HIOKI

INSTRUCTION MANUAL

8853

MEMORY HiCORDER

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing this Hioki 8853 MEMORY HiCORDER.
To get the maximum performance from this unit, please read this manual first, and keep this at hand.

Safety Notes

This Instruction Manual provides information and warnings essential for operating this equipment in a safe manner and for maintaining it in safe operating condition. Before using this equipment, be sure to carefully read the following safety notes.

⚠ WARNING

This equipment is designed according to IEC348 Electrical Measurement Equipment Safety Standards, and has been tested for safety prior to shipment. During high voltage measurement, incorrect measurement procedures could result in injury or death, as well as damage to the equipment. Please read this manual carefully and be sure that you understand its contents before using the equipment. The manufacturer disclaims all responsibility for any accident or injury except that resulting due to defect in its product.

Safety symbols

The following symbols are used in this Instruction Manual to indicate the relative importance of cautions and warnings.

	This symbol is affixed to locations on the equipment where the operator should consult corresponding topics in this manual (which are also marked with the ⚠ symbol) before using relevant functions of the equipment. In the manual, this mark indicates explanations which it is particularly important that the user read before using the equipment.
	Indicates a grounding terminal.
	Indicates a fuse.

⚠ DANGER	Indicates that incorrect operation presents extreme danger of accident resulting in death or serious injury to the user.
⚠ WARNING	Indicates that incorrect operation presents significant danger of accident resulting in death or serious injury to the user.
CAUTION	Indicates that incorrect operation presents possibility of injury to the user or damage to the equipment.
NOTE	Denotes items of advice related to performance of the equipment or to its correct operation.

⚠ DANGER

- **To avoid the danger of electric shock or damage to the unit, never apply more than 450 V (either AC or DC) between a pair of input units or between an input unit and the frame.**
  In particular, if a power line capable of carrying a current is connected, and applies an excess voltage, there is a danger of a short circuit accident.
- **If any metal parts of the input cables are exposed, there is a danger of electric shock. Use only the 9574 input cables supplied whose metal parts are not exposed.**
- **Normally keep all four input units installed permanently. If a unit is not fitted, it must be replaced by a blank panel. If the unit is operated with an input unit not in place, it poses a shock hazard.**
- **To prevent the danger of electric shock, be sure to ground the unit.**
  - **Connect the protective ground terminal to ground first.**
  - **Using the three-core power cord supplied provides grounding.**
  - **Insert the three-core power cord only in the socket equipped with the contact for the protective ground.**
  - **Do not use the extension cord without the protective conductor.**
  - **If using the three- to two-core conversion plug supplied, the unit is not grounded, so connect the earth cord of the conversion plug or the protective ground terminal to ground.**
  - **Do not disconnect the protective ground.**
- **To prevent the danger of electric shock, always check that the input cables are disconnected, turn off the power switch, and remove the power cord, before replacing the fuse.**
- **To prevent fire hazard, use only a fuse of the correct rating specified on the rear panel.**

⚠ WARNING

- **When the 8853 unit and also the measuring object are grounded, be extremely careful in connecting the grounds, because if connecting the ground of the logic probe to other than that of the measuring object, the unit or the measuring object may be damaged because of a short-circuit.**
- **To prevent damage to the 8853 unit, never exceed the limits in the table below for the various input/output terminals.**

Input/output terminals	Maximum capacity
Analog inputs	500 V DC + AC peak
EXT TRIG START STOP	-5 V to +10 V
TRIG OUT GO · NG	-20 V to +30 V 500 mA max. 200 mW max.

- **The unit should always be operated in the range of 5°C to 40°C and 35 % to 80 % relative humidity. To avoid damage to the unit, do not use in direct sunlight, in dusty conditions or in the presence of corrosive gases.**

Notes on Use

To ensure safe operation, and in order to exploit its functionality to the full, please follow the directions in this section carefully.

Shipping check

- When the unit is delivered, check that it has not been damaged in transit. In particular check panel switches and connectors (protective ground terminals, input terminals etc.).
- The screen cover can be removed. When it is undone, install it referring to Section 16.4, "Cleaning the CRT screen."
- Before use, check that it has not been damaged, because of severe storage or transit condition.
- In the event of any damage, contact your nearest service representative without delay.

Before powering on

Check that the power supply is correct for the rating of the unit, the correct fuse is fitted, and the protective ground terminal is wired. (See Section 3.1.)

Protective grounding

- The protective ground terminal must be connected to ground.
- The ground of the three-core power cord is a protective ground terminal, so if a properly grounded three-pin outlet is available, then using the supplied three-core power cord provides automatic grounding.
- The protective ground terminal is connected to the ground of the three-core power cord.
- When using the three- to two- core conversion plug supplied, connect the earth cord of the conversion plug or the protective ground terminal to ground. (See Section 3.1.)

Before measurement

Connect the input cables for measurement after powering on. (See Section 3.2.)

Using the printer

Using the printer for low-speed printing (the recorder function) in a high-temperature or high-humidity environment should be avoided at all cost. This can seriously reduce the printer life.

Recording paper

- This unit uses a thermal printer. The recording paper supplied has characteristics finely tuned for use with the printer. Always use the Hioki specified recording paper. (See Section 3.4.)
- Using recording paper of a different specification may not only result in impaired printing quality, but even prevent the printer from operating.

Storage

If the unit will not be used for a substantial period, to protect the printer head and prevent deformation of the rubber rollers, raise the head up/down lever to the head up position. (See Section 3.3.)

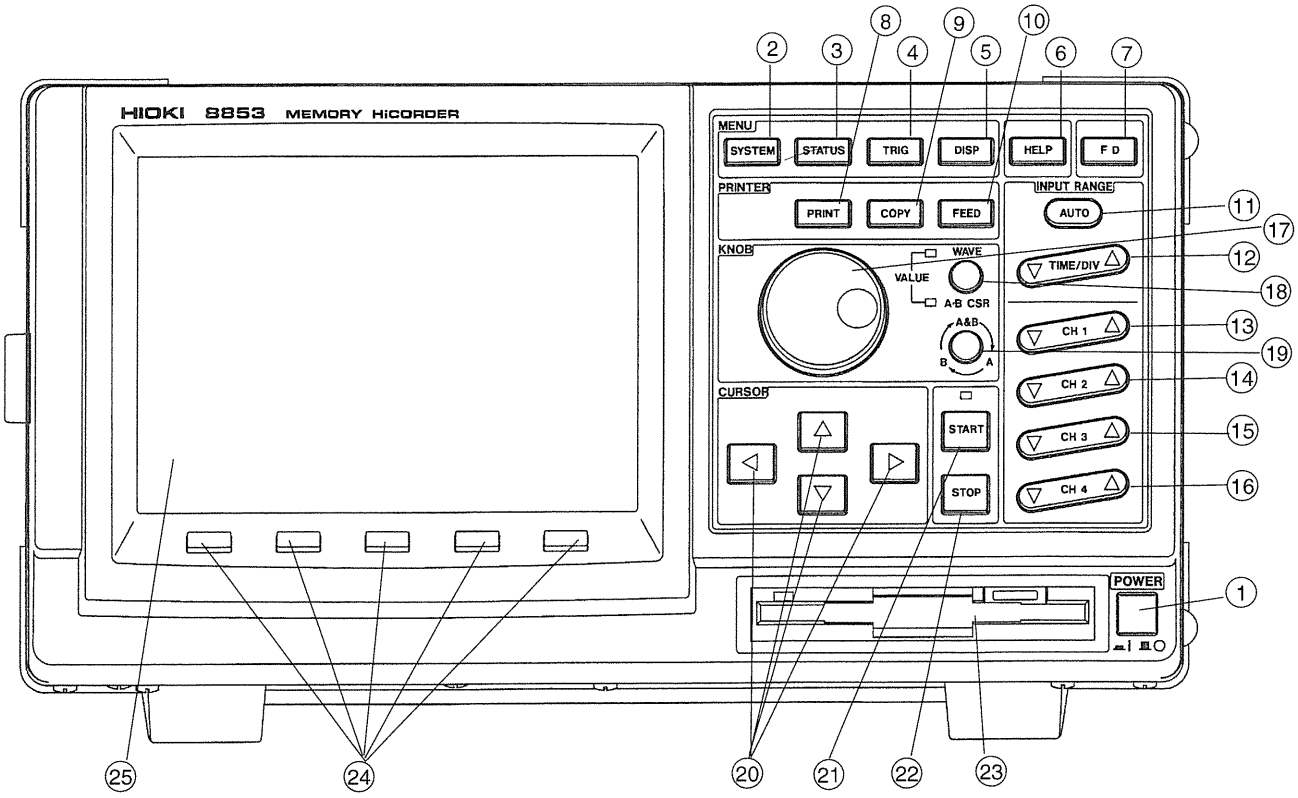
Shipment of the unit

- For repacking of the unit, preferably use the original packing.
- Always remove any floppy disk.
- Raise the head up/down lever to the head up position. (See Section 3.3.)

Miscellaneous

- In the event of problems with operation, first refer to Section 16.5, "Troubleshooting."
- Before operating, read each direction in this manual carefully.

Identification of Controls and Indicators



① POWER switch

Turn the power supply on and off.

② SYSTEM key

Displays the system screen on the screen display. (See Section 4.1 and Chapter 12.)

③ STATUS key

Displays the status screen (the screen for setting the conditions of measurement) on the screen display. (See Section 4.1.)

④ TRIG key

Displays the trigger screen (the screen for setting the conditions of trigger) on the screen display. (See Section 4.1 and Chapter 8.)

⑤ DISP key

Displays the display screen (the screen for waveform display) on the screen display. (See Section 4.1.)

⑥ HELP key (on the display screen)

Displays extra information including the position and block displays. (See Sections 5.3.22 and 6.3.15.)

⑦ FD (Floppy disk) key

- Displays the floppy disk control screen (the FD screen), or the SCSI control screen.
- Sets the FD screen or the SCSI screen to be displayed. (See Section 12.5.10.)
- Press this key after inserting a floppy disk or connecting a device connected to the SCSI interface. (See Chapter 13.)

⑧ PRINT key

Prints a waveform held in memory. (See Sections 5.3.20, 6.3.14, and 7.3.10.)

⑨ COPY key

Prints an exact copy of the screen. (See Sections 5.3.20, 6.3.14, and 7.3.10.)

⑩ FEED key

While this key is being held down, the recording paper is fed forward.

⑪ AUTO (auto-range) key (in the memory recorder function)

Automatically sets the time axis range and the voltage axis range, and performs measurement. (See Section 5.3.17.)

⑫ TIME/DIV key

Sets the time axis range. (See Sections 4.2 and 4.3.)

⑬ CH1 (channel 1) range key

Sets the voltage axis range for channel 1. (See Sections 4.2 and 4.3.)

⑭ CH2 (channel 2) range key

Sets the voltage axis range for channel 2. (See Sections 4.2 and 4.3.)

⑮ CH3 (channel 3) range key

Sets the voltage axis range for channel 3. (See Sections 4.2 and 4.3.)

⑯ CH4 (channel 4) range key

Sets the voltage axis range for channel 4. (See Sections 4.2 and 4.3.)

⑰ Rotary knob

Together with the next control (the knob select key), this allows waveform scrolling, A and B cursors movement, and so forth. Its function depends on which of the two LEDs to the right is lit. (See Section 4.2.)

⑱ Knob select key

- Determines the effect of turning the rotary knob. (See Section 4.2.)
- Each time it is pressed, the state of the two LEDs to the left changes.

⑲ A • B cursor select key

This key determines which of the A and B cursors the knob controls, or whether it moves both.

(See Sections 5.3.13, 6.3.11, and 7.3.9.)

⑳ Cursor keys

These four keys move the flashing cursor (the flashing portion on the screen). (See Section 4.2.)

㉑ START key

Starts measurement and analysis. During measurement and analysis, the LED above this key lights.

㉒ STOP key

Stops operation of the 8853. (Releases the START key.)

㉓ Floppy disk insertion slot

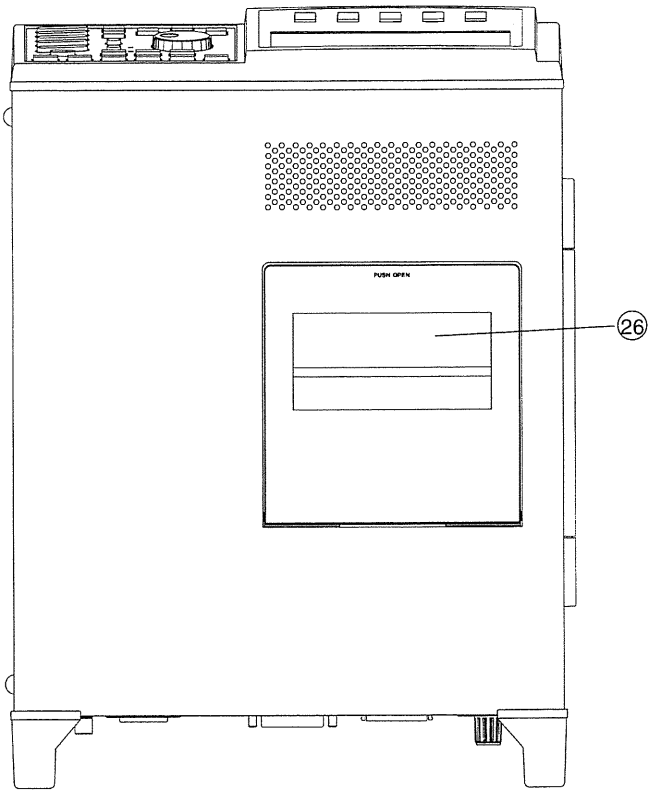
Insert a 3.5-inch floppy disk. (See Chapter 13.)

㉔ Soft keys

The functions of these keys are indicated on the lowest line of the screen. (See Section 4.2.)

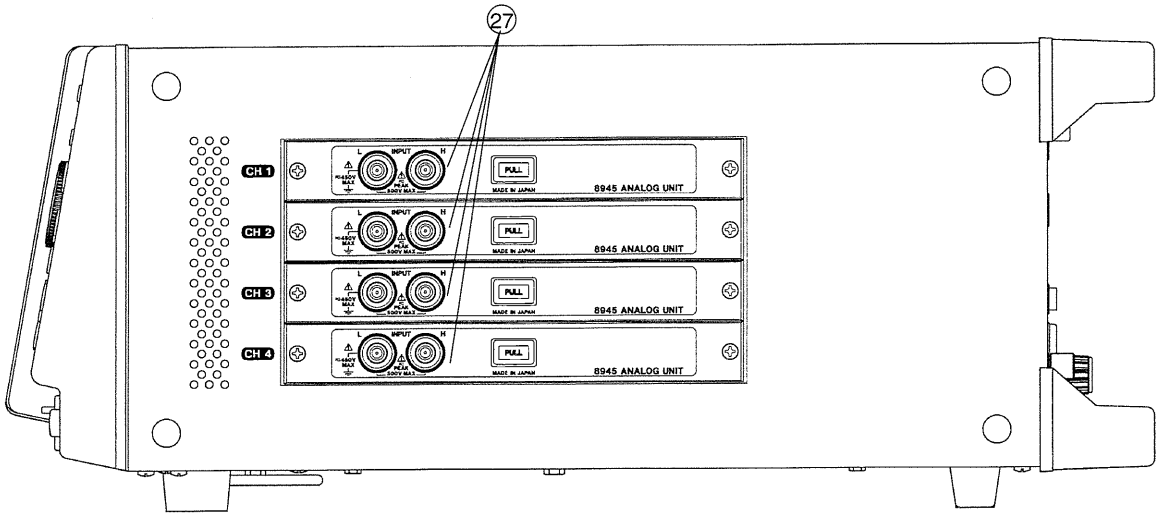
㉕ CRT screen

Top view



㉖ Printer

Right side view

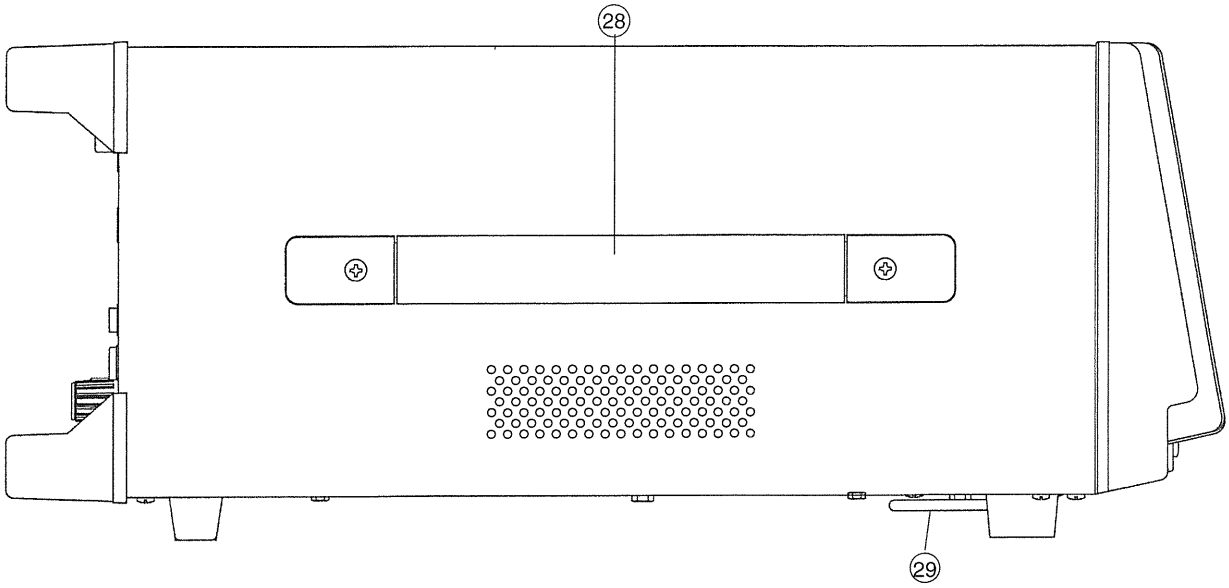


㉗ Analog input terminals (8945 analog units)

The 8945 analog units have unbalanced input terminals.
(See Section 15.2.)

H : high level input
L : low level input

Left side view

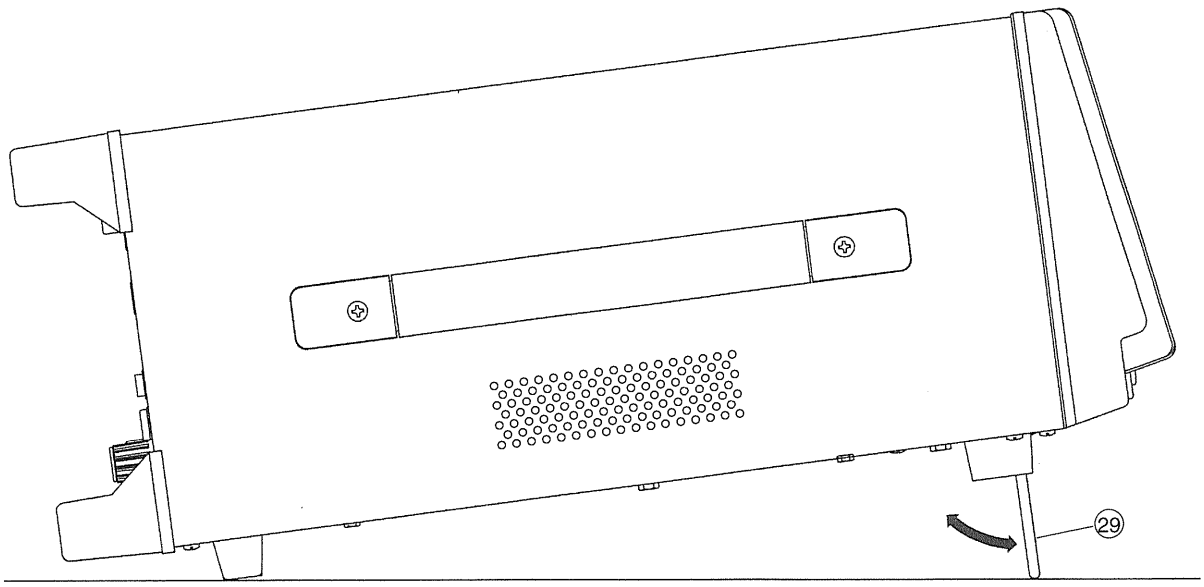


㉘ Handle

This is used for transporting the 8853.

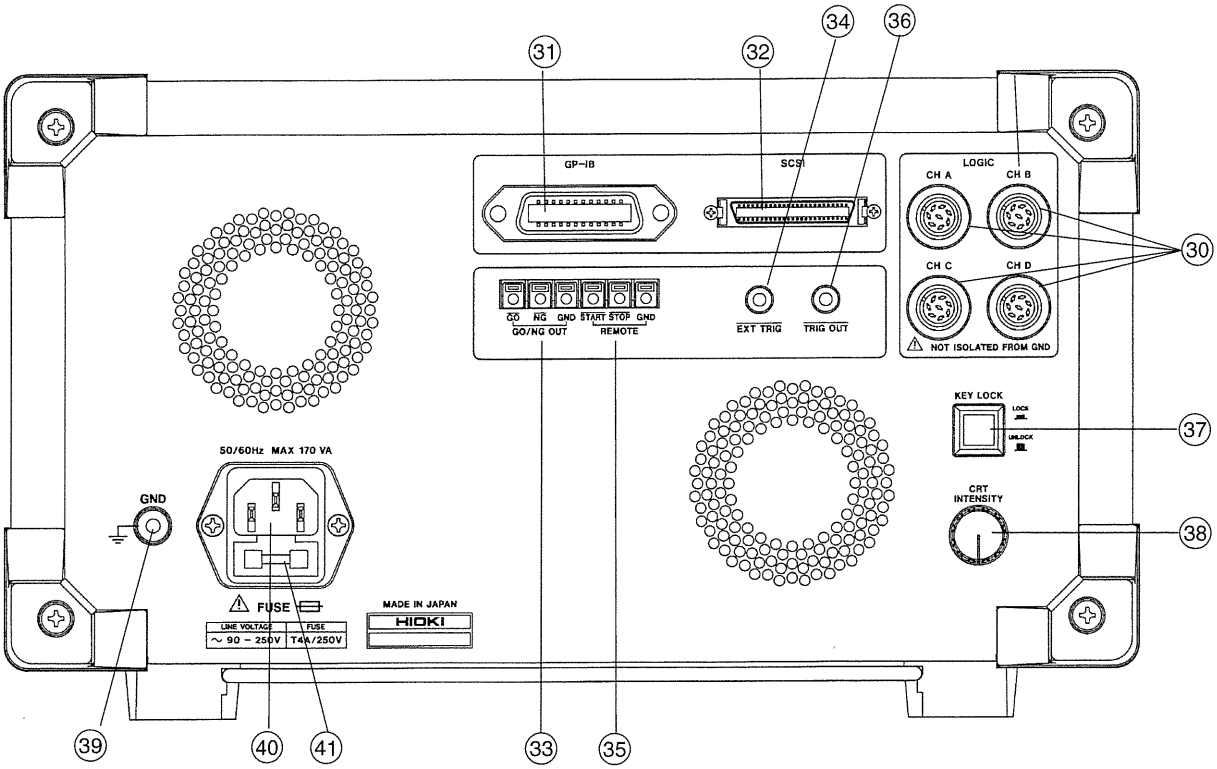
㉙ Stand

The 8853 can be tilted up by using this stand, as shown in the figure below.



Here the unit is tilted upwards on its stand.

Rear panel



㉚ Logic probe connectors

These are the input connectors for the logic inputs, and are only to be used for the optional logic probes. (See Section 15.1.)

A maximum of four sets of logic probes can be connected. (CHA, CHB, CHC, CHD)

㉛ GP-IB interface connector

Connect the GP-IB interface cable. (See Section 6.4 of the 8853 FFT Function·GP-IB Interface Instruction Manual.)

㉜ SCSI interface connector

The hard disk or the magneto-optical disk can be connected, as an external memory for the waveform and setting conditions. (See Section 13.4.1.)

㉝ GO/NG OUT terminals

These output a waveform decision result or a waveform parameter decision result. (Active low signals) (See Section 14.3.)

㉞ EXT TRG (external trigger input terminal) (See Section 8.4.)

This is the input terminal used when external triggering is enabled. (Active low or short circuit signal)

㉟ REMOTE input (See Section 14.2.)

This allows external controls of start/stop operations. (Active low or short circuit signal)

㊱ TRIG OUT (trigger output terminal)

When triggering has occurred, a signal is output here. (Active low) (See Section 8.10.)

㊲ KEY LOCK key

- Pressing this keys puts the 8853 into the locked condition. (See Section 14.5.)
- In order to release this locked condition, press this key again.
- A GP-IB command can also be used to switch to the key lock state.

㊳ CRT INTENSITY control

Adjusts the screen brightness. (See Section 3.5.)

㊴ Ground terminal (GND) (See Section 3.1.)

㊵ Power supply connector

- Connect the power cord supplied.
- This is a three-core connector equipped with a protective ground terminal connected to the ground terminal.

㊶ Fuse holder

This houses the fuse. (See Sections 3.1 and 16.1.)

Chapter Summary

Before reading the chapter summary, be sure to read "For Safety" and "Notes on Use" on the previous pages.

Chapter 1 gives an overview of the unit.

Chapter 2 contains the specifications of the unit.

Chapter 3 describes the installation and preparatory work for using the unit.

Chapter 4 describes the screen displays, key operations, and settings.

Chapter 5 describes the memory recorder function mode.

Chapter 6 describes the recorder function mode.

Chapter 7 describes the X-Y recorder function mode.

Chapter 8 explains the trigger functions. The powerful trigger functions are available.

Chapter 9 describes the memory segmentation functions. The memory of the unit can be used effectively.

Chapter 10 describes the waveform decision function, used to detect abnormal waveforms etc.

Chapter 11 describes the calculation functions covering ways of using the various calculation functions.

Chapter 12 describes the system screen for special function setting, check etc.

Chapter 13 covers floppy disk, hard disk, and magneto-optical disk operations.

Chapter 14 covers the operations to do with the rear panel.

Chapter 15 describes the input units.

Chapter 16 covers maintenance and servicing, and replacement of the fuse etc.

Appendices comprise error and warning messages, and a glossary.

For instructions on how to use the FFT function and GP-IB Interface, refer to the 8853 FFT Function·GP-IB Interface Instruction Manual.

Chapter 1 Overview

1.1 Product Introduction

- The 8853 Memory HiCorder is a waveform recorder, allowing simultaneous measurement and recording.
- It provides both analog and logic input channels, and will be ideal for capturing waveform phenomena over a very wide frequency range.

Principal 8853 system features

(1) Powerful waveform capture functions

A 10 MS/s sampling rate, and maximum 2 M word memory (using one channel only) enable complex and rapid waveform variations to be captured.

(2) Mixed analog and logic recording

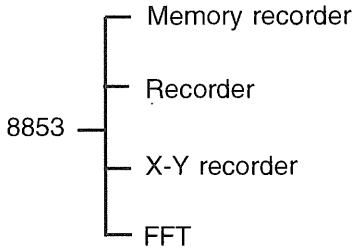
- The mixed analog and logic recording allows the features of both the digital oscilloscope and logic analyzer.
- The 16 channel logic input channels are built into the unit as standard.

(3) At-a-glance rapid investigation and observation of waveforms

The gray scale CRT display, in combination with the magnification and compression functions, zoom function, and waveform scrolling function, makes it easy to examine required sections from the large waveform memory.

(4) Four functions to meet a huge range of applications

The 8853 is provided with several functions: memory recorder function (X-Y recording also provided) to capture transients and other high-speed phenomena; recorder function, for extended real time recording; a continuous X-Y recorder function for X-Y plot; and a FFT function to analyze frequency.



(5) Flexible trigger functions

- The unit uses a digital trigger circuit.
- Many various settings are available, with types such as a level trigger, a window trigger and a glitch detection trigger, and with functions such as 1 % step trigger level, trigger filter, and other digital functions.

(6) Floppy disk drive

- A 3.5 inch floppy disk can be used to keep an external record of waveforms, settings and so forth.
- Data transfer to a personal computer is also easy. (Compatible with MS-DOS disks)

(7) Hard disk and magneto-optical disk

- The SCSI interface is fitted as standard.
- A commercially available hard disk or magneto-optical disk can be connected, as an external memory for the waveforms and the setting conditions.

(8) Record just the required portions at the required time

- The high-speed thermal printer, with its 1 cm/division high resolution, allows only those sections of the waveform which are needed to be printed.
- The printer also provides a handy screen dump function at any time.

(9) Automatic pass/fail waveform decision function

- This automatically produces a pass/fail (GO/NG) waveform assessment based on a user-defined reference area.
- A convenient graphics editor makes it simple to define the reference area.

(10) High-grade intelligent functions

Many auxiliary functions, including memory segmentation, cursor measurements, and a wealth of calculation functions.

(11) Scaling function

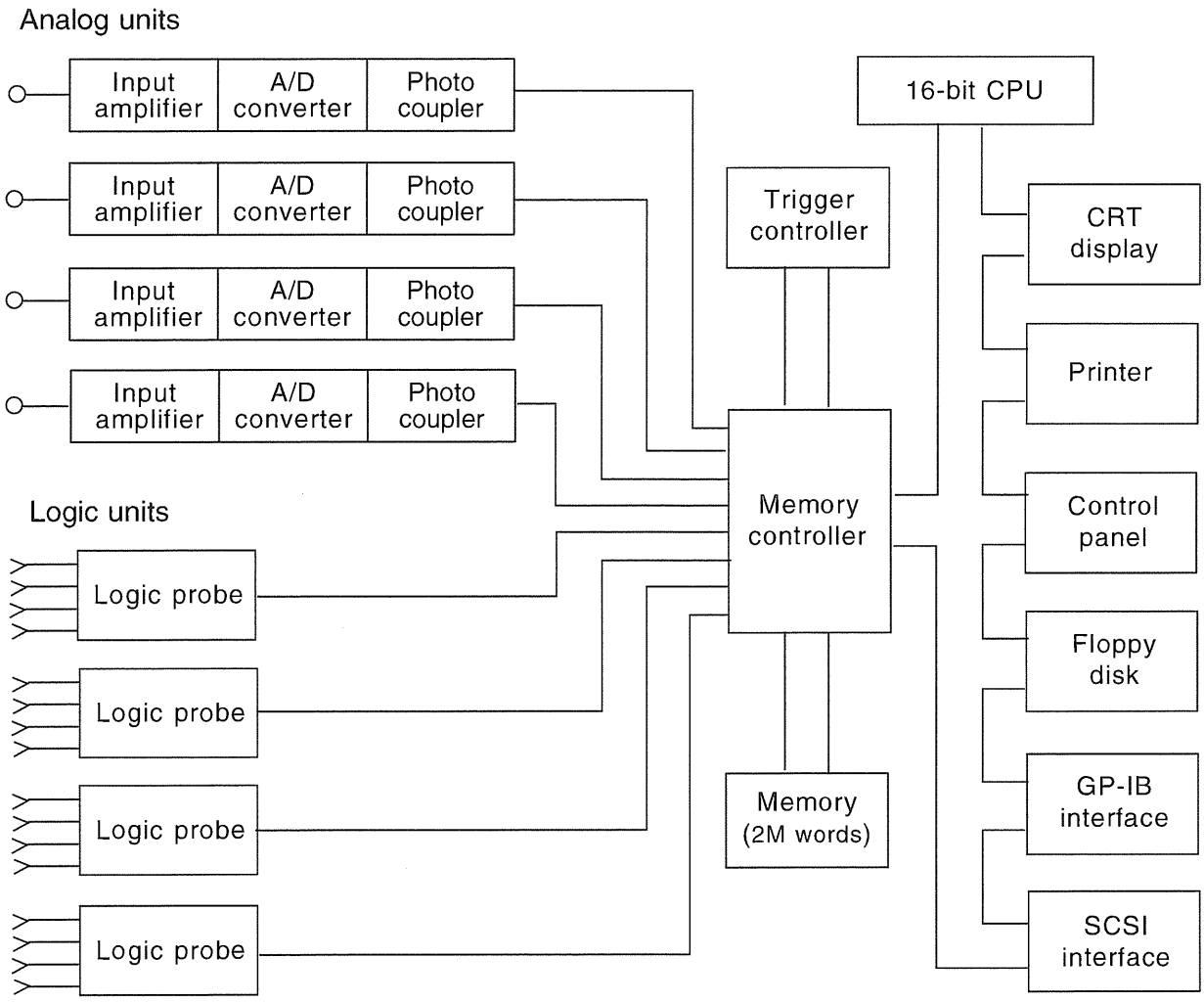
By setting the physical amount of input signal and the name of the units used, it is possible to convert measured data, which are obtained as voltage values, into values in set units.

(12) GP-IB interface

- The GP-IB interface is fitted as standard. [Complying with IEEE-488.2]
- This allows remote control with a wide range of commands.

1.2 System Operation

- The unit is built round a 16-bit microprocessor (CPU) which provides overall control.
- Data from the A/D converter is transferred through the memory controller and stored in the 2M word RAM.
- The unit uses a digital trigger circuit, and for an internal trigger the value undergoes A/D conversion, and digital comparison with the reference value, to determine whether or not to output a trigger signal.
- Measurement data stored in memory can be processed and displayed or output to the printer. Output to floppy disk, to the GP-IB or to the SCSI is also provided.



Block diagram

Chapter 2 Specifications

2.1 Main Unit Specifications

(1) General specifications

For analog input unit specifications, see Section 15.2.1, "Specifications."

[Basic specifications]

■ Measurement functions	Memory recorder (high speed recording) Recorder (real time recording) X-Y recorder (continuous X-Y recording) FFT (frequency analysis)
■ Maximum sampling rate	10 MS/s ±0.01 %
■ Time axis accuracy	±0.01 % (indicates relative accuracy of scale and real time)
■ Memory capacity	12 bits × 2 M words per channel (using channel 1) 12 bits × 1 M words per channel (using channels 1 and 2) 12 bits × 500 K words per channel (using channels 1 to 4)
■ Input method	Plug-in analog input units (insulated between the input units and the frame, and between the various input units)
■ Maximum number of channels	4 analog channels + 16 logic channels * The 16 logic channels are built into main unit as standard. (common ground with main unit)
■ External control connections	External trigger input, trigger output, start/stop input, GO/NG output

■ Backup battery lifetime	10 years (for clock and settings; at 25 ℃ reference value)
■ Operational ranges for temperature and humidity	Temperature : 5 to 40℃ Humidity : 35 to 80 % RH (no condensation)
■ Temperature and humidity ranges for assured accuracy	Temperature : 23℃±5℃ Humidity : 35 to 80 % RH (no condensation)
■ Temperature and humidity ranges for storage	Temperature : -10℃ to 50℃ Humidity : 5 to 90 % RH (no condensation)
■ Maximum floating voltage	450 V (AC, DC) (between the input units and the frame)
■ Insulation resistance and dielectric strength	10 MΩ minimum/500 V DC, 1.5 kV AC/one minute (between the frame and the power supply) 10 MΩ minimum/500 V DC, 2 kV AC/one minute (between the input units and the frame, and between the various input units)
■ Power supply	90 to 250 V AC, 50/60 Hz
■ Power consumption	170 VA max.
■ External dimensions	324 (W) × 168 (H) × 400 (D) mm approx. (excluding projections)
■ Mass	9.0 kg approx.

[Recording]

■ Recording method	Thermosensitive recording method using a thermal line-head
■ Recording paper	Roll-type thermosensitive recording paper 110 mm wide and 30 m long
■ Recording width	Overall width : 108 mm (864 dots) Waveform width : 100 mm f.s. (1 division=10 mm)
■ Recording speed	2.5 cm/s max.
■ Paper feed accuracy	±2 % (at 25 ℃, 60 % RH)

[Display]

■ Display type — 7-inch CRT raster scan (gray scale)

■ Display resolution — Waveform : 601 × 256 dots
25 dots/division (vertically), 40 dots/division (horizontally)
Character display : 40 characters × 29 lines

[External data storage]

■ Device

① 3.5-inch floppy disk drive
Capacity — 1.2 M bytes (2HD) for NEC PC9801
1.44 M bytes (2HD) for IBM-PC/AT or NEC PC9801
720 K bytes (2DD) for IBM-PC/AT

② A hard disk or a 3.5 inch magneto-optical disk can be connected through the SCSI interface.

■ Data format — MS-DOS (*) format
(*) MS-DOS is the registered trademark of Microsoft Corporation.

■ Data stored — Settings, measurement data, waveform decision area, screen data, result of the waveform calculation
A partial save of measurement data between the A and B cursors can be performed.

[Other]

■ Accessories — Power cord (1)
Recording paper (paper roll) (1)
Instruction manual (2)
Power plug (1)
Roll paper attachments (2)
Spare fuse (time-lag fuse, T4A/250 V, 20 mm × 5 mm dia.) (1)
Protective cover (1)

■ Option — 8945 analog unit

■ Optional accessories

9221 recording paper (10 rolls of 30 m)
9303 PT
9305 trigger cord
9306 logic probe
9307 line logic probe
9308 line dip detector
9151-02 GP-IB cable (2 m)
9151-04 GP-IB cable (4 m)
9536-01 utility disk
9574 input cable
220H paper winder

(2) Trigger functions

■ Trigger method

Digital comparison method

■ Trigger modes

Memory recorder	single, repeat, auto
Recorder	single, repeat
X-Y recorder	single
FFT	single, repeat, auto

■ Trigger sources

The external and timer trigger sources for each channel 1(A, B), channel 2(C, D), channel 3 and channel 4 can be set either on or off.
If all are off, the system runs free.
Analog or logic input can be set for channel 1 and channel 2.
Timer triggers allow start time, stop time and interval time to be specified.

■ Trigger conditions

Logical AND or OR of any trigger sources

■ Trigger types (analog)

Level trigger	0 to 100 % digital setting, triggered on rising above, or falling below the set level
Event trigger	Number of events 2 to 4000 (Available when specifying the level trigger.)
Window trigger	Specifies upper and lower trigger levels.
Glitch detection trigger	Glitch width 2 to 4000 samples
Time out trigger	Setting 2 to 4000 samples

■ Trigger types (logic)

Logic trigger — Set pattern of 1, 0, and × (don't care); AND/OR settings for each 8 channels

■ Trigger filter — Filter width 2 to 4000 samples (Settable only in the memory recorder function and the FFT function. Can only be set to ON or OFF in the recorder function and the X-Y recorder function.), specifiable when using level trigger or logic trigger

■ Level setting accuracy — ±0.4 % f.s. (f.s. = 100 %)

■ Pre-trigger — 0, 2, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100 %, -50 to -950 % (*) (in the memory recorder function and the FFT function, (*): depends on recording length)

■ Trigger timing — Start
Stop (in the recorder function and the X-Y recorder function)
Start and stop (in the recorder function and the X-Y recorder function)

■ Trigger output — Open collector output (maximum input voltage 30 V) (with 5 V output, active low, pulth width: approx. 1.5 ms)

■ Trigger I/O terminals — Mini-jack (3.5 mm dia.)

(3) Memory recorder function

■ Time axis — 4 μs/division, 5 μs to 5 s/division
20 ranges, 1-2-5 steps, except for 4 μs

■ Time axis resolution — 40 points/division

■ Sampling period — Automatically determined by time axis setting (1/40 of the time axis, accuracy: ±0.01 %)

■ Recording length — 15, 30, 75, 150, 300, 750, 1500, 3000, 6000, 12500, 25000(*1,*2), 50000 (*2) divisions
(*1): using channels 1 and 2 only
(*2): using channel 1 only

■ Format — Single, dual, quad (printer only), X-Y

■ Interpolation function	Provided, dot/line	
■ Superimposition function	Provided	
■ Waveform magnification and compression ratios	(time axis)	×10, ×5, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50, ×1/100, ×1/200, ×1/500, ×1/1000, ×1/2000, ×1/4000
	(voltage axis)	×10, ×5, ×2, ×1, ×1/2,
■ Waveform zooming	The whole waveform and the waveform partially magnified along the time axis can be displayed simultaneously.	
■ Waveform scrolling	Scrollable in both the left/right and the up/down directions (excluding X-Y format)	
■ Auto print function	ON/OFF, automatically prints the stored waveform.	
■ Manual print function	Provided	
■ Screen dump function	Provided	
■ Partial print function	Prints the section from the A cursor or between the A and B cursors.	
■ Smooth print function	When specified, the waveform is printed smoothly, with twice the density in the time axis direction.	

(4) Recorder function

■ Time axis	400, 500 ms/division 1, 2, 5, 10, 20 s/division 1, 2, 5, 10, 20 min/division 1 h/division (13 ranges)
■ Time axis resolution	80 points/division (400, 500 ms/division) 160 points/division (1 s to 1 h/division)
■ Sampling period	500 μs (400 ms/division), 625 μs (except 400 ms/division)
■ Recording length	15, 30, 75, 150, 300, 750 divisions, continuous
■ Format	Single, dual, quad (printer only)
■ Interpolation function	Line display only

■ CRT display	Available (can be used simultaneous with printing)
■ Waveform storage	Last 750 divisions saved in memory Can be observed by reverse scrolling.
■ Waveform magnification and compression ratios	(time axis) ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50 (voltage axis) ×10, ×5, ×2, ×1, ×1/2
■ Print function	On/off and screen dump; reprinting function

(5) X-Y recorder function

■ X channel	Any channel of channel 1 to 4
■ Y channel	Any channel of channel 1 to 4 except X channel (up to 3 combinations)
■ Effective recording dimensions	100 mm × 100 mm (10 × 10 divisions) (accuracy ±2.1 mm in the X-axis direction, ±0.1 mm in the Y-axis direction)
■ X-Y axis resolution	40 points/division (x-axis), 25 points/division (y-axis) [display] 80 points/division [printer output]

■ Sampling period (accuracy±0.01 %)

	Dot display (dark and light)	Line display (depending on amplitude)
One combination	500 μs fixed	0.5-9.5 ms (light)/0.5-14.5 ms (dark)
Two combinations	500 μs fixed	0.5-17.5 ms (light)/0.5-28.5 ms (dark)
Three combinations	500 μs fixed	0.5-25 ms (light)/0.5-42 ms (dark)

■ Recording time	Unlimited
■ Interpolation function	Provided, dot/line
■ Monitor function	Real time display on CRT
■ Print function	Manual print and screen dump

(6) FFT function

■ Analysis mode	1 channel FFT (channel 1, 2, 3 or 4) ① Time axis waveform ② Linear spectrum ③ Power spectrum

■ Processing time	6 seconds max. (only processing time, excluding data capture and display time)
■ Frequency range	4 Hz to 4 MHz, 5 MHz (for the time axis range)
■ Frequency resolution	1/400
■ Frequency accuracy	±0.01 %
■ Number of samples	800
■ Dynamic range	72 dB (theoretical value)
■ Input data	Part of waveform captured in memory recorder function or newly captured waveform (selectable)
■ Window	Rectangular, hanning
■ Display scale	Linear scale, log scale, phase
■ Format	Single, dual
■ Print function	As per the memory recorder function, excluding partial print function
■ Averaging function	Additive average of time domain and frequency domain (2, 4, 8 to 256 samples)

(7) Auxiliary functions

[Calculation processing] (in the memory recorder function)

■ Waveform processing calculations	Four arithmetic operations, absolute value, exponentiations, common logarithm, square root, moving average, 1st and 2nd differentials, 1st and 2nd integrals, parallel displacement along the time axis
■ Waveform parameter calculation	Maximum value, minimum value, peak-to-peak value, average value, effective value, period, frequency, area value, XY area value, time to maximum value, time to minimum value, rise time, fall time
■ Averaging function	Additive averaging, exponential averaging (2, 4, 8 to 256 samples)

[Special functions]

■ Waveform decision function (in the memory recorder and FFT functions)

① Waveform area decision	Screen decision method: For an X-Y waveform, an X-T waveform, or FFT analysis results, waveform decision is possible against a reference area.
Decision modes	OUT: NG (fail) if any part of the waveform goes out of the decision area. ALL OUT: NG (fail) if the waveform is entirely outside the decision area.
Stop modes	GO (pass) stop, NG (fail) stop, GO & NG stop On stop, automatic printer output or waveform save (on the FD or the SCSI interface) is possible.
Decision output	Open collector outputs on the rear panel for GO and NG decision output (maximum input voltage 30 V) (with 5 V output, active low, pulse width 50 ms min.)
Decision time	66 ms max.
Decision period	240 ms max. (reference value: 50 μs /division, in 15 divisions, line display, using 1 channel, inputting a sine wave of 2 kHz) [During compressed display or when the recording length is long, this become slower.]
② Waveform parameter decision	Decision is possible by setting maximum and minimum values for the results of waveform parameter calculations.
Graphics editor	Used for defining an arbitrary reference area for waveform decisions
Editor commands	Line (straight line segments), paint (filling in), storage (waveform capture), erase (eraser), parallel (parallel displacement), reverse (reverse video), clear (partial deletion), all clr (screen deletion), undo, save, end

■ Memory segmentation function (in the memory recorder function)	Segmented use of the memory capacity for each channel is possible.
Number of segments	Maximum 63 ① Memory segmentation (multi-block memory) ② Sequential saving

[Other]

■ Cursor measurement functions	Time difference, voltage difference or frequency between A and B cursors Voltage at cursor A, time from trigger
■ Scaling function	Can be set for each channel.
■ Comment input function	Provided
■ Grid setting	OFF, NORMAL, FINE
■ Clock functions	Auto-calendar, automatic leap year calculation, 24-hour system
■ Clock accuracy	100 ppm (25 ℃)
■ Help function	In the memory recorder, and the recorder functions, indicates the position of the screen display with respect to the recording length and the full scale. In the memory recorder function, indicates the use status of each block during memory segmentation.
■ Key lock function	All keys can be locked except the KEY LOCK key (on rear panel).
■ List print function	After printing waveform data, outputs listing of settings (can be enabled or disabled); on the status, trigger, and system screens, also output by pressing the PRINT key.
■ Remote control	Start and stop input terminals (TTL levels, active low, or terminal short)
■ Plotter output	HP-GL plotter output

GP-IB	Complies with mechanical and electrical specifications of IEEE 488.2-1987. Full-remote control, including the input units (excluding CRT intensity)
SCSI	ANSI X3.131-1986 (SCSI level 2) JIS X6051 (SCSI level 2)
Driver/receiver	Single-ended
Bus-parity	Output data : odd parity Input data : none
Reset type	Hard reset
Data transfer method	Asynchronous
Terminator	Provided (not removable)
Initiator operation	Not operable as a target Single initiator operation only
Terminator power connector	Provided
Target	Hard disk (HDD) and 3.5 inch magneto-optical disk (MO)
Address	0 to 7

2.2 Table

Sampling period, maximum recording length, FFT frequency range, and FFT calculation time corresponding to each time axis range

Time axis range	Sampling period	Max. recording length (*)	FFT frequency range	FFT calculation time
4 μs/DIV	100 ns	200 ms	5 MHz	80 μs
5 μs/DIV	125 ns	250 ms	4 MHz	100 μs
10 μs/DIV	250 ns	500 ms	2 MHz	200 μs
20 μs/DIV	500 ns	1 s	1 MHz	400 μs
50 μs/DIV	1.25 μs	2.5 s	400 kHz	1 ms
100 μs/DIV	2.5 μs	5 s	200 kHz	2 ms
200 μs/DIV	5 μs	10 s	100 kHz	4 ms
500 μs/DIV	12.5 μs	25 s	40 kHz	10 ms
1 ms/DIV	25 μs	50 s	20 kHz	20 ms
2 ms/DIV	50 μs	1.6 min	10 kHz	40 ms
5 ms/DIV	125 μs	4.1 min	4 kHz	100 ms
10 ms/DIV	250 μs	8.3 min	2 kHz	200 ms
20 ms/DIV	500 μs	16 min	1 kHz	400 ms
50 ms/DIV	1.25 ms	41 min	400 Hz	1 s
100 ms/DIV	2.5 ms	1.3 hour	200 Hz	2 s
200 ms/DIV	5 ms	2.7 hour	100 Hz	4 s
500 ms/DIV	12.5 ms	6.9 hour	40 Hz	10 s
1 s/DIV	25 ms	13 hour	20 Hz	20 s
2 s/DIV	50 ms	27 hour	10 Hz	40 s
5 s/DIV	125 ms	69 hour	4 Hz	100 s

Time axis resolution 40 points/division

(*) : The maximum recording length in restricting the number of channel to be used to one channel.
The values are truncated to two significant digits. (See Section 12.5.8 "Channel Selection.")

Chapter 3
Installation and Preparations

3.1 Notes on Installation

(1) Main power supply and fuse

- The power supply voltage for the unit is 90 to 250 V AC and written on the rear panel.
- The fuse is also indicated on the rear panel. (For fuse replacement, see Section 16.1.)

Line voltage (±10 %, 250 V max.) : 90 to 250 V AC
Fuse rating : Time-lag fuse, T4A/250 V [size 20 mm × 5 mm dia.]

⚠ WARNING

- **Note that the maximum power supply voltage is 250 VAC.**
- **To ensure safe operation, use only a fuse of the correct rating.**

(2) Power cord

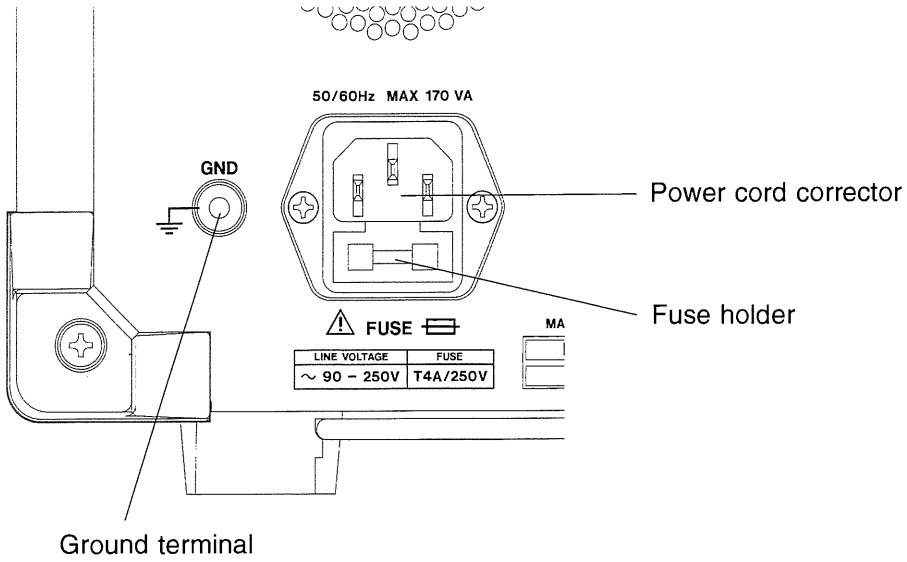
Use only the power cord supplied.

(3) Protective grounding

If a grounded power outlet is not available, ensure that the ground terminal (GND) is connected to a satisfactory ground with a thick wire of AWG 18 or over.

(4) Operating environment

- The operating environment for the unit should provide a temperature in the range 5 ℃ to 40 ℃, and 35 % to 80 % relative humidity
- To avoid damage to the unit, do not use in places where the unit will be exposed to direct sunlight, dust or corrosive gases.



3.2 During Measurements

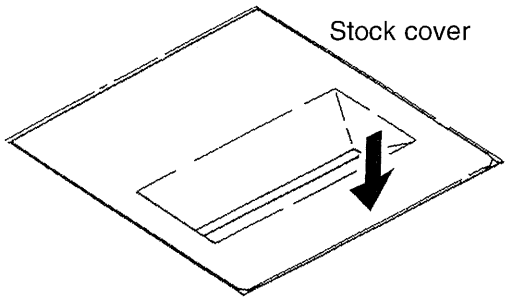
⚠ DANGER

- The permitted input voltage for the input terminal of the 8945 analog unit is 500 V (DC+AC peak). To avoid the danger of electric shock or damage to the unit, ensure that voltages exceeding this limit are never applied to the input terminal.
- The maximum floating voltage for the input unit is 450 V AC, DC. To avoid the danger of electric shock or damage to the unit, ensure that the voltages exceeding this limit are never applied between the channels and between the channel and the main unit.

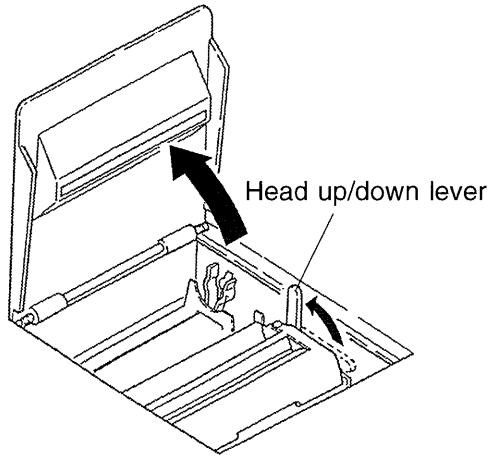
⚠ WARNING

The logic input unit allows four probes to be connected, but these are not floating, having a common ground with the main unit. To avoid the danger of electric shock, or damage to the unit, never connect the ground to the different voltages.

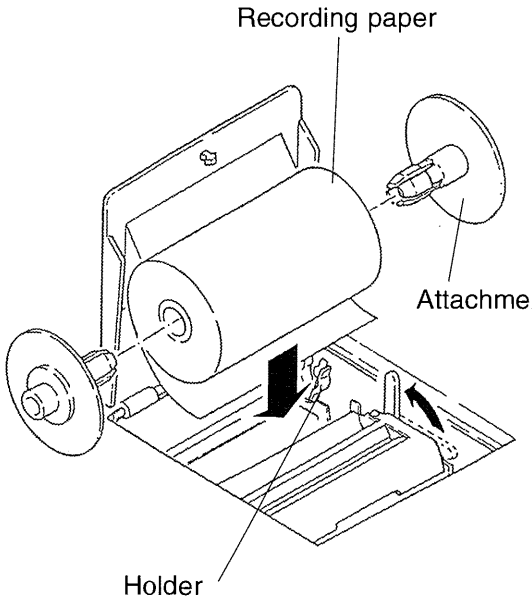
3.3 Loading Recording Paper



1. Press the stock cover and open it.



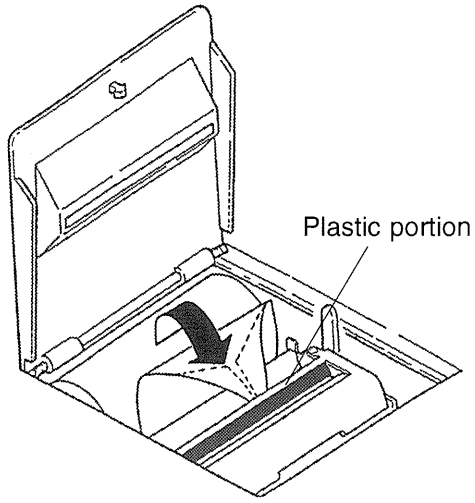
2. Raise the head up/down lever.



3. Insert the attachment into the end of the roll of recording paper and set the paper into its holder.

NOTE

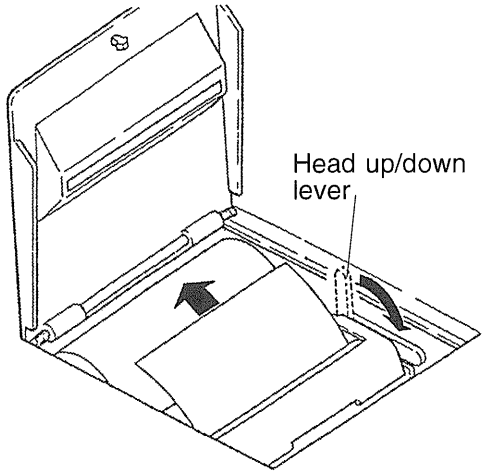
If the recording paper is put in back to front by mistake, the waveform cannot be drawn. (The outside is the front.)



4. Insert the leading edge of the recording paper from the above into the printer gap, and pull it out to the other side.

NOTE

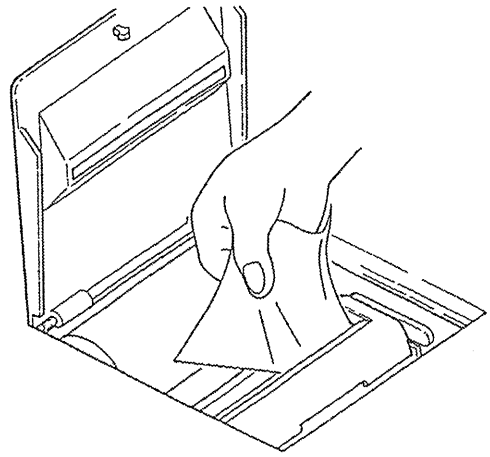
Do not insert it into the gap between the roller and the black plastic portion.



5. Pull the end of the recording paper out at least 10 cm, and make sure that it is positioned quite straight. If the recording paper is not pulled through properly, press the FEED key and feed some more paper through.

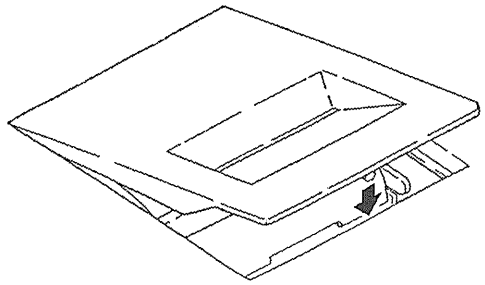
NOTE

If the recording paper is slanted with respect to the roller, there is a danger that later a paper jam will occur.



6. Pull down the head up/down lever.

7. Tear off the recording paper against the edge of the printer exit slot, and finish by closing the stock cover.



NOTE

- If transporting or storing the unit for a long period of time, always put the unit in the head up condition by raising the head up/down lever. If the unit is left to lie in the state where the roller is being subjected to pressure by the head, then the roller may become deformed or the characters may become uneven.
- Please use the Hioki specified recording paper, model 9221.

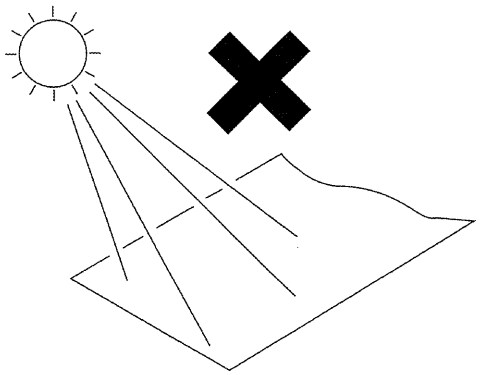
3.4 Care of Recording Paper

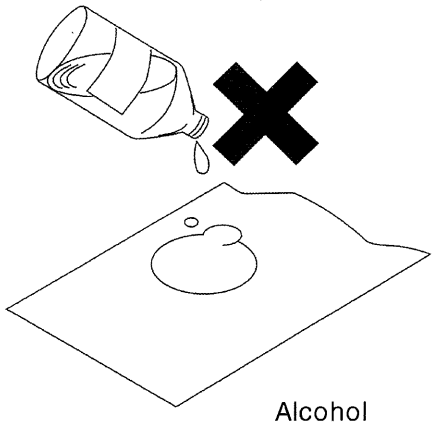
- Thermosensitive recording roll paper which until use is kept in normal conditions will not be affected by the environment. However the paper should not be kept for a long time at a temperature higher than 40℃. Low temperatures cause no problems.
- There is a tendency for the texture of the paper to be discolored if the paper is strongly illuminated for a long time. Therefore, after taking off the wrapping paper, be careful not to leave the roll paper in strong light.

How to store your data

Because the recording paper is thermosensitive paper which takes advantage of thermochemical reactions, attention should be paid to the following points in order to maintain the integrity of the recorded data.

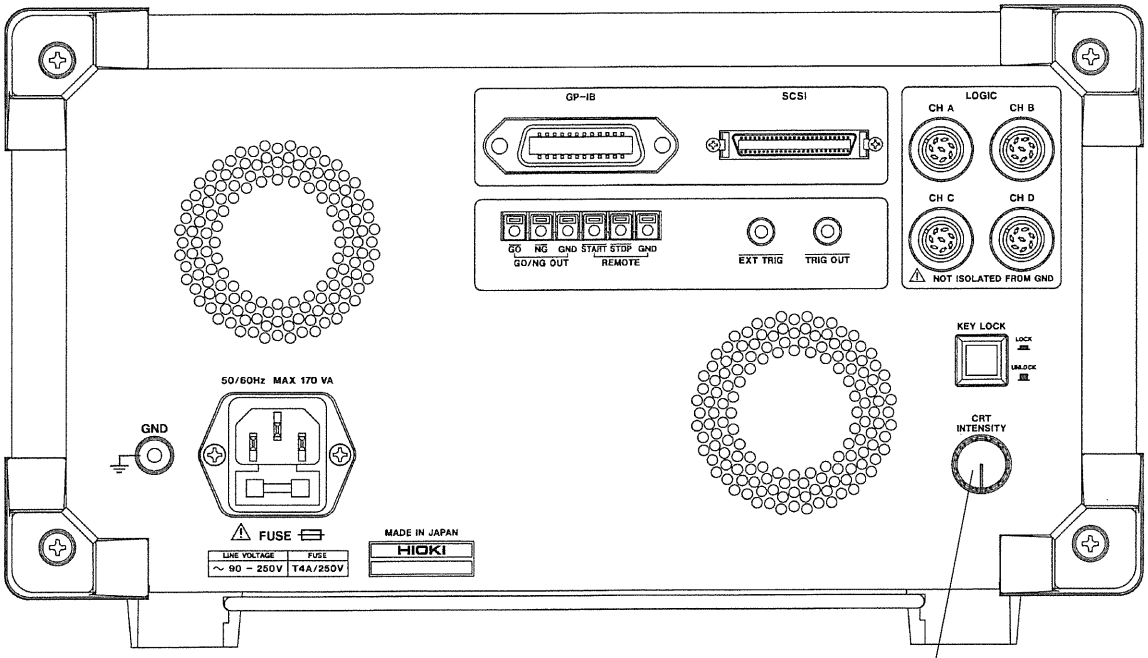
- Do not expose the paper to direct sunlight, or a recording fades.
- Keep the paper in conditions below 40℃ and 90 % relative humidity. The recording paper may discolor except in normal conditions.
- The proper way to file and store recorded data is to take the trouble to copy it.
- Thermosensitive paper changes color if it comes into contact with volatile organic solvents such as alcohols, esters, and ketones.
- Recordings changes color if they and wet diazo copies are put on top of one another.
- If thermosensitive paper absorbs a volatile organic solvent such as an alcohol, an ester, or a ketone, its colorability is reduced, and fading of the recorded portion can occur. Be careful, because various types of pressure sensitive tape such as cling film or adhesive tape are in fact included in this class of volatile organic solvents.





3.5 CRT Intensity

- The display is a gray-scale type. Adjust the intensity for optimum readability.
- To adjust the display turn the CRT INTENSITY knob on the rear panel.
- The lower the intensity, the longer the CRT itself will last.
- Using the screen saver function (see Section 12.5.1) prolongs the CRT life, by turning the display off automatically if no user operation occurs for 10 minutes.



CRT INTENSITY knob

Chapter 4
Settings

4.1 Screen Displays

There are five types of screen displays: status screen, trigger screen, display screen, system screen, and a floppy disk/SCSI control screen.

① Status screen

Press the [STATUS] key

Settings necessary for measurement are made.

② Trigger screen

Press the [TRIG] key.

The trigger types, conditions, and so on are set.

③ Display screen

Press the [DISP] key.

This is a screen for displaying the measured waveform. The main settings can also be made on this screen.

④ System screen

Press the [SYSTEM] key.

The special functions such as scaling and GP-IB settings, and various checking are set.

⑤ Floppy disk/SCSI control screen

Press the [FD] key.

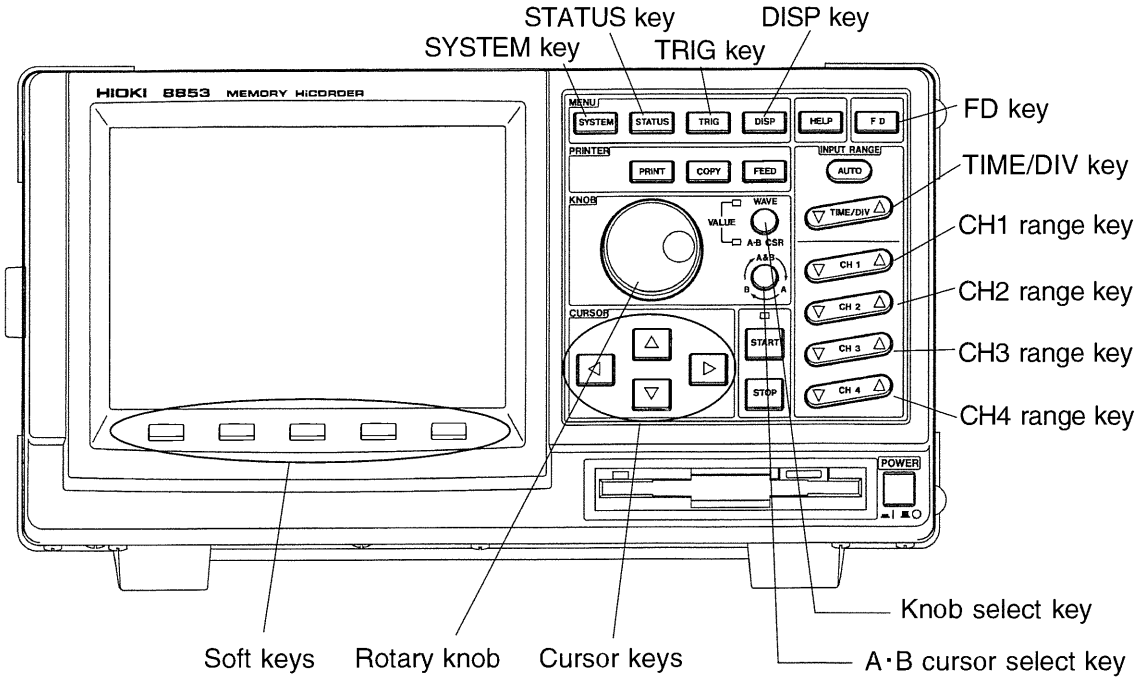
This is a screen for using a floppy disk, a hard disk, and a magneto-optical disk.

(The FD screen or the SCSI screen can be set to appear. See Section 12.5.10.)

4.2 Operation Keys

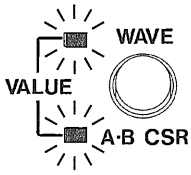
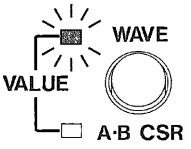
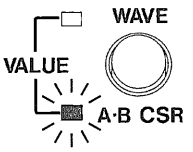
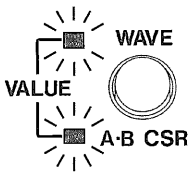
The operation keys for settings are as follows. (Please refer to the figure below.)

① Cursor keys	Use these to move the flashing cursor (flashing portion on the screen).
② Soft keys	Use these to make the required selection for the current item.
③ Rotary knob	Use for moving waveforms and the A and B cursors, and altering numerical values
④ Knob select key	Determines the effect of the rotary knob.
⑤ TIME/DIV key	Sets the time axis range.
⑥ Range key	Sets the voltage axis range for each channel.



Rotary knob

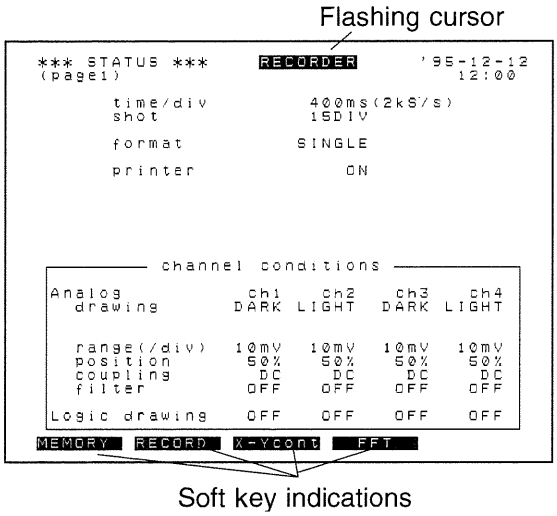
- The function of the rotary knob changes each time the knob select key is pressed.
- To the left of the knob select key are two LED indicators, one above the other. These indicate the current rotary knob function.

Screen	LEDs	Rotary knob operation
Status, Trigger, System, Floppy/SCSI control		**Altering numerical values (VALUE)** When the soft key indications include ↓ and ↑, the rotary knob has the same functions. • Turning the knob clockwise : same effect as the ↑ soft key. • Turning the knob counterclockwise : same effect as the ↓ soft key. Allows input characters to be selected, when inputting comments, file names or scaling units.
Display		**Waveform scrolling (WAVE)** • Turning the knob clockwise : moves the waveform to the right (or up). • Turning the knob counterclockwise : moves the waveform to the left. (or down).
		**Moving the A and B cursors (A·B CSR)** • Turning the knob clockwise : moves the cursor to the right (or up). • Turning the knob counterclockwise : moves the cursor to the left (or down).
		**Altering numerical values (VALUE)** • Turning the knob clockwise : same effect as the ↑ soft key. • Turning the knob counterclockwise : same effect as the ↓ soft key. (When the soft key indications include ↓ and ↑.)

4.3 Making Settings

All settings can be made by using the cursor keys and the soft keys.

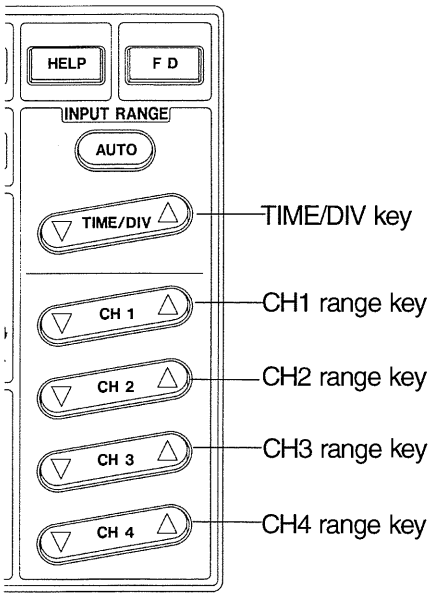
Setting procedure



1. Select the screen to display. (See Section 4.1)
   SYSTEM , STATUS , TRIG , DISP keys
2. Use the cursor keys to move the flashing cursor on the screen to the item to be set.
   ◀ ▶ ▲ ▼ keys
3. The available choices for the item to be set (soft key indications) appear at the bottom of the screen.
   Set the item by pressing the corresponding soft key.

NOTE You can use the TIME/DIVE key and the range keys to set the time axis range and the voltage axis ranges. (These settings can be made on the status or display screen.)

(These settings can be made without moving the flashing cursor.)



Time axis range: ▼ TIME/DIV ▲

Makes the recording slower. Makes the recording faster.

Voltage axis range: ▼ CH 1 to 4 ▲

Decreases the sensitivity. Increases the sensitivity.

Chapter 5
Memory Recorder Function Mode

5.1 What is the Memory Recorder Function?

5.1.1 Introduction

- This function allows you to carry out a variety of operations on an input signal which has been stored in memory.
- Since the data is available in memory there are a large number of different ways of exploiting it.

(1) Storing the input signal in memory, then displaying or recording it.

(2) Recording all input channels on the same time axis.

Since the different signals can be overlaid, it is easy to see the relationships among them.

(3) There is a range of 20 time axis scales, from 400 μs/division to 5 s/division.

(4) Memory capacity (recording length) is a maximum of 2 M words (50000 divisions) (using the channel 1 only).

(5) The pre-trigger function allows the signals before the trigger point to be observed.

(6) Magnified and compressed display and recording are available, both along the time axis and along the voltage axis.

- Along the time axis: ×10, ×5, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50, ×1/100, ×1/200, ×1/500, ×1/1000, ×1/2000, ×1/4000
- Along the voltage axis: ×10, ×5, ×2, ×1, ×1/2

(7) The whole waveform and its magnified section can be observed simultaneously, using the zoom function.

(8) Three different display formats, and four different recording formats can be selected.

- Time axis waveforms : single, dual and quad (quad recording only)
- X-Y format recording and display

(9) High quality printing

The smooth print function provides a smooth printed waveform, close to an analog waveform.

(10) Partial printing

The required section of a stored waveform can be extracted and printed.

(11) Reprint function

Once waveform data is stored, it can be printed as many times as required.

(12) Memory segmentation function

- Dead time when continuously recording transient phenomena can be reduced.
- It is possible to store a maximum of 63 waveforms corresponding to 150 divisions for each channel.

(13) Waveform decision function

It is possible to detect abnormal waveforms.

(14) The wealth of calculation functions

A captured waveform can be analyzed in various different ways.

(15) Averaging function

The sliding average enables noise components to be removed, and the underlying signal observed.

5.1.2 Finding Reference Material in this Manual

(1) Basic functions (See Section 5.3.)

For the basic functions, refer to Sections 5.3.1 to 5.3.22.

(2) Trigger functions (See Chapter 8.)

Depending on the application, there is a wide range of trigger types to choose from.

(3) Memory segmentation function (See Chapter 9.)

- The multi-block memory function allows memory to be segmented, and the different blocks to be used for different purposes.
- The sequential save function allows dead time when continuously recording sudden phenomena to be reduced.

(4) Waveform decision functions (See Chapter 10.)

- The input signal waveform decision is based on an arbitrary user-specified area.
- This allows abnormal waveforms to be detected and recorded.

(5) Calculation functions (See Chapter 11.)

A wide range of functions is provided, from arithmetic operations to differentiation and integration computations.

(6) Using floppy disks, hard disks, and magneto-optical disks (See Chapter 13.)

- The floppy disk, hard disk, and magneto-optical disk drive provide a storage mechanism for setting information, measurement data and waveform decision areas.
- Using the auto save function, waveform data collected during operation is automatically saved to any of floppy disk, hard disk, and magneto-optical disk.

(7) Scaling function (See Section 12.3, "Scaling Function.")

This allows the input voltages to be converted to other values and units, so that the physical quantities originally measured can be read off directly.

(8) Comment function (See Section 12.4, "Adding Comments.")

This provides a convenient means of annotating printed recordings.

(9) Screen auto off function (See Section 12.5, "Special Function Settings.")

Turns the display off automatically if no user operation occurs for 10 minutes.

(10) Grid setting (See Section 12.5.)

The grid can be selected as required, both on the screen and on the printed recording.

(11) Start key backup function (See Section 12.5.)

If the power supply fails during recording, enabling this function causes recording to restart when the power is restored.

(12) Channel marker function (See Section 12.5.)

Prints the channel numbers on the recording.

(13) Beep sound setting (See Section 12.5.)

When an error occurs, when a warning is issued, or when a waveform decision produces the result NG (fail), it is possible to arrange for a "beep" sound to be produced.

(14) List and gauge functions (See Section 12.5.)

Voltage axis scales and listings of settings on printed recordings.

(15) Channel selection (See Section 12.5.)

The unit can operate with one, two or four channels in use.

(16) Setting intensity of logic waveform display and recording (See Section 12.5.)

(17) The hard copy size of the screen can be set. (See Section 12.5.)

(18) Roll mode function (See Section 5.3.21, "Roll Mode".)

This allows waveform display to start as data capture begins after a trigger.

(19) Connection to a computer via the GP-IB interface (See 8853 FFT Function·GP-IB Interface Instruction Manual.)

(20) Output to an external plotter (See 8853 FFT Function·GP-IB Interface Instruction Manual.)

(21) Self check functions (See Section 12.8, "Self Check Functions.")

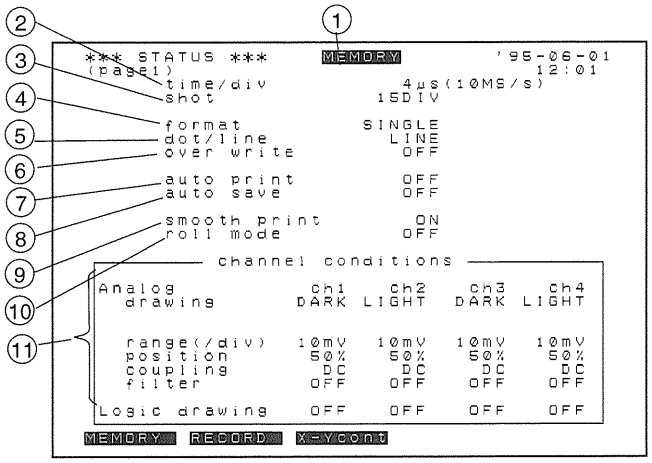
This performs simple tests on the unit's functioning.

5.2 Display Screens

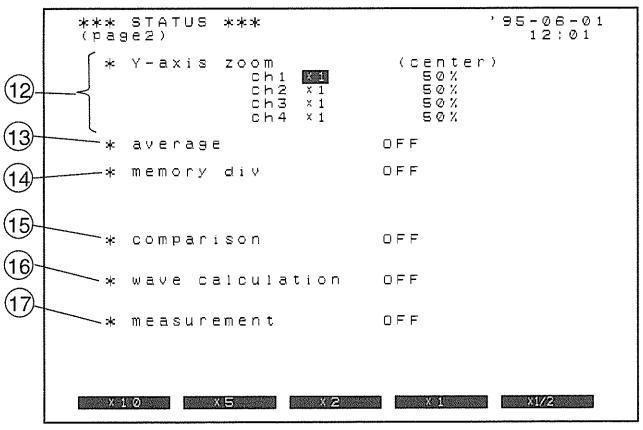
- This section describes the status, trigger and display screens.
- It shows you where to look in this manual for further explanation of specific items.
- The system screen is described in Chapter 12, and the floppy disk and SCSI control screens are described in Chapter 13.

5.2.1 Status Screen (STATUS)

- Press the STATUS key, and the status screen appears.
- Pressing the STATUS key alternately switches page 1 and page 2.
- On page 1, the basic settings for measurements are made.
- On page 2, settings of magnification and compression of the voltage axis, memory segmentation, waveform decision, waveform calculation etc. are made.



page 1

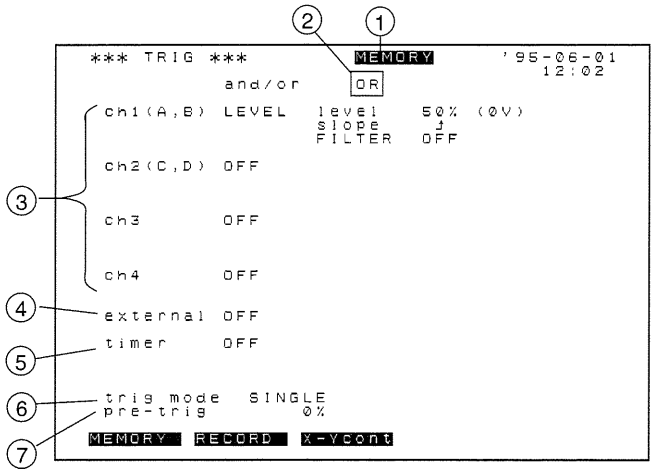


page 2

① Function mode (See Section 5.3.2.)
② Time axis range (See Section 5.3.3.)
③ Recording length (See Section 5.3.4.)
④ Format (See Section 5.3.5.)
⑤ Interpolation function (See Section 5.3.7.)
⑥ Superimposition function (See Section 5.3.18.)
⑦ Auto-print (See Section 5.3.20.)
⑧ Auto-save (See Section 13.9.)
⑨ Smooth print (See Section 5.3.20.)
⑩ Roll mode (See Section 5.3.21.)
⑪ Channel settings (See Sections 5.3.8 and 5.3.9.)
⑫ Magnification and compression of the voltage axis (See Section 5.3.16.)
⑬ Averaging (See Section 5.3.19.)
⑭ Memory segmentation function (See Chapter 9.)
⑮ Waveform decision function (See Chapter 10.)
⑯ Waveform processing calculation (See Chapter 11.)
⑰ Waveform parameter calculation (See Chapter 11.)

5.2.2 Trigger Screen (TRIG)

· Press the [TRIG] key, and the trigger screen appears.
· See Chapter 8, "Trigger Functions" for more details.

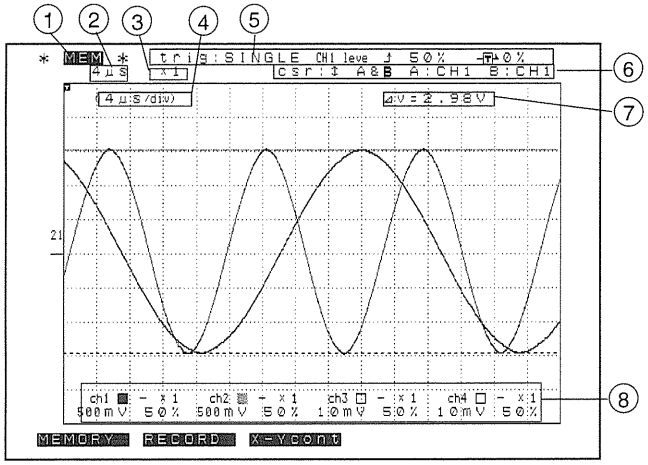


① Function mode (See Section 5.3.2.)
② Trigger logical operator (See Chapter 8.)
③ Internal triggers (See Chapter 8.)
④ External trigger (See Chapter 8.)
⑤ Timer trigger (See Chapter 8.)
⑥ Trigger mode (See Chapter 8.)
⑦ Pre-trigger (See Chapter 8.)

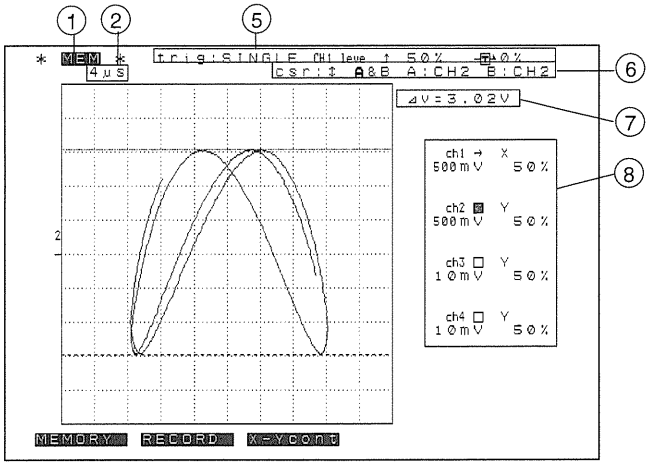
Trigger settings will be described in Chapter 8.

5.2.3 Display Screen (DISP)

- Press the DISP key, and the display screen appears.
- The figures below illustrate displays in SINGLE format and X-Y format.
- For details of other formats, see Section 5.3.5, "Format Selection."



SINGLE format



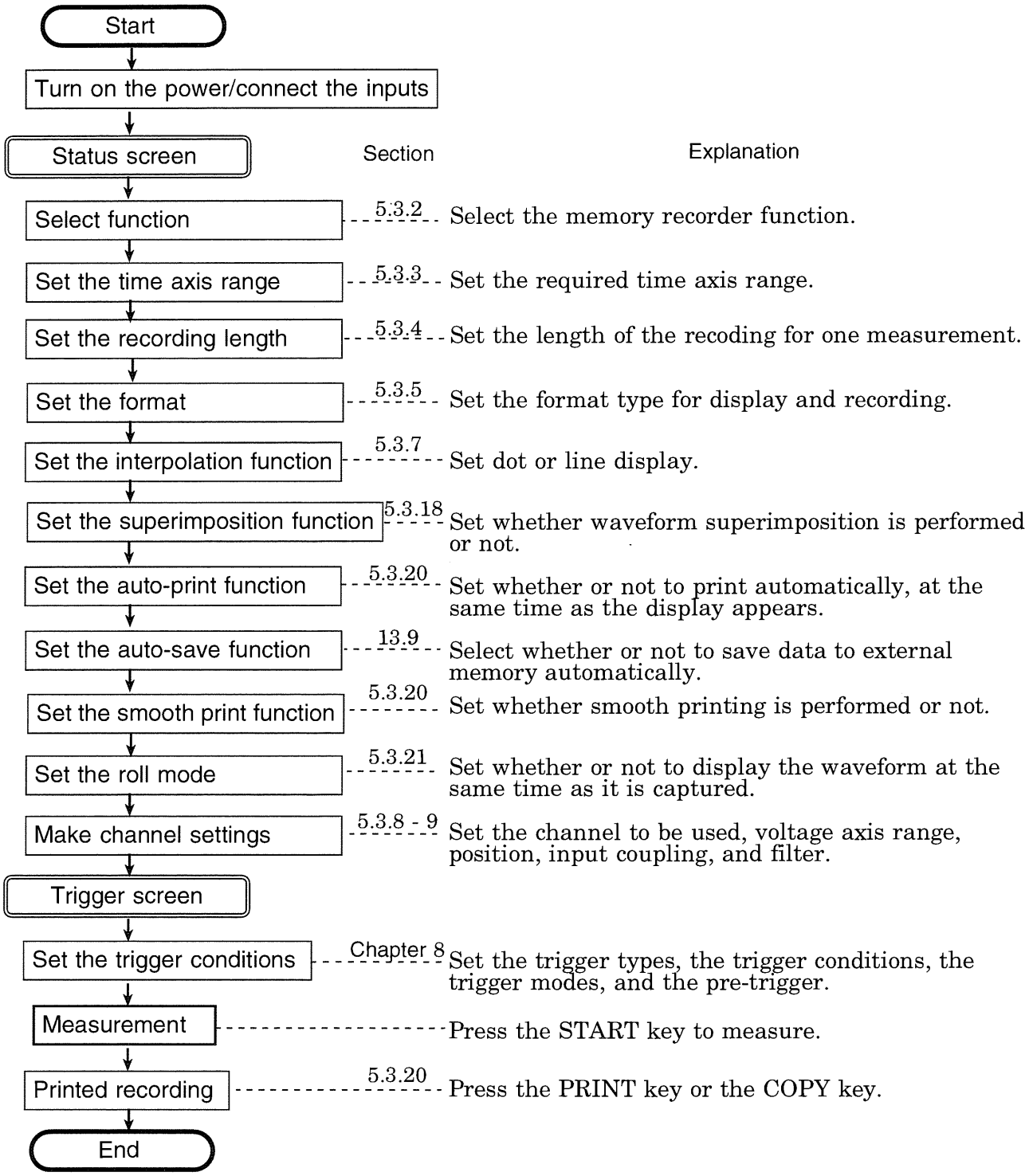
X-Y format

① Function mode (See Section 5.3.2.)
② Time axis range (See Section 5.3.3.)
③ Magnification and compression of the time axis (See Section 5.3.14.)
④ Time per one division (See Section 5.3.14.)
⑤ Trigger settings (See Chapter 8.)
⑥ A and B cursor settings (See Section 5.3.13.)
⑦ A and B cursor readout value (See Section 5.3.13.)
⑧ Channel information (See Sections 5.3.8 and 5.3.9.)

5.3 User Operations

5.3.1 Operational Flow

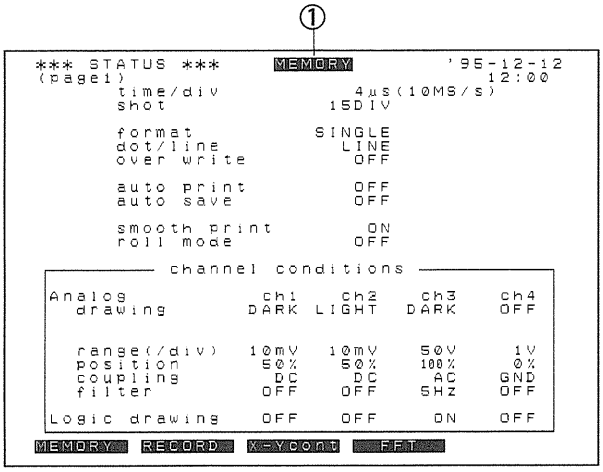
The flowchart below illustrates the sequence of operations involved in using the memory recorder function. (See Section 5.4 for operation example.)



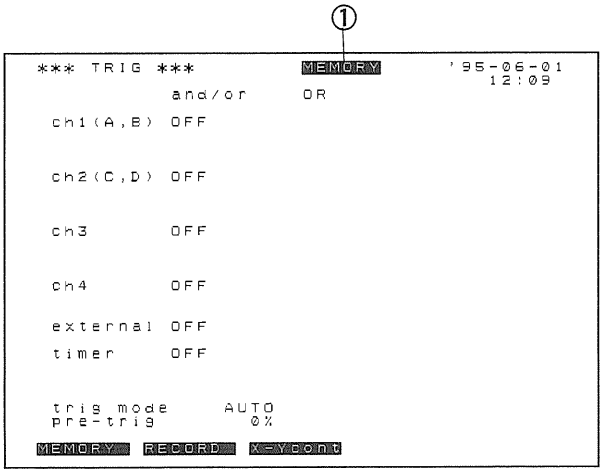
5.3.2 Function Selection

- The 8853 has four functions: memory recorder, recorder (Chapter 6), X-Y recorder (Chapter 7), and FFT (see FFT Function·GP-IB Interface Instruction Manual).
- In this case, select the memory recorder function.

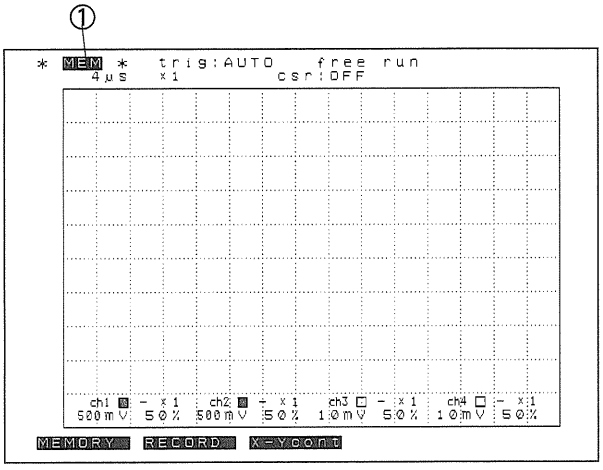
Procedure (Setting screen: status (page 1), trigger and display)



Status screen (page 1)



Trigger screen



Display screen

1. Using the cursor keys, move the flashing cursor to ① as shown in the figure on the left.
2. Press the **MEMORY** soft key.
   This selects the memory recorder function.

Soft key indication

MEMORY : Memory recorder function
RECORD : Recorder function
X-Ycont : X-Y recorder function
FFT : FFT function

NOTE

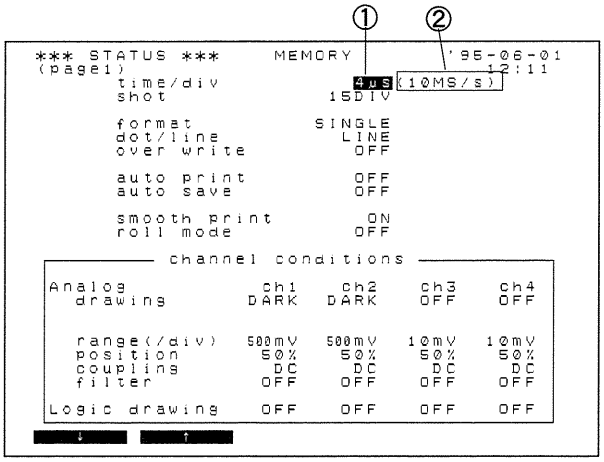
The function indication in ① on the display screen is abbreviated:

MEM : MEMORY
REC : RECORDER
XYc : X-Ycont

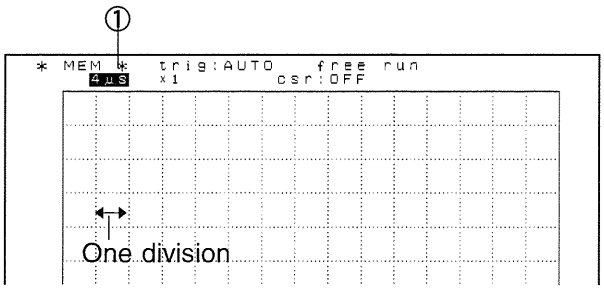
5.3.3 Time Axis Range Setting (time/div)

- This sets the speed at which the input signal waveform is captured.
- The value to be set is the time for one division. (One grid in the graph is one division.)
- The sampling period is 1/40 of the time axis range setting. (See the table in Background information (3).)

Procedure (Setting screen: status (page 1)and display)



Status screen (page 1)



Display screen

1. Using the cursor keys, move the flashing cursor to the "time/div" item, ① in the figures on the left and the left below.
2. By using the soft keys or the rotary knob (VALUE), set the time axis range.

   The sampling rate is indicated in ② in the figure above.

   [4 µs, 5 µs, 10 µs, 20 µs, 50 µs, 100 µs, 200 µs, 500 µs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s]

You can also use the (▼TIME/DIV▲) key, without moving the flashing cursor.

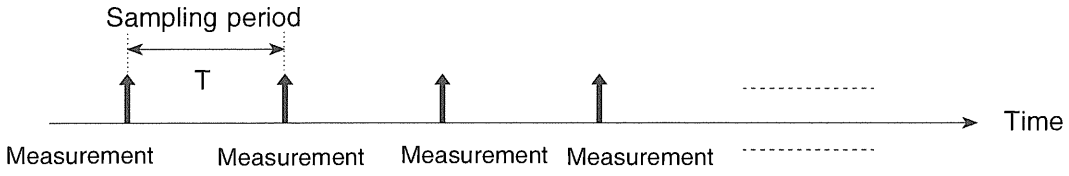
NOTE If using the rotary knob, set the rotary knob operation to "Altering numerical value (VALUE)"; (two LEDs light). See Section 4.2, "Operation Keys".

Related items
- Setting the recording length longer makes the measurement time longer.
- If using the roll mode function, the waveform display begins at the point that the trigger starts data capture, thus reducing waiting time. For more details, see Section 5.3.21, "Roll Mode."

Background

(1) Sampling

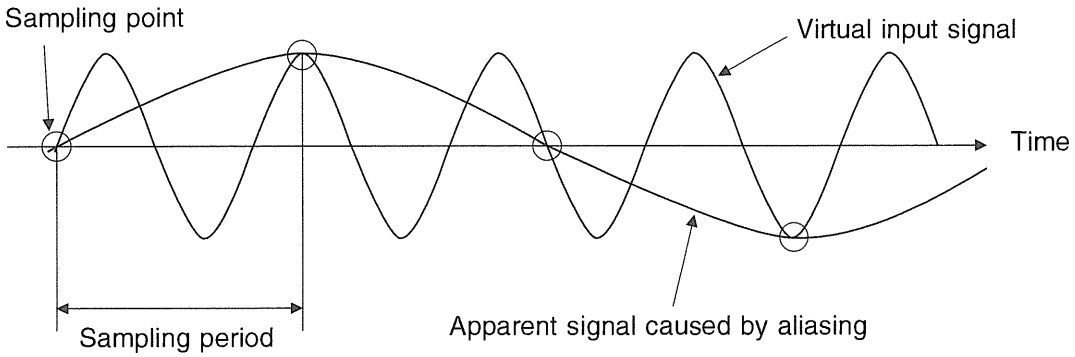
- The 8853 converts the input signal to a digital value, then carries out all internal processing digitally. This process of converting an analog signal to digital values is termed sampling.
- Sampling measures the magnitude of the signal at fixed time intervals (sampling periods).



- The rate of taking these measurements is termed the sampling rate.
- The units are S/s, read as samples per second.
- This is the reciprocal of the sampling period. (1/T)

(2) Aliasing

- If the frequency of the signal being measured is significantly higher than the sampling rate, it is possible for sampling to produce an apparent signal which is actually nonexistent. This phenomenon is termed aliasing.

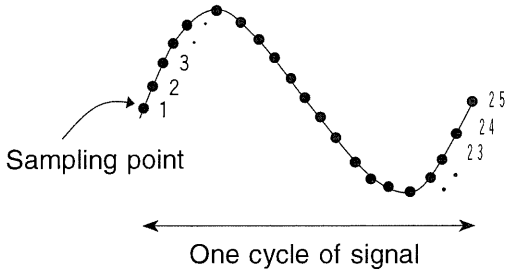


- When using the memory recorder function, because the sampling period for the time axis range may vary widely, care should be taken in setting the range not to produce aliasing.
- The measurement limit frequency (see the next page) is determined by the setting of the time axis range. In any event, it is always best to use the highest practicable sampling rate.
- When measuring a repeating signal, using the auto ranging function is another useful technique. See Section 5.3.17, "Auto Ranging Function."

(3) Measurement limit frequency (The frequency, when 25 samples per period is taken as the limit.)

· As a general rule, to ensure that sampling catches the peaks of a typical sine wave input on the display, more than 25 samples are required for each input cycle. (Display : 8-bit resolution)

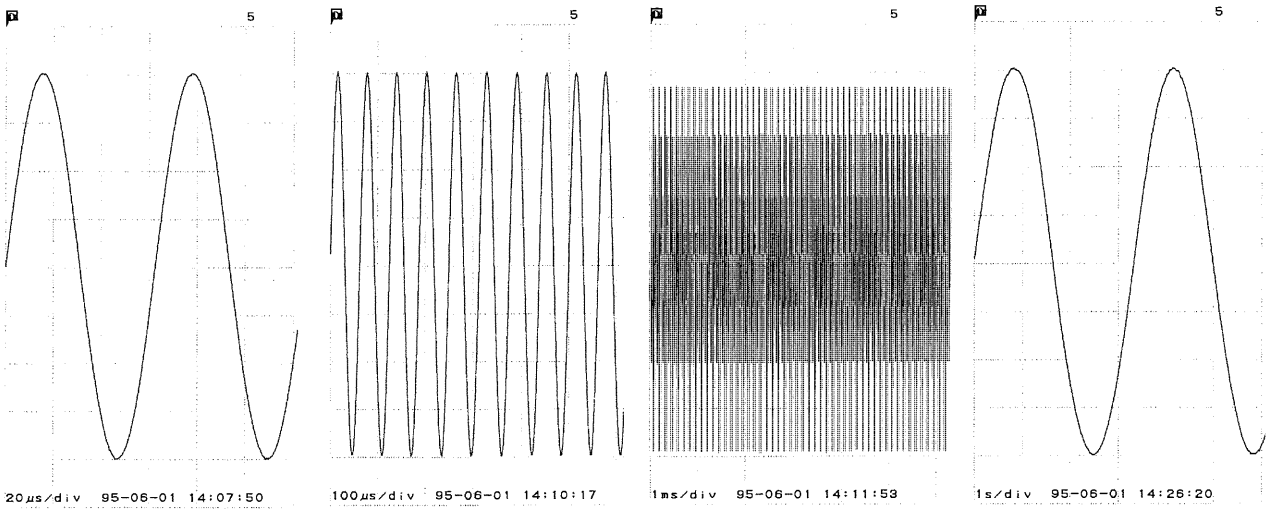
· The measurement limit frequency changes depending on the time axis range.



Time axis range	Sampling period	Measurement limit frequency	Time axis range	Sampling period	Measurement limit frequency
4 μs/DIV	100 ns	400 kHz	5 ms/DIV	125 μs	320 Hz
5	125	320	10	250	160
10	250	160	20	500	80
20	500	80	50	1.25 ms	32
50	1.25 μs	32	100	2.5	16
100	2.5	16	200	5	8
200	5	8	500	12.5	3.2
500	12.5	3.2	1 s/DIV	25	1.6
1 ms/DIV	25	1.6	2	50	0.8
2	50	800 Hz	5	125	0.32

(Note) To display a wave input with 12-bit resolution, more than 100 samples are required for each input cycle.
The measurement limit frequency in this case is one fourth of the frequency in the table above.

Example Recording a sine waveform of about 16 kHz with different time axis ranges.

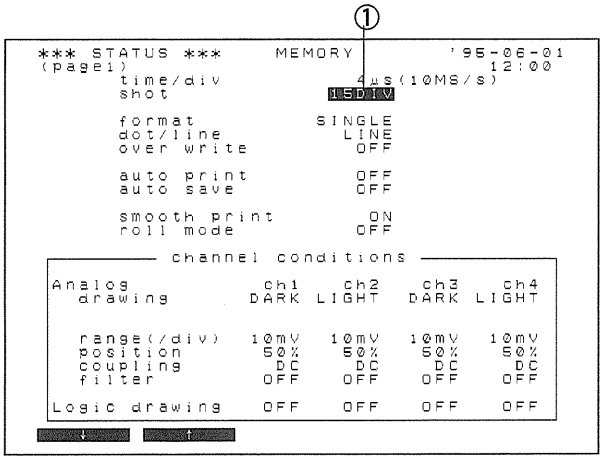


20 μs/division	100 μs/division	1 ms/division	1 s/division
Correct waveform	Almost the measurement limit frequency	The peaks are not reproduced.	Aliasing (A signal of about 300 mHz is observed.)

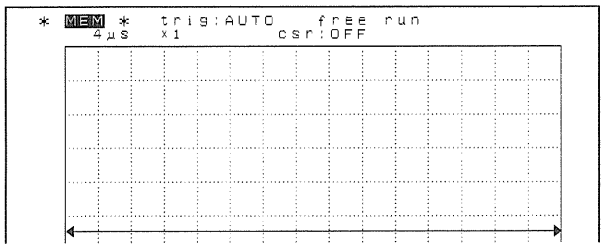
5.3.4 Recording Length Selection (shot)

· Sets the recording length (number of divisions) for a single shot measurement.
· One grid in the graph on the screen is one division.

Procedure (Setting screen: status (page 1))



Status screen (page 1)



15 divisions

1. Using the cursor keys, move the flashing cursor to the "shot" item, ① as shown in the figure on the left.
2. By using the soft keys or the rotary knob, set the recording length.

   [15, 30, 75, 150, 300, 750, 1500, 3000, 6000, 12500, 25000(*1, *2), 50000(*2)] (unit : divisions)

   (*1) setting the number of channels to be used to two channels

   (*2) setting the number of channel to be used to one channel

For more details, see Section 12.5.8, "Channel Selection."

The screen is 15 divisions. (In X-Y format, 10 divisions)

NOTE

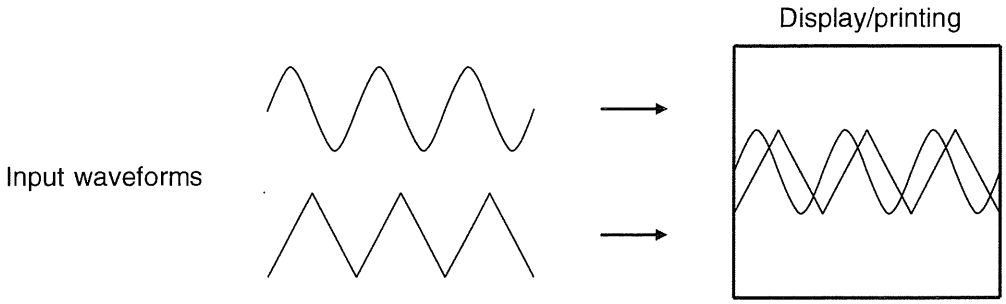
· If performing averaging, the upper limit on the recording length is 3000 divisions. See Section 5.3.19, "Averaging Function Setting".
· If performing waveform calculations, the upper limit on the recording length is 1500 divisions. See Section 11.2, "Waveform Processing Calculation".

5.3.5 Format Selection (format)

- Set the format for showing input waveforms on the screen display and recording them on the printer.
- There are four possibilities: SINGLE, DUAL, DUAL (print QUAD), and X-Y.

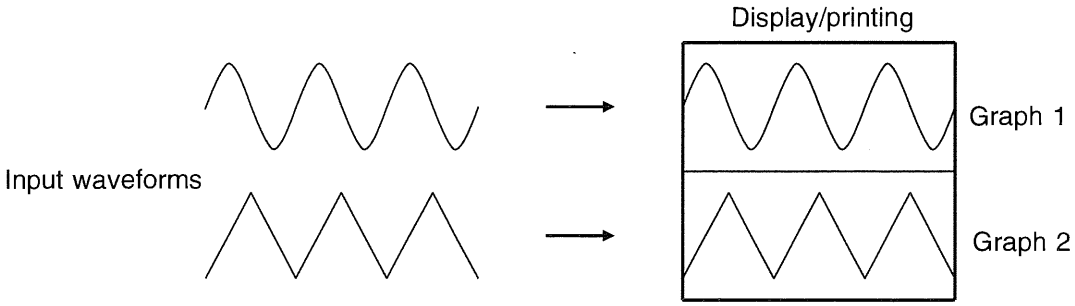
(1) SINGLE format

Display and record as one graph.



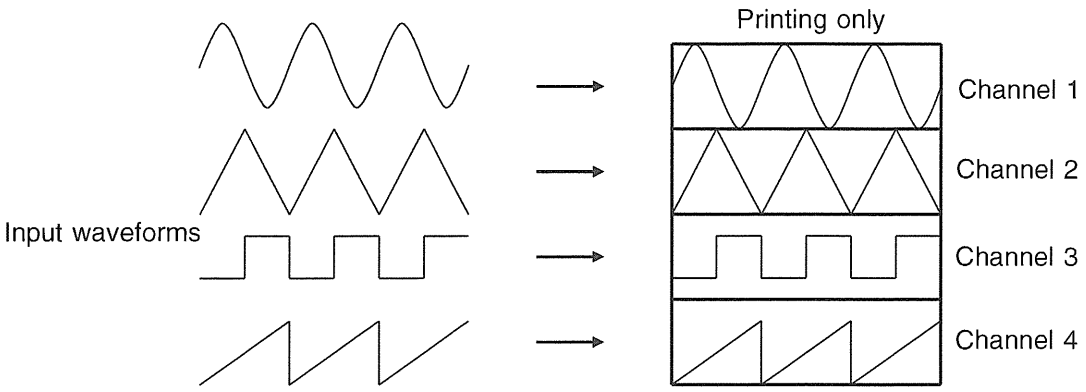
(2) DUAL format

Display and record as two graphs, one above the other.



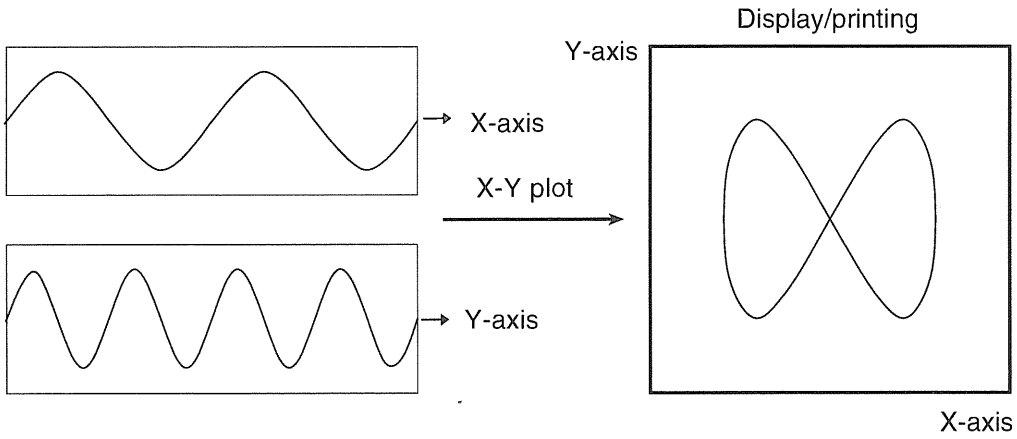
(3) DUAL (print QUAD) format

- Prints as four graphs.
- The display format is the same as in DUAL format.

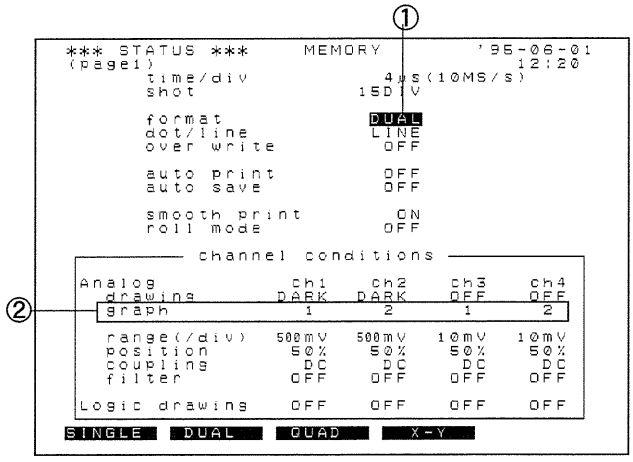


(4) X-Y format

- The waveforms are printed and displayed as X-Y plots. (Maximum three X-Y combinations)
- One analog input is assigned to the x-axis.



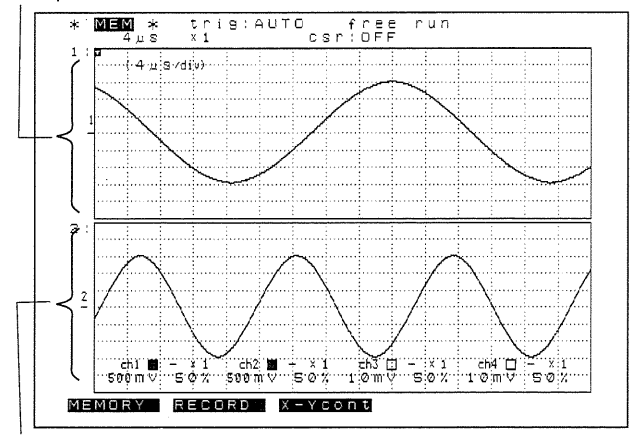
Procedure (Setting screen: status (page 1))



Status screen

1. Move the flashing cursor to the "format" item, ① in the figure on the left.
2. By using the soft keys, select the format.
   [SINGLE, DUAL, QUAD, X-Y]
   QUAD : DUAL (print QUAD)

Graph 1



Graph 2 DUAL format

3. If DUAL or DUAL (print QUAD) format was selected, set on which of the upper or lower graph the waveform of each channel will be displayed.

(1) Move the flashing cursor to the "graph" item, ② for each channel.

(2) By using the soft keys, select the graph.

Soft key indication

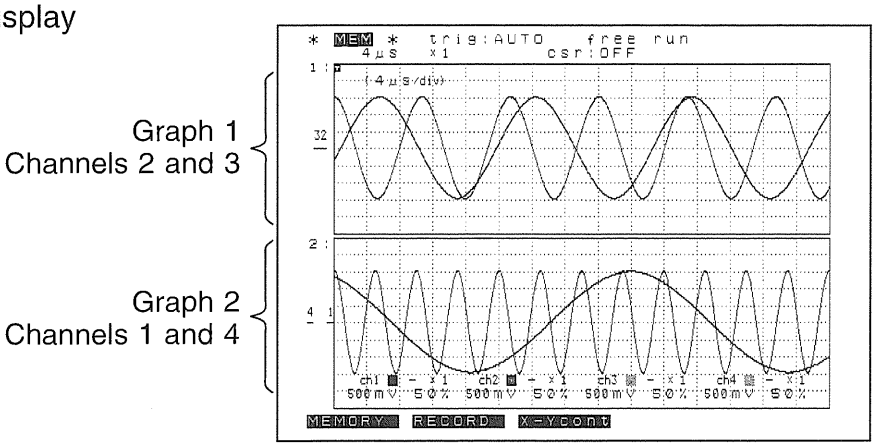
1 : Graph 1 (upper)
2 : Graph 2 (lower)

NOTE

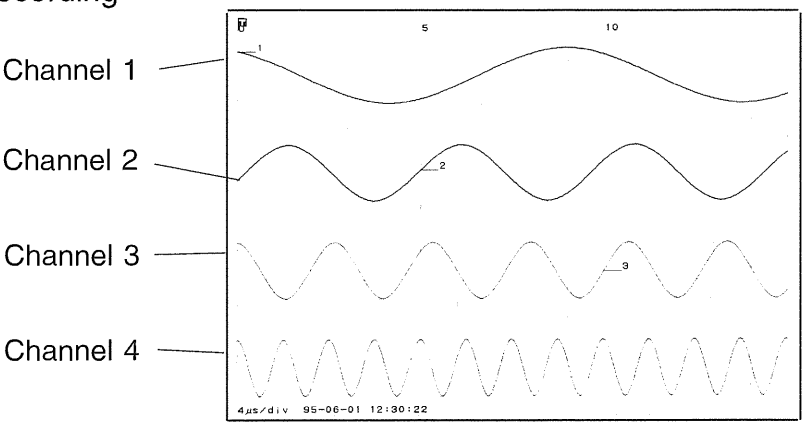
- The logic channel display and recording positions are not variable. See NOTE, b in Section 5.3.8.
- In DUAL (print QUAD) format, the four channels are printed out in sequence channel 1 to channel 4, regardless of their positions (in the graph 1 or 2) on the screen.

Example

Display



Printed recording



Although channels 2 and 3, and channels 1 and 4 are displayed in the graph 1 and graph 2 respectively on the screen, the four channels are printed in sequence channel 1 to channel 4.

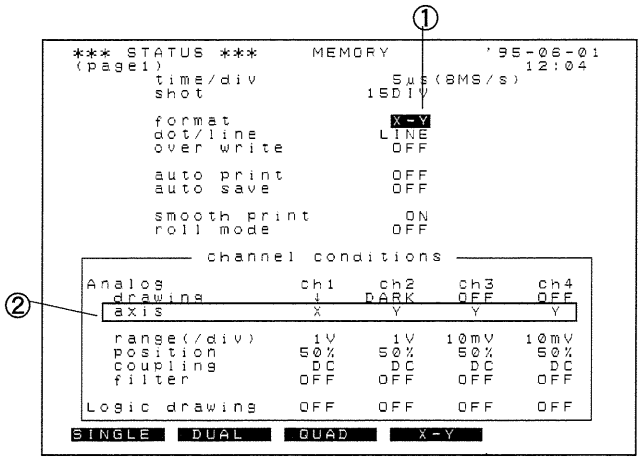
5.3.6 Using X-Y Waveform Plots

- Setting the format to X-Y allows for X-Y combination of waveforms. (Maximum three X-Y combinations)
- The X-Y plots are displayed or printed, with one channel assigned to the x-axis and the other channels assigned to the y-axis.
- Magnification and compression along the voltage axis remain in effect in X-Y format.
- There are two types: normal X-Y plot and partial X-Y plot.

(1) Normal X-Y plot

The X-Y plot is formed using the data for the entire recording length.

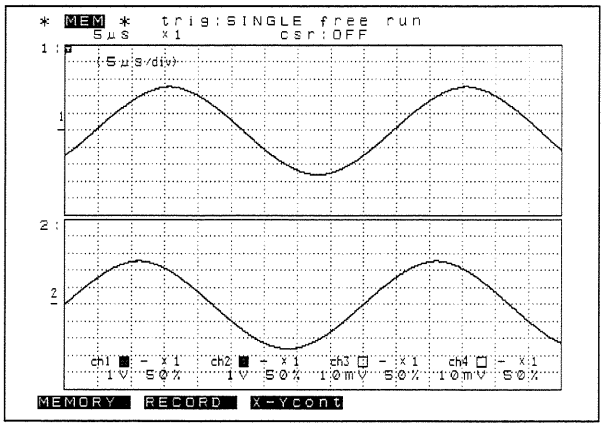
Procedure (Setting screen: status (page 1))



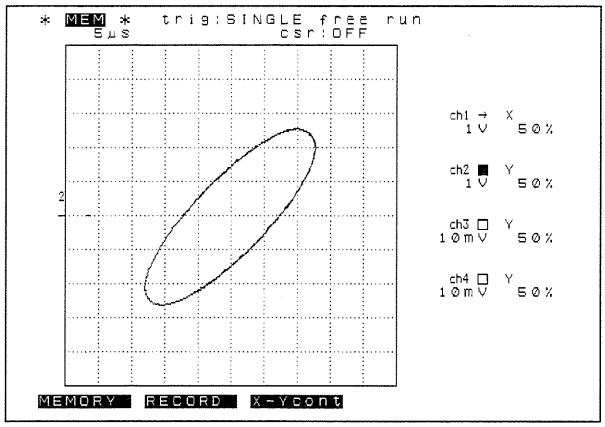
Status screen (page 1)

1. Move the flashing cursor to the "format" item, ① as shown in the figure on the left.
2. Press the **X-Y** soft key to set the format to X-Y.
3. Move the flashing cursor to the "axis" item, ② for the channel to be assigned to the x-axis.
4. Pressing the **(X set)** soft key assigns the channel to the x-axis.

   (The other three channels are automatically assigned to the y-axis.)



DUAL format



X-Y format

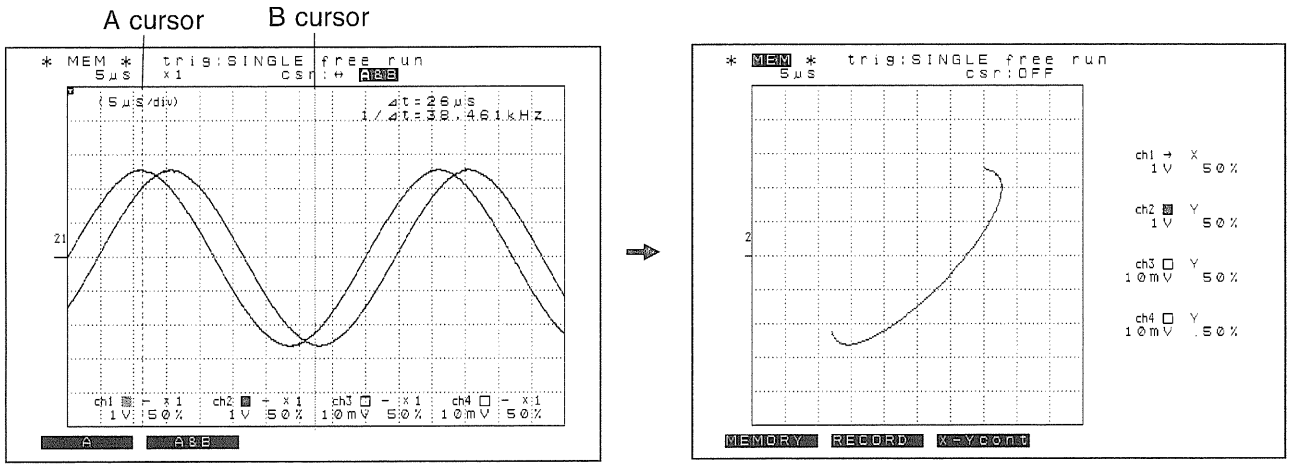
(2) Partial X-Y plot

The X-Y plot is made only for the waveform between the A and B cursors.

Procedure (Setting screen: display and status (page 1))

1. Capture the waveform data in any of SINGLE, DUAL, or DUAL (print QUAD) format.
2. Using the A and B cursors (vertical cursors or trace cursors), specify the range of data for which the X-Y plot is to be made.
   - Using the A cursor only: from the A cursor to the end of the waveform
   - Using both A and B cursors: between the A and B cursors
   See Section 5.3.13, "Using A and B Cursors."
3. Press the [STATUS] key, and the status screen appears.
4. The remainder of the operation is the same as for a normal X-Y plot.

   Continue from step 1 of the procedure for (1) "Normal X-Y plot."



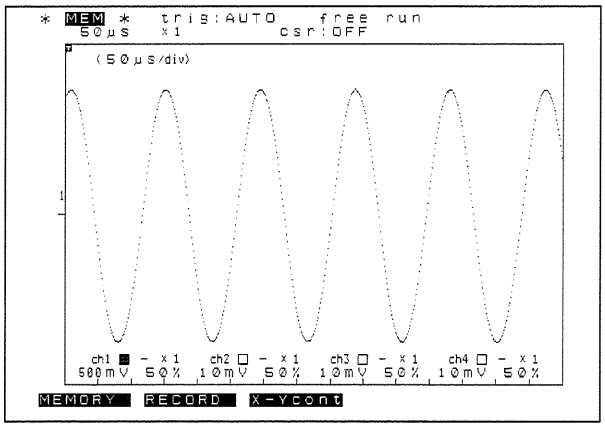
SINGLE format X-Y format

NOTE

- Each X-Y plot is drawn with the "Analog drawing" intensity setting for the respective y-axis channel. (See Section 5.3.8, "Display and Recording Channel Settings.")
- The "Analog drawing" setting for the x-axis channel is indicated as "↓"(on the status screen), or "→" (on the display screen).
- You can switch between the time axis and X-Y displays simply by changing the format setting.

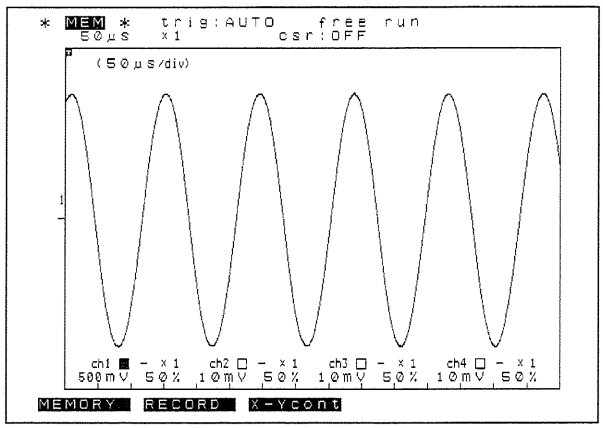
5.3.7 Interpolation Setting (dot/line)

This function determines whether to display and record the sampled data as detached points (dot mode) or with straight-line interpolation (line mode).



Dot mode

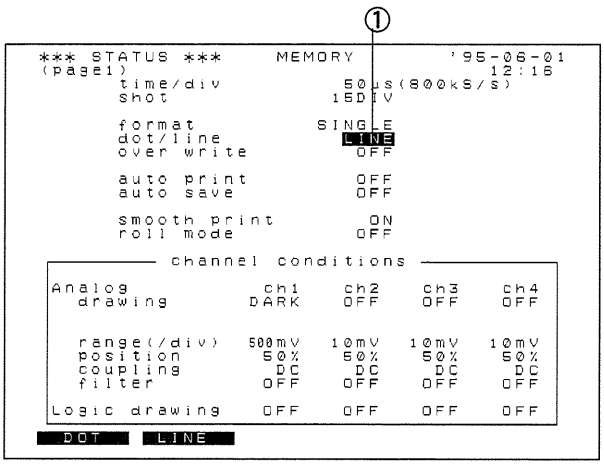
- No linear interpolation.
- The sampled values are displayed exactly as measured.



Line mode

- Linear interpolation.
- This gives a more readable display.

Procedure (Setting screen: status (page 1))



Status screen (page 1)

1. Move the flashing cursor to the "dot/line" item, ① as shown in the figure on the left.
2. Set the interpolation function by using the soft keys.

Soft key indication

DOT : Dot mode
LINE : Line mode

NOTE

- This setting affects the display only, and is therefore effective for previously captured data.
- Logic channel displays are not affected by this setting. They are always subject to linear interpolation between samples.
- In dot mode, compressing the time axis using a long recording length, changing the line display intensity (DARK/LIGHT) etc. can take a long time. The recommended procedure is to adjust the display settings using line mode initially, and then switch to dot mode if required.

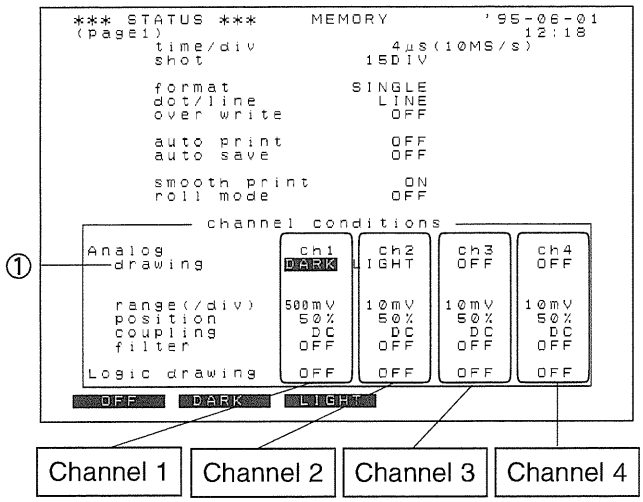
5.3.8 Display and Recording Channel Settings

- The maximum of four analog channels and 16 logic channels are available on the 8853.
- These settings determine which channels are displayed or recorded.
- The four analog channels can each be set independently.
- The 16 logic channels can only be set in groups of four.

Procedure (Setting screen: status (page 1) and display)

(1) On the status screen (page 1)

① Analog channels



Settings for each channel

1. Using the cursor keys, move the flashing cursor to the "Analog drawing" item, ① as shown in the figure on the left
2. Make settings for display and recording for each channel by using the soft keys.

Soft key indication

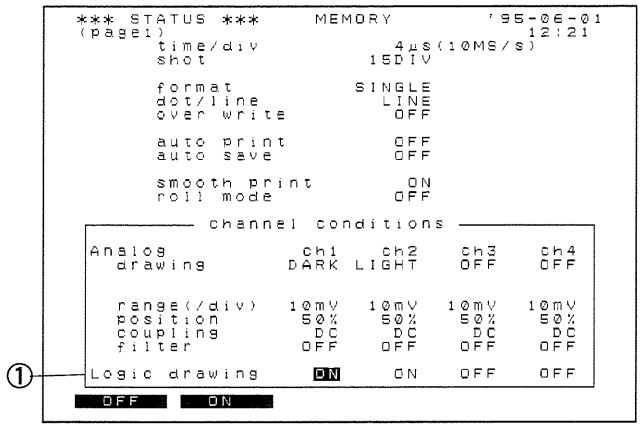
OFF : No display or recording
DARK : High intensity display, bold printed recording
LIGHT : Low intensity display, fine printed recording

The "range", "position", "coupling", and "filter" items will be described in Section 5.3.9.

NOTE

- For the channels with no input units installed, the indication "—" appears.
- In DUAL or DUAL(print QUAD) format, the "graph" item also appears, below the "drawing" item. (See Section 5.3.5.)
- In X-Y format, the "axis" item also appears below the "drawing" item, indicating the channel which is assigned to the x-axis as "↓". (See Section 5.3.6.)

② Logic channels



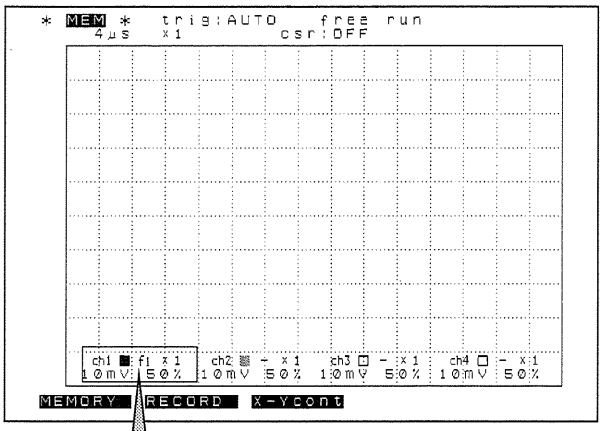
Status screen (page 1)

1. Move the flashing cursor to the "Logic drawing" item, ① as shown in the figure on the left.
2. Enable or disable display and recording of the logic channels by using the soft keys. (in groups of four channels)

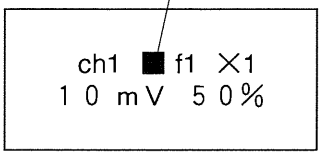
   [OFF,ON]

The groups of four channels under channels 1 to 4 correspond to the connectors CHA, CHB, CHC and CHD on the rear panel. (See Section 15.1.1.)

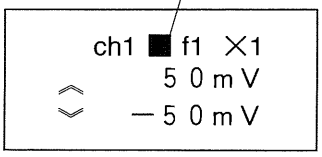
(2) On the display screen



Input unit information ①



Scale information ①



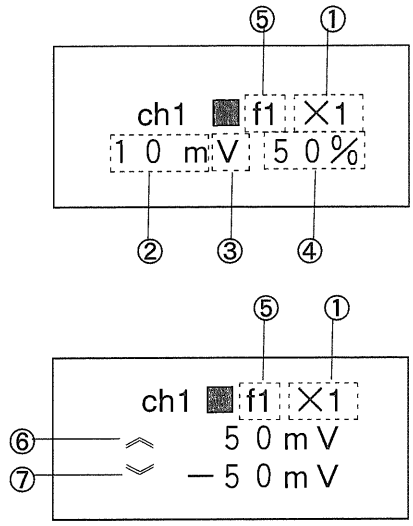
1. Move the flashing cursor to ① as shown in the figure on the left below for each channel.
2. For each analog channel or group of four logic channels, make settings for display and recording by using the soft keys.

   You can also select whether to display input unit information or scale information at the bottom of the screen.

Soft key indication — Indication of ① as shown in the figure on the left.

- **OFF** : No display or recording
- **DARK** : High intensity display and recording
- **LIGHT** : Low intensity display and recording
- **(scale)** : Switches to the scale information at the bottom of the screen.
- **(unit)** : Switches to the input unit information at the bottom of the screen.
- **(logic)** : Enables or disables display and recording of the logic channels (in groups of four channels).

The groups of four channels under channels 1 to 4 correspond to the connectors CHA, CHB, CHC and CHD on the rear panel. (Pressing the **(logic)** soft key toggles the setting on or off.)



Input unit information

① Magnification/compression ratio along the voltage axis (See Section 5.3.16.)
② Voltage axis range (See Section 5.3.9.)
③ Input coupling (See Section 5.3.9.)
④ Position (See Section 5.3.9.)
⑤ Filter (See Section 5.3.9.)

The soft key indication changes to **(scale)** .

Scale information

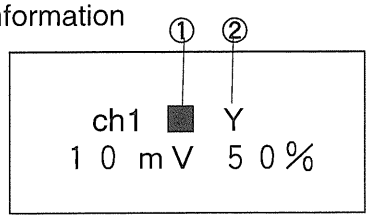
① Magnification/compression ratio along the voltage axis (See Section 5.3.16.)
⑤ Filter (See Section 5.3.9.)
⑥ Top value on the vertical axis
⑦ Bottom value on the vertical axis

The soft key indication changes to **(unit)** .

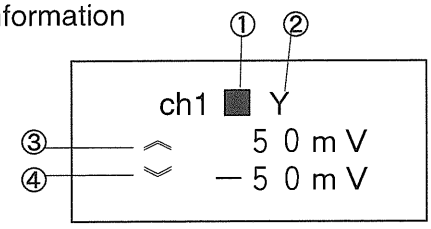
In X-Y format

The input unit information and the scale information are displayed in the right part of the screen.

Input unit information



Scale information



1. Move the flashing cursor to ① for the channel assigned to the y-axis.
   (X and Y indicate the x-axis and the y-axis in ②.)
2. Make settings for display and recording for each channel assigned to the y-axis, by using the soft keys.

- The scale information shows ③ the rightmost value and ④ the leftmost value, for the channel assigned to the x-axis, and ③ the top value and ④ the bottom value, for the channel assigned to the y-axis.
- The channel assigned to the y-axis determines intensity.
- For the channel assigned to the x-axis, the indication "→" appears in ①. (The flashing cursor skips this position.)
- For the channels with no input units installed, nothing is displayed.
- Switching between the scale and unit information affects all channels together.

NOTE

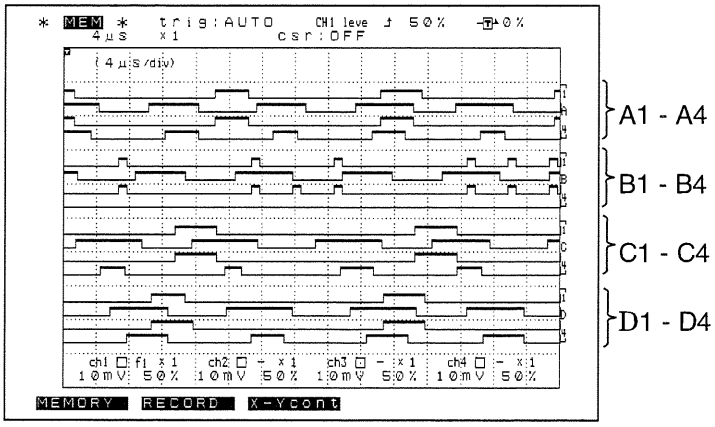
a. Scale information

- The scale information shows the range of values of the voltage axis range and the position actually appearing on the screen when capturing the waveform data.
- Even if you change the input unit range and position settings, the values are not changed.
- If the scaling function is enabled, the scale information shows the values after scaling. (See Section 12.3, "Scaling Function.")

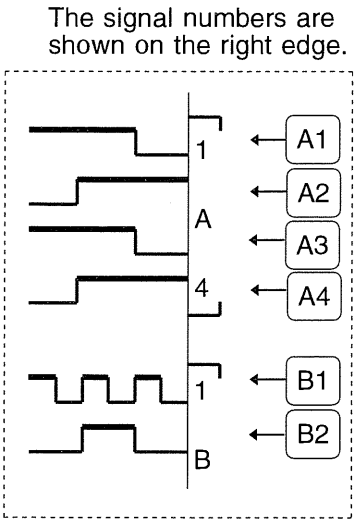
b. Position of logic channel displays

- In any format, the 16 logic channels are displayed in the order A1 to A4, B1 to B4, C1 to C4, and D1 to D4 from top to bottom. (Channels A1 to A4 correspond to the CHA connector on the rear panel. B, C, and D are similar.)
- When no logic probe is connected, the signals are always high level.
- Brightness of logic waveforms can be set in the "Logic drawing" item on the system screen. (See Section 12.5.7.)

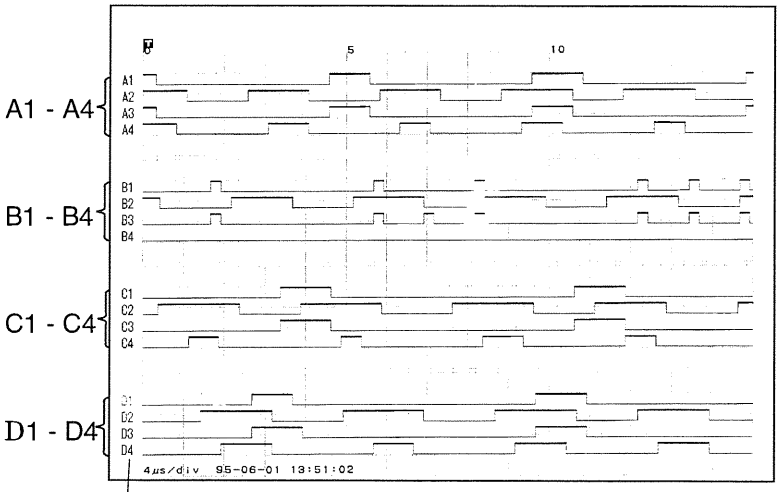
Display screen



SINGLE format



Print out



DUAL (print QUAD) format

The signal numbers are printed by using the gauge function. (See Section 12.5.6.)

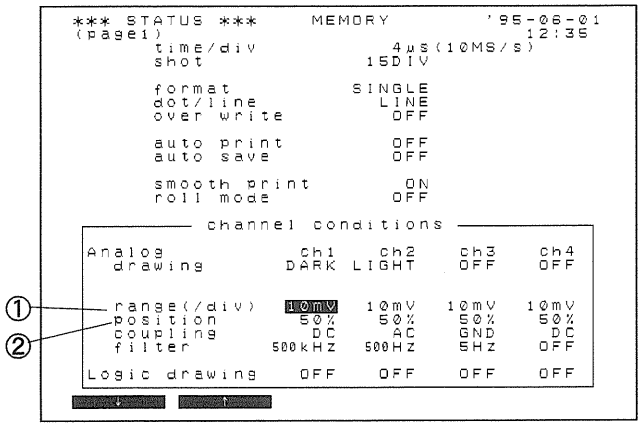
5.3.9 Voltage Axis Range, Position, Input Coupling and Filter Settings

These settings determine the voltage axis range, position, input coupling and filter for each channel.

(1) Voltage axis range (range/div) setting

The voltage value for one division is set.

Procedure (Setting screen: status (page 1) and display)



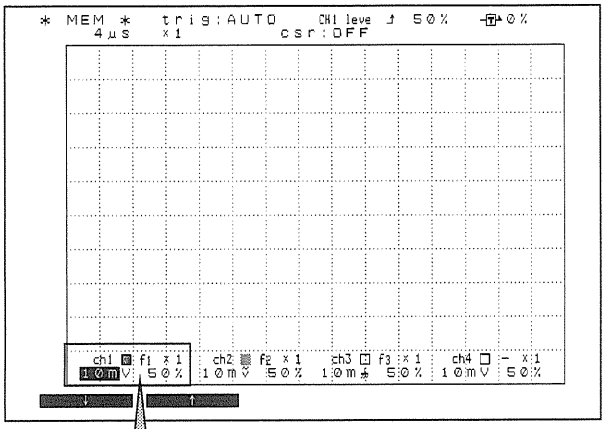
Status screen (page 1)

1. Move the flashing cursor to the "range(/div)" item for each channel, ① in the figures on the left and the left below.
2. The settings are made by using the ↓ and ↑ soft keys, or the rotary knob (VALUE),

   [10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V, 10 V, 20 V, 50 V]

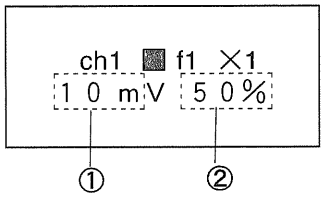
   The "V" is omitted in ① in the figure on the left below.

You can also use the (▼CH1–CH4▲) key for each channel, without moving the flashing cursor.



Display screen

Input unit information



(2) Position setting

The position of the zero voltage is set.

Procedure (Setting screen: status (page 1) and display)

1. Move the flashing cursor to the "position" item for each channel, ② in the figures on the previous page.
2. The settings are made by using the soft keys, or the rotary knob (VALUE).

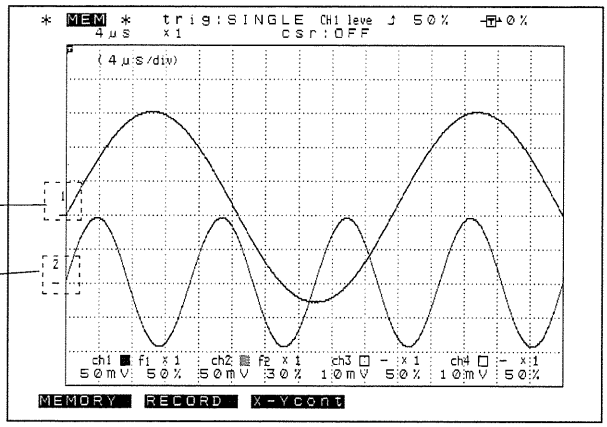
Soft key indication

↓ , ↑ : in 1 % step

10↓ , 10↓ : in 10 % step

(range : -100 % to 100 %) See the background information on the next page.

For an explanation of the 0 adj soft key, refer to Section 5.3.10, "Zero Adjustment".

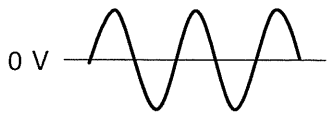


The position (the zero voltage position) for each channel is shown on the left edge of the screen. (Only for the channel for which display is set on.)

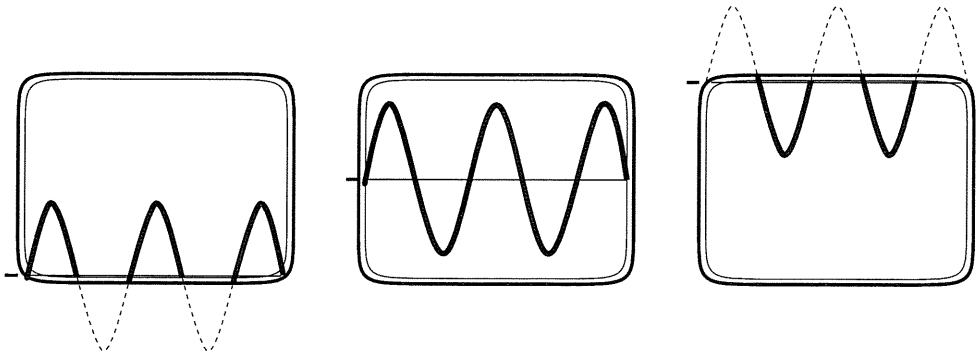
Example
① channel 1 : position 50 %
② channel 2 : position 30 %

The number indicates the channel number.

Example

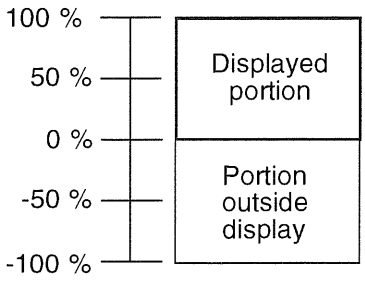


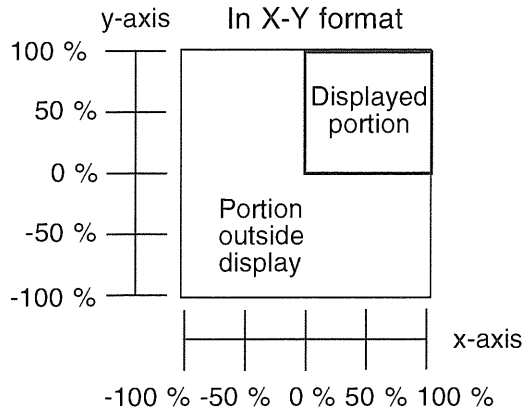
When inputting the waveform as shown on the left.



position : 0 % position: 50 % position: 100 %

Background The range that can be displayed is shown in the figure below.

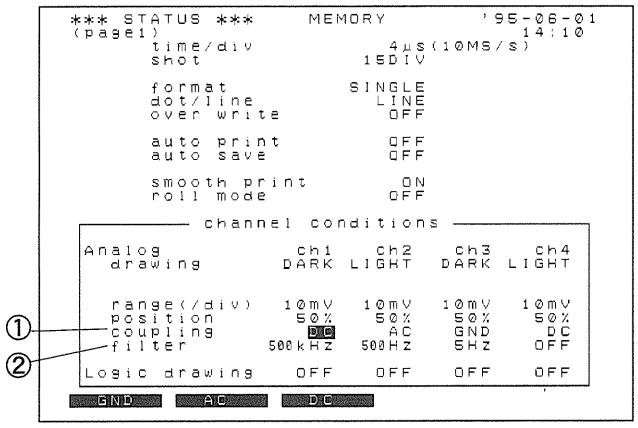




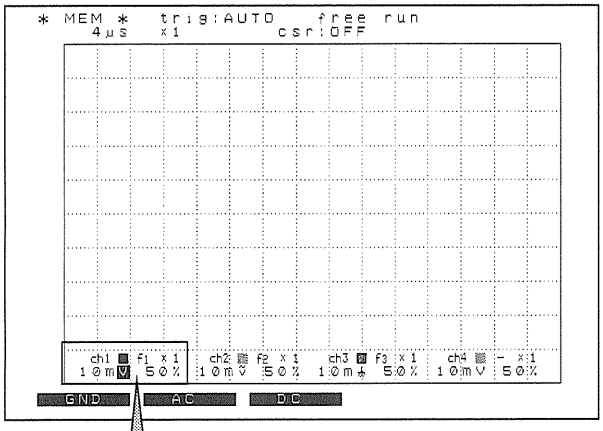
(3) Input coupling setting

The input signal coupling method is set.

Procedure (Setting screen: status (page 1) and display)

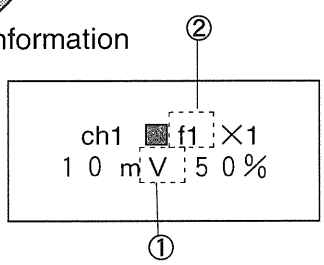


Status screen (page 1)



Display screen

Input unit information



1. Move the flashing cursor to the "coupling" item, ① as shown in the figures on the left and the left below.
2. Select the input coupling by using the soft key.

Soft key indication

GND : The input signal is not connected. This enables zero potential checking.

AC : This removes DC components from the input. This measures the AC component only.

DC : Input signal directly connected to amplifier. This allows measurement from the DC component.

[ ] is an indication of ① as shown in the figure on the left below.

(4) Low-pass filter (filter) setting

The low-pass filter in the input unit itself is set.

Procedure (Setting screen: status (page 1) and display)

1. Move the flashing cursor to the "filter" item, ② as shown in the figures on the previous page.
2. Select the low-pass filter by using the soft keys.

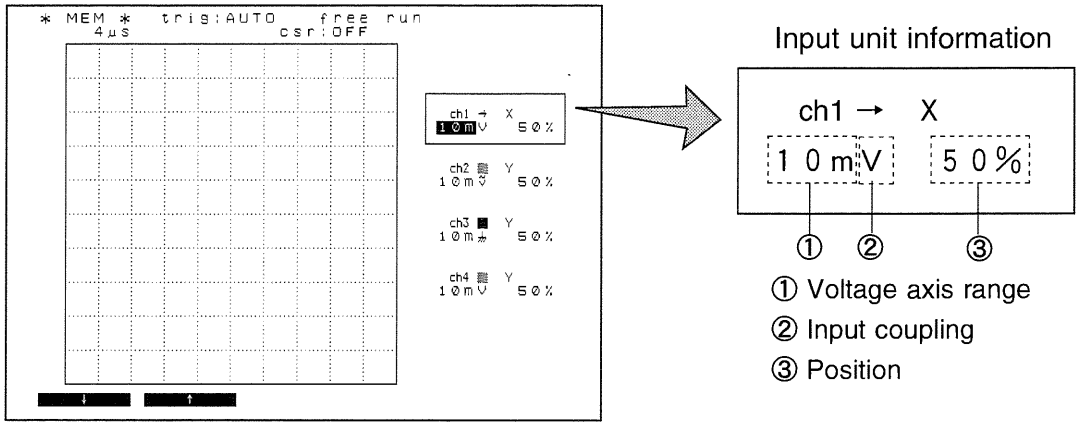
Soft key indication

OFF	[–]	: No low-pass filter used
f1 500kHz	[f1]	: Use a low-pass filter with a cutoff frequency of 500 kHz
f2 500Hz	[f2]	: Use a low-pass filter with a cutoff frequency of 500 Hz
f3 5Hz	[f3]	: Use a low-pass filter with a cutoff frequency of 5 Hz

[ ] is an indication of ② as shown in the figure on the left below on the previous page.

In X-Y format

- The input unit information is shown in the right part of the display screen.
- The settings are made in the positions of ① to ③ as shown in the figure below, like in other formats.



You can also use the (▼CH1–CH4▲) key (range key) for each channel, without moving the flashing cursor.

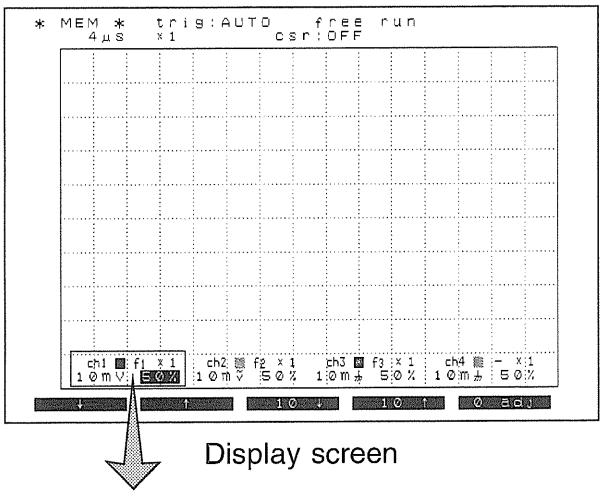
NOTE Filters cannot be set on the display screen in X-Y format. Set on the status screen.

5.3.10 Zero Adjustment

- This function provides for accurate adjustment of the waveform to the origin position when a zero voltage is input.
- Use it for reading precise values from the screen or a printed recording or to ensure accurate results from waveform calculations.

Procedure (Setting screen: display)

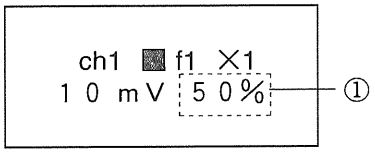
Allow at least 60 minutes after powering on before carrying out this procedure, to ensure that the internal temperature of the input units has stabilized.



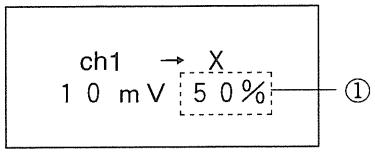
Display screen

1. Move the flashing cursor to the position of ① as shown in the figure on the left below. (The item for setting the position)
2. Press the **0 adj** soft key to carry out zero adjustment.

Input unit information



SINGLE format



X-Y format

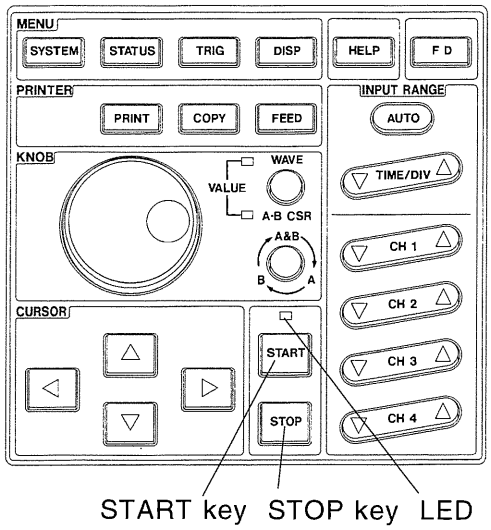
NOTE

- Zero adjustment is performed for all the analog channels, if it is set in ① as shown in the figures on the left above for any channel. (When the number of channels to be used is specified (see Section 12.5.8), zero adjustment is performed only for them.)
- Zero adjustment is not possible while the unit is measuring.
- Perform zero adjustment after changing the input units.
- Perform zero adjustment also after carrying out a system reset (see Section 16.5) by powering on the unit while pressing down the STOP key.

5.3.11 Starting and Stopping Measurement Operation

- The START and STOP keys control the measurement operation mode of the unit.
- The LED above the START key is lit during measurement.

Procedure



1. Press the **START** key.
   Measurement starts and the LED is lit.
2. Press the **STOP** key.
   Measurement stops and the LED goes out.

NOTE

(1) Measurement starting and stopping in the three trigger modes.

a. When the trigger mode is SINGLE:

- After pressing the START key, when the trigger conditions are met, the unit captures data for the specified recording length.
- After completing data capture, it terminates measurement operation automatically (without the STOP key being pressed).

b. When the trigger mode is REPEAT:

- After pressing the START key, when the trigger conditions are met, the unit captures data for the specified recording length.
- It remains in measurement operation mode, and if the conditions are met again, repeats the data capture, each time overwriting memory.
- It continues measurement until the STOP key is pressed.

c. When the trigger mode is AUTO:

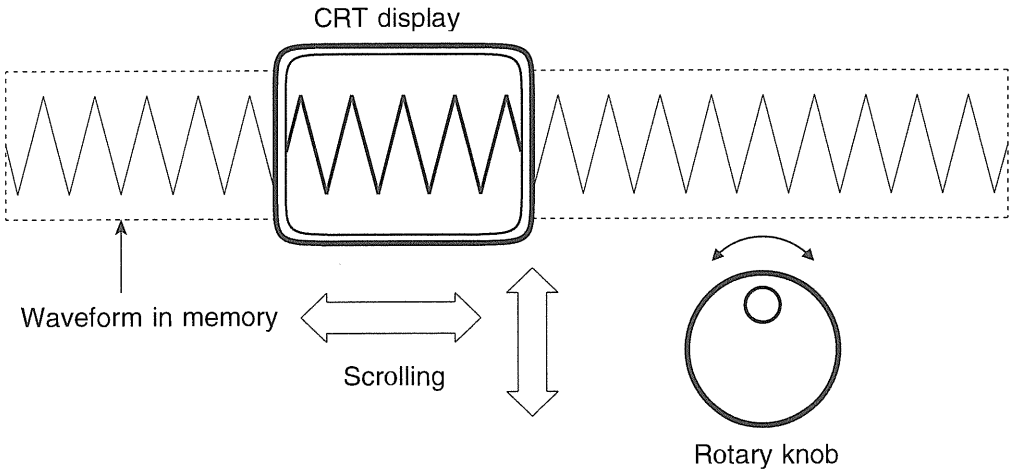
- After pressing the START key, when the trigger conditions are met, the unit captures data for the specified recording length.
- Even if the trigger conditions are not met, the unit captures data for the specified recording length, after approx. one second.
- Thereafter it captures data repeatedly, overwriting memory.
- It continues measurement until the STOP key is pressed.

(2) Terminating measurement operation mode

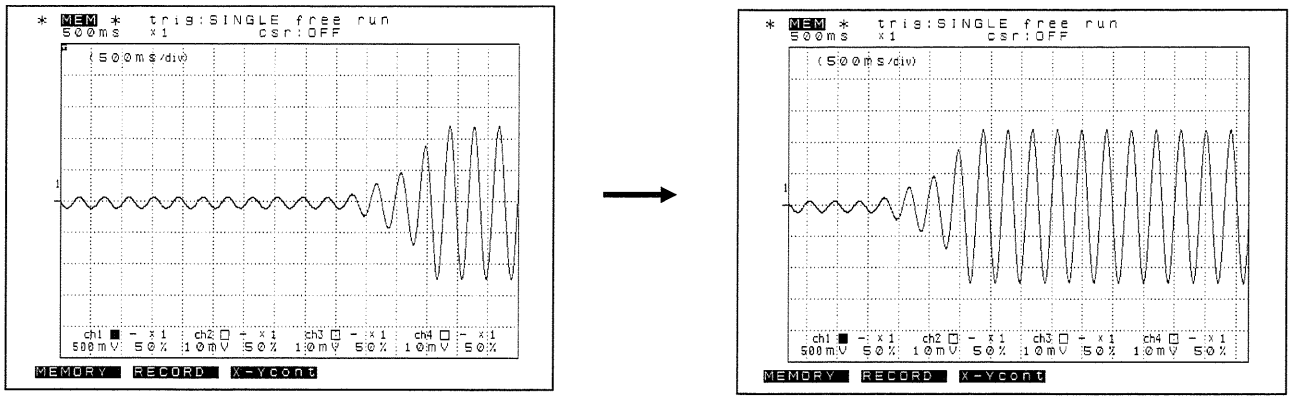
- Even if the STOP key is pressed, until capturing waveform data for the specified recording length, the unit continues measurement operation. (The auto-save and auto-print functions however, are disabled.)
- At this point, pressing the STOP key a second time abandons the data capture. If the trigger mode is REPEAT or AUTO, the immediately previously captured waveform is displayed. (If the roll mode function is enabled, the waveform is displayed up to the point of termination. See Section 5.3.21, "Roll Mode.")
- If after once pressing the STOP key, you press the START key before the waveform capture is completed, this applies a restart, and the unit starts measurement from the beginning again.

5.3.12 Waveform Scrolling

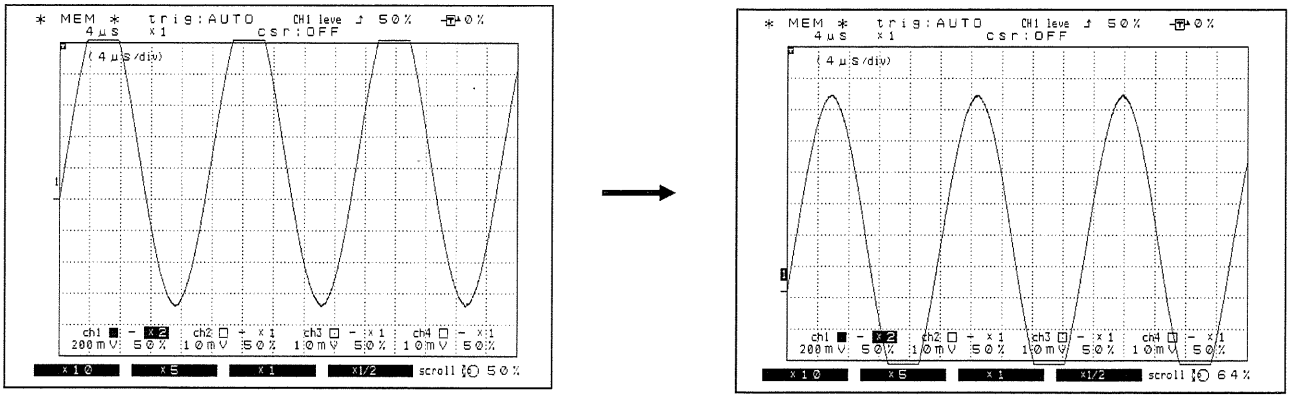
- This function scrolls the waveform display both vertically and horizontally.
- The waveform stored in memory is moved, and the required sections can be examined on the screen.



(1) Scrolling horizontally (on the time axis)

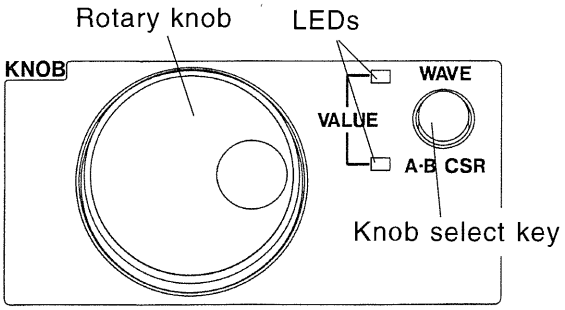


(2) Scrolling vertically (on the voltage axis)



Procedure (Setting screen: display)

(1) Horizontal scrolling (on the time axis)

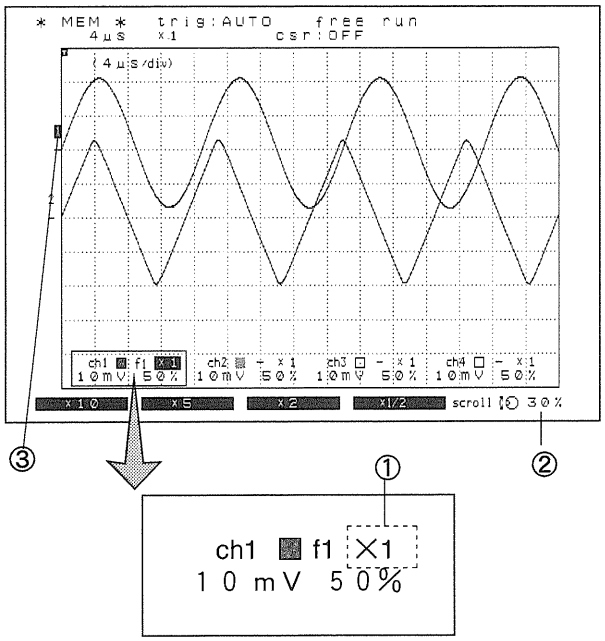


1. Press the knob select key so that only the upper (WAVE) indicator is lit.
2. Use the rotary knob to scroll the waveform horizontally.

auto scroll
Turning the rotary knob rapidly switches to auto-scroll mode, and the waveform continues scrolling automatically.

If the flashing cursor is positioned in ① as shown in the figure on the next page, the rotary knob will scroll the waveform vertically. For details see (2) below.

(2) Vertical scrolling (on the voltage axis)



1. Move the flashing cursor to ① as shown in the figure on the left, for the channel you wish to scroll.
2. Press the knob select key so that only the upper (WAVE) indicator is lit.
3. Use the rotary knob to scroll the waveform vertically.

When the position of the displayed waveform portion (see Section 5.3.16) in ② as shown in the figure on the left indicates other than 50 %, the channel number indicating the position, ③ is reversed.

Related item By using the horizontal scroll bar in the help function (see Section 5.3.22), the displayed position along the time axis and along the voltage axis can be confirmed. Also the position of the displayed waveform portion can be moved instantaneously.

5.3.13 Using A and B Cursors

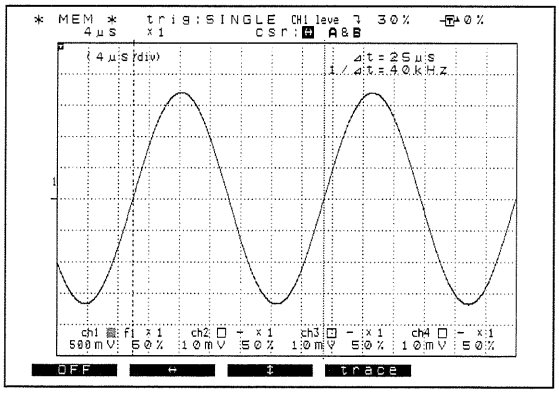
- You can use the cursors to measure time, frequencies, or voltage differences (if using the scaling function, the scaled values; see Section 12.3, "Scaling Function"), getting a direct readout.
- There are three cursor patterns: vertical, horizontal, and trace.
- As the trace point (the intersection of the waveform and the trace cursor) traces the waveform of the specified channel, the trace cursor read out the value.

Cursor readout value

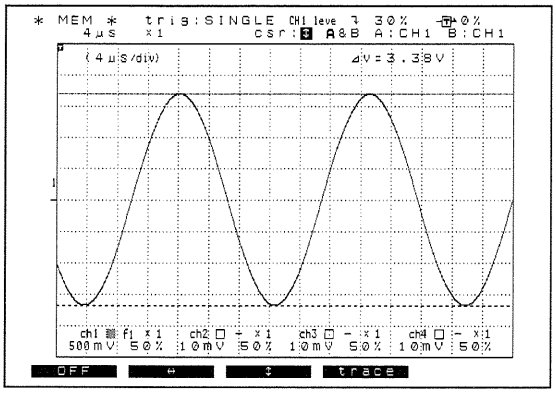
Cursor	A cursor only (A)	Both A and B cursors (A&B)
Vertical cursor	t time from the trigger point *	Δt time interval between the A and B cursors
	1/t the frequency, taking t as the period	1/Δt the frequency, taking Δt as the period
Horizontal cursor	V voltage from 0 V	ΔV voltage difference between the A and B cursors
Trace cursor	t time interval from the trigger position to the trace point *	Δt time interval between the trace points
	V voltage from 0 V to the trace point	ΔV voltage difference between the trace points

*: time from the measurement start point, when the trigger is disabled.

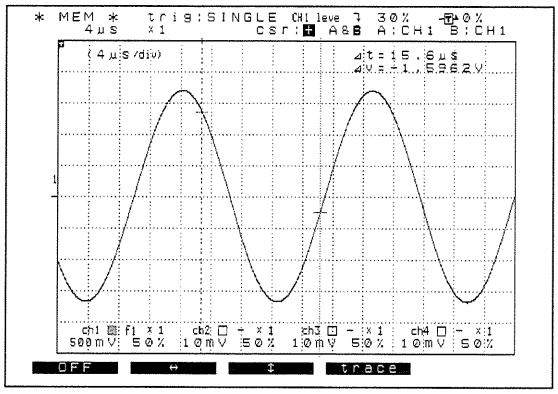
Each cursor readout value is shown at the upper right of the screen.



↔ Vertical cursor



↕ Horizontal cursor



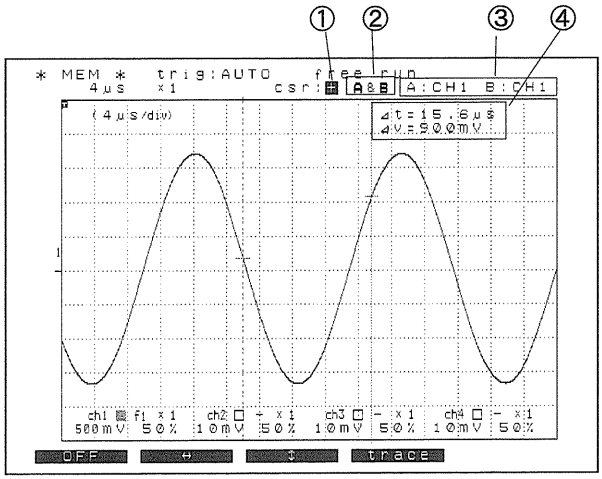
+Trace cursor

Related item

- If the PRINT key is pressed when using the A and B cursors, the waveform is printed partially. (See Section 5.3.20.)
- If saving the waveform when using the A and B cursors, it is partially saved. (See Section 13.8.)

Procedure (Setting screen: display)

(1) A and B cursors setting



1. Move the flashing cursor to the "csr" item, ① as shown in the figure on the left.
2. Select the cursor to be used by using the soft keys.

Soft key indication

OFF : Do not use cursors.

↔ : Vertical cursors (for reading off time and frequencies)

↕ : Horizontal cursors (for reading off voltage (differences))

trace : Trace cursors (for reading off time and voltage (differences), ① appears as "+".)

3. Move the flashing cursor to ②, and select the number of the cursors to be used.

Soft key indication

A : (One) Use the A cursor only.

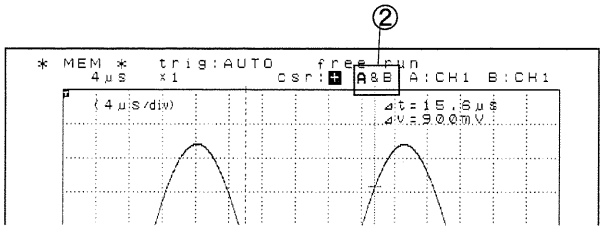
A&B : (Two) Use both A and B cursors.

4. If using the horizontal cursors or trace cursors, select the channel for which the values are read off in ③. You can make independent settings for the A and B cursors by using the soft keys.
   [CH1, CH2, CH3, CH4]

- The trace cursors cannot be set for the channel for which the display is off.
- If using the A cursor only, the setting for the B cursor is not possible.
- This item does not appear when using vertical cursors.
- Even if the A and B cursors have different channels specified, the A to B voltage difference is derived from the absolute values of the voltages relating to their respective channels.
- If the scaling function is enabled, you can read the scaled value directly. If, however, the A and B cursors are on different channels, and those channels have different units, then a difference cannot be read off. (See Section 12.3, "Scaling Function")

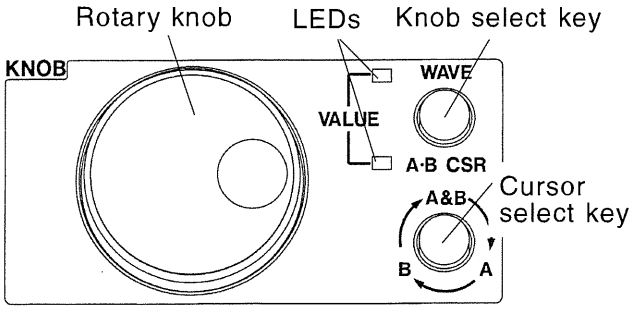
5. The values which are read off are shown in ④.

(2) Moving the A and B cursors



1. Press the cursor select key to select the cursor or cursors to control. (When using the A cursor only, this setting is not required.)
   Each time the key is pressed, the A & B indication in ② changes as follows:

A & B (A displayed high intensity) : Move the A cursor only.
A & **B** (B displayed high intensity) : Move the B cursor only.
A & **B** (A and B displayed high intensity) : Move both A and B cursors.



2. Press the knob select key so that only the lower LED (A·B CSR) is lit.
3. The rotary knob controls the position of the cursors.

Rotary knob	A·B cursor
Turning the knob clockwise	Moves the cursors up or to the right.
Turning the knob counterclockwise	Moves the cursors down or to the left.

- See Section 4.2, "Operation Keys" for a detailed description of rotary knob operation.
- It is possible for the vertical cursors and the trace cursors to move off the screen when the waveform is scrolled.
- If a cursor is off the screen, as soon as you start moving it toward the center of the screen, it jumps to the edge.
- It is possible to tell the approximate location of the cursor in the total recording length. For details, see Section 5.3.22, "Help Function".

In X-Y format

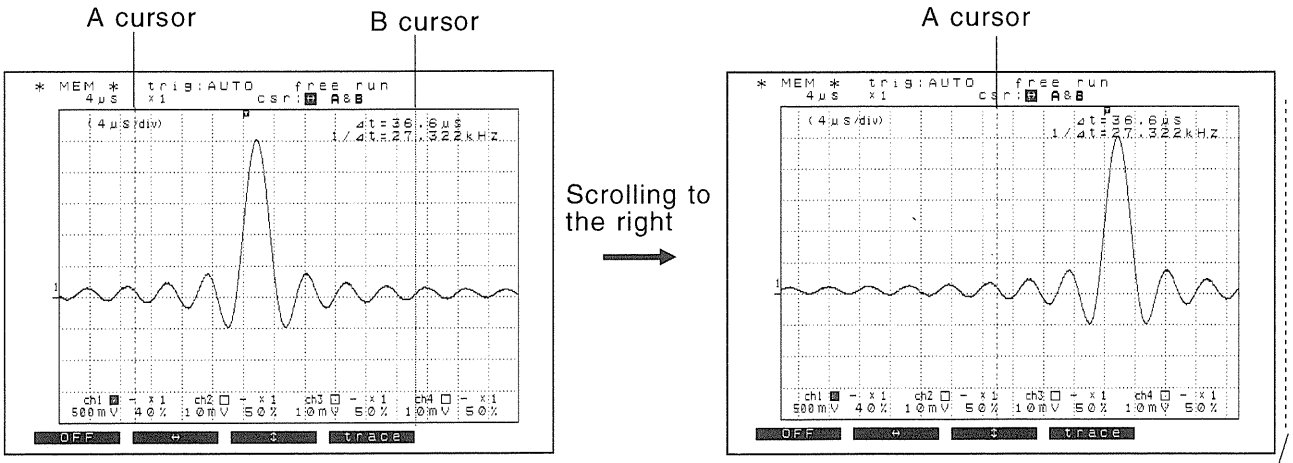
- For the channel for which the values are read off, select the vertical cursors on the x-axis channel, and the horizontal cursors on the y-axis channels. (③ as shown in the figure on the previous page.)
- The trace cursors cannot be used.

NOTE

The scrolling and cursor behavior with horizontal cursors is different from that with the vertical or trace cursors.

(1) When scrolling the waveform

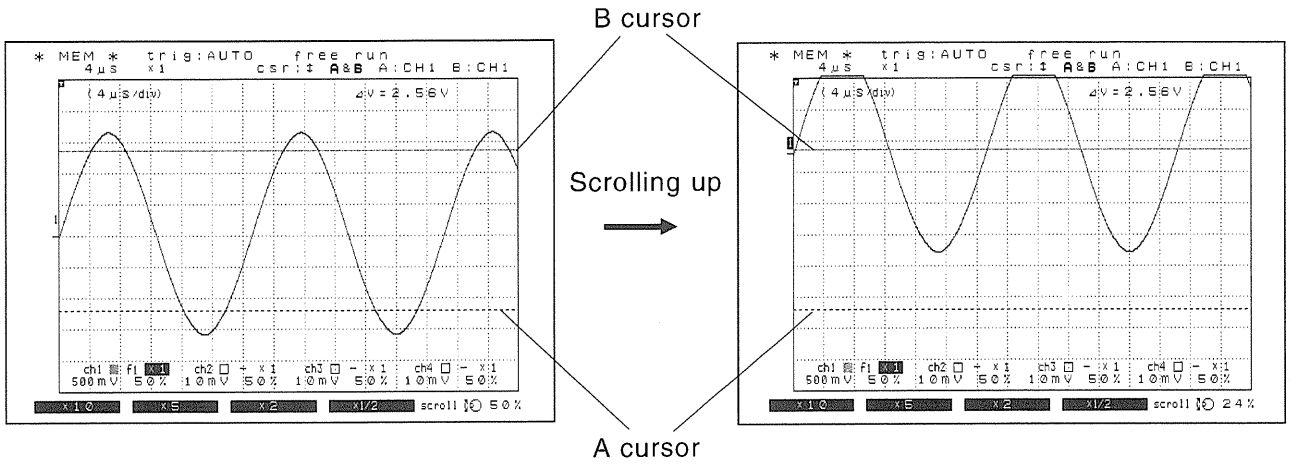
a. Using the vertical or trace cursors (The example shows vertical cursors.)



When scrolling the waveform horizontally, the cursors move with the waveform, disappearing off the edge of the screen. (When scrolling the waveform vertically, the cursors do not move.)

The B cursor disappearing off the edge of the screen.

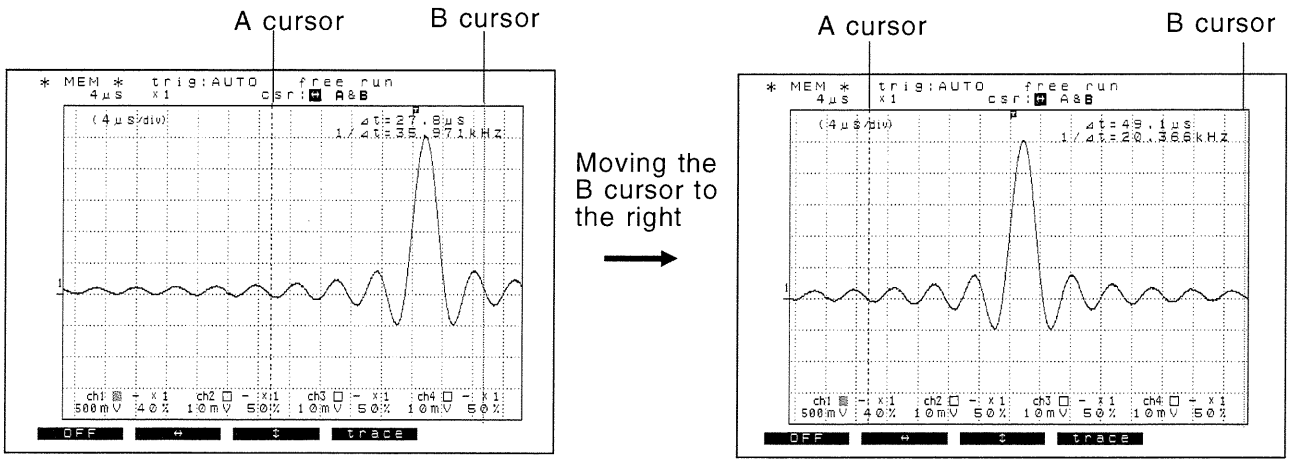
b. Using horizontal cursors



When scrolling the waveform vertically, the cursor position does not change.
(When scrolling the waveform horizontally, the cursors do not move.)

(2) When moving the cursors

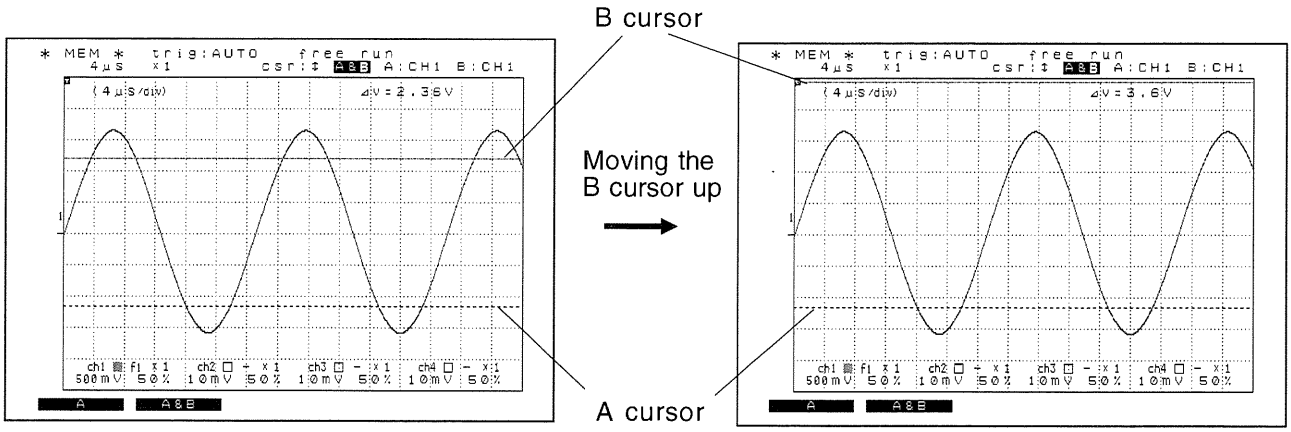
a. Using the vertical or trace cursors (The example shows vertical cursors.)



When the moving cursor reaches the edge of the screen, it does not disappear off the edge of the screen, and the waveform scrolls in the opposite direction.

When the B cursor reaches the edge of the screen, the waveform and the A cursor scroll left, so that the B cursor continues to move relative to the waveform.

b. Using horizontal cursors

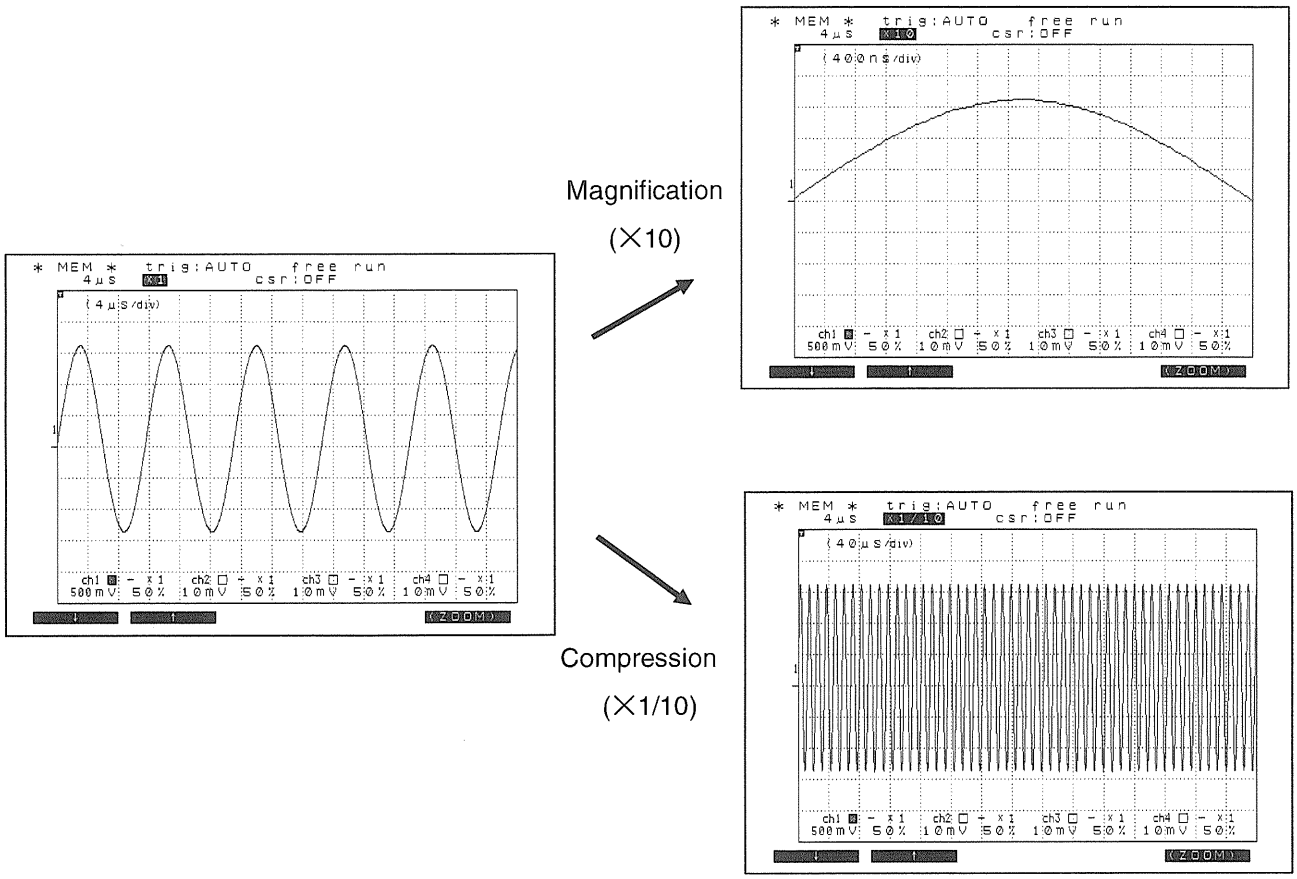


The horizontal cursor does not disappear off the top of the screen, and when it reaches the top of the display area, it stops moving, and the waveform does not scroll.

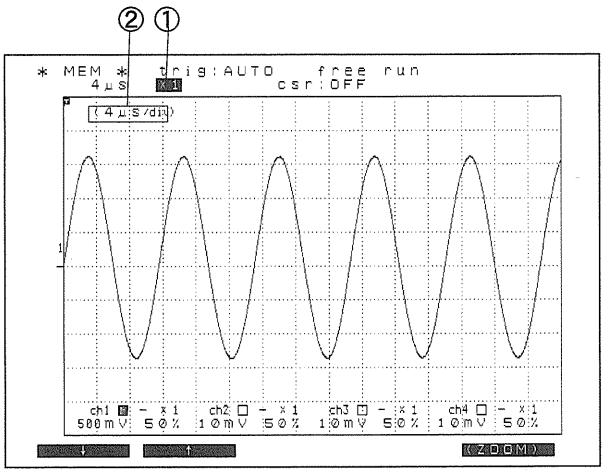
Related item When a cursor is outside the display area, it is still possible to tell its approximate location in the total recording length.
See Section 5.3.22, "Help Function" for details.

5.3.14 Magnification/Compression Along the Time Axis

- This function allows display with the time axis magnified or compressed.
- Magnification/compression is also applied to the printed recording.
- Compression is useful for getting an overall view of the waveform pattern.
- Magnification enables more detailed examination of the waveforms.



Procedure (Setting screen: display)



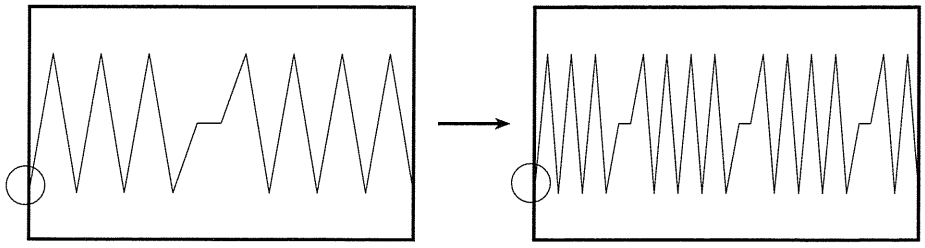
1. Move the flashing cursor to ① as shown in the figure on the left.
2. By using the ⇩ and ⇧ soft keys or the rotary knob (VALUE), perform the magnification or compression.

   [×10, ×5, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50, ×1/100, ×1/200, ×1/500, ×1/1000, ×1/2000, ×1/4000]

- In ②, time per division is shown.
- The setting of the magnification/compression ratio can be carried out either before or after the data is captured.

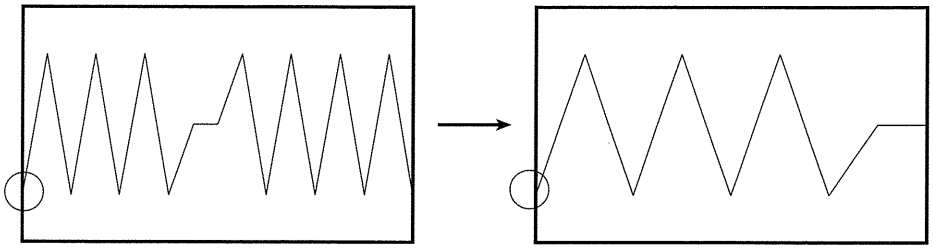
Reference position when magnifying or compressing

① When compressing



The display contacts along the time axis,
leaving the left edge at the same position.

② When magnifying



The display expands along the time axis,
leaving the left edge at the same position.

NOTE

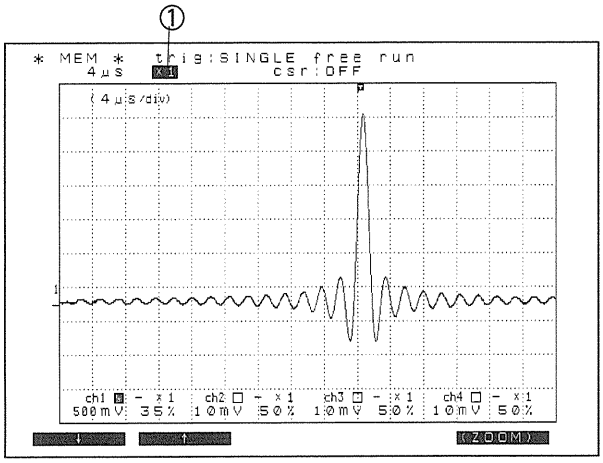
- If compressing with the interpolation function (see Section 5.3.7) disabled (i.e. set to "DOT"), then display can take time. The recommended procedure is to set the interpolation function to "LINE", when a recording length is particularly long.
- Redisplay after changing the magnification/compression ratio takes the same amount of time.
- See Section 5.3.15, "Zoom Function" for the (zoom) soft key.

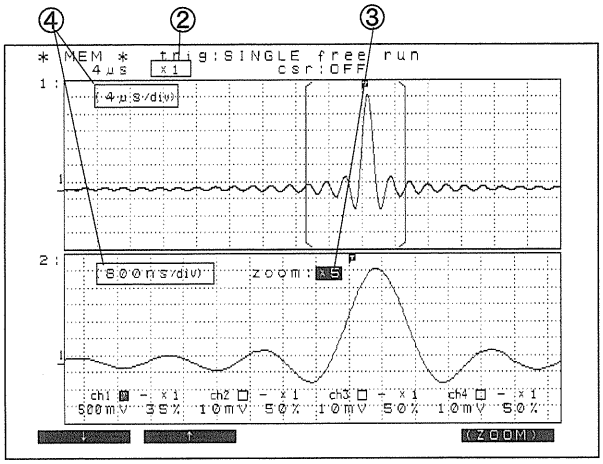
Related item A scroll bar display is available, to show where the current screen display is in relation to the whole stored waveform. See Section 5.3.22, "Help Function" for details.

5.3.15 Zoom Function (ZOOM)

This function divides the display screen into two screens (upper and lower), and allows the waveform in the upper graph to be magnified along the time axis and displayed in the lower graph. (The magnification or compression is the same as the magnification or compression ratios in Section 5.3.14, "Magnification/Compression Along the Time Axis.")

Procedure (Setting screen: display)





② Magnification of the upper graph
③ Magnification of the lower graph

1. Move the flashing cursor to ① as shown in the figure on the left.
2. Press the (ZOOM) soft key, and the screen changes as shown in the figure on the left below.
   - The waveform in the frame of the upper graph is magnified in the lower graph.
   - The frame is moved by using the rotary knob (WAVE).
3. The magnification in ② and ③ are for the time axis range.
   - Move the flashing cursor to ③ and, set the magnification of the lower graph by using the ↓ and ↑ soft keys or the rotary knob (VALUE).
   - Time per one division is shown in ④.
4. To terminate the zoom function, move the flashing cursor to ② or ③ and press the (ZOOM) soft key.

NOTE

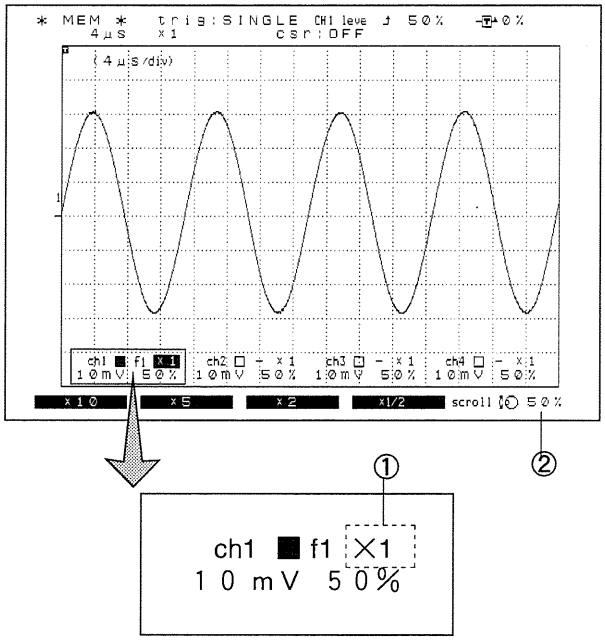
- The magnification of the lower graph cannot be set lower than that of the upper graph.
- The A and B cursors affect the lower graph.
- When using the zoom function, the waveform in the lower graph is printed out by pressing the PRINT key. (The waveform is printed in SINGLE format. When using the A and B cursors, it is printed partially. See Section 5.3.20.)
- The logic waveforms can be magnified only in the CHA and CHB.

5.3.16 Magnification/Compression Along the Voltage Axis

This function allows the voltage axis to be magnified or compressed for any channel independently.
[×1/2, ×1, ×2, ×5, ×10]

Procedure (Setting screen: display and status(page 2))

(1) On the display screen



1. Move the flashing cursor to ① as shown in the figure on the left for the channel to be magnified or compressed.
2. Select the magnification or compression ratio by using the soft keys.

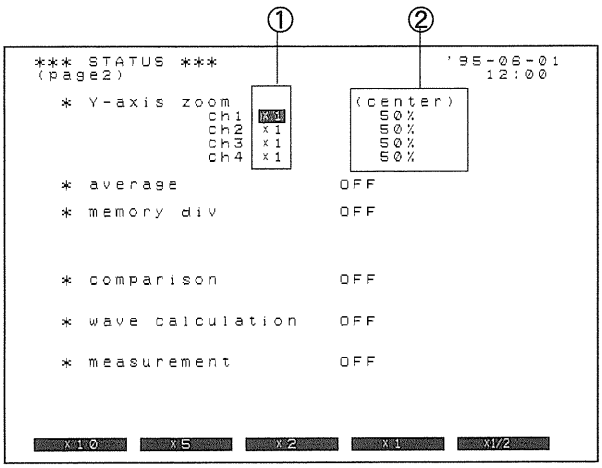
Soft key indication

×1/2 : Compression (×1/2)
×1 : Standard (×1)
×2 : Magnification (×2)
×5 : Magnification (×5)
×10 : Magnification (×10)

(The soft key indication for the selected magnification or compression ratio is not shown.)

- The position of the displayed waveform portion along the voltage axis is indicated in ②. (This is defined in terms of percentages (0 to 100 %) of the full scale of the waveform in measurement, and indicates the percentage of the center of the display screen. This is the "(center)" value in ② as shown in the figure on the next page.)
- If the soft key is pressed, the display expands or contracts vertically about the center (position: 50 %)
- If the rotary knob is in the waveform scrolling mode (the upper (WAVE) indication is lit), using the rotary knob scrolls the waveform vertically. (See Section 5.3.12.)

(2) On the status screen (page 2)

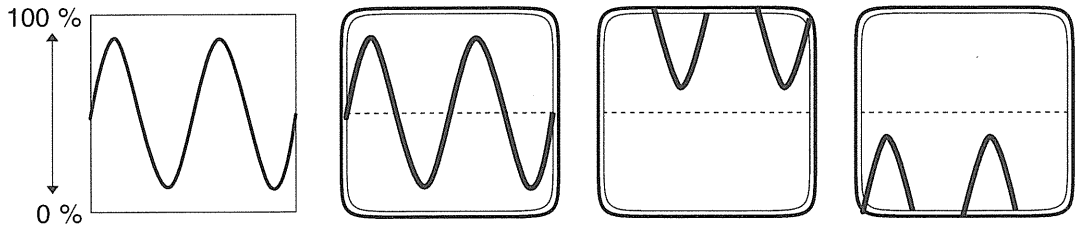


1. Move the flashing cursor to ① as shown in the figure on the left for the channel to be magnified or compressed of the "Y-axis zoom" item.
2. Select the magnification or compression ratio by using the soft keys.

Soft key indication

×1/2 : Compression (×1/2)
×1 : Standard (×1)
×2 : Magnification (×2)
×5 : Magnification (×5)
×10 : Magnification (×10)

3. Set the position of the displayed waveform portion along the voltage axis, in "(center)", ②.
   (This is defined in terms of percentages (0 to 100 %) of the full scale of the waveform in measurement, and indicates the percentage of the center of the display screen.)
   Move the flashing cursor to "center", ② for the required channel, and make the setting by using the ↓ , ↑ , 10↓ , 10↑ soft keys or the rotary knob. [0 to 100 %]



NOTE

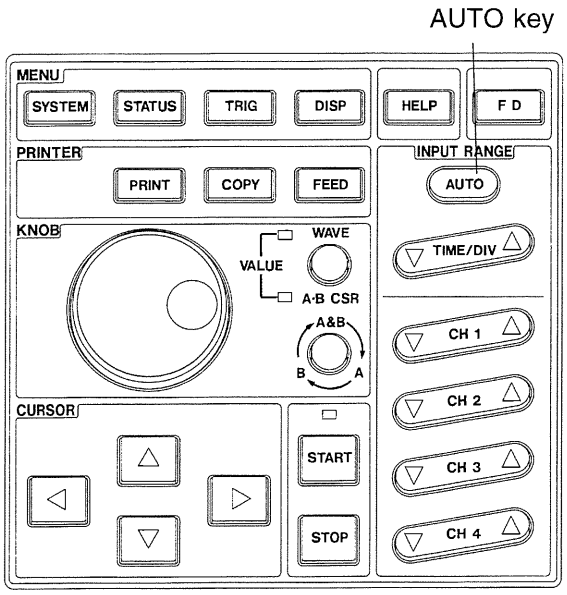
The setting of the magnification/compression ratio can be carried out either before or after the data is captured.

Related item A scroll bar is available on the display screen, when magnifying, to show where the screen display is in relation to the graph voltage axis range (at ×1), and when compressing, to show where the input waveform range is. (See Section 5.3.22, "Help Function".)

5.3.17 Auto-Ranging Function (AUTO)

This function provides automatic setting of the time axis range (time/division) and voltage axis range (range/division) appropriate for the input waveform, and starts measurement. (Effective for the waveform of 5 Hz or more)

Procedure (Setting screen: display)



1. Press the AUTO key.
   Press the cancel key to cancel.
2. Press the (exec) soft key.

- The indicator above the START key lights and measurement starts automatically.
- Press the STOP key to stop measurement.

NOTE

- Time axis range/voltage axis range setting
  - The waveform is captured on the channel for which waveform display is enabled, and the voltage axis range is selected based on the maximum and minimum values of the data.
  - The time axis range is set automatically so that between 1 and 2.5 cycles are recorded for 15 divisions.
  - If the ranges cannot be set on any channels for which waveform display is enabled, the warning message is displayed, and measurement stops.

- When measuring with the auto-ranging function, the setting conditions are as follows (other settings are not changed):

a. Input unit conditions

· Voltage axis range	Set automatically	Only the channels for which display is enabled
· Input coupling	AC	
· Position	50%	
· Low pass filter	OFF	

b. Trigger conditions

- Logical operator (AND/OR) between triggers OR
- Internal triggers Only ON for the channels selected in the range setting
  OFF for the other three channels

- Trigger type level
  - Slope ↴
  - Level Automatic setting
  - Filter OFF
- External trigger OFF
- Timer trigger OFF
- Pre-trigger 20%
- Trigger mode AUTO

c. Status conditions

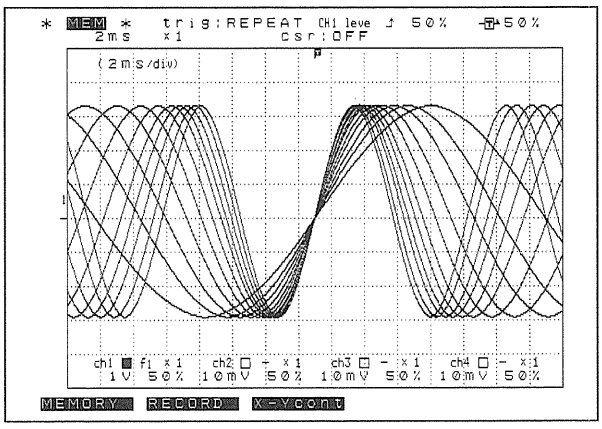
- Time axis range Automatic setting
- Auto-print function OFF
- Magnification/compression ratio along the voltage axis ×1, 50 % (center)
- Memory segmentation function OFF (only in the sequential save)
- Waveform decision function OFF
- Waveform processing calculation OFF
- Waveform parameter calculation OFF
- Roll mode OFF
- Format SINGLE
- Auto save function OFF
- Averaging OFF

d. Display condition

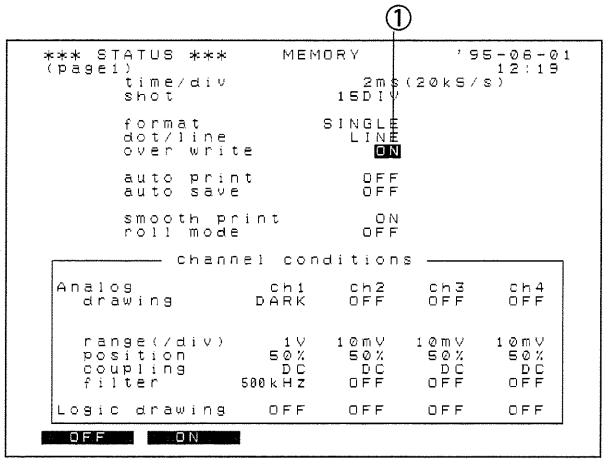
- Magnification/compression along the time axis ×1

5.3.18 Superimposition Function (over write)

- This function disables clearing of existing waveforms on the screen, allowing waveforms to be superimposed. (When the trigger mode is REPEAT or AUTO, see Section 8.6, "Trigger Modes".)
- Using this function, you can easily make comparisons with the previous waveform.



Procedure (Setting screen: status (page 1))



Status screen (page 1)

1. Move the flashing cursor to the "over write" item, ① as shown in the figure on the left.
2. Set the superimposition function ON or OFF by using the soft keys.

Soft key indication

OFF : Do not perform superimposition.
ON : Perform superimposition.

NOTE

(1) When the trigger mode is set to SINGLE, the superimposition function has no significance since data capture then stops once the data is input.

(2) The following functions are no longer available when using the superimposition function:

Waveform scrolling, zoom function, waveform decision function, magnification or compression ratio setting on the display screen.

(3) After using the superimposition function, all of the following operations delete the superimposition (leaving only the last captured waveform data):

- Changing the magnification or compression ratio (along the voltage axis) on the status screen
- Changing the position of the waveform (along the voltage axis) on the status screen
- Changing the format
- Changing the interpolation function (DOT or LINE)
- Changing the channel settings for display or printed recording (Analog drawing or Logic drawing)
- Changing the channel assigned to the x-axis in X-Y format
- Moving the position of the displayed waveform portion in the help function

(4) The printout and plotter output functions print only the last captured waveform data.

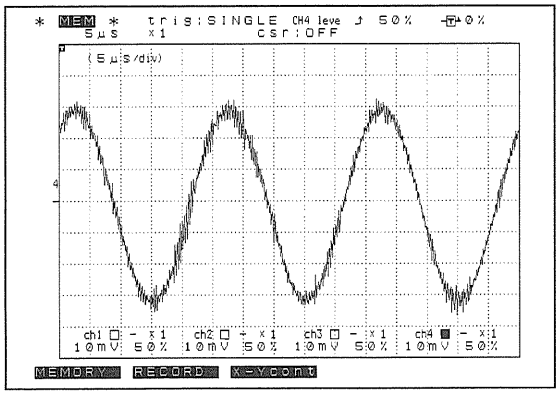
(5) Pressing the START key deletes all of the displayed superimposed waveforms. (The most recently captured waveform also disappears.)

(6) Superimposition is impossible, when the roll mode (see Section 5.3.21) is enabled.

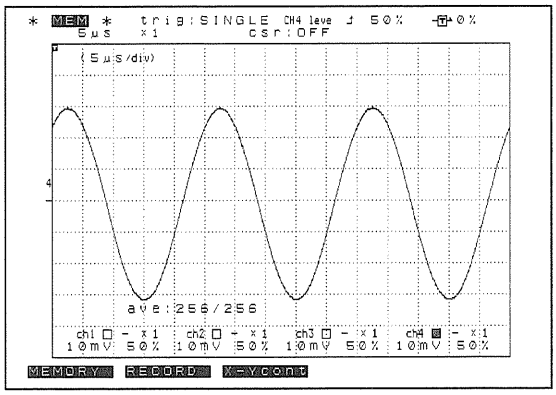
(7) Only the last captured waveform data is saved, when saving the waveform data on a floppy disk, hard disk or magneto-optical disk (see ② in Section 13.7.1).

5.3.19 Averaging Function Setting (average)

- This function provides a sliding average value for the waveform, and perform measurement.
- This enables noise components to be removed, and the underlying signal observed.
- The averaging length is variable, and can be set to 2, 4, 8, 16, 32, 64, 128, or 256 samples.
- The larger this value, the more the waveform is smoothed, and the more noise components are removed.

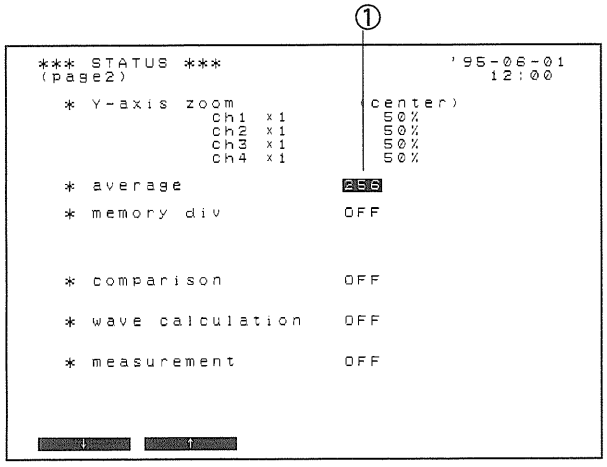


No averaging

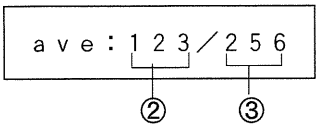


Averaging

Procedure (Setting screen: status(page 2))



Status screen (page 2)



1. Move the flashing cursor to the "average" item, ① as shown in the figure on the left.
2. By using the ↓ and ↑ soft keys or the rotary knob (VALUE), set the averaging length. [OFF, 2, 4, 8, 16, 32, 64, 128, 256]

- At the lower left of the display screen, ② the number of captured samples and ③ the averaging length are shown in the figure on the left.
- After this number of samples has been captured, and the arithmetic mean calculated, the waveform appears. (The waveform does not appear, until the arithmetic mean has been completed.)
- Averaging does not apply to logic channels, which simply show the last captured value.

NOTE

(1) The averaging function and the memory segmentation cannot be used simultaneously.

(2) When the averaging function is in use, no waveform processing calculations cannot be carried out simultaneously. For an averaged waveform, after data capture it is possible to carry out waveform calculations by pressing the (exec) soft key. (See Procedure step 3, ② in Section 11.2.1, "Method of Calculation.")

(3) When using averaging, ensure that the trigger mode is either SINGLE or REPEAT.

a. When the trigger mode is SINGLE:

- Once the trigger conditions hold, data is captured, and after the specified number of samples have been captured measurement stops. Then averaging is applied to the data, and the waveform is displayed on the screen.
- If the STOP key is pressed to abandon measurement, the data captured up to the point of abandonment is subjected to averaging, and the waveform is displayed.

b. When the trigger mode is REPEAT:

- Once the trigger conditions hold, data is captured, and after the specified number of samples have been captured, averaging is applied to the data, and the waveform is displayed on the screen. Thereafter, each time a data sample is captured, a sliding average is calculated, and the display waveform is rewritten.
- Measurement continues until the STOP key is pressed.

c. When the trigger mode is AUTO:

Even if the trigger conditions do not hold, once a certain time interval has elapsed data is captured. It is therefore possible to apply averaging to signals which are not synchronized, yielding meaningless data.

(4) The averaging method comprises two slightly different algorithms, that for the initial samples, which is a simple averaging method, and that for the continuing samples, which is a true sliding average.

The simple averaging method gives the mean value of the values captured:

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

n	number of samples
A_n	n th average value
Z_n	n th measurement value

(5) The sliding averaging method is used once the number of captured samples exceeds the averaging length. This gives the greatest weighting to the latest samples, and progressively reduces the weighting for the previous samples. The value is determined by the following expression:

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

N	specified averaging length (2 to 256 samples)
n	number of samples captured (n>N)
A_n	n th average value
Z_n	n th measurement value

(6) Upper limit on recording length

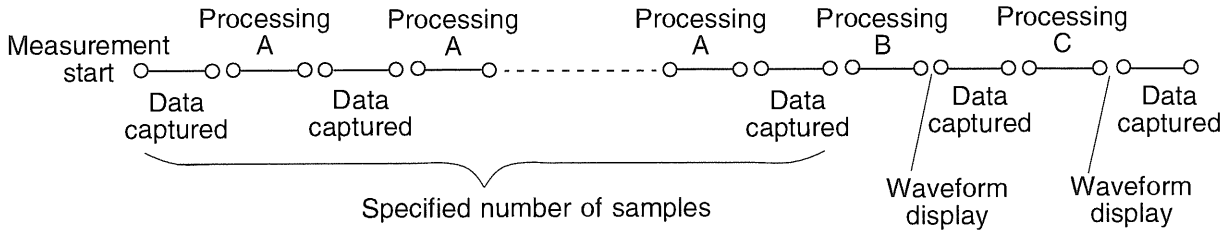
- When using averaging, the upper limit on the recording length is 3000 divisions.
- Setting the recording length above this limit automatically disables the averaging function.

(7) When setting the number of channels to be used (see Section 12.5.8) to one or two channels, the averaging function is not available.

(8) When the roll mode (see Section 5.3.21) in enabled, the averaging function is not available.

(9) Time taken for averaging processing

The time from starting measurement until the specified number of samples has been captured and the waveform displayed, or if the trigger mode is REPEAT, the time required after the specified number of samples is initially captured to rewrite the waveform display for each new data sample, depends on the product of the time axis range and the recording length, and the specified averaging length.



Time of captured data ≒ Recording length × time axis range

Time of processing A (additive processing) ≒ 1 ms × recording length (in REPEAT)

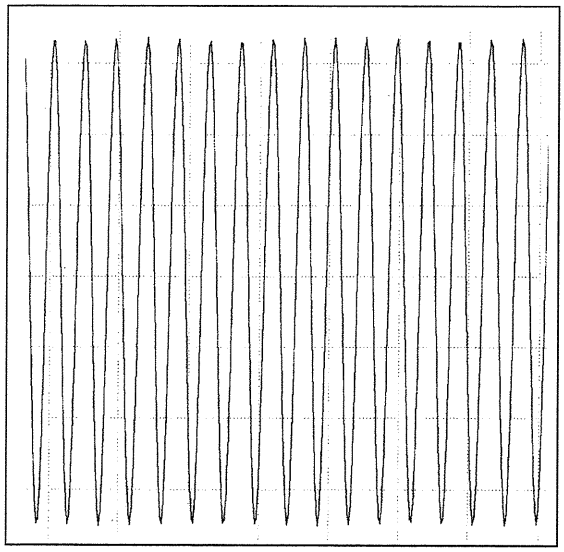
Time of processing B and C (averaging processing) ≒ 2 ms × recording length (in REPEAT)

5.3.20 Printing Waveform Recordings

(1) Smooth print function

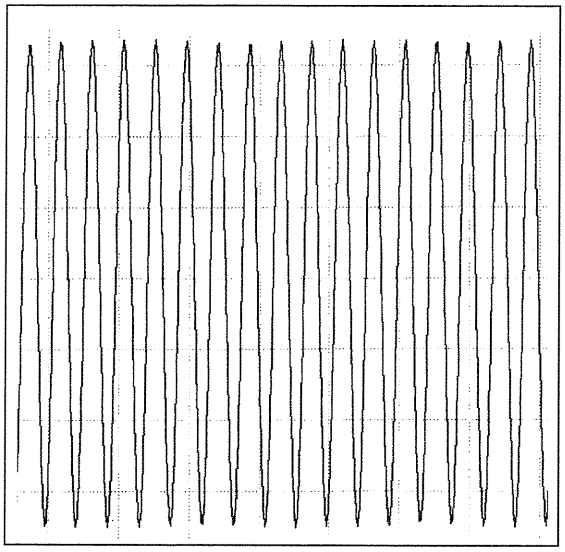
- This function enables smooth printing of quality close to that of an analog waveform, with the time axis density of 80 dots/division.
- Initialize with the smooth print enabled.
- With the smooth print disabled, the time axis density is 40 dots/division, however the printing speed is doubled.

smooth print ON



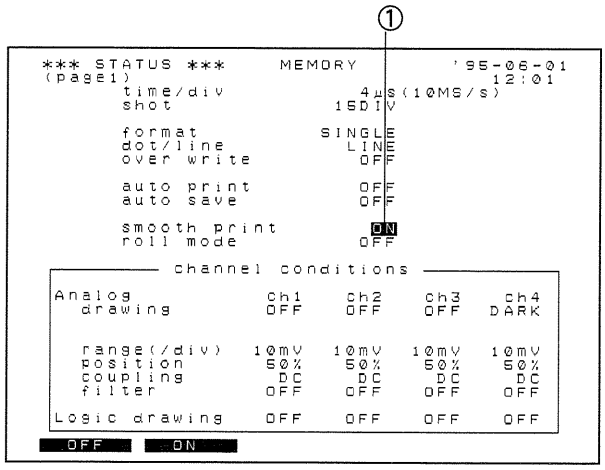
Density of 80 dots/division

smooth print OFF



Density of 40 dots/division

Procedure (Setting screen: status (page 1))



Status screen (page 1)

1. Using the cursor keys, move the flashing cursor to the "smooth print" item, ① as shown in the figure on the left.
2. Set smooth print ON or OFF by using the soft keys. [OFF, ON]

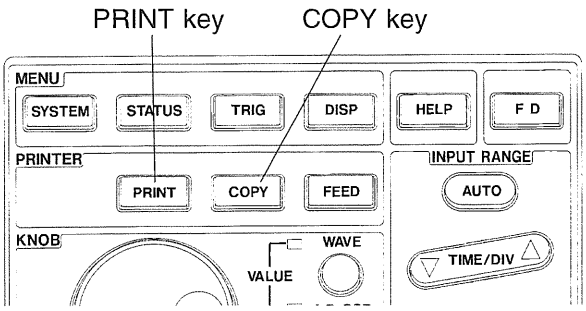
(2) Printing method

There are four methods of printing waveforms: manual print, partial print, screen dump and auto-print.

① Manual print

Prints out the stored waveform for its entire recording length.

Procedure

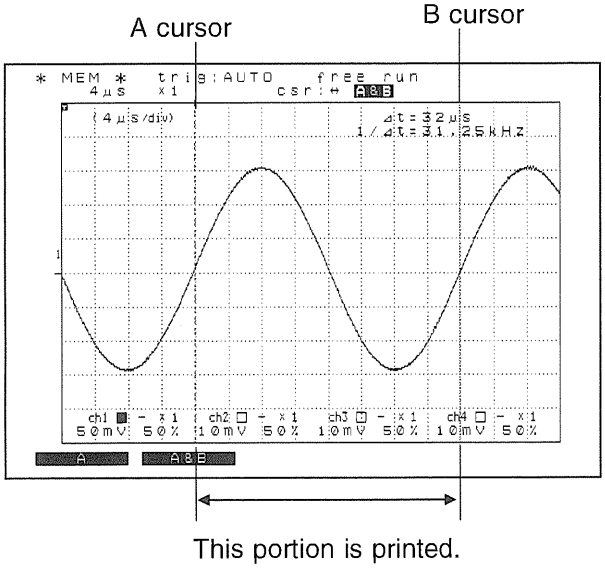


- Press the **PRINT** key.
- If magnification or compression is in effect, it is also applied to the printing.
- Since the data is held in memory, it can be printed as many times as required.
- When using the A and B cursors (as vertical or trace cursors), this prints partially. See ② below.
- Pressing the **STOP** key in printing allows a forced exit.

② Partial print

Using the A and B cursors, it is possible to print out only the desired portion of the stored data.

Procedure



1. Use the A cursor or A and B cursors (as vertical or trace cursors) to indicate the portion of the waveform to be recorded.
   - When using the A cursor only
     From the A cursor to the end of the waveform.
   - When using both A and B cursors
     Portion between the cursors.

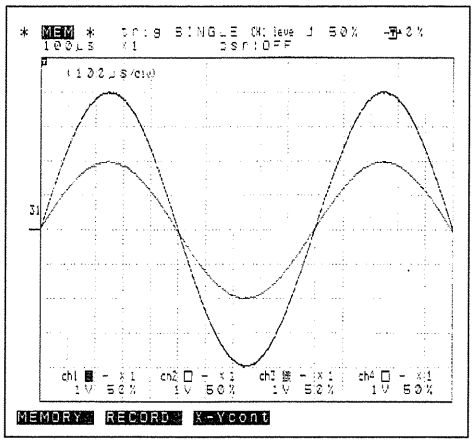
   This function is effective even if either cursor is outside the screen area. See the Example.
2. Press the **PRINT** key.
   - If magnification or compression is in effect, it is also applied to the printing.
   - Since the data is held in memory, it can be printed as many times as required.

③ Screen dump function

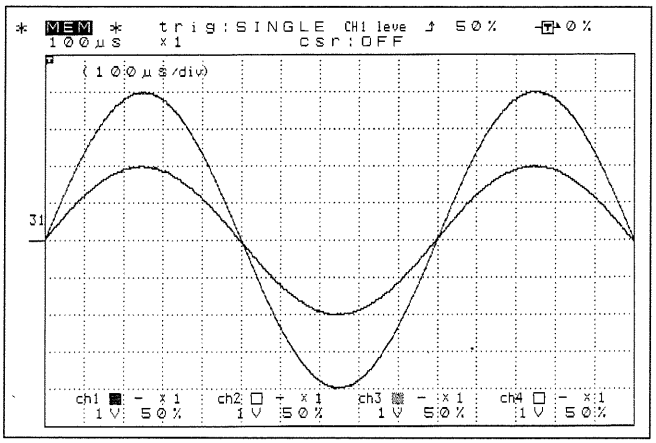
Prints an exact copy of the screen.

Procedure

- Press the [COPY] key. (If the screen dump output designation is not set to the printer, press the COPY key again.)
- The screen dump output designation can be set on the system screen. (See Section 12.7.)
- The copy size (SMALL or LARGE) can be set on the system screen. (See Section 12.5.9.)



SMALL

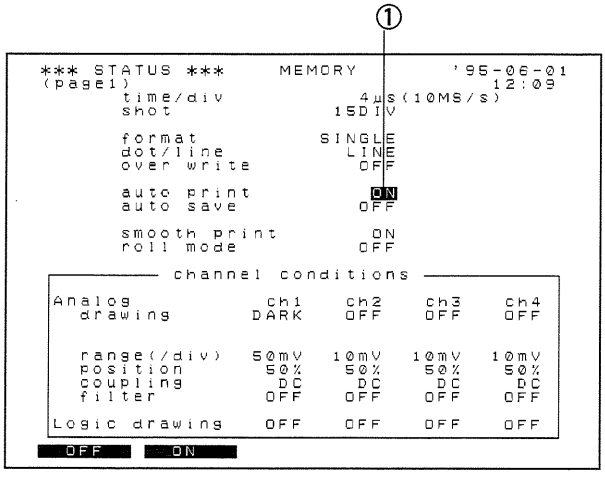


LARGE

④ Auto print function

During measurement operation, the waveform is automatically printed at the same time that it is displayed.

Procedure (Setting screen: status (page 1))



Status screen (page 1)

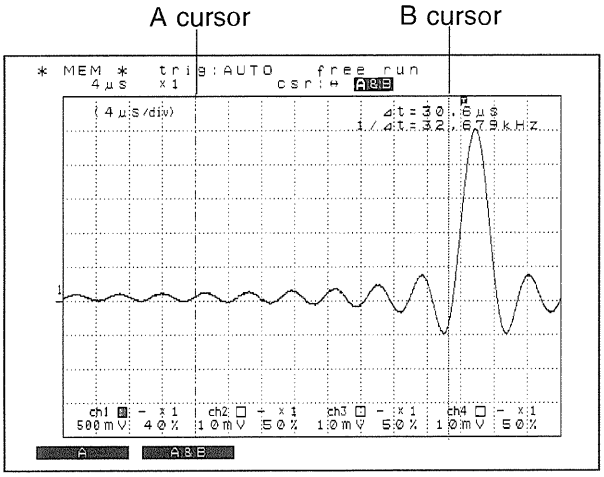
1. Move the flashing cursor to the "auto print" item, ① as shown in the figure on the left.
2. Set auto print ON or OFF, by using the soft key. [OFF, ON]

NOTE

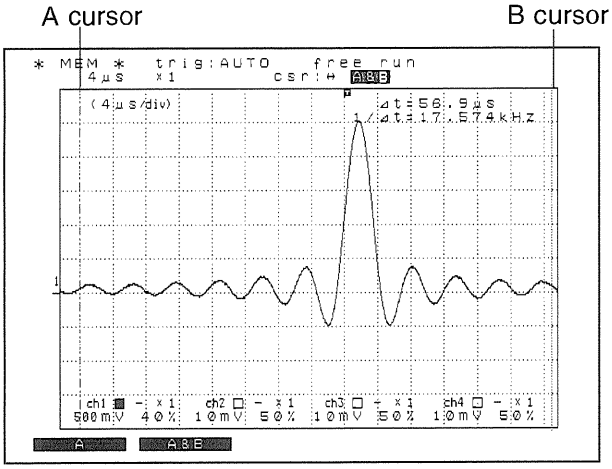
- The recording paper is fed, while holding down the [FEED] key.
- In DUAL (print QUAD) format, the channels are in order channel 1 to 4 on the printed recoding. regardless of their positions on the screen. (See the NOTE in Section 5.3.5, "Format Selection".)
- On the system, status, or trigger screen, pressing the [PRINT] key produces a listing of settings. This is the same as the printing when the listing function is enabled. (See Section 12.5.6.)

Related item You can select whether or not to print voltage scales (gauges) and listings of settings when using either of the manual and auto print functions. (See Section 12.5.6, "Listing and Gauge Functions.")

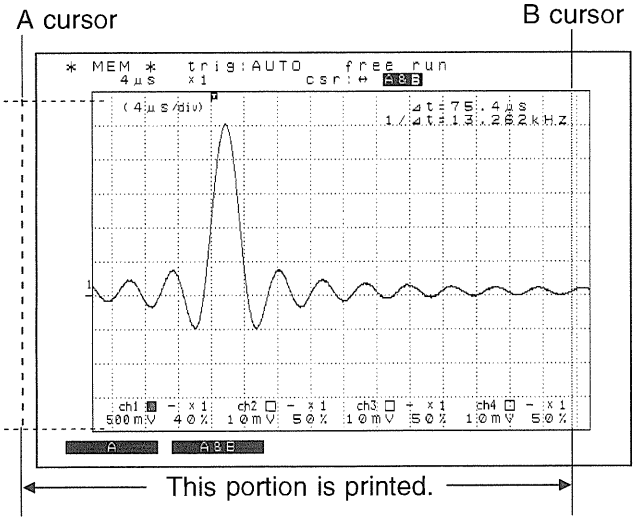
Example The A and B cursors (vertical or trace) can be used to mark a portion of waveform to print, even when either of the cursors is outside the screen area.



1. Use the A cursor to determine the start position.



2. Move the B cursor to the right.
   - When it reaches the edge of the display window, the waveform scrolls to the left.
   - The A cursor scrolls left with the waveform and even disappears off the left side of the display window.

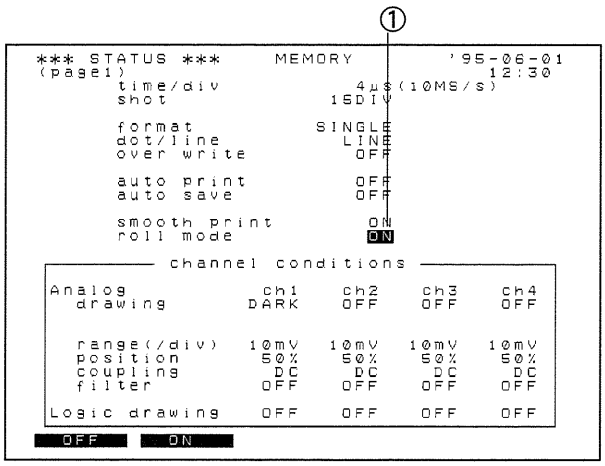


3. Determine the end position with the B cursor.
4. At this point, the A cursor has disappeared off the left side of the display window, but pressing the **PRINT** key still prints the correct portion of the waveform.

5.3.21 Roll Mode (roll mode)

- This function is available in the time axis range which is slower than 10 ms/div.
- Because display occurs from when the recording length of all the data has finished being sampled, when the roll mode is disabled, in the slow time axis ranges it takes a long time to display.
- If roll mode is enabled, waveform display starts simultaneously with waveform sampling (scrolling is performed just as is done during the operation of the recorder function.

Procedure (Setting screen: status (page 1))



Status screen (page 1)

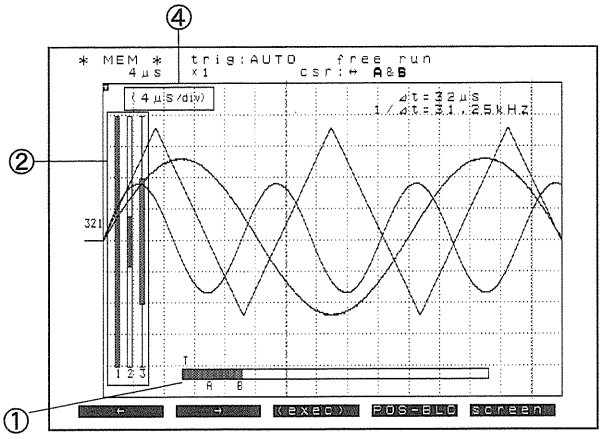
1. Move the flashing cursor to the "roll mode" item, ① as shown in the figure on the left.
2. Set roll mode ON or OFF by using the soft keys. [OFF, ON]

NOTE

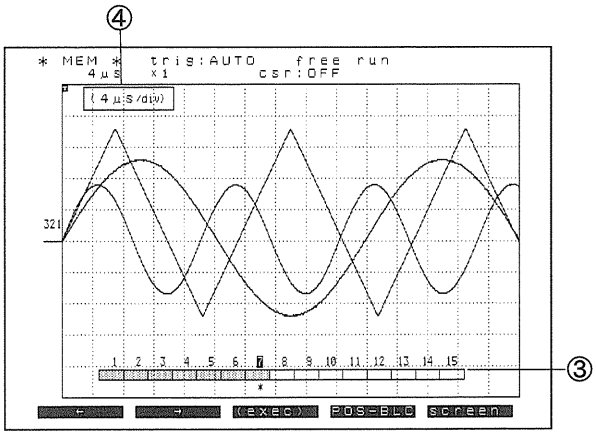
- If roll mode is enabled, the superimposition function, averaging function, memory segmentation function and waveform decision function cannot be used.
- If roll mode is enabled in DOT mode (see Section 5.3.7), the magnification along the time axis is ×1, when starting measurement. (The zoom function is released.)
- If the waveform processing calculation (see Section 11.2) is enabled, roll mode is not performed.

5.3.22 Help Function (HELP)

On the display screen, the information shown in the following figures is superimposed on the screen.
This includes scroll bars which indicates the position of the displayed waveform portion (position display), and the block display which indicates the use status of the memory blocks.



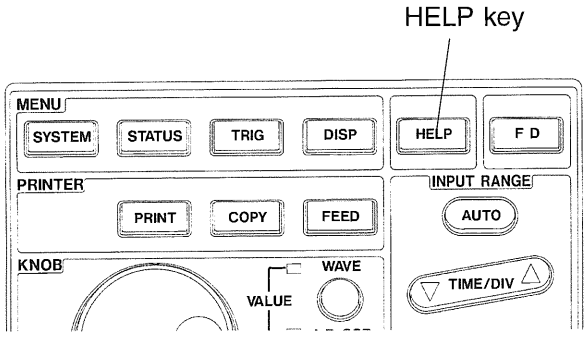
Position display (scroll bars)



Block display

① Display position along the time axis
② Display position along the voltage axis
③ Use status of the memory blocks
④ Time per one division

Procedure (Setting screen: display)



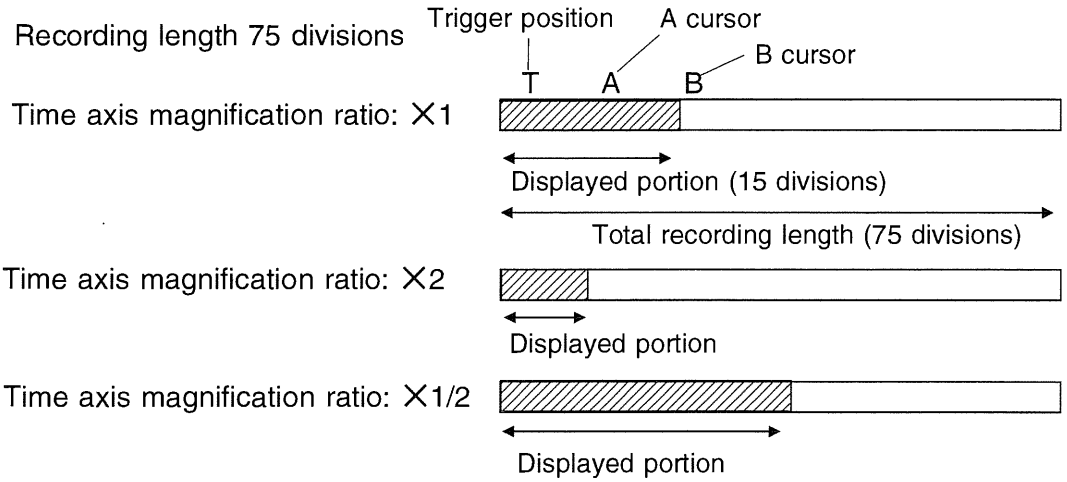
1. Pressing the **HELP** key superimposes scroll bars (or block) on the screen.
   - Pressing the **POS-BLC** soft key alternately switches between the scroll bar display and the block display.
   - If the **screen** soft key is pressed, ① to ④ as shown in the figures above and the soft key indications except **screen** disappear. (If it is pressed again, they appear.)
2. To exit from the help function, press the **HELP** key.
   Pressing the SYSTEM, STATUS, DISP FD, AUTO, TIME/DIV key, the cursor key or the range key for each channel exits from the help function.

(1) Position display

① Display position along the time axis

- The horizontal scroll bar shows the position with respect to the recording length of the displayed part of the waveform.
- The positions of the trigger and the A and B cursors (if they are being used, as vertical or trace cursors) are also shown.
- This display can be used to move horizontally the position of the displayed part of the waveform instantaneously. See the following ③.

Example



② Display position along the voltage axis

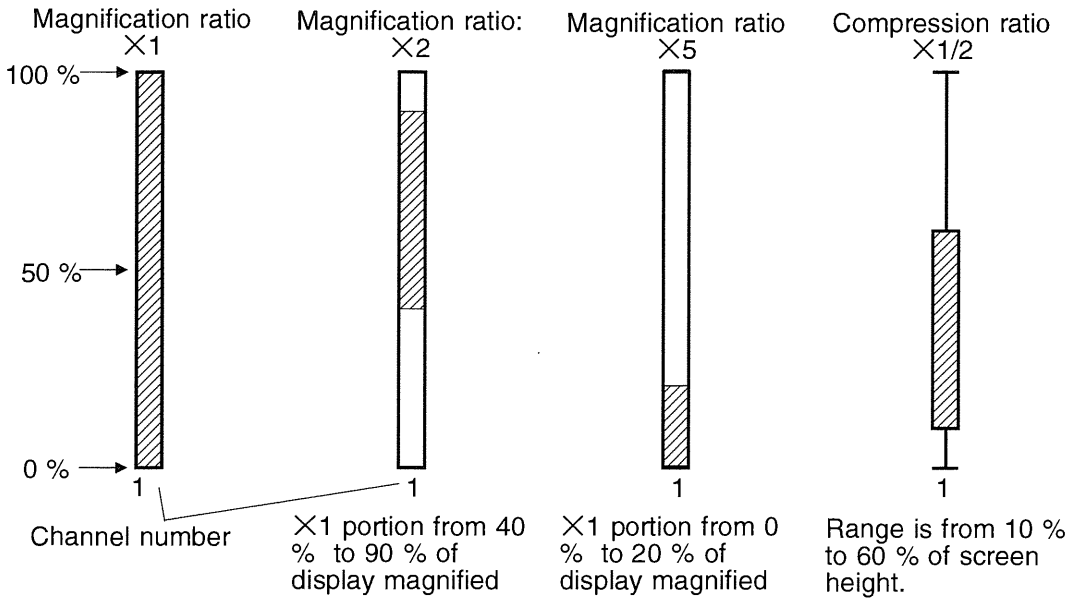
- The vertical scroll bars show the position of the displayed part of the waveform on the voltage axis.

  When the magnification ratio is set for the voltage axis:
  Shows which portion of the ×1 display is magnified.

  When the compression ratio is set for the voltage axis:
  Shows which portion of the display is being displayed.

- There is a scroll bar only for the channel for which the display is on, and the numeral at the bottom indicates the channel number.

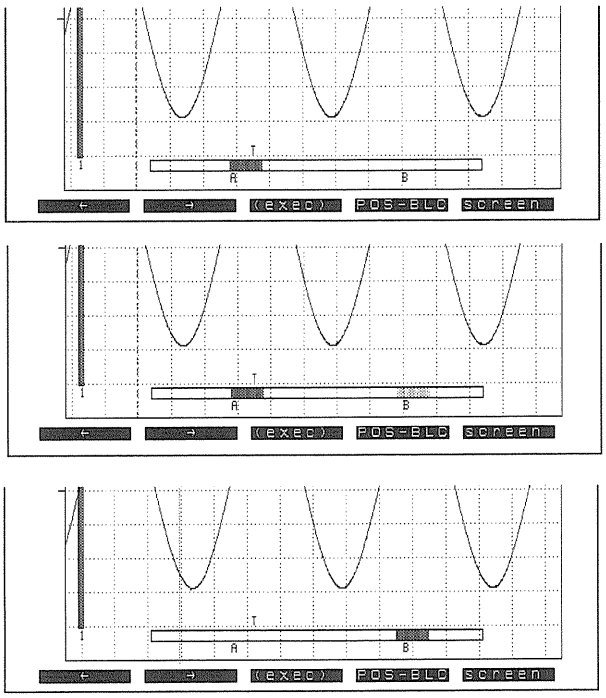
Example



③ Moving the position of the displayed waveform portion

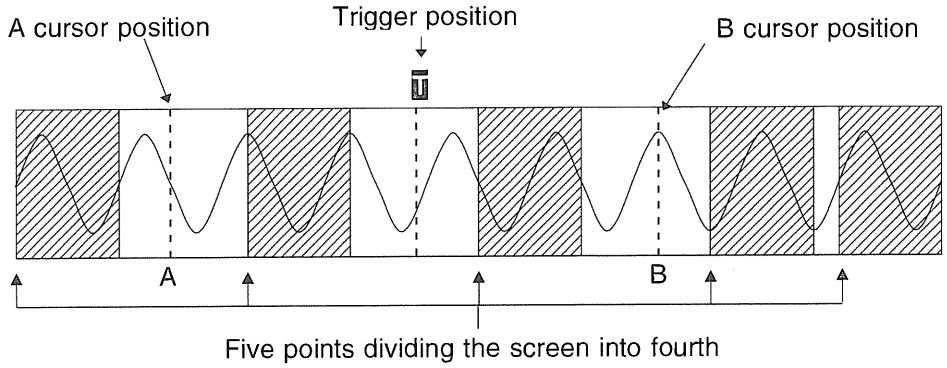
Using the position display, the position of the displayed waveform portion is moved horizontally.

Procedure



1. The horizontal scroll bar shows the position of the displayed portion.
2. Move the scroll bar bubble (indicated faintly on the screen) to the position to be moved to by using the ← and → soft keys.
3. Press the (exec) soft key to indicate the position specified in step 2.

- There are a total of eight positions on which you can position the display window cursor: five evenly spaced positions (dividing the recording length into fourths), plus the A and B cursor positions and the trigger position.
- When for example the total recording length is short, this limitation does not apply.



(three points with the dividing point at the left edge of the screen, the first point and the last point.)

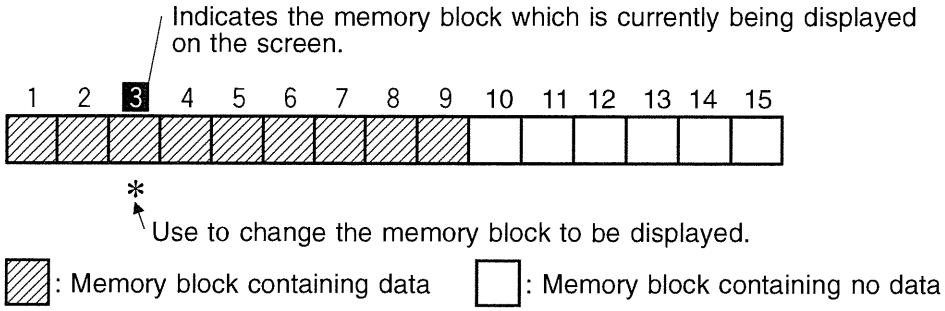
NOTE In X-Y format, the position display is not possible. (Only the block display appears.)

(2) Block display

① When using the memory segmentation function (See Chapter 9, "Memory Segmentation Function.")

· This display indicates which memory blocks are in use, with the bar display.
· Using this block display, the memory block that is being displayed on the screen can be changed. See the following procedure.

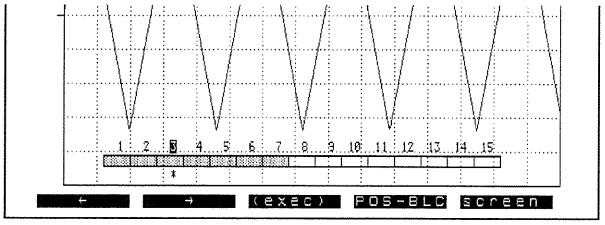
Example



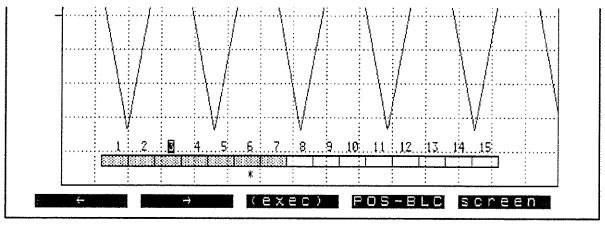
This bar display is the same as is displayed in the memory segmentation function, Chapter 9.

● Changing the memory block displayed on the screen

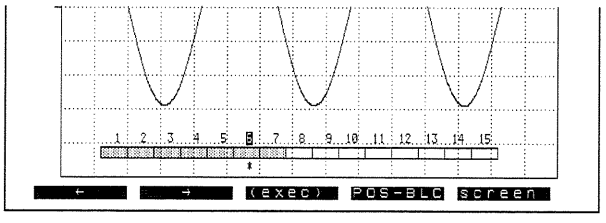
Procedure



1. The reverse video numeral indicates the memory block currently displayed on the screen (in this case, 3).



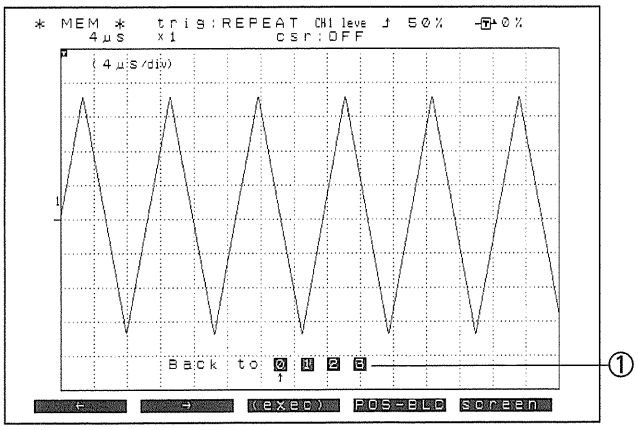
2. Using the ← and → soft keys or the rotary knob(VALUE), move the "*" mark to the new memory block to be displayed.



3. Press the (exec) soft key to display the new memory block, specified in step 2.

② When not using the memory segmentation function (When the trigger mode is REPEAT or AUTO)

- In addition to the most recently captured set of data, a maximum of three previous sets is also held in memory.
- Starting new measurement clears the data held in memory.



- The block storing no data appears as for example "1", and the block storing data appears as for example "1" (in reverse video).
- The four reverse video numerals refer to the latest set of data 0, and the previous three (1 is the immediately previous, and 3 the oldest).
- The up-arrow under the numeral indicates the currently displayed data set.
- It is possible to change the displayed waveform. See the procedure in "Changing the displayed waveform".

NOTE

Depending on the recording length, it may not be possible to store all four sets of data. In this case and when the trigger mode is SINGLE, the display appears as "Single wave", in ①.

• Changing the displayed waveform

Procedure

1. When you press either of the ← and → soft keys, a "*" mark appears; move this to the required set of data. (0 to 3)
2. Press the (exec) soft key to display the required set of data.

5.4 Operation Example

This example illustrates the basic procedure using the memory recorder function to measure, a 3 V p-p 1 kHz sine wave input.

(1) Power on the unit

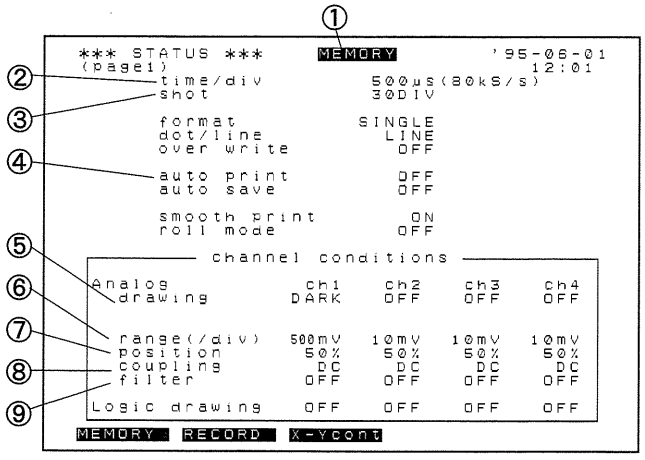
Connect the power cord to the 8853 and press the power switch.

(2) Input connection

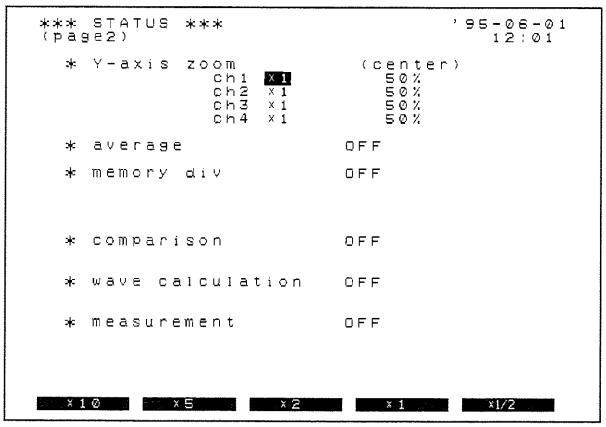
- Connect a signal generator to the input terminals of channel 1 (the 8945 analog unit).
- Set the signal generator so that it outputs a 3 V p-p 1 kHz sine wave.

(3) Settings on the status screen (page 1)

Using the cursor keys and the soft keys, make settings as shown in the figure below.



Status screen (page 1)

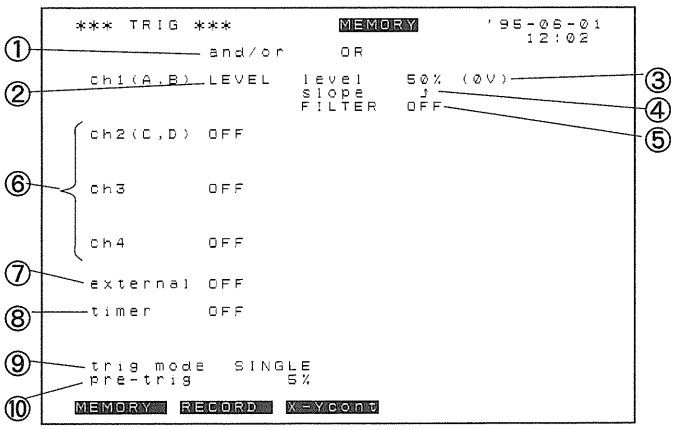


(page 2)

① Function mode	MEMORY	
② Time axis range time/div	500 µs	
③ Recording length shot	30 DIV	
④ Auto print auto print	OFF	
⑤ Display intensity drawing	ch1: DARK, ch2 to 4: OFF	
⑥ Voltage axis range range (/div)	500 mV	ch1 only
⑦ Position position	50 %	ch1 only
⑧ Input coupling coupling	DC	ch1 only
⑨ Filter filter	OFF	ch1 only

(4) Settings on the trigger screen (See Chapter 8.)

Using the cursor keys and the soft keys, make settings as shown in the figure below.



Trigger screen

① Trigger logical operator OR and/or	
② ch1 (A, B)	LEVEL
③ Trigger level level	50 %
④ Slope slope	↓
⑤ Filter FILTER	OFF
⑥ ch2 to ch4	OFF
⑦ External trigger external	OFF
⑧ Timer trigger timer	OFF
⑨ Trigger mode trig mode	SINGLE
⑩ Pre-trigger pre-trig	5 %

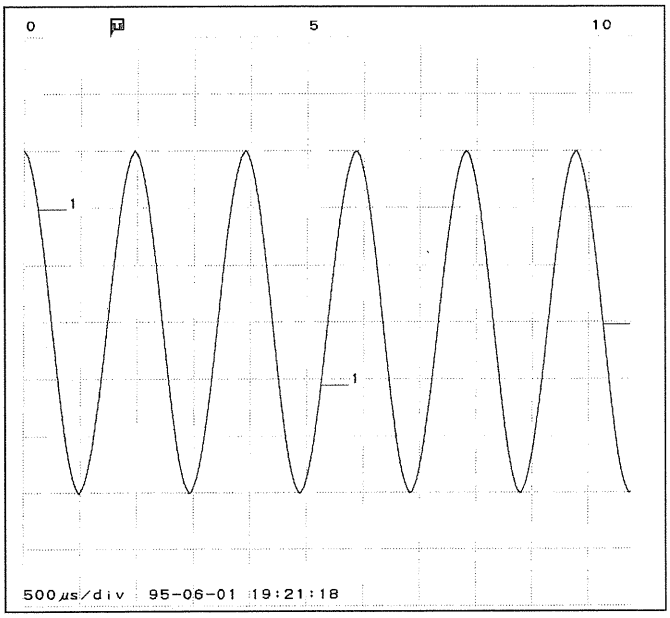
(The items of ③, ④ and ⑤ are shown, after the setting for ② is made.)

(5) Measurement

Press the **START** key to start measurement. (When the 30 divisions of data have been captured, measurement terminates.)

(6) Printing

Press the **PRINT** key to print out the measured waveform.

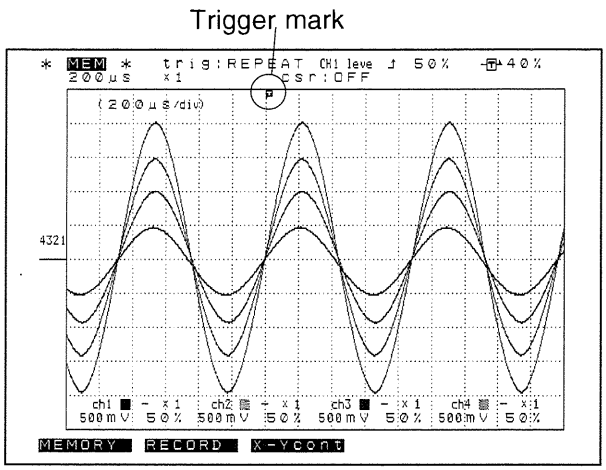


5.5 Interpreting Waveform Displays and Recordings

This section illustrates the display and printed recording (manual print) in each of the formats (with the gauges and the channel markers enabled).

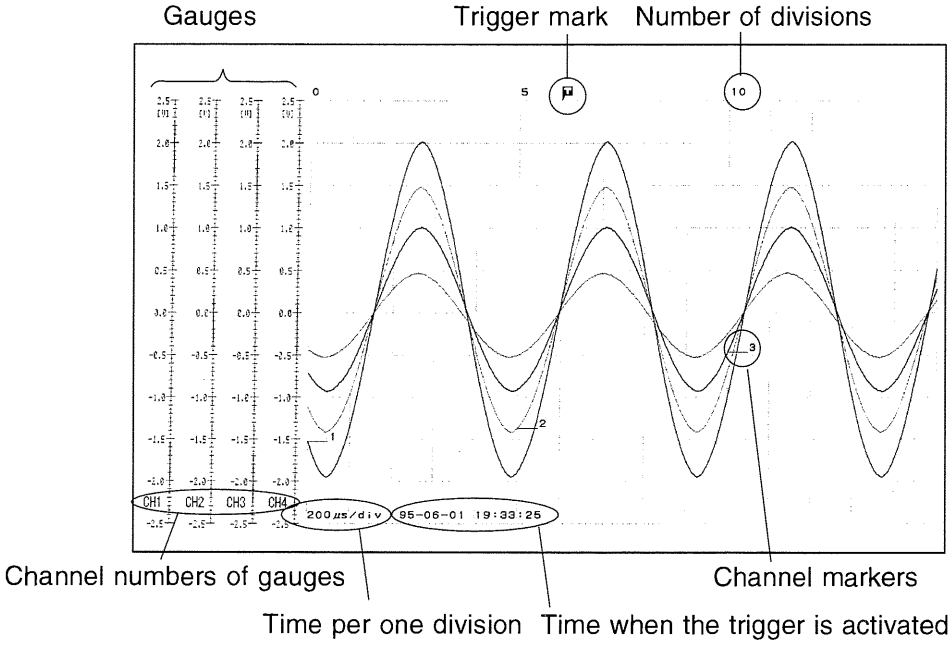
(1) SINGLE format

Display



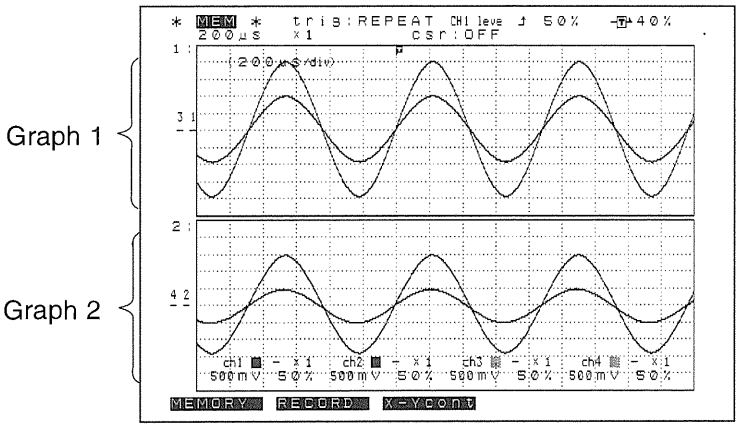
Trigger mark
(This indicates the point when the trigger is activated.)

Manual print

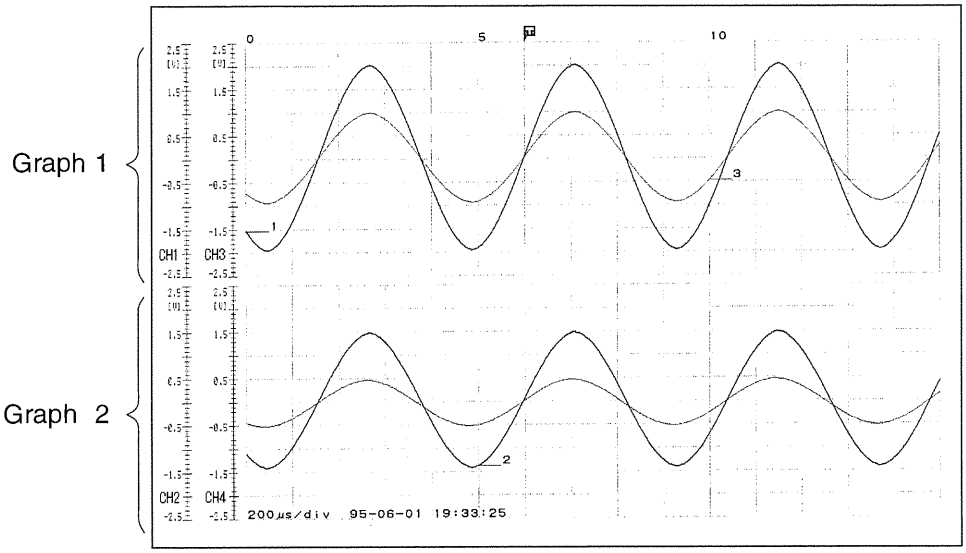


(2) DUAL format

Display

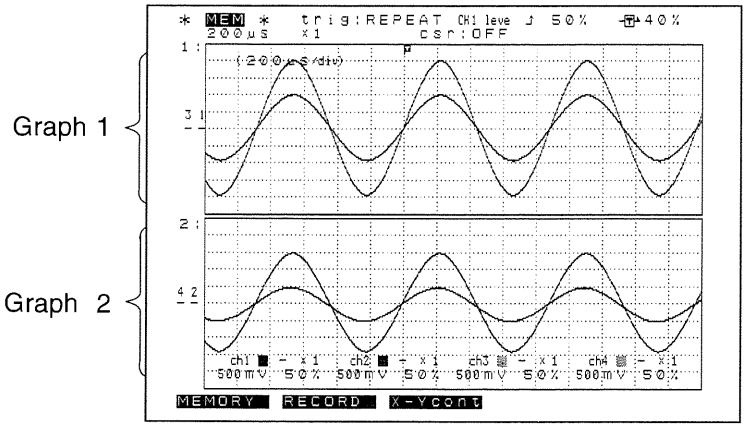


Manual print



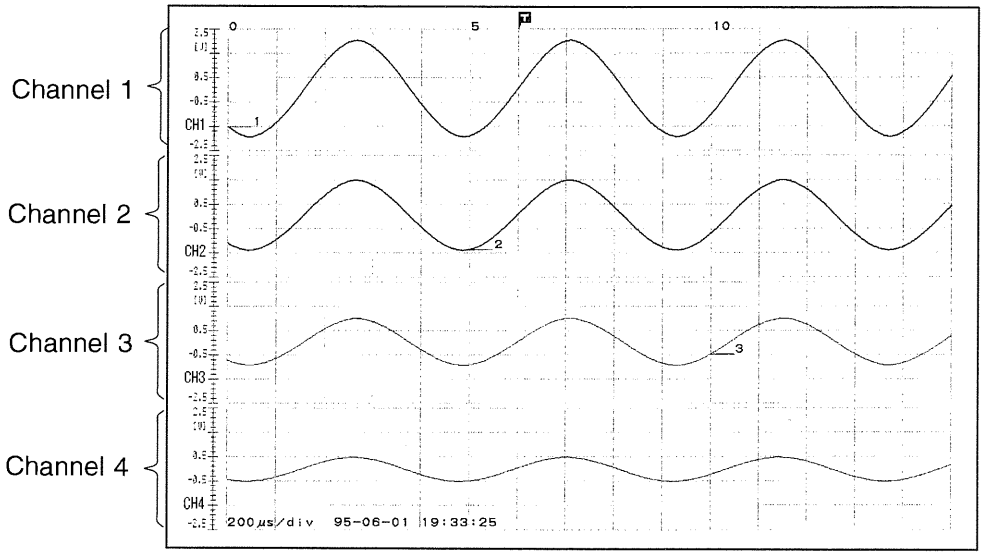
(3) DUAL (print QUAD) format

Display



Time indications on the screen are the same as in (2) DUAL format.

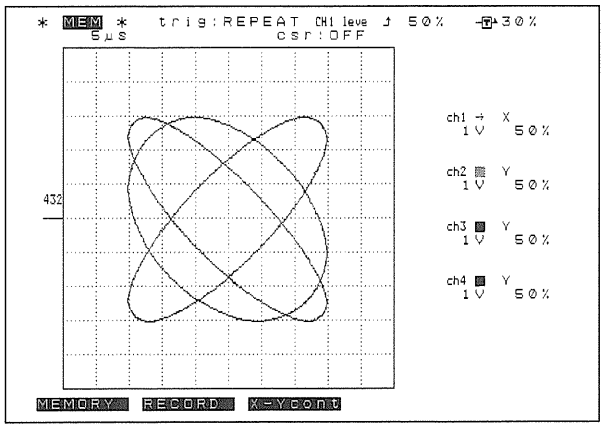
Manual print



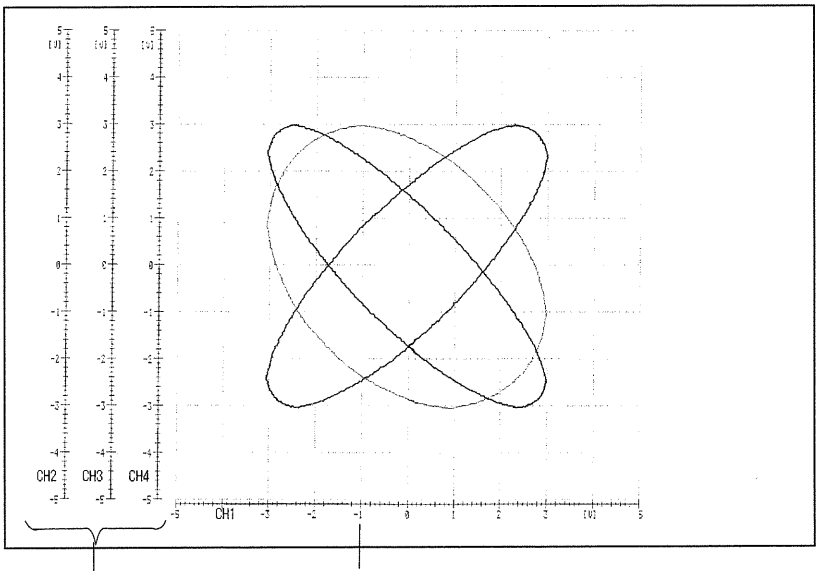
The four channels are assigned one to each of the four graphs, in sequence channel 1 to 4, regardless of their positions (in graph 1 or 2) on the screen.

(4) X-Y format

Display



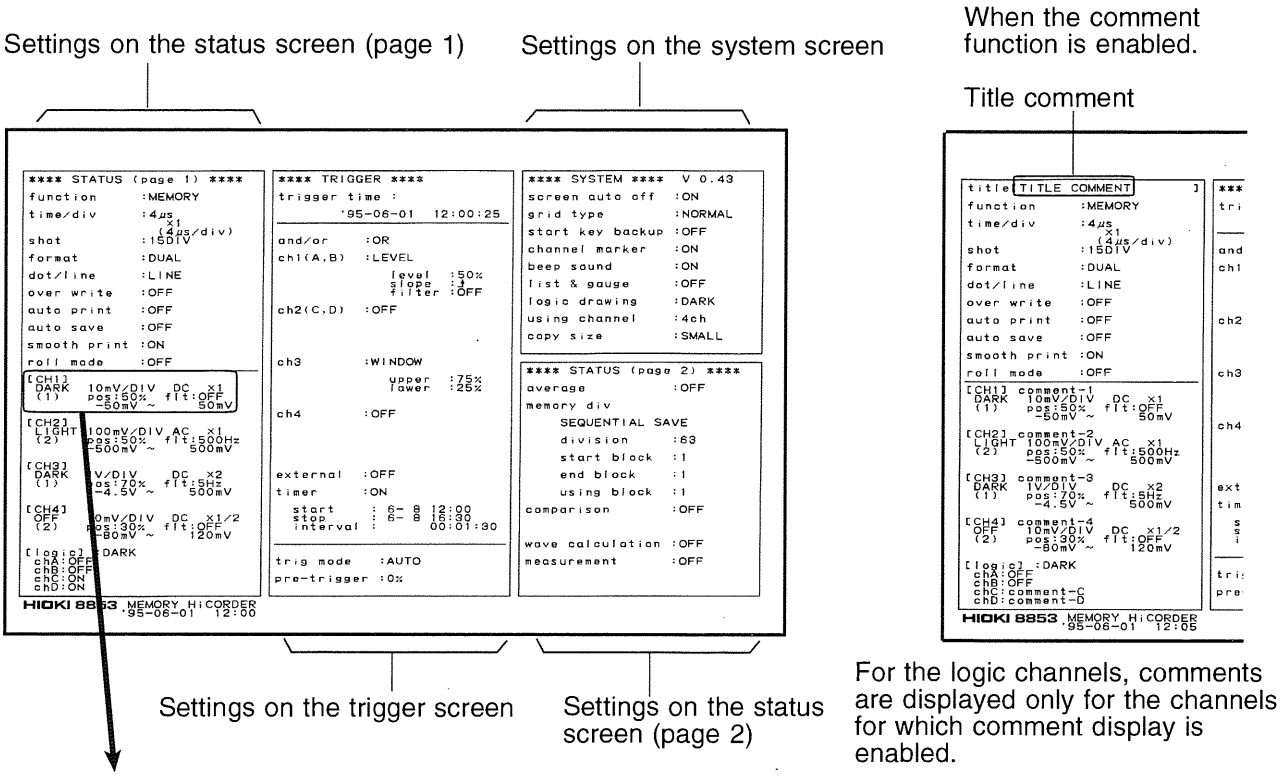
Manual print

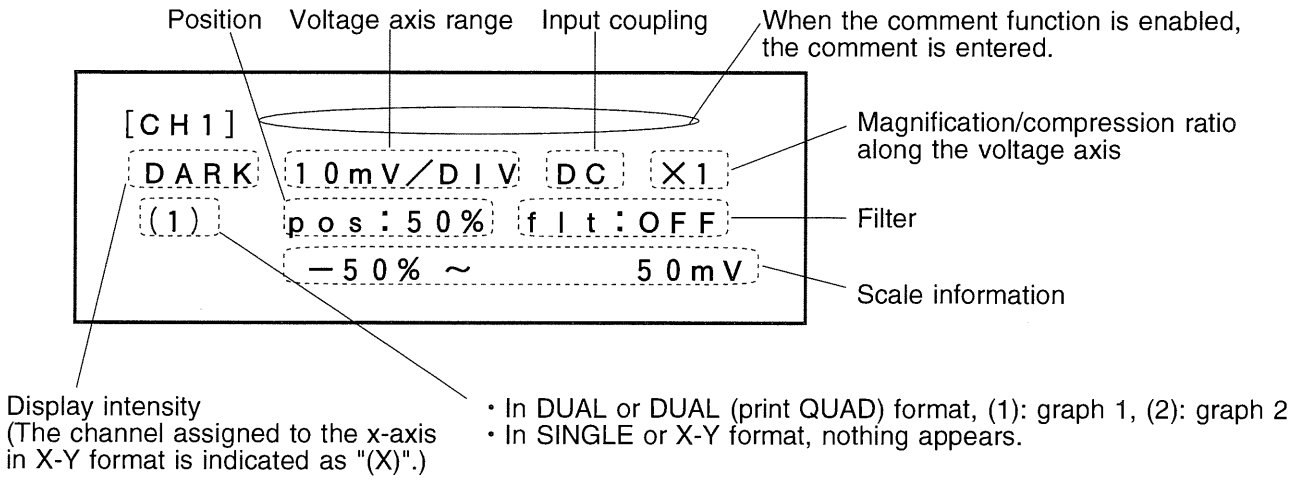


Gauges (Y-axis) Gauge (X-axis)

5.6 Interpreting Listing

- This section illustrates the listing.
- The listing is printed by enabling the list function (see Section 12.5.6) or pressing the [PRINT] key on the status, trigger or system screen.





Chapter 6
Recorder Function Mode

6.1 What is the Recorder Function?

6.1.1 Introduction

This function provides real time display and recording of the input signal.

(1) Real time continuous recording of the input signal.

(2) Recording all input channels on the same time axis.

Since the different signals can be overlaid, it is easy to see the relationships among them.

(3) There is a range of 13 chart speeds, from 400 ms/division to 1 hour/division.

(4) High-speed sampling

High-speed sampling is carried out at 2 kS/s in the time axis range of 400 ms, and at 1.6 kS/s in other time axis ranges, thus allowing the envelope function to be used.

(5) Compressed display and recording are available along the time axis, and magnified and compressed display and recording are available along the voltage axis.

- Along the time axis ×1, ×1/2, ×1/5, ×/10, ×1/20, ×1/50
- Along the voltage axis ×10, ×5, ×2, ×1, ×1/2

(6) Scrollable display

Although this is real time continuous recording, 750 divisions of the waveform (including the screen portion) are held in memory. It is thus possible to scroll back for easy review of the waveform.

(7) Two display formats and three formats for printed recordings selectable.

Single, dual, and quad (printing only) formats are available for the time axis.

(8) High quality printed recordings

The high time axis resolution of the printing yields results close to those of an analog recorder.

- 400 or 500 ms/division 80 points/division
- 1 s to 1 hour/division 160 points/division

(9) Reprint function

The waveform data held in memory (the most recent 750 divisions, including the section displayed) can be printed as many times as required.

6.1.2 Finding Reference Material in this Manual

(1) Basic functions (See Section 6.3, "User Operations.")

These are described in Sections 6.3.1 to 6.3.15. These have many functions in common with the memory recorder function's, so please refer to Chapter 5 as will, if necessary.

(2) Trigger functions (See Chapter 8.)

Depending on the application, there is a wide range of trigger types to choose from.

(3) Using floppy disks, hard disks, and magneto-optical disks. (See Chapter 13.)

The floppy disk, hard disk, and magneto-optical disk drive provide a storage mechanism for setting information.

(4) Scaling function (See Section 12.3, "Scaling Function.")

This allows the input voltages to be converted to other values and units, so that the physical quantities originally measured can be read off directly.

(5) Comment function (See Section 12.4, "Adding Comments.")

This provides a convenient means of annotating printed recordings.

(6) Screen auto off function (See Section 12.5, "Special Function Settings.")

Turns the display off automatically if no use operation occurs for 10 minutes.

(7) Grid setting (See Section 12.5.)

The grid for the printed recording can be selected as required.

(8) Start key backup function (See Section 12.5.)

If the power supply fails during recording, enabling this function causes recording to restart when the power is restored.

(9) Channel marker function (See Section 12.5.)

Prints the channel numbers on the recording.

(10) Beep sound setting (See Section 12.5.)

When an error occurs or when a warning is issued, it is possible to arrange for a "beep" sound to be produced.

(11) List and gauge functions (See Section 12.5.)

Voltage axis scales and listings of settings on printed recordings.

(12) Connection to a computer via the GP-IB interface (See 8853 FFT Function·GP-IB Interface Instruction Manual.)

(13) Output to an external plotter (See 8853 FFT Function·GP-IB Interface Instruction Manual.)

(14) Self check functions (See Section 12.8, "Self Check Functions.")

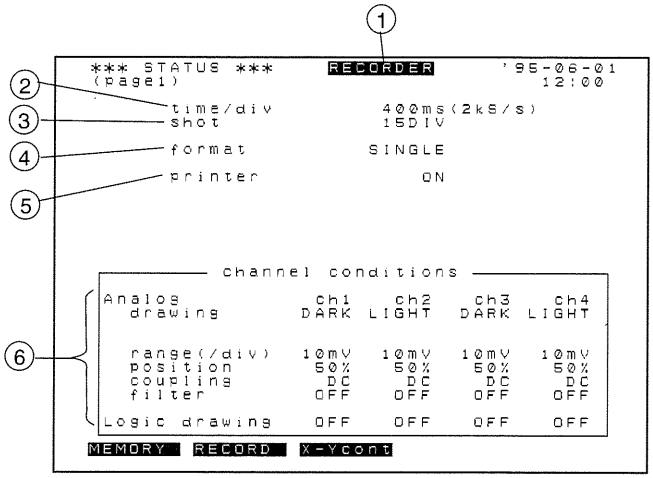
This performs simple tests on the unit's functioning.

6.2 Display Screen

- This section describes the status, trigger and display screens.
- It shows you where to look in this manual for further explanation of specific items.
- The system screen is described in Chapter 12, and the floppy disk and SCSI control screens are described in Chapter 13.

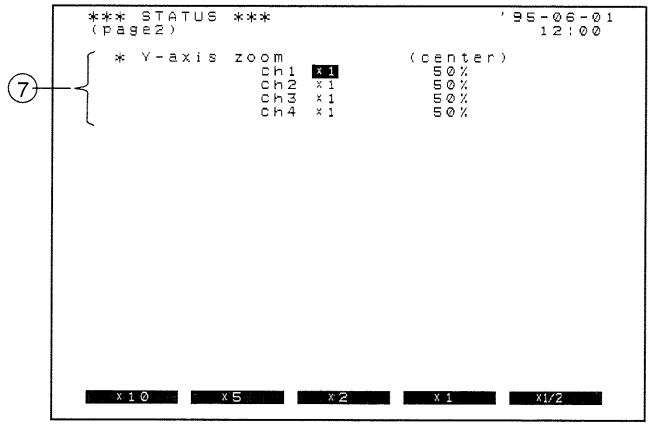
6.2.1 Status Screen (STATUS)

- Press the [STATUS] key, and the status screen appears.
- Pressing the [STATUS] key alternately switches between page 1 and page 2.



page 1

① Function mode (See Section 6.3.2.)
② Time axis range (See Section 6.3.3.)
③ Recording length (See Section 6.3.4.)
④ Format (See Section 6.3.5.)
⑤ Printer on/off (See Section 6.3.14.)
⑥ Channel settings (See Sections 6.3.6 and 6.3.7.)

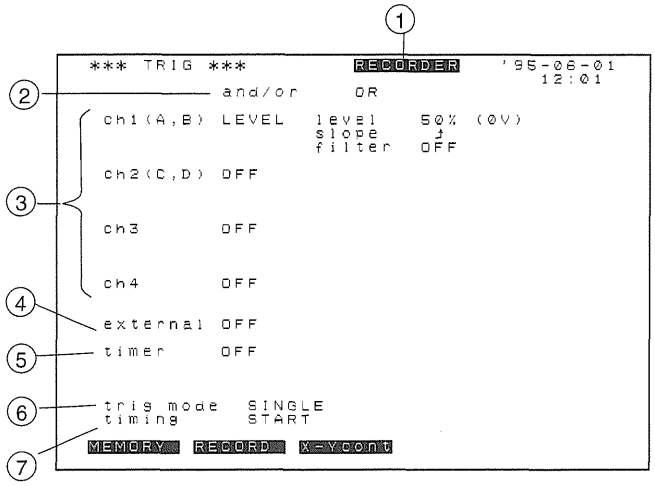


page 2

⑦ Magnification and compression of the voltage axis (See Section 6.3.13.)

6.2.2 Trigger Screen (TRIG)

· Press the [TRIG] key, and the trigger screen appears.
· See Chapter 8, "Trigger Functions" for more details.

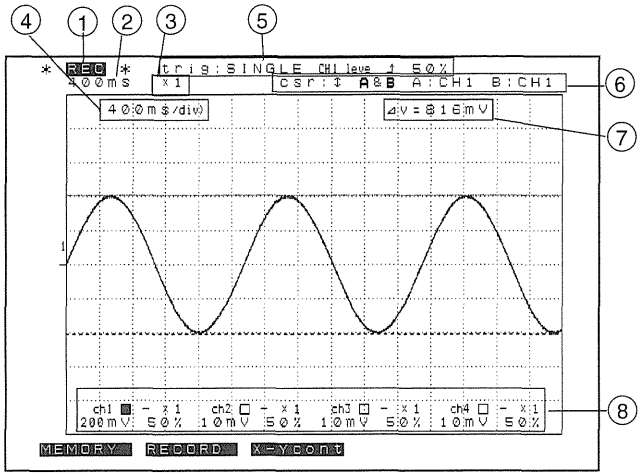


① Function mode (See Section 6.3.2.)
② Trigger logical operator (See Chapter 8.)
③ Internal triggers (See Chapter 8.)
④ External trigger (See Chapter 8.)
⑤ Timer trigger (See Chapter 8.)
⑥ Trigger mode (See Chapter 8.)
⑦ Trigger timing (See Chapter 8.)

Trigger settings will be described in Chapter 8.

6.2.3 Display Screen (DISP)

· Press the [DISP] key, and the display screen appears.
· The figure below illustrates a display in SINGLE format. (See Section 6.3.5, "Format Selection.")

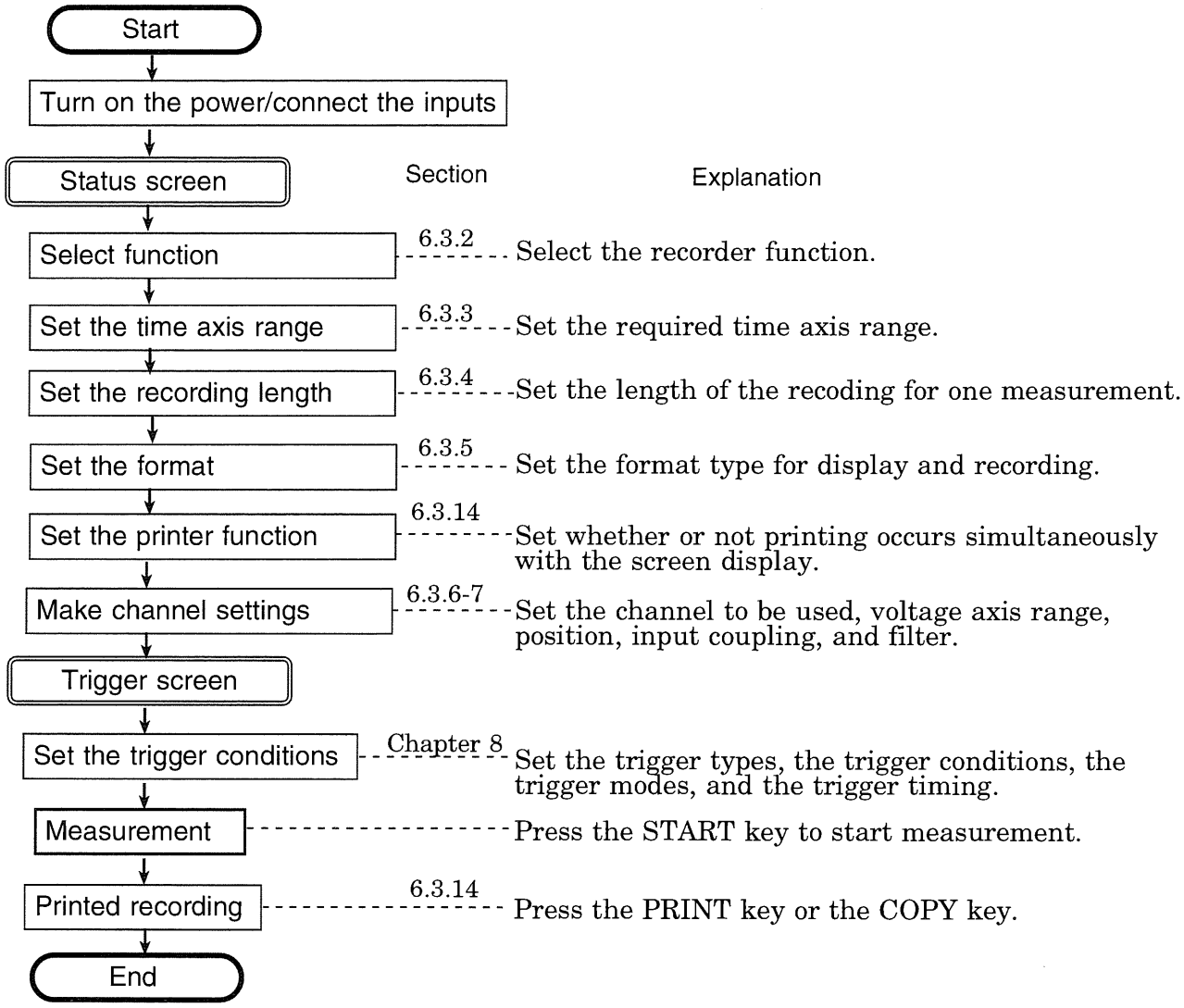


① Function mode (See Section 6.3.2.)
② Time axis range (See Section 6.3.3.)
③ Compression of the time axis (See Section 6.3.12.)
④ Time per one division (See Section 6.3.12.)
⑤ Trigger settings (See Chapter 8.)
⑥ A and B cursor settings (See Section 6.3.11.)
⑦ A and B cursor readout values (See Section 6.3.11.)
⑧ Channel information (See Sections 6.3.6 and 6.3.7.)

6.3 User Operations

6.3.1 Operational Flow

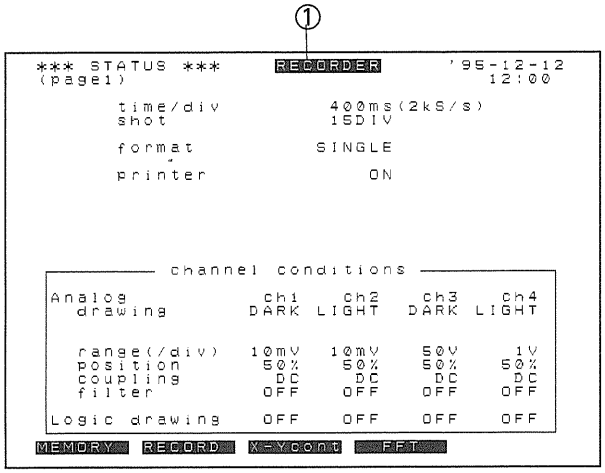
The flowchart below illustrates the sequence of operations involved in using the recorder function. (See Section 6.4, for the operation example.)



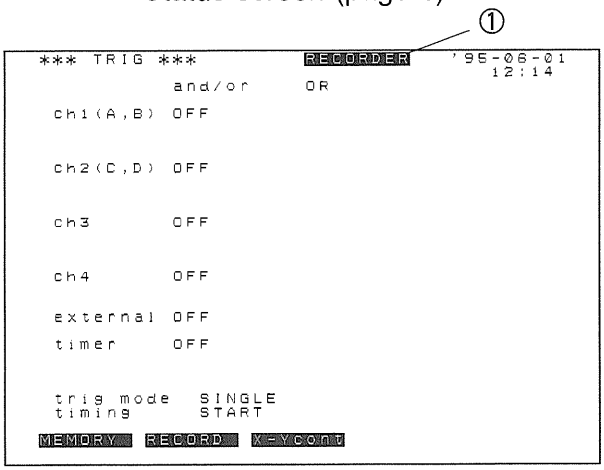
6.3.2 Function Selection

- The 8853 has four functions: memory recorder (Chapter 5), recorder, X-Y recorder (Chapter 7), and FFT (see FFT Function·GP-IB Interface Instruction Manual).
- In this case, select the recorder function.

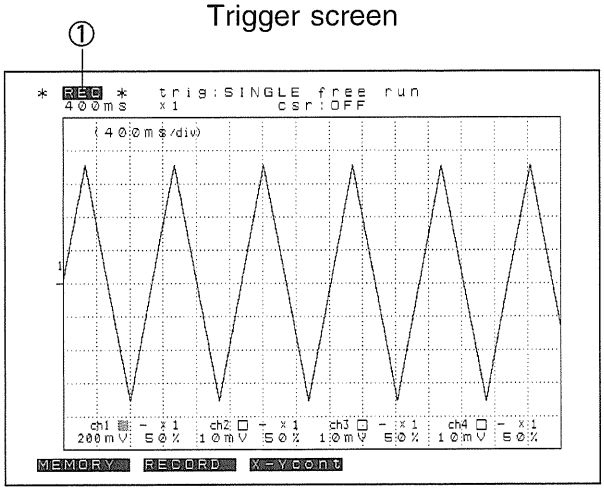
Procedure (Setting screen: status (page 1), trigger and display)



Status screen (page 1)



Trigger screen



Display screen

1. Using the cursor keys, move the flashing cursor to ① as shown in the figure on the left.
2. Press the **RECORD** soft key.

   This selects the recorder function.

Soft key indication

MEMORY : Memory recorder function
RECORD : Recorder function
X-Ycont : X-Y recorder function
FFT : FFT function

NOTE

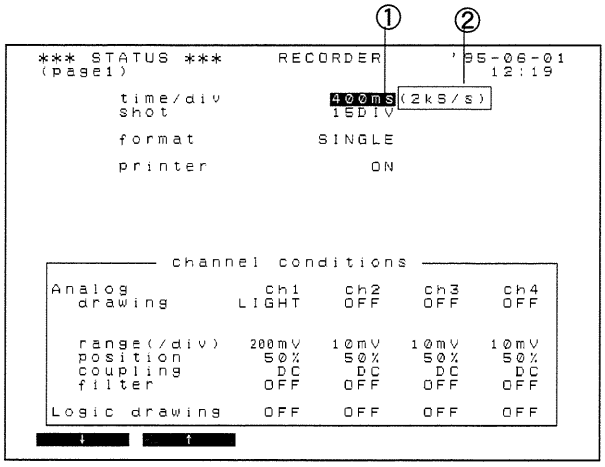
The function indication in ① on the display screen is abbreviated.

MEM : MEMORY
REC : RECORDER
XYc : X-Ycont

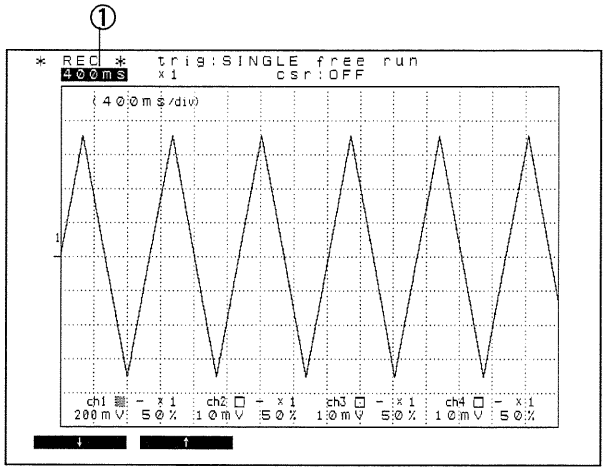
6.3.3 Time Axis Range Setting (time/div)

- This sets the chart speed (the paper feed speed).
- The value to be set is the time for one division along the time axis.
- The sampling rate is 2 kS/s in the time axis range of 400 ms, and 1.6 μs in other ranges. (See Background in Section 5.3.3.)

Procedure (Setting screen: status (page 1) and display)



Status screen (page 1)



Display screen

1. Using the cursor keys, move the flashing cursor to the "time/div" item, ① as shown in the figures on the left.
2. By using the soft keys or the rotary knob (VALUE), set the time axis range.

   [400 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s, 1 min, 2 min, 5 min, 10 min, 20 min,1 hour]

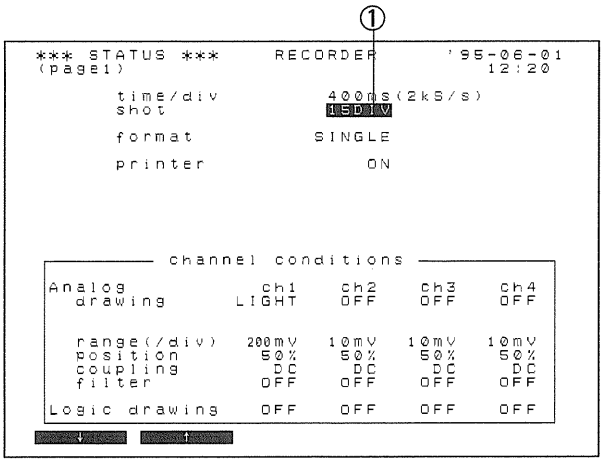
By using the (▼TIME/DIV▲) key, you can set the time axis range without moving the flashing cursor.

The sampling rate (see Section 5.3.3) is indicated in ②.

6.3.4 Recording Length Selection (shot)

Sets the recording length (number of divisions) for a single measurement.

Procedure (Setting screen: status (page 1))



Status screen (page 1)

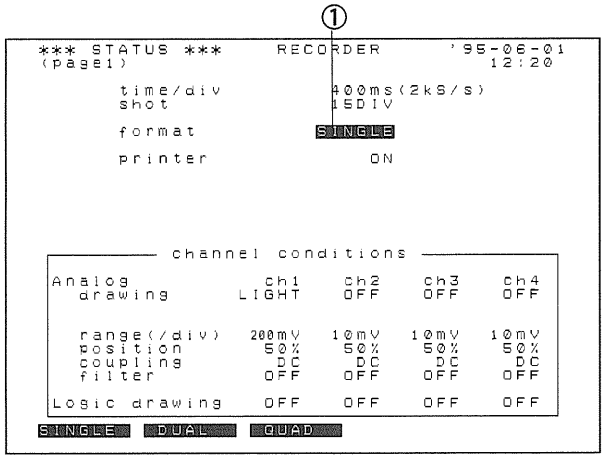
1. Move the flashing cursor to the "shot" item, ① as shown in the figure on the left.
2. By using the soft keys or the rotary knob, set the recording length.
   [15, 30, 75, 150, 300, 750, CONT]

- The CONT (continuous) setting causes the measurement to continue until the STOP key is pressed.
- When the recording length is set to any of the values from 15 to 750 divisions, the entire measurement data is held in memory. On the continuous setting, the most recent 750 divisions of data are always retained in memory.

6.3.5 Format Selection (format)

- Sets the format for display and printing.
- There are three possibilities: SINGLE, DUAL, and DUAL (print QUAD).
- The setting procedure is the same as in the memory recorder function. For details, see Section 5.3.5.

Procedure (Setting screen: status (page 1))



Status screen (page 1)

1. Using the CURSOR keys, move the flashing cursor to the "format" item, ①.
2. By using the soft keys, select the format.
   [SINGLE, DUAL, QUAD]

   Pressing the QUAD soft key selects the DUAL (print QUAD) format.

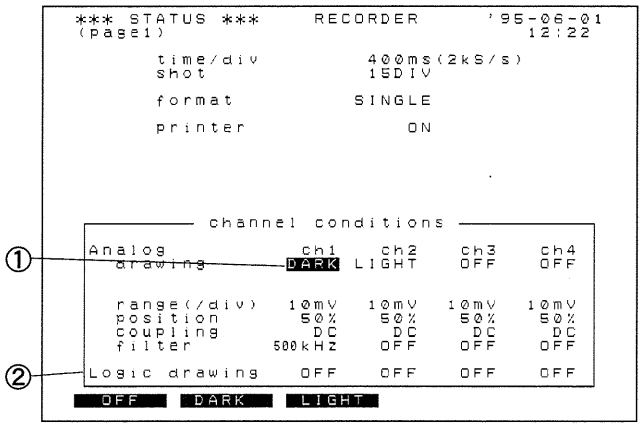
   The X-Y format is not available in the recorder function.

6.3.6 Display and Recording Channel Settings

- The maximum of four analog channels and 16 logic channels are available.
- These settings determine which channels are displayed or recorded.
- The setting procedure and are the same as in the memory recorder function. For details, see Section 5.3.8.

(1) Analog channel setting (Analog drawing)

Procedure (Setting screen: status and display)



Status screen (page 1)

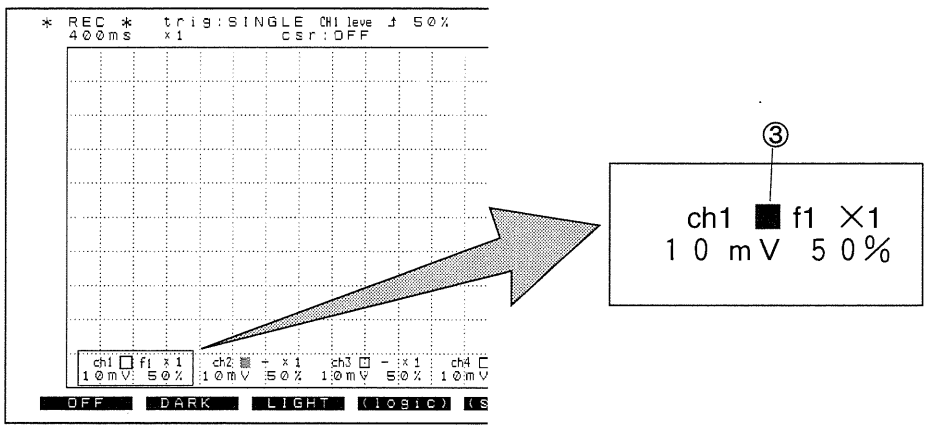
Move the flashing cursor to the "Analog drawing" item for each channel, ① as shown in the figure on the left or ③ as shown in the figure below, and make settings by using the soft keys.

Soft key indication — Indication of ③ as shown in the figure below

OFF : □ No display or recording

DARK : ■ High intensity display and recording

LIGHT : ▒ Low intensity display and recording



Display screen

(2) Logic channel setting (Logic drawing)

Procedure (Setting screen: status and display)

Move the flashing cursor to the "Logic drawing" item for each channel, ② or ③ as shown in the figures above, and make settings by using the soft keys.

a. On the status screen

Soft key indication

OFF : No display or recording

ON : Display or recording

b. On the display screen

Soft key indication

(logic) : Pressing the soft key toggles the display or recording on or off.

- The groups of four channels under channels 1 to 4 correspond to the connectors CHA,CHB, CHC, and CHD on the rear panel.
- The intensity of logic channel display and recording can be set on the system screen (See Section 12.5.7).

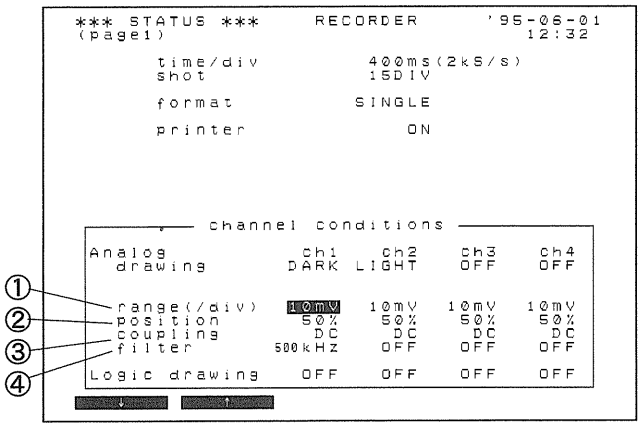
6.3.7 Voltage Axis Range, Position, Input Coupling and Filter Settings

The setting procedures are the same as in the memory recorder function. For details, see Section 5.3.9

(1) Voltage axis range (range/div) setting

The voltage value for one division is set.

Procedure (Setting screen: status and display)

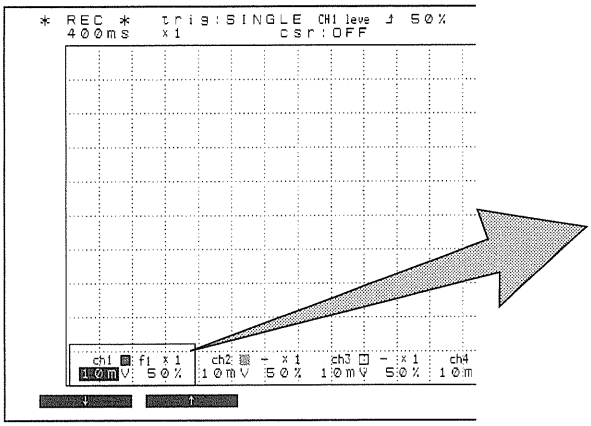


Status screen (page 1)

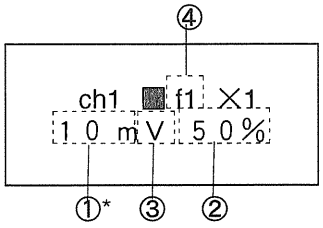
Move the flashing cursor to ① as shown in the figures on the left or below for each channel and make the setting by using the soft keys or the rotary knob.

You can also use the ▼CH1-CH4▲ key for each channel, without moving the flashing cursor.

[10 mV to 50 V]



Display screen



* "V" is omitted.

(2) Position setting

The position of the zero voltage (%) is set.

Procedure (Setting screen: status and display)

Move the flashing cursor to ② as shown in the figures on the previous page for each channel, and make the setting by using the soft keys or the rotary knob.

[-100 % to 100 % (in 1 % increments)]

(3) Input coupling setting

Procedure (Setting screen: status and display)

Move the flashing cursor to ③ as shown in the figures on the previous page for each channel, and make the setting by using the soft keys.

Indications of ③: [GND, AC, DC]

⏚ : GND
~V : AC
V : DC

(4) Low-pass filter setting

The low-pass filter in the input unit itself is set.

Procedure (Setting screen: status and display)

Move the flashing cursor to ④ as shown in the figures on the previous page for each channel, and select the cutoff frequency for the low-pass filter by using the soft keys. [OFF, 500 kHz, 500 Hz, 5 Hz]

6.3.8 Zero Adjustment

- This function provides for accurate adjustment of the waveform to the origin position when a zero voltage is input.
- Use it for reading precise values from the screen or a printed recording.
- Zero adjustment is the same as in the memory recorder function. For details, see Section 5.3.10.

Procedure (Setting screen: display)

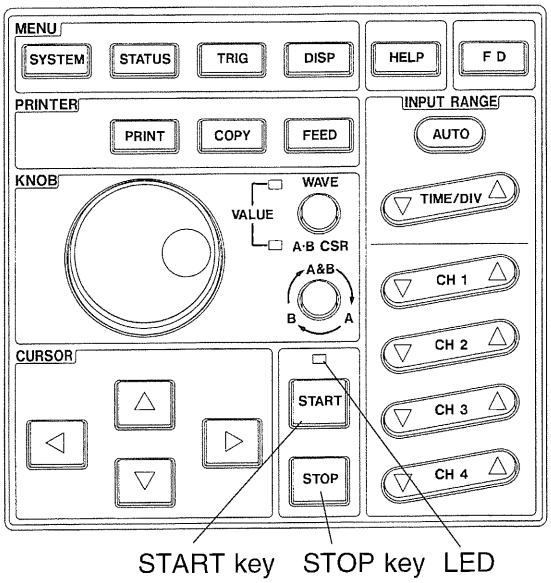
Allow at least 60 minutes after powering on, before carrying out this procedure, to ensure that the internal temperature of the input units has stabilized.

Move the flashing cursor to the item for setting the position (see Section 6.3.7), and press the **0 adj** soft key. This carries out the correction of the position of the zero voltage for all analog channels.

6.3.9 Starting and Stopping Measurement Operation

- The START and STOP keys control the measurement operation mode of the unit.
- The LED above the START key is lit during measurement.

Procedure



1. Press the START key.
   Measurement starts and the LED is lit.
2. Press the STOP key.
   Measurement stops and the LED goes out.

NOTE

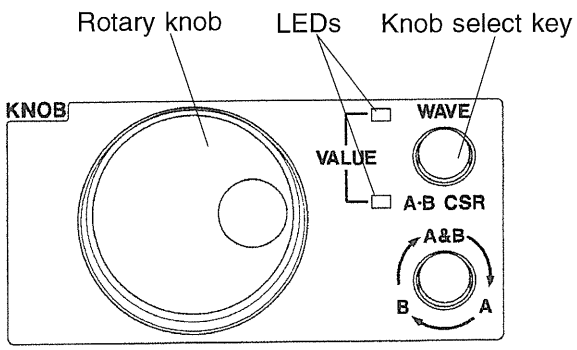
If the trigger mode is set to REPEAT, or the recording length is set to CONT, the unit continues measurement until the STOP key is pressed. (In the other cases, it terminates measurement operation after capturing data for the specified recording length.)

6.3.10 Waveform Scrolling

- This function scrolls the waveform display both vertically and horizontally.
- This function is the same as in the memory recorder function. For details, see Section 5.3.12.

Procedure (Setting screen: display)

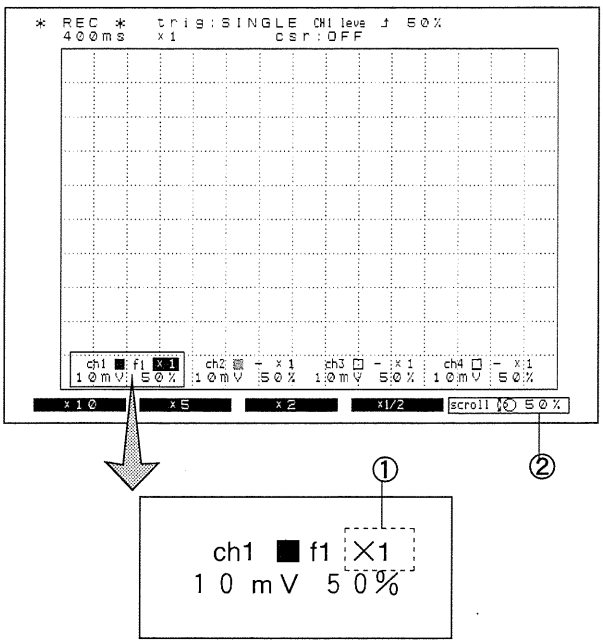
(1) Horizontal scrolling (on the time axis)



1. Press the knob select key so that only the upper (WAVE) indicator is lit.
2. Use the rotary knob to scroll the waveform horizontally.

- Turning the rotary knob rapidly switches to auto-scroll mode, and the waveform continues scrolling automatically.
- If the flashing cursor is positioned in ① as shown in the figure on the next page, the rotary knob will scroll the waveform vertically.

(2) Vertical scrolling on the voltage axis



1. Move the flashing cursor to ① as shown in the figure on the left for the channel you wish to scroll.
2. Press the knob select key so that only the upper (WAVE) indicator is lit.
3. Use the rotary knob to scroll the waveform vertically.

The position of the displayed waveform portion (see Section 6.3.13) is indicated in ②.

Related item By using the horizontal scroll bar in the help function (see Section 6.3.15), the displayed position along the time axis and along the voltage axis can be confirmed. Also, the position of the displayed waveform portion can be moved instantaneously.

6.3.11 Using A and B Cursors

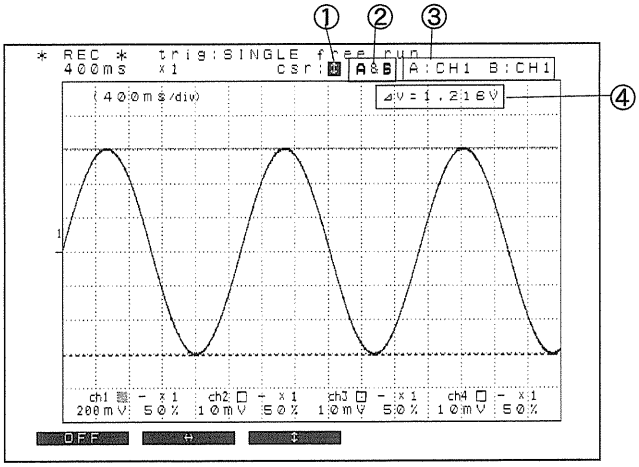
- You can use the cursors to measure time, frequencies, or voltage differences (if using the scaling function, the scaled values; see Section 12.3, "Scaling Function"), getting a direct readout.
- The operation is almost the same as in the memory recorder function. For details, see Section 5.3.13. However, the trace cursors cannot be used.

(Cursor readout value)

Cursor	A cursor only (A)	Both A and B cursors (A&B)
Vertical cursor	t time from the recording start point 1/t the frequency, taking t as the period	Δt time interval between the A and B cursors 1/Δt the frequency, taking Δt as the period
Horizontal cursor	V voltage from 0 V	ΔV voltage difference between the A and B cursors

Procedure (Setting screen: display)

(1) A and B cursors setting



1. Move the flashing cursor to the "csr" item, ① as shown in the figure on the left.
2. Select the cursor to be used by using the soft keys.

Soft key indication

OFF : Do not use cursors.
↔ : Vertical cursors
↕ : Horizontal cursors

3. Move the flashing cursor to ②, and select the number of the cursors to be used, by using the soft keys.

Soft key indication

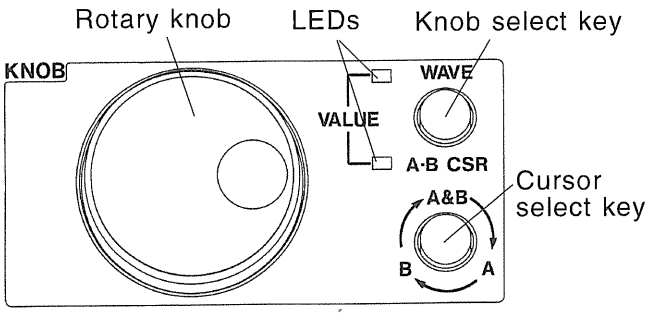
A : (One) Use the A cursor only.
A&B : (Two) Use both A and B cursors.

4. If using the horizontal cursors, select the channel for which the values are read off in ③.

   You can make independent settings for the A and B cursors by using the soft keys. [CH1, CH2, CH3, CH4]

5. The values which are read off are shown in ④.

(2) Moving the A and B cursors



Rotary knob	A·B cursor
Turning the knob clockwise	Moves the cursors up or to the right.
Turning the knob counterclockwise	Moves the cursors down or to the left.

1. Press the cursor select key to select which cursor or cursors to control. (When using the A cursor only, this setting is not required.) Each time the key is pressed, the A&B indication, ② in the figure above, on the display screen changes as follows.

   A & B : (A displayed high intensity)
   Move the A cursor only.
   A & **B** : (B displayed high intensity)
   Move the B cursor only.
   A & **B** : (Both A and B displayed high intensity)
   Move both A and B cursors.

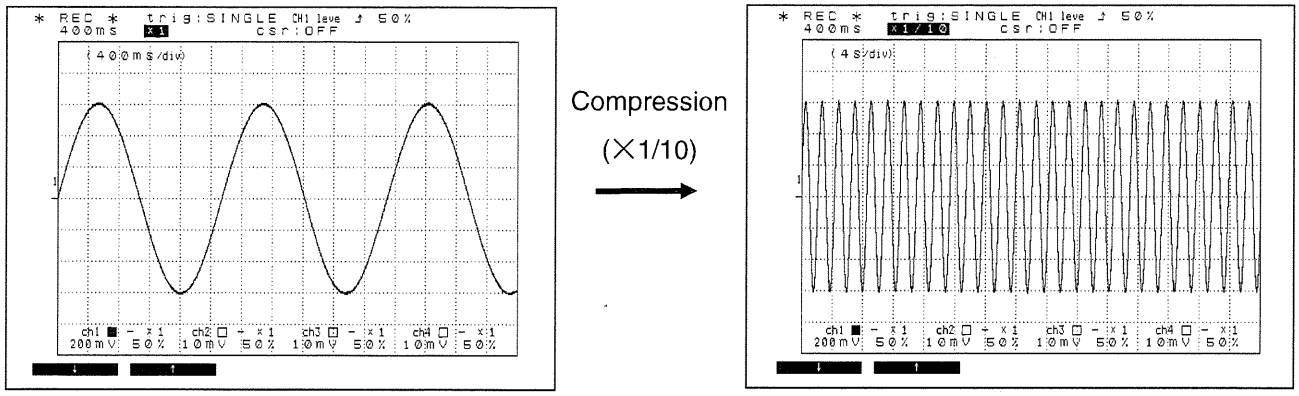
2. Press the knob select key so that only the lower LED (A·B CSR) is lit.
3. The rotary knob controls the position of the cursors.

NOTE In the recorder function, the trace cursors are not present.

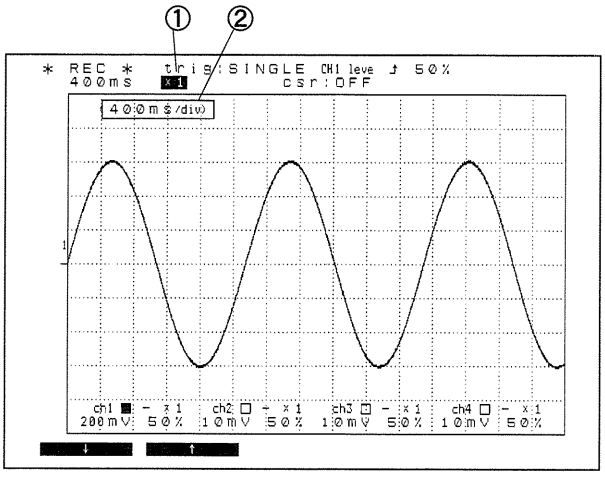
Related item
- When a vertical cursor is outside the display area, it is still possible to tell its approximate location in the whole stored waveform. See Section 6.3.15, "Help Function" for details.
- See Section 4.2, "Operation Keys" for detailed description of rotary knob operation.
- If the [PRINT] key is pressed when using the A and B cursors, the waveform is printed partially. See (3) Partial print" in Section 6.3.14.

6.3.12 Compression Along the Time Axis

- The maximum of the most recent 750 divisions of the waveform are held in memory.
- It is possible to observe the waveform, compressed along the time axis. [×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50]



Procedure (Setting screen: display)



1. Move the flashing cursor to ① as shown in the figure on the left.
2. Using the ↓ and ↑ soft keys or the rotary knob (VALUE), perform compression.

Time per one division is shown in ②.

NOTE Resuming measurement returns the compression ratio to ×1.

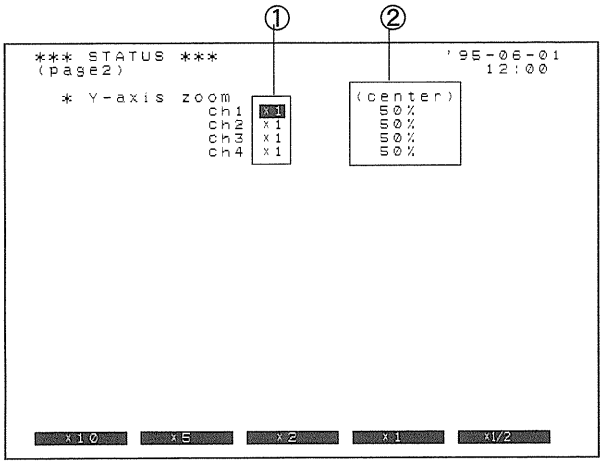
Related item A scroll bar display is available, to show where the current screen display is in relation to the whole stored waveform. See Section 6.3.15, "Help Function" for details.

6.3.13 Magnification/Compression Along the Voltage Axis

- This function allows the voltage axis to be magnified or compressed for any channel independently.
- The setting procedures are the same as in the memory recorder function. For details, see Section 5.3.16. [×10, ×5, ×2, ×1, ×1/2]

Procedure (Setting screen: status (page 2) and display)

(1) On the status screen



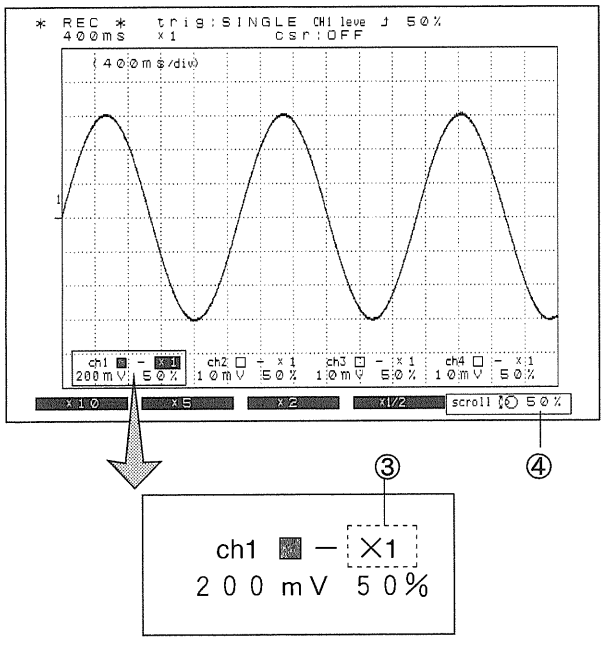
Status screen(page 2)

1. Move the flashing cursor to the magnification or compression ratio of the "Y-axis zoom" item, ① as shown in the figure on the left.
2. Select the magnification or compression ratio by using the soft keys.
   [×10, ×5, ×2, ×1, ×1/2]
3. Set the displayed waveform portion along the voltage axis in ②, "(center)".

   (This is defined in terms of percentages (0 to 100 %) of the full scale of the waveform in measurement, and indicates the percentage of the center of the display screen.)

   Make settings by using the ↓, ↑, 10↓, and 10↑ soft keys or the rotary knob. [0 to 100 %]

(2) On the display screen



1. Move the flashing cursor to ③ for the channel to be magnified or compressed.
2. Select the magnification or compression ratio by using the soft keys.

   (The selected magnification or compression ratio is not shown.)

The "(center)" value in ② as shown in the figure above is displayed in ④.

6.3.14 Printing Waveform Recordings

There are four methods of printing waveforms: real time continuous recording, manual print, partial print and screen dump.

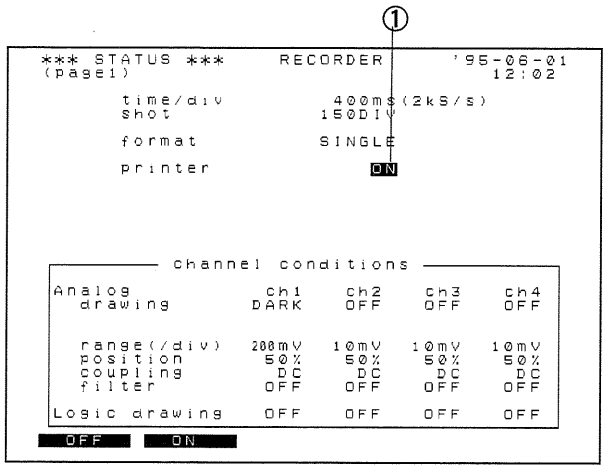
> **⚠ CAUTION** As far as possible, avoid low-speed printing in a high-temperature or high-humidity environment. This may sharply reduce printer life.

(1) Real time continuous recording

This outputs a printed recording simultaneously with the screen display, when measurement starts.

Procedure (Setting screen: status (page 1) and display)

a. Setting on the status screen



Status screen (page 1)

1. Move the flashing cursor to the "printer" item, ① as shown in the figure on the left.
2. Set real time continuous recording ON or OFF by using the soft keys. [OFF, ON]

If magnification or compression along the voltage axis is in effect, it is also applied to the printing.

b. Setting on the display screen

Pressing the [PRINT] key in measurement switches the printer on and off.

(2) Manual print

- Prints out the whole stored waveform.
- The maximum of the most recent 750 divisions of the waveform are held in memory.

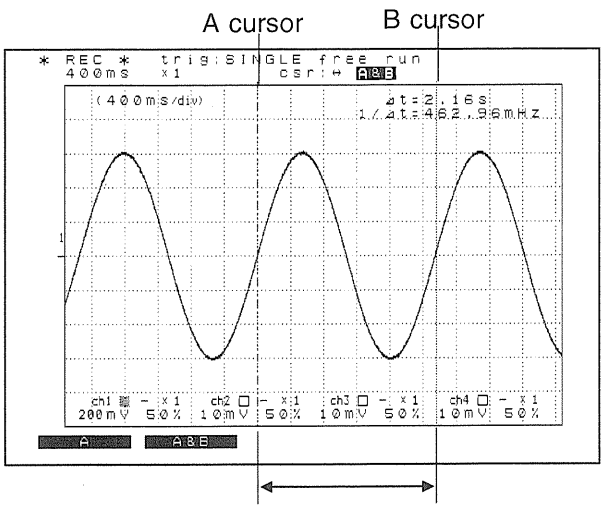
Procedure

- Press the [PRINT] key after measurement.
- The waveform can be printed as many times as required.
- If magnification or compression along the voltage axis is in effect, it is also applied to the printing.
- Pressing the [STOP] key in printing allows a forced exit.

(3) Partial print

Using the A and B cursors (as vertical cursors), it is possible to print out only the desired portion of the stored waveform.

Procedure



1. Use the A cursor or A and B cursors as vertical cursors to indicate the portion of the waveform to be recorded.
   - When using the A cursor only
     From the A cursor to the end of the waveform.
   - When using both A and B cursors
     Portion between the cursors.
2. Press the [PRINT] key.

- If a magnification or compression along the voltage axis is in effect, it is also applied to the printing
- This function is effective even if either cursor is outside the screen area. For more details, see "Example" in Section 5.3.20.

(4) Screen dump function

Prints an exact copy of the screen.

Procedure

- Press the [COPY] key. (If the output designation is not set to the printer, press the [COPY] key again.)
- The screen dump output designation can be set on the system screen. (See Section 12.7.)
- The copy size (SMALL or LARGE) can be set on the system screen. (See Section 12.5.9.)

NOTE

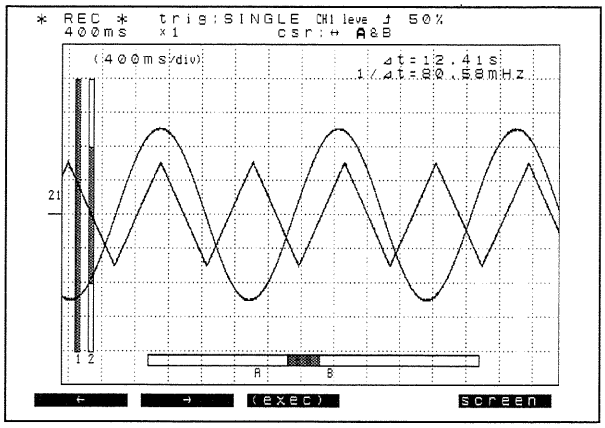
- The recording paper is fed, while holding down the [FEED] key.
- In DUAL (print QUAD) format, the channels are in order channel 1 to 4 on the printed recording, regardless of their positions on the screen. See the NOTE in Section 5.3.5.
- On the system, status, or trigger screen, pressing the [PRINT] key produces a listing of settings. (See Section 12.5.6.)

Related item You can select whether or not to print voltage scales (gauges) and listings of settings when using either real time continuous recording or the manual print function. (See Sections 6.5, 6.6 and 12.5.6.)

6.3.15 Help Function (HELP)

- It is possible to tell the position of the displayed part of the waveform in the whole stored waveform. (The maximum of the most recent 750 divisions of the waveform are held in memory.)
- The positions of the A and B cursors (if they are being used as vertical cursors) are also shown.
- The position of the displayed part of the waveform can be horizontally moved instantaneously. See the following " Moving the position of the displayed waveform portion".
- This function is the same as the position display of the help function in the memory recorder function. For more details, see Section 5.3.22.

Procedure (Setting screen: display)



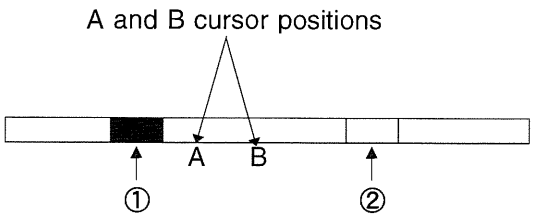
Position display (scroll bars)

1. Pressing the HELP key superimposes scroll bars on the left edge and at the bottom of the screen.
2. Press the HELP key again to exit from the help function.

Moving the position of the displayed waveform portion

Using the position display, the position of the displayed waveform portion is moved.

Procedure (Setting screen: display)



1. The horizontal scroll bar indicates the position of the currently displayed portion in high intensity, as shown in ① in the figure on the left.
2. Press the ← and → soft keys to move the scroll bar bubble (indicated faintly on the screen as shown in ② in the figure on the left).
3. Press the (exec) soft key to indicate the position specified in ②.

There are a total of seven positions on which you can position the display window cursor: five evenly spaced positions (dividing the recording length into fourths), plus the A and B cursor positions. (When for example the total recording length is short, this limitation does not apply.)

6.4 Operation Example

This example illustrates the basic procedure using the recorder function to measure a 3 V p-p 1 kHz sine wave input.

(1) Power on the unit

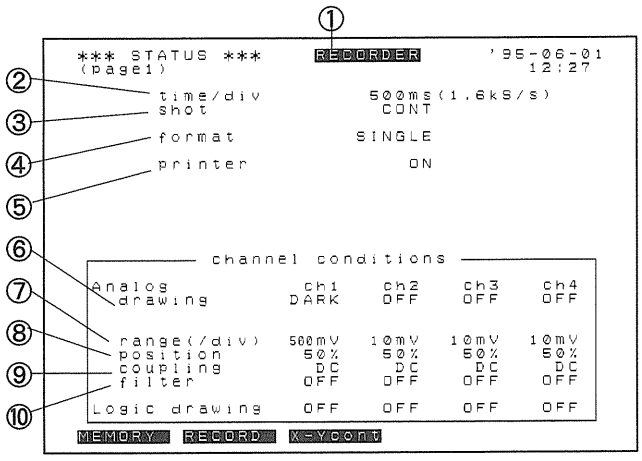
Connect the power cord to the 8853 and press the power switch.

(2) Input connection

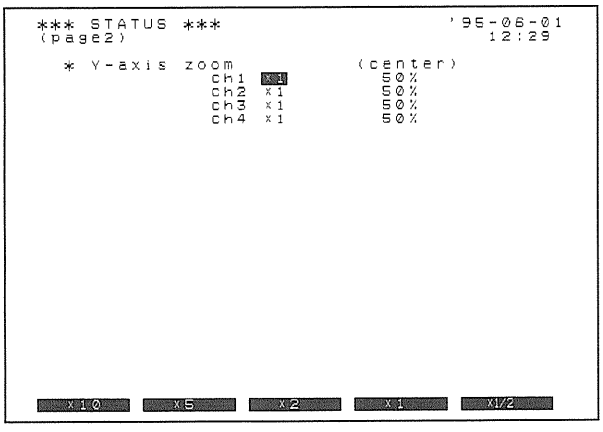
- Connect a signal generator to the input terminals of channel 1 (the 8945 analog unit).
- Set the signal generator so that it outputs a 3 V p-p 1 kHz sine wave.

(3) Settings on the status screen (page 1)

Using the cursor keys and the soft keys, make settings as shown in the figure below.



Status screen (page 1)

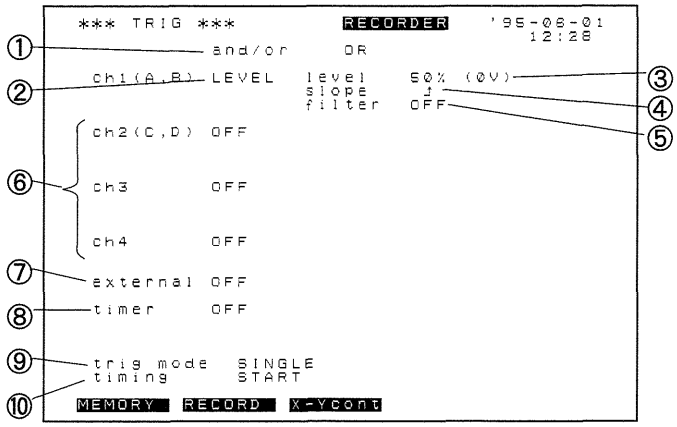


(page 2)

① Function mode	RECORDER	
② Time axis range time/div	500 ms	
③ Recording length shot	CONT	
④ Format format	SINGLE	
⑤ Printer printer	ON	
⑥ Display intensity drawing	ch1: DARK, ch2 to 4: OFF	
⑦ Voltage axis range range (/div)	500 mV	ch1 only
⑧ Position position	50 %	ch1 only
⑨ Input coupling coupling	DC	ch1 only
⑩ Filter filter	OFF	ch1 only

(4) Settings on the trigger screen (See Chapter 8.)

Using the cursor keys and the soft keys, make settings as shown in the figure below.



Trigger screen

① Trigger logical operator	OR
② ch1 (A, B)	LEVEL
③ Trigger level level	50 %
④ Slope slope	↴
⑤ Filter filter	OFF
⑥ ch2 to ch4	OFF
⑦ External trigger external	OFF
⑧ Timer trigger timer	OFF
⑨ Trigger mode trig mode	SINGLE
⑩ Trigger timing timing	START

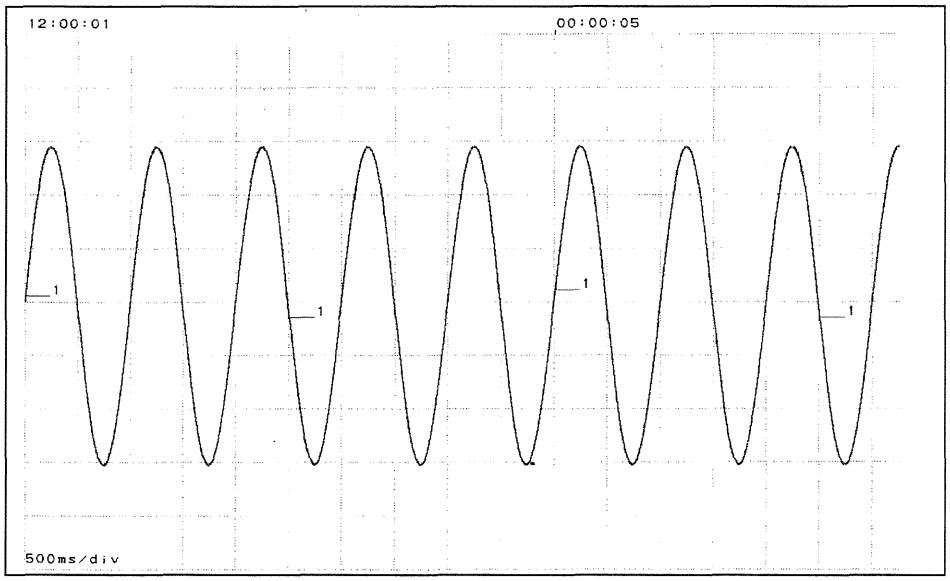
(The items of ③, ④ and ⑤ are shown, after the setting for ② is made.)

(5) Measurement

1. Press the **START** key to start measurement.

   Since the printer is set to ON, and the recording length is set to "CONT" in step (3), measurement continues together with the printed recording until the STOP key is pressed.

2. Press the **STOP** key to stop measurement and recording.

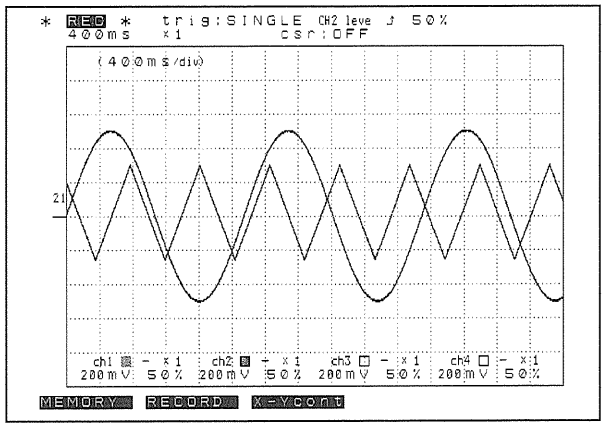


6.5 Interpreting Waveform Displays and Recordings

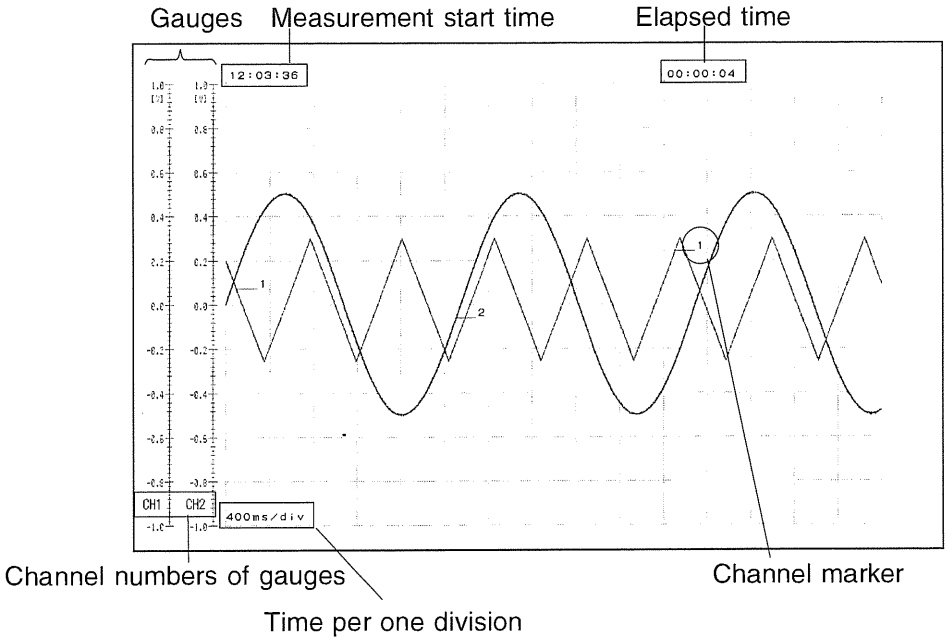
This section illustrates the display and printed recording (manual print) in each of the format (with the gauges and channel markers enabled).

(1) SINGLE format

Display

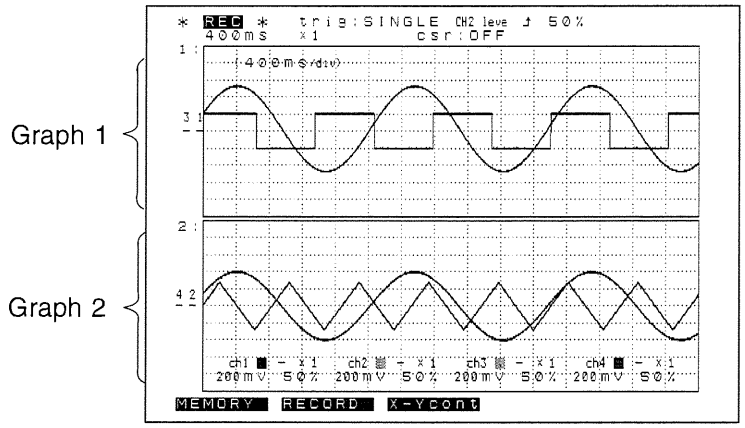


Manual print

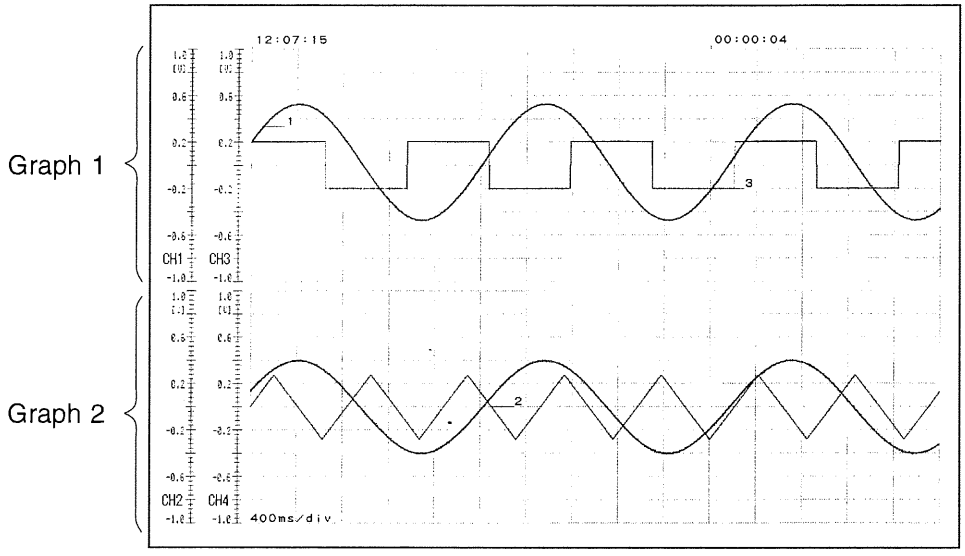


(2) DUAL format

Display

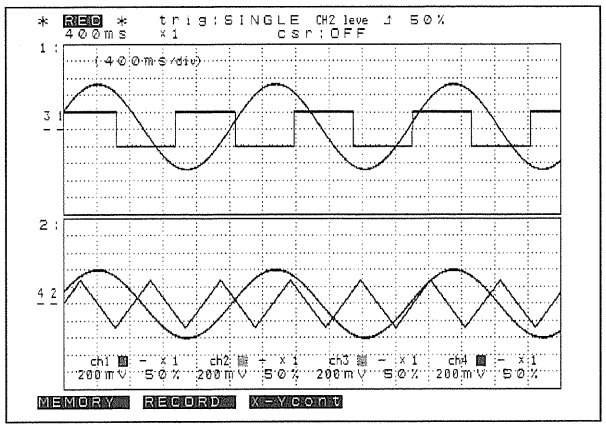


Manual print



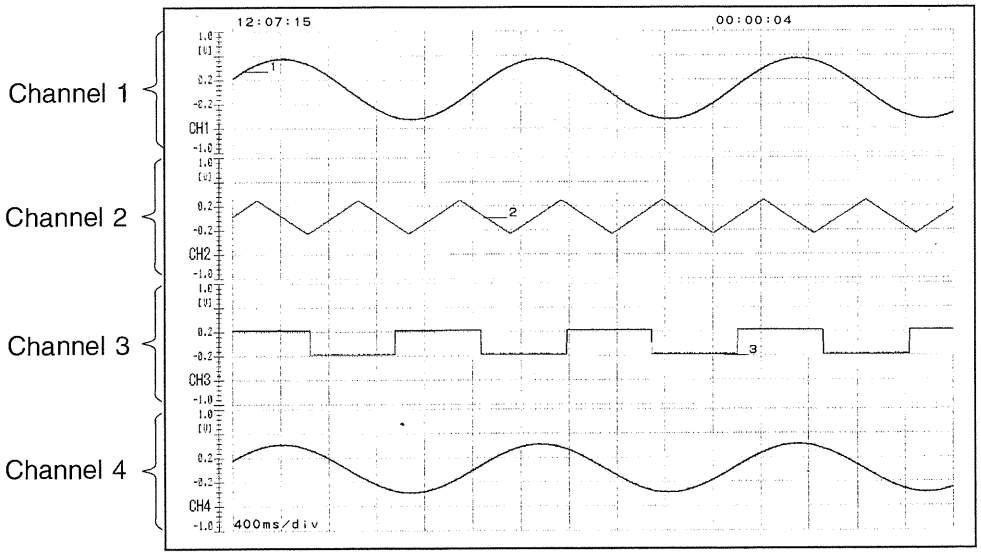
(3) DUAL (print QUAD) format

Display



The indications on the screen are the same as in (2) DUAL format.

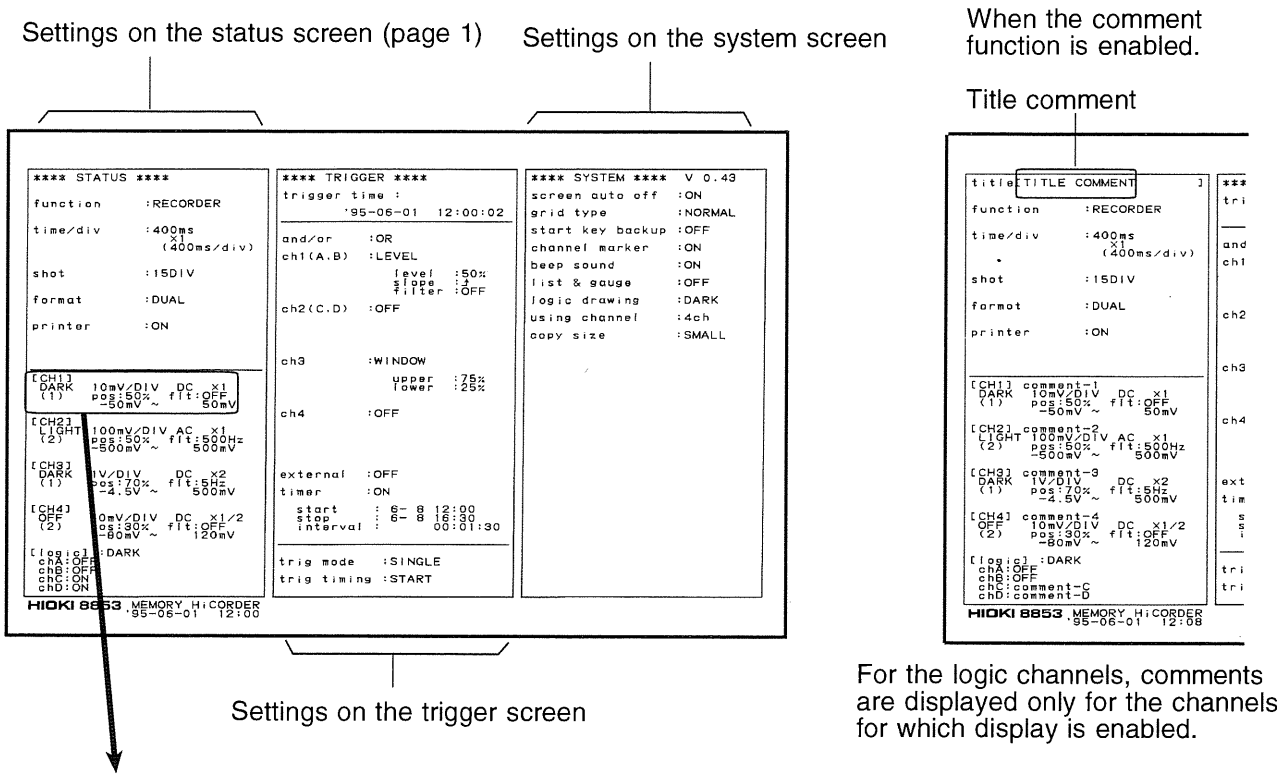
Manual print

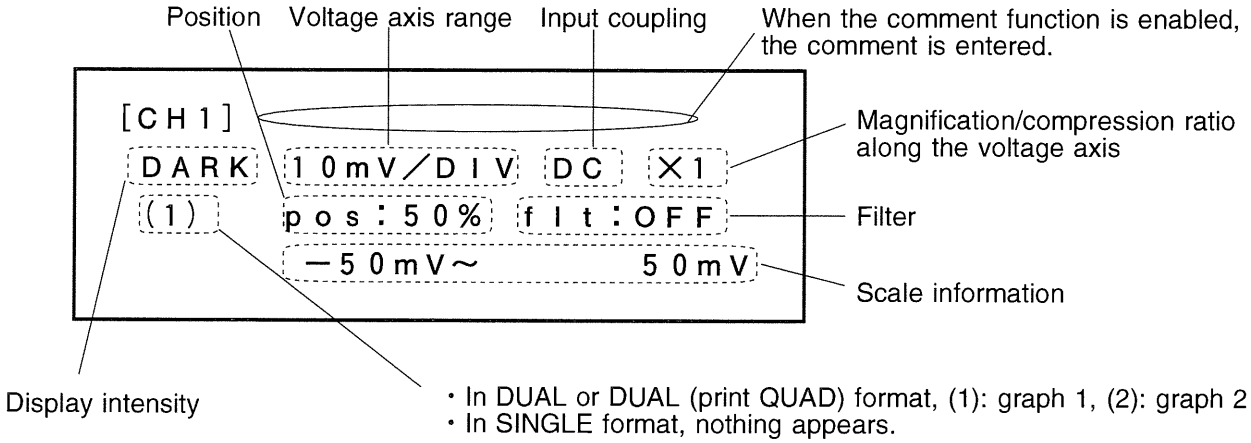


The four channels are assigned one to each of the four graphs, in sequence channel 1 to 4, regardless of their positions (in graph 1 or 2) on the screen.

6.6 Interpreting Listing

- This section illustrates the listing.
- The listing is printed by enabling the list function (see Section 12.5.6) or pressing the [PRINT] key on the status, trigger or system screen.





Chapter 7
X-Y Recorder Function Mode

7.1 What is the X-Y Recorder Function?

7.1.1 Introduction

This function allows real time X-Y plots of pairs of input signals.

(1) Normal X-Y recorder function, displaying the relationships between pairs of input signals.

(2) One of the four channels can be selected for the x-axis.

The remaining three channels are automatically assigned to the y-axis.

(3) High-speed sampling

In dot display mode the sampling period is 500 μ s, and in line display mode it is 0.5 to 42 ms (depending on the number of channels to be used, the amplitude etc.)

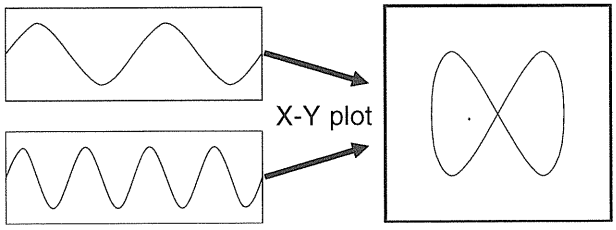
(4) No limit on recording time

In principle, as with a conventional X-Y recorder, recording can continue indefinitely.

(5) Superimposition function

If the display clear function is disabled, the waveform is superimposed.

(6) Unlike the X-Y plot format in the memory recorder function, the system does not store the time axis waveforms for each channel.



7.1.2 Finding Reference Material in this Manual

(1) Basic functions (See Section 7.3, "User Operations.")

These are described in Sections 7.3.1 to 7.3.10. These have many functions in common with the memory recorder function's, so please refer to Chapter 5 as well, if necessary.

(2) Trigger functions (See Chapter 8.)

Depending on the application, there is a wide range of trigger types to choose from.

(3) Using floppy disks, hard disks, and magneto-optical disks (See Chapter 13.)

The floppy disk, hard disk and magneto-optical disk provide a storage mechanism for setting information.

(4) Scaling function (See Section 12.3, "Scaling Function.")

This allows the input voltages to be converted to other values and units, so that the physical quantities originally measured can be read off directly.

(5) Comment function (See Section 12.4, "Adding Comments.")

This provides a convenient means of annotating printed recordings.

(6) Screen auto off function (See Section 12.5, "Special Function Settings.")

Turns the display off automatically, if no user operation occurs for 10 minutes.

(7) Grid setting (See Section 12.5.)

The grid for the printed recording can be selected as required.

(8) Start key backup function (See Section 12.5.)

If the power supply fails during recording, enabling this function causes recording to restart when the power is restored.

(9) Beep sound setting (See Section 12.5.)

When an error occurs or when a warning is issued, it is possible to arrange for a "beep" sound to be produced.

(10) List and gauge functions (See Section 12.5.)

Voltage axis scales and listings of settings on printed recordings.

(11) Connection to a computer via the GP-IB interface (See 8853 FFT Function·GP-IB Interface Instruction Manual.)

(12) Output to an external plotter (See 8853 FFT Function·GP-IB Interface Instruction Manual.)

(13) Self check functions (See Section 12.8, "Self Check Functions.")

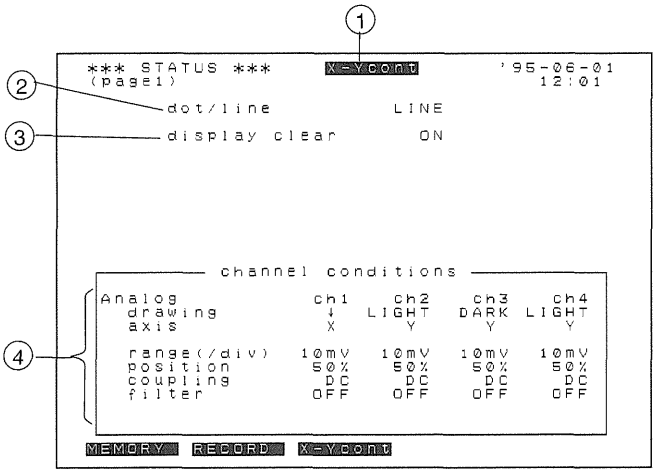
This performs simple tests on the unit's functioning.

7.2 Display Screens

- This section describes the status, trigger and display screens.
- It shows you where to look in this manual for further explanation of specific items.
- This system screen is described in Chapter 12, and the floppy disk and SCSI control screens are described in Chapter 13.

7.2.1 Status Screen (STATUS)

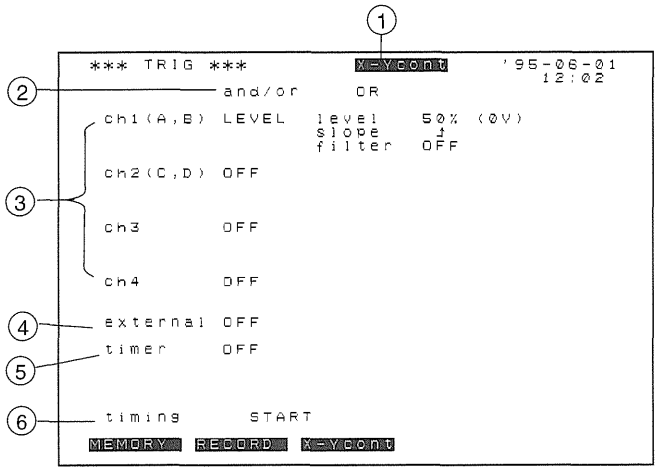
- Press the STATUS key, and the status screen appears.
- Make settings for measurement.



① Function mode (See Section 7.3.2.)
② Interpolation function (See Section 7.3.3.)
③ Display clear function (See Section 7.3.4.)
④ Channel settings (See Sections 7.3.5 and 7.3.6.)

7.2.2 Trigger Screen (TRIG)

- Press the TRIG key, and the trigger screen appears.
- See Chapter 8, "Trigger Functions" for more details.

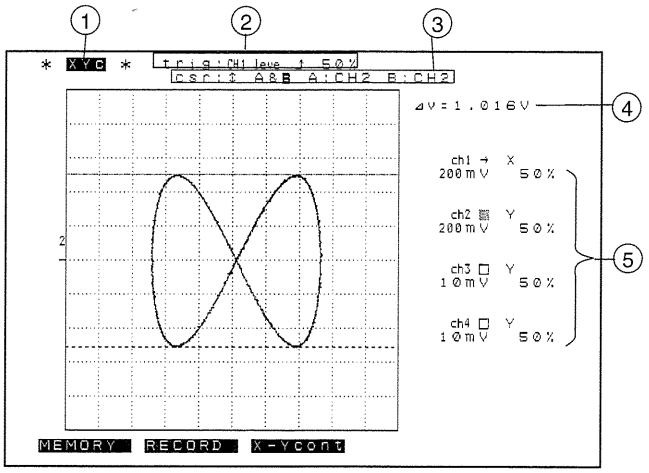


① Function mode (See Section 7.3.2.)
② Trigger logical operator (See Chapter 8.)
③ Internal triggers (See Chapter 8.)
④ External trigger (See Chapter 8.)
⑤ Timer trigger (See Chapter 8.)
⑥ Trigger timing (See Chapter 8.)

Trigger settings will be described in Chapter 8.

7.2.3 Display Screen (DISP)

· Press the DISP key, and the display screen appears.
· Measurement is performed on this screen.

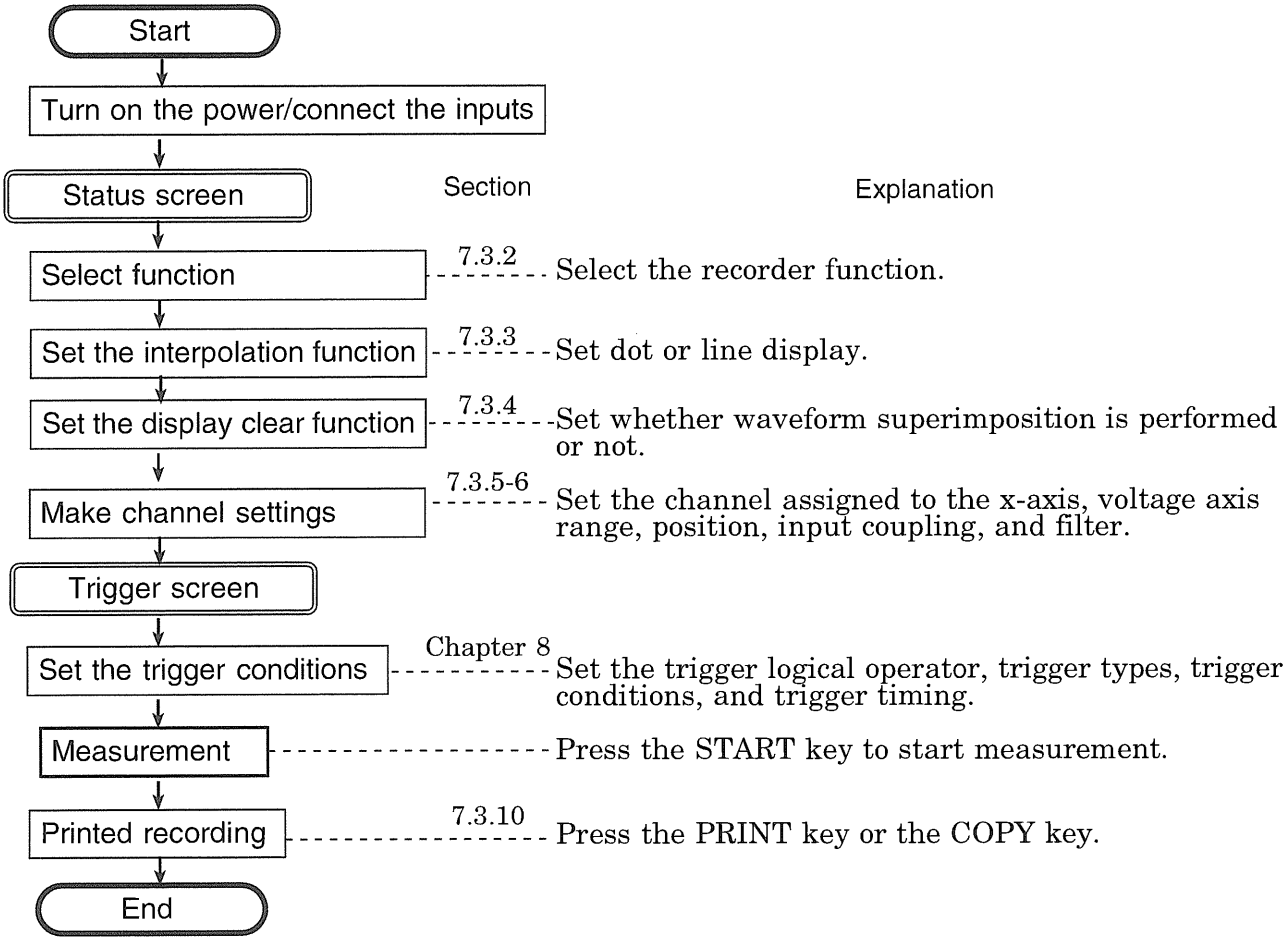


① Function mode (See Section 7.3.2.)
② Trigger settings (See Chapter 8.)
③ A and B cursor settings (See Section 7.3.9.)
④ A and B cursor readout values (See Section 7.3.9.)
⑤ Channel information (See Sections 7.3.5 and 7.3.6.)

7.3 User Operations

7.3.1 Operational Flow

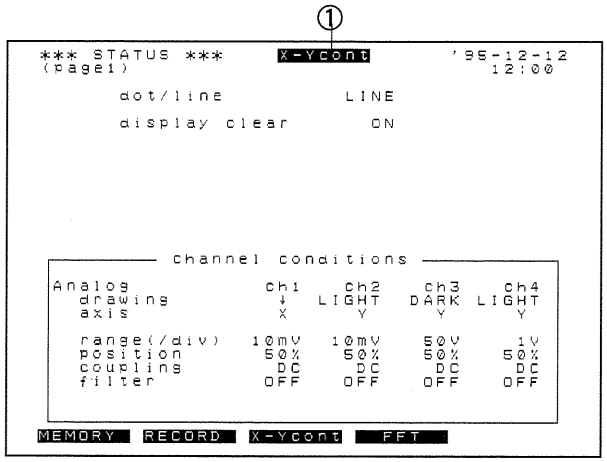
The flowchart below illustrates the sequence of operations involved in using the X-Y recorder function. (See Section 7.4, for operation example.)



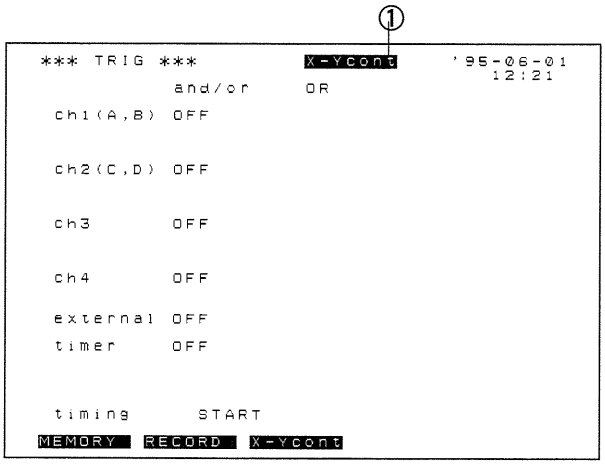
7.3.2 Function Selection

- The 8853 has four functions: memory recorder (Chapter 5), recorder (Chapter 6), X-Y recorder, and FFT function (see FFT Function·GP-IB Interface Instruction Manual).
- In this case, select the X-Y recorder function.

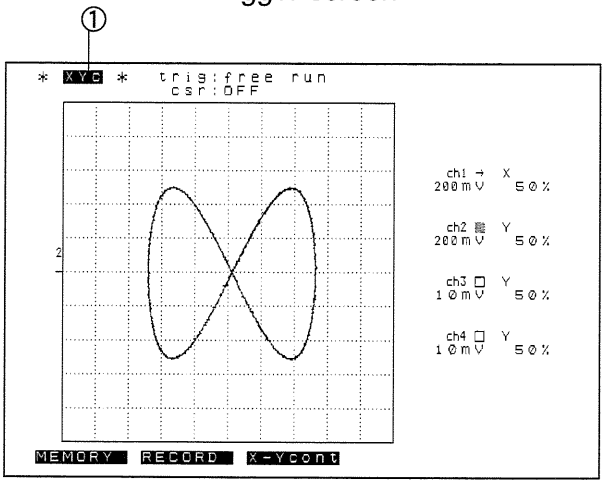
Procedure (Setting screen: status, trigger and display)



Status screen



Trigger screen



Display screen

1. Using the cursor keys, move the flashing cursor to ① as shown in the figure on the left.
2. Press the **X-Ycont** soft key.
   This selects the X-Y recorder function.

Soft key indication

MEMORY : Memory recorder function
RECORD : Recorder function
X-Ycont : X-Y recorder function
FFT : FFT function

NOTE

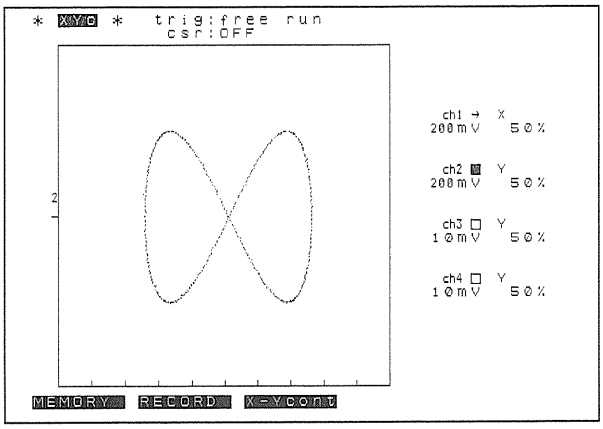
The function indication in ① on the display screen is abbreviated.

MEM : MEMORY
REC : RECORDER
XYc : X-Ycont

On the display screen, if switching from the X-Y recorder function to any other function, the X-Y plot is cleared from the screen.

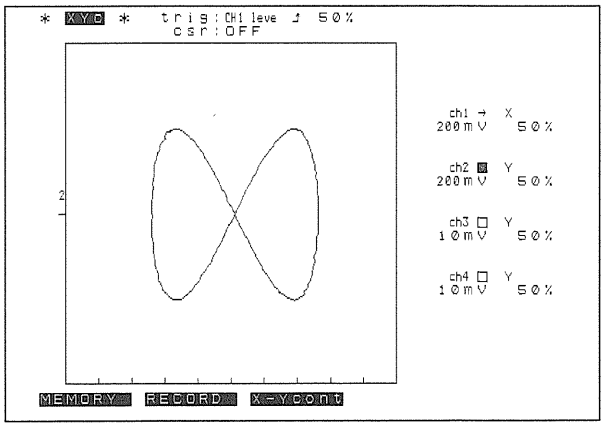
7.3.3 Interpolation Setting (dot/line)

This function determines whether to display and record the sampled data as detached points (dot mode) or with straight-line interpolation (line mode).



Dot mode

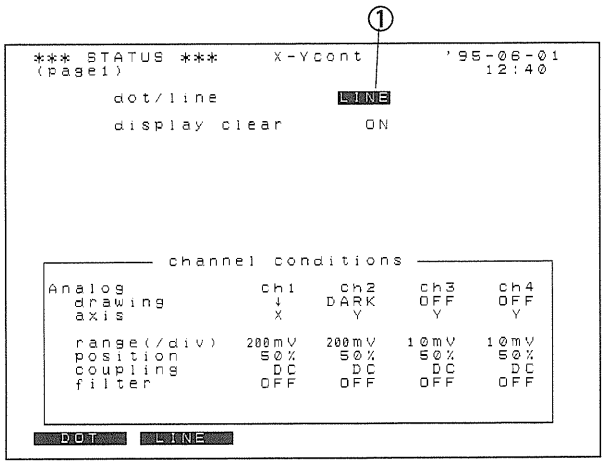
- No linear interpolation.
- The sampled values are displayed exactly as measured.



Line mode

- Linear interpolation.
- This gives a more readable display.
- The sampling rate is reduced, compared with the dot mode.

Procedure (Setting screen: status)



Status screen

1. Move the flashing cursor to the "dot/line" item, ① as shown in the figure on the left.
2. Set the interpolation function by using the soft keys.

Soft key indication

DOT : Dot mode
LINE : Line mode

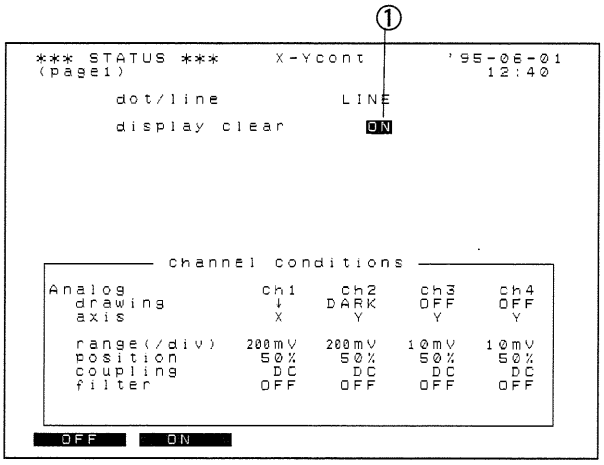
NOTE

- Changing the setting after capturing data has no effect on the X-Y display.
- The sampling rate is fixed in dot mode, in line mode, however, it depends on the number of channels, the amplitude, and density of the displayed X-Y plots. See the specifications for the X-Y recorder function in Section 2.1.

7.3.4 Display Clear Function (display clear)

- This function determines whether or not an existing X-Y display is cleared when you start recording.
- If the function is not set to clear, the new X-Y plot is superimposed on the existing one.

Procedure (Setting screen: status)



Status screen

1. Move the flashing cursor to the "display clear" item, ① as shown in the figure on the left.
2. Set the display clear function ON or OFF by using the soft keys.

Soft key indication

ON : Starting recording clears the display window.

OFF : Starting recording does not clear the display window. The new recording is superimposed on the existing one.

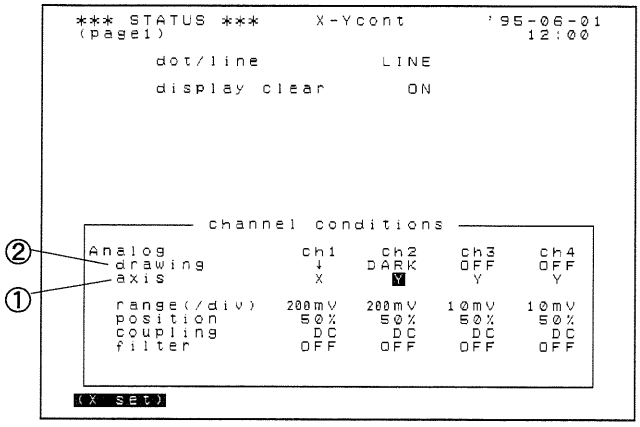
7.3.5 Display and Recording Channel Settings

The x-axis and y-axis channels, and the channels to be displayed and recorded are set.

(1) Axis assignment (axis)

Select one of the channels 1 to 4 to assign to the x-axis.

Procedure (Setting screen: status)



Status screen

1. Move the flashing cursor to the "axis" item, ① as shown in the figure on the left for the channel to be assigned to the x-axis.
2. Press the **(X set)** soft key on the required channel.

   The remaining channels are automatically assigned to the y-axis.

(2) Display and recording settings (drawing)

For the channels assigned to the y-axis, make settings for display and recording. (The channel assigned to the y-axis determines intensity.)

a. On the status screen

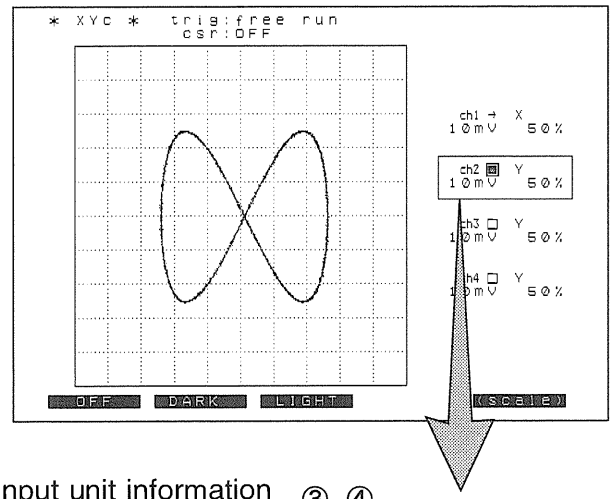
1. Move the flashing cursor to the "Analog drawing" item, ② as shown in the figure on the previous page for the channel assigned to the y-axis.
2. Make settings for display and recording for each channel assigned to the y-axis, by using the soft keys.

Soft key indication

OFF : No display or recording
DARK : High intensity display, bold printed recording
LIGHT : Low intensity display, fine printed recording

For the channels assigned to the x-axis, the indication "↓" appears, and for the channels with no input unit installed, "—" appears in ②. (The flashing cursor skips these positions.)

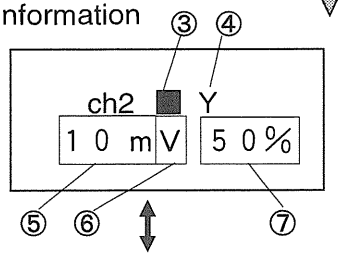
b. On the display screen



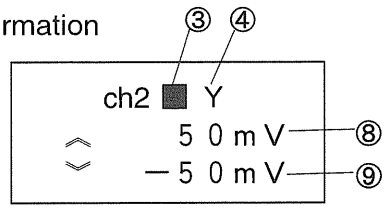
1. Move the flashing cursor to ③ as shown in the figure on the left for the channel assigned to the y-axis. (X and Y indicates the x-axis and the y-axis in ④.
2. Make settings for display and recording for the channel assigned to the y-axis, by using the soft keys.

   Also, select whether to display scale information (scale) or input unit information (unit) in the right part of the screen.

Input unit information



Scale information



Soft key indication — Indication of ③ as shown in the figure on the left.

OFF : No display or recording
DARK : High intensity display and recording
LIGHT : Low intensity display and recording
(scale) : Switches to the scale display in the right part of the screen.
↕
(unit) : Switches to the input unit display in the right part of the screen.

Input unit information

⑤ Voltage axis range
⑥ Input coupling
⑦ Position

} See Section 7.3.6.

The soft key indication changes to (scale).

Scale information

x-axis channel	⑧ Rightmost value on the x-axis
	⑨ Leftmost value on the x-axis
y-axis channel	⑧ Top value on the y-axis
	⑨ Bottom value on the y-axis

The soft key indication changes to **(unit)**.

- For the channels with no input units installed, nothing is displayed.
- For the channel assigned to the x-axis, the indication "→" appears in ③. (The flashing cursor skips this position.)

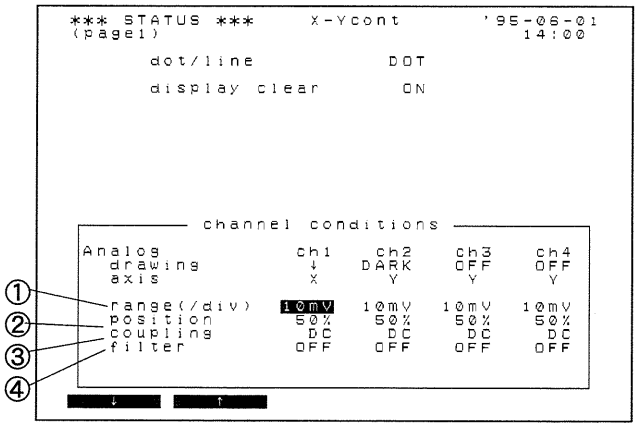
7.3.6 Voltage Axis Range, Position, Input Coupling and Filter Settings

The setting procedures are the same as in the memory recorder function. For details, see Section 5.3.9.

(1) Voltage axis range (range/div) setting

The voltage value for one division is set.

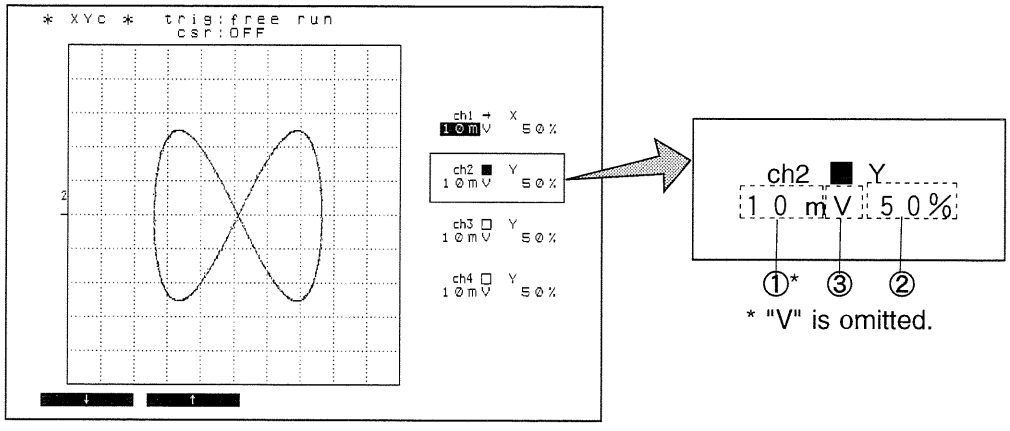
Procedure (Setting screen: status and display)



Status screen

Move the flashing cursor to ① in the figures for each channel, and make the setting by using the soft keys or the rotary knob.

You can also use the ▼CH1-CH4▲ key (range key) without moving the flashing cursor.
[10 mV to 50 V]



Display screen

(2) Position setting

The position of the zero voltage (%) is set.

Procedure (Setting screen: status and display)

Move the flashing cursor to ② as shown in the figures on the previous page for each channel, and make the setting by using the soft keys or the rotary knob.
[-100 % to 100 % (in 1 % increments)]

(3) Input coupling setting

Procedure (Setting screen: status and display)

Move the flashing cursor to ③ as shown in the figures on the previous page for each channel, and make the setting by using the soft keys.

Indications of ③: [GND, AC, DC]

⏚ : GND
~V : AC
V : DC

(4) Low-pass filter setting

The low-pass filter in the input unit itself is set.

Procedure (Setting screen: status) * The setting cannot be make on the display screen.

Move the flashing cursor to ④ as shown in the figure on the previous page for each channel, and select the cutoff frequency for the low-pass filter by using the soft keys. [OFF, 500 kHz, 500 Hz, 5 Hz]

7.3.7 Zero Adjustment

- This function provides for accurate adjustment of the waveform to the origin position when a zero voltage is input.
- Use it for reading precise values from the screen or a printed recording.
- Zero adjustment is the same as in the memory recorder function. For details, see Section 5.3.10.

Procedure (Setting screen: display)

Allow at least 60 minutes after powering on, before carrying out this procedure, to ensure that the internal temperature of the input units has stabilized.

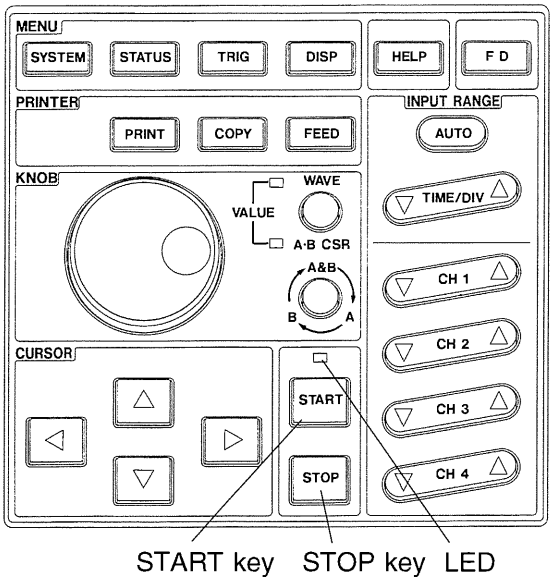
Move the flashing cursor to the item for setting the position (see Section 7.3.6).

Press the **0 adj** soft key. This carries out the correction of the position of the zero voltage for all analog channels.

7.3.8 Starting and Stopping Measurement Operation

- The START and STOP keys control the measurement operation mode of the unit.
- The LED above the START key is lit during measurement.

Procedure



1. Press the **START** key.
   Measurement starts and the LED is lit.
2. Press the **STOP** key.
   Measurement stops and the LED goes out.

NOTE

If the trigger timing is set to STOP or START&STOP, then measurement will stop automatically if the trigger occurs. (See Section 8.8) (In other cases, measurement continues until the STOP key is pressed.)

7.3.9 Using A and B Cursors

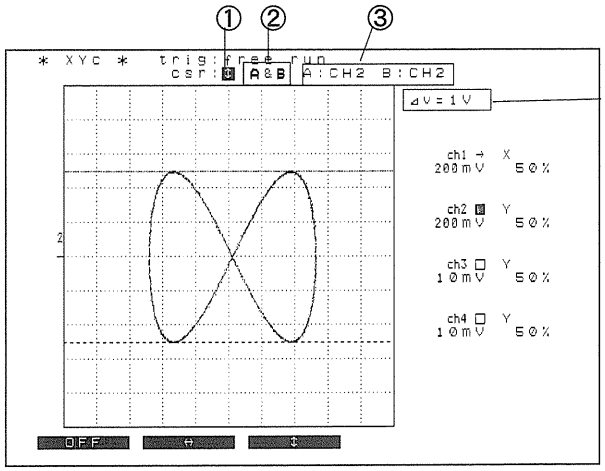
- You can use the cursors to measure voltage differences, getting a direct readout.
- The cursors can be used both along the x-axis and the y-axis.
- When using horizontal cursors, the A and B cursors can be attached to different y-axis channels.

(Cursor readout value)

Cursor	A cursor only (A)	Both A and B cursors (A&B)
Readout value	V voltage from 0 V	ΔV voltage difference between the A and B cursors

Procedure (Setting screen: display)

(1) A and B cursors setting



1. Move the flashing cursor to the "csr" item, ① as shown in the figure on the left.
2. Select the axis along which the cursors are used by using the soft keys.

Soft key indication

OFF : Do not use cursors.
↔ : X-axis (vertical cursors)
↕ : Y-axis (horizontal cursors)

3. Move the flashing cursor to ②, and select the number of the cursors to be used.

Soft key indication

A : [One] Use the A cursor only. (Measure the voltage from 0 V to the A cursor.)
A&B : [Two] Use both A and B cursors. (Measure the voltage difference between the A and B cursors.)

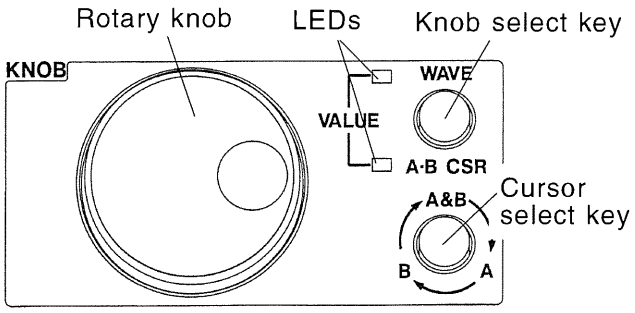
4. If using the horizontal cursors, select the channel for which the values are read off in ③.

   You can make independent settings for the A and B cursors by using the soft keys. [CH1, CH2, CH3, CH4]

- If using the A cursor only, the setting for the B cursor is not possible.
- If using the vertical cursors, the x-axis channel appears.
- Using the horizontal cursors, determines the absolute voltage difference between the A and B cursors on their respective channels.
- If the scaling function is enabled, you can read the scaled value directly. (See Section 12.3.) (If the A and B cursors are on different channels on the y-axis, and those channels have different units, then a difference cannot be read off.)

5. The values which are read off are shown in ④.

(2) Moving the A and B cursors



1. Press the cursor select key to select which cursor or cursors to control. (If using the A cursor only, the setting is not necessary.) Each time the key is pressed, the A&B indication, in ② as shown in the figure on the previous page, changes as follows.

   A & B : (A displayed high intensity)
   Move the A cursor only.
   A & **B** : (B displayed high intensity)
   Move the B cursor only.
   A & **B** : (Both A and B displayed high intensity)
   Move both A and B cursors.

Rotary knob	A·B cursor
Turning the knob clockwise	Moves the cursors up or to the right.
Turning the knob counterclockwise	Moves the cursors down or to the left.

2. Press the knob select key so that only the lower LED (A·B CSR) is lit.
3. The rotary knob controls the position of the cursors.

Related item See Section 4.2, "Operation Keys" for a detailed description of rotary knob operations.

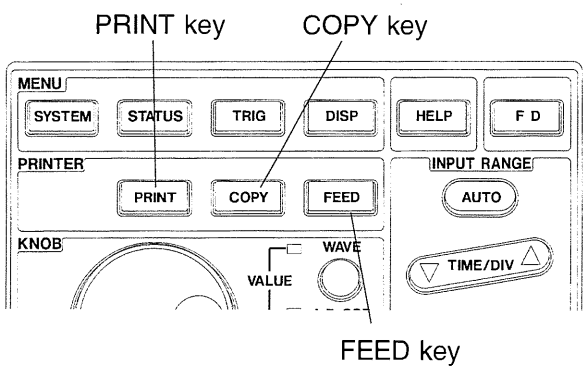
7.3.10 Printing Waveform Recordings

There are two methods of printing waveforms: manual print and screen dump.

(1) Manual print

Prints out the displayed waveform.

Procedure



- Press the **PRINT** key after measurement.
- The A and B cursors have no effect on the printing (and do not appear on the recording).

(2) Screen dump function

Prints out an exact copy of the screen.

Procedure

- Press the [COPY] key. (If the output designation is not set to the printer, press the COPY key again.)
- The screen dump output designation can be set on the system screen. (See Section 12.7.)
- The copy size (SMALL or LARGE) can be set on the system screen. (See Section 12.5.9.)

NOTE

- The recording paper is fed, while holding down the [FEED] key.
- On the system, status, or trigger screen, pressing the [PRINT] key produces a listing of settings. (See Section 12.5.6.)

Related item You can select whether or not to print voltage scales (gauges) and listings of settings when using the manual print function. (See Section 12.5.6.)

7.4 Operation Example

This example illustrates the basic procedure using the X-Y recorder function to plot the Lissajous's figure resulting from two 3 V p-p sine wave inputs, one of frequency 1 Hz, and the other 2 Hz.

(1) Power on the unit

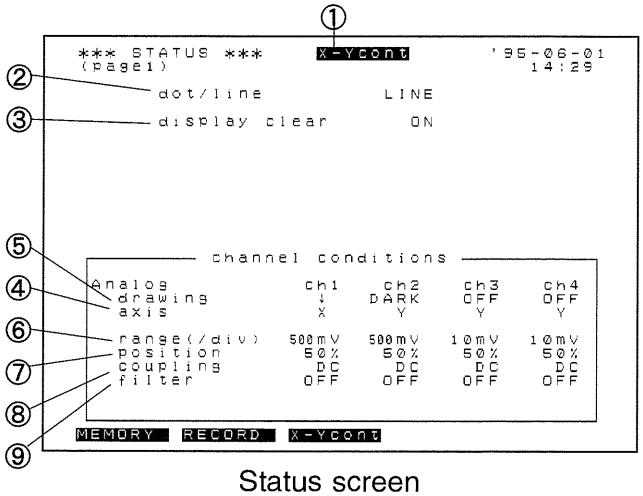
Connect the power cord to the 8853 and press the power switch.

(2) Input connection

- Connect signal generators to the input terminals of channels 1 and 2 (the 8945 analog units).
- Signal generator settings: Channel 1 3 V p-p 1 Hz sine wave
  Channel 2 3 V p-p 2 Hz sine wave

(3) Settings on the status screen

Using the cursor keys and the soft keys, make settings as shown in the figure below.

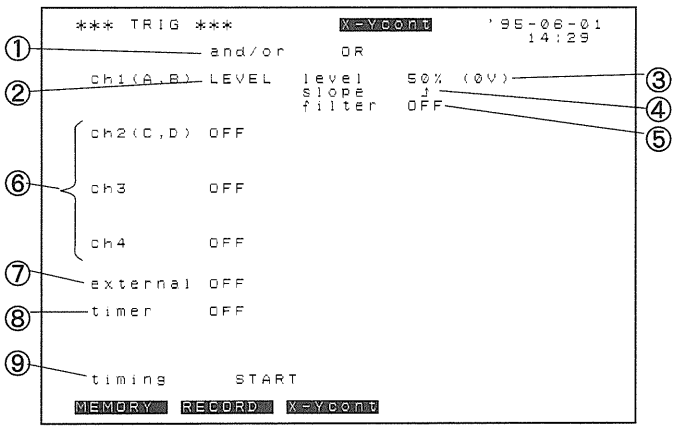


Status screen

① Function mode	X-Y cont	
② Interpolation function dot/line	LINE	
③ Display clear function display clear	ON	
④ Axis assignment axis	ch1: X, ch2: Y	
⑤ Display intensity drawing	ch2: DARK, ch3 and ch4: OFF	
⑥ Voltage axis range range (/div)	500 mV	} ch1, ch2
⑦ Position position	50 %	} ch1, ch2
⑧ Input coupling coupling	DC	} ch1, ch2
⑨ Filter filter	OFF	} ch1, ch2

(4) Settings on the trigger screen (See Chapter 8.)

Using the cursor keys and the soft keys, make settings as shown in the figure below.



Trigger screen

①	Trigger logical operator	OR
②	ch1 (A, B)	LEVEL
③	Trigger level level	50 %
④	Slope slope	↴
⑤	Filter filter	OFF
⑥	ch2 to ch4	OFF
⑦	External trigger external	OFF
⑧	Timer trigger timer	OFF
⑨	Trigger timing timing	START

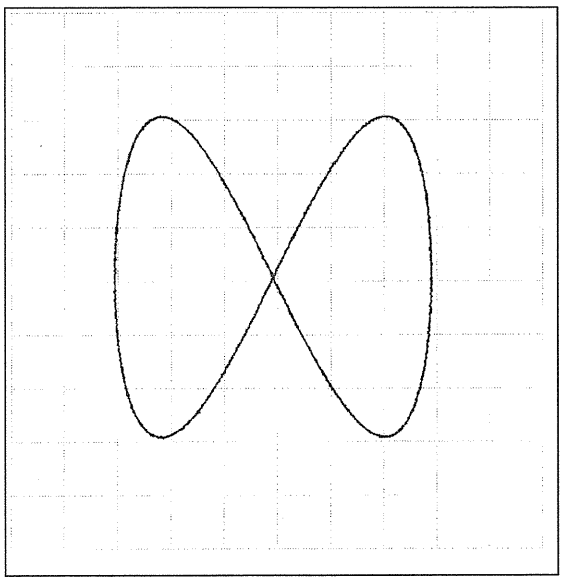
(The items of ③, ④ and ⑤ are shown, after the setting for ② is made.)

(5) Measurement

1. Press the **START** key to start measurement.
2. Press the **STOP** key to stop measurement.

(6) Printed recording

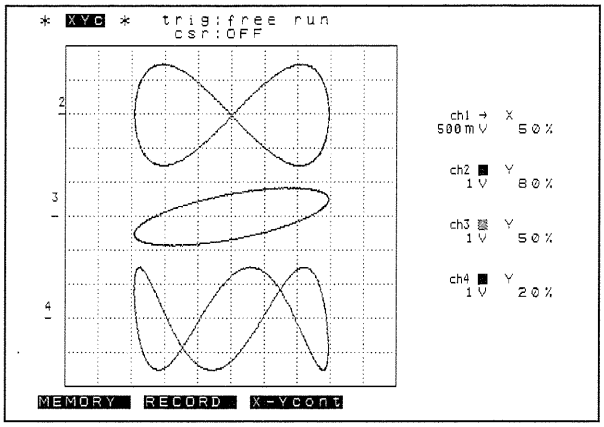
Press the **PRINT** key to print out the measured waveform.



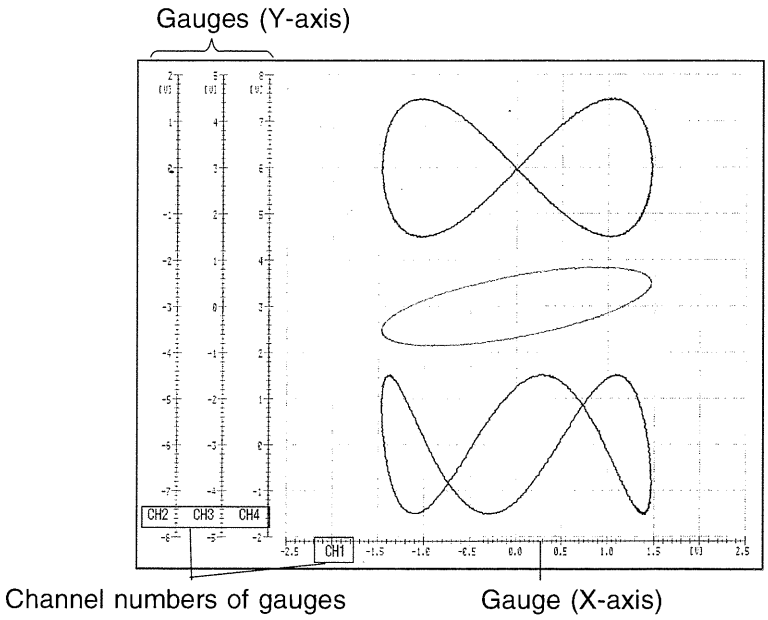
7.5 Interpreting Waveform Displays and Recordings

This section illustrates the display and printed recording (manual print).

Display

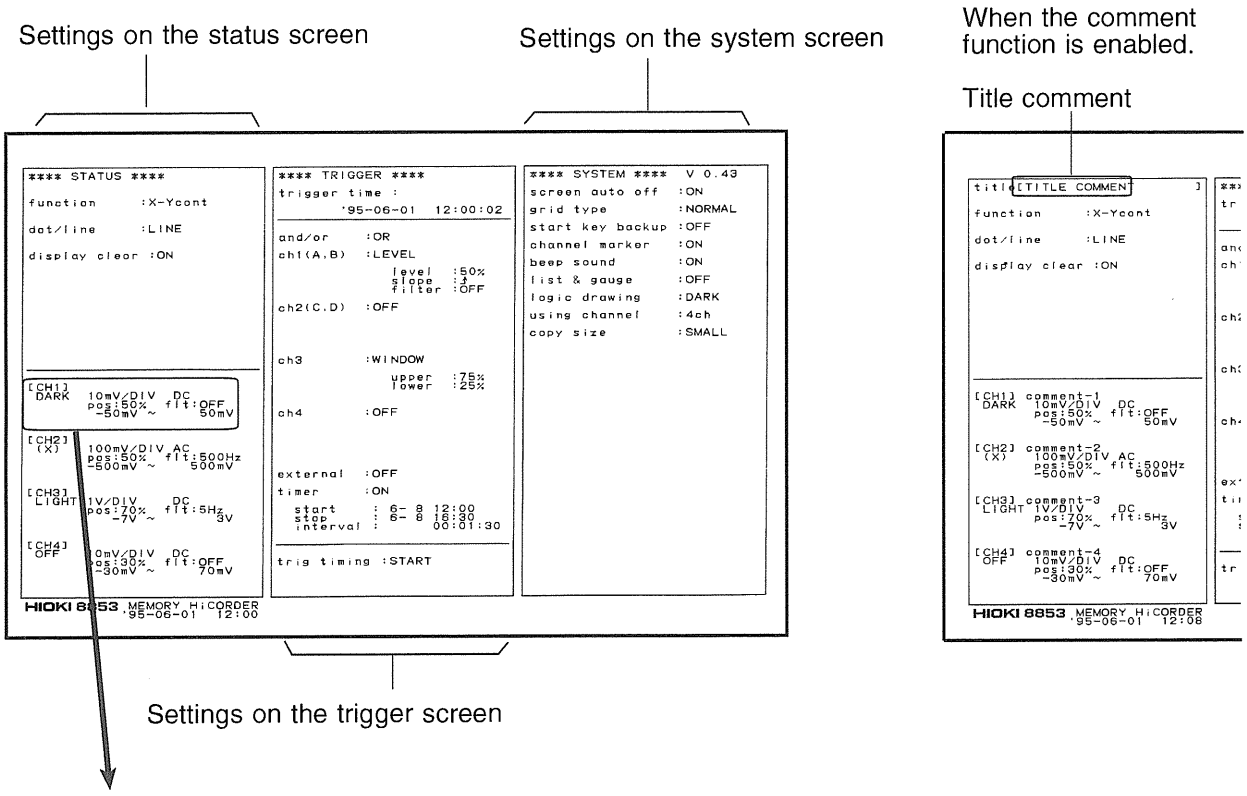


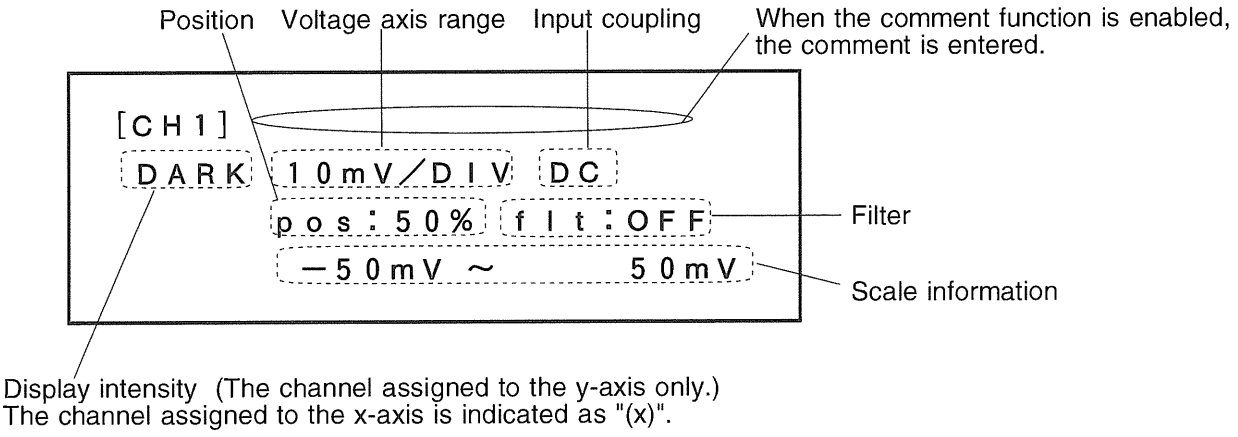
Manual print (with the gauge function enabled)



7.6 Interpreting Listing

- This section illustrates the listing.
- The listing is printed by enabling the list function (see Section 12.5.6) or pressing the [PRINT] key on the status, trigger or system screen.





Chapter 8
Trigger Functions

8.1 Overview

(1) The term "trigger" refers to a signal which determines the timing to start or stop recording.

(2) There are following three different types of trigger sources - the signal from which the trigger is derived.

① Internal triggers [ch1 to ch4, ch(A,B), ch(C,D)]
- The trigger is derived from the analog input signals to channels 1 to 4 or the logic inputs to channel groups A to D.
- The trigger function monitors the state of the signals, and is activated when a predetermined signal state occurs.

② External trigger [external]
- The trigger is activated when the EXT TRIG terminal is shorted or the signal input falls below 0.7 V.
- The external trigger facility enables the unit to be synchronized to other equipment. It also enables a number of 8853 units to be synchronized for parallel use.

③ Timer trigger [timer]
- The timer trigger is activated between predetermined start and stop intervals.
- Use the timer trigger for fixed time recording.

(3) Trigger mode setting (except in the X-Y recorder function)
This determines whether the trigger is accepted repeatedly after once completing a measurement operation.

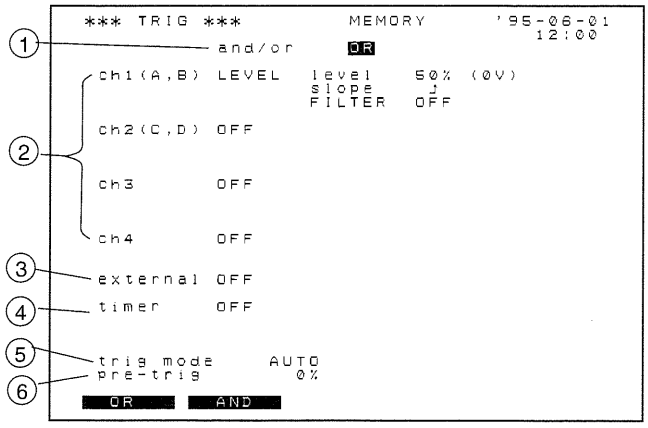
(4) Pre-trigger and trigger timing settings
- The pre-trigger setting determines how much data is captured before the trigger event.
- The trigger timing setting refers to which start and stop events controlled by the trigger.

NOTE If setting all of the trigger sources to OFF, the data is captured immediately after measurement starts. (free run)

8.2 Trigger Screen

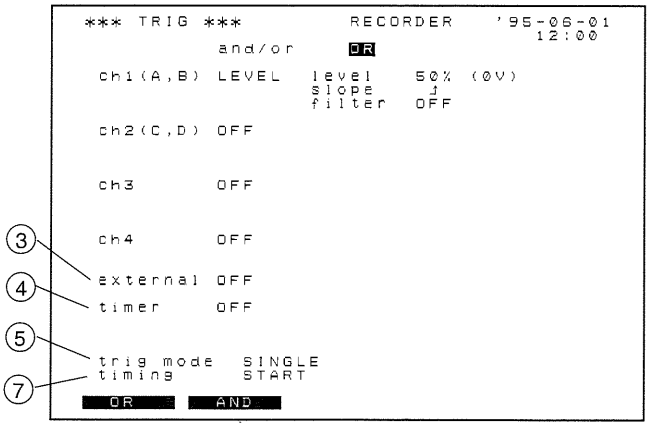
· Press the TRIG key, and the trigger screen appears.
· The trigger settings are made on this screen, some items however can be set on the display screen as well.

	Memory recorder and FFT	Recorder	X-Y recorder
Internal trigger	Yes	Yes	Yes
External trigger	Yes	Yes	Yes
Timer trigger	Yes	Yes	Yes
Trigger mode	Yes	Yes	No
Pre-trigger	Yes	No	No
Trigger timing	No	Yes	Yes

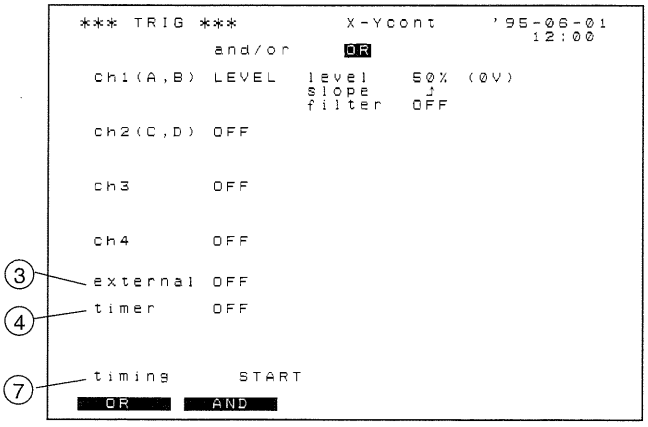


Memory recorder and FFT

① Trigger logical operator (See Section 8.5.)
② Internal triggers (See Section 8.3.)
③ External trigger (See Section 8.4.)
④ Timer trigger (See Section 8.9.)
⑤ Trigger mode (See Section 8.6.)
⑥ Pre-trigger (See Section 8.7.)
⑦ Trigger timing (See Section 8.8.)



Recorder



X-Y recorder

8.3 Internal Triggers

- All of the analog inputs and logic inputs can be used as the basis for trigger signals.
- These are five types of analog triggers using the analog input signals, and logic triggers using the logic inputs.
- The trigger filter can be used for the level trigger and logic trigger.

Analog triggers
- Level trigger (See Section 8.3.1.)
- Window trigger (See Section 8.3.2.)
- *Time out trigger (See Section 8.3.3.)
- *Glitch detection trigger (See Section 8.3.4.)
- *Event trigger (See Section 8.3.5.)

Logic trigger (See Section 8.3.6.)

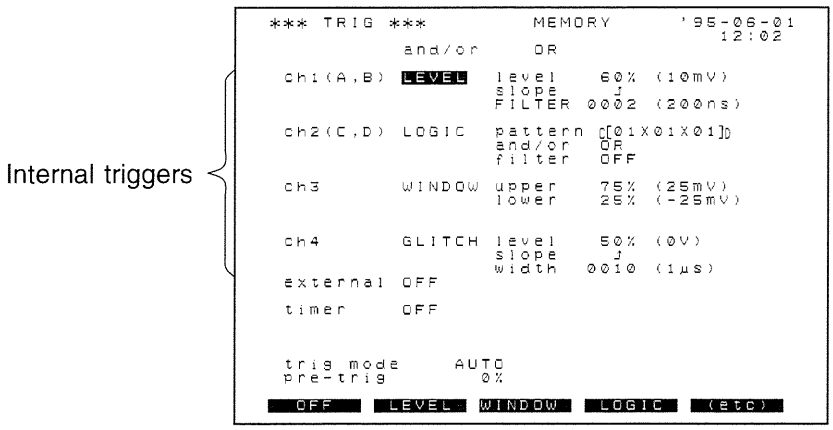
*: The time out trigger, glitch detection trigger, event trigger, and trigger filter cannot be used, if the trigger logical operator (see Section 8.5) is set to AND.

Combinations of the functions and internal triggers available

	Memory recorder and FFT	Recorder	X-Y recorder
Level trigger	Yes	Yes	Yes
Window trigger	Yes	Yes	Yes
Time out trigger	Yes	No	No
Glitch detection trigger	Yes	No	No
Event trigger	Yes	No	No
Logic trigger	Yes	Yes	Yes

- Either the analog triggers or logic trigger can be used for channels 1 and 2.
- Only the analog triggers can be used for channels 3 and 4.

Channel 1 (A,B)	Analog channel 1 or logic inputs (channel A and B)
Channel 2 (C,D)	Analog channel 2 or logic inputs (channel C and D)
Channel 3	Analog channel 3
Channel 4	Analog channel 4

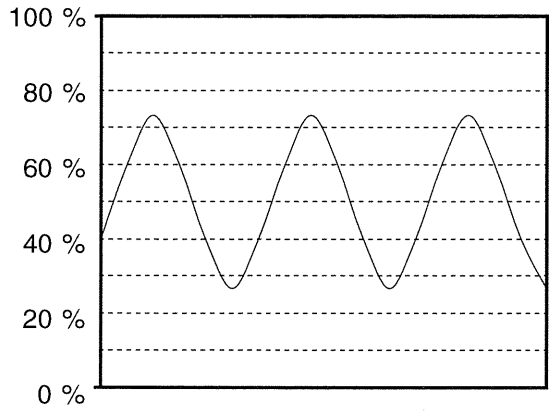


Background

Trigger mark

T : This indicates the point when the trigger is activated (the trigger position).

Trigger level

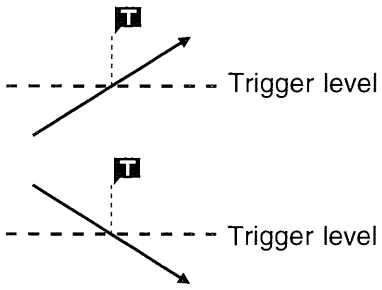


- When there is no magnification or compression in effect and no waveform display is scrolled along the voltage axis, the lower limit on the screen is 0 % and the upper limit is 100 %.
- By using the soft keys or the rotary knob (VALUE), make the setting in 1 % steps.

Soft key indication

↓ : Decrement in 1 % steps
↑ : Increment in 1 % steps
10↓ : Decrement in 10 % steps
10↑ : Increment in 10 % steps

Trigger direction (slope)



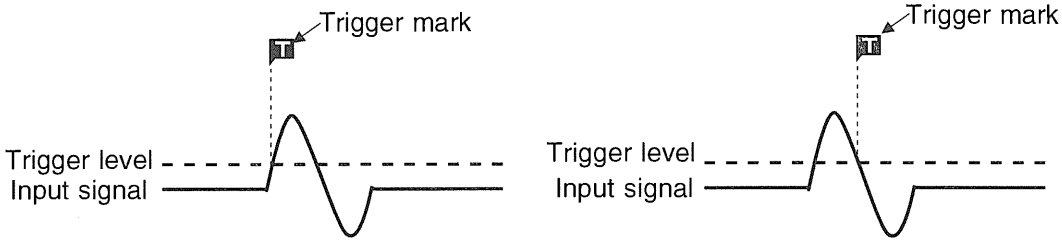
Soft key indication

↥ : The trigger is activated when the signal crosses the trigger level in the upward direction. [rising]

↧ : The trigger is activated when the signal crossed the trigger level in the downward direction. [falling]

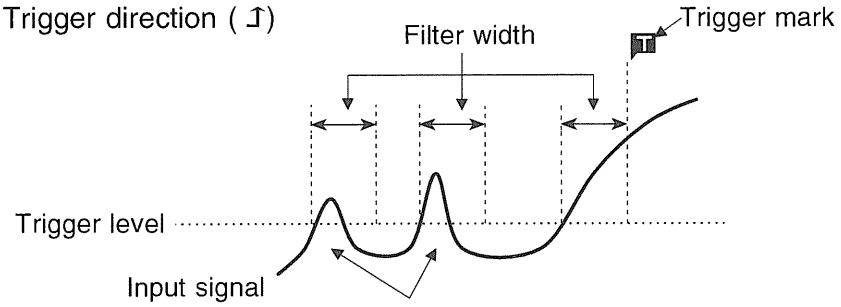
8.3.1 Level Trigger (LEVEL)

· This trigger is activated when the input signal level crosses a predetermined level (0 % to 100 % of the range) in a particular direction ("slope": ↑ or ↓).



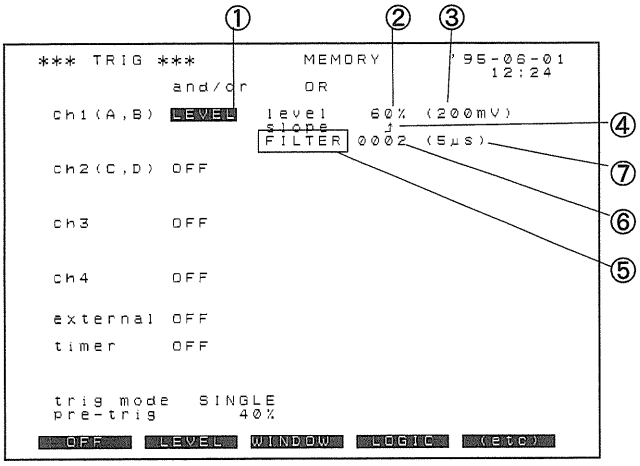
· Using the trigger filter requires the condition to be stable in the filter width before the trigger is activated. This provides a mechanism for avoiding spurious triggers caused by noise.

Example



Noise fluctuations do not cause a trigger.

Procedure (Setting screen: trigger)



1. Move the flashing cursor to ① as shown in the figure on the left for the channel to be set.
2. Press the **LEVEL** soft key to set to the level trigger.

Soft key indication

OFF : OFF
LEVEL : Level trigger
WINDOW : Window trigger
LOGIC : Logic trigger
GLITCH : Glitch detection trigger
TIMEOUT : Time out trigger

Pressing the **(etc)** key changes the soft key indication menu.

3. Set the trigger level in the "level" item, ②. [0 % to 100 %]
   · The setting is variable in 1% steps by using the soft keys.
   · The trigger level is indicated in the voltage value in ③.

4. Select the trigger direction (slope) in the "slope" item, ④ as shown in the figure on the previous page.

Soft key indication

↥ : Rising
↧ : Falling

5. Press the **FILTER** soft key in ⑤. (Only in the memory recorder and FFT functions)

Soft key indication

FILTER : Trigger filter
EVENT : Event trigger (See Section 8.3.5.)

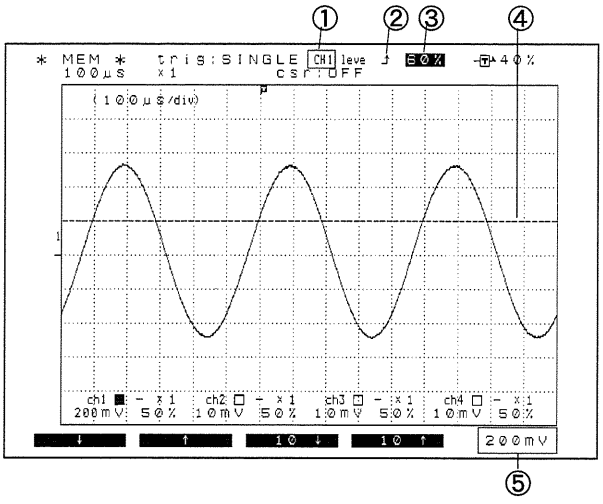
6. Set the trigger filter in ⑥ as shown in the figure on the previous page.

[OFF, 2 to 4000]

- The filter width (the specified number multiplied by the sampling interval) is displayed in ⑦ as shown in the figure on the previous page.
- In the recorder and X-Y recorder functions, it is only possible to set this to ON or OFF.
  [Filter width : 40 ms (32 ms in 400 ms/division) in the recorder function, 32 ms in the X-Y recorder function]

This cannot be used when AND is selected in the trigger logical operator (see Section 8.5).

It is also possible to set the trigger level and direction (slope) on the display screen.



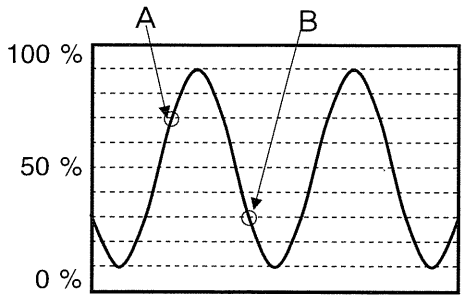
1. Select the channel to be set in ① as shown in the figure on the left.

[CH1 to CH4]

2. Set the trigger direction in ②. [↥, ↧]
3. Set the trigger level in ③. [0 % to 100 %]

- The trigger level is shown on the screen by a broken line, ④.
- The trigger level is indicated in the voltage value in ⑤.

Example

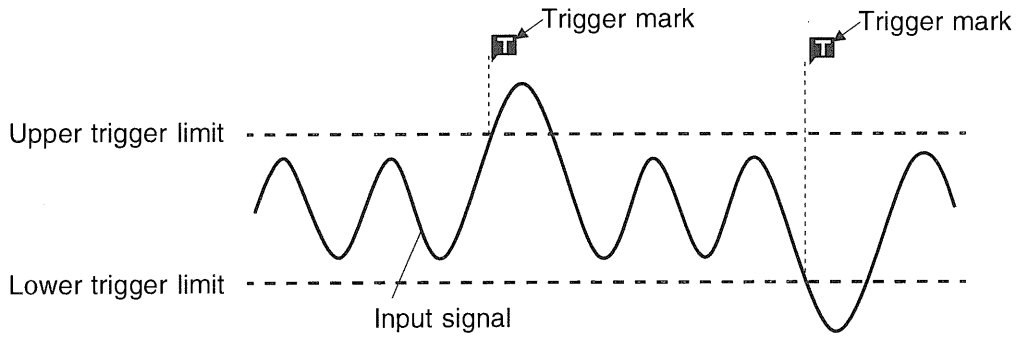


To apply a trigger at point A or point B on the waveform shown on the left, use the following settings.

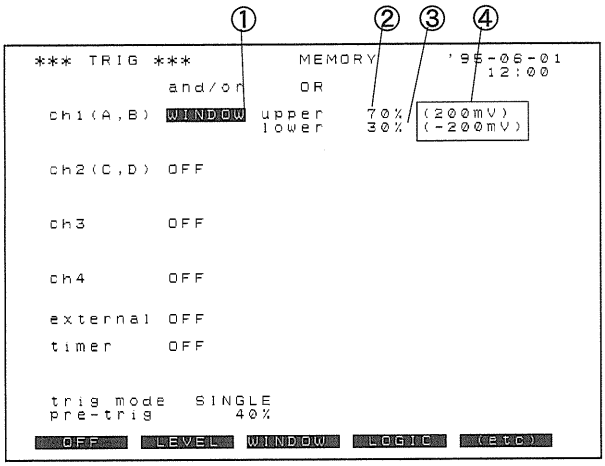
Point A { trigger level: 70 %, trigger direction: ↥
Point B { trigger level: 30 %, trigger direction: ↧

8.3.2 Window Trigger (WINDOW)

The window trigger is applies to lower and upper limits; when the input signal goes outside these limits, the trigger is activated.



Procedure (Setting screen: trigger)



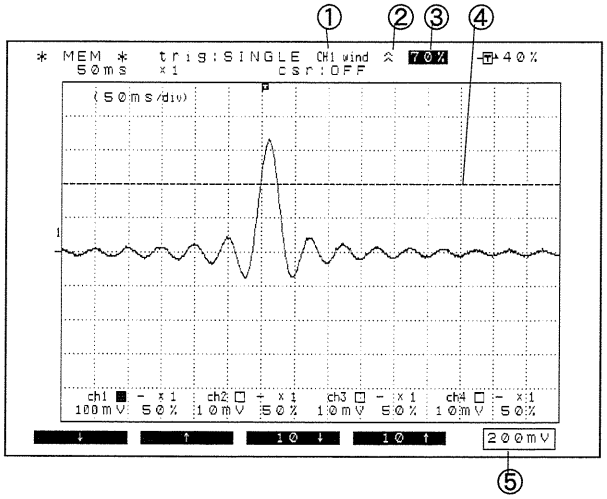
1. Move the flashing cursor to ① as shown in the figure on the left for the channel to be set.
2. Press the **WINDOW** soft key to set to the window trigger.

   [OFF, LEVEL, WINDOW, LOGIC, GLITCH, TIMEOUT]

   Pressing the **(etc)** key changes the soft key indication menu.
3. Set the upper trigger limit in ②, and the lower trigger limit in ③.

   · The setting is variable in 1% steps.
   [0 % to 100 %]
   · The lower limit cannot be set higher than the upper limit.
   · The trigger level is indicated in the voltage value in ④.

It is also possible to set the upper and lower trigger limits on the display screen.



1. Select the channel to be set in ① as shown in the figure on the left. [CH1 to CH4]
2. Select the upper or lower limit in ②.

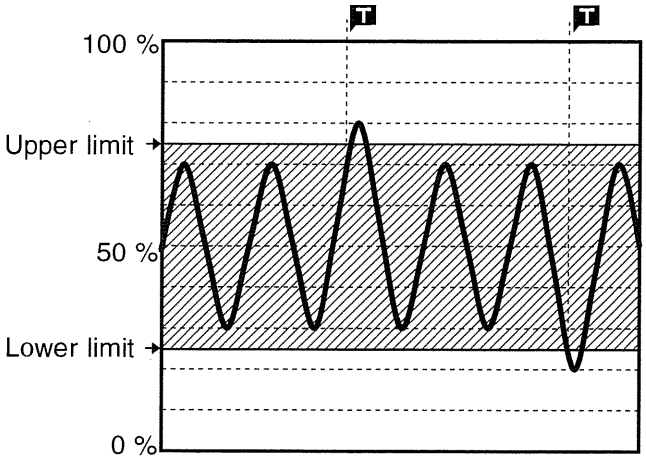
Soft key indication

upper : ⩓
lower : ⩔
} (Indication in ②)

3. Set the corresponding level. [↓, ↑, 10↓, 10↑]

· The corresponding limit is shown on the screen by a broken line, ④.
· The trigger level is indicated in the voltage value in ⑤.

Example

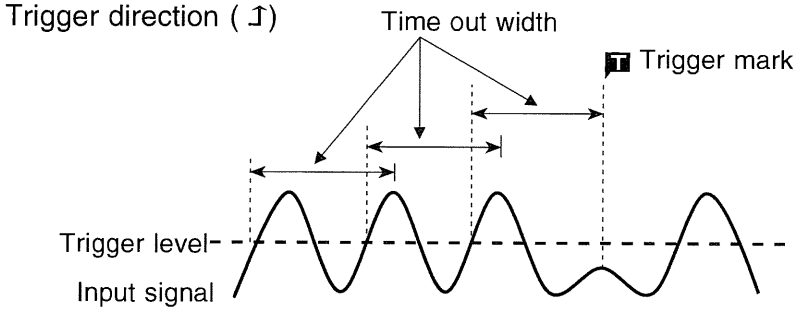


To apply a window trigger to detect when the waveform shown on the left goes outside the hatched area, use the following settings.

Upper limit: 75 %
Lower limit: 25 %

8.3.3 Time Out Trigger (TIMEOUT)

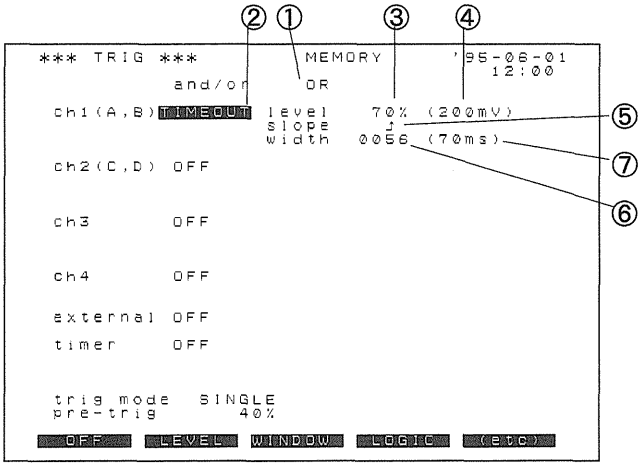
· The time out trigger is activated when more than a certain time interval elapses between successive occasions on which the input signal crosses a predetermined trigger level (0 % to 100 %) in the up or down direction, (set by the "trigger slope").



· This can therefore be used to detect missing pulses in an encoder output etc.
· This can be used in the memory recorder and FFT functions.

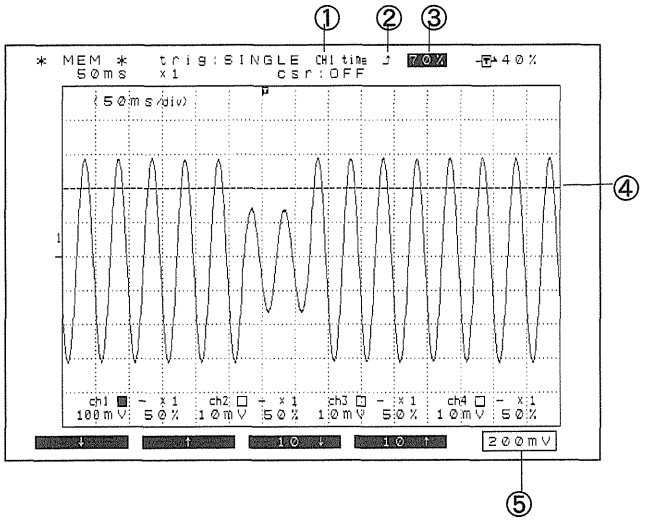
Procedure (Setting screen: trigger)

The time out trigger can be set when OR is selected in the trigger logical operator (see Section 8.5). (① as shown in the figure on the left)



1. Move the flashing cursor to ② as shown in the figure on the left for the channel to be set.
2. Press the **TIMEOUT** soft key to set to the time out trigger.
   [OFF, LEVEL, WINDOW, LOGIC, GLITCH, TIMEOUT]
3. Set the trigger level in the "level" item, ③.
   [0 % to 100 %]
   The trigger level is indicated in the voltage value in ④.
4. Select the trigger direction (slope) in the "slope" item, ⑤. [↴, ↳]
5. Set the specified number in the "width" item, ⑥. [2 to 4000]
   The time out width (the specified number multiplied by the sampling interval) is displayed in ⑦.

It is also possible to set the trigger level and direction (slope) on the display screen.



1. Select the channel to be set in ① as shown in the figure on the left. [CH1 to CH4]
2. Set the trigger direction in ②. [↴, ↳]
3. Set the trigger level in ③. [↓, ↑, 10↓, 10↑]
   - The trigger level is shown on the screen by a broken line, ④.
   - The trigger level is indicated in the voltage value in ⑤.

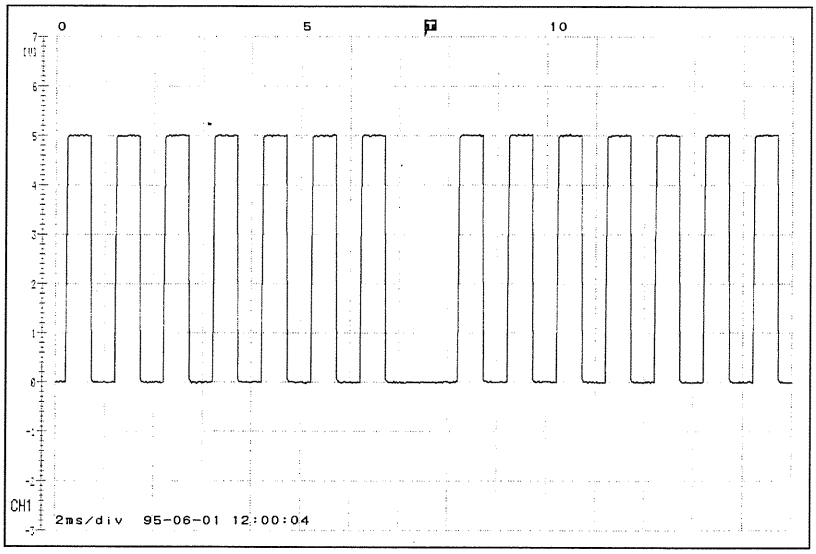
Example Detecting missing pulses of 500 Hz (period 2 ms) in an encoder output.

Settings

- Control the voltage axis range so that the waveform is kept within the screen.
- Time axis range: 2 ms/division (sampling period 50 μ s).

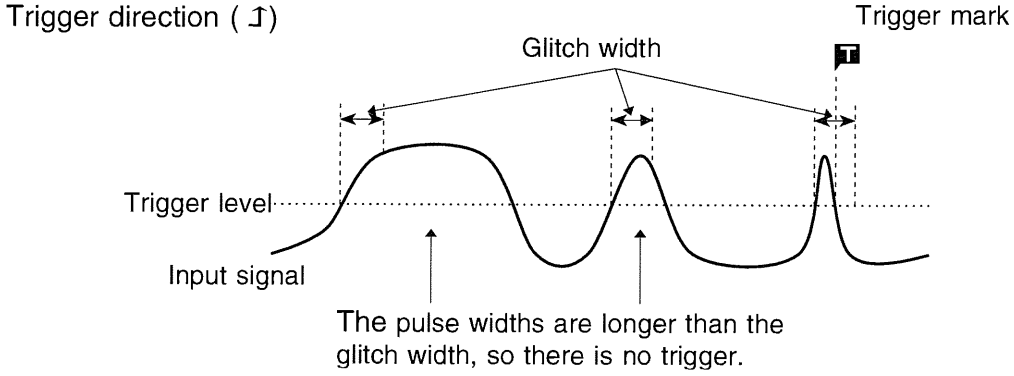
Trigger conditions

- Trigger direction: rising (slope = ⤴), time out width setting: 50 (2.5 ms).
- The trigger level is set close to the peak value in an encoder output.
- The time out width is set to be slightly longer than the period of the signal (2 ms).



8.3.4 Glitch Detection Trigger (GLITCH)

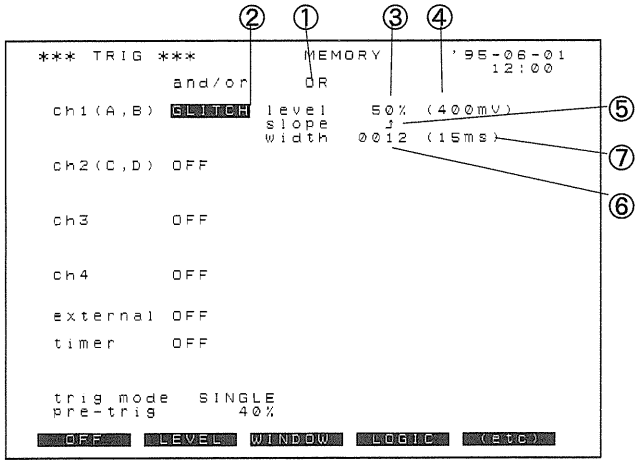
- The glitch detection trigger is activated when the input signal crosses a predetermined trigger level (0 % to 100 %) in the up or down direction, (set by the "trigger slope") and then returns to the same level in the opposite direction within a set time (the glitch width).



- This thus detects particularly narrow pulses.
- This can be used in the memory recorder and FFT functions.

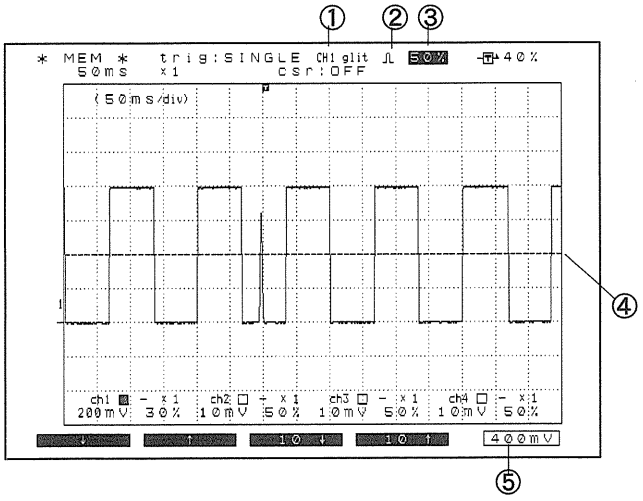
Procedure (Setting screen: trigger)

The glitch detection trigger can be set, when OR is selected in the trigger logical operator (see Section 8.5). (① as shown in the figure on the left)



1. Move the flashing cursor to ② for the channel to be set.
2. Press the **GLITCH** soft key to set to the glitch detection trigger.
   [OFF, LEVEL, WINDOW, LOGIC, GLITCH, TIMEOUT]
3. Set the trigger level in the "level" item, ③.
   [0 % to 100 %]
   The trigger level is indicated in the voltage value in ④.
4. Select the trigger direction (slope) in the "slope" item, ⑤. [↥, ↧]
5. Set the specified number for the glitch width in the "width" item, ⑥. [2 to 4000]
   The glitch width (the specified number multiplied by the sampling interval) is displayed in ⑦.

It is also possible to set the trigger level and direction (slope) on the display screen.



1. Select the channel to be set in ① as shown in the figure on the left. [CH1 to CH4]
2. Set the trigger direction in ②.

Soft key indication

: Trigger direction (slope = ↥)
: Trigger direction (slope = ↧)

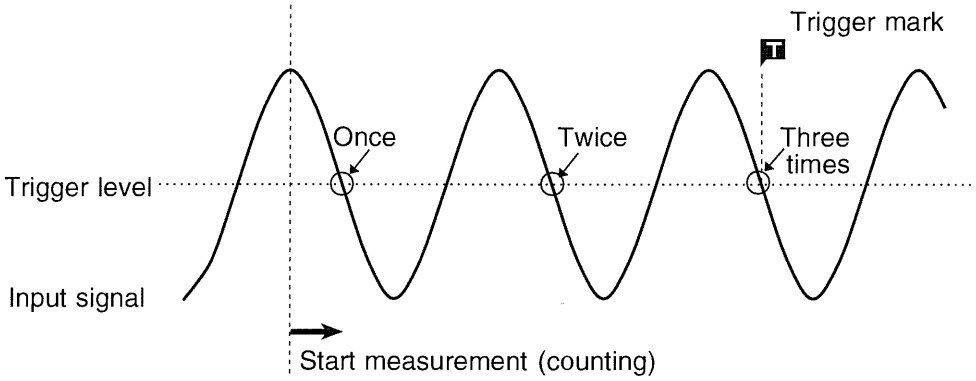
3. Set the trigger level in ③. [0 % to 100 %]

- The trigger level is shown on the screen by a broken line, ④.
- The trigger level is indicated in the voltage value in ⑤.

8.3.5 Event Trigger (EVENT)

· The event trigger is activated when the input signal has crossed a predetermined trigger level (0 % to 100 %) in the up or down direction (set by the "trigger slope") a particular number of times after beginning measurement operation (in the trigger wait state).

Trigger direction (↴)
Setting count: 3

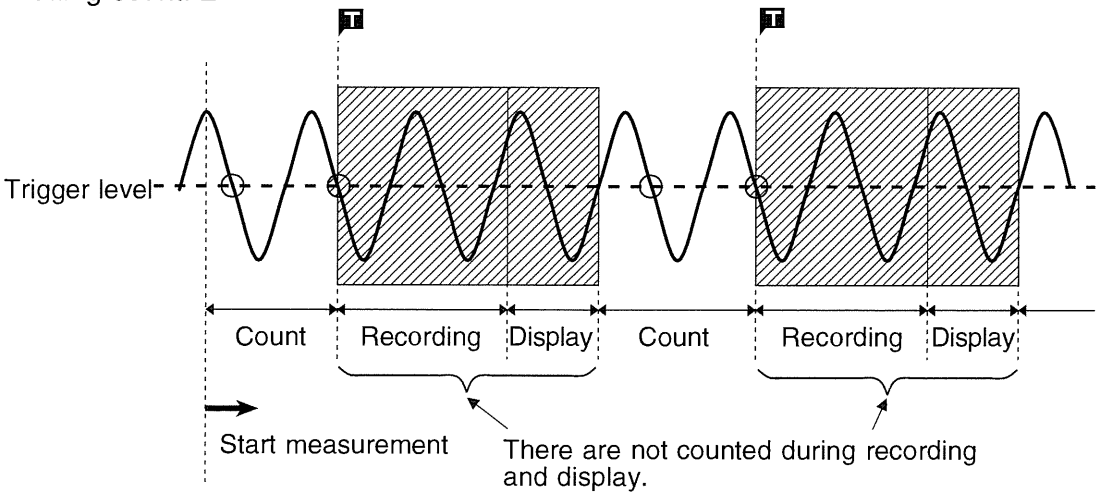


· This can be used in the memory recorder and FFT functions.

When the trigger mode is set to REPEAT:

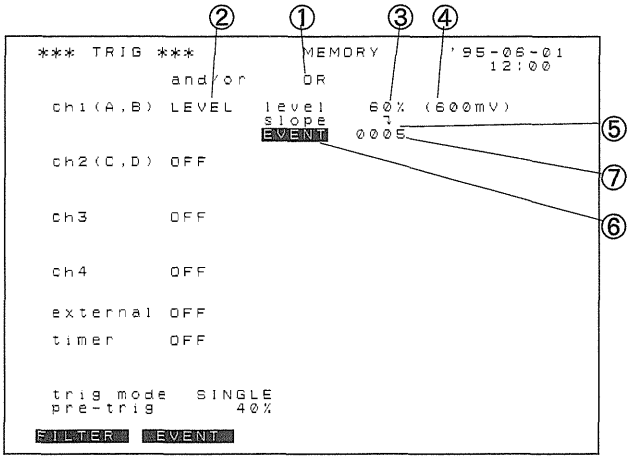
Counting from twice onward starts after the previous recording and display finish.

Trigger direction (↴)
Setting count: 2



Procedure (Setting screen: trigger)

The event trigger can be set, when OR is selected in the trigger logical operator (see Section 8.5). (① as shown in the figure on the left)



1. Move the flashing cursor to ② for the channel to be set.
2. Press the **LEVEL** soft key to set to the level trigger. [OFF, LEVEL, WINDOW, LOGIC, GLITCH, TIMEOUT]
3. Set the trigger level in the "level" item, ③.
   [0 % to 100 %]
   The trigger level is indicated in the voltage value in ④.
4. Select the trigger direction (slope) in the "slope" item, ⑤. [↴, ↳]
5. Press the **EVENT** soft key in ⑥, and the event trigger is selected.

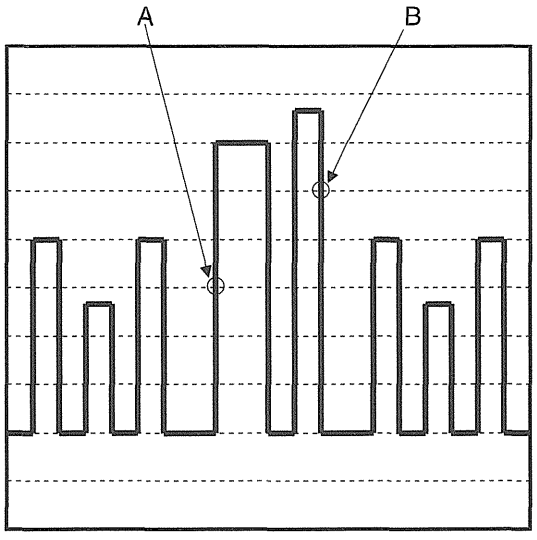
Soft key indication

FILTER : Trigger filter (See Section 8.3.1.)
EVENT : Event trigger

6. Set the event count in ⑦. [OFF, 2 to 4000]
   The OFF setting is equivalent to a simple level trigger (see Section 8.3.1), that is, a count of 1.

It is also possible to set the trigger level and direction (slope) on the display screen. (See Section 8.3.1.)

Example



To apply a trigger at the point A or point B on the waveform shown on the left, use the following settings.

Point A	trigger level: 50 %
	trigger direction: slope = ↴
	event count: 3
Point B	trigger level: 70 %
	trigger direction: slope = ↳
	event count: 2

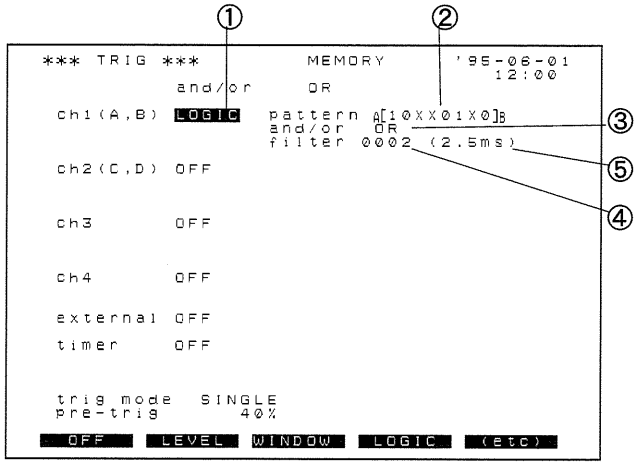
8.3.6 Logic Trigger (LOGIC)

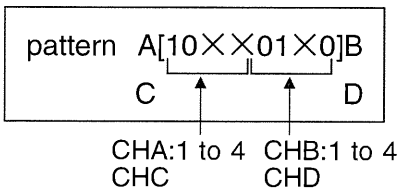
- Logic triggers are derived from the logic inputs.
- A trigger pattern and logical operator (AND or OR) are specified, and when the conditions are met, the trigger is activated.
- Using the trigger filter means that the trigger conditions have to hold for the specified interval in order to activate the trigger.
- The settings are made in groups of eight logic channels on channel 1 (A, B), and channel 2 (C, D).

  Channel 1 (A, B): Setting for the channel group A (1 to 4) and channel group B (1 to 4)

  Channel 2 (C, D): Setting for the channel group C (1 to 4) and channel group D (1 to 4)

Procedure (Setting screen: trigger)





The setting for channel 1 (A, B) corresponds to logic channels A1 to A4, and B1 to B4.

1. Move the flashing cursor to ① as shown in the figure on the left for channel 1 (A, B) or channel 2 (C, D).
2. Press the **LOGIC** soft key to set to the logic trigger.
   [OFF, LEVEL, WINDOW, LOGIC, GLITCH, TIMEOUT]
   Pressing the **(etc)** key changes the soft key indication menu.
3. Set the trigger pattern in ②.

   Soft key indication

   × : Ignore signal
   0 : Low level signal
   1 : High level signal
4. Select the trigger pattern logical operator in ③.

   Soft key indication

   OR : The trigger conditions hold, if any one of the logic signals agrees with the trigger pattern.
   AND : The trigger conditions hold, if all of the logic signals agree with the trigger pattern.

5. Set the trigger filter in ④. [OFF, 2 to 4000]
   - The filter width (the specified number multiplied by the sampling interval) is displayed in ⑤.
   - In the recorder and X-Y recorder functions, it is only possible to set this to ON or OFF.
     (The filter width is 32 ms in the time axis range of 400 ms/division, and 40 ms in the other ranges, in the recorder function. It is 32 ms in the X-Y recorder function.)

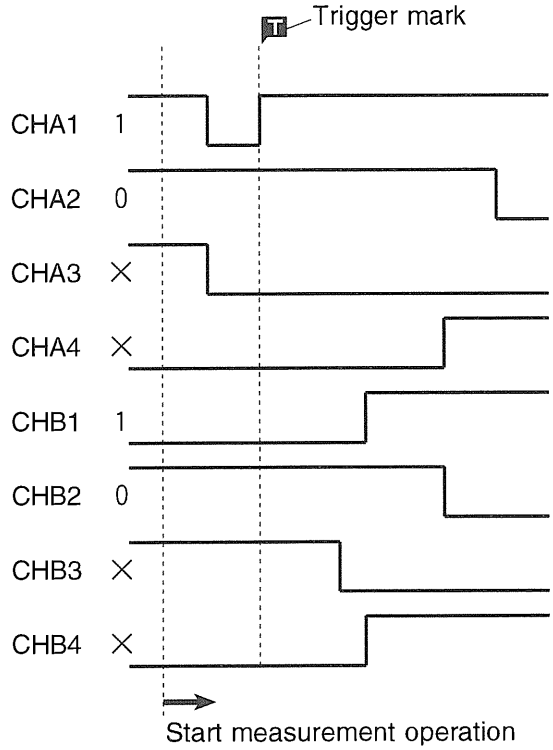
     This cannot be used, when AND is selected in the trigger logical operator (see Section 8.5).

NOTE

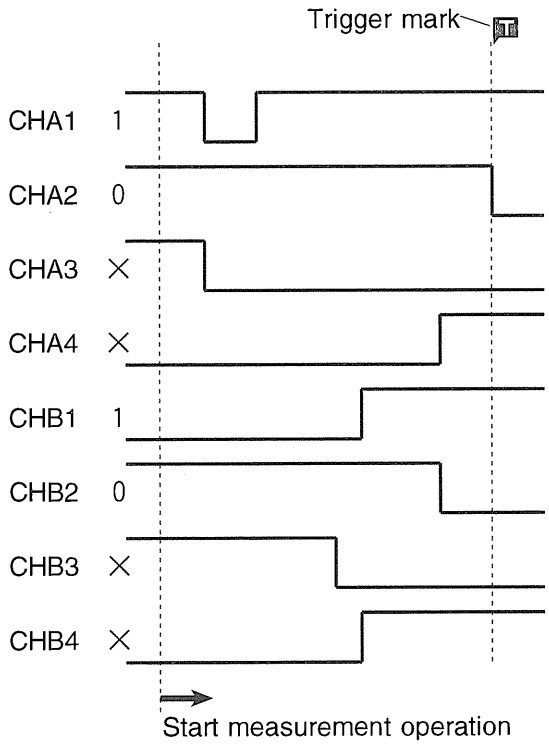
- The trigger is not activated even if the trigger conditions hold when starting measurement.
- The trigger is activated, when the trigger conditions hold after they don't hold first.

Example

(1) When the trigger pattern is set to "A[10××10××]B" with the operator OR.



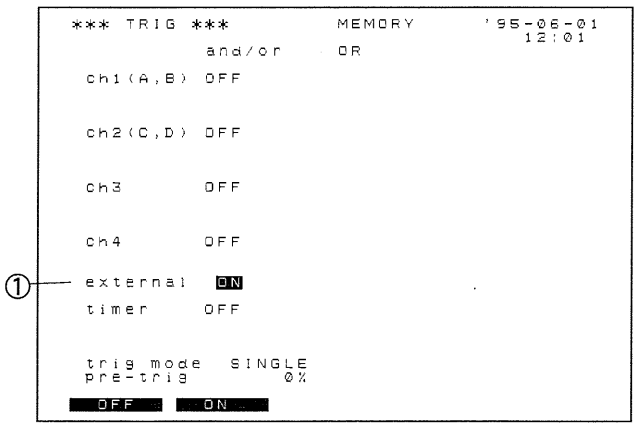
(2) When the trigger pattern is set to "A[10××10××]B" with the operator AND.



8.4 External Trigger (external)

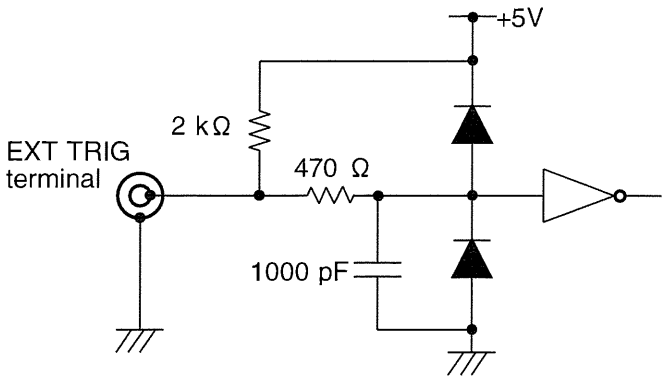
- The external input is available as a trigger source.
- The external trigger is activated by either shorting the EXT TRIG terminal or applying a falling edge signal going below 0.7 V.

Procedure (Setting screen: trigger)

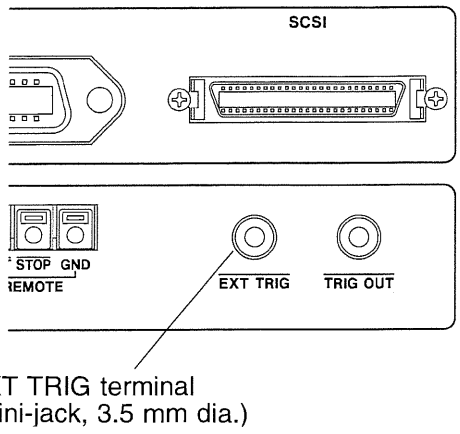


1. Move the flashing cursor to the "external" item, ① as shown in the figure on the left.
2. Set the external trigger ON or OFF by using the soft keys. [OFF, ON]

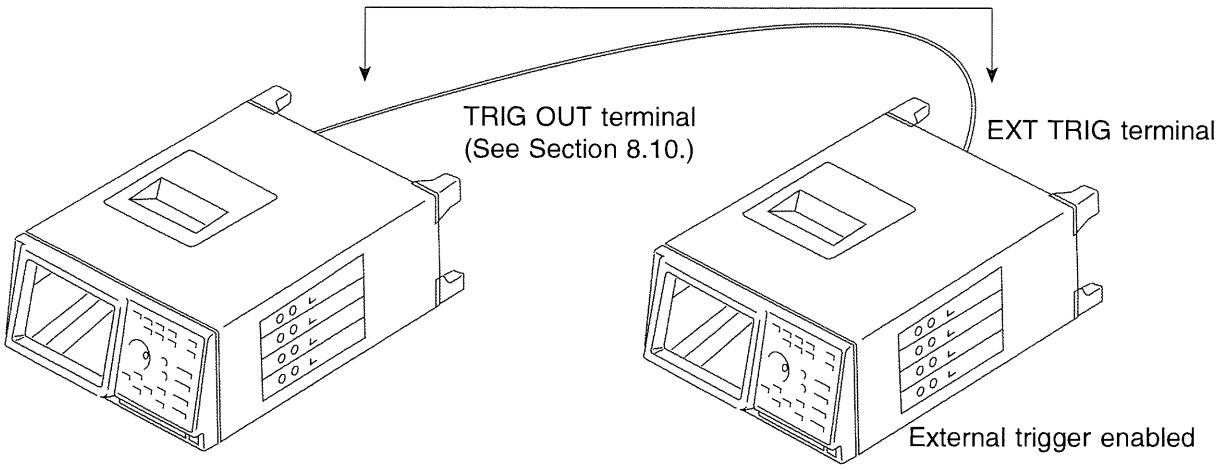
Input circuit Input voltage range -5 V to +10 V



Input terminal (rear panel)



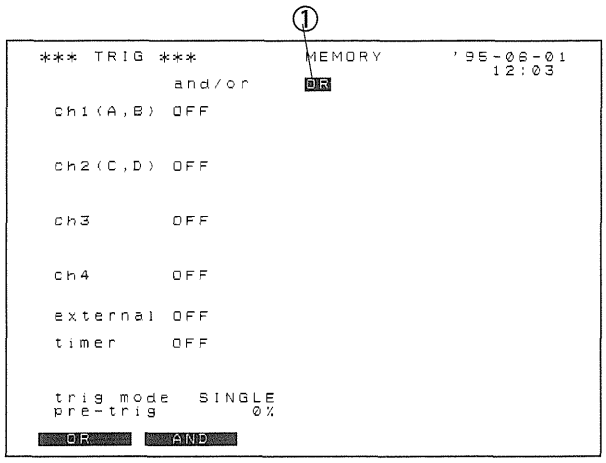
The external trigger facility can be used to synchronize a number of 8853 units for parallel operation.



8.5 Internal, External and Timer Trigger Logical Operator (and/or)

This setting determines whether the internal, external and timer triggers read AND or OR to produce the final effective trigger.

Procedure (Setting screen: trigger)



1. Move the flashing cursor to the "and/or" item, ① as shown in the figure on the left.
2. Make the setting by using the soft keys.

Soft key indication

OR : Triggering occurs if any one of the trigger conditions hold.

AND : Triggering occurs only if all of the trigger conditions hold.

NOTE

When setting to AND:

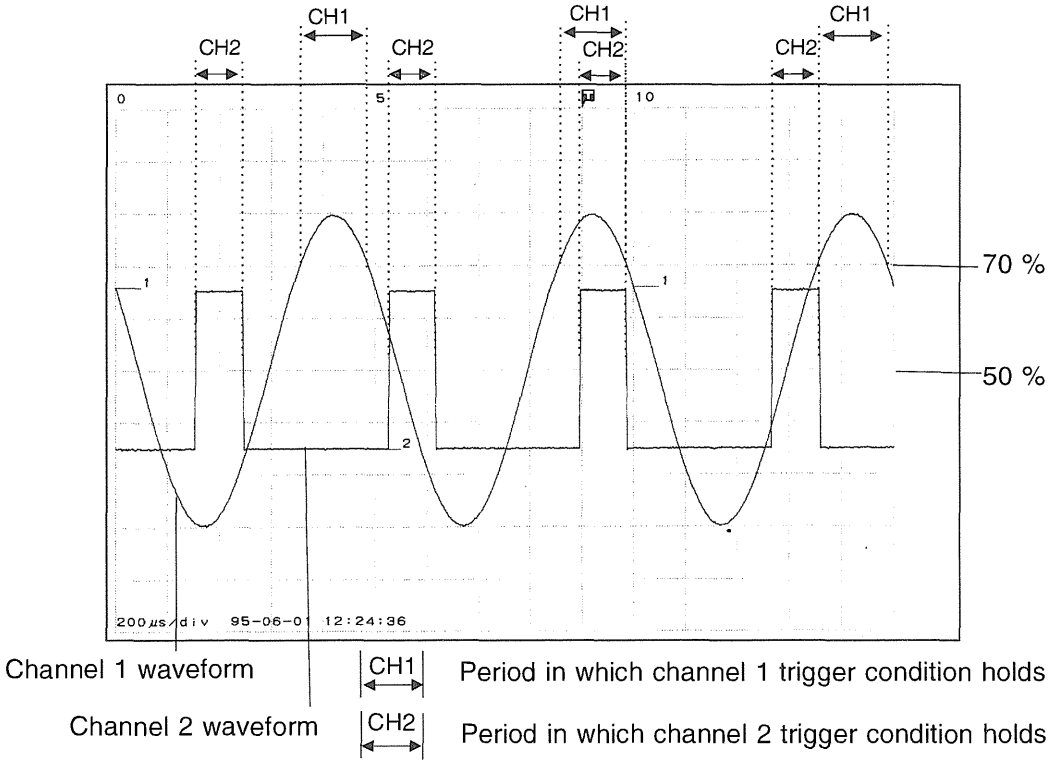
- The time out trigger, glitch detection trigger and event trigger cannot be used.
- Trigger filter cannot be used.
- The trigger conditions are considered to hold, if the waveform is above the trigger level, when the trigger direction is slope = ⤴, (if it is below the trigger level, when the trigger direction is slope = ⤵).

Example

and/or AND setting

Channel 1(A ,B) : level trigger (level: 70 %, direction: slope = ⤴)

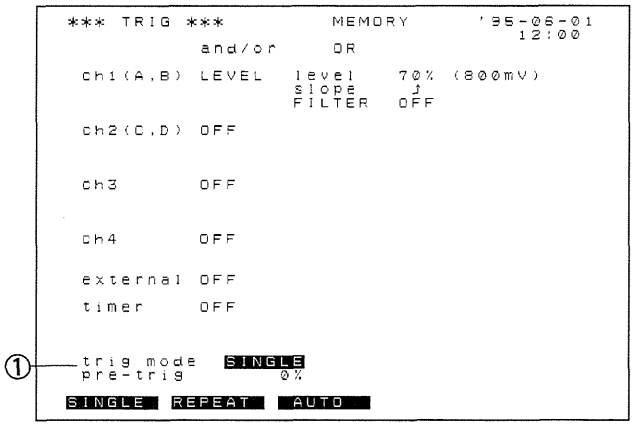
Channel 2(C, D) : level trigger (level: 50 %, direction: slope = ⤴)



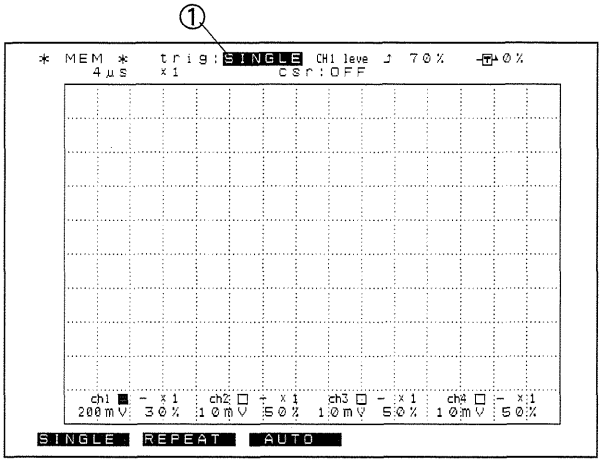
8.6 Trigger Modes (trig mode)

- The trigger mode is variable in the memory recorder, recorder, and FFT functions.
- It determines whether triggers are activated repeatedly after a recording operation is completed.

Procedure (Setting screen: trigger and display)



Trigger screen



Display screen

1. Move the flashing cursor to the "trig mode" item, ① as shown in the figure on the left.
2. Select the trigger mode by using the soft keys.

Soft key indication

SINGLE : The trigger is activated once (when measuring once).

REPEAT : The trigger is activated repeatedly (when measuring each time the trigger event occurs).

AUTO : The trigger is activated repeatedly. If approximately 1 second elapses without the trigger being activated, recording starts automatically (for checking input waveforms, etc.).

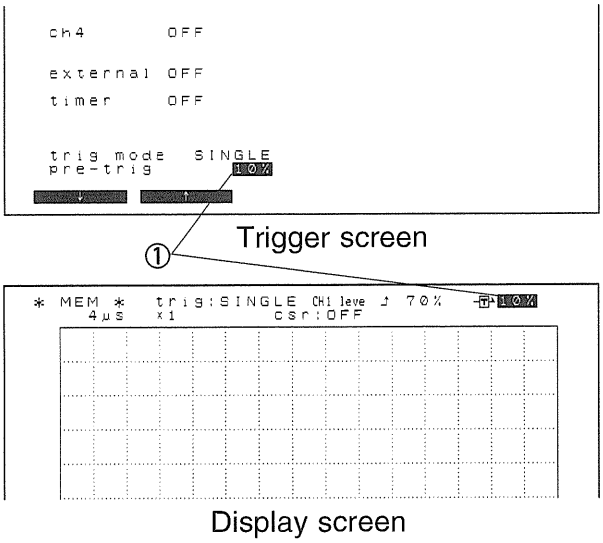
NOTE

- If all triggers are disabled, the measurement operation begins immediately. (free run)
- The trigger mode is not available in the X-Y recorder function.
- AUTO is not available in the recorder function.

8.7 Pre-Trigger (pre-trig)

- The pre-trigger function is available in the memory recorder and FFT functions.
- The moment the trigger occurs, the time related to the waveform being recorded can be set. The waveform before the trigger can be recorded.
- The portion of the recording before the trigger point is set as a percentage of the recording length.

Procedure (Setting screen: trigger and display)



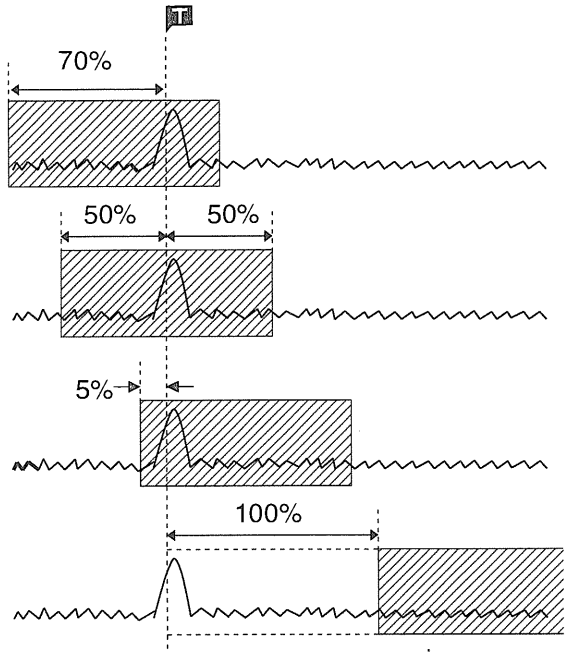
Display screen

1. Move the flashing cursor to the "pre-trig" item, ① as shown in the figure on the left.
2. Make a setting by using the ↓ and ↑ soft keys or the rotary knob.

   [0, 2, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100, -50 % to -950 %(*)]

   (*): The values between -50 % and -950 % are set in 50 % steps. However, if the recording length is 12500 divisions or more, only -50 and -100 settings are possible.

Example : Recorded range (recording length)



[70 %] : Recording 70 % of the recording length before the trigger

[50 %] : Recording 50 % of the recording length before the trigger

[5 %] : Recording 5 % of the recording length before the trigger

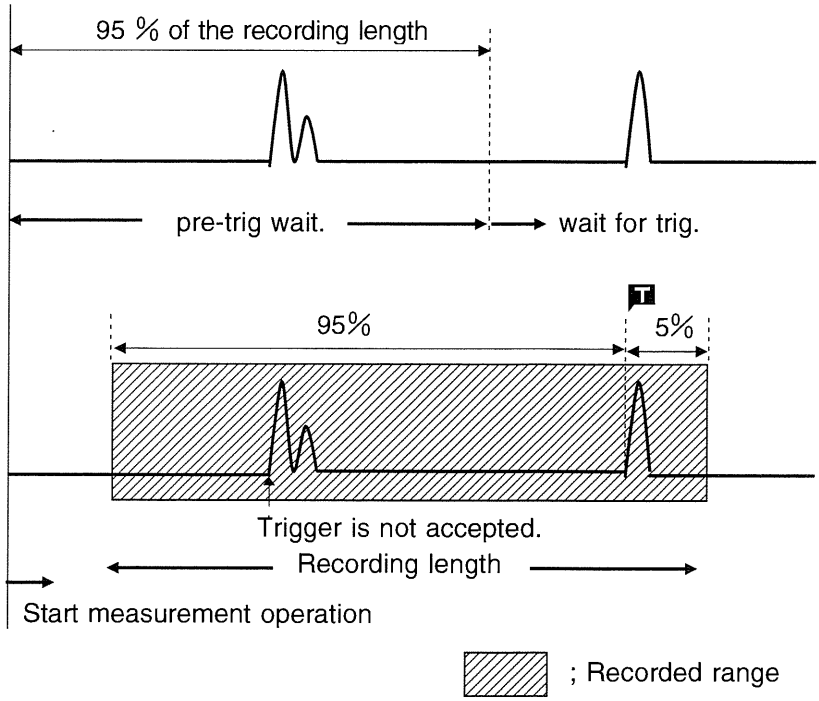
[-100 %] : Recording begins one recording length after the trigger

NOTE

- If all the trigger settings are disabled, the pre-trigger cannot be set.
- When the pre-trigger setting is between 2 and 100% inclusive, the trigger is not accepted during a time for the pre-trigger after starting the measurement. In this interval the message "pre-trig wait" appears on the screen. See Example below.
- In the interval until a trigger is applied, the message "wait for trig" appears.

Example When the pre-trigger is set to 95 %

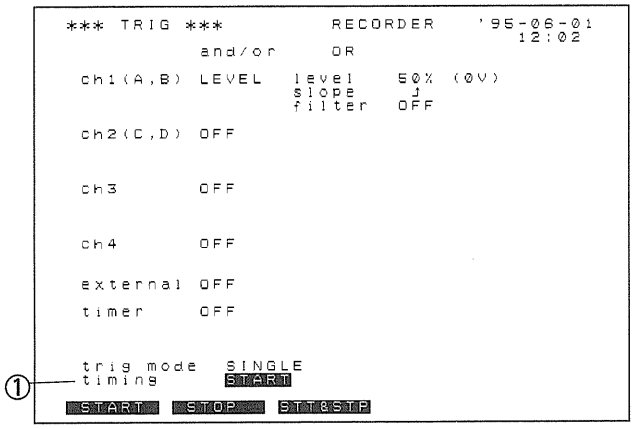
No trigger is accepted for 95 % of the recording length, after starting the measurement.



8.8 Trigger Timing (timing)

- Trigger timing is available in the recorder and X-Y recorder functions.
- This setting determines whether the trigger controls starting or stopping the recording or both.

Procedure (Setting screen: trigger)



Recorder function

1. Move the flashing cursor to the "timing" item, ① as shown in the figure on the left.
2. Set the trigger timing by using the soft keys.

Soft key indication

START : Recording starts when the trigger is applied.

STOP : Recording starts only when the START key is pressed, and stops when the trigger is applied.

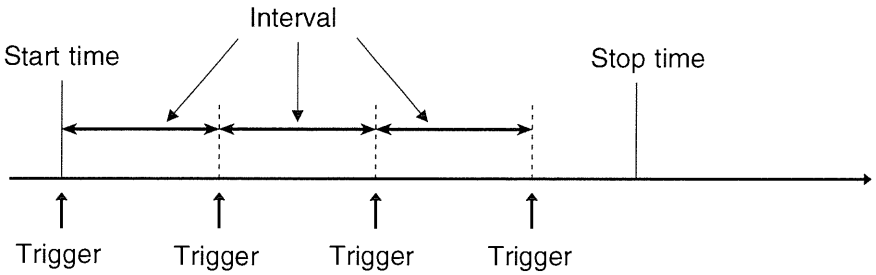
STT&STP : START&STOP
Recording starts when the trigger is applied, and stops when the trigger is applied next.

NOTE

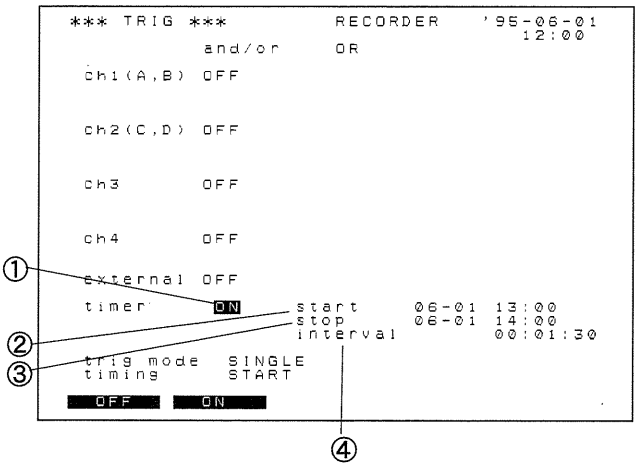
If all the triggers are disabled, the trigger timing setting is ignored, and the measurement operation begins immediately.

8.9 Timer Trigger (timer)

- The timer trigger is useful for carrying out recordings at fixed times.
- It activates a trigger at a predetermined interval from the start time to the stop time.



Procedure (Setting screen: trigger)



1. Move the flashing cursor to the "timer" item, ① as shown in the figure on the left.
2. Press the **ON** soft key, and the setting items appear on the right.
3. Set the time to start triggering (start time) in the "start" item, ②. [months, days, hours, and minutes]

   Press the **(time)** key to set to the current time.
4. Set the time to stop triggering (stop time) in the "stop" item, ③. [months, days, hours, and minutes]

   Press the **(time)** key to set to the current time.
5. Set the timer repeat interval in the "interval" item, ④. [hours, minutes, and seconds]

The date and time settings can be made by using the **↓**, **↑**, **10↓**, and **10↑** soft keys or the rotary knob.

NOTE

- If the timer repeat interval is set to "00:00:00", the trigger applies once only, at the start time.
- Set the start and stop times to times after the START key is pressed.
- When the trigger mode is set to SINGLE, the trigger is activated only once, at the start time.
- When the trigger timing setting is START&STOP, recording starts from the start time, and stops after the interval has elapsed. (Recorder and X-Y recorder functions)
- In the recorder and X-Y recorder functions, even if the trigger logical operator (see Section 8.5) is set to AND, the timer trigger occurs with OR.

Notes when using the timer trigger and other triggers simultaneously.

When AND is selected in the trigger logical operator:

- The timer repeat interval setting for the timer trigger is ignored, and if the conditions for other triggers hold from the start time to the stop time, the trigger occurs.
- Measurement stops at the stop time.

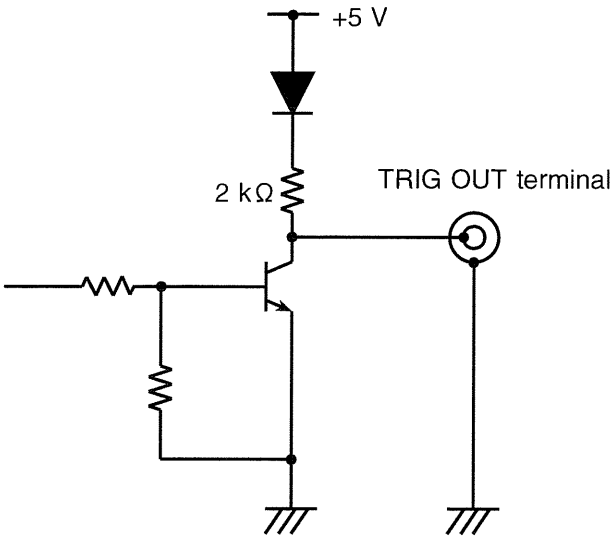
When OR is selected in the trigger logical operator:

- Before the start time and after the stop time, if the conditions for other triggers hold, the trigger occurs.
- From the start time to the stop time, if the conditions for either trigger hold, the trigger occurs.

8.10 Trigger Output Terminal

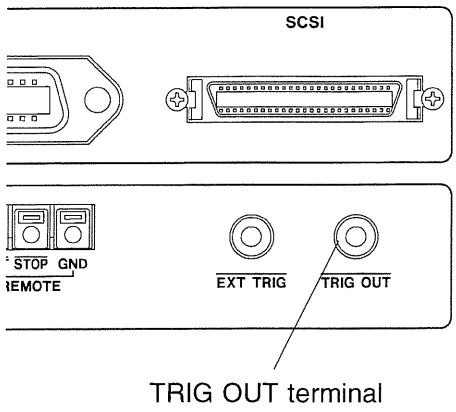
The TRIG OUT terminal on the rear panel outputs the trigger signal of TTL level.

Output circuit



Input voltage range : -20 to 30 V
Maximum input current : 500 mA
Maximum input power : 200 mW

Output terminal (rear panel)



Open collector output
With 5 V output
Active low
Pulth width : approx.1.5 ms
Mini-jack, 3,5 mm dia.

NOTE

Pressing the AUTO key to use the auto ranging function causes a trigger signal to be output.
Care is therefore required when using the auto ranging function when the trigger output terminal is in use. (Only a memory recorder function)

Chapter 9
Memory Segmentation Function

9.1 What is the Memory Segmentation Function? (memory div)

- This function is available in the memory recorder function.
- The memory can be divided into blocks for use.
- There are two different functions for different applications of the segmented memory.

① The sequential save function (See Section 9.2.)

- The memory is segmented into a number of blocks.
- The successive blocks are used to hold successively triggered recordings, without displaying or recording on the printer, the floppy disk, etc.
- The recording and display dead time can be reduced.

② The multi-block function (See Section 9.3.)

- The memory space is segmented into as many blocks as required.
- The user can select any memory blocks as required.
- The waveforms in any two memory blocks can be superimposed, for easy comparison.

NOTE

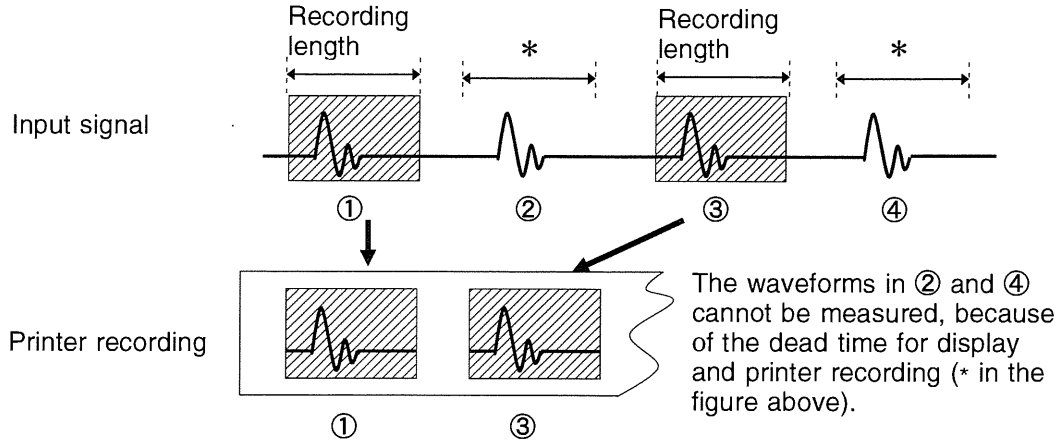
- If the averaging function (see Section 5.3.19) is used, the memory segmentation function is not available.
- If the roll mode (see Section 5.3.21) is enabled, the memory segmentation function is not available.

9.2 Sequential Save Function (SEQUENTIAL SAVE)

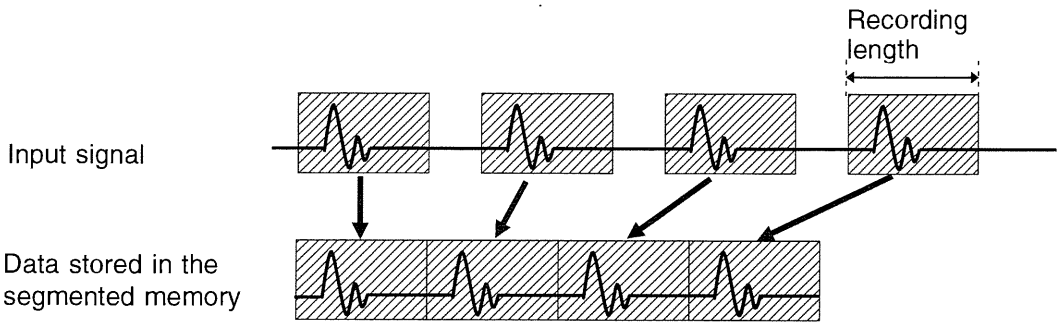
- During measurement operation, until all blocks have been filled with data, the successive blocks are used to hold successively only triggered recordings, without displaying or recording on the printer, the floppy disk, etc.
- While captured waveforms are being displayed or printed, waveform capture is not carried out. As a result, if carrying out measurement without using memory segmentation, the dead time is increased.

Measurement without memory segmentation

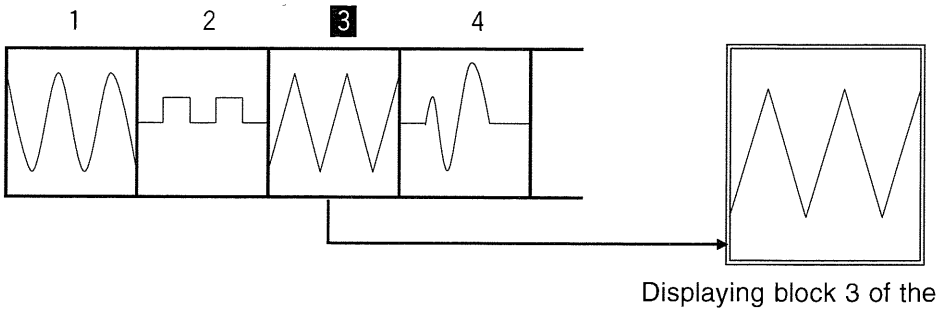
(Trigger mode: REPEAT, using the auto print function)



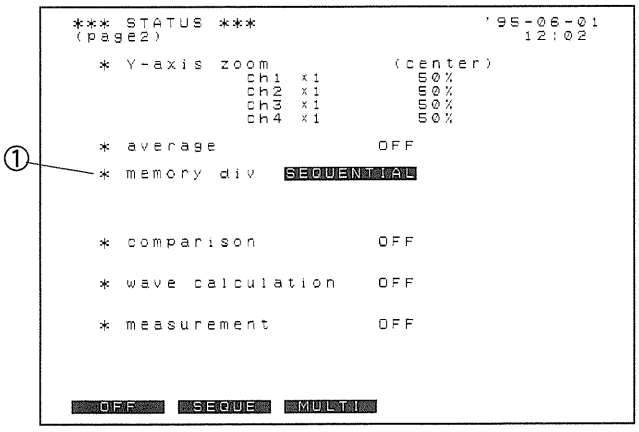
Measurement using the sequential save function



- After measurement, any block in which an input signal has been recorded can be shown on the screen, and recorded on the printer.

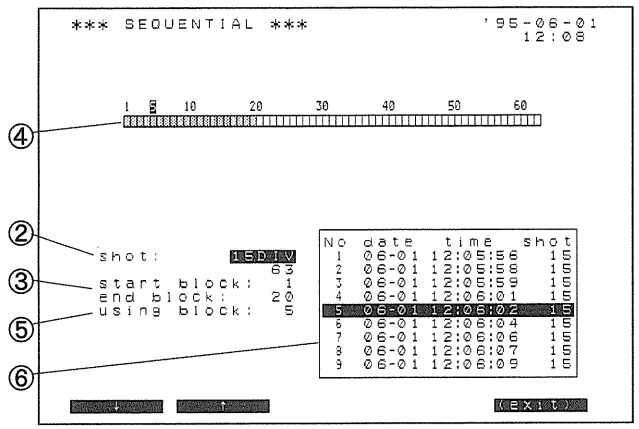


Procedure (Setting screen: status screen (page 2))



Status screen (page 2)

1. Move the flashing cursor to the "memory div" item, ① as shown in the figure on the left.
2. Press the **SEQUE** soft key to set to the sequential save function.
3. Press the **(map)** soft key, and the memory segmentation screen appears.



Memory segmentation screen

4. Set the recording length in one block in the "shot" item, ②.

   The number of memory segmentations is displayed below. [2, 3, 7, 15, 31, 63]
   (See Section 9.4.)
5. Set the block in which recording starts in the "start block" item, and the block in which recording stops in the "end block" item, ③.
6. Press the **START** key, and the display screen appears, then measurement starts.

Relationship between the trigger mode and the sequential save function

① When the trigger mode is SINGLE

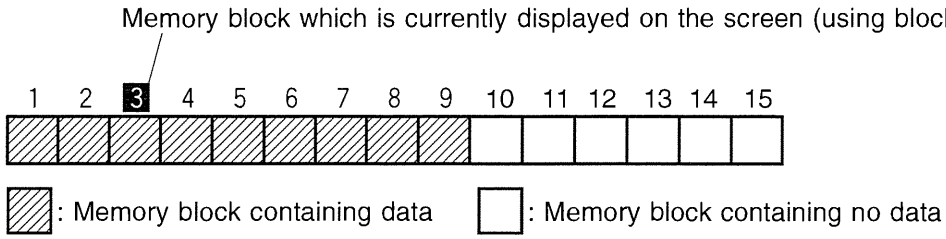
When the START key is pressed, after data is captured and stored in each block in order from "start block" to "end block", the data in the "start block" is displayed on the screen, and the data capture process then automatically terminates.

② When the trigger mode is REPEAT or AUTO

- When the START key is pressed, data is captured and stored in each block in order from "start block" to "end block", but after this last block the data capture process continues, storing data in "start block" again, and so on, cyclically.
- When data has been stored in the last block ("end block"), the data in the "end block" is displayed on the screen. (If the auto print function (see Section 5.3.20) is enabled, a printed recording is also made.)
  (If the auto save function (see Section 13.9) is enabled, the auto save is also performed.)
- When the STOP key is pressed, this process terminates.

7. After measurement, press the STATUS key to display the memory segmentation screen.
8. The bar graph, ④ as shown in the figure on the previous page, indicates which memory blocks are in use.

Example



9. The number of the memory block whose waveform is to be displayed can be selected in the "using block" item, ⑤.
10. The date and time of recording and the recording length for "using block" is displayed in the box, ⑥ on the lower right of the memory segmentation screen.
11. Press the (exit) soft key to exit from the memory segmentation screen.

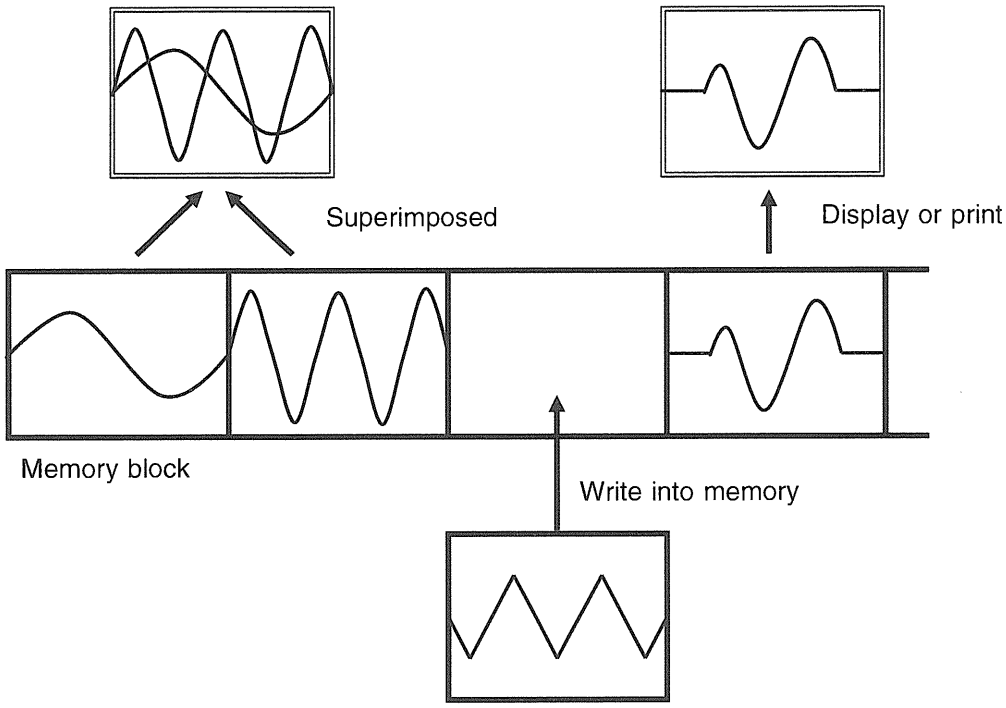
NOTE

- When the averaging function (see Section 5.3.19) is used, the sequential save function cannot be used.
- When the roll mode (see Section 5.3.21) is enabled, the sequential save function cannot be used.
- The time (dead time) between after the data is captured into one block and before the next block waits for a trigger is approximately 12.5 ms when no bar graph is displayed on the screen, and approximately 30 ms when the bar graph is displayed.

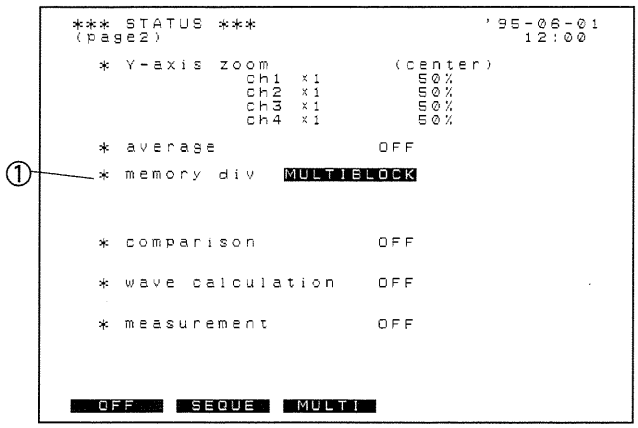
Related item The "using block" setting and the memory block utilization can be displayed on the screen. Refer to Section 5.3.22, "Help Function" for details.

9.3 Multi-Block Function (MULTI-BLOCK)

- Measurement data can be stored in any block.
- A block that has already been used, can be reused as required, overwriting the existing waveform data in it.
- The measurement data held in any block can be shown on the display screen.
- The measurement data held in any two different blocks can be superimposed on the screen, to make comparison of two waveforms easy.

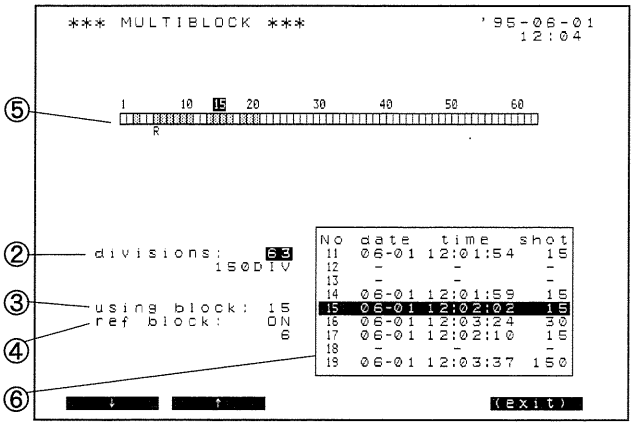


Procedure (Setting screen: status screen (page 2))



Status screen (page 2)

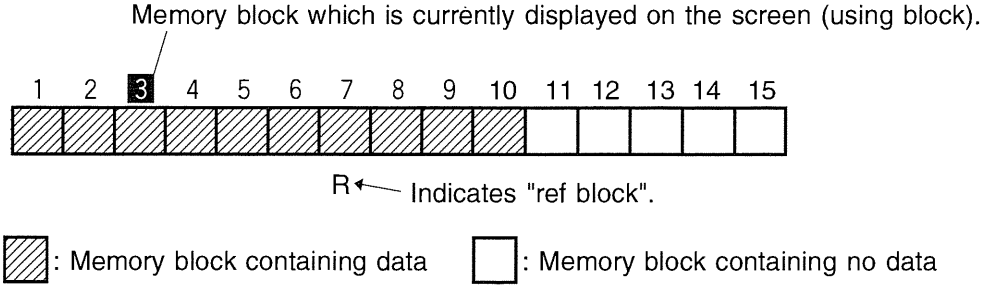
1. Move the flashing cursor to the "memory div" item, ① as shown in the figure on the left.
2. Press the **MULTI** soft key to set to the multi-block function.
3. Press the **(map)** soft key, and the memory segmentation screen appears.



Memory segmentation screen

4. Set the number of memory segmentations in the "division" item, ②. [2, 3, 7, 15, 31, 63]
   The maximum recording length that can be set appears below. (See Section 9.4.)
5. Set the number of the memory blocks to be used in the "using block" item, ③.
6. When the waveform is not superimposed (see the next page), set the "ref block", ④ to OFF.
7. The bar graph, ⑤ indicates which memory blocks are in use.

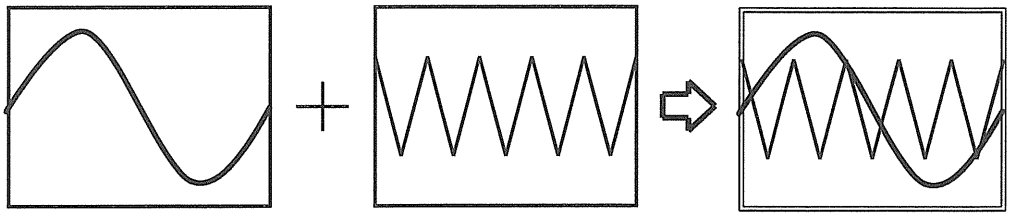
Example



8. The date and time of recording and the recording length for "using block" are displayed in the box on the lower right of the memory segmentation screen, ⑥.
9. Press the **(exit)** soft key to exit from the memory segmentation screen. The remainder is the same as in the usual measurement.

When superimposing the waveform

1. Move the flashing cursor to the "ref block" item, ④ as shown in the figure on the previous page.
2. Press the ON soft key, and a block number appears below "ref block". Set the number by using the ↓ and ↑ soft keys or the rotary knob.
3. The waveform in "ref block" set in step 2 is superimposed on the waveform in the "using block" (in step 5 on the previous page), and displayed on the display screen.



NOTE

- When the averaging function (see Section 5.3.19) is enabled, the multi-block function cannot be used.
- When the roll mode (see Section 5.3.21) is enabled, the multi-block function cannot be used.
- The waveform data in the "ref block" and the "using block" must have the same recording length in order to be used in a superimposed display.
- Setting the number of memory blocks takes priority over the setting of the recording length. Because of this, if a small number of memory blocks is set along with a long recording length, then if the number of memory blocks is increased, the recording length will automatically be decreased.
- For the relationship between the number of memory blocks and the recording length, refer to Section 9.4, "The relationship Between the Number of Memory Blocks and the Recording Length."

Related item The "using block" setting and the memory block utilization can be displayed on the screen. Refer to Section 5.3.22, "Help Function" for details.

9.4 The Relationship Between the Number of Memory Blocks and the Recording Length

The table below shows the relationship between the number of memory blocks and the recording length, according to the number of channels in use (see Section 12.5.8).

Number of memory blocks \ Number of channels	4 channels	2 channels	1 channel
2	6000 DIV	12500 DIV	25000 DIV
3	3000 DIV	6000 DIV	12500 DIV
7	1500 DIV	3000 DIV	6000 DIV
15	750 DIV	1500 DIV	3000 DIV
31	300 DIV	750 DIV	1500 DIV
63	150 DIV	300 DIV	750 DIV

Notes on the table

① In sequential save operation

- The recording length has priority over the number of memory blocks.
- The number of memory blocks that can be used can be read off, according to the number of channels in use and the recording length on the table.

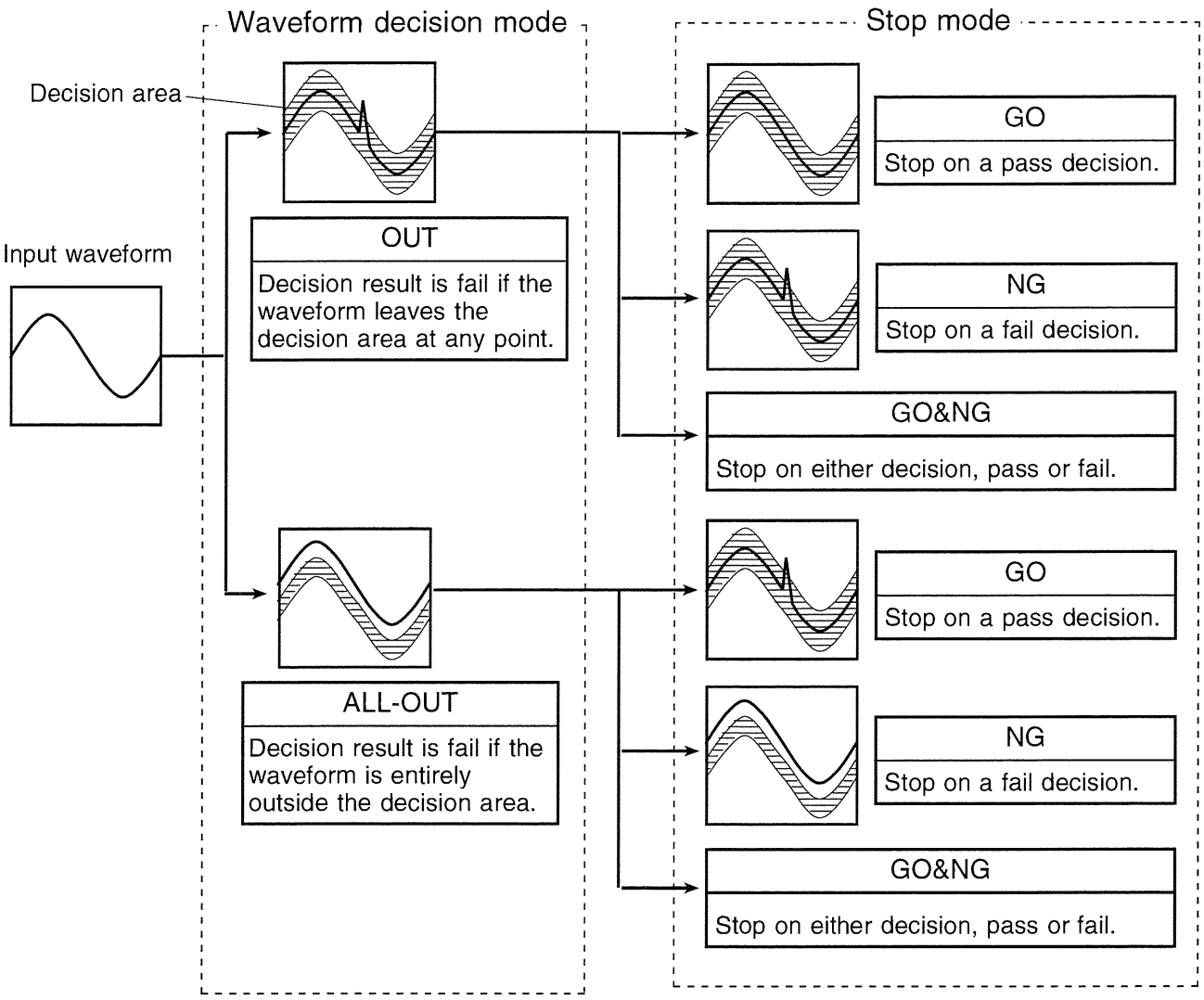
② In multi-block operation

- The number of memory blocks has priority over the recording length.
- The maximum recording length in one block can be read off, according to the number of memory blocks and the number of channels in use.

Chapter 10
Waveform Decision Function

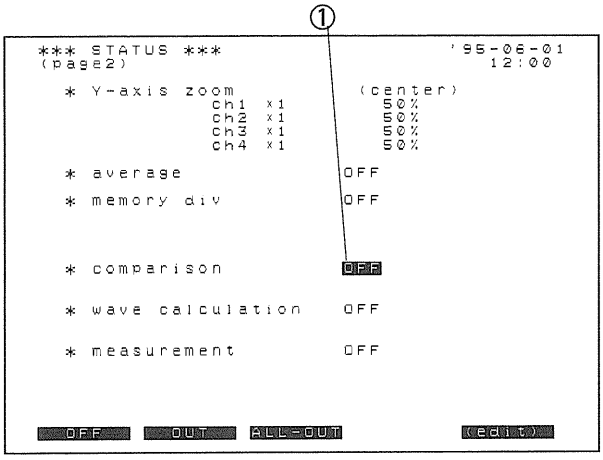
10.1 Overview

- The waveform decision function can be used in the memory recorder function SINGLE format and X-Y format, and in the FFT function SINGLE format.
- This function provides a pass/fail decision (GO/NG) for the input signal with respect to an arbitrarily defined decision area.
- It can be used to detect abnormalities in the input waveform.
- The decision result is output from the rear panel, for production line applications.


Waveform decision mode
Stop mode
Decision area
Input waveform
OUT
Decision result is fail if the waveform leaves the decision area at any point.
ALL-OUT
Decision result is fail if the waveform is entirely outside the decision area.
GO
Stop on a pass decision.
NG
Stop on a fail decision.
GO&NG
Stop on either decision, pass or fail.
GO
Stop on a pass decision.
NG
Stop on a fail decision.
GO&NG
Stop on either decision, pass or fail.

10.2 Waveform Decision Mode Setting (comparison)

Procedure (Setting screen: status (page 2))



Memory recorder function

1. Move the flashing cursor to the "comparison" item, ① as shown in the figure on the left.
2. Select the required decision mode by using the soft keys.

Soft key indication

OFF : Waveform decision is not performed.

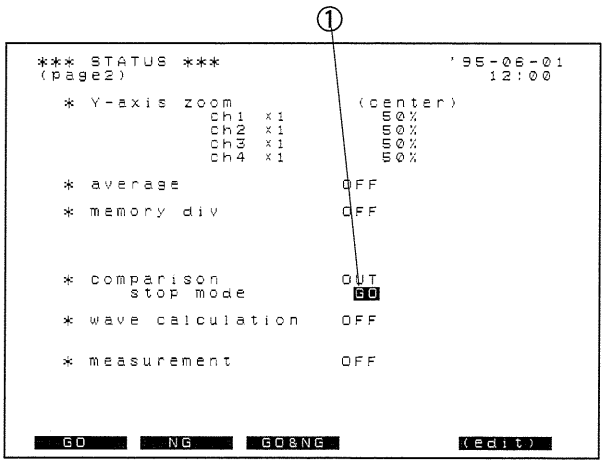
OUT : Decision result is fail if the waveform leaves the decision area at any point.

ALL-OUT : Decision result is fail if the waveform is entirely outside the decision area.

(edit) : Graphic editor screen (see Section 10.4) appears.

10.3 Stop Mode Setting (stop mode)

Procedure (Setting screen: status (page 2))



Memory recorder function

1. Move the flashing cursor to the "stop mode" item, ① as shown in the figure on the left.
2. Select the required stop mode by using the soft keys.

Soft key indication

GO : Stop operation only after a pass.
NG : Stop operation only after a fail.
GO&NG : Stop operation regardless of the decision result.
edit : Graphic editor screen (see Section 10.4) appears.

When the waveform decision mode (see Section 10.2) is disabled, this setting cannot be made.

Trigger mode and stop operation

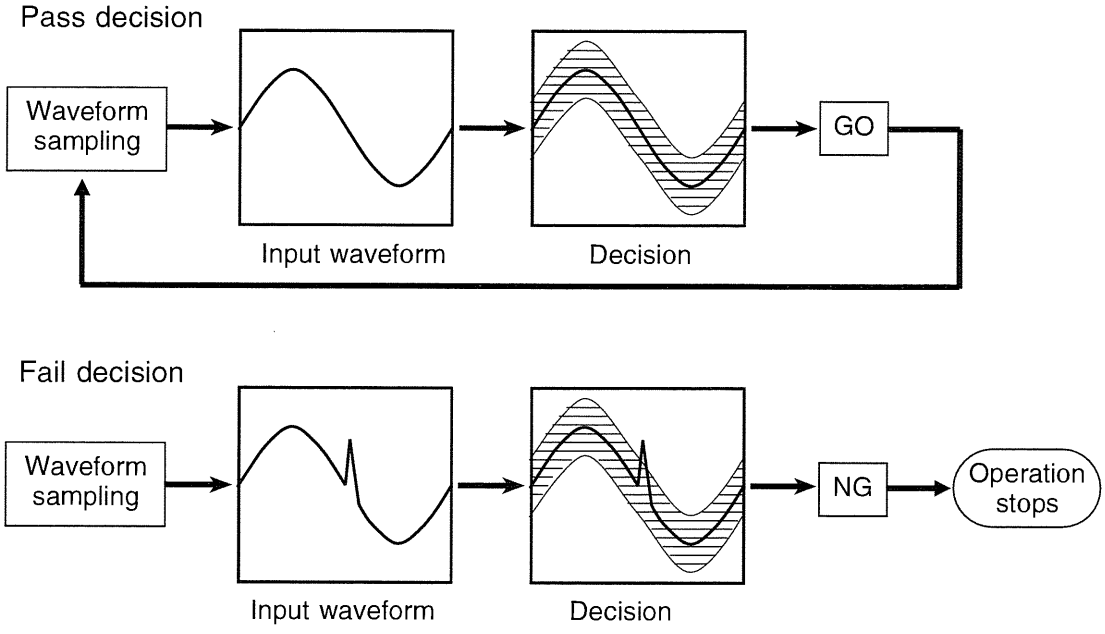
① When the trigger mode is SINGLE:

Measurement continues until the operation stop then stops.

② When the trigger mode is REPEAT or AUTO:

After the operation stop, the unit returns to the start state.
Pressing the STOP key terminates measurement.

Example When the trigger mode is SINGLE, the waveform decision mode is OUT, and the stop mode is NG. (The sampling of the input signal waveform continues until a fail decision.)



When an operation stop occurs

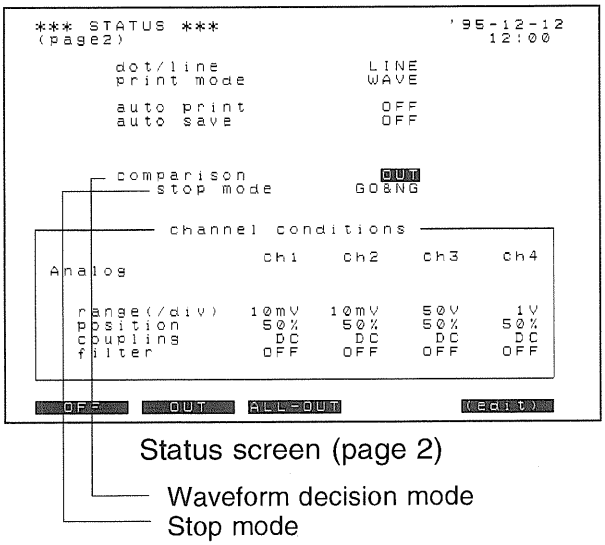
- When the auto print function (see Section 5.3.20) is enabled, the waveform is printed when the operation stop occurs.
- When the auto save function (see Section 13.9) is enabled, the waveform is saved when the operation stop occurs.
- When the sequential save function (see Section 9.2) is used, data is stored in memory when the operation stop occurs.

NOTE

- When the roll mode (see Section 5.3.21) is enabled, the waveform decision function cannot be used.
- When the trigger mode is AUTO, the trigger point may move, and NG may occur. Measure in the SINGLE or REPEAT mode.
- The waveform decision function comprises two operations: ① capturing the data and ② making the decision. These are repeated alternately, and therefore during the decision making, no data is captured. Note therefore that this function cannot be used for continuous monitoring of the input signal.
- The time required to make the decision is approximately 66 ms. (This does not include the time to capture the data or the display time.)
- The following table shows the approximate time for the decision cycle, when making a decision on approximately two cycles of a sine wave on the screen.

Number of channels for decision	Time axis	Recording length	Compression factor	Interpolation function	Decision cycle
1 ch	50 μs	15 DIV	1/1	DOT	235 ms
2 ch	50 μs	15 DIV	1/1	LINE	300 ms
1 ch	50 μs	150 DIV	1/10	LINE	265 ms

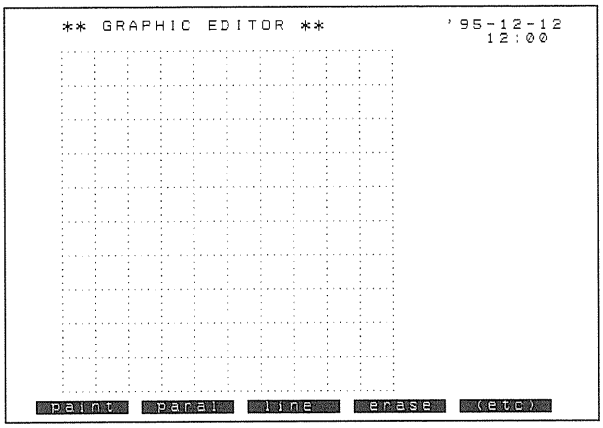
- When using the manual print function, the decision area is printed as well as the waveform.
- The input waveform is automatically shown in high intensity, and the decision area in low intensity.
- In the FFT function, the screen displays are different from those in the memory recorder function, as follows.



Status screen (page 2)

Waveform decision mode

Stop mode

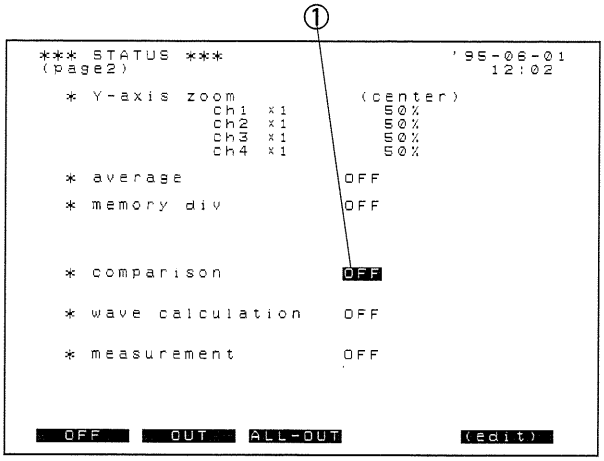


Graphics editor screen

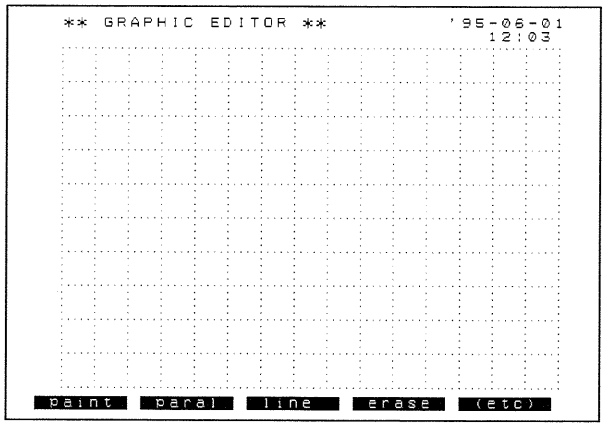
10.4 Using the Graphics Editor (GRAPHIC EDITOR)

- The graphics editor can be used in the memory recorder function SINGLE format and X-Y format, and in the FFT function SINGLE format.
- The graphics editor allows you to draw the waveform decision area directly on the screen.

Procedure (Setting screen: status (page 2))



Memory recorder function



Graphics editor screen

1. Move the flashing cursor to the "comparison" item, ① as shown in the figure on the left.
2. Press the **(edit)** soft key, and the graphics editor screen appears.
3. The waveform decision area can be set up by selecting the appropriate editor commands by using the soft keys. (See Section 10.5.)

Soft key indication

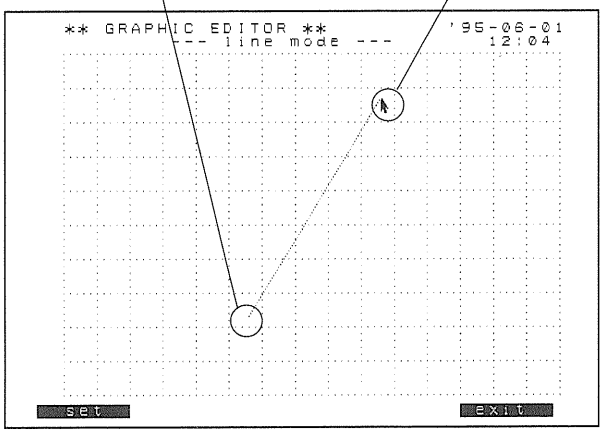
line : Draw a chain of straight-line segments
paint : Fill the closed curve surrounding the arrow cursor
reverse : Reverse the sense of all pixels
storage : Capture the displayed waveform into the graphics editor
paral : (parallel) Spread out the display pattern by parallel movement
erase : Use the block cursor to erase selected portions
clear : Clear a rectangular area
all clr : (all clear) Clear the whole screen
undo : Undo the previous operation
save : Save the decision area in memory
end : Exit from the graphics editor

* **(etc)** : change the soft key indication menu.

10.5 Details of the Graphics Editor Commands

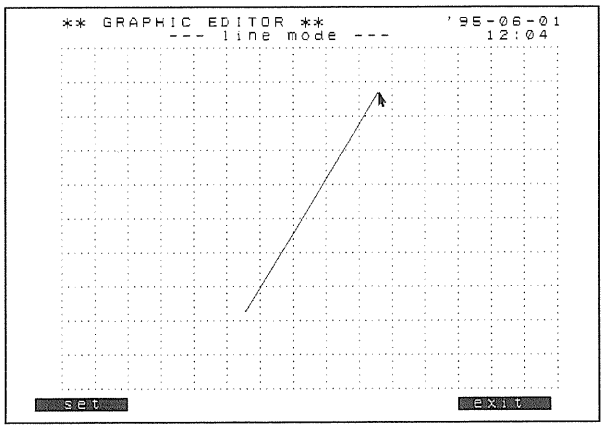
① line	Draws a chain of straight line segments.

Procedure

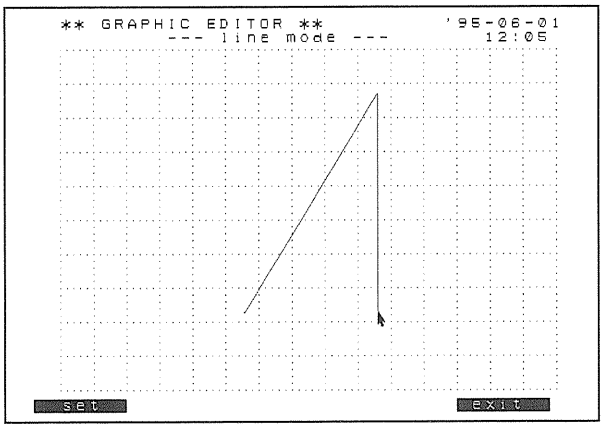


Line mode

1. Press the **line** soft key to enter the line mode.
2. Use the cursor keys to move the arrow cursor to the start point.
3. Press the **set** soft key to set the start point.
4. Using the cursor keys, move the arrow cursor.
   (A dotted line appears, joining the start point to the current cursor position.)



5. Press the **set** soft key to make the line into a solid line joining the start point to the current cursor position.

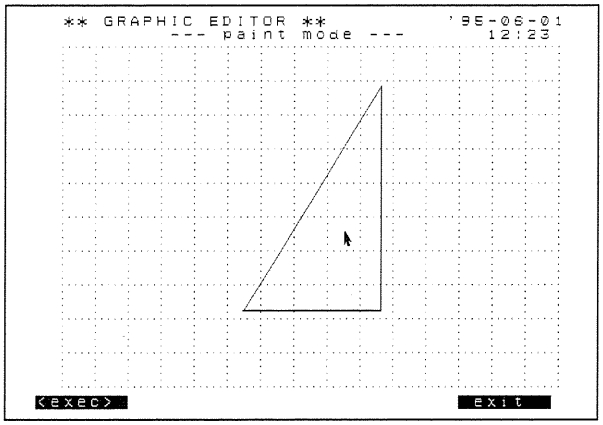


6. Use the cursor keys to move the arrow cursor again.
7. Press the **set** soft key to draw another straight-line segment joining the previous end-point to the current cursor position.
8. Press the **exit** soft key to exit from line mode.

② **paint**	Fills the closed curve surrounding the arrow cursor.

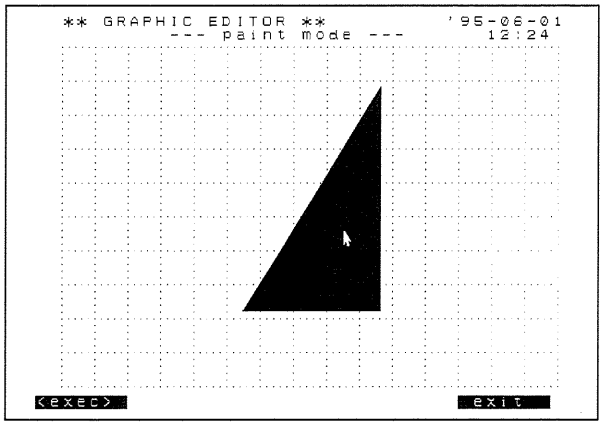
The closed curve to be filled is a decision area.

Procedure



Paint mode

1. Press the **paint** soft key to enter the paint mode.
2. Use the cursor keys to move the arrow cursor inside the closed curve to be filled.



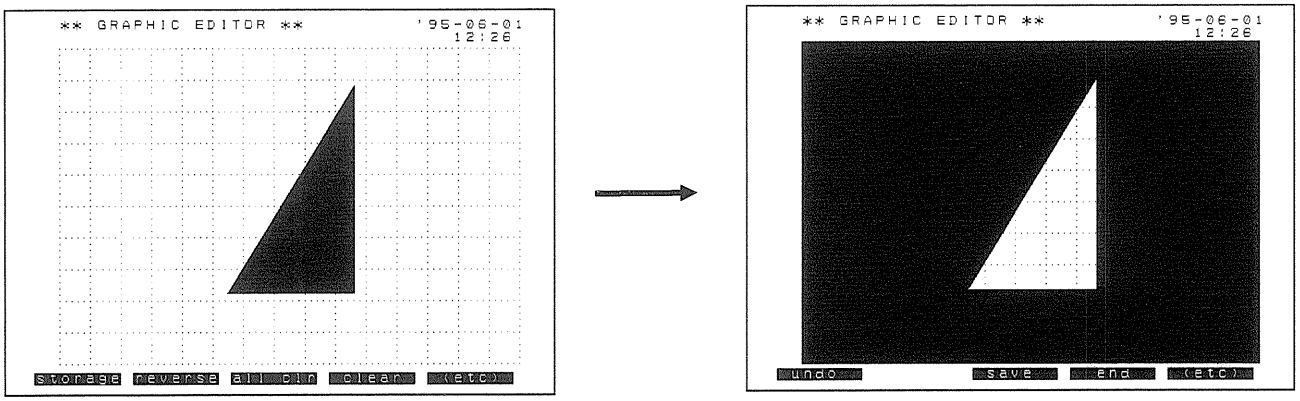
3. Press the **<exec>** soft key to fill the area with solid pixels.
4. Press the **exit** soft key to exit from paint mode.

NOTE

Take care that the required area is completely surrounded. Otherwise the "paint" may leak out and fill the screen.

③ reverse　Reverses the sense of all pixels.

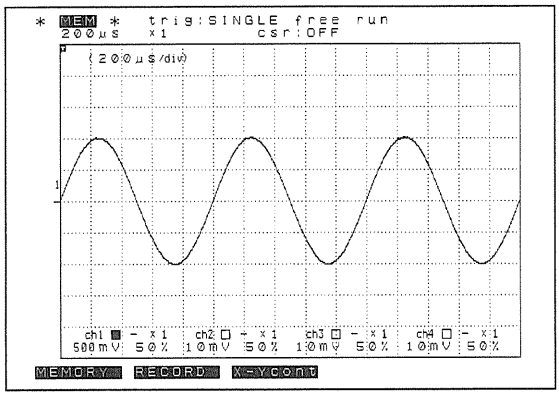
Procedure Press the **reverse** soft key to reverse the video.



④ storage　Captures the displayed waveform into the graphics editor.

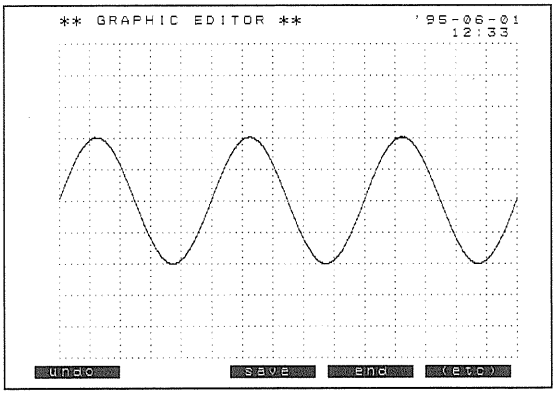
Procedure Press the **storage** soft key to capture the displayed waveform into the graphics editor.

Displayed waveform



Display screen

After executing the storage command

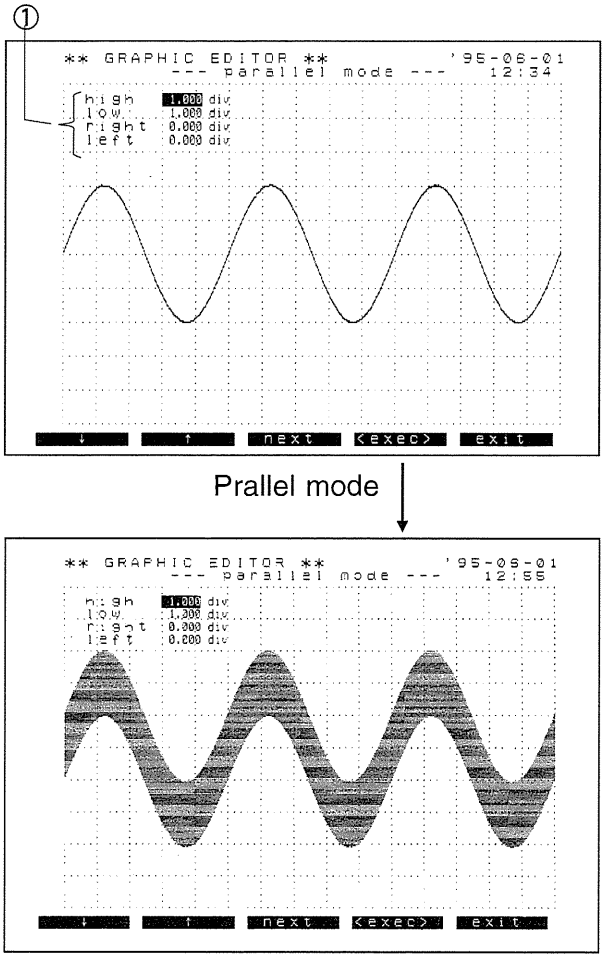


Graphics editor screen

NOTE　Regardless of its original display mode, the waveform appears in the graphics editor screen in low intensity.

⑤ parallel Spreads out the display pattern by parallel movement.

Procedure



1. Press the **paral** soft key to enter the parallel mode.
2. Set the amounts for the parallel movement, ① as shown in the figure on the left.
   - Select the item to be set by using the **next** soft key or the [▼] and [▲] cursor keys. (The numerical value is reversed.)
   - Set the movement amounts by using the **↓** and **↑** soft keys or the rotary knob.

Screen display

high Amount of upward spreading (in 0.04-division steps)

low Amount of downward spreading (in 0.04-division steps)

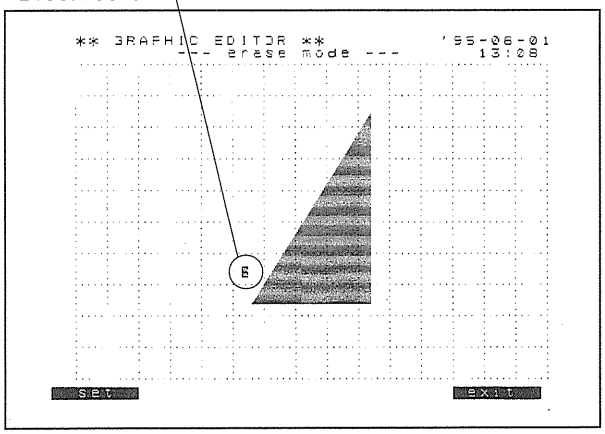
right Amount of rightward spreading (in 0.025-division steps)

left Amount of leftward spreading (in 0.025-division steps)

3. Press the **<exec>** soft key to carry out the parallel spreading, and create the decision area.
4. Press the **exit** soft key to exit from parallel mode.

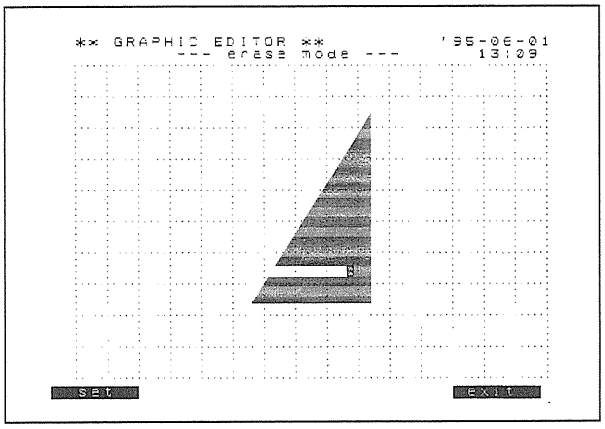
⑥ **erase**	Erases selected portions with the block cursor.

Procedure



Erase mode

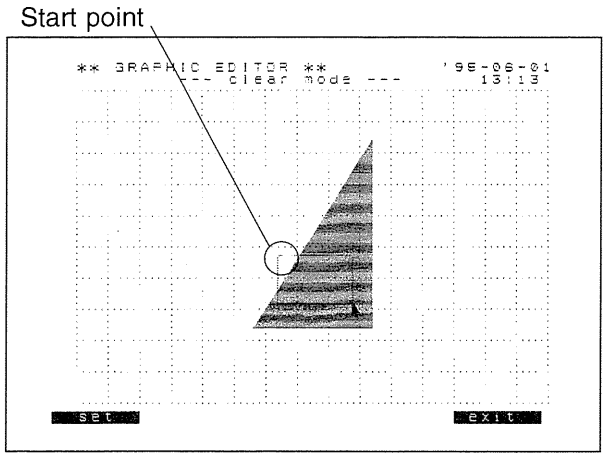
1. Press the **erase** soft key to enter the erase mode.
2. Use the cursor keys to move the arrow cursor to the start point.
3. Press the **set** soft key to change from the arrow cursor to the block cursor.
4. Use the cursor keys to move the block cursor, and erase portions not required.



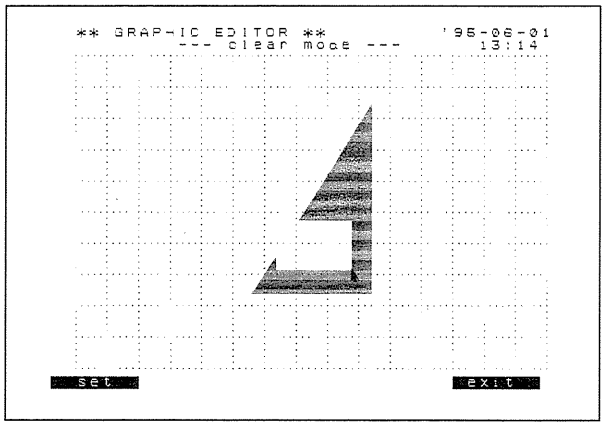
5. Press the **exit** soft key to exit from erase mode.

⑦ clear	Clears a rectangular area.

Procedure



Clear mode



1. Press the **clear** soft key to enter the clear mode.
2. Use the cursor keys to move the arrow cursor to the start point.
3. Press the **set** soft key to set the start point.
4. Using the cursor keys, move the arrow cursor to set the area to be cleared. (A dotted line appears, outlining a rectangle with the start point and the current cursor position at diagonally opposite corners.)
5. Press the **set** soft key to clear the rectangular area.
6. Press the **exit** soft key to exit from clear mode.

⑧ all clear	Clears the whole screen.

Procedure Pressing the **all clr** soft key clears the whole screen.

⑨ undo	Undoes the previous operation. *This undoes the effect of any operation other than save or end.

Procedure Pressing the **undo** soft key to undo the previous operation.

⑩ save	Saves the decision area in memory.

Procedure Pressing the **save** soft key to save the decision area on the screen in memory.

⑪ end	Exits from the graphics editor with or without saving the decision area.

Procedure After pressing the end soft key, select the save or nosave soft key.

a. save — save the decision area in memory, then exit from the graphics editor. The decision area can then be used for waveform decisions.

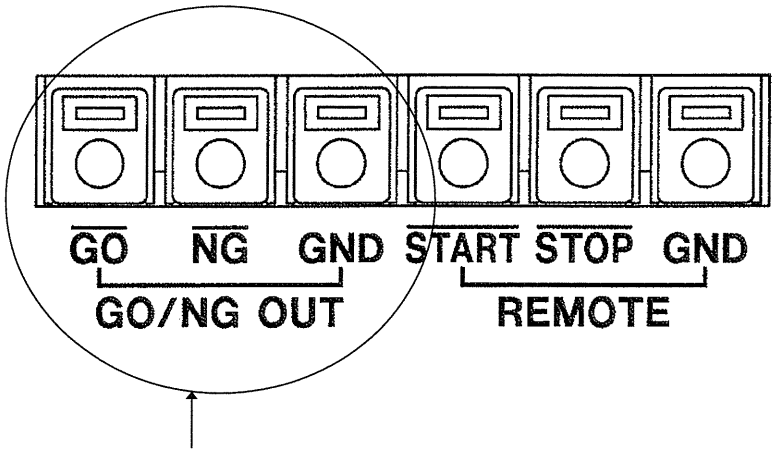
b. nosave — exit from the graphics editor without saving the decision area in memory. The decision area is then lost.

NOTE If you exit the graphics editor immediately after starting it, or after a save command without any intervening commands, then pressing the end soft key exits immediately.

Related item The decision area can be saved to the floppy disk, hard disk, or magneto-optical disk. (See the ② SAVE command in Section 13.7.1.)

10.6 Using the Pass/Fail Decision Output

- Terminals on the rear panel provide an output of the waveform decision result.
- The signal between the GO and GND terminals is the pass output. (active low)
- The signal between the NG and GND terminals is the fail output. (active low)
- For further details, see Section 14.3, "Pass/Fail Decision Output", and Section 14.4, "Connections to the "External Terminals."

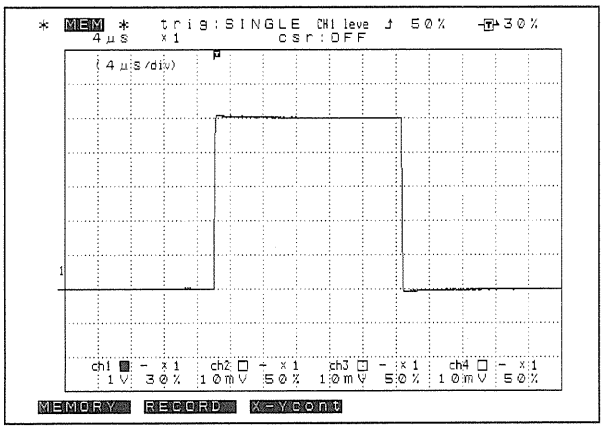


Rear panel

10.7 Example Waveform Decision Settings

Rising and falling edges from a logic IC are input, and a decision area is derived from this output. This is used to test ICs for undershoot and overshoot waveform problems.

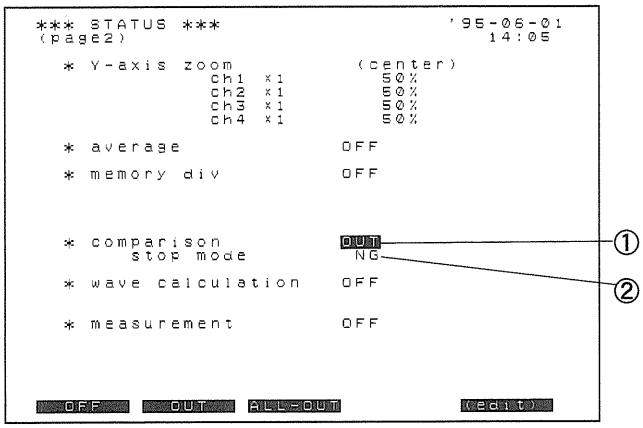
(1) First a reference waveform is captured.



Display screen

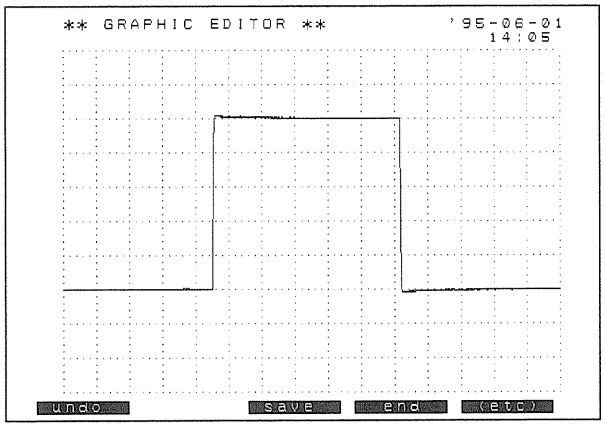
A trigger is used so that the same waveform is always drawn on the screen, then this is captured, and displayed in high intensity.

(2) The waveform decision area is built from this reference waveform.



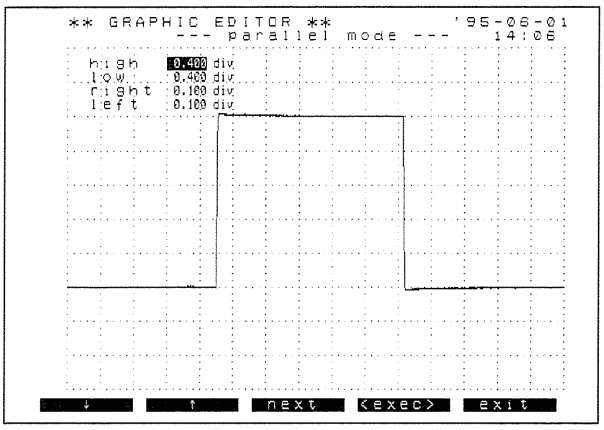
Status screen (page 2)

1. Set so that an operation stops if the waveform goes outside the decision area.
   - Set the "comparison", ① on the status screen (page 2) to OUT.
   - Set the "stop mode", ② to NG.

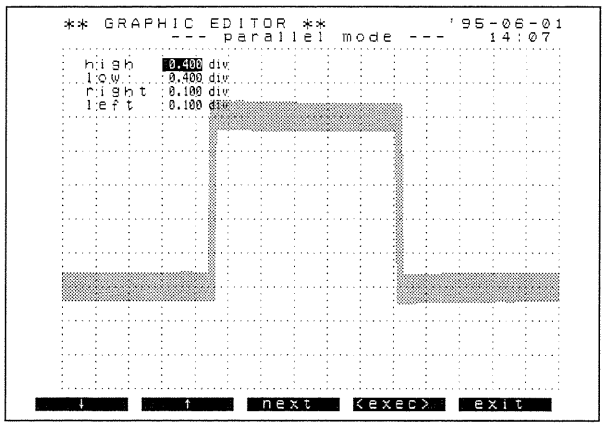


Graphics editor screen

2. Press the (edit) soft key to display the graphics editor screen.
3. Press the storage soft key, to copy the displayed waveform into the graphics editor.

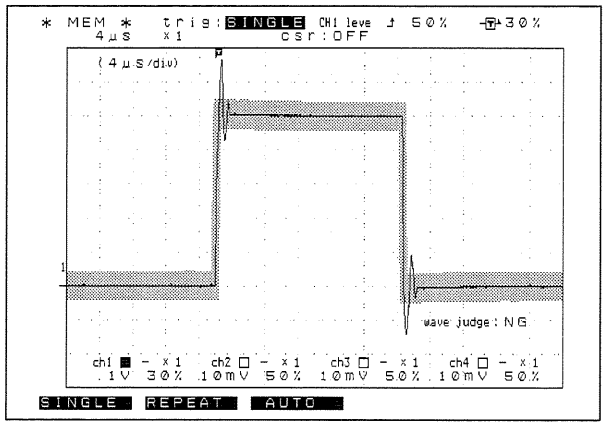


4. Press the **paral** soft key for parallel spreading of the waveform.
5. Use the ↑, ↓, and **next** soft keys, or the cursor keys and the rotary knob to adjust the parallel spreading amount.



6. Press the **<exec>** soft key to carry out the spreading.
7. Press the **exit** soft key to exit from parallel spreading.
8. Press the **end** soft key, and then the **save** soft key to save the waveform decision area, to exit from the graphics editor.

(3) Set the trigger mode (see Section 8.6) to SINGLE.



Example failing waveform

A single waveform decision operation is carried out.

(4) Press the START key to begin the waveform decision operation.

Decision result is fail if the waveform leaves the decision area at any point, and the operation stops.

Chapter 11
Calculation Functions

11.1 Summary of the Calculation Functions

- The calculation functions can be carried out in the memory recorder function.
- These are the averaging function (see Section 5.3.19), and the three types which are listed below.

(1) Waveform processing calculation (See Section 11.2.)

This is a calculation whose result appears as a waveform.

① Four arithmetic operations
② Absolute value
③ Exponent
④ Common logarithm
⑤ Square root
⑥ Moving average
⑦ Differentiation (once and twice)
⑧ Integration (once and twice)
⑨ Parallel displacement along the time axis

(2) Waveform parameter calculation (See Section 11.3.)

This is a calculation whose result appears as a numerical value.

① Average value
② Effective value
③ Peak to peak value
④ Maximum value
⑤ Time to maximum value
⑥ Minimum value
⑦ Time to minimum value
⑧ Area value
⑨ Period
⑩ Frequency
⑪ Rise time
⑫ Fall time
⑬ XY area

(3) Waveform parameter decision (See Section 11.3.3.)

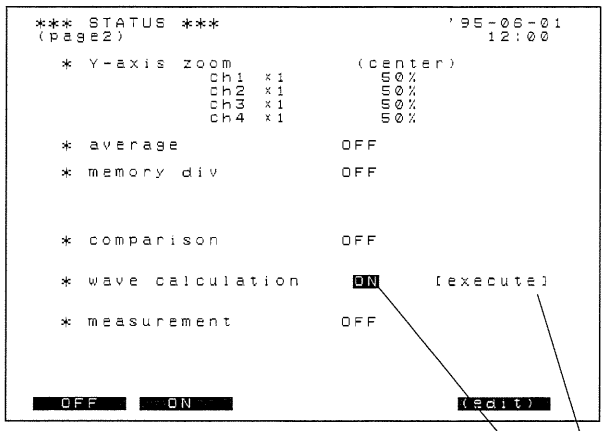
By comparing the result of a waveform parameter calculation with a set value, a pass/fail decision is reached.

11.2 Waveform Processing Calculation (wave calculation)

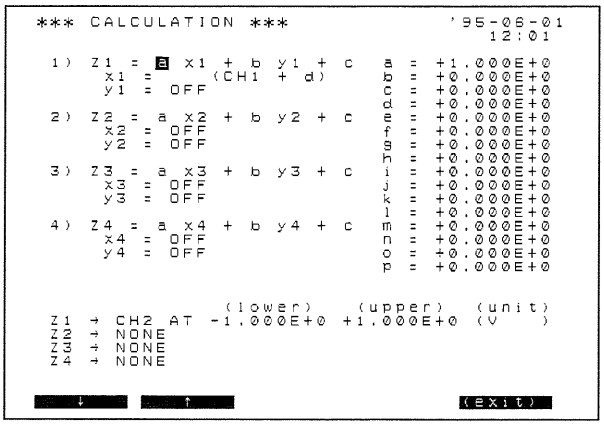
- The following operations can be performed on measurement data: the four arithmetic operations, taking absolute value, exponentiation, taking common logarithm, taking square root, taking moving average, differentiation (once and twice), integration (once and twice), and parallel displacement along the time axis.
- The result of each of these types of calculation appears as a waveform.
- The display scale in the vertical direction can be set either manually or automatically.

11.2.1 Method of Calculation

Procedure (Setting screen: status (page 2))



Status screen (page 2) ① ②



Waveform processing calculation screen

1. Move the flashing cursor to the "wave calculation" item, ① as shown in the figure on the left.
2. Press the **(edit)** soft key, and the waveform processing calculation screen appears.

   Each of the types of calculation is available for selection. See Section 11.2.2.

   Press the **(exit)** key, and the status screen (page 2) returns.
3. The following two alternative methods are available for performing calculation.

(1) When calculation is to be performed for a waveform that will be sampled:

① Set "wave calculation", ① to ON.
② Press the **START** key.

After the waveform has been sampled, the result of the calculation performed will be displayed on the screen.

(2) When calculation is to be performed for a waveform loaded from an external memory or a waveform that has been previously sampled:

① Set "wave calculation", ① to ON.
② Move the flashing cursor to the right, to the "[execute]" item, ②.
③ Press the **(exec)** soft key. The calculation will be performed and its results will be displayed on the screen.

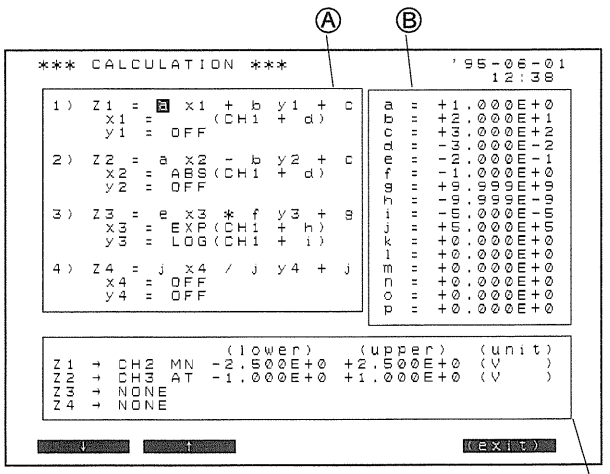
NOTE

- Calculation cannot be performed in the following settings.
  - If the number of channels to be used (see Section 12.5.8) is set to one or two channels.
  - If the recording length is greater than or equal to 3000 divisions.
  - If sampling a waveform using the averaging function (see Section 5.3.19). However calculation can be performed by pressing the (exec) key after sampling data.
  - When the memory segmentation function (see Chapter 9) is in use. After performing a temporary save to the floppy disk, disable the memory segmentation function, then load the data again, to allow the calculation to be performed.
- If scaling is set, only the units are valid, and anything else will be disregarded.

  By entering the equation for scaling in the calculation equations, it is possible to calculate by the converted unit.

11.2.2 Calculation Setting

Procedure (setting screen: waveform processing calculation screen)



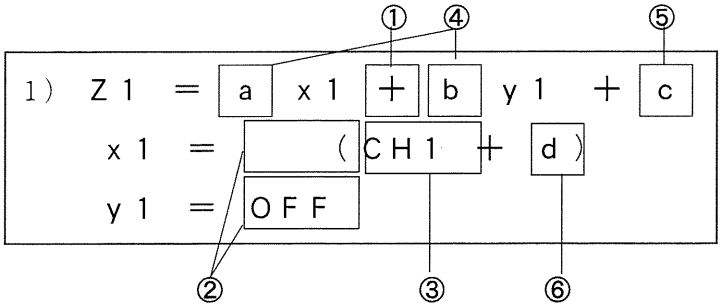
Waveform processing calculation screen

1. These are for setting equations for calculation. (Ⓐ as shown in the figure on the left)
   Z1 to Z4
2. These are for inputting constants. (Ⓑ)
   a to p
3. These are for setting into which channels of the memory, from channel 1 to channel 4, the results of the calculations are to be stored. (Ⓒ)

   Furthermore, the vertical scale of the display can be set.
4. Pressing the (exit) soft key causes the waveform processing calculation screen to be deleted and returns to the status screen (page 2).

(1) Calculation equations (Ⓐ in the figure on the previous page)

- Four calculation equations can be set, denoted Z1 to Z4.
- The order of calculation proceeds by first calculating Z1. This calculation is repeatedly performed in order for Z2 to Z4.
- The explanations are given to ① to ⑥ as shown in the figure below.



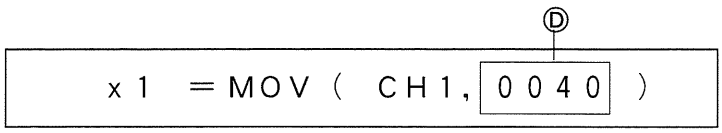
① For setting the four arithmetic operations, the following keys are used.
+ : addition, − : subtraction, * : multiplication, / : division

② For setting operations other than the four arithmetic operations. (See Section 11.2.4, " Details of the Various Calculations".)

Soft key indication

OFF : Same meaning as the constant value 0
(: If no calculation is set, the measurement data are used in their original unchanged form.
ABS : Absolute value
EXP : Exponentiation
LOG : Common logarithm
SQR : Square root
* **MOV** : Moving average
* **SLI** : Parallel displacement along the time axis
DIF : Differentiation
INT : Integration
DIF2 : Differentiation twice
INT2 : Integration twice
(etc) : Changes the soft key indication menu.

*: When selecting MOV (moving average) or SLI (parallel displacement), set the number of points for movement. (Ⓓ)



MOV : 0 to 4000 points SLI : -4000 to 4000 points

③ Set the source channel (the channel to be used in the calculation equations). Set the channel of which measurement data will be used.
Select among the following.
Z1: CH1 to CH4
Z2: CH1 to CH4 and Z1
Z3: CH1 to CH4, Z1, and Z2
Z4: CH1 to CH4 and Z1 to Z3

④ Set the coefficients (a to p).

⑤ Set the offset values for the calculation results (a to p).

⑥ Set the offset values for the measurement data (a to p).

- Select among a to p.
- These must be previously set to numerical values in Ⓑ as shown in the figure on the previous page.
  See the following "(2) Constants".

(2) Constants (Ⓑ)

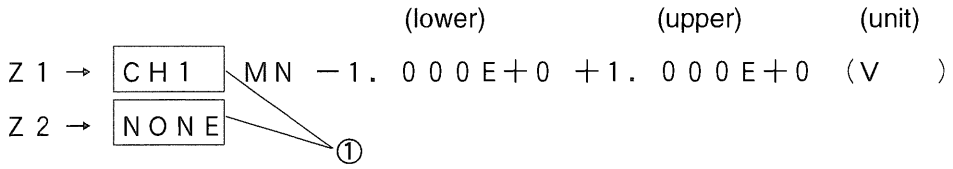
Altogether 16 constants can be set, denoted a to p.

a = ±0.000E±0 (Mantissa / Exponent)

Mantissa : -9.999 to +9.999
Exponent : -9 to +9

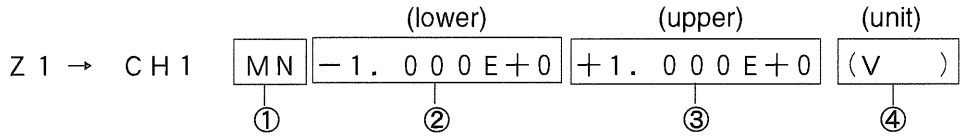
(3) Channels for storage of calculation results (Ⓒ)

- Set the channel in memory into which each of the calculation results obtained from the calculation equations Z1 to Z4 will be stored.
- When a calculation result is not used, set the corresponding channel to NONE (the calculation result is not recorded). [NONE, CH1 to CH4] (①)



If a source channel and the channel in which the results of the calculation are stored are the same, after the calculation has been performed the data before the calculation in the source channel is lost.

(4) Vertical scaling of the screen (Ⓒ)



① Select the scaling setting method.

Soft key indication

AUTO : [AT] Automatically set by the unit when the calculation is performed.

MANUAL : [MN] Set to the values set in ② and ③.

② Set the scaling lower end value for the vertical axis.

③ Set the scaling upper end value for the vertical axis.

} Same as "(2) Constants".

④ Shows the units to be used for the vertical axis.

Although these units are usually volts, when scaling (see Section 12.3) is being performed the name of the units which have been set (up to 4 characters) is displayed. However, scaling processing other than the unit naming is invalid.

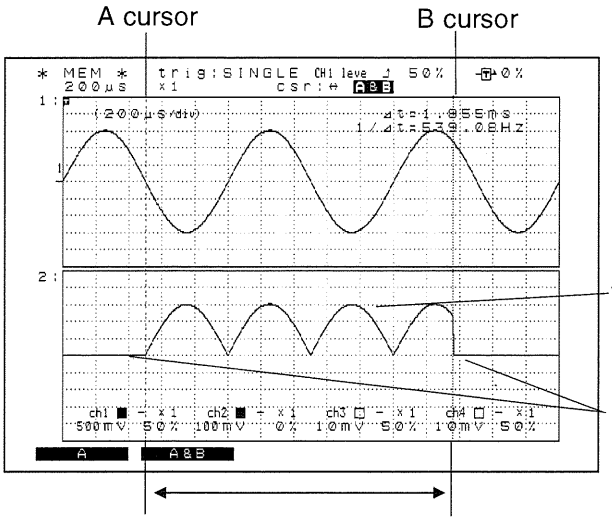
11.2.3 Waveform Calculation Positions

- When the A and B cursors (except horizontal cursors) are not being used, the calculation is performed for all the data.
- It is possible to designate the range for calculation using the A and B cursors (vertical or trace cursors).

Only the A cursor is used	The calculation is based on the waveforms after the A cursor.
Both A and B cursors are used	The calculation is based on the waveforms between the A cursor and the B cursor.

(The voltage value of 0 V is inserted for the calculation result outside the designated range.)

Example Calculate the absolute value of the waveform on channel 1, and display the result on channel 2 (in Dual format).



11.2.4 Details of the Various Calculations

(1) The four arithmetical operations [+, −, *, /]

According to the operators set, the four arithmetical operations are performed.

(2) Absolute value [ABS]

The calculation equation is set up as follows:

$b_i = |d_i|$ (i=0, 1, ..., n)

b_i : The ith data item of the result of the calculation
d_i : The ith data item of the source channel

(3) Exponential [EXP]

The calculation equation is set up as follows:

$b_i = \exp(d_i)$ (i=0, 1, ..., n)

b_i : the ith data item of the result of the calculation
d_i : the ith data item of the source channel

(4) Common logarithm [LOG]

The calculation equation is set up as follows:

when $d_i > 0$ $b_i = \log_{10} d_i$
when $d_i = 0$ $b_i = -\infty$
when $d_i < 0$ $b_i = \log_{10} | d_i |$ (i=0, 1, ..., n)

b_i : the ith data item of the result of the calculation
d_i : the ith data item of the source channel

Reference When calculation of the natural logarithm is required:

because $log_e X = \frac{log_{10} X}{log_{10} e}$,

it can be done according to the following equation.

Z1 = a LOG(CH1+d)+b OFF +c

a = + 2.303 E + 0 ($\fallingdotseq 1/\log_{10} e$) c = + 0. 000 E + 0
b = + 0.000 E + 0 d = + 0. 000 E + 0

(5) Square root [SQR]

The calculation equation is set up as follows:

when $d_i \geqq 0$ $b_i = \sqrt{d_i}$
when $d_i < 0$ $b_i = -\sqrt{|d_i|}$ (i=0, 1, ..., n)

b_i : the ith data item of the result of the calculation
d_i : the ith data item of the source channel

(6) Moving average [MOV]

The calculation equation is set up as follows:

$$b_i = \frac{1}{k} \sum_{t=i-k/2}^{i+k/2} d_i \quad (i=0, 1, ..., n)$$

b_i : the ith data item of the result of the calculation
d_i : the ith data item of the source channel
k : the number of points for averaging (1 to 4000)

(7) Differentiation once or twice [DIF, DIF2]

- The calculation of the first and second differential coefficients uses the fifth degree Lagrange interpolation formula, and the result for one data point is obtained from the five data points centered on the given data point.
- Using d_0 to d_n for the data at sampling times t_0 to t_n, the values of the differential coefficients are calculated.

Equations for calculating the first differential coefficient:

$$\text{Point } t_0 \quad b_0 = \frac{1}{12h}[-25d_0 + 48d_1 - 36d_2 + 16d_3 - 3d_4]$$

$$\text{Point } t_1 \quad b_1 = \frac{1}{12h}[-3d_0 - 10d_1 + 18d_2 - 6d_3 + d_4]$$

$$\text{Point } t_2 \quad b_2 = \frac{1}{12h}[d_0 - 8d_1 + 8d_3 - d_4]$$

$$\vdots$$

$$\text{Point } t_i \quad b_i = \frac{1}{12h}[d_{i-2} - 8d_{i-1} + 8d_{i+1} - d_{i+2}]$$

$$\vdots$$

$$\text{Point } t_{n-2} \quad b_{n-2} = \frac{1}{12h}[d_{n-4} - 8d_{n-3} + 8d_{n-1} - d_n]$$

$$\text{Point } t_{n-1} \quad b_{n-1} = \frac{1}{12h}[-d_{n-4} + 6d_{n-3} - 18d_{n-2} + 10d_{n-1} + 3d_n]$$

$$\text{Point } t_n \quad b_n = \frac{1}{12h}[3d_{n-4} - 16d_{n-3} + 36d_{n-2} - 48d_{n-1} + 25d_n]$$

b_0 to b_n : the data values resulting from the calculation
$h = \Delta t$: the sampling interval (See Section 2.2, "Table.")

Equations for calculating the second differential coefficient:

$$\text{Point } t_0 \quad b_0 = \frac{1}{12h^2}[35d_0 - 104d_1 + 114d_2 - 56d_3 + 11d_4]$$

$$\text{Point } t_1 \quad b_1 = \frac{1}{12h^2}[11d_0 - 20d_1 + 6d_2 + 4d_3 - d_4]$$

$$\text{Point } t_2 \quad b_2 = \frac{1}{12h^2}[-d_0 + 16d_1 - 30d_2 + 16d_3 - d_4]$$

$$\vdots$$

$$\text{Point } t_i \quad b_i = \frac{1}{12h^2}[-d_{i-2} + 16d_{i-1} - 30d_i + 16d_{i+1} - d_{i+2}]$$

$$\vdots$$

$$\text{Point } t_{n-2} \quad b_{n-2} = \frac{1}{12h^2}[-d_{n-4} + 16d_{n-3} - 30d_{n-2} + 16d_{n-1} - d_n]$$

$$\text{Point } t_{n-1} \quad b_{n-1} = \frac{1}{12h^2}[-d_{n-4} + 4d_{n-3} + 6d_{n-2} - 20d_{n-1} + 11d_n]$$

$$\text{Point } t_n \quad b_n = \frac{1}{12h^2}[11d_{n-4} - 56d_{n-3} + 114d_{n-2} - 104d_{n-1} + 35d_n]$$

(8) Integration once or twice [INT, INT2]

- The calculation of the first and second integrals is done using the trapezoidal formula.
- Using d_0 to d_n for the data at sampling times t_0 to t_n, the values of the integrals are calculated.

Equations for calculating the first integral:

Point t_0 $\quad I_0 = 0$

Point t_1 $\quad I_1 = \frac{1}{2}(d_0 + d_1)h$

Point t_2 $\quad I_2 = \frac{1}{2}(d_0 + d_1)h + \frac{1}{2}(d_1 + d_2)h = I_1 + \frac{1}{2}(d_1 + d_2)h$

$\vdots$

Point t_n $\quad I_n = I_{n-1} + \frac{1}{2}(d_{n-1} + d_n)h$

I_0 to I_n : the data values resulting from the calculation
$h = \Delta t$: the sampling interval (See Section 2.2, "Table.")

Equations for calculating the second integral:

Point t_0 $\quad II_0 = 0$

Point t_1 $\quad II_1 = \frac{1}{2}(I_0 + I_1)h$

Point t_2 $\quad II_2 = \frac{1}{2}(I_0 + I_1)h + \frac{1}{2}(I_1 + I_2)h = II_1 + \frac{1}{2}(I_1 + I_2)h$

$\vdots$

Point t_n $\quad II_n = II_{n-1} + \frac{1}{2}(I_{n-1} + I_n)h$

II_0 to II_n : the data values resulting from the calculation

(9) Parallel displacement along the time axis [SLI]

The number of points for displacement is specified, and then a displacement is performed along and parallel to the time axis.
The calculation equation is set up as follows:

$b_i = d_{i-k}$ $\quad (i=0, 1, ..., n)$

b_i : the ith data item of the result of the calculation
d_i : the ith data item of the source channel
k : number of points for displacement (-4000 to 4000)

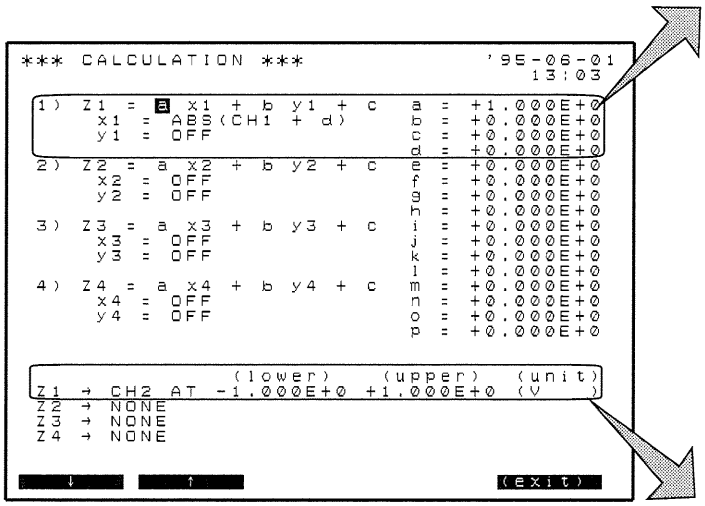
NOTE

- For the part of the calculation result data, for which there is no source data in the source channel, a voltage value of 0 V is supplied.
- One division is 40 points.

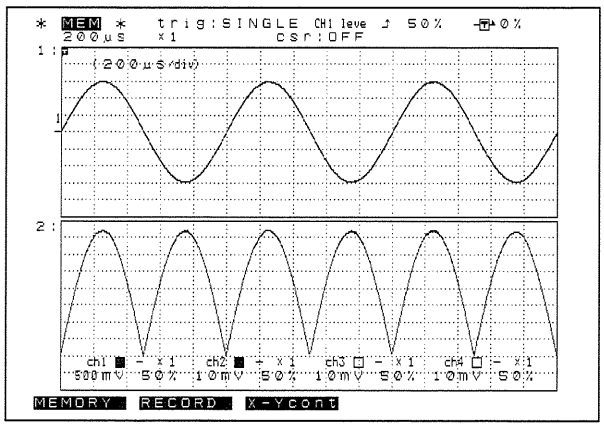
11.2.5 Examples of Settings

- This example illustrates the calculation for taking the absolute value of the channel 1 waveform data.
- The calculated result Z 1 will be stored in channel 2, and the display scaling will be done automatically.
- The settings are as in the figure below.

```
1) Z1 = a x1 + b y1 + c      a = +1.000E+0
     x1 = ABS (CH1+d)        b = +0.000E+0
     y1 = OFF                c = +0.000E+0
                             c = +0.000E+0
```




```
                (lower)      (upper)      (unit)
Z1 → CH2 AT  −1.000E+0  +1.000E+0  (V    )
```



The above display is obtained when the format is set to DUAL, and when graph 1 is set to show the waveform data in channel 1 while graph 2 is set to show the calculation result Z 1.

11.3 Waveform Parameter Calculation (measurement)

- It is possible to perform calculation on sampled waveform data or on waveform data which are the results of waveform calculation processing, of the following types:

  ① Average value
  ② Effective value
  ③ Peak to peak value
  ④ Maximum value
  ⑤ Time to maximum value
  ⑥ Minimum value
  ⑦ Time to minimum value
  ⑧ Area value
  ⑨ Period
  ⑩ Frequency
  ⑪ Rise time
  ⑫ Fall time
  ⑬ XY area

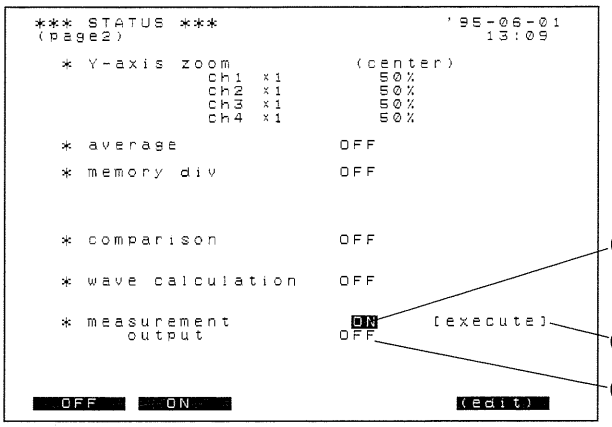
- The result of each of these types of calculation appears as a numerical value.
- The result of the calculation can be output to the printer, floppy disk, or SCSI interface.
- By using the A and B cursors, it is possible to specify the range for calculation. (See Section 11.3.4.)
- By setting an upper limit value and a lower limit value, it is possible to decide whether the result of one of these calculations falls in the specified range or not. (See Section 11.3.3, "Waveform Parameter Decision".)

NOTE

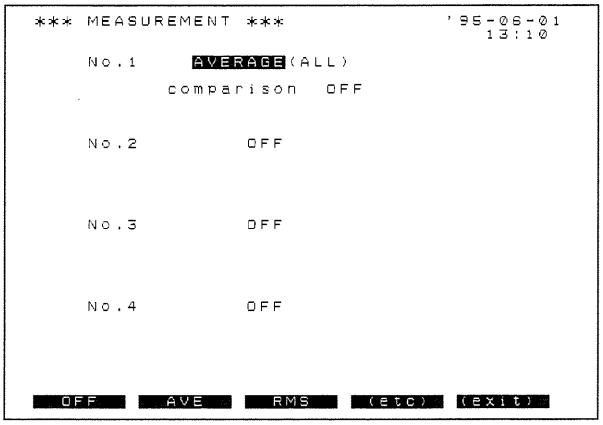
- When the waveform processing calculation (see Section 11.2) is being performed (with "wave calculation" enabled), the waveform parameter calculation is performed for the waveform after the waveform processing calculation.
- The scaling function (see Section 12.3) can be used simultaneously with the waveform parameter calculation. (The effective value and area value are calculated after the scaling is performed.)
- The averaging function (see Section 5.3.19) and the memory segmentation function (see Chapter 9) can be used simultaneously with the waveform parameter calculation. (However, the averaging function cannot be used simultaneously with the memory segmentation function.)

11.3.1 Method of Calculation

Procedure (Setting screen: status (page 2))



Status (page 2) screen



Waveform parameter calculation screen

1. Move the flashing cursor to the "measurement" item, ① as shown in the figure on the left.
2. Press the **(edit)** soft key, and the waveform parameter calculation screen appears.

① Each of the types of calculation is available for selection. See Section 11.3.2.

③ Press the **(exit)** soft key, and the status screen (page 2) returns.

②

3. Set the calculation result output designation in the "output" item, ②.

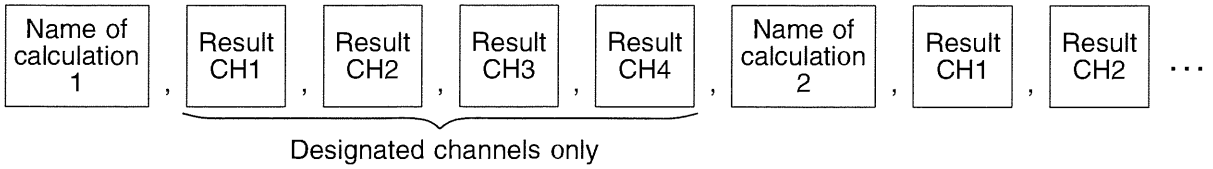
Soft key indication

OFF : No output
PRINTER : Printer
FD : Floppy disk
SCSI : SCSI interface

*The setting can be made when "measurement", ①, is ON.

Save the file in ASCII format for the floppy disk and SCSI interface.

- A file is created for a single data capture.
- File name : #MEAS○○○. PRN (○○○ : number from 001)
- The calculation result is saved as follows.

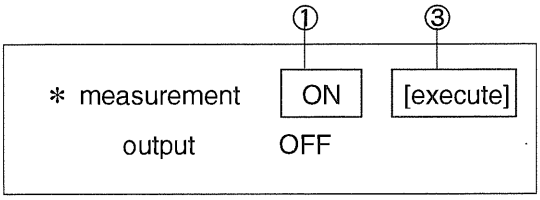


- The names of the calculations are displayed as follows.

AVE	Average value	RMS	Effective value
P-P	Peak to peak value	AREA	Area value
MAX	Maximum value	MAXT	Time to maximum value
MIN	Minimum value	MINT	Time to minimum value
PERIO	Period	RISE	Rise time
FREQ	Frequency	FALL	Fall time
XY-AR	XY area		

4. The following two alternative methods are available for performing calculation.

● When calculation is to be performed for a waveform that will be sampled.



Status (page 2)

(1) Set "measurement" to ON, ①.
(2) Press the START key.

After the waveform has been sampled, the calculation will be performed, and the results will be displayed.

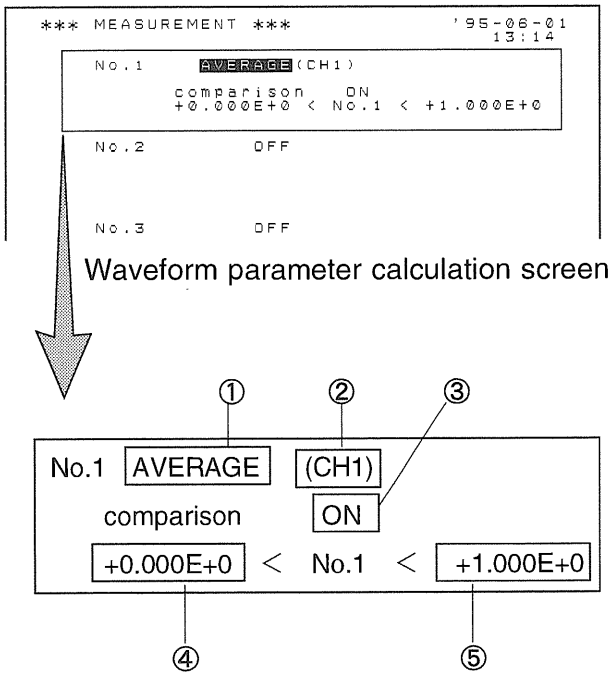
● When calculation is to be performed for a waveform that has been previously sampled or a waveform loaded from an external memory.

(1) Set "measurement" to ON, ①.
(2) Move the flashing cursor to the right to the "[execute]" item, ③.
(3) Press the (exec) soft key.

The calculation will be performed and its result will be displayed on the screen.

11.3.2 Calculation Setting

Procedure (Setting screen: waveform parameter calculation screen)



Waveform parameter calculation screen

1. Select the calculations, ① as shown in the figure on the left.

· Calculations, No. 1 to No. 4, can be set.
· The calculations are performed in order from No. 1 to No. 4.

Soft key indication

OFF : No calculation is performed.
AVE : Average value
RMS : Effective value
P-P : Peak to peak value
MAX : Maximum value
MAX-T : Time to maximum value
MIN : Minimum value
MIN-T : Time to minimum value
AREA : Area value
PERIO : Period
FREQ : Frequency
RISE-T : Rise time
FALL-T : Fall time
XY-AREA : XY area value
(etc) : Changes the soft key indication
(exit) : Returns the status screen (page 2)

Each calculation will be described in detail in Section 11.3.5.

2. Select the channel or channels for which calculation will be performed, ②.
   [ALL, CH1, CH2, CH3, CH4]
   ↖All channels. However, calculation is not performed for channels for which display and recording are OFF.

* If XY area value was selected in step 1, the setting is done differently. See Section 11.3.5, (13).

3. Select whether or not waveform parameter decision (see Section 11.3.3) will be performed, ③.
   [OFF, ON]

* If the item, ① is OFF, this item does not appear.

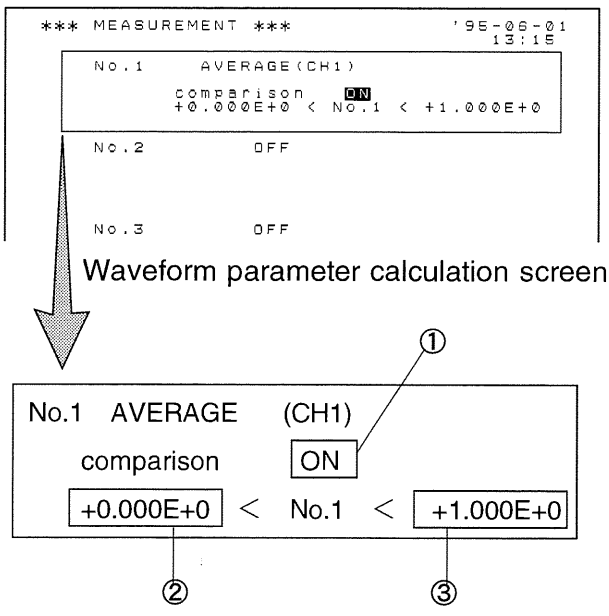
4. If waveform parameter decision is to be performed, set the lower (④) and upper (⑤) limit values here.

* If the item, ③ is OFF, this item does not appear.

11.3.3 Waveform Parameter Decision (comparison)

- An upper limit value and a lower limit value are set, and then a pass/fail (GO/NG) decision is made as to whether the result of a waveform parameter calculation falls in the specified range or not.
- For each of the waveform parameter calculations, No. 1 to No. 4, a corresponding waveform parameter decision can be set.

Procedure (Setting screen: waveform parameter calculation screen)



1. Select whether or not to make a waveform parameter decision, ① as shown in the figure on the left.

Soft key indication

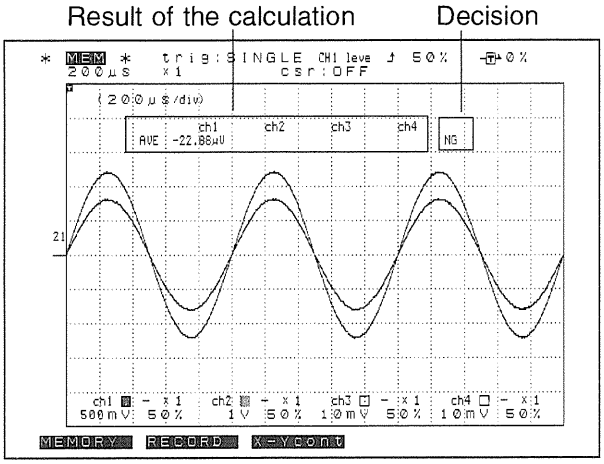
OFF : A waveform parameter decision is not made.

ON : A waveform parameter decision is made.

2. Set the lower (②) and upper (③) limit values.

+0.000 E +0
Mantissa Exponent

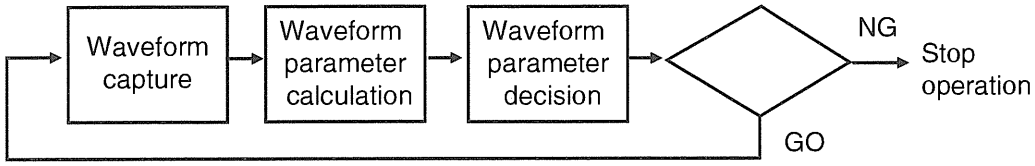
Mantissa : -9.999 to +9.999
Exponent : -9 to +9



Display screen

- If calculation is performed (see Section 11.3.1), the result of the calculation is displayed in the upper part of the screen.
- If the result of the calculation does not lie between the upper and lower limit values, then the result of the decision is fail (NG), and "NG" is displayed on the right of the result of the calculation. (Nothing is displayed for the pass (GO) decision.)
- If the trigger mode (see Section 8.6) is SINGLE, when the result of the decision is fail (NG), then the 8853 stops operating. (If the trigger mode is REPEAT or AUTO, the operation is repeated.)

Example If the trigger mode is SINGLE



If the trigger mode is REPEAT or AUTO, the above series of operations is repeated.

● When operation stops:

- If the auto print function is enabled, when operation stops the waveform is printed.
- If the auto save function is enabled, when operation stops the data is saved.
- If the memory segmentation function (sequential save) is enabled, data is recorded in the memory blocks only when operation is stopped.

● Pass (GO)/fail (NG) decision output:

- The output of the results of waveform parameter decisions can be taken from the rear panel of the 8853.
- The pass decision output is provided between the GO and GND terminals. (active low)
- The fail decision output is provided between the NG and GND terminals. (active low)
- For further details, see Section 14.3, "Pass/Fail Decision Output", and Section 14.4, "Connection to the External Terminals."

NOTE

- If the lower limit is set to be greater than or equal to the upper limit, then the result of the decision will always be fail (NG).
- If several waveform parameter decisions are set, they are ORed together. If any one of them has resulted in a fail (NG) decision, operation stops.
- If the waveform decision function (Chapter 10) is enabled, the result of the waveform parameter decision is disregarded, and therefore stopping operation and output of the waveform decision function is given priority.

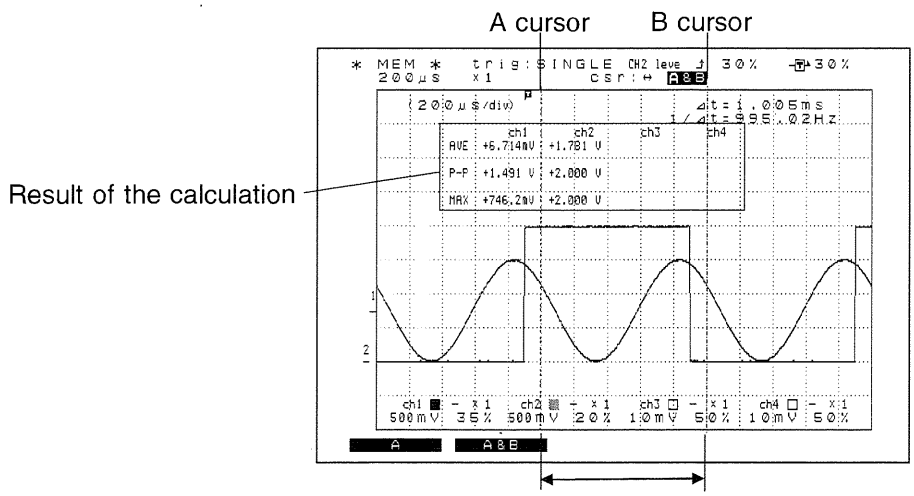
11.3.4 Waveform Calculation Position

- If the A and B cursors (except the horizontal cursors) are not being used, the calculation is performed for all of the data.
- When the A and B cursors are being used as vertical or trace cursors, it is possible to designate the range for calculation.

  When only the A cursor is in use : the calculation is performed for the waveforms after and from the A cursor.

  When both the A and B cursors are used : the calculation is performed for the waveforms between the A cursor and the B cursor.

Example When the average value, peak to peak value and maximum value are calculated (in SINGLE format):



Calculation is performed for the waveforms in this interval.

11.3.5 Details of the Various Calculations

(1) Average value

- The average value (in volts) of the waveform data is shown.
- The equation used for the calculation is as follows:

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

n number of data samples
d_i the ith data value of the source channel

(2) Effective value (RMS)

- The effective value (in volts) of the waveform data is shown.
- The equation used for the calculation is as follows:

$$\text{Effective value RMS} = \sqrt{\frac{\sum_{i=0}^{n} d_i^{\,2}}{n+1}}$$

n number of data samples
d_i the ith data value of the source channel

(3) Peak to peak value

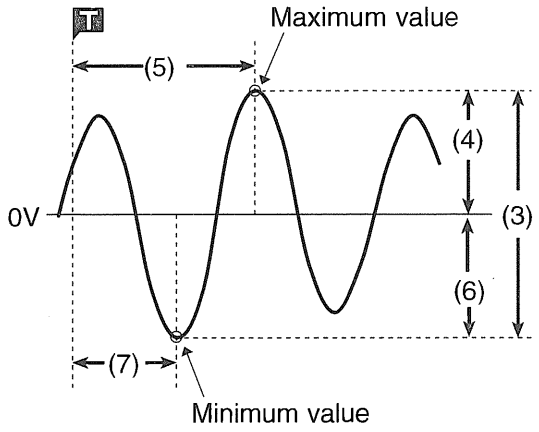
The difference between the maximum value and the minimum value of the waveform data is shown (in volts).

(4) Maximum value

The maximum value of the waveform data is shown (in volts).

(5) Time to maximum value

- The time period from the moment that triggering occurred till the maximum value is attained is shown (in seconds).
- If the points of the same maximum value are shown two or more, regard the first captured point as the maximum value.



(6) Minimum value

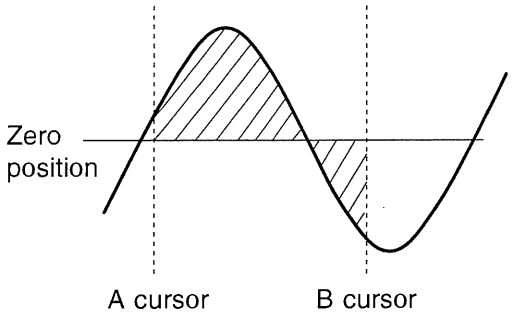
The minimum value of the waveform data is shown (in volts).

(7) Time to minimum value

- The time period from the moment that triggering occurred till the minimum value is attained is shown (in seconds).
- If the points of the same minimum value are shown two or more, regard the first captured point as the minimum value.

(8) Area value

- The value of the area from the position of the waveform (the point corresponding to 0 V) to the waveform is shown in volt-seconds.
- If the A and B cursors are in use, the area of the space bounded by the cursors (the shaded area in the figure) is displayed.
- The equation used for the calculation is as follows:



$$\text{Area value } A = \sum_{i=1}^{n} |d_i| \cdot h$$

n number of data samples
d_i the ith data value of the source channel
$h = \Delta t$ sampling interval

(9) Period (See "(10) Frequency.")

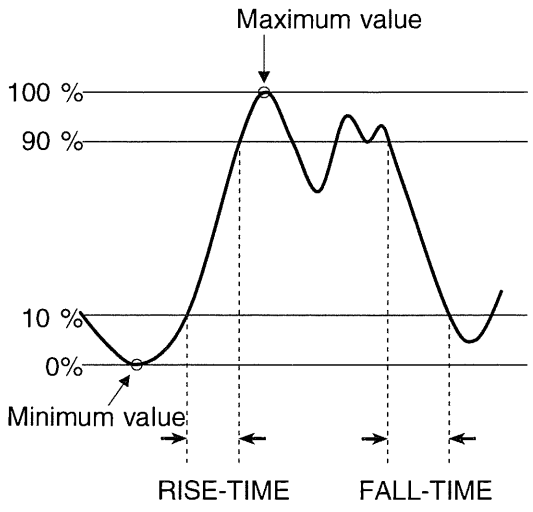
(10) Frequency

- These are, respectively, the period of the signal waveform (in seconds) and its frequency (in Hz).
- The midpoint of the amplitude of the waveform is found, and then the period or frequency, as appropriate, is calculated, based upon the time period from the instant that the signal first passes that level when rising or falling to the next instant that it again passes that level.

(11) Rise time (See "(12) Fall time.")

(12) Fall time

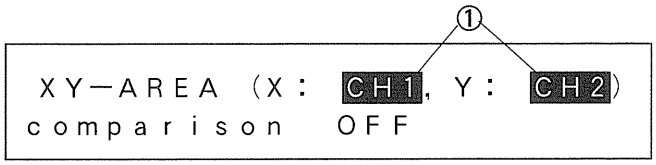
- The time (in seconds) is displayed which is taken by the waveform, either to rise from the 10 % level to the 90 % level, or to fall from the 90 % level to the 10 % level, respectively.
- The calculation is performed based upon the minimum and maximum values of the sampled waveform, as 0 % and 100 % respectively.
- If the A and B cursors are in use, then the first rise or fall time that occurs in the portion of the sampled waveform data between them is displayed.
- If the A and B cursors are not being used, then the very first occurring rise or fall time of the entire sampled waveform data is displayed.



(13) XY area

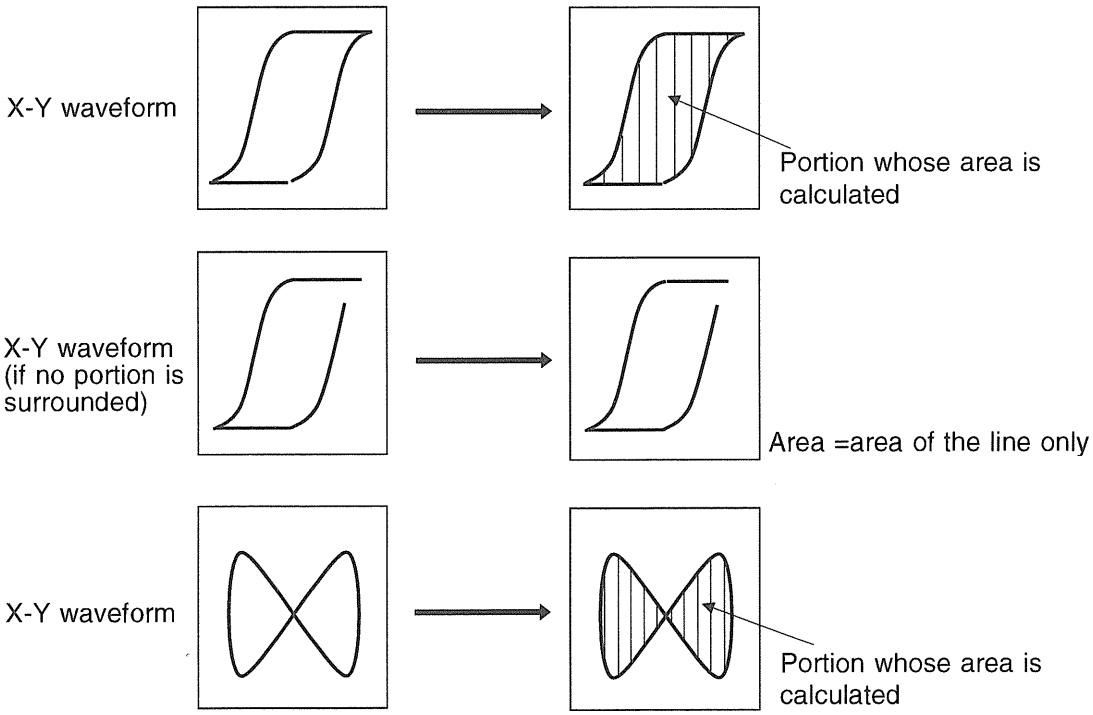
- This shows the area enclosed by an XY plot (in volts-squared). (This does not depend upon the current format.)
- The XY waveform is defined by a line, and the area bounded by the line is calculated.
- For formats other than the XY format, if the vertical cursors or trace cursors are used, the X-Y plot is generated for the section of data between the two cursors, and the area is calculated. (See Section 11.3.4.) (In the XY format, it is not possible to delimit an area between the A and B cursors.)

● How to designate the channels



Move the flashing cursor to the position, ① as shown in the figure above, and set the x-axis channel and the y-axis channel.
(The setting has no relation to the settings of the x-axis and y-axis for display using the XY format.)

● The portion for which calculation is performed:



NOTE

- Depending on the waveform, it can happen that no calculated result will be displayed for (9), (10), (11), and (12).
- If scaling has been set, calculation will be executed after scaling the waveform data. Further, the set units are used as the units of voltage values.

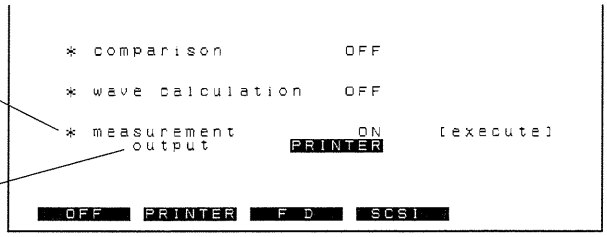
11.3.6 Examples of Settings

- A 10 Vp-p and 4 Vp-p sine waves are input to the channels 1 and 2, respectively, and the maximum and minimum values are calculated.
- Set so that the waveform parameter decision is made for the results of calculation, and the result is printed.

Settings

Waveform parameter decision : ON

Calculation result output designation : printer



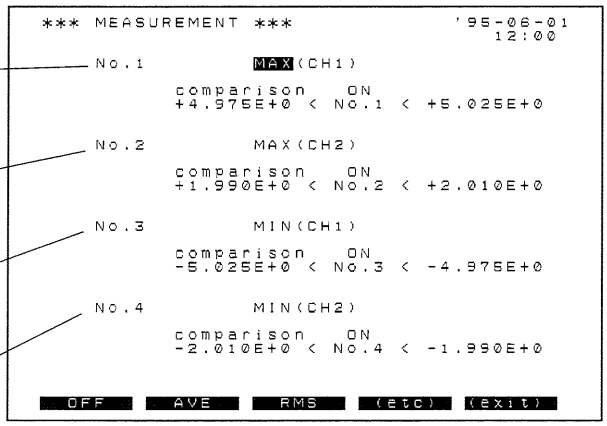
Status screen (page 2)

Calculation and decision of the maximum value in channel 1.

Calculation and decision of the maximum value in channel 2.

Calculation and decision of the minimum value in channel 1.

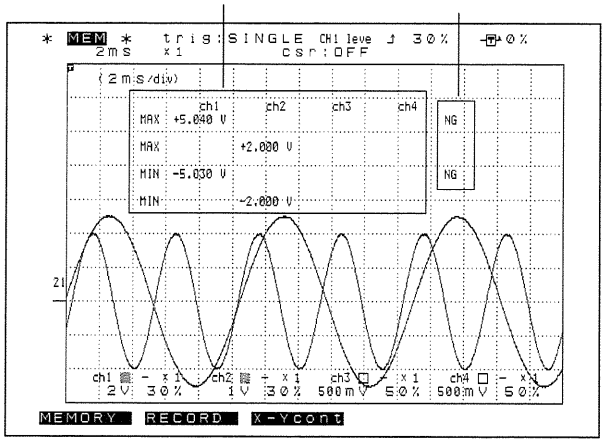
Calculation and decision of the minimum value in channel 2.



Waveform parameter calculation screen

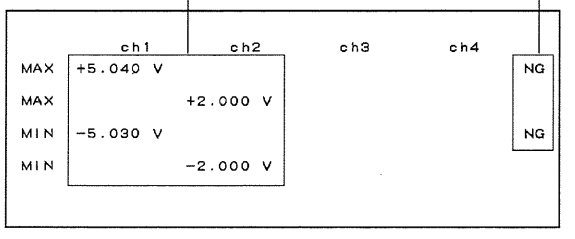
Calculated and decided result

Calculated result Decided result



Display screen

Calculated result Decided result



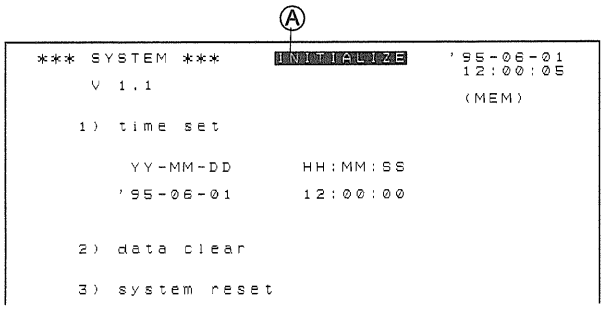
Recording paper

Chapter 12
System Screen

12.1 System Screen Basics (SYSTEM)

- Pressing the SYSTEM key switches to the system screen.
- On the system screen, the following functions are available.

① Initialization
② Setting scaling
③ Appending comments
④ Setting special functions
⑤ Setting the interface
⑥ Setting the screen dump output designation
⑦ Self-checking



On the system screen, select the screen to be set by pressing the soft key.
The soft keys, ① to ⑦ which are listed below appear, when the flashing cursor is at the top of the screen, Ⓐ as shown in the figure on the left. Press the SYSTEM key to move the flashing cursor to the position, Ⓐ.

Soft key indication

① INITIAL : [Initialize] Initialization (Section 12.2)
② SCALE : [Scaling] Setting scaling (Section 12.3)
③ COMMENT : [Comment] Appending comments (Section 12.4)
④ SETUP : [Setup] Setting special functions (Section 12.5)
⑤ INTER : [Interface] Setting the interface (Section 12.6)
⑥ CRTCOPY : [CRT copy] Setting screen dump output (Section 12.7)
⑦ CHECK : [Self check] Self-checking (Section 12.8)
(etc) : Changes the soft key indication

* The selection is also made by using the SYSTEM key.
Pressing the SYSTEM key switches the screen in order from ① to ⑦.

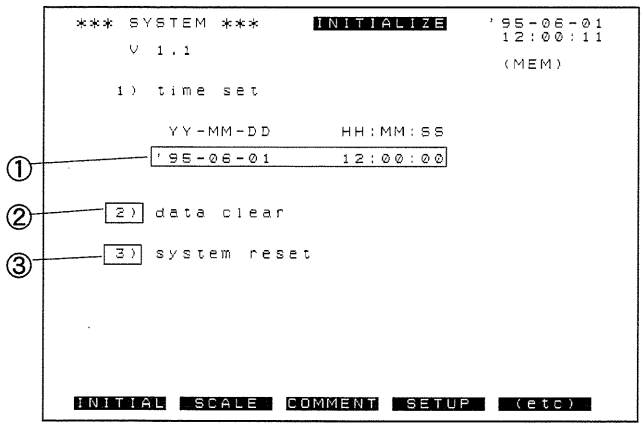
NOTE

- You can use a plotter, by connecting it to the GP-IB interface of this unit.
- The settings on the GP-IB interface and plotter output will be described in the 8853 FFT Function·GP-IB Interface Instruction Manual.

12.2 Initialization (INITIALIZE)

- Setting the clock (time set), clearing waveform data (data clear), and initialization of setting items (system reset) are available.
- The 8853 is internally provided with a calendar capable of automatic leap year discrimination, and with a twenty-four hour clock. (The current date and time are shown on the status, trigger, and system screens.)

Procedure (Setting screen: system)



Initialization screen

Press the **INITIAL** soft key to display the initialization screen.

Pressing the **(etc)** key changes the soft key menu.

(1) Setting the clock

1. Move the flashing cursor to the "time set" item, ① as shown in the figure above.
2. By using the **↓** and **↑** soft keys or the rotary knob, set the date and time.

YY	-	MM	-	DD		HH	:	MM	:	SS
year		month		day		hour		minute		second

- Press the **cancel** soft key to leave the time and date at the current values, as displayed in the upper right corner of the screen.
- Press the **(set)** soft key to change the time and date to the new setting.

(2) Clearing Waveform Data

1. Move the flashing cursor to the "data clear" item, ②.
2. Press the **(exec)** soft key to clear the waveform data.

NOTE When using the memory segmentation function, data in all blocks are cleared.

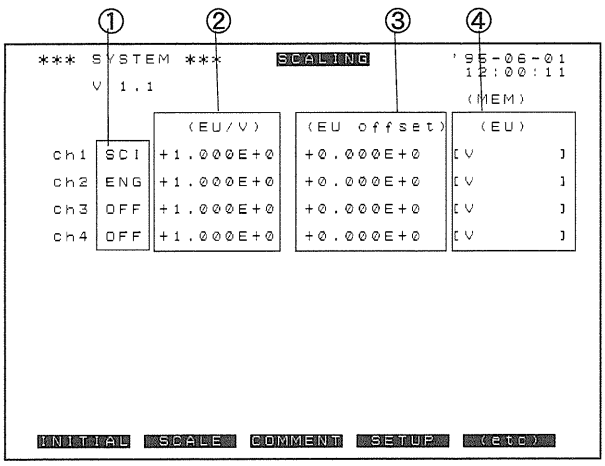
(3) System Reset

1. Move the flashing cursor to the "system reset" item, ③.
2. Press the **(exec)** soft key to make all settings initialized (factory settings).

12.3 Scaling Function (SCALING)

- By setting the physical amount of input signal per one volt (EU/V), the offset (EU offset), and the name of the units used (EU), a measurement value which has been obtained as a voltage value is converted into a value in the set units.
- The scaled values appear on the gauge scale, the scale display (the upper and lower limit values along the perpendicular axis), and the value of V read by the A and B cursors. (See the NOTE.)
- For the waveform processing calculation (see Section 11.2), only the names of the units are effective.
- In the FFT function, scaling is performed, when performing FFT calculation (when the START key is pressed.).

Procedure (Setting screen: system)



Scaling setting screen

1. Press the **SCALE** soft key, and the scaling setting screen will appear.
   Pressing the **(etc)** key changes the soft key menu.
2. Set scaling for each channel by using the soft keys, ① as shown in the figure on the left.

Soft key indication

OFF : No scaling
SCI : Scaling indicating the exponent in integer can be performed.
ENG : Scaling indicating the exponent in multiple of 3 can be performed.

Example

0.012 → 1.2E−2 [SCI]
0.012 → 12E−3 [ENG]

In the FFT function, scaling indicating in the auxiliary unit (μ, k, M etc.), without indicating the exponent is performed, whether SCI or ENG is selected.

Example

$6.8 \times 10^{-6} \rightarrow 6.8\ \mu$
$1.2 \times 10^{4} \rightarrow 12$ k

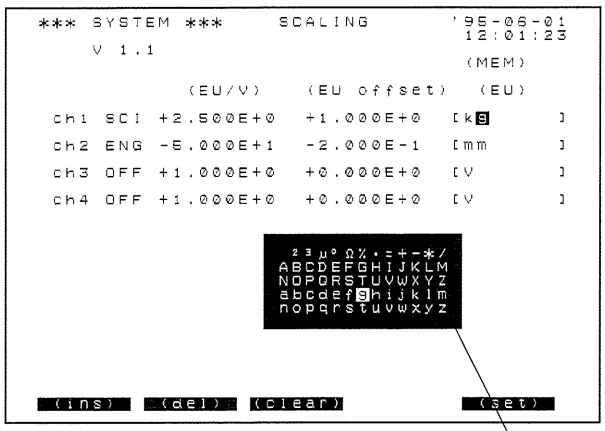
3. Set the scaling value for each channel in ②, ③ and ④.

① (EU/V)
② (EU offset) } +1.000E+0 (Mantissa: -9.999 to +9.999; Exponent: -9 to +9)
Mantissa Exponent
③ (EU) —— Input the physical unit name for each channel (up to 7 characters long).

Making settings ② and ③:

Set each digit in order using the ↓ and ↑ soft keys, or the rotary knob.

Making setting ④:



Scaling setting screen Window

Bring the flashing cursor into the area [V], ④ and a window will appear.

a. Turn the rotary knob and move the cursor in this window, to select each character required.

b. Pressing the **(set)** soft key moves the flashing cursor one space to the right.

Repeat actions a. and b.

Soft key indication

(ins) : Inserts a character between two other characters.

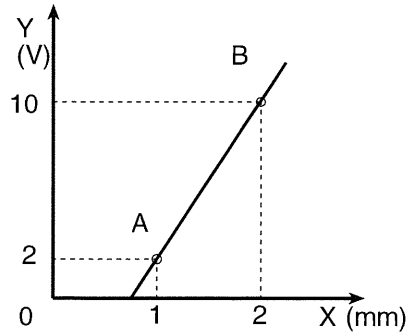
(del) : Deletes the character at the position indicated by the flashing cursor.

(clear) : Deletes all characters to the right of the position indicated by the flashing cursor.

(set) : Accepts the character at the position indicated by the flashing cursor and moves the cursor one space to the right.

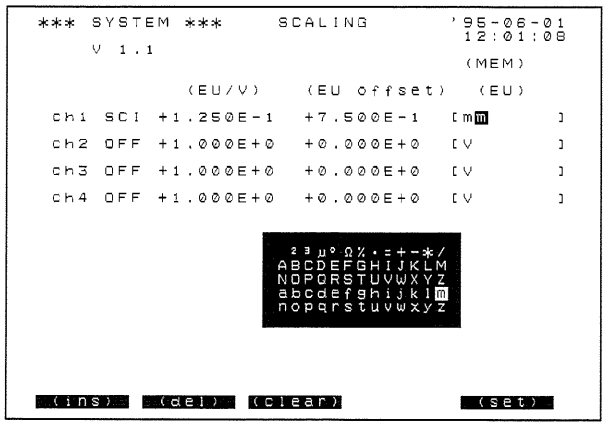
Example Scaling operation

To set the scaling for the measurement values which are produced when a displacement sensor with a characteristic as shown by the following graph is used.



$Y = 8X - 6$ .....(1)
(V) (mm)

$X = 0.125Y + 0.75$....(2)
(mm) (V)



· Inverting equation (1) results in equation (2).

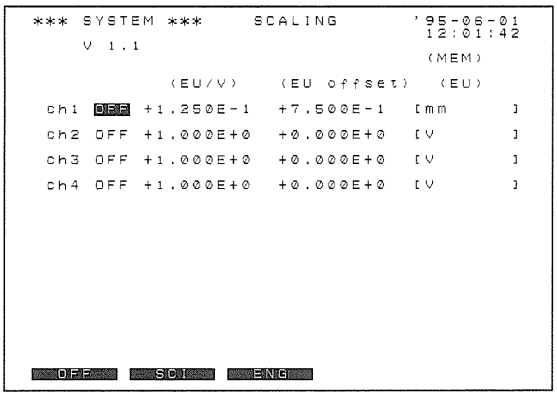
· If scaling is performed as specified in the figure shown on the left, then the results of measurement, which have been obtained as voltage values, are scaled into displacement values in mm.

For example, point A, when Y=2V, is scaled into a position;
(+1.250E -1) × 2 + (+7.500E -1) = 1 mm
and point B, when Y=10V, is scaled into a position;
(+1.250E -1) × 10 + (+7.500E -1) = 2 mm.

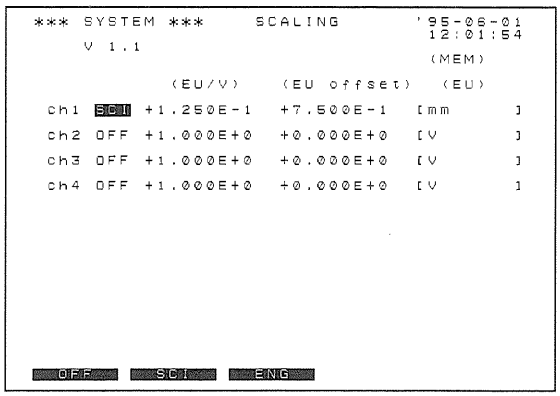
NOTE

- Scaling cannot be performed for the logic channels.
- The scaled values are shown in the following way on the gauge scale, as the scale display (the upper and lower limit values along the perpendicular axis), and the value of V when the A and B cursors are in use.

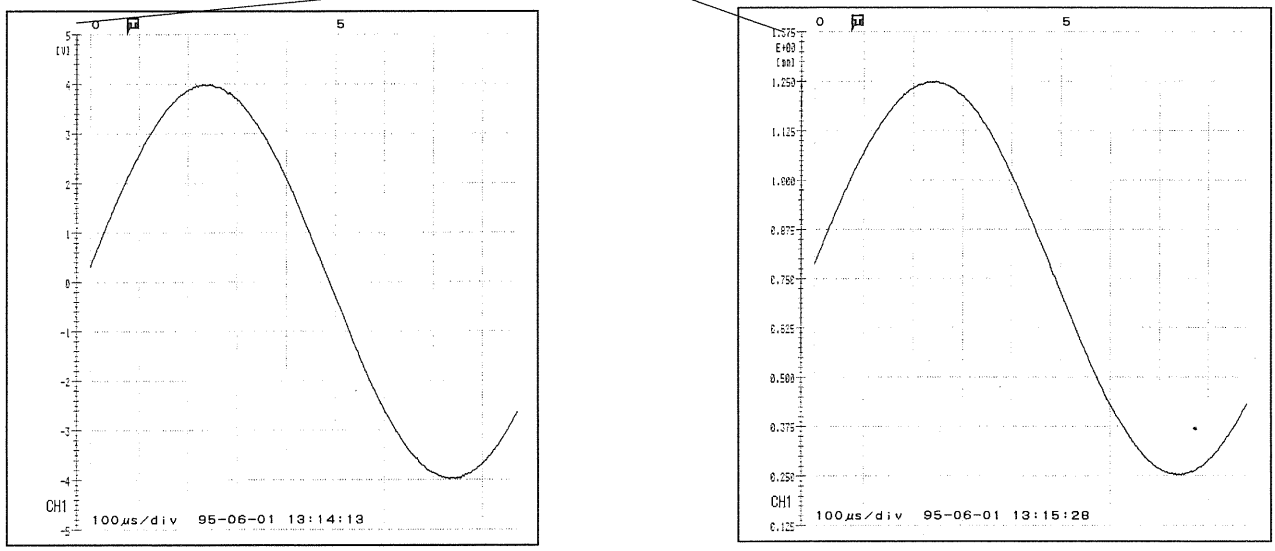
Scaling : off



Scaling : on (SCI)



Gauge markings

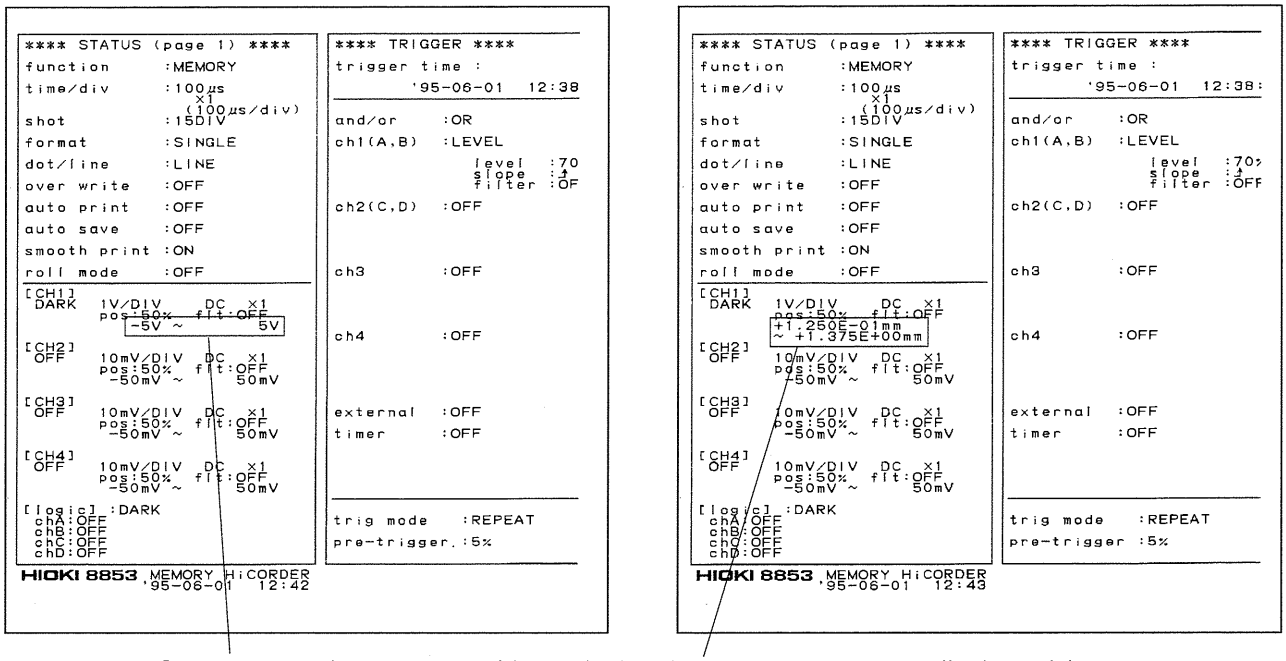


For the gauge function, see Section 12.5.6.

Listing

Scaling : off

Scaling : on (SCI)



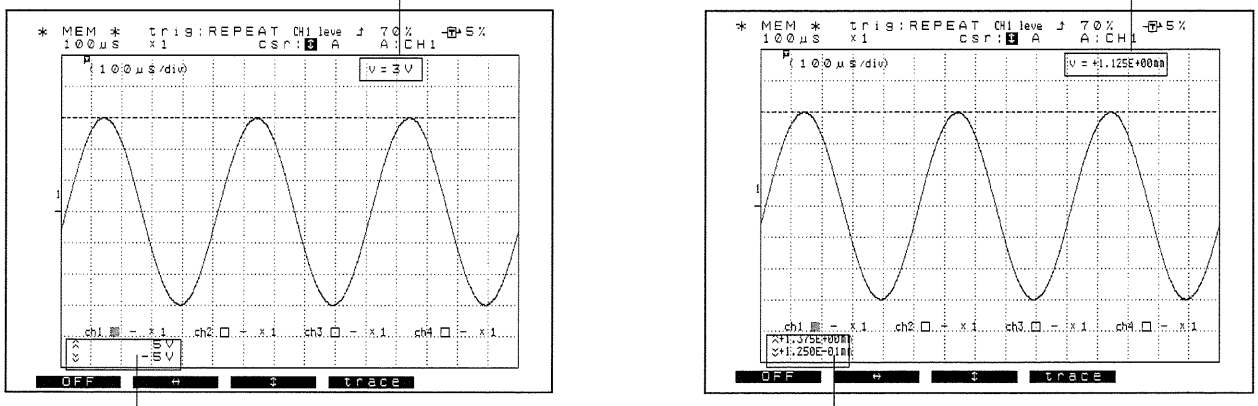
Scale display (the upper and lower limit values along the perpendicular axis)

Screen display (When the A and B cursors are in use.)

Scaling : off

Scaling : on (SCI)

Values of the A and B cursors



Scale display

12.4 Adding Comments (COMMENT)

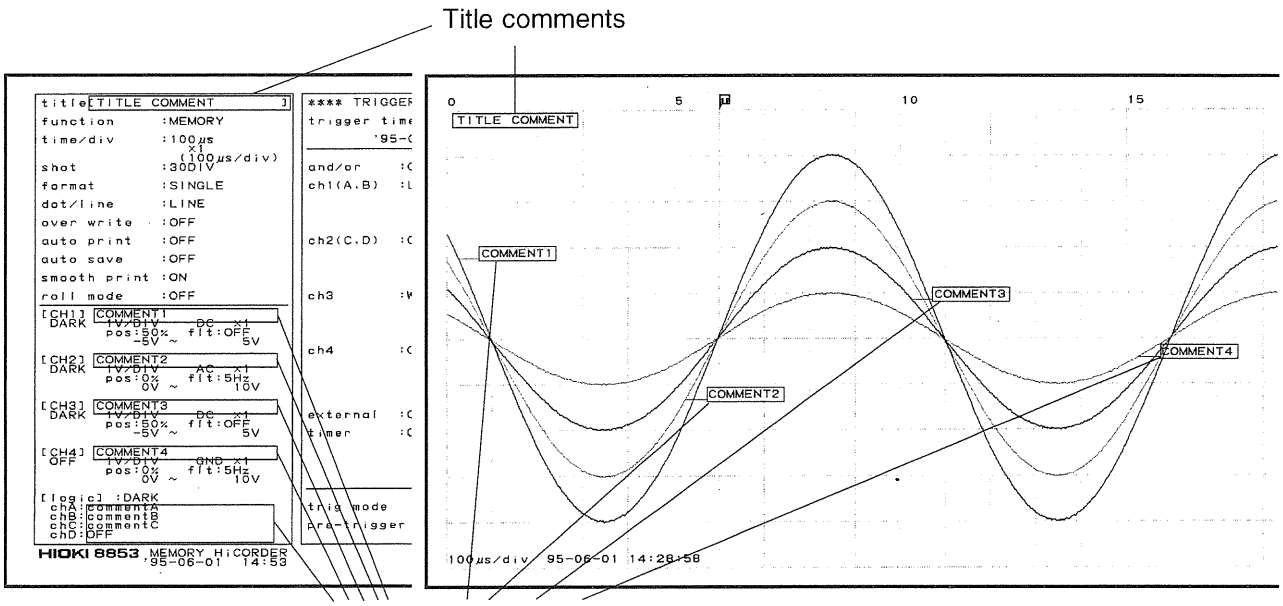
- The comments can be included in the listings, on the printed waveforms, etc.
- The comment also appears on plotter output.

(1) Title comment input

- Title comments of up to 20 characters can input.
- Title comments are included in listings and at the upper left of the waveform chart.
- Title comments are also entered into the file information on the floppy disk, hard disk and magneto-optical disk. (See Section 13.7.1, ⑤.)

(2) Input of comments for each channel

- Comments of up to 20 characters can be input in listings on each channel.
- If channel marker (see Section 12.5.4) is enabled, the comments for each channel are included on the waveform chart.
  (The comments for the logic, X-Y, and FFT waveforms are not shown on the waveform chart.)

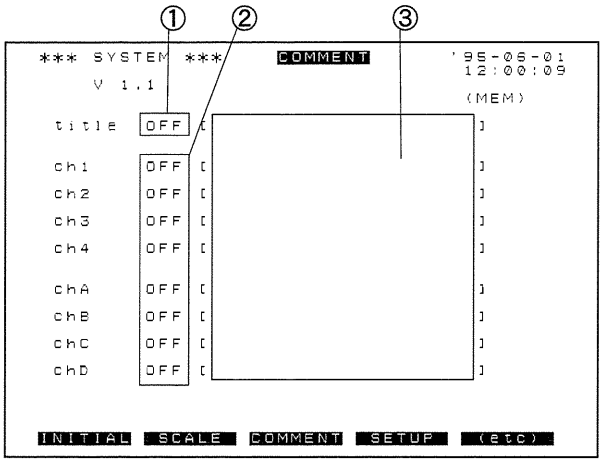


Listing

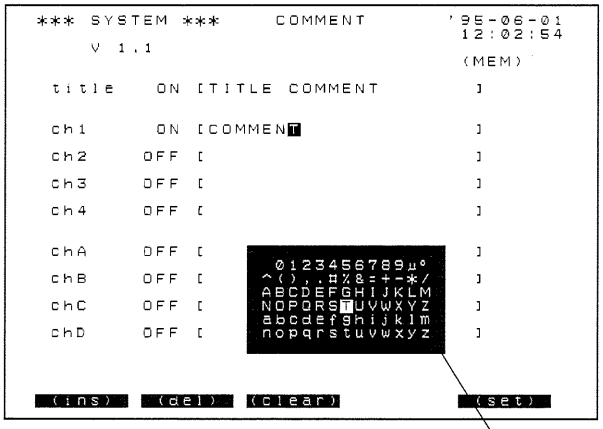
(The comments for the logic waveforms are shown only for the channels for which display is on.)

When printing out the waveforms by using the PRINT key.
(with channel maker enabled)

Procedure (Setting screen: system)



Comment setting screen



Comment setting screen Window

1. Press the **COMMENT** soft key to display the comment setting screen.

   Pressing the **(etc)** soft key changes the soft key menu.

2. Enable or disable the title comment in ① as shown in the figure on the left.

3. Enable or disable the comments for each channel in ②.

4. How to input a title comment:

   Bring the flashing cursor into the area [ ], ③ and a window will appear.

a. By turning the rotary knob and moving the cursor in this window, select each character required.

b. Pressing the **(set)** soft key moves the cursor one space to the right.

   Repeat actions a. and b.

Soft key indication

(ins) : Inserts a character between two other characters.

(del) : Deletes the character at the position indicated by the flashing cursor.

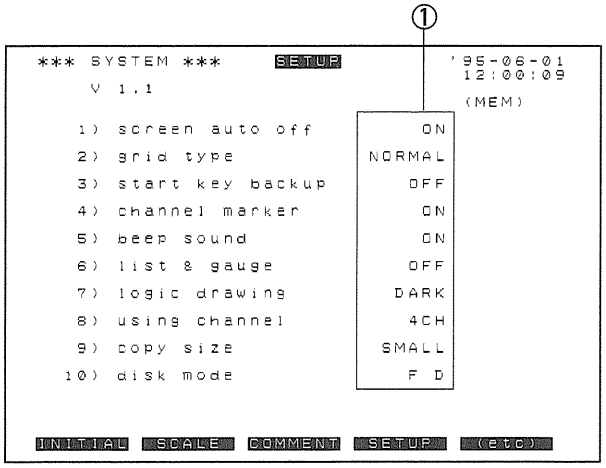
(clear) : Deletes all characters to the right of the position indicated by the flashing cursor.

(set) : Accepts the character at the position indicated by the flashing cursor and moves the cursor one space to the right.

12.5 Special Function Settings (SETUP)

Ten items to be set are available. (Sections 12.5.1 to 12.5.10)

Procedure (Setting screen: system)



Special function setting screen

1. Press the **SETUP** soft key to display the special function setting screen.

   Pressing the **(etc)** key changes the soft key menu.

2. Bring the flashing cursor to the item to be set, ① as shown in the figure on the left, and perform setting with the soft keys.

1) screen auto off	Screen saver function (Section 12.5.1)
2) grid type	Setting the grid (Section 12.5.2)
3) start key backup	Start key backup function (Section 12.5.3)
4) channel marker	Channel marker function (Section 12.5.4)
5) beep sound	Setting the beep sound (Section 12.5.5)
6) list & gauge	Listing and gauge function (Section 12.5.6)
7) logic drawing	Setting logic waveform brightness (Section 12.5.7)
8) using channel	Channel selection (Section 12.5.8)
9) copy size	Setting the copy size (Section 12.5.9)
10) disk mode	Setting the FD key (Section 12.5.10)

12.5.1 Screen Saver Function (screen auto off)

- If for a continuous period of ten minutes no operation key is pressed, the display is automatically switched off.
- Pressing any key turns the display on again.
- Eliminating unnecessary display operation prolongs the operational life of the display.

Procedure (Setting screen: special function setting)

1. Move the flashing cursor to the "screen auto off" 1) item, ① as shown in the figure above.
2. Select whether to enable or disable by using the soft keys.
   [OFF, ON]

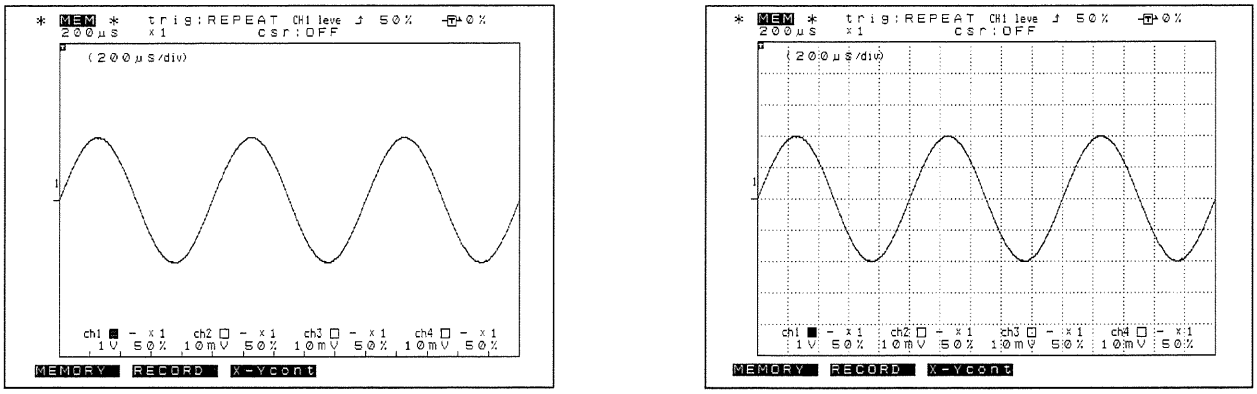
12.5.2 Setting the Grid (grid type)

- The type of grid shown on the display screen and drawn on the recording paper is selected.
- There are three settings: OFF, NORMAL, and FINE.
- Whichever of NORMAL and FINE is selected for the display screen and the FFT function, in fact NORMAL will be implemented.

Procedure (Setting screen: special function setting)

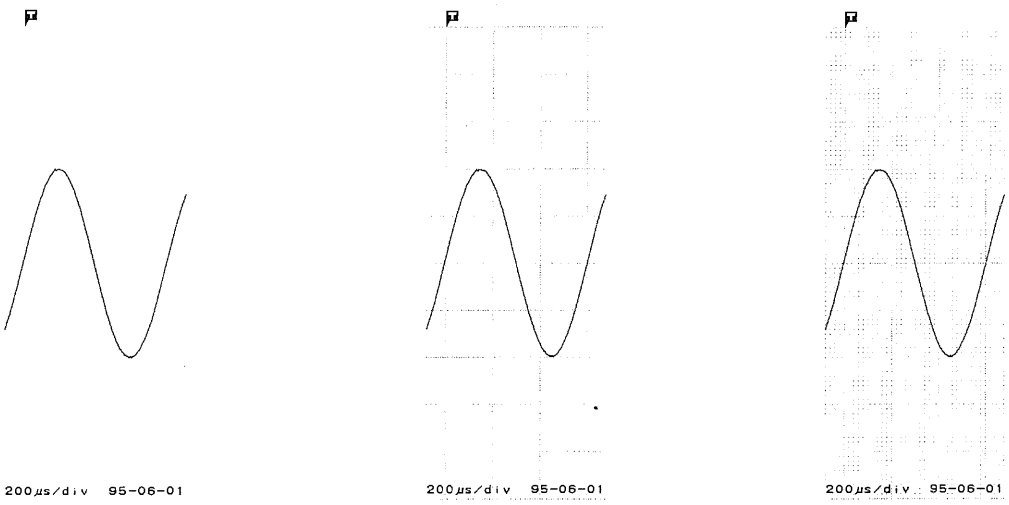
1. Move the flashing cursor to the "grid type" 2) item, ① as shown in the figure on the previous page.
2. Select the type of grid by using the soft keys. [OFF, NORMAL, FINE]

On the display screen



OFF NORMAL, FINE

On the printed chart



OFF NORMAL FINE

12.5.3 Start Key Backup Function (start key backup)

- If the power supply fails during recording operation (while the LED above the START key is illuminated), and then the power supply is restored, so that the 8853 goes back into the measurement operation mode, then recording starts immediately.
- If a trigger is in use, then startup is in the waiting-for-trigger state.

Procedure (Setting screen: special function setting)

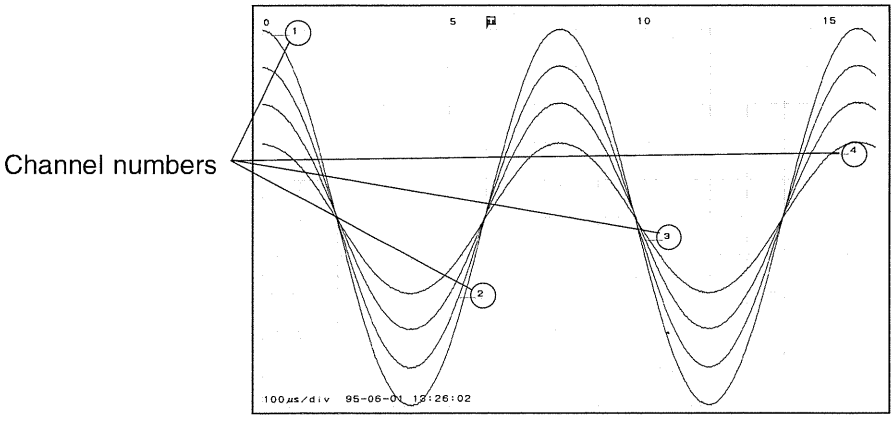
1. Move the flashing cursor to the "start key back" 3) item, ① as shown in the figure in Section 12.5.
2. Select whether to enable or disable start key backup by using the soft keys. [OFF, ON]

12.5.4 Channel Marker Function (channel marker)

The channel numbers are printed attached to the waveform on the recording paper.

Procedure (Setting screen: special function setting)

1. Move the flashing cursor to the "channel marker" 4) item, ① as shown in the figure in Section 12.5.
2. Select whether to enable or disable channel marker by using the soft keys. [OFF, ON]



NOTE

- In X-Y format in the memory recorder function, and in the X-Y recorder and FFT functions, the channel numbers are not printed.
- The channel numbers of logic channels are not printed.
- When adding comments for each channel (see Section 12.4) is enabled, the comments are displayed instead of the channel numbers.

12.5.5 Setting the Beep Sound (beep sound)

When an error occurs or a warning is made, and when a waveform decision results in an NG verdict, the speaker produces a beep sound.

Procedure (Setting screen: special function setting)

1. Move the flashing cursor to the "beep sound" 5) item, ① as shown in the figure in Section 12.5.
2. Select whether to enable or disable beep sound by using the soft keys. [OFF, ON]

12.5.6 Listing and Gauge Functions (list&gauge)

- When a waveform is printed, the gauge (scale) can be printed attached before the waveform, and a listing (settings) can be printed attached after the waveform (except for screen dumps).
- The gauge is only printed out for the channels for which the waveform display is on.
- A listing can also be printed by pressing the PRINT key on the status, trigger or system screen.

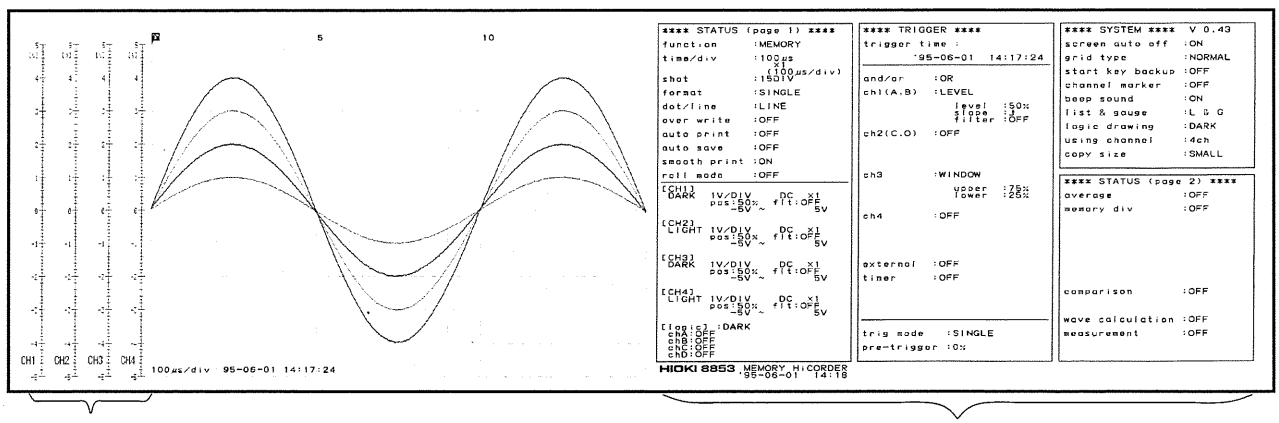
Procedure (Setting screen: special function setting)

1. Move the flashing cursor to the "list & gauge" 6) item, ① as shown in the figure in Section 12.5.
2. Select the type of function by using the soft keys.

Soft key indication

OFF : No gauges or listing
LIST : Print listing only
GAUGE : Print gauges only (indicating the signal name of the logic waveform)
L&G : Print both gauges and listing (LIST&GAUGE)

When the setting is "L&G":



12.5.7 Setting Logic Waveform Brightness (logic drawing)

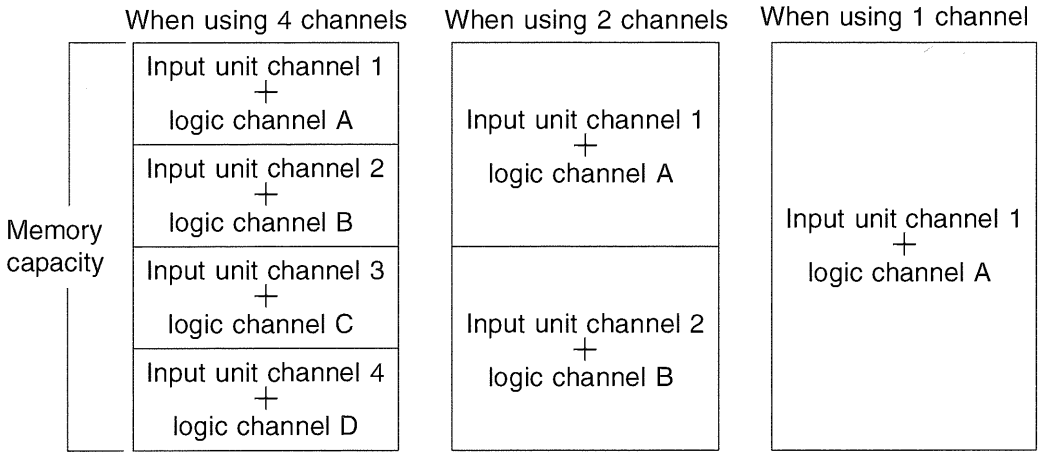
Set the logic waveform display to high intensity (DARK) or low intensity (LIGHT).

Procedure (Setting screen: special function setting)

1. Move the flashing cursor to the "logic drawing" 7) item, ① as shown in the figure in Section 12.5.
2. Set logic waveform brightness by using the soft keys. [DARK, LIGHT]

12.5.8 Channel Selection (using channel)

- Set whether the memory for measurement data is used by being divided up into four channels, or two channels, or by all being used for one channel.
- This function is only effective in the memory recorder function.



The fewer channels are used, the greater the maximum recording length settable are.

Number of channels	4	2	1
Maximum recording length settable	12,500 DIV	25,000 DIV	50,000 DIV

Procedure (Setting screen: special function setting)

1. Move the flashing cursor to the "using channel" 8) item, ① as shown in the figure in Section 12.5.
2. Select the number of channels to be used by using the soft keys.

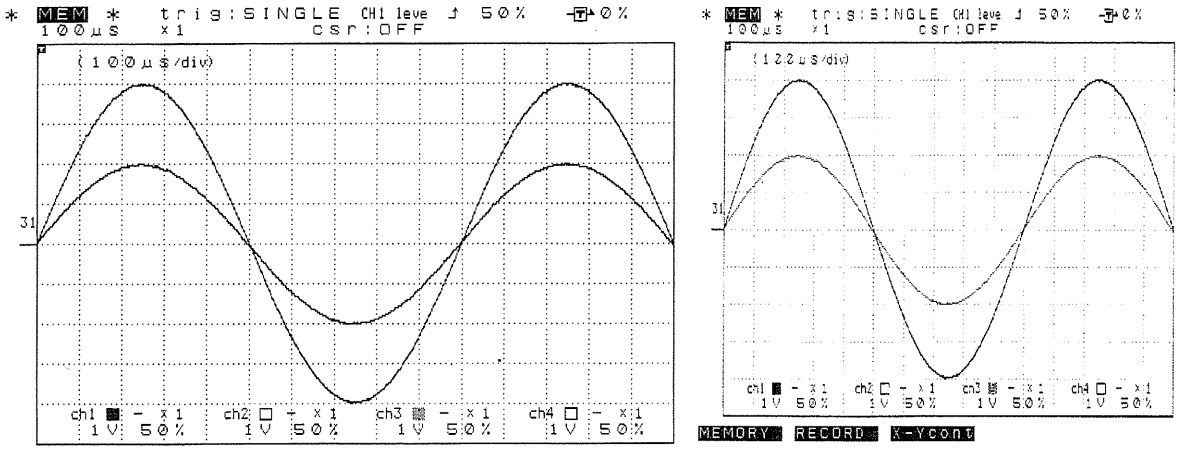
   [4ch, 2ch, 1ch]

12.5.9 Setting the COPY Size (copy size)

- The hard copy size of the screen (LARGE/SMALL) is set.
- This function is available, when the screen dump output destination (see Section 12.7) is set to printer.

Procedure (Setting screen: special function setting)

1. Move the flashing cursor to the "copy size" 9) item, ① as shown in Section 12.5.
2. Select the hard copy size by using the soft keys. [LARGE, SMALL]



LARGE SMALL

12.5.10 Setting the FD key (disk mode)

- Set which of the FD screen (see Section 13.5) and the SCSI screen (see Section 13.6) is displayed, when the FD key is pressed.
- Initial settings are made on the FD screen.

Procedure (Setting screen: special function setting)

1. Move the flashing cursor to the "disk mode" 10) item, ① as shown in the figure in Section 12.5.
2. Select the screen to be displayed when the FD key is pressed, by using the soft keys.

Soft key indication

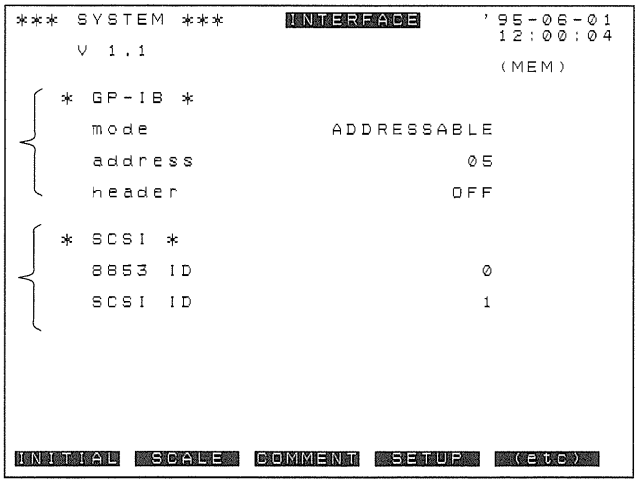
FD : Floppy disk control screen (FD screen)
SCSI : SCSI control screen (SCSI screen)
FD&SCSI : FD screen and SCSI screen (Pressing the FD key alternately switches between them.)

12.6 Interface Settings (INTERFACE)

Settings for the GP-IB interface and the SCSI interface are made.

①Settings for the GP-IB interface

②Settings for the SCSI interface



Interface setting screen

Procedure (Setting screen: system)

1. Press the INTER soft key to display the interface setting screen.
2. Make settings for each of the following items.

① GP-IB interface settings

- · mode [ADDRESSABLE / TALK ONLY / DISABLE]
- · address [0 to 30]
- · header [OFF / ON]
- · delimiter [CR-LF(EOI) / CR(EOI) / LF(EOI) / (EOI)]

(in TALK ONLY mode only)

For the details, read Chapter 7 of the 8853 FFT Function·GP-IB Interface Instruction Manual.

② SCSI interface settings

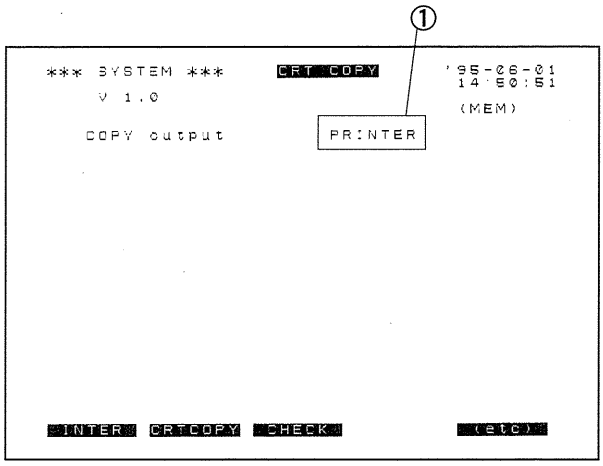
- · Device address of the 8853 8853 ID : [0 to 7]
- · Device address of the HD and MO SCSI ID : [0 to 7]

For the details, read Section 13.4, "Using the Hard Disk Drive and the Magneto-optical Disk Drive."

12.7 Screen Dump Output Setting (CRT COPY)

- Specify the screen dump output destination. (Screen data can be sent to the following four destinations.)
  ① Printer ② Plotter ③ Floppy disk ④ SCSI
- The screen data can be sent to floppy disk or SCSI outputs in bitmap file (.bmp) format.
- The .bmp bitmap file format is a standard used by graphics applications running under Microsoft Windows.
- For example, screen images (640 × 290 pixels) can be used for creating presentations in word processor or spreadsheet software running under Microsoft Windows.
  (Data can be saved with color coding to distinguish text, waveforms and cursor.)
  * Windows is a trademark of Microsoft Corporation.

Procedure (Setting screen: system)



Screen dump output setting screen

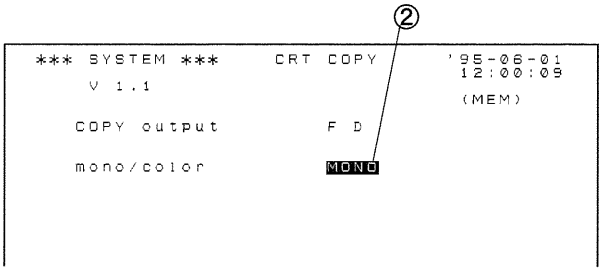
1. Press the **CRTCOPY** soft key to display the screen dump output setting screen.
2. Move the flashing cursor to the "COPY output" item, ① as shown in the figure on the left.
3. Set the output destination by using the soft keys.

Soft key indication

PRINTER : Printer
PLOTTER : Plotter
FD : Floppy disk
SCSI : SCSI

- When selecting printer, the setting is completed. (See Section 5.3.20, ③.)
- The plotter will be described in Chapter 11 of the 8853 FFT Function·GP-IB Interface Instruction Manual.

4. When selecting floppy disk or SCSI.

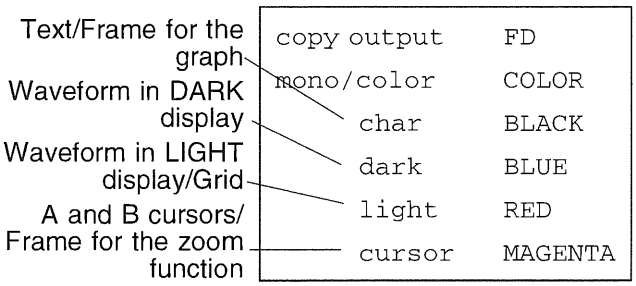


Set the color in the"mono/color" item, ②.

Soft key indication

MONO : Monochrome
COLOR : Color

5. When selecting **COLOR** in step 4, set the color for the text, waveform and cursor.



The color can be selected by using the ↓ and ↑ soft keys or the rotary knob.
[BLACK, BLUE, RED, MAGENTA, GREEN, CYAN, YELLOW, ORANGE]

(For the zoom function, see Section 5.3.15.)

6. Press the COPY key on the screen to be dumped.

When the output destination is floppy disk or SCSI.

- Press the **(exec)** soft key to start screen dump.
- Press the **cancel** soft key to cancel.
- A file called #AUTO ○○○. BMP is created. (○○○: Number from 001)
- Then pressing the COPY key again without pressing the soft key outputs to the printer.

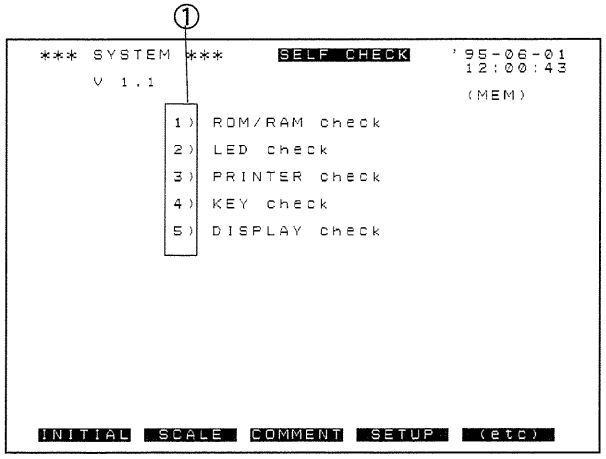
Related item If the screen dump output destination is printer, the copy size (LARGE/SMALL) can be set.
See Section 12.5.9, "Setting the Copy Size".

NOTE Screen data sent to floppy disk or SCSI output has a wider aspect ratio than the actual screen.

12.8 Self Check Functions (SELF CHECK)

There are five items of self-check (Sections 12.8.1 to 12.8.5).

Procedure (Setting screen: system)



Self check screen

1. Press the **check** soft key to display the self check screen.

   Pressing the **(etc)** key changes the soft key menu.

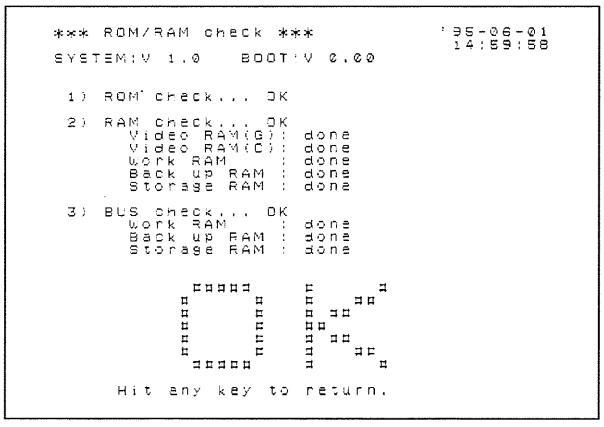
2. Move the flashing cursor to the position for the item, ① as shown in the figure on the left, to be performed and press the **(exec)** soft key to perform a self check.

1) ROM/RAM check (Section 12.8.1)
2) LED check (Section 12.8.2)
3) PRINTER check (Section 12.8.3)
4) KEY check (Section 12.8.4)
5) DISPLAY check (Section 12.8.5)

12.8.1 ROM and RAM Checks (ROM/RAM check)

- A check of the internal memory (ROM and RAM) of the 8853 is performed.
- Even when the ROM/RAM check is performed, the contents of the RAM are not disturbed.
- The result is displayed on the screen.
  OK : passed NG : failed

Procedure (Setting screen: self check)



Screen display after the self check has been completed satisfactorily.

1. Move the flashing cursor to position 1), ① as shown in the figure in Section 12.8.
2. Press the **(exec)** soft key.

- During the self checking process, no key has any effect.
- If the result "OK" appears, the self-check was passed.

3. After the check has been completed, press any key to return to the self check screen.

12.8.2 LED Check (LED check)

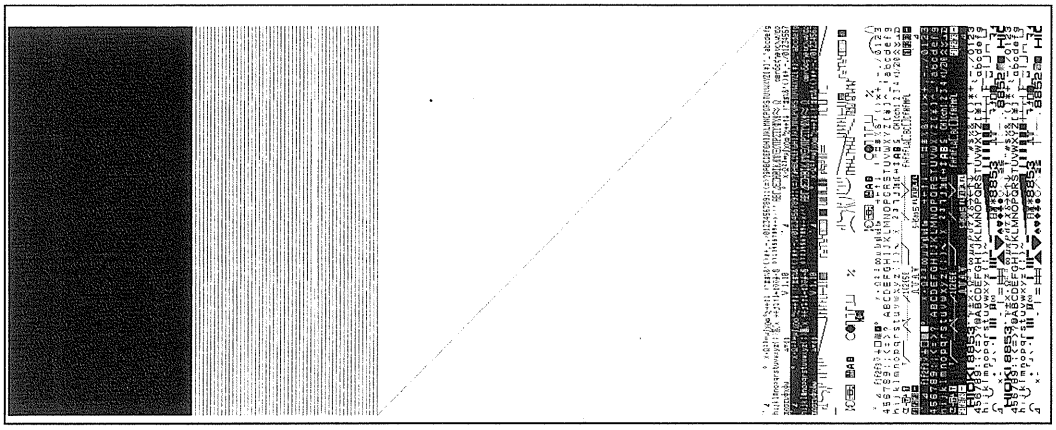
- This checks all of the LED indicators.
- Check that the LED indicators on the front panel flash in turn.
- When the beep sound setting (see Section 12.5.5) is enabled, a beeper sound is produced.
- The LED indicator for the floppy disk drive does not flash.

Procedure (Setting screen: self check)

1. Move the flashing cursor to position 2), ① as shown in the figure in Section 12.8.
2. Press the (exec) soft key.
3. In order to terminate the LED check, press any key.

12.8.3 Printer Check (PRINTER check)

A check is made of printer printing capability.



Test pattern of printer check

Procedure (Setting screen: self check)

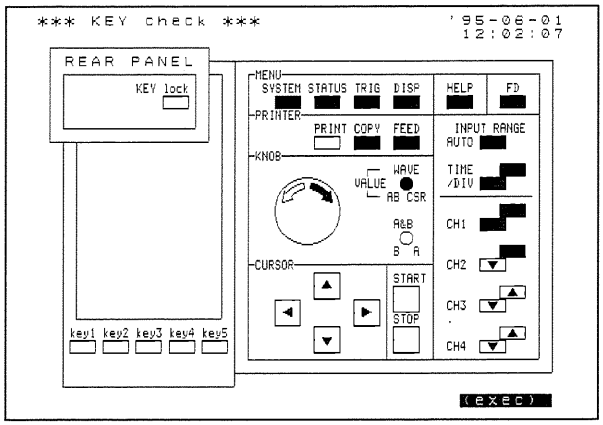
1. Move the flashing cursor to position 3), ① as shown in the figure in Section 12.8.
2. Press the (exec) soft key.
3. To abandon the printer check during execution, press the STOP key.

See Section 16.3.1. for how to clean the printer head.

12.8.4 Key Check (KEY check)

A check is made as to whether the keys are operating normally.

Procedure (Setting screen: self check)



Key check screen

1. Move the flashing cursor to position 4), ① as shown in the figure in Section 12.8.
2. Press the **(exec)** soft key to display the KEY check screen.
3. Pressing each key causes the corresponding place on the display to go dark.
   - Turning the rotary knob causes the arrow in the turning direction to go dark.
   - Press the KEY lock key (on the rear panel) again after pressing it to release the key lock condition.
4. After all the keys and arrows go dark, "Hit any key to return" is displayed, and pressing any key returns to the self check screen.

NOTE

- If something is wrong with the keys, and if even one of the keys cannot be recognized, then the key self-check cannot be terminated.
- In this case, press the START key and the STOP key together to display "Hit any key to return" and press any key to return to the self check screen.)

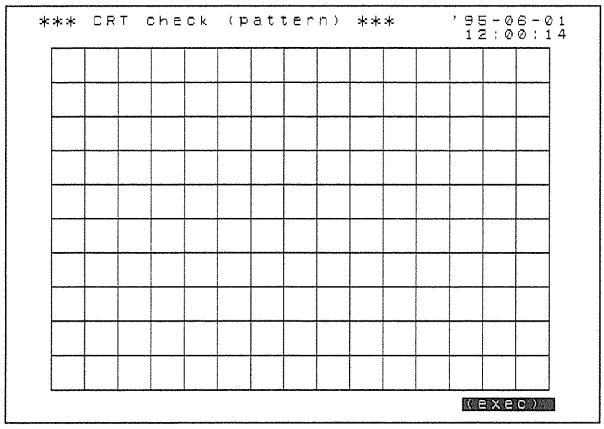
12.8.5 Display Check (DISPLAY check)

This checks the display screen.

Procedure (Setting screen: self check)

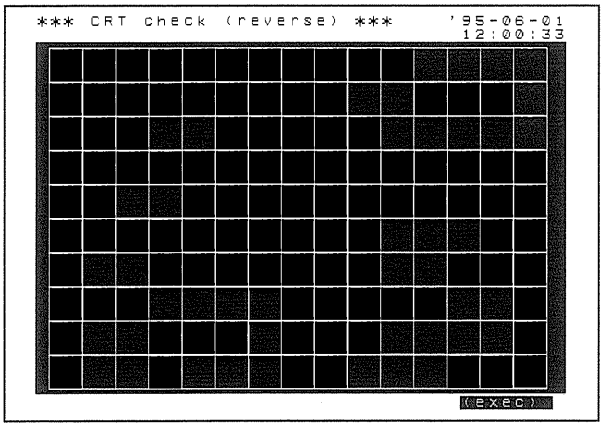
1. Move the flashing cursor to position 5), ① as shown in the figure in Section 12.8.
2. Press the **(exec)** soft key.
3. Pressing any key switches the display test pattern in the following order.

   ① pattern → ② reverse → ③ character → ④ contrast → ⑤ focus



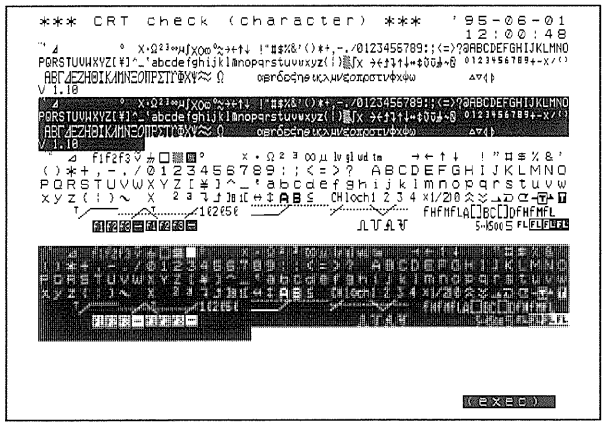
① Pattern check (pattern)

- A 10×15 grid pattern is displayed.
- Check for distortion on the screen.



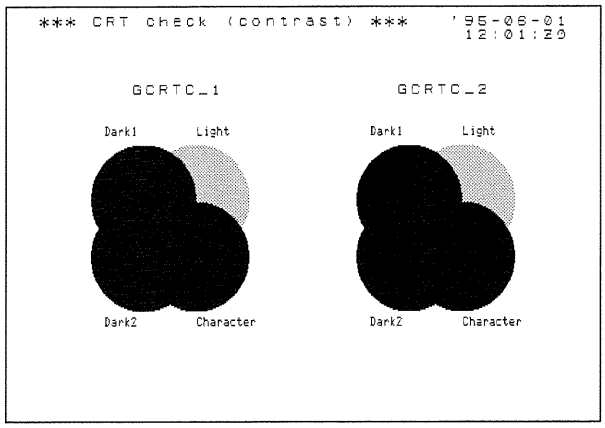
② Reverse check (reverse)

- The same grid pattern is displayed, in reverse video.
- Check for distortion on the screen.



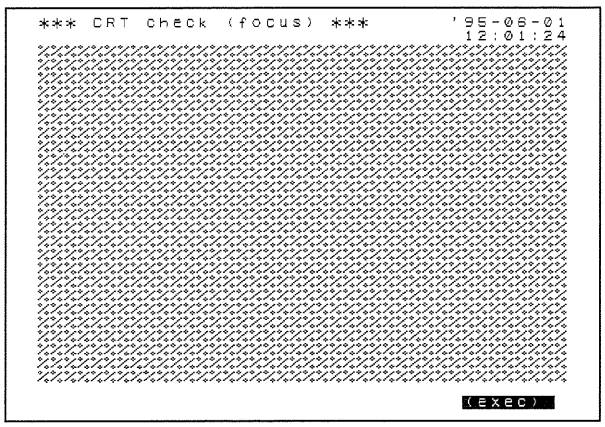
③ Character check (character)

The contents of the character generator are displayed.



④ Contrast check (contrast)

This checks contrast of the display.



⑤ Focus check (focus)

A focus check is performed.

Chapter 13
Floppy Disk, Hard Disk and Magneto-optical Disk Operations

13.1 Floppy Disk, Hard Disk and Magneto-optical Disk Functions

(1) 3.5 inch 2HD or 2DD floppy disks can be used.

The recording capacity can be formatted in 720 K bytes (IBM-PC/AC format), 1.2 M bytes (PC9801 format), and 1.44 M bytes (IBM-PC/AC or PC9801 (for three modes) format).

(2) The unit complies with the SCSI standard, and can therefore be used with a wide selection of commercially available disk drives and 3.5 inch magneto-optical disk drives. (Drives which can be used are described in Section 13.4.2.)

- The unit can access a disk of up to 2 G bytes capacity.
- The unit can access a 3.5 inch magneto-optical disk of up to 230 M bytes capacity.
- It is possible to access an MS-DOS format (version 3.3 or later) hard disk as compatible with the NEC PC9801 or IBM PC/AT or compatible computer.
- A partitioned hard disk which has been formatted using a personal computer can also be accessed.
- The unit allows subdirectories to be created and deleted on the disk, and also allows a current directory to be specified.

(3) If measurement data is recorded on a floppy disk (FD), a hard disk (HD) and a magneto-optical disk (MO), afterwards it can be read out, analyzed, and compared with other data. (In the memory recorder and FFT functions)

(4) The setting state of the unit can be saved on a FD, HD, and MO.

(5) The waveform decision area can be saved on a FD, HD, and MO. See Chapter 10, "Waveform Decision Function". (In the memory recorder and FFT functions)

(6) Partial save function See Section 13.8.

It is possible to record any portion of the captured waveform on the FD, HD and MO.

(7) Auto save function See Section 13.9.

With the memory recorder and FFT functions, during measurement it is possible automatically to record the captured waveform on the FD, HD and MO.

(8) Auto setup function See Section 13.10.

It is possible, when the power is turned on, automatically to read a setting state or a waveform decision area which has been recorded on a floppy disk and to set it up.

(9) The 8853 is capable of reading the waveform data and decision area created on the floppy disk with a Hioki 8851. See Section 13.11.

(10) The following commands can be used:

FORMAT	Formats a FD, HD, or MO in MS-DOS format.
SAVE	Writes to the FD, HD, or MO.
LOAD	Reads out from the FD, HD, or MO to the 8853.
DELETE	Erases from the FD, HD, or MO.
INFOR	Gives detailed information on a file on the FD, HD, or MO.
MKDIR	Creates a subdirectory on the HD or MO.
CD	Changes the current directory on the HD or MO.
DISK	Displays information about the HD or MO.

⚠ CAUTION

- If a floppy disk is inserted upside down, backwards, or in the wrong direction, it is possible to damage the floppy disk or the 8853.
- While the floppy disk unit is operational (the LED on the floppy disk unit is on), do not remove the floppy disk.
- When transporting the 8853, be sure to remove any floppy disk.

NOTE

• Floppy disk (FD)

2DD floppy disks formatted in PC9801 640 K bytes format cannot be used.

• Hard disk (HD)

- There are restrictions on use depending on the way in which the disk is formatted.
- The 8853 always formats the disk according to the NEC PC9801.
- For partition support, the 8853 can only access the first partition.
- The 8853 cannot be used to format a partitioned disk.

• Magneto-optical disk (MO)

- When using a magneto-optical disk connected to a personal computer, if the MS-DOS version is 5.00 or earlier, format it using a personal computer.
- The magneto-optical disk formatted on the 8853 can only access the MS-DOS version 5.00 or later.

13.2 What Can Be Recorded And How Much

(1) Setting state (FUNC)

1. It is possible to record the setting state for each of the functions: the memory recorder function, the recorder function, the X-Y recorder function and the FFT function.
2. When a setting state is read into the 8853, the unit can be set to that setting state.
3. Size of recording for a setting state

· 720 K-byte/1.2 M-byte format : 2 clusters (1 cluster is 1024 bytes)
· 1.44 M-byte format : 4 clusters (1 cluster is 512 bytes)

(2) Measurement data (WAVE)

1. It is possible to save a waveform in the memory recorder and FFT functions.
2. When measurement data is read into the 8853, the waveform data on the FD, HD, or MO is put into the designated memory channel. (See ③ LOAD in Section 13.7.1.)
3. The time axis range, the voltage axis range, etc are also recorded simultaneously with waveform data.
4. Memory capacity required for measurement data (In the memory recorder function)

· 720 K-byte/1.2 M-byte format : (1 cluster is 1024 bytes)

$$\frac{\{\text{Recording length (DIV)} \times 40\} \times 2 \times \text{number of channels}}{1024} + 1 \text{ cluster (rounded upwards)}$$

· 1.44 M-byte format : (1 cluster is 512 bytes)

(Memory capacity in 1.2 M-byte format) × 2 clusters

In the FFT function, refer to Section 4.21 of the 8853 FFT Function·GP-IB Interface Instruction Manual.

(3) Waveform decision area (AREA)

1. For the memory recorder and FFT functions, it is possible to save a waveform decision area which has been created.
2. Memory capacity required for a waveform decision area

· 720 K-byte/1.2 M-byte format : 21 clusters (1 cluster is 1024 bytes)
· 1.44 M-byte format : 42 clusters (1 cluster is 512 bytes)

(4) Memory capacity

The memory capacity for one floppy disk is as follows.

- 2DD (720 K-byte) : 713 clusters
- 2HD (1.2 M-byte) : 1221 clusters
- 2HD (1.44 M-byte) : 2847 clusters

Example For a recording length of 300 division, using four channels, the capacity of data given by the expression in (2) 4, above is

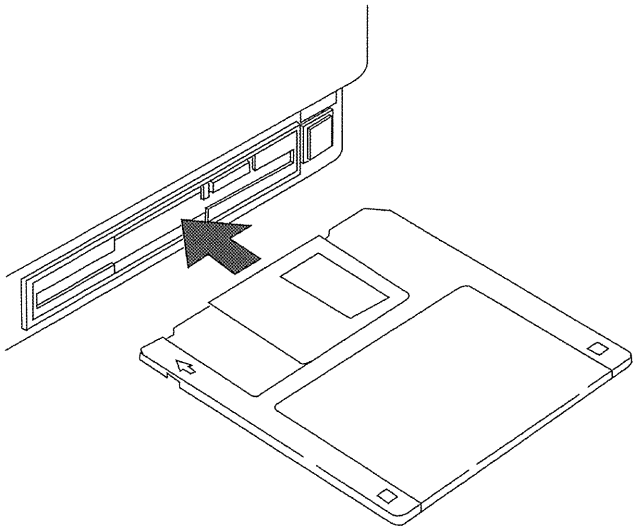
$$\frac{300 \times 40 \times 2 \times 4}{1024} + 1 = 94.75 \text{ (rounded upwards)}$$

And is thus 95 clusters. Therefore, a 2DD (720 K-byte) floppy disk holds 713 ÷ 95 = 7.5, thus 7 files.
A 2HD (1.2 M-byte) floppy disk holds 1221 ÷ 95 = 12.9, thus 12 files.

13.3 Using the Floppy Disk Drive

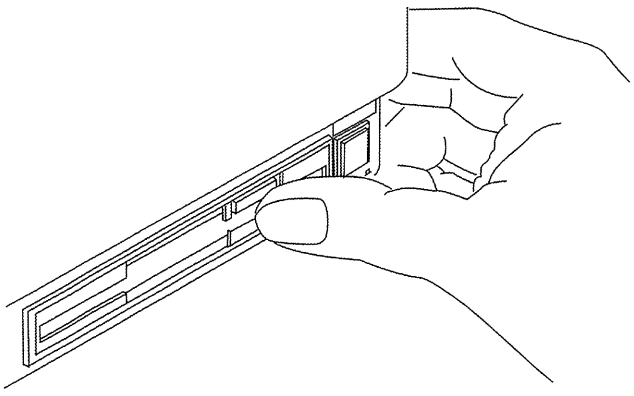
How to insert a floppy disk

Hold the disk with its written-on face upwards and push it all the way into the slot in the proper orientation.



How to remove a floppy disk

Press the button as shown in the figure below and the disk is ejected.



13.4 Using the Hard Disk Drive and the Magneto-optical Disk Drive

13.4.1 SCSI Interface Specifications

(1) General specifications

See the description of SCSI in "Other" of (7) Auxiliary functions in Section 2.1 Main Unit Specifications.

(2) Electrical specifications

① Input signals

■ Receiver	CMOS receiver with hysteresis
■ Input signal levels	0 to 0.8 V DC (Low level) 2.0 to 5.25 V DC (High level)
■ Maximum load current	±10 μA (excluding terminator)
■ Minimum hysteresis	0.2 V DC

② Output signals

■ Driver	Open-drain CMOS driver
■ Output signal levels	0 to 0.8 V DC (Low level) 2.0 to 5.25 V DC (High level)
■ Driver sink current	48 mA (low level voltage: 0.5 V DC)

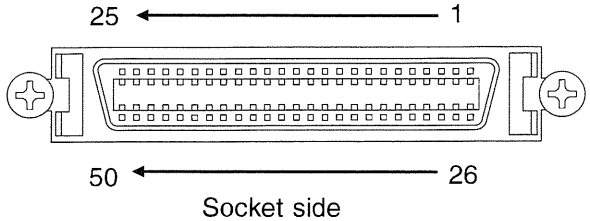
③ Terminator power signal

■ Output voltage	4 to 5.25 V DC
■ Maximum output current	1.2 A

(3) Connector

① Recommended connector:

■ Socket used	DHA-RE50-3TS, made by DDK (50-pin half-pitch shielded female connector)
■ Matching plug	DHA-PA50-3G, made by DDK or equivalent (50-pin half-pitch shielded male connector) FCN-247R050-GE, made by FUJITSU or equivalent (50-pin half-pitch shielded male connector)



Socket side

② SCSI connector pin outs

Pin number	Signal	Pin number	Signal	Pin number	Signal
1	GND	18	GND	35	GND
2	GND	19	GND	36	GND
3	GND	20	GND	37	GND
4	GND	21	GND	38	TERMPWR
5	GND	22	GND	39	GND
6	GND	23	GND	40	GND
7	GND	24	GND	41	−ATN
8	GND	25	GND	42	GND
9	GND	26	−DB0	43	−BSY
10	GND	27	−DB1	44	−ACK
11	GND	28	−DB2	45	−RST
12	GND	29	−DB3	46	−MSG
13	GND	30	−DB4	47	−SEL
14	GND	31	−DB5	48	−C/D
15	GND	32	−DB6	49	−REQ
16	GND	33	−DB7	50	−I/O
17	GND	34	−DBP		

NOTE

- The cables for connection to the hard disk and the magneto-optical disk are not supplied with the 8853.
- Use commercially available cables. See Section 13.4.2 "Connection to a Hard Disk or Magneto-optical Disk."
- The connector of the 8853 is other than the high density connector specified by the SCSI-2 standard.

13.4.2 Connection to a Hard Disk or Magneto-optical disk

Procedure

1. Check that the 8853 and the hard disk drive or the magneto-optical disk drive are powered off.
2. Select a SCSI cable with a connector corresponding to that of the disk drive and connect firmly the SCSI connector (on the rear panel of the 8853) and the disk drive.

Hard disk drive

Connector type	Cable type
8853 ↔ D-subminiature 37-pin	HD-4020-03 (made by ICM)
8853 ↔ Half pitch 50-pin (specified by the SCSI-2 standard)	HD-4020-23 (made by ICM)
8853 ↔ Amphenol type 50-pin	HD-4020-12 (made by ICM)
8853 ↔ Header connector 50-pin	PSB-9310A-CA2 (made by Nihon Microcomputer)

Magneto-optical disk drive

Connector type	Cable type
8853 ↔ Half pitch 50-pin	HD-4020-07 (made by ICM)

NOTE Notes on the hard disk drive and magneto-optical disk drive operations

(1) Powering on

- Always power on the hard disk drive or the magneto-optical disk drive before powering on the 8853.
- Do not power off while the hard disk or the magneto-optical disk is being accepted.

(2) System configuration

- A maximum of seven SCSI interfaces can be connected, but the 8853 can only access either of one hard disk drive and one magneto-optical disk drive.
- Do not operate more than one SCSI initiator (a personal computer for example) on the same SCSI bus.

  In the worst case this could lead not only to bus collisions and data loss, but also to damage to one or other SCSI controller.
- Ensure that all devices on the SCSI bus have different address IDs.
- Fit a terminator on the last SCSI device on the daisy-chain.

(3) Drives which can be used

- Within the SCSI standard, some commands are left for manufacturer-dependent use. A hard disk drive or a magneto-optical disk drive which requires such commands cannot be used with the 8853.
- Depending on the operating environment and any impedance mismatch of the interface cable, it is possible for timing discrepancies on the SCSI bus to prevent the hard disk drive or the magneto-optical disk drive from operating normally.
- The following drives have been used satisfactorily by HIOKI (As of February 1, 1996):

(Hard disk drives)

Quantum	LPS 270S
Quantum	LPS 540S
IBM	DPES-31080
IBM	DORS-32160

(Magneto-optical disk drives)

ICM	MO-230S
MIDORI ELEC.	UM-323R
Elecom	EMO-2300
LOGITEC	LMO-400
TEAC	MO-230
OLYMPUS	230MO TURBO II

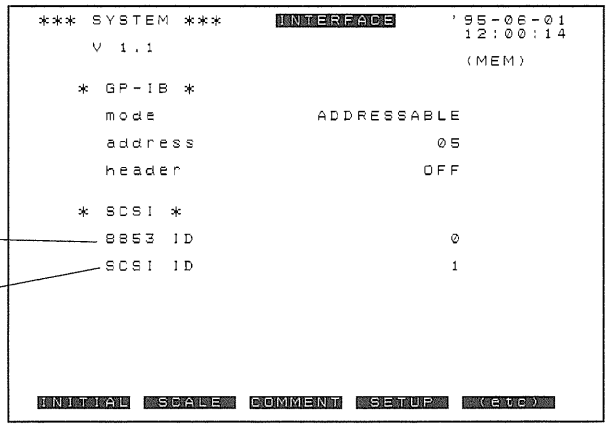
(4) Format

- When using the hard disk with the 8853 and a computer (IBM/PC or compatible), always format it using the computer.
- A hard disk formatted on the 8853 cannot be accessed from a IBM/PC or compatible.
- The above drives have been checked using the adaptec AHA-2940 for the SCSI interface.
- For a partitioned hard disk, which has been formatted using a personal computer, format it so that the first partition which the 8853 accesses is always the first cylinder.
- If the first partition is other than the first cylinder, an error (Illegal format) occurs.
- The magneto-optical disk can be formatted in 230 M- or 128 M-byte format (IBM standard).

13.4.3 SCSI Interface Settings

Carry out the settings of the SCSI device address ID.

Procedure (Setting screen: system)



Interface setting screen

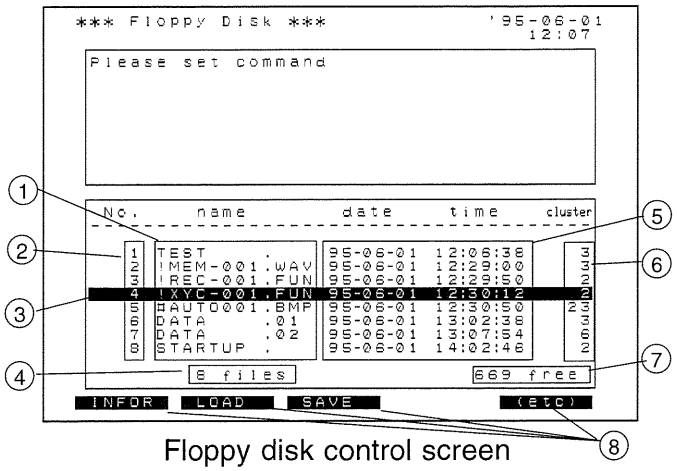
1. Pressing the INTER soft key on the system screen displays the interface setting screen.
2. Set the device address of the 8853 on the SCSI bus, in the "8853 ID" item, ① as shown in the figure on the left. [0 to 7]
3. Set the device address of the hard disk drive or the magneto-optical disk drive on the SCSI bus, in the "SCSI ID" item, ②. [0 to 7]

*The GP-IB interface settings will be described in the 8853 FFT Function·GP-IB Interface Instruction Manual.

NOTE Do not set "8853 ID" and "SCSI ID" to the same number.

13.5 Settings on the Floppy Disk Control Screen (FD screen)

- This section describes settings on the floppy disk control screen.
- Each command will be described in detail in Section 13.7, "Detailed Explanation of the Commands".



Floppy disk control screen

① File name
② File number
③ Bar cursor
④ Total number of files
⑤ Date and time
⑥ Space used (in clusters)
⑦ Space available (in clusters)
⑧ Commands (soft keys)

The (etc) key switches the command menu.

1 cluster = 1024 bytes (720 K/1.2 M bytes)
= 512 bytes (1.44 M bytes)

1. Put in a floppy disk.
2. Press the FD key to display the floppy disk control screen or the SCSI control screen.

* Set the FD key setting (see Section 12.5.10) on the system screen to "FD" or "FD&SCSI".

(When this is set to "FD&SCSI", if the SCSI control screen appears when the hard disk or the magneto-optical disk is not being used, then an error message is displayed after 10 seconds elapse.
Press the STOP key and, after the error message has disappeared, press the FD key again to display the floppy disk control screen.)

- While information about the files is being loaded, the following message appears:

  Now loading. Please wait.

- If the disk is not formatted in MS-DOS format, the following error message is displayed:

  ERROR 72: Illegal format.

- If the above error message is displayed, press the STOP key and, after the error message has disappeared, format the disk. (See Section 13.7.1, ① FORMAT).

3. The file names can be seen by scrolling them up and down by using the rotary knob.
   - The file names can be seen by scrolling every ten file names by using the up and down cursor keys.
   - Pressing the right cursor key moves the bar cursor to the first file, and the left cursor key to the last file.
4. The commands can be selected with a soft key.

Soft key indication

INFOR : File information
DELETE : Deletes a file
LOAD : Loads data
FORMAT : Formats in MS-DOS format
SAVE : Saves data
(etc) : Switches the command menu (soft key indication)

Each command will be described in detail in Section 13.7 "Detailed Explanation of the Commands".

5. When finished with the floppy disk control screen, press any of the following MENU keys (the [SYSTEM], [STATUS], [TRIG] and [DISP] keys).

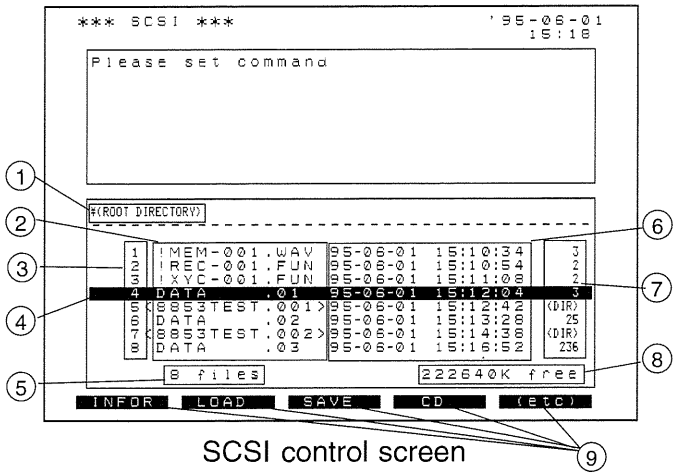
File Name

The following files have special meanings:

!MEM−○○○.WAV !MEM−○○○.FUN !MEM−○○○.ARE !REC−○○○.FUN !XYC−○○○.FUN !FFT−○○○.WAV !FFT−○○○.FUN !FFT−○○○.ARE	(○○○ : Number from 001) These are names of files made during auto setup. (See Section 13.7.1, "②SAVE".)
#AUTO○○○.BMP	This is a file created by the screen dump function. (See Section 12.7.)
#AUTO○○○.WAV	This is a file created by the auto save function. (See Section 13.9.)
#MEAS○○○.PRN	This is a file created by the waveform parameter calculation. (See Section 11.3.)
STARTUP . STARTUPA.	These are files used by the auto setup function. (See Section 13.10.)

13.6 Settings on the SCSI Control Screen (SCSI screen)

- This section describes settings on the SCSI control screen.
- Each command will be described in detail in Section 13.7, "Detailed Explanation of the Commands".



SCSI control screen

① Current directory name
② File name
③ File number
④ Bar cursor
⑤ Total number of files
⑥ Date and time
*⑦ Space used (in clusters)
⑧ Space available (in clusters)
⑨ Command (soft key)

The (etc) key switches the command menu.

*: if a directory, "<DIR>" is displayed.

Procedure

1. Connect a hard disk drive or a magneto-optical disk drive to the 8853. (See Section 13.4.)
2. Set the FD key setting (see Section 12.5.10) on the system screen to "SCSI" or "FD&SCSI".
3. Press the FD key to display the floppy disk control screen or the SCSI control screen.

*When the floppy disk control screen is displayed, press the FD key again to display the SCSI control screen.

- While information about the files is being loaded, the following message appears:

  Now loading. Please wait.

- If the disk is not formatted in MS-DOS format, the following error message is displayed:

  ERROR 85: Illegal format.

- If the above error message is displayed, press the STOP key and, after the error message has disappeared, format the disk. (See Section 13.7.1, "① FORMAT".)

4. The file names can be seen by scrolling them up and down by using the rotary knob.

- The file names can be seen by scrolling every ten file names by using the up and down cursor keys.
- Pressing the right cursor key moves the bar cursor to the first file, and the left cursor key to the last file.

5. The commands can be selected with a soft key. See Section 13.7 "Detailed Explanation of the Commands".

Soft key indication

INFOR : File information
FORMAT : Formats in MS-DOS format
LOAD : Loads data
MKDIR : Creates a directory
SAVE : Saves data
CD : Changes the current directory
DELETE : Deletes a file
DISK : Information about the hard disk
(etc) : Switches the command menu (soft key indication)

6. When finished with the SCSI control screen, press any of the following MENU keys (the SYSTEM, STATUS, TRIG and DISP keys).

Current Directory

- The 8853 saves a record of the current directory internally.
- When the current directory is changed, all subsequent control operations access files in the new directory (including GP-IB and program commands).
- After exiting from the SCSI control screen, when the SCSI control screen is displayed again, the files are listed from the current directory.
- To set the current directory, use either the command on the SCSI control screen, or the appropriate GP-IB command.

File Name

The following files have special meanings:

< . >	Indicates the current directory.
< . . >	Indicates the parent directory.
<directory name>	Indicates a subdirectory.

!MEM−○○○.WAV	(○○○ : Number from 001)
!MEM−○○○.FUN	
!MEM−○○○.ARE	
!REC−○○○.FUN	These are names of files made during auto setup. (See Section 13.7.1, "② SAVE".)
!XYC−○○○.FUN	
!FFT−○○○.WAV	
!FFT−○○○.FUN	
!FFT−○○○.ARE	
#AUTO○○○.BMP	This is a file created by the screen dump function. (See Section 12.7.)
#AUTO○○○.WAV	This is a file created by the auto save function. (See Section 13.9.)
#MEAS○○○.PRN	This is a file created by the waveform parameter calculation. (See Section 11.3.)

13.7 Detailed Explanation of the Commands

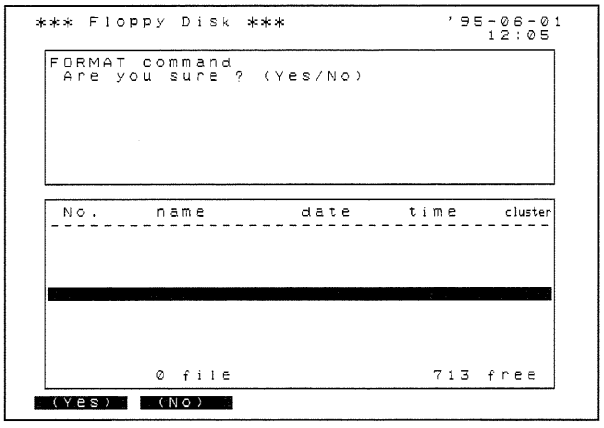
13.7.1 Commands Common to the Floppy Disk and SCSI Control Screens

This section describes the commands common to the floppy disk and SCSI control screens. (① to ⑤)

① FORMAT	Formats in MS-DOS format.

- Format the floppy disk, hard disk and magneto-optical disk to be used on the 8853.
- When the "Illegal format" error is displayed, format the disk.
- The magneto-optical disk can be formatted in 230 M- or 128 M-byte format (IBM standard).

Procedure



Floppy disk control screen

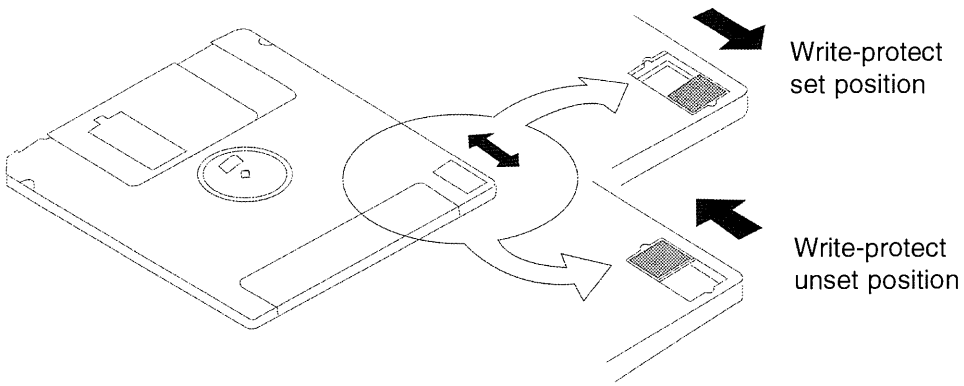
1. Press the **FORMAT** soft key, and the screen shown on the left appears.
2. Select the type of format for the 2HD floppy disk by using the soft keys. (Both types are available on the 8853.)

Soft key indication

1.2MB : 1.2 M bytes (for PC9801)
1.44MB : 1.44 M bytes (for IBM-PC/AT, and PC9801(for three modes))

3. Press the **(Yes)** soft key.
   During the formatting process, "Now formatting. Please wait." is displayed.

NOTE If the write-protect tab on the floppy disk or the magneto-optical disk is in the set position, the disk can not be formatted. To allow formatting, move the write-protect tab to the unset position.



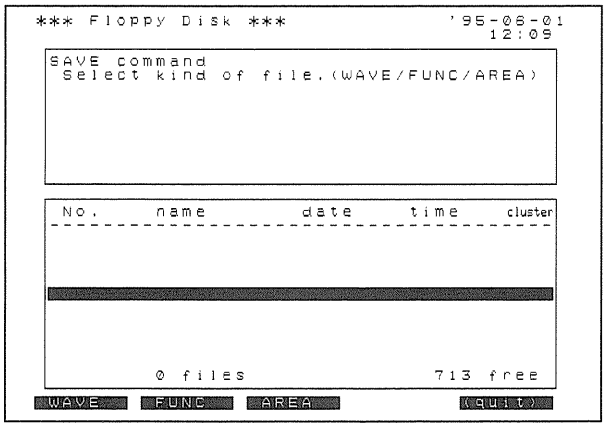
② SAVE	Transfers a setting state, measurement data, or a waveform decision area on the 8853 to the floppy disk, the hard disk, or the magneto-optical disk.

The information which can be transferred depends upon the function:

Memory recorder function and FFT function	Setting state, measurement data, or waveform decision area.
Recorder function and X-Y recorder function	Setting state only

(1) Memory recorder function and FFT function

Procedure

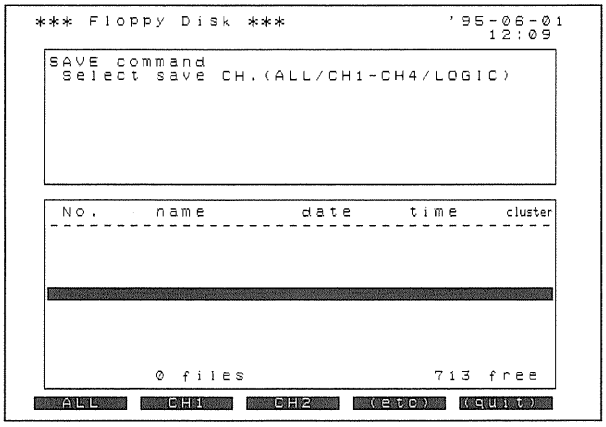


Floppy disk control screen

1. Press the **SAVE** soft key and the screen shown on the left appears.
2. Select the data to be transferred by using the soft keys.

Soft key indication

WAVE : Measurement data
FUNC : Setting state
AREA : Waveform decision area
(quit) : Cancel the SAVE command

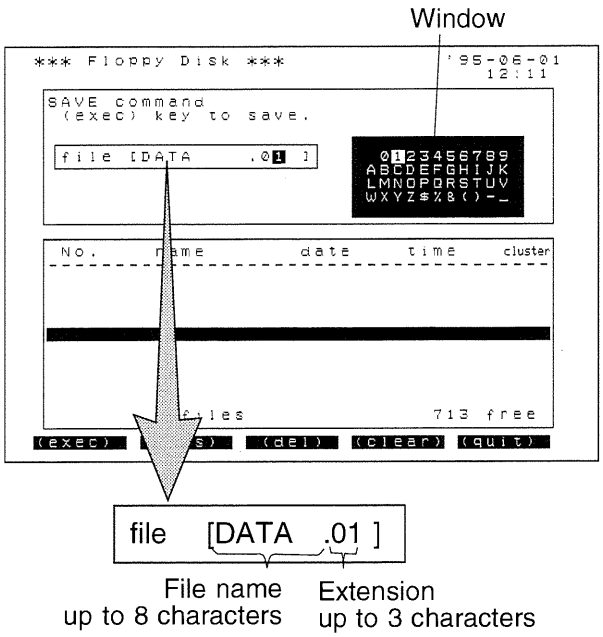


Floppy disk control screen

3. Only when pressing the **WAVE** soft key in the memory recorder function, specify the channel to be transferred by using the soft keys. (The screen shown on the left appears.)

Soft key indication

ALL : Transfers all the channels. (The channels for which the display is off are not transferred.)
CH1 to **CH4** : Transfers only the specified channel.
LOGIC : Transfers the logic waveforms (CHA to CHD)



4. Next input the file name.

a. By turning the rotary knob and moving the cursor in the window, the desired characters for the filename can be selected.

b. Pressing the ▶ right cursor key moves the cursor to the right.

(Repeat actions a. and b. as appropriate.)
File names are left justified and cannot include spaces.

Soft key indication

(exec) : Starts the transfer.
(ins) : Inserts a character between two other characters.
(del) : Deletes the character at the cursor position.
(clear) : Deletes all characters from the cursor position to the right.
(quit) : Cancels the SAVE command.

5. Pressing the **(exec)** soft key starts the data transfer.

· During data transfer, the following message appears:

Now saving. Please wait.

· If a file already exists with the same name as that input, the following message appears:

File already exists.
Overwrite OK ? (Yes/No)

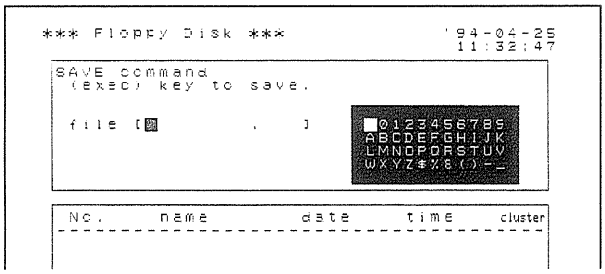
Press the **(Yes)** soft key if it is desired to overwrite the already existing current file and to create a new file.

The number of files which can be saved on one floppy disk is as follows.

· 2DD (720 K bytes) : 112
· 2HD (1.2 M bytes) : 192
· 2HD (1.44 M bytes) : 224

(2) Recorder function and X-Y recorder function

Procedure



1. Press the SAVE soft key and the screen shown on the left appears.
2. Input a file name and the setting state will be transferred.

Refer to steps 4 and 5 in (1) Memory recorder function and FFT function.

● Automatic creation of file names

If nothing is entered into the file name, "file [.]", when it is saved, a file name is automatically created.

!MEM—○○○.WAV

Function	Number	Type of file
MEM (memory recorder) REC (recorder) XYC (X-Y recorder) FFT	from 001	WAV (measurement data) FUN (setting state) ARE (waveform decision area)

● Time taken for saving (using a floppy disk)

Setting state (FUNC)	approx. 5 seconds.
Waveform decision area (AREA)	approx. 6 seconds.
Measurement data (WAVE)	for a recording length of 300 divisions and 4 channels, approx. 28 seconds.

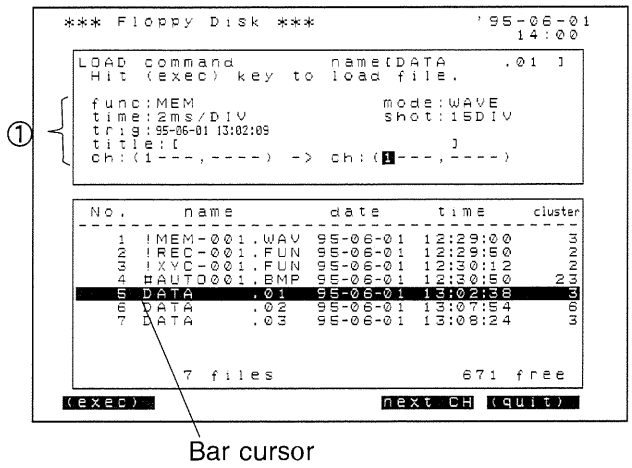
- In the case of measurement data, the time taken for saving is approximately proportional to the recording length and to the number of channels.
- After the save has been completed, a time of approx. 0.2 seconds multiplied by the total number of files is required to redisplay the list of files on the floppy disk control screen.

NOTE

- If the write-protect tab on the floppy disk or the magneto-optical disk is in the set position, saving is not possible. Make sure the write-protect tab is in the unset position. (See Section 13.7.1, ① FORMAT.)
- When using the A and B cursors, the data is partially saved. (See Section 13.8.)

③ LOAD	Transfers (loads) data to the 8853.

Procedure

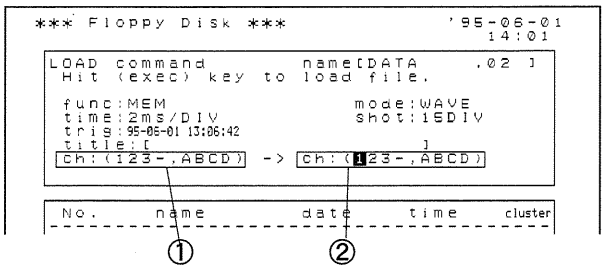


1. Using the rotary knob or the cursor keys, move the bar cursor to the file to be transferred.
2. Press the **LOAD** soft key, to display the file information, ① as shown in the figure on the left.
3. Pressing the **(exec)** soft key transfers the file at the position of the bar cursor.

Soft key indication

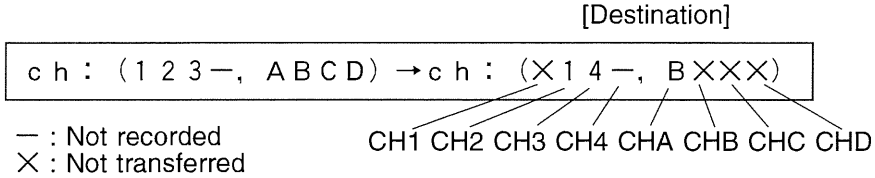
(quit) : Cancels the LOAD command.

When loading measurement data (WAVE), then the destination channel can be specified.



1. The channels which are recorded in the file are displayed in ① as shown in the figure on the left.
   - 1, 2, 3, and 4 correspond to the analog channels 1, 2, 3, and 4 respectively.
   - A, B, C and D correspond to the logic channel groups A, B, C and D respectively.
   - A dash "-" is shown for channels that are not recorded.
2. Specify the destination of data (channel) in ②.
   - At first the contents described in ① are shown on the screen.
   - To transfer to other channels, move the reverse cursor using the cursor keys and set the destination channels with the **next CH** soft key.
   - Press the **(exec)** soft key to perform the transfer.

Example



- The data of CH4 is not recorded.
- The data of CH2 is transferred to CH1. The data of CH3 is transferred to CH4. The data of CHA is transferred to CHB.
- The data of CH1, CHB, CHC and CHD are not transferred.

Time taken for saving (using a floppy disk)

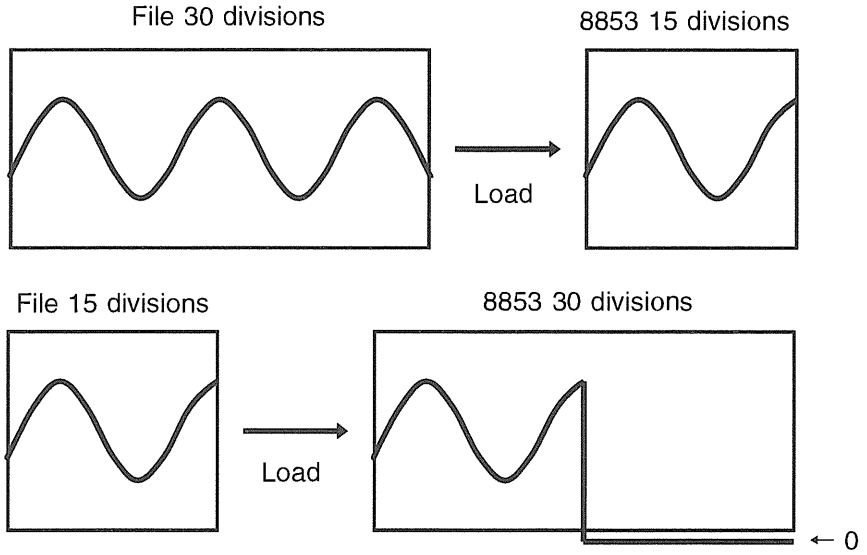
Setting state (FUNC)	approx. 2 seconds.
Waveform decision area (AREA)	approx. 3 seconds.
Measurement data (WAVE)	for a recording length of 300 divisions and 4 channels, approx. 25 seconds.

In the case of measurement data, the time taken for loading is approximately proportional to the recording length and to the number of channels.

NOTE

- Data transfer takes place in the order of the analog channels 1, 2, 3 and 4, and the logic channel groups A, B, C and D.
- If a channel is designated more than once, that channel is written into several times and the data transferred last takes precedence.
- When setting state (FUNC) is loaded, the waveforms recorded on the 8853 is erased.
- If the recording length of the file is longer than the recording length of the 8853, only the initial portion of the waveform data from its start as far as the recording length of the 8853 will be loaded, and the remaining portion of the data will not be loaded.
- If the recording length of the 8853 is longer than the recording length of the file, then the last portion of the recording length not filled by the waveform data is filled with zeros. (Zero is the lowest possible data value if there is no magnification or compression in the direction of the voltage axis.)

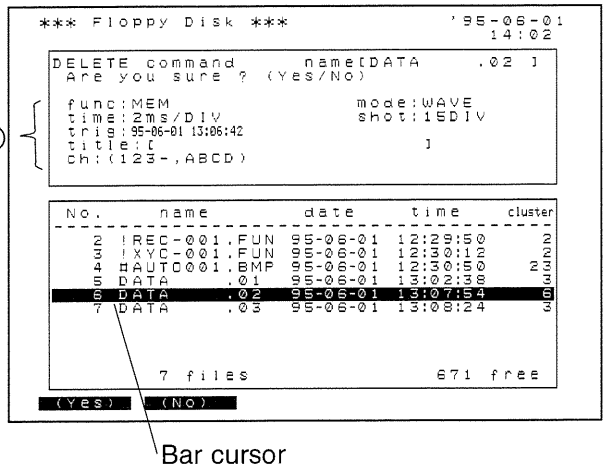
Example



- If the number of channels to be used (see Section 12.5.8) is set to 1 or 2 channels, or changed to 4 channels, load the measurement data after starting measurement.

④ DELETE Deletes a selected file.

Procedure



1. Using the rotary knob or the cursor keys, move the bar cursor to the file to be deleted.
2. Press the **DELETE** soft key to display the file information, ① as shown in the figure on the left.
3. Now pressing the **(Yes)** soft key deletes the file at the position of the bar cursor.

- Pressing the **(No)** key cancels the DELETE command.
- During the deletion, the following message appears on the display:

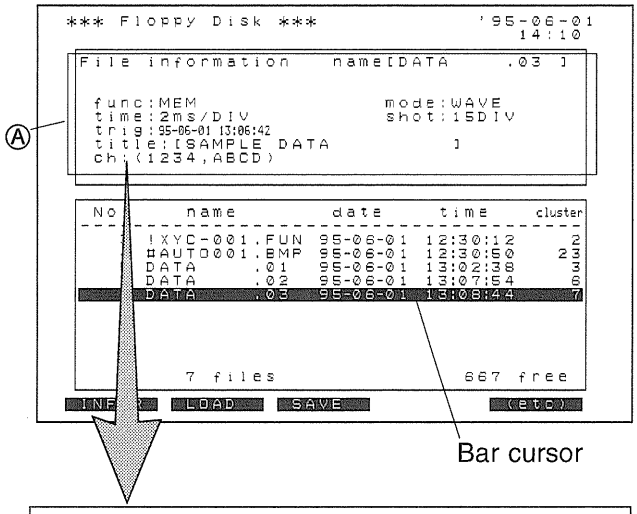
  Now deleting. Please wait.

NOTE

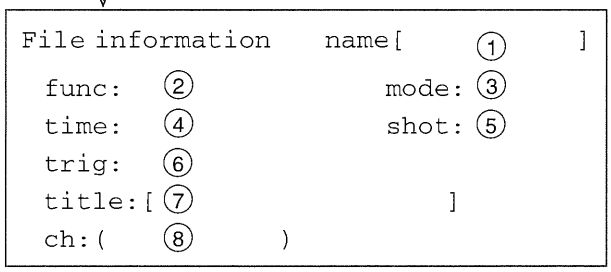
- After pressing **DELETE** , soft keys other than **(Yes)** and **(No)** will have no effect.
- On the hard disk or the magneto-optical disk, delete a subdirectory, after deleting all the files in the subdirectory.
- If the write-protect tab on the floppy disk or the magneto-optical disk is in the set position, files cannot be deleted. Make sure the write-protect tab is in the unset position. (See Section 13.7.1, ① FORMAT.)

⑤ INFOR Provides details about a file.

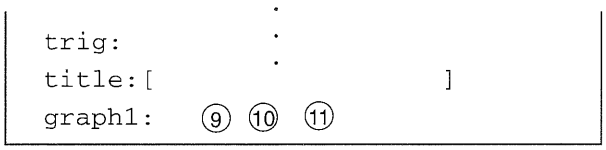
Procedure



1. Using the rotary knob or the cursor keys, move the bar cursor to the file about which the information is required.
2. Press the **INFOR** soft key, to display detailed information about the file, Ⓐ as shown in the figure on the left.



Memory recorder function



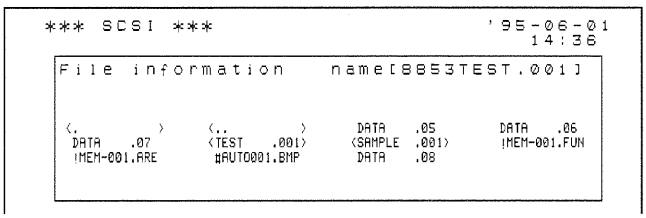
FFT function

① File name
② Function
③ File type
④ Time axis range (frequency range in the FFT function)
⑤ Recording length
⑥ Trigger instant
⑦ Title comment
* ⑧ Recorded channel
(See Section 13.7.1, ③ LOAD.)
* ⑨ Analysis mode
* ⑩ Analysis channel
* ⑪ Y-axis setting

(*: Displays when in measurement data)

NOTE

- The information about the file is also shown when LOAD and DELETE are executed.
- When executing INFOR for a subdirectory on the SCSI control screen, the file names in the subdirectory are shown.

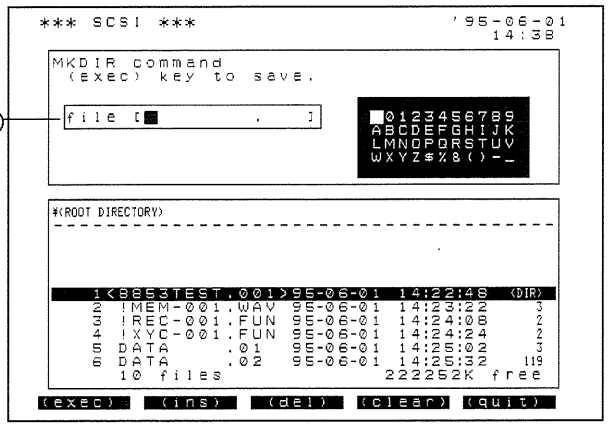


13.7.2 Commands Only on the SCSI Control Screen

This section describes the commands only on the SCSI control screen. (① to ③)

① MKDIR	Creates a subdirectory.

Procedure



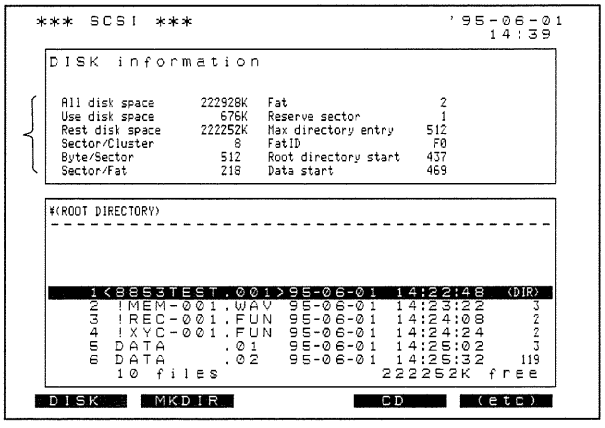
1. Press the **MKDIR** soft key, and the screen shown on the left appears.
2. Enter the directory name, ① as shown in the figure on the left.

   The input procedure is the same as that for inputting the file name. See step 4 of procedure in Section 13.7.1, ② SAVE.

NOTE A directory cannot be created, if the total path name from the root would exceed 60 characters, including the "¥" (corresponding to "\") and the "." separators.

② DISK	Displays information about the hard disk, or the magneto-optical disk.

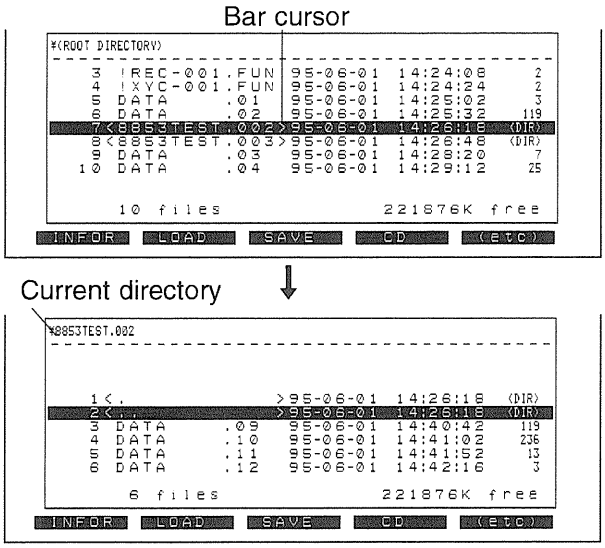
Procedure



- Press the **DISK** soft key.
- Information about the hard disk or the magneto-optical disk, ① as shown in the figure on the left is displayed.

③ CD	Changes the current directory to the specified directory.

Procedure



1. Using the rotary knob or the cursor keys, move the bar cursor to the directory to be selected.
2. Pressing the CD soft key changes the current directory to the specified directory, and lists the files in that directory.

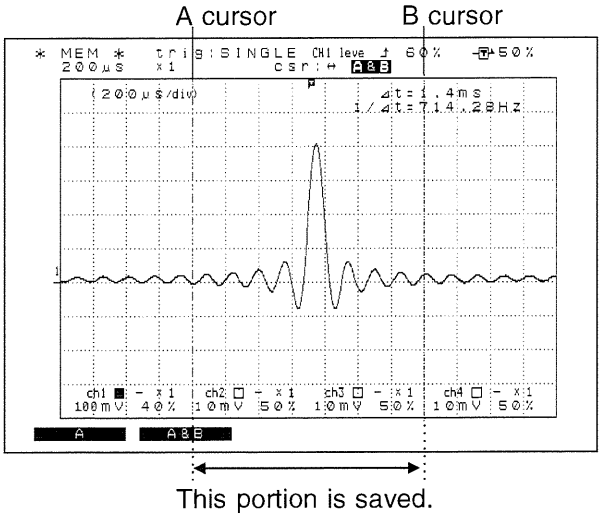
NOTE

- The 8853 provides direct movement only one layer up or down in the directory hierarchy.
- To move to the parent directory, select <. . > with the bar cursor, and press the CD soft key.
- It's not possible to move to a directory if the total path name from the root would exceed 60 characters, including the "¥" (corresponding to '\') and the "." separators.

13.8 Partial Save Function

- Only the portion of the waveform delimited by the A and B cursors is saved as measurement data.
- This function is available in the memory recorder function.

Procedure (Setting screen: display)



1. Select the portion to save with the A and B cursors, which may be vertical cursors or trace cursors.

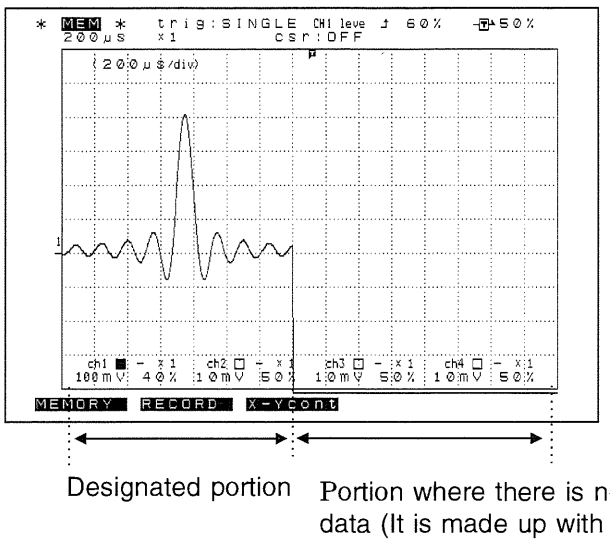
   If only the A cursor is used, the portion from the A cursor to the end of the waveform is saved.

2. Press the FD key to display the floppy disk control screen or the SCSI control screen.

3. Then perform a save by an identical procedure to that employed for normal measurement data. (See Section 13.7.1, ② SAVE.)

NOTE

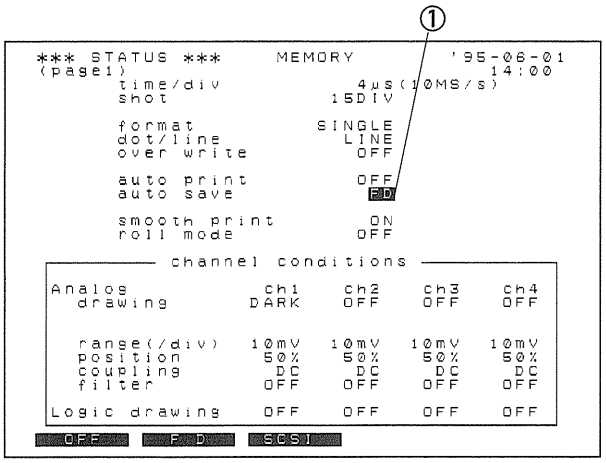
- The recording length of a waveform which is partially saved is determined as the minimum recording length including the designated range.
- The remainder of the recording length is filled by zeros. (Zero is the lowest possible data value if there is no magnification or compression along the voltage axis.)



13.9 Auto Save Function (auto save)

- This function automatically saves a captured waveform during the measurement process.
- After the measurement data is captured into the memory of the 8853, and is shown on the display, a save is automatically performed.
- This function is available in the memory recorder and FFT functions.

Procedure (Setting screen: status)



Status screen (page 1) in the memory recorder function

1. Move the flashing cursor to the "auto save" item, ① as shown in the figure on the left.
2. Set the auto save function by using the soft keys.

Soft key indication

OFF : Auto save is not used.

FD : Saves on the floppy disk.

SCSI : Saves in the current directory on the hard disk or on the magneto-optical disk.

- When the waveform data is saved, the filename used follows this pattern:

#AUTO○○○.WAV

#AUTO	○○○	.WAV
Shows that this is a file made by the auto save function.	Number from 001	Shows that the file type is measurement data (WAVE). In the FFT function, "WAV" changes to "FFT".

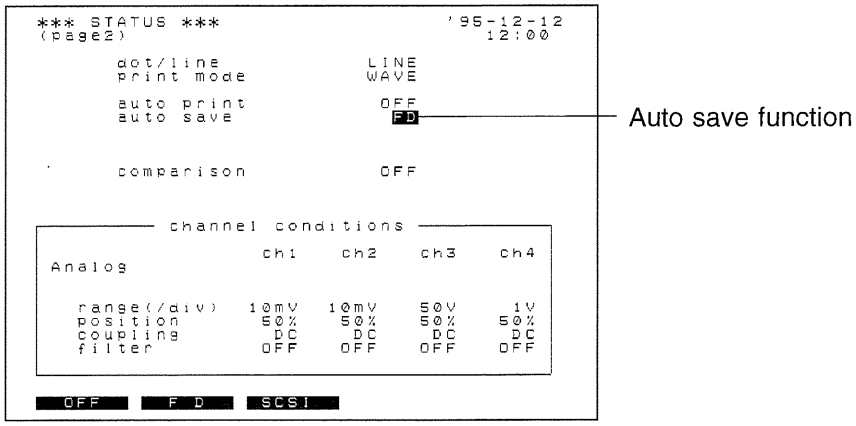
- When the waveform decision function is on: (See Chapter 10.)
  When the waveform decision action has stopped, its measurement data is saved.
- When the memory segmentation function (sequential save) is on: (See Section 9.2.)
  The captured waveform data is saved into all the indicated memory blocks by stages in order from the first memory block.

NOTE

- Check the space remaining on the floppy disk, the hard disk or the magneto-optical disk.
  If the remaining space is not sufficient, a save is not performed.
- During a save, capturing of the waveform is not performed, and the following message appears:

  Now saving data.

- The channels that are saved are only those for which ON appears.
- Make sure the write-protect tab on the floppy disk or the magneto-optical disk is in the unset position. See Section 13.7.1, ① FORMAT.
- In the FFT function, the auto save function is set on the status screen (page 2).



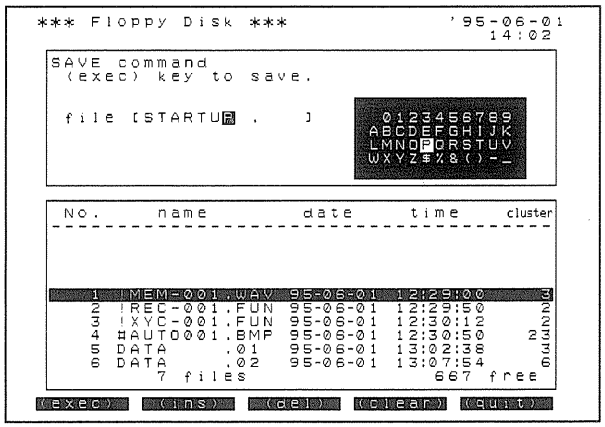
Status screen (page 2) in the FFT function

13.10 Auto Setup Function

(1) Auto setup function for setting state [FUNC]

- When the power is switched on with a floppy disk inserted, the setting up of the 8853 is performed automatically by reading the setting state (FUNC) file called "STARTUP . ".
- Just by switching on the power with the floppy disk in, the same measurement conditions can be simply established.

Procedure



Floppy disk control screen

1. Press the FD key and the floppy disk control screen will appear.
2. Press the SAVE soft key and the FUNC soft key in order.
3. Set the file name to [STARTUP .].
4. Press the (exec) soft key and the save will be performed.

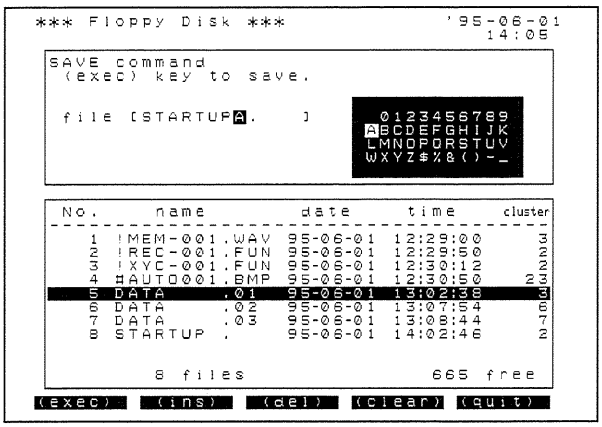
   This creates a file called "STARTUP . ", and the current setting state is recorded in it.
5. This completes the setting up.

   Then when the power is switched on again with a floppy disk inserted, the setting state saved in step 4 will be read and set.

(2) Auto setup function for waveform decision area [AREA].

- When the power is switched on with a floppy disk inserted, by reading the waveform decision area (AREA) file called "STARTUPA. ", waveform decision area is automatically loaded.
- This function can be taken advantage of when waveform decision with always the same area is desired, for purposes of examination or the like.

Procedure



Floppy disk control screen

1. Set the waveform decision area which it is desired to record. (See Section 10.)
2. Press the FD key and the floppy disk control screen will appear.
3. Press the **SAVE** soft key and the **AREA** soft key in order.
4. Set the file name to [STARTUPA.].
5. Press the **(exec)** soft key and the save will be performed.

   This creates a file called "STARTUPA. ", and the waveform decision area is recorded in it.
6. With this the setting up is completed.
   Then when the power is switched on again with a floppy disk inserted, the waveform decision area saved in step 5 will be read.
7. Perform the waveform decision by setting the waveform decision mode (see Section 10.2) and the stop mode (see Section 10.3).

13.11 Reading 8851 Files 8851 → 8853

- The 8853 is capable of reading waveform data (WAVE) files or waveform decision area (AREA) files created with a Hioki 8851.
- However, setting state (FUNC) files and auto set-up (STARTUP(A).) files cannot be read.

(1) Reading 8851 waveform data

- Memory recorder function waveform data can be read in and displayed.
- The A and B cursors can be used for reading out measurements from the read-in data, and calculation functions are also possible.
- Not all of the setting conditions are changed, however, when the 8851 waveform data is read in, and in some cases the settings are still those of the 8853 before reading the data.
- The setting conditions of the read-in 8851 data are not the same as the current setting conditions on the 8853, so after reading in, output list and check.
- The list shows the setting conditions for the 8851 which have been read in, but there are differences in some items.
  (Trigger filter width and logic filter setting functions are different on the 8851 and 8853.)
- If new measurement is started, the list also changes to the 8853 setting conditions.
- It is not possible to read in 8851 envelope data.
  (Doing so results in ERROR 76: General failure.)

(2) Reading 8851 waveform decision area data

This can be read in in the same way as 8853 waveform decision area data.

NOTE

- It is not possible to read 8853 files on the 8851.
- It is only possible to read from a floppy disk.
- It is not possible to read from a hard disk or magneto-optical disk. First copy to a floppy disk.

13.12 Internal File Format

From the start of a file, information is stored in the following manner. The following is the internal format, which will be required in order to read data stored on the floppy disk into a personal computer.

```
HIOKI8853V␣1.00␣1MEMWAVE95-06-01␣12:16:11␣␣␣20%HIOKI␣8853␣Sample␣01
␣␣40/DIV␣␣15␣DIV␣␣␣␣601W12␣50us/DIV␣400/DIV␣␣4␣␣1111108945␣␣1V␣/DIV
␣␣␣30%␣␣␣OFF␣DC8945␣␣2V␣/DIV␣␣␣50%␣␣␣OFF␣DC8945␣10V␣/DIV␣␣␣70%␣␣␣OFF
␣DC8945␣␣1V␣/DIV␣␣␣50%␣␣␣OFF␣DC
```

("␣" indicates a space character.)

Byte number / Example data	Meaning	Number of characters
1:HIOKI8853	ID	(9)
10:V␣1.00	Version	(6)
16:␣1	Length of header	(2)
18:MEM	Function	(3)
21:WAVE	Type of file	(4)
25:95-06-01␣12:16:11	Trigger instant	(17)
42:␣␣␣20%	Pre-trigger	(6)
48:HIOKI␣8853␣Sample␣01	Title comment	(20)
68:␣␣40/DIV	Time axis data/division	(8)
76:␣␣15␣DIV	Recording length	(8)
84:␣␣␣␣601	Total number of data values	(7)
91:W	Length of data word	(1)
92:␣12	A/D resolution	(2)
94:␣50us/DIV	Time/division	(9)
103:␣␣400/DIV	Voltage axis data/division	(8)
111:␣␣4	Number of analog channels	(3)
114:␣␣1	Number of logic channels	(3)
117:11110	Data save conditions	(4+1)
122:8945␣␣1V␣/DIV␣␣␣30%␣␣␣OFF␣DC	Channel 1	(28)*
150:8945␣␣2V␣/DIV␣␣␣50%␣␣␣OFF␣DC	Channel 2	(28)*
178:8945␣10V␣/DIV␣␣␣70%␣␣␣OFF␣DC	Channel 3	(28)*
206:8945␣␣1V␣/DIV␣␣␣50%␣␣␣OFF␣DC	Channel 4	(28)*

*: Model number (4), voltage axis range (9), position (6), filter (6), input coupling (3)

Details of the data values

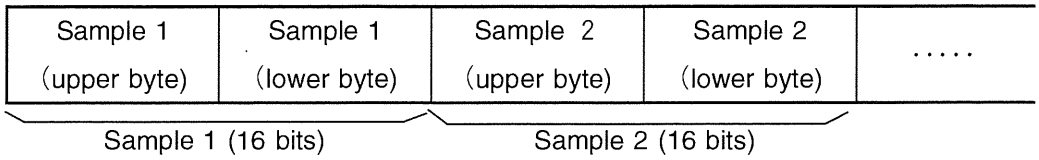
ID	Shows the name of the type of device the data was stored from.
Version	Shows the ROM version.
Length of header	Shows the length of the header portion present at the head of the data (unit is blocks, 1 block = 1024 bytes).
Function	Shows the function of the saved data: MEM memory recorder function REC recorder function XYc X-Y recorder function FFT FFT function
Type of file	Shows the type of the saved data: WAVE measurement data FUNC setting state AREA waveform decision area
Trigger instant	Shows the trigger time.
Pre-trigger	Indicates the proportion of the recording length before the trigger.
Title comment	Shows a comment used for a title.
Time axis data/division	Shows the number of data samples per division.
Recording length	Shows the recording length of the saved data.
Total number of data samples	Shows the total number of saved data samples.
Length of data word	Shows the length of one data sample. W 16 bits (2 bytes)
A/D resolution	Shows the A/D resolution.
Time/division	Shows time axis information for the saved waveform.
Voltage axis data/division	Shows the resolution per one division.
Number of analog channels	Shows the number of analog input units. (maximum value)
Number of logic channels	Shows the number of logic channels.
Data save condition	Shows whether the data for the corresponding channel was saved; 0 not saved 1 saved
Channel 1 to Channel 4	Show the information in the corresponding channel: model number voltage axis range position filter input coupling

Internal structure of a waveform data file

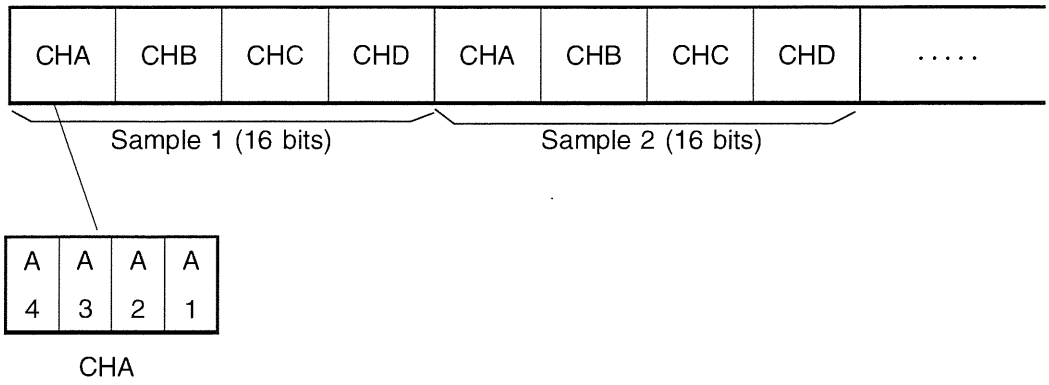
The following example shows the case when channel 1, channel 3 and logic data have been saved.

File information (1024 bytes)
Waveform data 1 (Total number of data samples × 2 bytes) (CH1)
Waveform data 2 (Total number of data samples × 2 bytes) (CH3)
Waveform data 3 (Total number of data samples × 2 bytes) (logic)

① Analog data



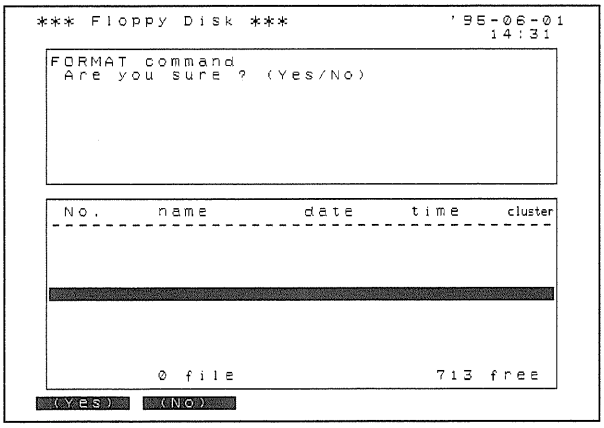
② Logic data



13.13 Operation Example

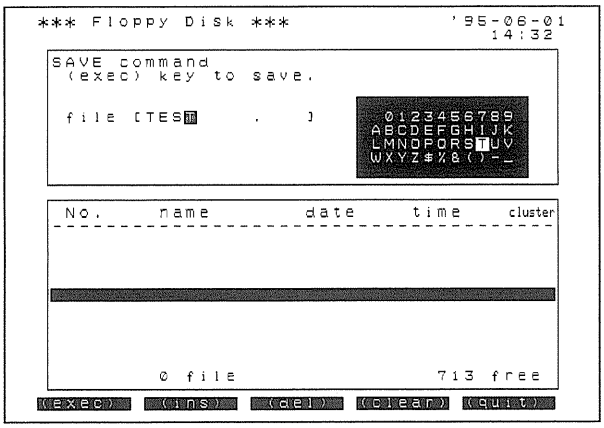
In this example a waveform which was recorded on channel 1, then saved on the floppy disk is superposed upon a newly recorded waveform, and is displayed and compared with it.

1. In the memory recorder function, the input signal on channel 1 is recorded with the following settings:
   - Set the display of channel 1 to DARK.
   - Set the display of channels 2 to 4 to OFF.
2. Insert the floppy disk into the 8853 main unit.
3. By pressing the FD key, the floppy disk control screen is displayed.



FORMAT

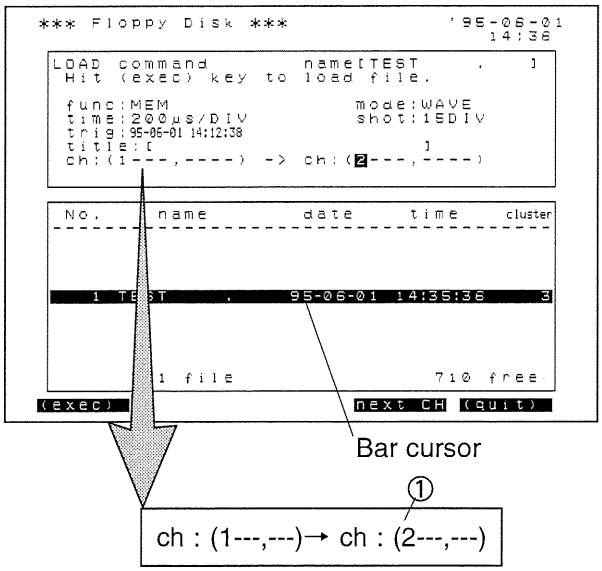
4. If the floppy disk is a new one, an error message is displayed, so it should be formatted after canceling it by pressing the STOP key.
   - Press the (etc) soft key and then the FORMAT soft key in order.
   - For a 2HD floppy disk, press either of the 1.2MB and 1.44MB keys.
   - Press the (Yes) key to perform formatting.



SAVE

5. The measurement data of channel 1 is saved on the floppy disk by pressing the SAVE soft key, the WAVE soft key, and the CH1 soft key in order.
6. Input "TEST" in the file name.

   The letters are input in order by turning the rotary knob so as to select characters, and by pressing the ▶ cursor key.
7. The soft (exec) key is pressed and the save is performed.
8. By pressing the DISP key, the display screen is displayed.
9. In the same setting state as step 1, a new waveform is recorded on channel 1.
10. The FD key is pressed, and the floppy disk control screen appears.

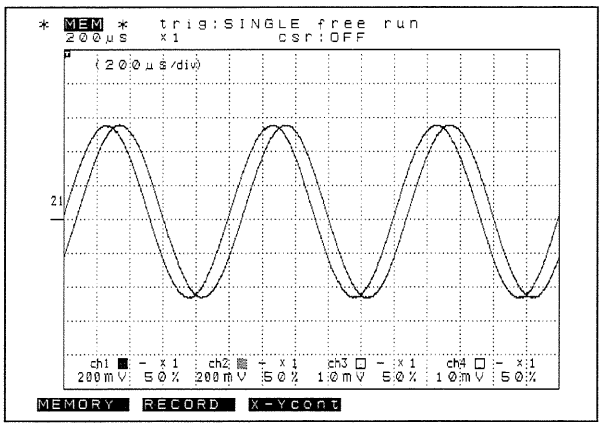


11. The file "TEST" will now be loaded from the floppy disk into channel 2 of the the 8853.

a. Move the bar cursor to the file "TEST", and the **LOAD** soft key is pressed.

b. By pressing the **next CH** soft key, the screen is set so as to load into the memory for channel 2, ① as shown in the figure below.

c. By pressing the **(exec)** soft key, the load is executed.



12. Set the display of channel 2 to LIGHT.

- A newly recorded waveform is displayed on channel 1 and the waveform "TEST" on the floppy disk is displayed on channel 2, simultaneously.
- It is possible to compare a waveform recorded on the floppy disk and a newly measured waveform.

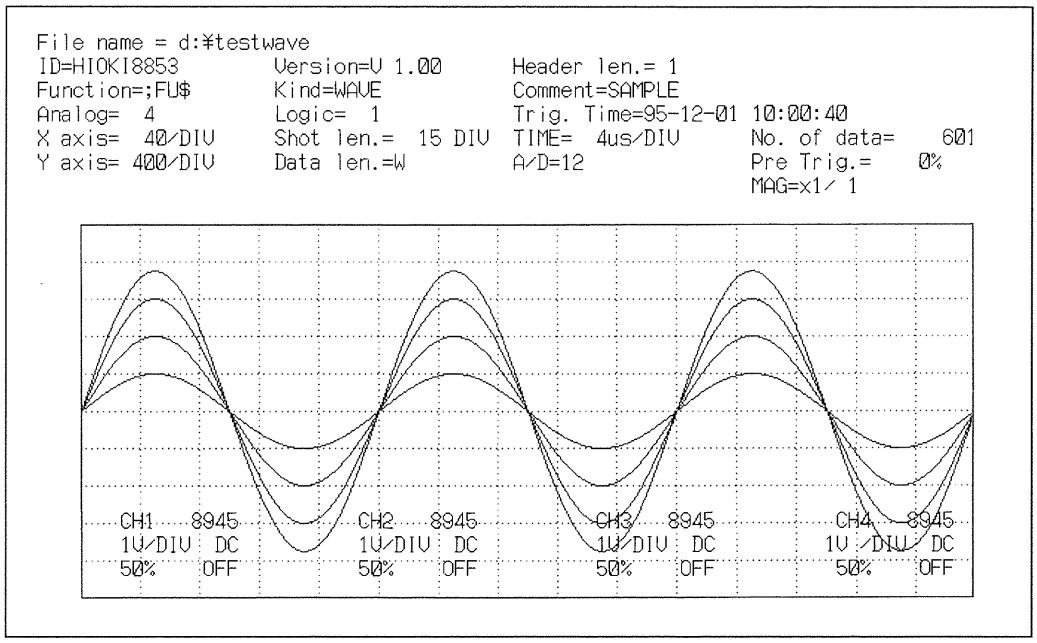
13.14 Sample Program for IBM-PC(VGA) Series

This program runs on a IBM-PC(VGA) series computer, and reads and lists the data from a file on floppy disk.

```
1000 CLS : SCREEN 12
1010 'Read Header from File ******************************
1020 INPUT "File name = ", FI$
1030 OPEN FI$ FOR BINARY AS #1
1040 FLAG = 1
1050 FOR I = 0 TO 1023
1060 A$ = INPUT$(1, #1): IF A$ = CHR$(&H1A) THEN FLAG = 0
1070 IF FLAG = 0 THEN 1090
1080 HD$ = HD$ + A$
1090 NEXT
1100 'Display Header**************************************
1110 ID$ = MID$(HD$, 1, 9): LOCATE 3, 1: PRINT "ID="; ID$
1120 VR$ = MID$(HD$, 10, 6): LOCATE 3, 21: PRINT "Version="; VR$
1130 HL$ = MID$(HD$, 16, 2): LOCATE 3, 41: PRINT "Header len.="; HL$
1140 FU$ = MID$(HD$, 18, 3): LOCATE 4, 1: PRINT "Function="; FU$
1150 KI$ = MID$(HD$, 21, 4): LOCATE 4, 21: PRINT "Kind="; KI$
1160 TT$ = MID$(HD$, 25, 17): LOCATE 5, 41: PRINT "Trig. Time="; TT$
1170 PT$ = MID$(HD$, 42, 6): LOCATE 7, 61: PRINT "Pre Trig.="; PT$
1180 CO$ = MID$(HD$, 48, 20): LOCATE 4, 41: PRINT "Comment="; CO$
1190 TP$ = MID$(HD$, 68, 8): LOCATE 6, 1: PRINT "X axis="; TP$
1200 SH$ = MID$(HD$, 76, 8): LOCATE 6, 21: PRINT "Shot len.="; SH$
1210 TD$ = MID$(HD$, 84, 7): LOCATE 6, 61: PRINT "No. of data="; TD$
1220 DL$ = MID$(HD$, 91, 1): LOCATE 7, 21: PRINT "Data len.="; DL$
1230 AD$ = MID$(HD$, 92, 2): LOCATE 7, 41: PRINT "A/D="; AD$
1240 TI$ = MID$(HD$, 94, 9): LOCATE 6, 41: PRINT "TIME="; TI$
1250 YP$ = MID$(HD$, 103, 8): LOCATE 7, 1: PRINT "Y axis="; YP$
1260 AN$ = MID$(HD$, 111, 3): LOCATE 5, 1: PRINT "Analog="; AN$
1270 LN$ = MID$(HD$, 114, 3): LOCATE 5, 21: PRINT "Logic="; LN$
1280 AC$ = MID$(HD$, 117, VAL(AN$))'Analog channel ON,OFF
1290 LC$ = MID$(HD$, 121, VAL(LN$))'Logic channel ON,OFF
1300 'Display Graph **************************************
1310 IF ID$ <> "HIOKI8853" THEN 1940
1320 IF KI$ <> "WAVE" THEN 1960
1330 X = 30: Y = 255: XW = 600: YW = 250: AD = 2 ^ VAL(AD$) / 2: AD2 = AD / 128
1340 XB = 15: YB = INT(2 ^ VAL(AD$) / VAL(YP$))
1350 YD = INT(2 ^ VAL(AD$) / YW)
1360 LOCATE 8, 61: PRINT "MAG=x1/"; (VAL(TD$) - 1) / (VAL(TP$) * XB)
1370 LINE (X, Y - YW / 2)-(X + XW, Y - YW / 2): LINE -(X + XW, Y + YW / 2)
1380 LINE -(X, Y + YW / 2): LINE -(X, Y - YW / 2)
1390 FOR L = 1 TO XB - 1
1400 LINE (X + L * XW / XB, Y - YW / 2)-(X + L * XW / XB, Y + YW / 2), , , &H1111
1410 NEXT
1420 FOR L = 1 TO YB - 1
1430 LINE (X, Y - YW / 2 + L * YW / YB)-(X + XW, Y - YW / 2 + L * YW / YB), , ,&H1111
1440 NEXT
```

```
1450 'Display Analog wave and Channel information *********
1460 FOR CH = 1 TO VAL(AN$)
1470 IF MID$(AC$, CH, 1) = "0" THEN 1640
1480 COLOR CH + 1 MOD 4 + 8: LOCATE 25, 8 + (CH - 1) * 20: PRINT "CH"; HEX$(CH)1490 N =
     117 + VAL(AN$) + VAL(LN$)
1500 LOCATE 25, 14 + (CH - 1) * 20: PRINT MID$(HD$, N + (CH - 1) * 28, 4)
1510 LOCATE 26, 5 + (CH - 1) * 20: PRINT MID$(HD$, N + (CH - 1) * 28 + 4, 9)
1520 LOCATE 27, 5 + (CH - 1) * 20: PRINT MID$(HD$, N + (CH - 1) * 28 + 13, 6)
1530 LOCATE 27, 12 + (CH - 1) * 20: PRINT MID$(HD$, N + (CH - 1) * 28 + 19, 6)
1540 LOCATE 26, 15 + (CH - 1) * 20: PRINT MID$(HD$, N + (CH - 1) * 28 + 25, 3)
1550 A$ = INPUT$(1, #1): B$ = INPUT$(1, #1)
1560 DT = (ASC(A$) AND AD2 - 1) * 256 + ASC(B$)
1570 PSET (X, Y + (AD - DT) / YD), CH + 1 MOD 4
1580 FOR J = 1 TO VAL(TD$) - 1
1590 K = X + J * XW / (VAL(TD$) - 1)
1600 A$ = INPUT$(1, #1): B$ = INPUT$(1, #1)
1610 DT = (ASC(A$) AND AD2 - 1) * 256 + ASC(B$)
1620 LINE -(K, Y + (AD - DT) / YD), CH + 1 MOD 4 + 8
1630 NEXT
1640 NEXT
1650 'Display Logic wave **********************************
1660 IF MID$(LC$, 1, 1) = "0" THEN 1910
1670 FOR LG = 1 TO 16
1680 LINE (10, Y - (8 - LG + 1) / 20 * YW)-(25, Y - (8 - LG + 1) / 20 * YW), INT((LG - 1)
     / 4) + 2
1690 NEXT
1700 FOR J = 0 TO VAL(TD$) - 1
1710 A$ = INPUT$(1, #1): B$ = INPUT$(1, #1)
1720 AA = ASC(A$): BB = ASC(B$)
1730 FOR LG = 1 TO 8
1740 K = X + J * XW / (VAL(TD$) - 1)
1750 BIT = (2 - INT((LG - 1) / 4)) * 4 - 4 + ((LG - 1) MOD 4)
1760 IF J = 0 THEN 1790
1770 IF (INT(AA / (2 ^ (BIT))) AND 1) = (INT(AAA / (2 ^ (BIT))) AND 1) THEN 1790
1780 LINE (K, Y - (8 - LG + 1) / 20 * YW)-(K, Y - (8 - LG + 1) / 20 * YW - 1 * YW / 30),
     INT((LG - 1) / 4) + 2
1790 PSET (K, Y - (8 - LG + 1) / 20 * YW - (INT(AA / (2 ^ (BIT))) AND 1) * YW / 30),
     INT((LG - 1) / 4) + 2
1800 NEXT
1810 FOR LG = 9 TO 16
1820 K = X + J * XW / (VAL(TD$) - 1)
1830 BIT = (4 - INT((LG - 1) / 4)) * 4 - 4 + ((LG - 1) MOD 4)
1840 IF J = 0 THEN 1870
1850 IF (INT(BB / (2 ^ (BIT))) AND 1) = (INT(BBB / (2 ^ (BIT))) AND 1) THEN 1870
1860 LINE (K, Y - (8 - LG + 1) / 20 * YW)-(K, Y - (8 - LG + 1) / 20 * YW - 1 * YW / 30),
     INT((LG - 1) / 4) + 2
1870 PSET (K, Y - (8 - LG + 1) / 20 * YW - (INT(BB / (2 ^ (BIT))) AND 1) * YW / 30),
     INT((LG - 1) / 4) + 2
1880 NEXT
1890 AAA = AA: BBB = BB
1900 NEXT
1910 'End of display ***************************************
```

```
1920 COLOR 7: LOCATE 29, 1, 0
1925 PRINT "Hit any key !";
1926 IF INKEY$ = "" THEN 1926
1930 CLOSE : END
1940 LOCATE 10, 1: PRINT "This is not a 8853's file."
1950 GOTO 1930
1960 LOCATE 10, 1: PRINT "This is not a wave file."
1970 GOTO 1930
```



Chapter 14
Using the Rear Panel

14.1 Overview

- The various connections can be made to the rear panel.
- Refer to the sections listed in Section, "Identification of Controls and Indicators" at the beginning of this manual, for detailed descriptions of the functions of the connectors.
- Chapter 14 deals with the external start/stop function, the pass/fail decision output and the key lock function.

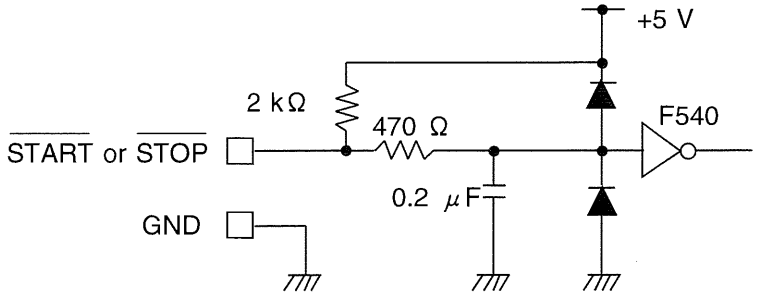
14.2 External Start/Stop Function (REMOTE)

The external control terminals on the rear panel provide start and stop functions for measurement.

START Uses a TTL level input signal low (0.7 V or less) between the START and GND terminals, or a terminal short.

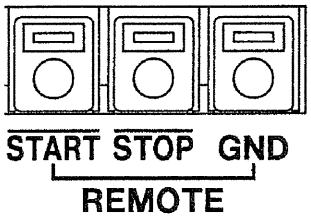
STOP Uses a TTL level input signal low (0.7 V or less) between the STOP and GND terminals, or a terminal short.

Input circuit



Input voltage range : -5 V to +10 V

Input terminals (rear panel)

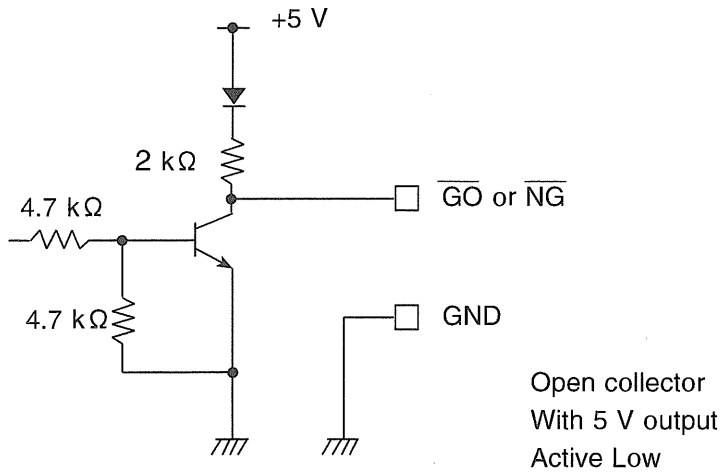


See Section 14.4, "Connections to the External Terminals".

14.3 Pass/Fail Decision Output (GO/NG OUT)

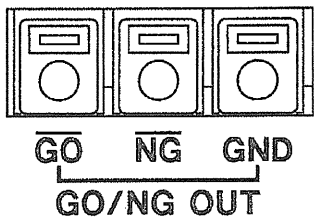
- Terminals on the rear panel (see Chapter 10) provide an output of the result of the waveform decision.
- Terminals on the rear panel provide an output of the result of the waveform parameter decision (see Chapter 11.3.3).
- The signal between the GO and GND terminals is the pass output.
- The signal between the NG and GND terminals is the fail output.

Output circuit



Input voltage range : -20 to +30 V
Maximum input current : 500 mA
Maximum input power : 200 mW

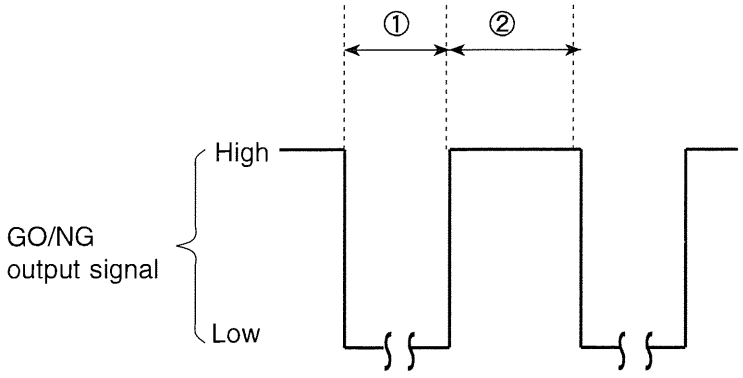
Output terminals (rear panel)



See Section 14.4, "Connections to the External Terminals".

NOTE When performing the waveform decision and the waveform parameter decision simultaneously, the result of the waveform decision is output.

GO and NG output signals



① Time period for low level output

[About 125 ms or more (during waveform decision), about 105 ms or more (during waveform parameter decision)]

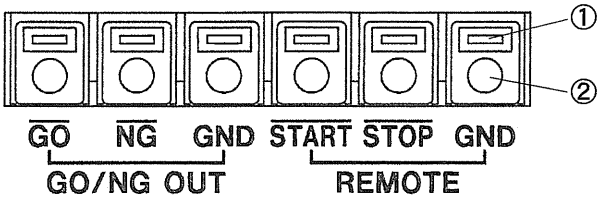
- During this period, data sampling takes place and the waveform data is created.
- The slower the time axis is set, and the longer the recording time is set, the longer this time period becomes.
- Either the $\overline{GO}$ or the $\overline{NG}$ output, whichever is appropriate, goes low.

② Time period for high level output

[About 50 ms or more (during waveform decision), about 10 ms or more (during waveform parameter decision)]

- The decision takes place during his period.
- Both the $\overline{GO}$ and $\overline{NG}$ outputs are high at this time.

14.4 Connections to the External Terminals



① Button

When inserting or removing wires, use a tool to press the button.

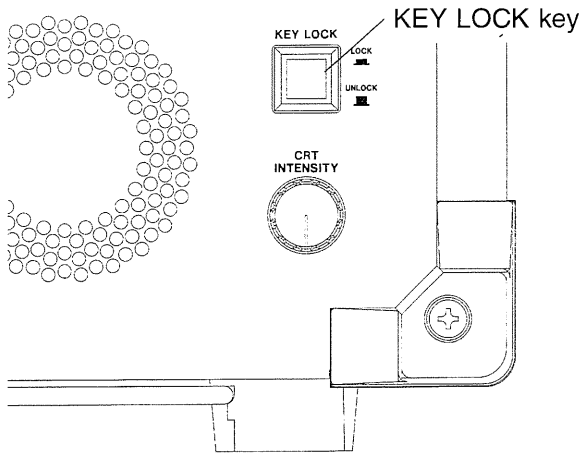
② Wire connection aperture

Insert the end of the wire to be connected.

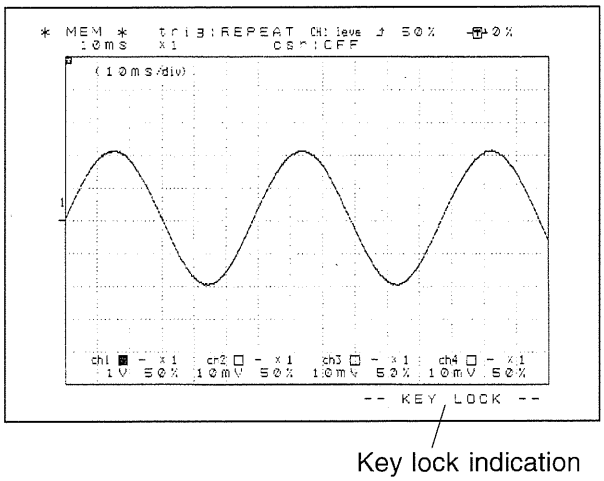
Connecting wires and tools

Recommended wire size	Single strand, 1.0 mm dia. (AWG 18), multi-strand 0.75 mm^2.
Usable wire sizes	Single strand, 0.4 to 1.0 mm dia. (AWG 26 to 18), multi-strand 0.3 to 0.75 mm^2 (AWG 22 to 20). Minimum strand diameter 0.18 mm
Standard insulation stripping length	10 mm
Button pressing tool	Blade screwdriver (tip width 2.6 mm)

14.5 Key Lock Function (KEY LOCK)



- The KEY LOCK key switches to the key lock state, and all keys on the front panel are disabled.
- This function can prevent inadvertent operation of the controls during recording.
- The key lock state does not change even if the unit is powered off and on again.
- To release the key lock state, press the KEY LOCK key again.



- In the key lock state, the message "--KEY LOCK--" appears on the lower right of the screen.

NOTE

If performing the key lock, when using external remote control (through the GP-IB interface):

- The "[LCL]" indication of the [LCL] soft key changes to "[LCL]". (The indication is reversed.)
- The key lock indication does not appear.
- Even the [LCL] soft key is disabled.

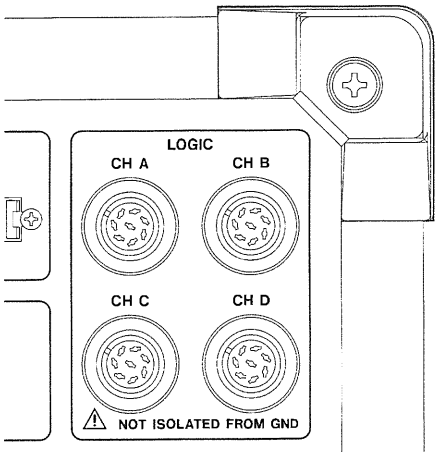
Chapter 15
Input Units

15.1 Logic Inputs

- The 8853 has logic input unit built-in, and provides a maximum of 16 logic channel recordings.
- For operation details, see Section 5.3.8, "Display and Recording Channel Settings" and Section 8.3.6, "Logic Trigger."

15.1.1 Logic Input Unit

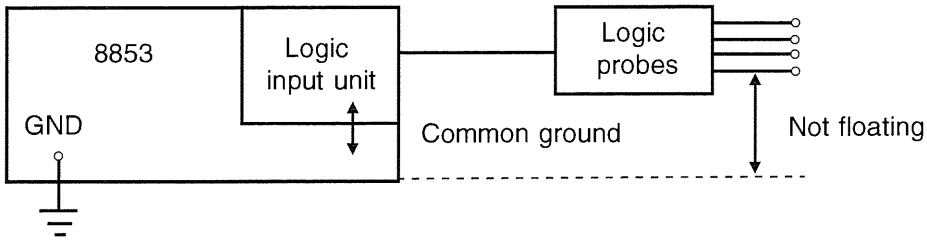
The connections to the logic input section are on the upper right of the rear panel.



The logic input unit has a common ground with the 8853 GND.

⚠ WARNING

- **The logic input unit allows four probes to be connected, but these are not floating, having a common ground with the main unit.**
- **Do not connect logic probes other than those supplied by Hioki to the logic inputs.**



15.1.2 Logic Probes

(1) 9306 logic probe

· Switchable between voltage input and contact input.
· Allows a wide range of measurements from electronic circuits to relay timings.

⚠ WARNING

- **The 8853 allows a maximum of four 9306 units to be connected, but these are not floating having a common ground.**
- **The permitted voltage for digital input is ±50 V.**
- **The permitted voltage for contact input is ±30 V.**

Refer to the instruction manual for the 9306.

NOTE

The maximum response time of the 9306 is 2 μs. Therefore, when observing the analog waveform simultaneously with the logic waveform in the time axis range faster than 100 μs/division, the response time lag between them may occur.

(2) 9307 line logic probe

· Can detect the on/off state of an AC line.
· A line voltage up to 250 V can be input and this allows timing measurement of relay sequencers and so forth.

⚠ DANGER

- **Insulation is provided in the probes between the input and output, and between channels.**
- **To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds the maximum floating voltage (250 V AC).**
- **If using an early model (serial number 1987 191974 and earlier), when connected to the 8853 the indicator does not light. (All other functions operated correctly.)**
- **When replacing the fuse, be sure to disconnect the clip from the measured circuit.**
- **To ensure safe operation, use only a fuse of the correct rating. [0.3 A/250 V, non-arcing midget fuse]**
- **The permitted input voltage for the LOW range is 150 V AC.**
- **The permitted input voltage for the HIGH range is 250 V AC.**

Refer to the instruction manual for the 9307.

NOTE

The maximum response time of the 9307 is 3 ms. Therefore, when observing the analog waveform simultaneously with the logic waveform in the time axis range faster than 100 ms/division, the response time lag between them may occur.

(3) 9308 line dip detector

- Detects instantaneous dips on a commercial power line (100 or 120 V AC).
- The dip level is switchable between approximately 80 % and 90 %.
- An 8945 analog unit is required.

⚠ DANGER

- **The low side banana plug (black) is directly connected to the input clip (black); take care to avoid electric shock.**
- **When replacing the fuse, be sure to disconnect the clip from the measured circuit.**
- **To ensure safe operation, use only a fuse of the correct rating. [0.3 A/250 V, non-arcing midget fuse]**
- **The permitted input voltage is 130 V AC.**
- **The maximum floating voltage is 130 V AC.**
- **The analog output cable should always be connected to the 8945 analog unit. Use with the cable removed risks a short and errors caused by noise.**

Refer to the instruction manual for the 9308.

NOTE

Can also be carried out in the same way using the time out trigger of the 8853.

15.2 8945 Analog Unit

· The 8945 analog unit is the analog unit for the 8853 Memory HiCorder.
· Line voltages up to 100 V AC systems can be measured directly.

15.2.1 Specifications

Accuracy at 23℃±5℃, after 60 minutes warming-up time (Accuracy guaranteed for six months.)

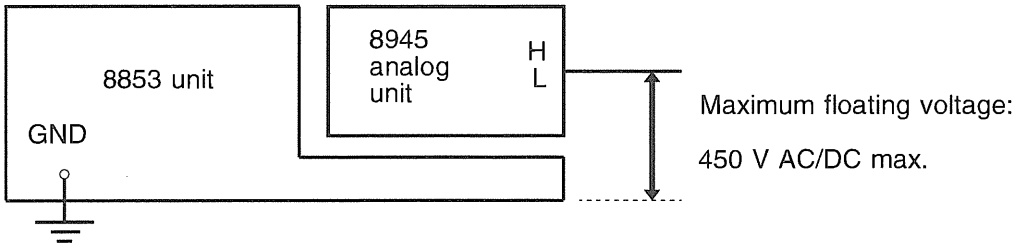
■ Measurement ranges	10 mV/DIV to 50 V/DIV, 12 ranges in 1-2-5 steps
■ DC amplitude accuracy	±0.25 % f.s.
■ Zero position adjustment	-100 % to +100 %, adjustable in 1 % steps, with zero adjust function
■ Zero position accuracy	±0.1 % f.s. (after zero adjustment)
■ Temperature characteristic	Gain: ±0.025 % f.s./℃ Zero position: 0.015 % f.s./℃ (after zero adjustment)
■ Frequency characteristics	DC to 4 MHz :±1/3 dB (DC coupling) Approx. 7 Hz to 4 MHz :±1/3 dB (AC coupling)
■ Noise	650 μVp-p typical, 1.4 mVp-p max. (maximum sensitivity range, with input shorted)
■ Common mode exclusion ratio	80 dB minimum (at 50 Hz or 60 Hz and with signal source resistance 100 Ω maximum)
■ Low pass filter	Cut-off frequency approximately 5 Hz, 500Hz or 500 kHz, switchable on/off
■ Input type	Unbalanced (insulated between input and output)
■ Input RC	1 MΩ±1 %, 30 pF approx. (at 100 kHz)
■ Input coupling	AC, GND, DC
■ A/D resolution	12 bits
■ Maximum sampling speed	10 MS/s
■ Input terminals	2 terminals (for banana plugs)
■ Permitted input voltage	500 V (DC+AC peak)
■ Maximum floating voltage	450 V AC or DC (between input unit and frame, and between input units)

■ Dimensions and mass	181(W) × 24(H) × 101(D) mm approx. (excluding projections); 275 g approx.
■ Accessories	9574 input cable (1)

15.2.2 Safety Precautions

⚠ DANGER

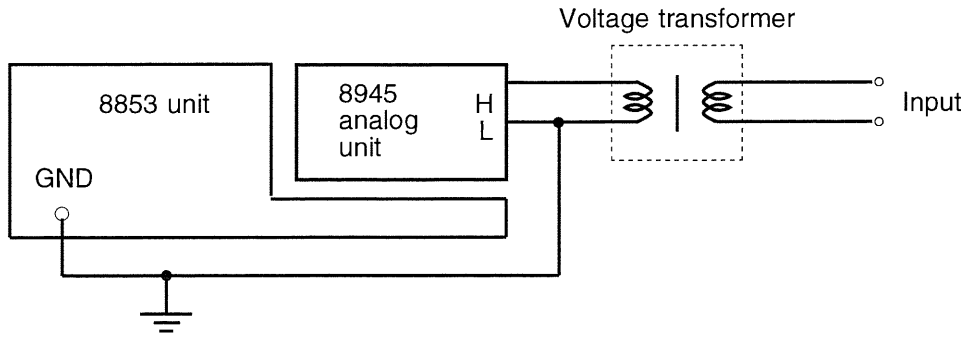
- **If any metallic portions of the input cables are exposed, there is a danger of electric shock. Use only the 9574 input cables supplied.**
- **The 8945 input and the 8853 frame are insulated.**
- **The maximum floating voltage between the inputs of the 8945 units and the frame of the 8853, or with other analog units, is 450 V AC/DC.**
- **To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds the maximum floating voltage.**
- **The maximum floating voltage does not change even when using an attenuator with the input, for example.**



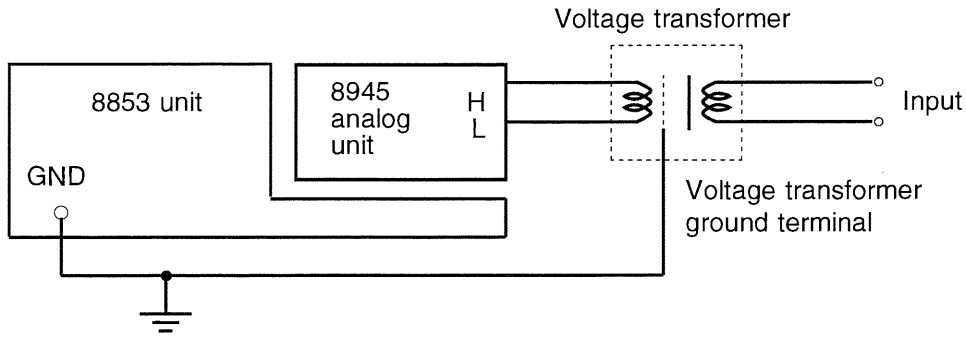
⚠ DANGER

- **The maximum permitted input to the 8945 is 500 V (DC+AC peak). To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds this level.**
- **When making measurements on an AC power line for example, using a voltage transformer, ensure that the transformer is appropriately grounded as illustrated below.**

(a) When the voltage transformer has no ground terminal



(b) When the voltage transformer has a ground terminal



15.2.3 How to Replace the Analog Input Units

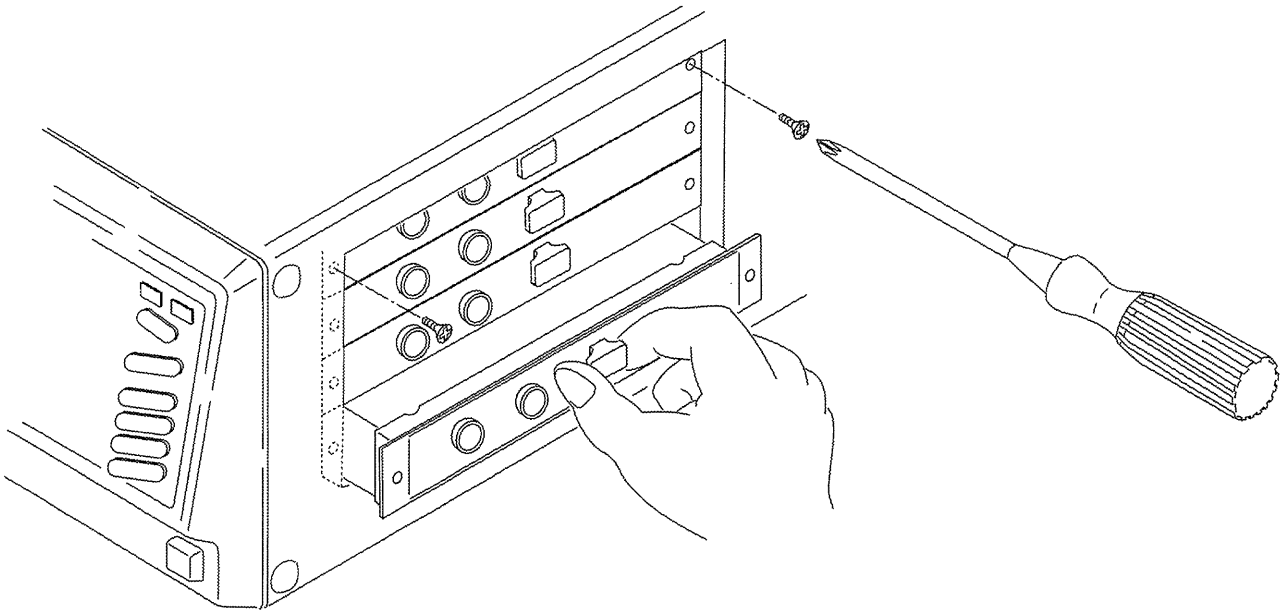
- This section describes how to remove an analog input unit.
- Reverse the procedure to insert the replacement.

Procedure

1. Remove the input cables from all the input units.
2. Power off the 8853 main unit, and disconnect the power cord.

⚠ DANGER **To avoid the danger of electric shock, always disconnect the input cables and the power cord before replacing input units.**

3. Remove the two fixing screws with a Phillips screwdriver, as shown in the figure below.
4. Holding the handle at the center of the input unit, withdraw it from the main unit.



⚠ DANGER

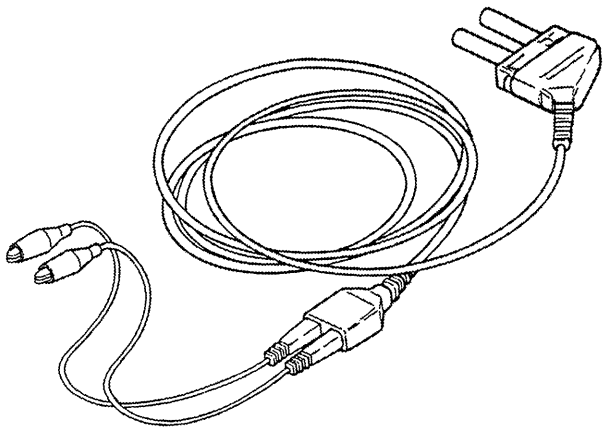
- **To avoid the danger of electric shock, never operate the 8853 unit with an input unit removed.**
- **For a channel with no input unit fitted, fit a blanking panel.**

15.2.4 Input Cables

The 9574 input cables have a length of 1.7 m, and the portion which plugs into the 8945 has a plastic cover for added safety.

⚠ DANGER

- **If any metal parts of the input cables are exposed, there is a danger of electric shock.**
- **Use only the special-purpose 9574 input cables with the 8945 input unit.**
- **If any metal parts are exposed, do not use the 9574 input cables and purchase the new ones.**



9574 input cables

15.2.5 Functional Description

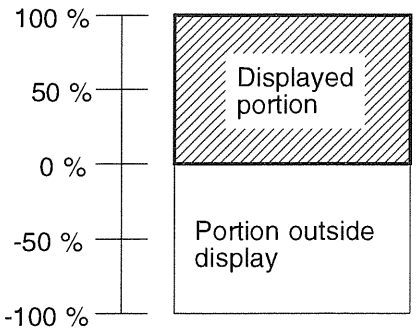
This section covers the voltage axis range, position, input coupling, and filter settings of the 8945 input unit.

(1) Voltage axis range

- This indicates the voltage value corresponding to one division of the graph on the screen and the recording paper. (10 mV to 50 V/division, 1-2-5 steps, 12 ranges)
- Since the voltage axis is 10 divisions, the maximum value which can be recorded is ten times this value. (100 mV to 500 V)

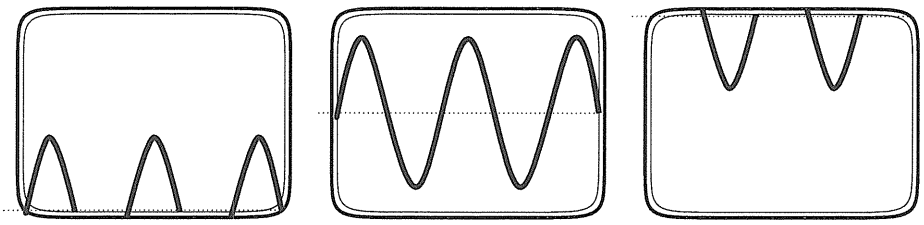
(2) Position

The position setting indicates the location of the origin (0 V) on the screen (recording paper). (-100 % to 100 %, 1 % steps)



It possible to observe the hidden portion of the waveform by varying the position.

Example



(3) Zero adjustment

- Because of thermally dependent drift of components in the input units and other factors, it is possible for the position of the waveform with a zero input to vary somewhat.
- The zero adjustment function provides for accurate adjustment of the waveform to the origin position when a zero voltage is input, to cancel this effect.
  - Allow at least 60 minutes warming up after powering on before carrying out zero adjustment.
  - Always repeat zero adjustment after changing input units.
  - In particular, if using the waveform calculation functions, to ensure accurate results, carry out zero adjustment first.
  - Carry out zero adjustment also if carrying out a system reset (see Section 16.5) by powering on the unit while holding down the STOP key.

(4) Input coupling

This indicates the method of coupling the input signal.

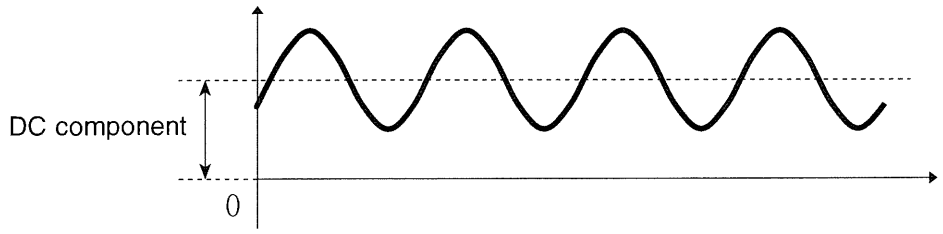
(a) GND

- No input signal is connected, and the effect is the same as if 0 V were applied.
- The position of 0 V can be confirmed.

(b) DC coupling

The input signal is connected directly to the amplifier, allowing both AC and DC components to be measured.

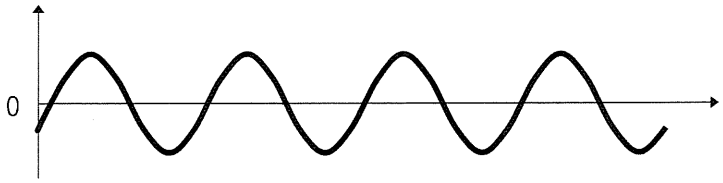
(Frequency characteristics: DC to 4 MHz $^{+1}_{-3}$dB)



(C) AC coupling

The input signal is connected with a capacitor in series, cutting any DC component. This allows only the AC component to be measured.

(Frequency characteristics: approximately 7 Hz to 4 MHz $^{+1}_{-3}$dB)



(5) Filter setting

This controls the frequency band of the built-in low pass filter.

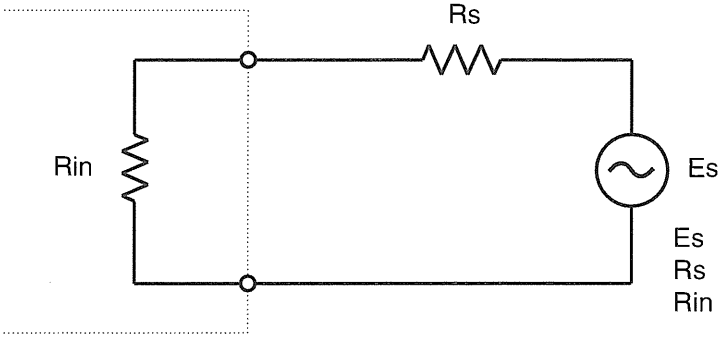
- Attenuation -6 dB/oct
- Cut-off frequency: approximately 5 Hz, 500 Hz or 500 kHz

This is effective for the following phenomena

- When recording the level of some signal in the recorder function, the recording trace is a broad line.
  (Because the combination of high sampling rate and high band amplifier can cause ripple or noise on the signal.)
- Ripple in the output of a transducer can make the recording trace into a broad line.

15.2.6 Measurement Errors Caused by Signal Source Internal Resistance

This problem only arises if the internal resistance of the signal source is not sufficiently low compared to the internal resistance of the 8853 unit. If it is high, it can lead to measurement errors.



Es signal voltage
Rs signal source resistance
Rin internal resistance

$$\text{Measurement error} = Es\left[1 - \frac{Rin}{Rs + Rin}\right]$$

Example The internal resistance of the 8853 is approximately 1 MΩ, and therefore if the signal source resistance is 10 kΩ the error is increased by approximately 1 %.

6

Chapter 16
Maintenance and Servicing

16.1 Fuse Replacement

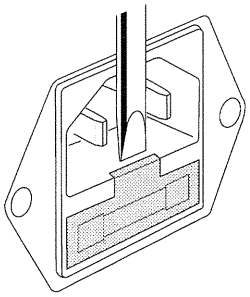
This section describes how to replace the fuse.

⚠ DANGER

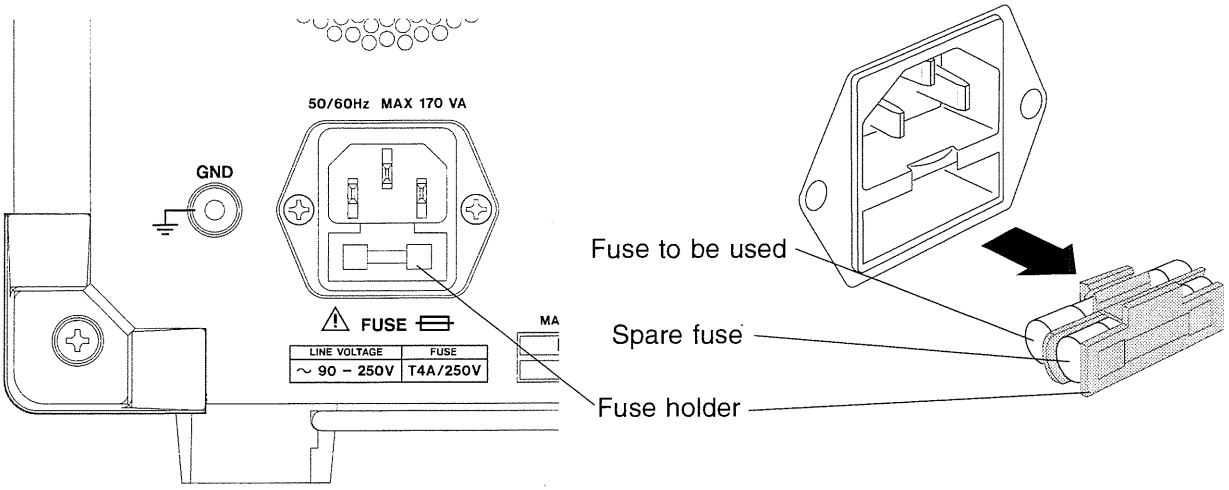
- **To avoid the danger of electric shock, always disconnect the power cord and input cables from the 8853 before changing the fuse.**
- **To ensure safe operation, use only a fuse with the correct rating as shown on the rear panel.**
- **If the fuse has blown, there is a possibility of an internal 8853 failure. Check the cause of the fault carefully before replacing the fuse.**
- **To ensure safe operation, use only a fuse of the correct rating.**

  Time-lag fuse T4 A/250 V, size 20 mm × 5 mm dia.

Procedure



1. Turn off the power switch on the 8853.
2. Remove the input cables and 8853 power cord.
3. Remove the fuse holder from the power supply connector with a blade screw driver etc.
4. Replace with the specified fuse.
   (At shipment, a spare fuse is fitted in the position as shown in the figure below.)
5. Insert the fuse holder into the power supply connector.
6. Reconnect the power cord.



16.2 Removing the Battery Before Ultimate Disposal

- The 8853 uses a lithium battery for memory backup.
- Before ultimate disposal of the 8853, remove the battery.
- This section describes how to remove the battery.

Procedure

1. Power off the unit, and remove the power cord and input cables.
2. Remove the screws holding the handle, the bottom panel, and the rear panel with a Phillips screwdriver. (Remove the two screws on the handle, and the four screws on the bottom and rear panels respectively.) (Figure 1, 2, and 3)
3. Move the top cover a little in the direction as shown in the figure 1 and remove the top cover, spreading the metal sheets on the sides in the directions as shown in the figure 3. (The top cover is removed easily by opening the stock cover for the printer.)

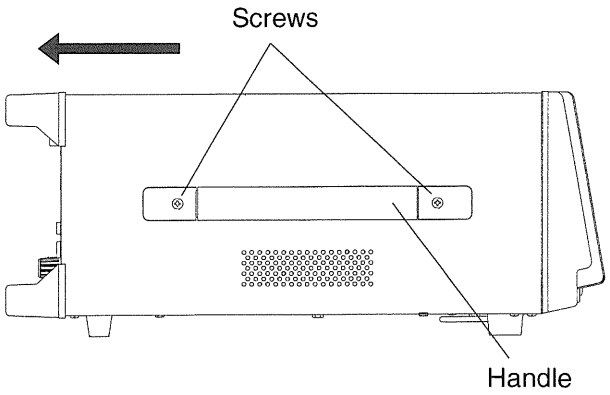


Figure 1 Left side

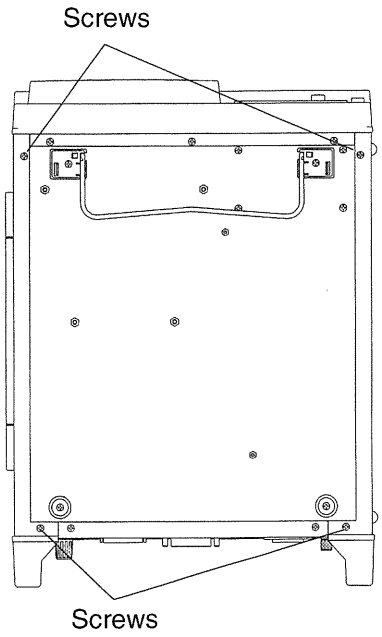


Figure 2 Bottom panel

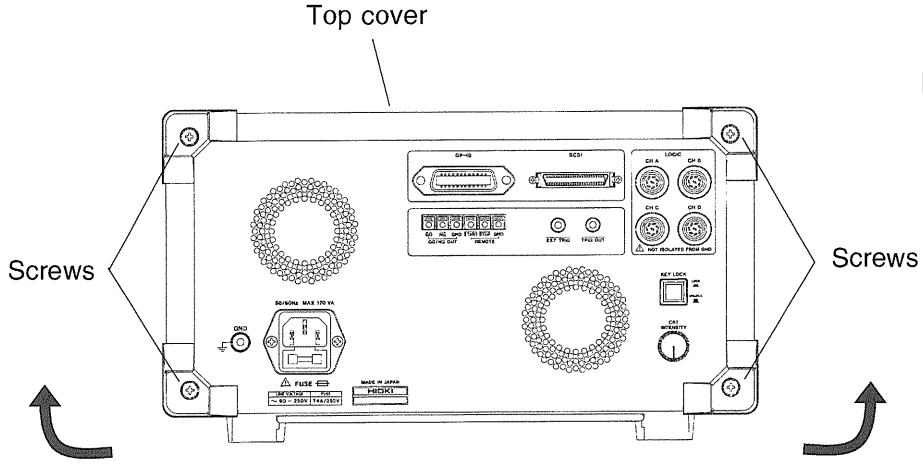


Figure 3 Rear panel

4. The battery is mounted with solder in the position as shown in the figure 4. Remove it, after cutting the both connections with nippers etc.

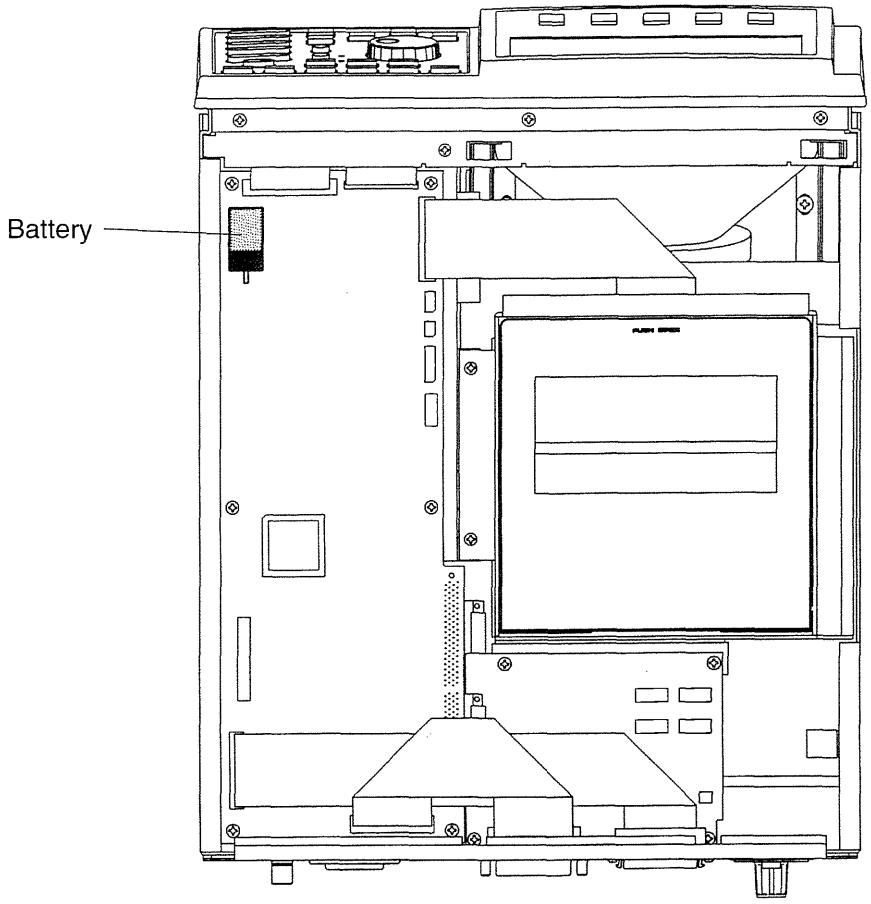


Figure4 Top view (after removing the top cover)

⚠ WARNING

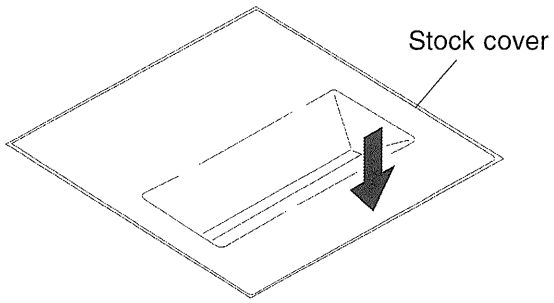
- **To avoid the danger of electric shock, always disconnect the input cables and the power cord before removing the battery.**
- **Dispose of the used batteries in the prescribed manner and in the proper location according to their types.**
- **Lithium is extremely poisonous, keep used batteries out of reach of children.**
- **The capacitors for the switching power supplies in the 8853 remain charged, even if the power cord is disconnected. To avoid the danger of electric shock, do not disassemble the unit in other procedure than described here.**

16.3 Printer

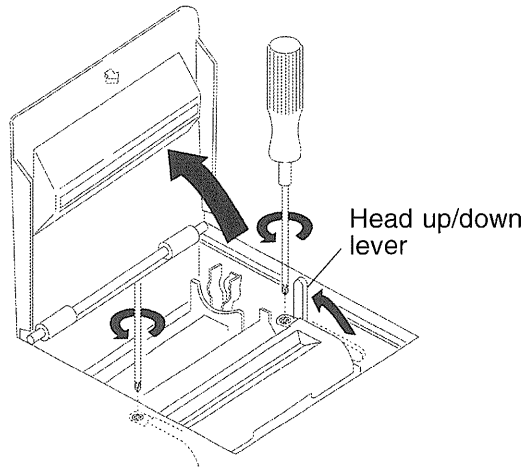
16.3.1 Cleaning the Printer Head

- The printer does not normally require any maintenance.
- With extended use, however, it is possible for dirt or paper dust to adhere to the thermal printer head, causing the printing to be faint or otherwise indistinct.
- If this occurs, use the following procedure to clean the printer head.

Procedure

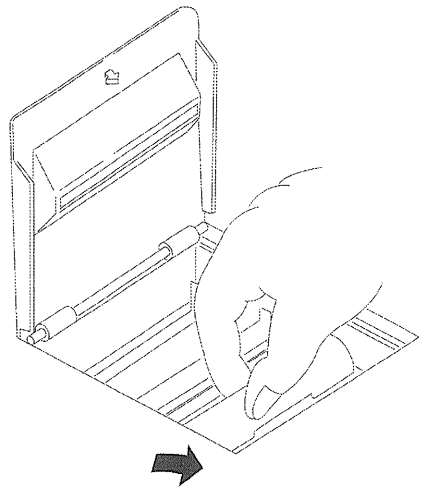


1. Open the stock cover.

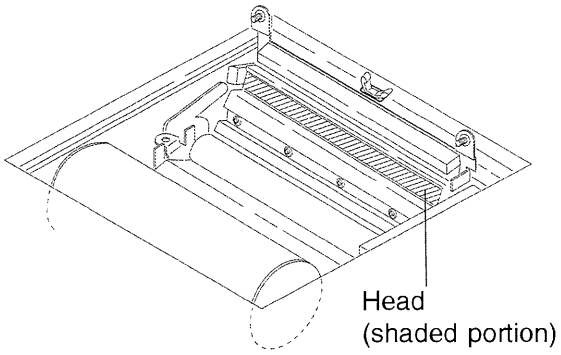


2. Raise the head up/down lever, then use a Phillips screwdriver to remove the two screws.

   (Leave the screws and the washers in the metal part containing the head.)



3. Reverse the metal part containing the head. Do not hold the roller and pull up, or the entire mechanism including the gears will come out. This can cause failure.



4. Apply some neat alcohol to a cotton swab, and use it to remove the dirt and dust from the head.

5. Reverse the disassembly procedure to reassemble the printer.

⚠ CAUTION

- Avoid any more than the minimum necessary adjustments or dismantling of the printer. This can lead to printer failure.
- Do not use thinners, benzine or other organic solvents. These can damage the head.
- After using alcohol, be sure that the printer is completely dry before operating it.

16.3.2 Printer Head Temperature Protection Function

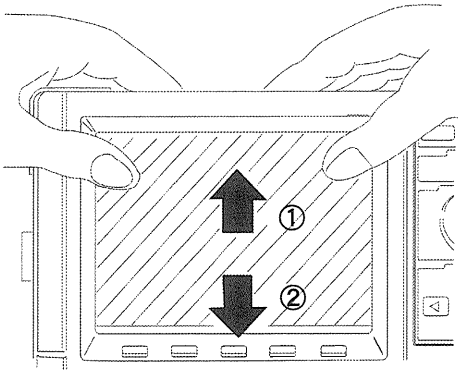
- The printer has a thermal head equipped with a temperature protection circuit.
- This stops printing, if the head temperature reaches a certain level. It is therefore possible for the printer to stop operating while in use, and temporarily feed blank paper.
- The tendency of the head temperature to rise is exacerbated by a greater black area being printed, and by a faster paper feed speed.
- Higher ambient temperatures make the head temperature rise.
- When the temperature protection circuit operates, disabling printing, once the head temperature has cooled appropriately printing is once more possible.
- If printing stops repeatedly, it may be advisable to adjust the ranges to reduce the area of black printed, or to change the recording style using LIGHT or DOT settings.

Related item A check can be made of printer printing capability. See Section 12.8.3, "Printer Check."

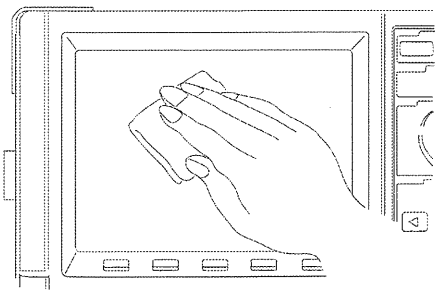
16.4 Cleaning the CRT Screen

- The screen has a cover to prevent dirt from getting at it.
- Depending on the conditions under which the unit is used, dirt may penetrate the small gap around the cover, and stick to the screen.
- If this occurs, use the following procedure to clean the screen.

Procedure

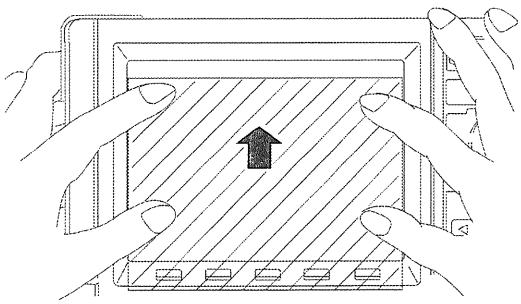


1. Press gently on the top left and right corners of the screen cover, sliding the cover upwards. The cover can then be detached from the bottom.



2. Clean the screen and both surfaces of the cover with a tissue or soft cloth steeped in neat alcohol, to remove dust and dirt.

   (You can use an antistatic preparation on both cover and screen to reduce the incidence of dust.)



3. Holding the left and right sides of the cover, and taking care not to pull the bottom toward you, slide the cover up in the rails.

   The bottom should click into place when the cover is properly positioned.

   (If you pull the bottom toward you while inserting the cover, it may not fit correctly into place.)

⚠ CAUTION

- Do not use thinners, benzine or other organic solvents. These can damage the cover.
- After using alcohol or antistatic preparation, be sure that the parts are completely dry before operating the unit.

16.5 Troubleshooting

If the unit is not functioning normally, check the following items before sending it for repair.

The screen and indicators do not light when powered on.	Is the power cord correctly connected?
	Has the fuse blown?
	Try adjusting the brightness control.
	Is the screen saver function (screen auto off) function enabled? Press any key to check whether the display comes back to life.
No waveform appears on the display when the START key is pressed.	Has the "pre-trig wait." message appeared? If the pre-trigger is set to 2 to 100 %, a trigger is not accepted during the time for the pre-trigger.
	Has the "wait for trig." message appeared? Check the trigger settings.
	Are all of the channels switched off?
	Is the timer trigger set?
There is absolutely no variation in the recorded waveform.	Is the measurement range setting correct?
	Is the input coupling set to GND?
	Is the low-pass filter being used?
The printed recording is very faint or nonexistent.	Is the recording paper back to front?
	Are you using the correct recording paper?
The apparent frequency of the recording is much lower than the expected frequency.	This is likely to be an aliasing error.
	Make the time axis range setting faster. See the background information (2) in Section 5.3.3, "Time Axis Range Setting."
The recording line is very thick in the recorder function.	A ripple component in the input signal may be the cause. Use the low-pass filter (see Section 6.3.7).
Only a portion of the waveform is printed out.	Are the A and B cursors being used? The waveform is printed partially, when using the A and B cursors. See Section 5.3.20, "Printing Waveform Recordings".
Only a portion of the waveform is saved.	Are the A and B cursors being used? The waveform is saved partially, when using the A and B cursors. See Section 13.8, "Partial Save Function".
The screen display is unstable.	Is the unit close to something producing a powerful magnetic field?
	Is the power supply voltage fluctuating?
The keys on the front panel do not operate.	Is the unit in the key lock state? (If so "--KEY LOCK--" will appear.) Press the KEY LOCK key to release the lock.
	Is the unit being remotely controlled through the GP-IB interface? (If so, "[LCL]" will appear.)

The FD screen does not appear, even if the FD key is pressed.	Is the FD key (see Section 12.5.10) set to SCSI? Set it to FD or FD&SCSI.
The SCSI screen does not appear, even if the FD key is pressed.	Is the FD key (see Section 12.5.10) set to FD? Set it to SCSI or FD&SCSI.
The waveform or cursor is not moved, or the numerical value is not altered, even if the rotary knob is turned.	Is the rotary knob function (see Section 4.2) correct?

If other operating problems occur which cannot be solved immediately, try carrying out a system reset.
This returns all settings to their default values at shipment. Then make all required settings again, and check whether performance is normal.

System reset

- Power on the unit while holding down the [STOP] key.
- Hold down the STOP key, until the display screen appears.
- Carry out zero adjustment (see Section 5.3.10), after execution.

*This is also available on the system screen. See Section 12.2 (3), "System Reset".

If the unit is not functioning properly, check the "Troubleshooting" list.

If a problem is found, contact your dealer or Hioki representative. Pack the unit carefully so that it will not be damage during transport, and write a detailed description of the problem. Hioki cannot bear any responsibility for damage that occurs during shipment.

Appendices

Appendix 1 Error and Warning Messages

The unit produces two levels of message to indicate problems. These are distinguished as follows.

Error messages

(1) The "ERROR" indication appears on the bottom line of the screen, followed by the message. This remains until the cause of the error is removed, or a proper key is pressed. (In some cases all keys other than the STOP key are disabled.)

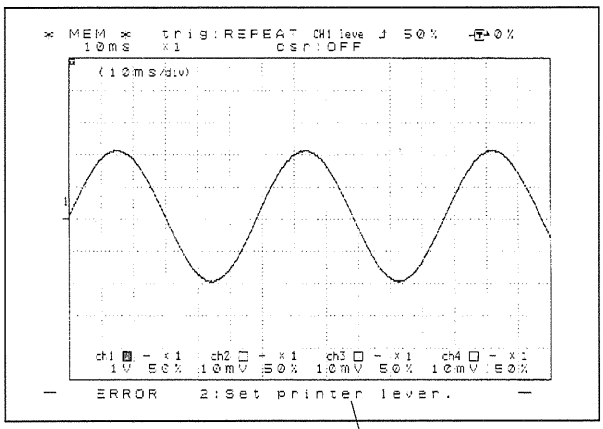
(2) If the "beep sound" (see Section 12.5.5) on the system screen is set to ON, then the beeper sounds intermittently while the message is displayed.

Warning messages

(1) The "WARNING" indication is displayed on the bottom line of the screen, followed by the message, but disappears after a few seconds.

(2) Warning messages also disappear if any key is pressed.

(3) If the "beep sound" (see Section 12.5.5) on the system screen is set to ON, then the beeper sounds once only when the message is displayed.



① Error Messages

ERROR 1: Set printer paper.	Printer paper has run out. Reload.
ERROR 2: Set printer lever.	The head up/down lever has been left in the up position. Lower it.
ERROR 3: No waveform data.	There is no waveform data present. Press the START key to capture data.
ERROR 41: Bad A&B cursor position.	Move the A and B cursors to appropriate positions for the current operation.
ERROR 70: Set Floppy disk.	No disk is present in the floppy disk drive. Insert one.
ERROR 71: Can't load. (not 8853)	File cannot be loaded, because it is not a set of data created by the 8853.
ERROR 72: Illegal format.	The floppy disk is not a correctly formatted MS-DOS disk.
ERROR 73: Write Protect.	The floppy disk is write-protected. Change the write-protect setting or use a different disk.
ERROR 74: Disk full.	There is insufficient space remaining on the floppy disk.
ERROR 75: Access Read Only file.	File cannot be written or deleted, because it is read-only.
ERROR 76: General failure.	Access to disk is not possible because of some low-level error, such as in formatting or file saving.
ERROR 80: SCSI device not ready.	SCSI device is not ready.
ERROR 81: SCSI selection timeout.	Specified SCSI device is not found.
ERROR 82: Not Hard disk.	Specified SCSI device is not a hard disk.
ERROR 83: SCSI reset condition.	Reset from other SCSI device.
ERROR 84: SCSI device reserve.	Specified SCSI device is reserved by other SCSI device.
ERROR 85: Illegal format.	Hard disk is a wrong format.
ERROR 86: Hard ware error.	Hardware error occurred.
ERROR 87: Hard disk type mismatch.	This hard disk cannot be used.
ERROR 92: File type mismatch.	This file cannot be loaded.
ERROR 93: Directory full.	No further files cannot be stored in current directory on hard disk.
ERROR 94: Directory not empty.	Directory is non-empty, and cannot be deleted.
ERROR 95: Disk full.	There is insufficient space remaining on the hard disk.
ERROR 96: Same file exists.	Directory cannot be created because file of same name already exists.
ERROR 97: Path name error.	Path length exceeds 60 characters.

② Warning Messages

WARNING 205: Invalid. (START)	The key pressed is not valid, because measurement operation is in progress.
WARNING 206: No calc. (AVERAGE)	Because the averaging function is enabled, waveform processing calculation is not possible during measurement operation.
WARNING 207: Fault AUTO range.	The auto ranging function has failed. Check the input signal.
WARNING 208: Can't SAVE. (Write Protect)	The auto save function has failed, because the floppy disk in the drive is write-protected. Change the write-protect setting or use a different disk.
WARNING 209: Can't SAVE. (Disk Full)	The auto save function has failed, because there is insufficient space remaining on the floppy disk.
WARNING 210: Can't SAVE. (FD not Ready)	There is no floppy disk in the floppy disk drive.
WARNING 211: Can't SAVE. (General failure)	The auto save function has failed.
WARNING 212: Bad A&B cursor position.	The A and B cursors art not suitably positioned.
WARNING 217: Hardware error.	Hardware error occurred.
WARNING 301: Invalid key. (SYSTEM)	The key pressed is not valid on the system screen.
WARNING 327: Invalid key. (FFT)	The key pressed is not valid in the FFT function.
WARNING 328: Invalid. (Over write)	Operation is not possible, since the superimposition function (see Section 5.3.18) is enabled.
WARNING 329: Wrong format. (Dual)	Since the format is DUAL or DUAL (print QUAD), a waveform decision is not possible.
WARNING 330: Invalid. (SHOT too long)	The recording length is too long for the operation to be carried out.
WARNING 331: Invalid. (AVERAGE)	Since the averaging function is enabled, the memory segmentation function cannot be set.
WARNING 333: Invalid. (Using CH 1ch)	Since the number of channel to be used is set to one channel, averaging and waveform processing calculations cannot be carried out.
WARNING 334: Invalid. (Using CH 2ch)	Since the number of channels to be used is set to two channels, averaging and waveform processing calculations cannot be carried out.
WARNING 335: Invalid. (SEQUENTIAL)	Since memory segmentation (sequential save) is in use, operation cannot be carried out.
WARNING 336: Invalid. (MULTI BLOCK)	Since memory segmentation (multi-block) is in use, operation cannot be carried out.
WARNING 337: Invalid. (ROLL MODE)	Since the roll mode function is enabled, operation is not possible.
WARNING 338: Invalid. (COMPARISON)	Since the waveform decision function is enabled, operation is not possible.
WARNING 339: Invalid key. (STATUS)	On the status screen, the key pressed is invalid.
WARNING 340: Invalid. (MEM DATA)	Since the reference data is MEM DATA, averaging cannot be carried out.

WARNING 350: Can't select. (AND trig)	This selection is not possible, since the trigger logical operator is set to AND.
WARNING 351: Invalid. (Free run)	The pre-trigger setting cannot be made, since all trigger sources are switched off (free run).
WARNING 352: Invalid key. (TRIG)	On the trigger screen, the key pressed is invalid.
WARNING 380: No reference data.	When using the memory segmentation function (multi-block), there is no data in the reference block.
WARNING 381: Ref. block = using block	When using the memory segmentation function (multi-block), the reference block and the block specified by the "using block" item are the same.
WARNING 382: No waveform data.	Because there is no waveform data present, it cannot be displayed. Press the START key to capture data.
WARNING 384: Different REF shot.	The recording lengths are different for the reference block and the using block. (See Section 9.3.) Capture data with the recording lengths set the same.
WARNING 385: Different REF time/div.	The time axis ranges are different for the reference block and the using block. (See Section 9.3.) Capture data with the time axis ranges set the same.
WARNING 386: Invalid key. (RECORDER)	In the recorder function, the key pressed is invalid.
WARNING 387: Invalid key. (X-Ycont)	In the X-Y recorder function, the key pressed is invalid.
WARNING 389: Insufficient storage data.	There is insufficient data for FFT calculation (when the reference data is MEM DATA). Secure 800 points (20 divisions) of data, by setting the recording length longer or moving the positions of the A and B cursors.
WARNING 391: Can't set over up level.	The lower limit for the window trigger cannot be set over the upper limit.
WARNING 392: Can't set under low level.	The upper limit for the window trigger cannot be set under the lower limit.
WARNING 393: Can't set drawing off CH.	The channel for which drawing is off cannot selected.
WARNING 394: Can't set x-axis.	The channel set on the x-axis cannot be selected.
WARNING 395: Can't set no unit CH.	Since no input unit is fitted, the setting cannot be made.
WARNING 396: No comparison AREA.	The waveform decision area is not set.

Appendix 2 Glossary

Aliasing error	The phenomenon of not obtaining an accurate signal waveform, due to aliasing distortion. See Background (2) in Section 5.3.3.
CH	Used as an abbreviation for channel. "CH3" means channel 3; "4ch" means four channels.
Cutoff frequency	The frequency for which the output of a filter falls below $1/\sqrt{2}$ (-3 dB) of the input.
Dark	High intensity display or recording. This is "blackboard" terminology when the display is white on black.
DIV	A unit corresponding to one division of the chart scale.
Full span voltage	The voltage difference corresponding to 10 divisions.
GO	Pass result for a waveform decision.
Light	Low intensity display or recording. This is "blackboard" terminology when the display is white on black.
MS-DOS	Personal computer operating system. MS-DOS is a registered trademark of Microsoft Corporation.
NG	Fail result for a waveform decision.
PC-9801	Series of personal computers manufactured by NEC and using a Japanese-language version of MS-DOS.
Position	When referring to the position of the waveform along the voltage axis on the display, this refers more precisely to the origin, that is the position corresponding to 0 V.
Pre-trigger	Refers to recording the waveform before the trigger. This value is represented as the percentage of the whole recording length coming before the trigger.
PT	Voltage transformer
Recording length	The length which is always expressed in terms of divisions.
Scaling	The conversion of an input voltage to some convenient external units.
Timer trigger	Trigger function using the clock for fixed real time triggering.
Trigger timing	Determines whether the trigger controls starting, stopping, or both.
Unbalanced input	When one of two input terminals is used as the reference for the signal.
Word	The amount of memory representing a single sampled value digitally.

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