Summary (Memory Mode) .....	A-2
Appendix 2. Key Summary (Recorder Mode) .....	A-8
Appendix 3. Menu Hierarchy Structure .....	A-11









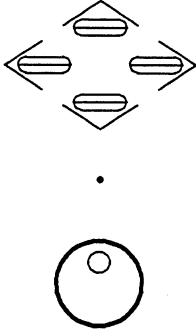
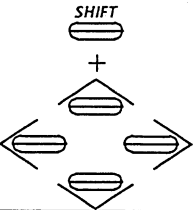
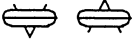
# APPENDIX 1. Key Summary (Memory Mode)

Panel Key	Operation	Reference
	Mode setting Memory size setting Memory partitioning setting Averaging setting	Section 4.2, "Mode Setting" Section 4.3, "Memory Size Setting" Section 4.4, "Setting of Memory Partitioning" Section 4.5, "Setting of Averaging"
	Input coupling setting Input range setting Input filter setting Thermocouple setting	Section 4.6, "Setting of Input Coupling, Input Range, Input Filter and Thermocouple"
	Trigger setting	Section 4.7, "Trigger Setting" Section 8.20, "Using External Trigger" Section 8.22, "Parallel Synchronous Operation"
	Use / no-use of PROGRAM (computation) and computation expression setting	Section 4.8, "Setting PROGRAM (Computations) to OFF" Section 4.9, "Setting PROGRAM (Computations) to ON"
	Display format setting Display scale setting	Section 4.10, "Setting of Display Format" Section 4.11, "Setting of Display Scale"
	Sampling rate setting	Section 4.12, "Setting of Sampling Rate" Section 8.21, "Using External Sampling"
	Trigger mode setting	Section 4.13, "Setting of Trigger Mode"
	Measurement start	Section 4.14, "Measurement Start and Stop"
	Measurement stop	Section 4.14, "Measurement Start and Stop"


Panel Key	Operation	Reference
 + 	Forced measurement stop	Section 4.15, "Forcible Stop of Measurement"
	Redisplaying and recomputing measured data Redisplaying computation data	Section 5.2, "Redisplay and Recomputation of Measured / Computed Data"
	Cursor function Zoom function Scroll function Grid function Remeasurement for specific block Changing the block to be displayed Resetting data in blocks Resetting data in blocks Comment display Setting recording / save range from waveform panel	Section 5.3, "Reading Out of Data Values (CURSOR)" Section 5.4, "Enlarging Waveforms (ZOOM)" Section 5.5, "Shifting Waveforms (SCROLL)" Section 5.6, "Inserting a Grid" Section 8.2, "Remeasurement of Specific Block" Section 8.3, "Changing the Block to be Displayed" Section 8.4, "When Restarting Measurement for the Specified Block from the Displaying Block" Section 8.5, "Resetting Data Measured Using Memory Partitioning" Section 8.9, "Displaying Comments on Waveform Panel" Section 8.11, "Setting Recording Range and Saving Range on the Waveform Panel"
	Zone statistical computation	Section 5.7, "Zone Statistical Computations"
	Panel hard copy	Section 6.2, "Taking a Hard Copy of the CRT Screen"
	Recording format setting for internal printer Recording format setting for external plotter	Section 6.3, "Setting up for a High Resolution Print-out of the Displayed Waveform" Section 6.4, "Setting up for an Analog Print-out" Section 6.5, "Setting up for a Digital Print-out" Section 6.6, "Setting up to print out using an External Plotter"
 Again, 	Recording start Recording stop	Section 6.7, "Print-out and Paper Feed"
































APPENDIX 1. Key Summary (Memory Mode)

Panel Key	Operation	Reference
	Paper feed for internal printer	Section 6.7, "Print-out and Paper Feed"
	Saving setup information of measured/ computed data File utility	Chapter 7, "Memory Mode/ Storing Data on IC Memory Card and Floppy Disk "
	Monitoring measured data	Section 11.3, "Monitoring Measured Data"
	Forcible switch to local from remote control using GP-IB	Section 11.10, "Communication Related Settings" GP-IB / RS-232-C Interface User's Manual















Panel Key	Operation	Reference
	Changing sampling rate	Section 4.12, "Setting of Sampling Rate"
	Setting zone for zone statistical computations	Section 5.7, "Zone Statistical Computations"
	Moving cursor when cursor is displayed on waveform panel	Section 5.3, "Reading Out of Data Values (CURSOR)" Section 5.4, "Enlarging Waveforms (ZOOM)" Section 5.5, "Shifting Waveforms (SCROLL)" Section 8.11, "Setting Recording Range and Saving Range on the Waveform Panel"
	Creating test area for waveform test using standard waveform (when enlarging test area) Note: Rotary knob cannot be used for this.	Section 8.7, "Waveform Tests (Go/No-go)"
	Creating test area for waveform test using standard waveform (when shrinking test area)	Section 8.7, "Waveform Tests (Go/No-go)"
	Changing active waveform displayed on waveform panel	Section 5.3, "Reading Out of Data Values (CURSOR)" Section 5.4, "Enlarging Waveforms (ZOOM)" Section 5.5, "Shifting Waveforms (SCROLL)" Section 8.7, "Waveform Tests (Go/No-go)"
	Changing channel when range is changed while measurement in progress	Section 4.6, "Setting of Input Coupling, Input Range, Input Filter and Thermocouple"
	Changing number of trigger conditions while measurement in progress	Section 4.7, "Trigger Setting"
	Changing file name display of soft key menu	Section 7.11, "Saving Measured Data and Computed Data" Section 7.12, "Loading Measured Data and Computed Data" Section 7.13, "Deleting Measured Data Files and Computed Data Files" Section 7.14, "Saving, Loading and Deleting Setup Information" Section 7.17, "Checking Files"




APPENDIX 1. Key Summary (Memory Mode)

Panel Key	Operation	Reference
<p>MISC</p> 	Initializing setting and memory contents Date/time setting	Section 11.1, "Initializing Setting and Memory Contents" Section 2.9, "Date and Time Setting"
	Waveform overwrite setting (accumulate) Protecting data measured with memory partitioning Operations for data measured with memory partitioning	Section 8.1, "Setting Waveform Overwrite (ACCUMULATE)" Section 8.12, "Protecting Data in Blocks" Section 8.2, "Remeasurement of Specific Block" Section 8.3, "Changing the Block to be Displayed" Section 8.4, "When Restarting Measurement for the Specified Block from the Displaying Block" Section 8.5, "Resetting Data Measured Using Memory Partitioning"
	Linear scaling setting	Section 8.6, "Setting Linear Scaling"
	Auto sequence setting	Section 8.8, "Setting Automatic Operation (AUTO SEQUENCE)"
	Comment registration	Section 8.10, "Comment Registration"
	Memory block usage map review	Section 8.13, "Memory Block Usage Map Review"
	Cursor setting Computation related setting	Section 8.14, "Cursor Setting" Section 8.15, "Computation Related Setting"
	Selecting integral computation type	Section 8.16, "Integral Computation Type Selection"
	Selecting population for standard deviation computation	Section 8.17, "Selecting Population for Standard Deviation Computation"
	Preserving the zoom multiplier at remeasurement/redisplay	Section 8.18, "Preservation of Zoom Multipliers at Remeasurement or Redisplay"
	Selecting whether to use zoom position display	Section 8.19, "Disabling Zoom Position Display"
	Recording related setting	Section 11.4, "Recording Related Settings"
	Grid setting	Section 11.5, "Inserting a Grid Immediately after Power-ON"
	Alarm beep setting	Section 11.6, "Disabling the Alarm Beep"
	Checking setup information	Section 11.7, "Checking Setup Information"
	Checking hardware configuration	Section 11.8, "Checking Hardware Configuration"
	Checking operations using SHIFT key	Section 11.9, "Reviewing Functions Activated by SHIFT + Function Keys"
	Communication related setting	Section 11.10, "Communication Related Settings"

Panel Key	Operation	Reference
 + 	Forced measurement stop	Section 4.15, "Forcible Stop of Measurement"
 + 	Preserving the zoom multiplier for redisplay (when Window settings=Clear) Resetting the zoom multiplier for redisplay (when Window settings=Hold)	Section 8.18, "Preservation of Zoom Multipliers at Remeasurement or Redisplay"
 + 	Waveform test functions (Go/No-go)	Section 8.7, "Waveform Tests (Go/No-go)"
 + 	Auto sequence execution	Section 8.8, "Setting Automatic Operation (AUTO SEQUENCE)"
 + 	Recording setup list	Section 6.8, "Printing out a Setup List"
 + 	Exchanging display / computation settings	Section 11.2, "Exchanging Display / Computation Settings (SWAP)"
 + 	Exchanging display / computation settings for redisplay	Section 11.2, "Exchanging Display / Computation Settings (SWAP)"
 + 	Turning CRT screen OFF	Section 11.11, "CRT Screen OFF"
 +   +   +   +   +   +  to   + 	Automatically moves the cursor to the left (auto cursor). Automatically moves the cursor to the right (auto cursor). Moves the cursor to the center of the panel. Moves the cursor to the trigger point. Moves the cursor to the left end of the panel. Moves the cursor to the position corresponding to n/10 of the panel. Moves the cursor to the right end of the panel.	Section 5.3, "Reading Out of Data Values (CURSOR)" Section 5.5, "Shifting Waveforms (SCROLL)" Section 5.7, "Zone Statistical Computations" Section 8.11, "Setting Recording Range and Saving Range on the Waveform Panel"

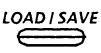


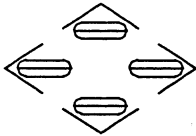

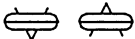
## APPENDIX 2. Key Summary (Recorder Mode)

Panel Key	Operation	Reference
	Mode selection	Section 10.2, "Mode Setting"
	Input coupling selection Input range selection Input filter selection Thermocouple selection	Section 10.3, "Setting of Input Coupling, Input Range, Input Filter and Thermocouple"
	Time trigger setting	Section 10.4, "Setting of Time Trigger"
	Display format setting  Display scale setting	Section 10.5, "Setting of Display Format" Section 10.6, "Setting of Display Scale"
	Chart speed setting	Section 10.8, "Setting of Chart Speed"
 + 	Panel display range setting	Section 10.9, "Setting of Display Range"
	Measurement start	Section 10.10, "Measurement Start and Stop"
	Measurement stop	Section 10.10, "Measurement Start and Stop"
	Scroll function  Grid function	Section 10.11, "Moving Waveforms on the Panel (SCROLL)" Section 10.12, "Inserting a Grid"
	Recording format setting	Section 10.13, "Setting of Print Format (Recording Format)"
 Again, 	Recording start  Recording stop	Section 10.14, "Recording Start/Stop and Paper Feed"
	Internal printer paper feed	Section 10.14, "Recording Start/Stop and Paper Feed"

Panel Key	Operation	Reference
 + 	Exchanging display settings	Section 11.2, "Exchanging Display / Computation Settings (SWAP)"
	Initializing setting and memory contents Recording related setting Grid setting Alarm beep setting Checking setup information Checking hardware configuration Checking operations using SHIFT key Communication related setting Linear scaling setting	Section 11.1, "Initializing Setting and Memory Contents" Section 11.4, "Recording Related Settings" Section 11.5, "Inserting a Grid Immediately after Power-ON" Section 11.6, "Disabling the Alarm Beep" Section 11.7, "Checking Setup Information" Section 11.8, "Checking Hardware Configuration" Section 11.9, "Reviewing Functions Activated by SHIFT + Function Keys" Section 11.10, "Communication Related Settings" Section 10.7, "Setting of Linear Scale"



APPENDIX 2. Key Summary (Recorder Mode)

Panel Key	Operation	Reference
	Saving / loading setup information and deleting file	Section 10.15, "Saving / Loading / Deleting Setup Information"
	Monitoring operations for measured data	Section 11.3, "Monitoring Measured Data"
	Forcible switch to local from remote control using GP-IB	Section 11.10, "Communication Related Settings" GP-IB / RS-232-C Interface User's Manual
	Changing chart speed	Section 10.8, "Setting of Chart Speed"
	Changing panel display range	Section 10.9, "Setting of Display Range"
	Changing channel when range is changed while measurement in progress	Section 10.3, "Setting of Input Coupling, Input Range, Input Filter and Thermocouple"
	Changing display format while measurement in progress	Section 10.5, "Setting of Display Format"



# APPENDIX 3. Menu Hierarchy Structure





## ■ Memory Mode

Setting Panel	Setting Item	Soft key / Menu Display								Operation of Menu Item	
		F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8		
<b>MODE</b> 	— Mode —	Memory	Record	FFT						Measurement mode selection	
	— Memory —									Memory size selection	
	Memory size	1k	2k	4k	8k	16k	32k	64k	Next		
		*1 125k	*2 250k	*2 500k	*2 1M				Next		
	*3 Sequential	off	on							Memory partitioning selection	
No. of blocks	4	8	16	32	64	(128)					
— *4 Averaging —									Averaging selection		
Averaging	off	Lin	Exp								
No. of data averages	4	8	16	32	64	128	256				
<p>*1 For 64k word/channel instrument : Up to 125k</p> <p>*2 For 512k word/channel instrument : Up to 1M</p> <p>*3, *4 May not be displayed, depending on instrument memory capacity, memory size, computational processing setting, etc. See Section 4.3, "Memory Size Setting".</p>											
<b>RANGE</b> 	ch1	Input	off	DC	AC	Temp				Input type selection	
	ch8 (ch6)	*1 Range	0.06V	0.2V	0.6V	2V	6V	20V	60V		Input range selection
		*2 Range	K	J	E	T	R	S	B	Next	Thermocouple type selection
	(ch4)		N	W	L	U			Next		
		*1 Filter	off	Auto	4kHz	400Hz	40Hz	1.5Hz			Input filter selection
		*2 Filter	off	1.5Hz							
	chA*3	Input	off	on						Logic input selection	
chB*3	Input	off	on								
<p>*1 If input is DC or AC</p> <p>*2 If input is Temp</p> <p>*3 For models with logic input only</p>											


Note: Value at initial state (See Section 11.1, "Initializing Setting and Memory Contents").

APPENDIX 3. Menu Hierarchy Structure

Setting Panel	Setting Item	Soft Key / Menu Display								Operation of Menu Item
		F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	
TRIGGER 	— Trigger mode —									Internal / external trigger selection
	Trigger source	Inl	Ext rise	Ext fall						
	Pre trigger	0	10	20	30	40	50	60	Next	Pretrigger selection
		70	80	90	100				Next	
	*1 Trigger AND/OR	AND	OR							AND/OR trigger selection
	— *2 Analog trigger —									Triggering on/off selection
	Trig no. on/off	off	on							
	1 Source ch	1	2	3	4	*5 5	*5 6	*5 *6 7	*5 *6 8	Trigger channel selection
	3 Slope	Rise	Fall	High	Low					Trigger slope selection
	4 Level	*3								Trigger level selection
	— *4 Logic trigger —									Logic input trigger condition selection
	Trig no. on/off	off	on							
5 source ch	A	B								
6 8,7,6,5,4,3,2,1	0	1	up	down	X					
<p>*1, *2 Not displayed if Trigger source=Ext rise or Ext fall.                      *3 Level is entered using alphanumeric keypad.                      *4 For models with logic input only                      *5 Analog 4-channel model doesn't have.                      *6 Analog 6-channel model doesn't have.</p>										
PROGRAM 	— Program —									Computation on/off selection
	*1 Program	off	on							
	— Expression —									Channel setting (Program=off)
	*2 W1~W4 (W6)	1	2	3	4	(A)	(B)			
	*3 W1~W6 (W8)	1	2	3	4	5	6	(A)	(B)	
	*4 W1~W8	1	2	3	4	5	6	7	8	
		ABS(	LOG(	EXP(	SQR(			:	Next	Computational expression setting (Program=on)
		SIN(	COS(	TAN(	ASIN(	ACOS(	ATAN(	:	Next	
	MEAN(	DIF(	DDIF(	INTG(	IINTG(		:	Next		
<p>*1 May not turn on, depending on instrument memory capacity, memory size, etc.                      See Section 4.3, "Memory Size Setting".                      *2 Analog 4-channel model, inside the parenthesis is the model with logic input.                      *3 Analog 6-channel model, inside the parenthesis is the model with logic input.                      *4 Analog 8-channel model</p>										

Setting Panel	Setting Item	Soft Key/Menu Display								Operation of Menu Item	
		F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8		
<b>DISPLAY FORMAT</b> 	— Display format —									Display format selection	
	Display mode	Single	Dual	Quad	X - Y						
	*1 — Scale —	off	on							Display scale selection	
	— Display — *2 G1~G8	off	W1	W2	W3	W4	W5	W6	Next	Assign waveform No. to graph No.	
		W7	W8						Next		
— Scale — Upper	*3								Upper display scale limit setting		
Lower	*3								Lower display scale limit setting		
<p>*1 Not displayed if Program=on.</p> <p>*2 Display Mode                      For Quad : G1 to G4                      For X-Y : G1 to G5</p> <p>*3 If Scale=on or Program=on:                      Enter using alphanumeric keypad.</p>											
<b>MISC</b> 	MISC	Help	Scale	Sequence	Other	Block	Map	Info.	Next		
		Overview	Program	Print	Comment	Time	Test	Commu.	Next		
		Init.							Next		
		— Linear scale mode —									Linear scaling setting
	Linear scale	off	on								
		Math error	+Over	-Over						Sets treatment of computational overflow	
— Moving average —	*1								Sets number of moving average points		
— Reference file — M1~M4	*2								Assigns files to use for computation		
<p>*1 Enter using alphanumeric keypad. (initial value : 100)</p> <p>*2 Assign file on IC memory card.</p>											



APPENDIX 3. Menu Hierarchy Structure

Setting Panel	Setting Item	Soft Key / Menu Display								Operation of Menu Item	
		F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8		
<b>MISC</b> 	— <b>Print</b> —									Channel print selection	
	Print channel	off	on								
	Print scale	off	on								Vertical axis values print setting
	Time scale	off	on								Time axis values print setting
	Print trigger	off	on								Trigger date, time print setting
	Print time	off	on								Print start time print setting
	Hard copy size	A5	A4								Hard copy recording size setting
	Paper size	A4	Letter								Chart paper size setting
	— <b>Other.</b> —										
	— <b>Display</b> —										
	Cursor mode	Single	Multi								Cursor designation
	Grid on/off	off	on								Grid setting
	— <b>Alarm</b> —										
	Alarm beep	off	on								Alarm beep on/off
	— <b>Measure</b> —										
	Negative integral	off	on								Handling of waveform negative area
	Standard deviation	n	n-1								Population for standard deviation
	— <b>Wave form</b> —										
	Window settings	Clear	Hold								Preserving window zoom setting
	— <b>Wave</b> —										
	Accumulate	off	Mode 1	Mode 2	Mode 3						Accumulate display mode setting
	— <b>Zoom</b> —										
	Zoom position	off	on								Zoom position display on/off
	<b>Test</b>	CRT	key	ROM/RAM	Print 1	Print 2	RJC				Self-test
	<b>Init.</b>							Execute	Exit		Initializing setup information
	<b>Block</b>										
	— <b>Block</b> —										
Protect	off	on								Block protect mode	
— <b>Block mode</b> —											
Block mode	Reset	View	Measure							Block data reset, View / Measurement block shift	


Setting Panel	Setting Item	Soft Key / Menu Display								Operation of Menu Item
		F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	
CURSOR 		Cursor			Grid	Comment			Block*	
	Cursor	Cursor		Ref cur	Grid	Comment	Span set	Zoom	Block*	Cursor display
	Comment	Comment1	Comment2	Comment3	Comment4	Print	Time	Trigger	Exit	Comment display
	Span set	First	Last						Exit	Recording / saving range
	When selecting Block	View blk	Meas blk				Retry	Exit	Next	When selecting Block, View blk, or Meas blk
	View blk   Meas blk	Next	Previous					Execute	Exit	
	Zoom	up	down	up	down			Execute	Exit	Zoom function
Zoom (X-Y display)	up	down	up	down	up	down	Execute	Exit		
MEASURE 	CRT screen display			A	B	C				Zone statistical computations for Single, Dual, or Quad display
	For Single, Dual, or Quad display			off	off	off		Execute	Exit	
				Max	Max	Max				
				Min	Min	Min				
				P-P	P-P	P-P				
				Ave	Ave	Ave				
				RMS	RMS	RMS				
				Std	Std	Std				
			Integ	Integ	Integ					
	CRT screen display			A	B	C				Area computation for X-Y display
	For X-Y display			off	off	off		Execute	Exit	
				Integ 1	Integ 1	Integ 1				
				Integ 2	Integ 2	Integ 2				
SHIFT  + MEASURE 	CRT screen display	Go / No-go	Auto Save	Judge					Waveform tests	
	For Go / no-go = on	off						Exit		
		on	off	in	Execute	Edit	Load	Save		Exit
			on	out						
	When selecting Edit	Clear	Up	Down	Up	Down	Band set	Band clr		Execute
	When selecting Load or Save			Up	Down			Execute		Exit

\* : Displayed when memory partitioning is used.

APPENDIX 3. Menu Hierarchy Structure

Setting Panel	Setting Item	Soft Key / Menu Display								Operation of Menu Item
		F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	
<b>PRINT FORMAT</b> 	Print format									
	— Output device —	Printer	Plotter							Specifies recording output destination
	<input type="checkbox"/> Printer Print mode	Plot	Analog	Digital						Sets recording mode
	Title on/off * Title	off	on							Title input
	Grid	Fine	Normal	off						Grid for analog recording
	Resolution	100	25	50	200	400	1000			Sets time resolution for analog recording
	Data number * First * Last	Auto	Manual							Sets data range for analog or digital recording
	* Interval									Sets data range for digital recording
	G1~G8	off	Thick	Thin						Sets density of each graph trace
	— Output device —									
	<input type="checkbox"/> Plotter Title on/off * Title	Printer	Plotter							Selects internal printer or external plotter
	Paper size	A4	A3	A5-1	A5-2					Sets paper size
	Pen speed	Normal	Slow							Sets pen speed
	Draw border	No	Yes							Sets whether or not to draw border
	— Pen number —									
	Title	1	2	3	4	5	6	7	Next	Specifies pens
	Label	8	9	10	11	12			Next	
	Axis									
	Cursor									
	G1~G8									
<b>TRIGGER MODE</b> 	Trig	Free	Single	Repeat					Trigger mode selection	

\* : Enter using the alphanumeric keypad.

Setting Panel	Setting Item	Soft Key/Menu Display								Operation of Menu Item
		F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	
LOAD / SAVE 	— Load/Save —									
	Load/Save mode	Data	Panel						Utility	
	<input type="button" value="Data"/>									Loads / saves measured data
	Type	Save	Load	Info	Delete					
	<input type="button" value="Save"/>									
	Data type	Bin / Meas	Bin / Prog	ASC / Meas	ASC / Prog					
	— Option —	off	on	Set OPT	Clr OPT					
	<input type="button" value="Load"/>									
	— Option —	off	on	Set OPT	Clr OPT					
	<input type="button" value="Panel"/>									Loads / saves setup information
	Type	Save	Load	Delete						
	<input type="button" value="Utility"/>									File utility
Function	PRN Dir	Copy	Del	Ren	MD	RD	Format	* Next		
CRT display	* Dump	* Retrieve								
	*Next file No. : (1~ )								Dump function	
	* Exit							* Execute		
Set								Execute	Executes load/save	

\* : For models with FDD only



■ Recorder Mode

Setting Panel	Setting Item	Soft Key/Menu Display								Operation of Menu Item	
		F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8		
<b>MODE</b> MODE	Mode Record	Memory	Record	FFT							
<b>RANGE</b> RANGE	ch1 Input	off	DC	AC	Temp					Input coupling selection	
	ch6 (ch6)	*1 Range	0.06V	0.2V	0.6V	2V	6V	20V	60V		Input range selection
	(ch4)	*2 Range	K	J	E	T	R	S	B	Next	Thermocouple type selection
			N	W	L	U				Next	
	chA*3	*1 Filter	off	Auto	4kHz	400Hz	40Hz	1.5Hz			Input filter selection
		*1 Filter	off	1.5Hz							
	chB*3	Input	off	on							Logic input selection
<b>TRIGGER</b> TRIGGER	— Trigger —										
	Start	off	on							Recording start time setting	
	Stop	off	on							Recording stop time setting	
	Start date	Now									
	Time	Now									
	Stop date	Now									
	Time	Now									
<b>DISPLAY FORMAT</b> DISPLAY FORMAT	— Display format —										
	Display mode									Display scale setting	
	Scale	off	on								
	— Display —										
	W1~W8	off	1	2	3	4	5	6	Next	Assign channel to waveform No.	
		7	8						Next		
— Scale —										Upper/lower display scale limits setting	
*2 Upper											
*2 Lower											
<b>PRINT FORMAT</b> PRINT FORMAT	Print mode	Analog	Digital							Recording mode selection	
	Title on/off	off	on							Title input	
	*2 Title										
	Grid	Fine	Normal	off						Grid for analog recording	
	— Wave —										
W1~W8	off	Thick	Thin						Specify waveform density for analog recording		
Time interval	1	2	5	10	20	30	60		Set time for digital recording		
<b>CURSOR</b> CURSOR	CRT screen display		Scale ch	Mode							
		Grid		W1	Slow	up	down			Grid display	
				W8	Fast					*1 Scroll function	

\*1 Only if "Scale = on" on DISPLAY FORMAT panel

\*2 Enter using the alphanumeric keypad.