

HIOKI

Instruction Manual

8826

MEMORY HiCORDER

HIOKI E. E. CORPORATION

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Errata

[p. ii] Options

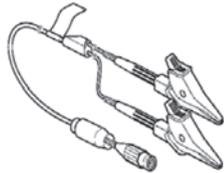
Incorrect	9197 CONNECTION CORD (for high voltage, maximum input voltage 500 V)
Correct	9197 CONNECTION CORD (for high voltage, maximum input voltage 600 V)
Added	<u>L9197 CONNECTION CORD (for high voltage, maximum input voltage 600 V)</u>

[p. vii] Grounding the unit

Incorrect	To avoid electric shock and ensure safe operation, connect the power cable to a grounded (3-contact) outlet. (refer to Section 2.2).
Correct	To avoid electrical accidents and to maintain the safety specifications of this instrument, connect the power cord <u>provided</u> only to a 3-contact (two-conductor + ground) outlet. (refer to Section 2.2).

[p. 14] 2.4.1 8936 ANALOG UNIT / 8938 FFT ANALOG UNIT

Incorrect	9197 CONNECTION CORD (Max. input voltage 500 V)
Correct	9197 CONNECTION CORD (Max. input voltage 600 V)
Added	<u>L9197 CONNECTION CORD (Max. input voltage 600 V)</u>



[p. 453, p. 454] 18.1 General Specifications

Operating place

Incorrect	Max. 2000 m height, indoors
Correct	Indoors, Pollution Degree 2 , Max. 2000 m height

Dielectric strength

Incorrect	One minute at 1.35 kVAC between the main unit and the power supply
Correct	<u>One minute at 1.5 kVAC</u> between the main unit and the power supply <u>anticipated transient overvoltage 4000 V</u>

Standard applying

Incorrect	EMC EN61326, ClassA EN 6100-3-2 EN 61000-3-3 Safety EN61010 Pollution Degree 2, measurement category II (anticipated transient overvoltage 4000 V)
Correct	EMC EN61326, ClassA EN 6100-3-2 EN 61000-3-3 Safety EN61010

[p. 475] 19.2.1 8936 ANALOG UNIT

[p. 478] 19.2.3 8938 FFT ANALOG UNIT

Maximum rated voltage to earth

Incorrect	370 V AC/DC (between each input channel and main unit, and between input channels)
Correct	370 V AC/DC (between each input channel and main unit, and between input channels) measurement category II (anticipated transient overvoltage 4000 V)

Standard Applying

Incorrect	EMC EN61326, ClassA Safety EN61010 Pollution Degree 2, measurement category II (anticipated transient overvoltage 4000 V)
Correct	EMC EN61326, ClassA Safety EN61010

[p. 477] 19.2.2 8937 VOLTAGE/TEMP UNIT

[p. 479] 19.2.4 8939 STRAIN UNIT

[p. 480] 19.2.5 8940 F/V UNIT

[p. 482, p. 484] 19.2.6 8947 CHARGE UNIT

Maximum rated voltage to earth

Incorrect	30 V rms or 60 V DC
Correct	30 V rms or 60 V DC anticipated transient overvoltage 330 V

Standard Applying

Incorrect	EMC EN61326, ClassA Safety EN61010 Pollution Degree 2, measurement category I (anticipated transient overvoltage 330 V)
Correct	EMC EN61326, ClassA Safety EN61010

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Introduction

Thank you for purchasing the HIOKI "8826 MEMORY HiCORDER". To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference.

Inspection

- When you receive the instrument, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the accessories, panel switches, and connectors.
- If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

Accessories

Power cord	1
9229 RECORDING PAPER	1
Protective cover	1
Roll paper attachment	2
PC card protector	1
Connector cable label	1
Instruction Manual	1
Application Disk (CD-R)	1

Options

8936 ANALOG UNIT
 8937 VOLTAGE/TEMP UNIT
 8938 FFT ANALOG UNIT
 8939 STRAIN UNIT
 8940 F/V UNIT
 8947 CHARGE UNIT
 9557 RS-232C CARD
 9558 GP-IB CARD
 9559 PRINTER CARD
 9578 10BASE-T LAN CARD
 9626 PC CARD 32M
 9627 PC CARD 64M
 9726 PC CARD 128M
 9727 PC CARD 256M
 9728 PC CARD 512M
 9729 PC CARD 1G
 9598 MO UNIT
 9599 MEMORY BOARD (48 M words)
 9229 RECORDING PAPER (6 rolls)
 9229-01 RECORDING PAPER (PERFORATED) (6 rolls)
 9197 CONNECTION CORD (for high voltage, maximum input voltage 500 V)
 L9198 CONNECTION CORD (for low voltage, maximum input voltage 300 V)
 9199 CONVERSION ADAPTOR (BNC-BANANA)
 L9217 CONNECTION CORD (BNC - BNC)
 9320 LOGIC PROBE (maximum input voltage 50 V)
 MR9321 LOGIC PROBE (maximum input voltage 250 V)
 *9303 PT
 9318 CONVERSION CABLE (For 9270 to 72, 9277 to 79)
 9319 CONVERSION CABLE (For 3273)
 9322 DIFFERENTIAL PROBE
 9324 POWER CORD (for logic connector)
 9325 POWER CORD (for the 8940 F/V UNIT sensor connector)
 3273 CLAMP ON PROBE (15 A, DC to 50 MHz)
 3273-50 CLAMP ON PROBE (30 A, DC to 50 MHz)
 *9018-10 CLAMP ON PROBE (10 to 500 A, 40 Hz to 3 kHz)
 *9132-10 CLAMP ON PROBE (20 to 1000 A, 40 Hz to 1 kHz)
 *9270 CLAMP ON SENSOR (20 A, 5 Hz to 5 kHz)
 *9271 CLAMP ON SENSOR (200 A, 5 Hz to 50 kHz)
 *9272 CLAMP ON SENSOR (20/200 A, 5 Hz to 10 kHz)
 9277 UNIVERSAL CLAMP ON CT (20 A, DC to 100 kHz)
 9278 UNIVERSAL CLAMP ON CT (200 A, DC to 100 kHz)
 *9279 UNIVERSAL CLAMP ON CT (500 A, DC to 20 kHz)
 *9555 SENSOR UNIT (used with the 9270 to 9272, and the 9277 to 9279)
 8910 CAN ADAPER
 9333 LAN COMMUNICATOR
 9555 WAVE PROCESSOR

NOTE

- *: Not complied with the CE marking
- The 9270 to 9272 CLAMP ON SENSORS and the 9277 to 9279 UNIVERSAL CLAMP ON CTs are used with the 9555 SENSOR UNIT. They cannot be used by themselves.

Safety Notes



This instrument is designed to comply with IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the instrument. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from instrument defects.

Safety symbols

This manual contains information and warnings essential for safe operation of the instrument and for maintaining it in safe operating condition. Before using the instrument, be sure to carefully read the following safety notes.

	<ul style="list-style-type: none"> • The symbol printed on the instrument indicates that the user should refer to a corresponding topic in the manual (marked with the symbol) before using the relevant function. • In the manual, the symbol indicates particularly important information that the user should read before using the instrument.
	Indicates a grounding terminal.
	Indicates AC (Alternating Current).
	Indicates DC (Direct Current).
	Indicates both DC (Direct Current) and AC (Alternating Current).
	Indicates the ON side of the power switch.
	Indicates the OFF side of the power switch.

Accuracy

We define measurement tolerances in terms of f.s. (full scale) with the following meanings:

f.s. (maximum display value or scale length)

The maximum displayable value or scale length. This is usually the name of the currently selected range.

Conventions used in this manual

The following symbols in this manual indicate the relative importance of cautions and warnings.

	<p>Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.</p>
	<p>Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.</p>
	<p>Indicates that incorrect operation presents a possibility of injury to the user or damage to the instrument.</p>
	<p>Advisory items related to performance or correct operation of the instrument.</p>

Measurement categories

This instrument complies with CAT II safety requirements.

To ensure safe operation of measurement instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories. These are defined as follows..

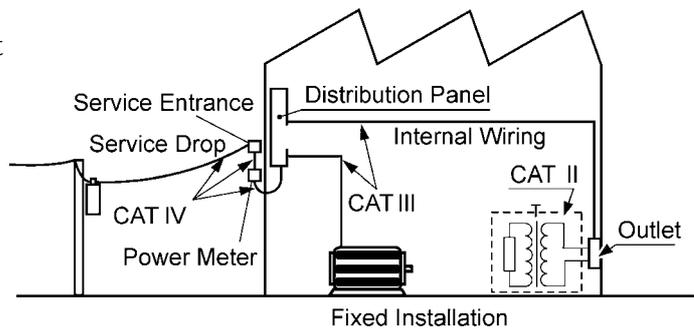
CAT II: Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)
 CAT II covers directly measuring electrical outlet receptacles.

CAT III: Primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.

CAT IV: The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).

Using a measurement instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.

Use of a measurement instrument that is not CAT-rated in CAT II to CAT IV measurement applications could result in a severe accident, and must be carefully avoided.



Notes on Use



Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

⚠ DANGER

Probe Connection, Measurement Voltage Input

- **Maximum input voltage ratings for the input units and the input terminals of the 8826 are shown below. To avoid the risk of electric shock and damage to the units, take care not to exceed these ratings.**
- **The maximum rated voltage to earth of the input units (voltage between input terminals and 8826 frame ground, and between inputs of other analog units) is shown below. To avoid the risk of electric shock and damage to the units, take care that voltage between channels and between a channel and ground does not exceed these ratings.**

Input/output terminal	Maximum input voltage	Maximum rated voltage to earth
8936 inputs	400 V DC max.	370 V AC/DC
8937 inputs	30 V rms or 60 V DC	30 V rms or 60 V DC
8938 inputs	400 V DC max.	370 V AC/DC
8939 inputs	10 V DC max.	30 V rms or 60 V DC
8940 inputs	30 V rms or 60 V DC (BNC/Sensor connector terminal)	<ul style="list-style-type: none"> • 30 V rms or 60 V DC (BNC terminal) • Not insulated (Sensor connector terminal)
8947 inputs	30 V rms or 60 V DC (BNC terminal)	30 V rms or 60 V DC (BNC terminal)
The maximum allowable charge that can be applied to the miniature connection terminals is 500 pC at the most sensitive of the six ranges, and 50,000 pC at the least sensitive range.		
EXT TRIG START · STOP PRINT EXT SMPL	-5 to +10 V DC	Not insulated
TRIG OUT GO NG	-20 V to +30 V DC 500 mA max. 200 mW max.	
9322 DIFFERENTIAL PROBE	2000 V DCmax. 1000 V ACmax.	1500 V AC/DC (when using grabber clips) 1000 V AC/DC (when using alligator clips)

⚠ DANGER

- The external I/O terminal and the unit have a common GND.
- The maximum rated voltage to earth rating applies also if an input attenuator or similar is used. Ensure that voltage does not exceed these ratings.
- When measuring power line voltages with the 8936 or 8938, always connect the probe to the secondary side of the circuit breaker. Connection to the primary side involves the risk of electric shock and damage to the units.
- Before using the instrument, make sure that the insulation on the connection cords is undamaged and that no bare conductors are improperly exposed. Using the instrument under such conditions could result in electrocution. Replace the connection cords specified by Hioki.
- To prevent an electric shock accident, confirm that the white or red portion (insulation layer) inside the cable is not exposed. If a color inside the cable is exposed, do not use the cable.

Logic Probe Connection

The logic input and 8826 Unit share a common ground. Therefore, if power is supplied to the measurement object of the logic probe and to the 8826 from different sources, an electric shock or damage to the equipment may result. Even if power is supplied from the same system, if the wiring is such that a potential difference is present between the grounds, current will flow through the logic probe so that the measurement object and 8826 could be damaged. We therefore recommend the following connection method to avoid this kind of result. Refer to Section 2.5 for details.

- (1) Before connecting the logic probe to the measurement object, be sure that power is supplied from the same outlet box to the measurement object and the 8826 using the supplied grounded 2-wire power cord.
- (2) Before connecting the logic probe to the measurement object, connect the ground of the measurement object to the 8826 ground terminal. Also in this case, power should be supplied from the same source. Refer to Section 2.2 for grounding terminal details.

 **WARNING**

Replacing the input units

- To avoid electric shock accident, before removing or replacing an input module, confirm that the instrument is turned off and that the power cord, connection cords, and thermocouples are disconnected.
- To avoid the danger of electric shock, never operate the instrument with an input module removed. To use the instrument after removing an input module, install a blank panel over the opening of the removed module.

Preliminary Checks

- Before using the instrument the first time, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.
- Before using the instrument, make sure that the insulation on the connection cords is undamaged and that no bare conductors are improperly exposed. Using the instrument under such conditions could result in electrocution. Replace the connection cords specified by Hioki.

Power supply connections

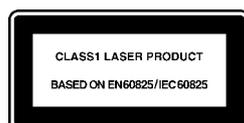
- Before turning the instrument on, make sure the source voltage matches that indicated on the instrument's power connector. Connection to an improper supply voltage may damage the instrument and present an electrical hazard.

Grounding the unit

- To avoid electric shock and ensure safe operation, connect the power cable to a grounded (3-contact) outlet. (refer to Section 2.2).

Usage Precautions for the Internal MO Drive (option)

- Please do not attempt to disassemble the MO drive.
- Laser radiation can be emitted when the MO drive is open. Avoid looking directly into the laser when the MO drive is open. Maximum laser output is 50 mW (at 685 nm, pulsed).



A laser warning label is attached to the bottom of the 8826 Unit. Refer to Section 1.2 for the label location.

 **CAUTION****Installation environment**

- This instrument should be installed and operated indoors only, between 5 and 40 °C and 35 to 80% RH.
- Do not store or use the instrument where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the instrument may be damaged and insulation may deteriorate so that it no longer meets specifications.
- To avoid electric shock, do not allow the instrument to get wet, and do not use it when your hands are wet.
- Do not use the instrument where it may be exposed to corrosive or combustible gases. The instrument may be damaged or cause an explosion.
- This instrument may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Before powering on

- The microgap power switch construction necessitates that the instrument be used near a power outlet. When not in use and while making connections to the circuit to be tested, disconnect the instrument from the power source by unplugging it from the outlet.

Using a connection cable

- Use only the specified connection cord. Using a non-specified cable may result in incorrect measurements due to poor connection or other reasons.

Storing

- When the unit is not to be used for an extended period, set the head up/down lever to the "head up" position. This will protect the printer head and prevent deformation of the rubber roller.

Precautions on carrying this equipment

- The terminal guard of the equipment protects the inputs. Do not hold this guard when carrying the equipment. To carry this equipment, use the handle. See section 1.2.

Shipping

- Remove the printer paper from the unit. If the paper is left in the unit, paper support parts may be damaged due to vibrations.
- To avoid damage to the instrument, be sure to remove the floppy disk, MO disk, PC card, and SCSI cable before shipping.

NOTE**Using a printer**

- Avoid using the printer in hot, humid environments, as this can greatly reduce printer life.

Recording paper

- This unit uses a thermal printer. The recording paper supplied has characteristics finely tuned for use with the printer. Using recording paper of a different specification may not only result in impaired printing quality, but even prevent the printer from operating. Always use the HIOKI specified instrument.
- Printing is not possible if the recording paper is loaded wrong-side up. (See Section 2.8)

Chapter Summary

Chapter 1	Product Overview Contains an overview of the unit and its features.
Chapter 2	Installation and Preparation Explains how to set the unit up for measurement.
Chapter 3	Basic Key Operation Explains how to operate the keys and the JOG/SHUTTLE control for carrying out basic measurement functions.
Chapter 4	Memory Recorder Function Explains how to use the memory recorder functions of the unit.
Chapter 5	Recorder Function Explains how to use the recorder functions of the unit.
Chapter 6	RMS Recorder Function Explains how to use the RMS recorder functions of the unit.
Chapter 7	Recorder & Memory Function Explains how to use the Recorder & Memory Functions of the unit.
Chapter 8	FFT Function Explains how to use the FFT recorder functions of the unit.
Chapter 9	Input Channel Settings Explains how to make settings using the channel setting screen.
Chapter 10	Trigger Functions Explains how to use the trigger functions of the unit.
Chapter 11	Display Screen Operation Explains how to perform waveform scrolling, how to use the A/B cursors and so.
Chapter 12	System Screen Settings Explains how to make settings using the system setting screen.
Chapter 13	Printout of Measurement Data Explains how to print out measurement data and how to read printed charts.
Chapter 14	Storing Measurement Data Explains how to store, recall, and delete measurement data and measurement settings.
Chapter 15	Memory Segmentation Function Explains how to use the Memory Segmentation Function.

Chapter 16	Waveform Operation Function Explains how to use the Calculating, Waveform Parameters/Evaluating Parameter value and Waveform GO/NG Evaluation.
Chapter 17	External Input/Output Terminals Gives specifications and usage details of the external input/output terminals, and explains how to use the key lock function.
Chapter 18	Specifications Contains general specifications and detailed function specifications.
Chapter 19	Logic and Analog Inputs Contains specifications and precautions for logic input section and input amplifier units.
Chapter 20	Maintenance and Service Describes maintenance procedures.
Chapter 21	Appendix Contains information that is necessary for using this unit, including a description of error messages, a glossary, and an explanation how to increase memory.

Chapter 1

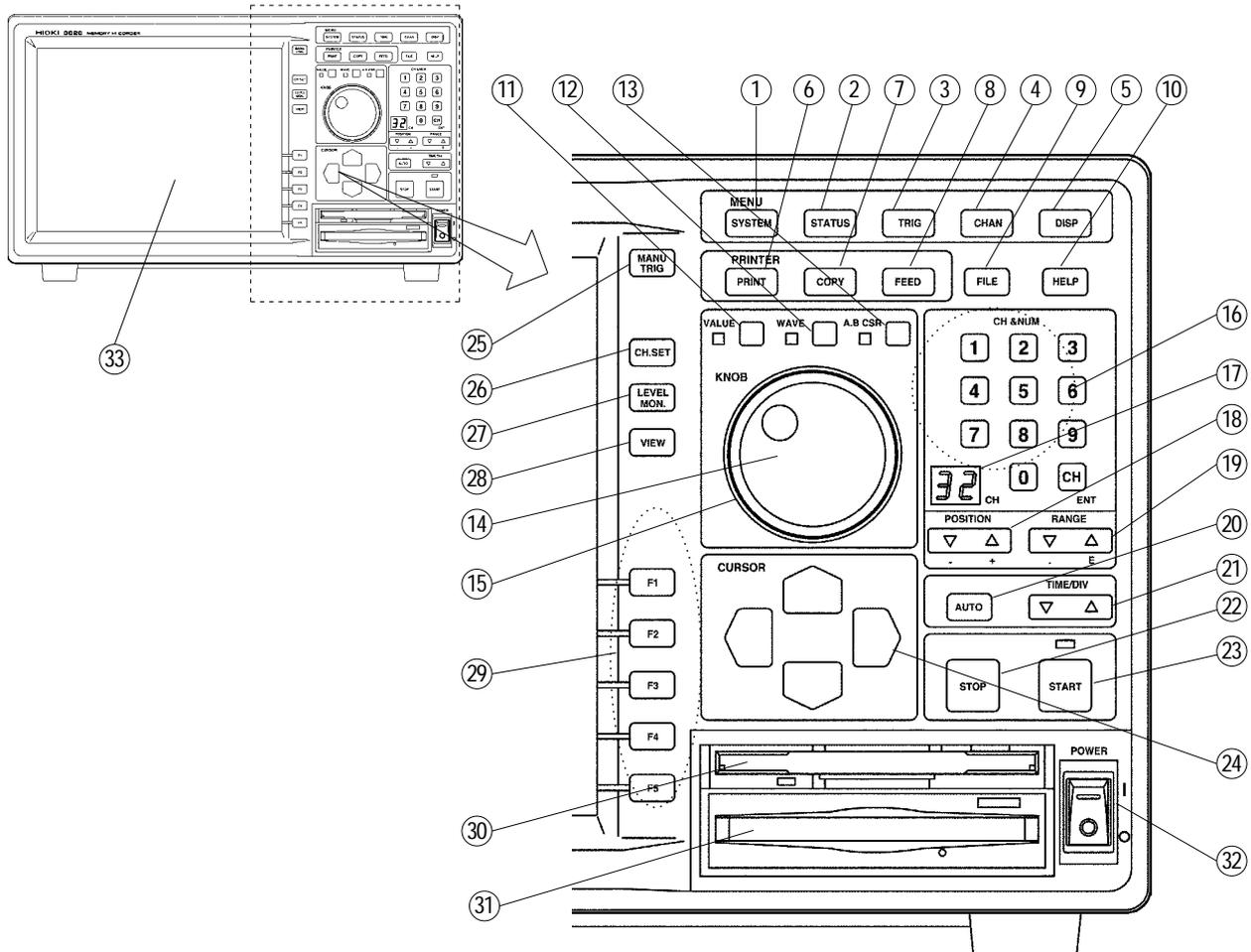
Product Overview

1.1 Major Features

- (1) Powerful waveform capture capability
 - Using the analog unit 8936 (unbalanced), waveform recording can be performed in up to 32 channels with 12-bit resolution.
- (2) Easy to read, TFT color display
 - The 10.4-inch TFT color screen with a resolution of 640 × 480 dots shows all information at a glance.
- (3) Five functions to meet a huge range of applications
 - Memory recorder with up to 1 μs (all channels simultaneously) (1 MS/s)
 - Real-time recording capability to paper in recorder function
 - RMS recorder function for recording rms values of AC power supply lines and DC sources.
 - Recorder & Memory Recorder function provides combined recorder and memory recorder functions
 - FFT function offers 12 types of analysis functions
- (4) Large capacity memory of max. 16 M words
 - The memory is expandable up to 64 M words. (option)
- (5) Flexible trigger function
 - Digital trigger circuit
 - Trigger types: level trigger, window-in trigger, window-out trigger, voltage drop trigger, RMS level trigger, logic trigger
- (6) Simple function key interface (GUI)
 - Thanks to its GUI-inspired design using large function key graphics, the unit is easy to set up and operate.
- (7) On-line help
 - On-line help guides the user through operation steps and various functions.
- (8) Scaling function
 - By setting the physical amount and the unit to be used for 1 V input, the measurement result can be converted into any desired scale.
- (9) Additional recording function
 - When enabled, the memory is regarded as printer paper.
- (10) Floating input units
 - The analog inputs are floating, and so each input can be connected to its own independent potentials.
- (11) Built-in thermal printer
 - Thermal line head
 - The built-in printer delivers waveform printouts on the spot.
 - The printer can also be used to print screen shots and parameter information.
 - Report print (B4 size) can be printed.

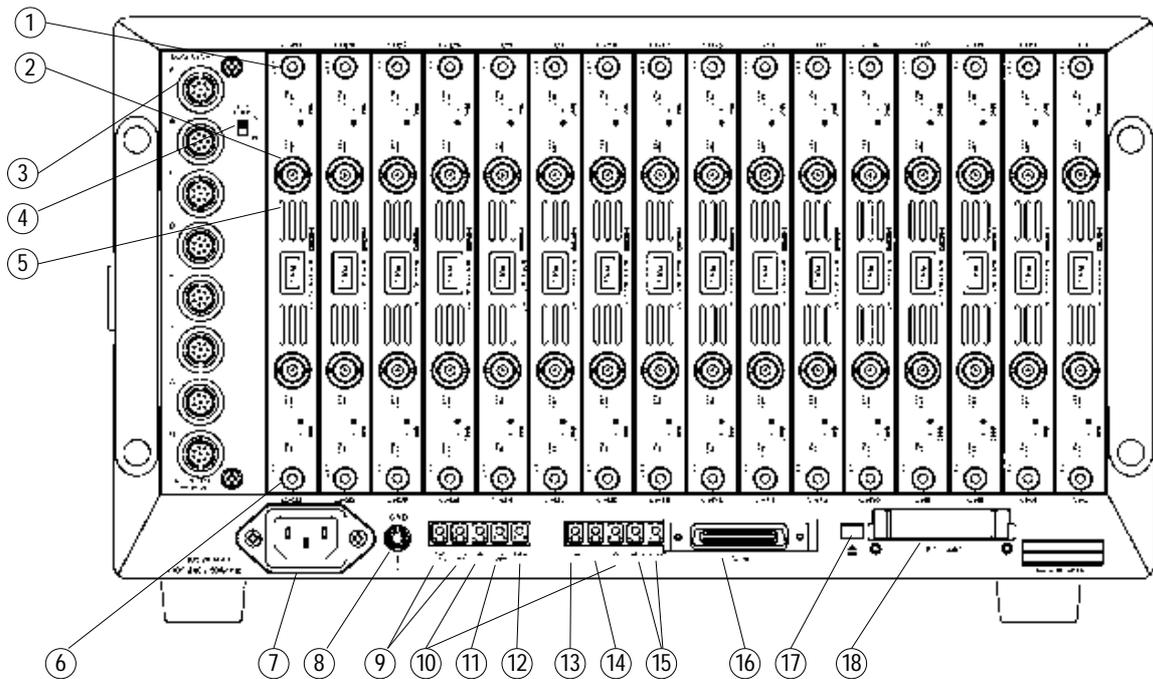
- (12) The floppy-disk drive, MO drive (option), and PC card can be used as external storage means.
- The waveform data and/or setup conditions can be stored on a floppy disk, MO disk, or PC card (SRAM, flash ATA, or HDD card).
- (13) SCSI and PC card slots are originally equipped as external interfaces.
- If a MO drive is connected to the SCSI interface, the waveform data and/or setup conditions can be stored on a MO disk.
 - A GP-IB card, RS-232C card, 10BASE-T LAN card, and printer card can be inserted into the PC card slot.
- (14) GP-IB and RS-232C interface
- Remote control including input unit is possible.
- (15) Color print
- If a color printer is connected to the printer card, the data can be printed in color.
- (16) Dual-language capability
- Display language is switchable between Japanese and English.

1.2 Names and Function of Parts



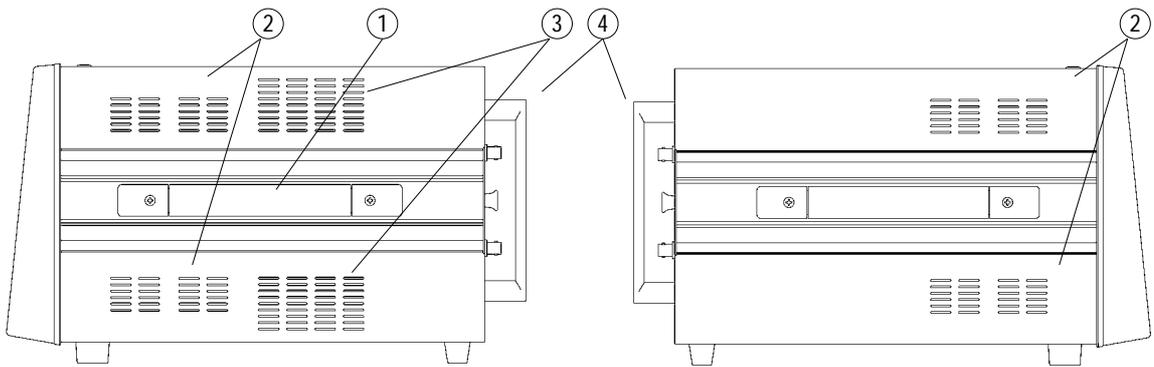
- | | |
|---|--|
| <p>① SYSTEM key</p> <p>② STATUS key</p> <p>③ TRIG key</p> <p>④ CHAN key</p> <p>⑤ DISP key</p> <p>⑥ PRINT key</p> <p>⑦ COPY key</p> <p>⑧ FEED key</p> <p>⑨ FILE key</p> | <ul style="list-style-type: none"> • Causes the display to show the SYSTEM screen which serves for making system-wide settings such as for the scaling function. • Causes the display to show the STATUS screen which serves for setting most measurement parameters. • Causes the display to show the TRIGGER screen. Setting the trigger functions. • Causes the display to show the CHANNEL screen which serves for making input channel settings. • Causes the display to show measurement and analysis results. • The display size can be change the normal size or wide size. • Serves to print out stored waveforms. • Output destination by the PRINT key set the SYSTEM4 screen. • Serves to print out a hard copy of the current screen display. • Copy destination by the COPY key set the SYSTEM4 screen • Causes the printer paper to advance for as long as the key is pressed. • Causes the display to show the FILE screen which serves for reading, storing, etc. the waveform data etc. |
|---|--|

- ⑩ **HELP** key • Provides on-line help.
- ⑪ **VALUE** key • Uses to set numerical values
- ⑫ **WAVE** key • Uses to scroll the waveform.
- ⑬ **A·B CSR** key • Uses to move the A/B cursor.
- ⑭ **JOG** • Rotary control knob that serves to change values, move the A/B cursors, and scroll the waveform.
- ⑮ **SHUTTLE** • Concentric ring that serves to move the A/B cursors, and to scroll the waveform. The speed of movement is proportional to the rotation angle.
- ⑯ **CH&NUM** key • Sets channels or inputs numerical values
- ⑰ Number display • Indicates the channel set using the **CH&NUM** keys.
- ⑱ **POSITION** key • Determines the zero position for the channel set using the **CH&NUM** keys.
- ⑲ **RANGE** key • Determines the measurement range for the channel set using the **CH&NUM** keys.
- ⑳ **AUTO** key • Pressing this key activates automatic setting of X and Y axis range values for easy reading.
- ㉑ **TIME/DIV** key • Serves to set the speed for inputting and storing the input signal.
- ㉒ **STOP** key • Stops measurement and analysis.
• When **STOP** key pressed twice, measurement is stopped.
- ㉓ **START** key • Initiates the measurement and analysis. During measurement, the LED above the key is lit.
- ㉔ **CURSOR** key • These keys serve to move the flashing cursor in the four directions.
- ㉕ **MANU TRIG** key • Serves to cause manual triggering.
- ㉖ **CH.SET** key • Sets the input channel on the display screen
• Toggles the screen among those for analog channels (1 to 16), analog channels (17 to 32), and logic channels (A to H).
- ㉗ **LEVEL MON.** key • Serves to check the input signal level.
- ㉘ **VIEW** key • Serves to indicate the position of the currently displayed screen information in relation to the entire recording length.
• Call up information about the status of memory block.
- ㉙ (**F1 ~ F5**) key • Serve to select setting items.
- ㉚ **FD** slot • Insert an floppy disk.
- ㉛ **MO** disk slot • Insert an MO disk. (If the 9598 MO UNIT is not equipped, a blank panel is equipped instead.)
- ㉜ **AC POWER** switch • Serves to turn the unit on and off.
- ㉝ **LCD** display



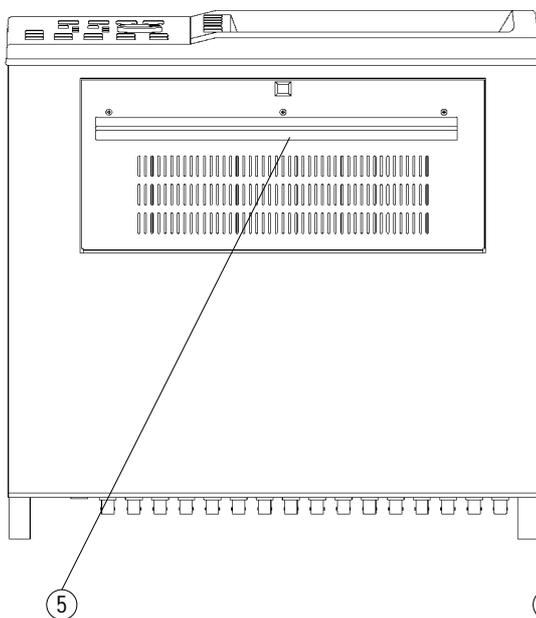
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|----------------------------------|--|
| ① Input unit slots | • These slots accept input units. |
| ② Analog input connector | • Unbalanced analog input. (on ANALOG UNIT) |
| ③ Logic probe connectors | • Input connector for the logic input section, designed for the dedicate logic probes (CH A to H). |
| ④ KEY LOCK switch | • When this switch is set to ON, all keys of the 8826 are inactive. The key lock condition is maintained also when the power is switched off and on again. |
| ⑤ Ventilation slots | |
| ⑥ Fastening screw | • Secures the plug-in unit. |
| ⑦ AC connector | • The supplied power cord must be plugged in here. |
| ⑧ Function ground terminal (GND) | • Connects to the earth. |
| ⑨ Trigger terminals | • Can be used to synchronize multiple units, using the EXT TRIG input and TRIG OUT output. |
| ⑩ ground terminal (GND) | • Uses with ⑨,⑪,⑫,⑬,⑭,⑮ terminals. |
| ⑪ External sampling terminal | • Allows input of an external sampling signal. |
| ⑫ External print terminal | • Print operation can be controlled. |
| ⑬ NG evaluation output terminal | • When the waveform evaluation has resulted in NG, a signal is output from this terminal. |
| ⑭ GO evaluation output terminal | • When the waveform evaluation has resulted in GO, a signal is output from this terminal. |
| ⑮ External start/stop terminals | • Start and stop operation can be controlled. |
| ⑯ SCSI connector | • An MO drive can be connected. |
| ⑰ Eject button | • Removes the PC card. |
| ⑱ PC card slot | • Inserts the PC card. |

1.2 Names and Function of Parts

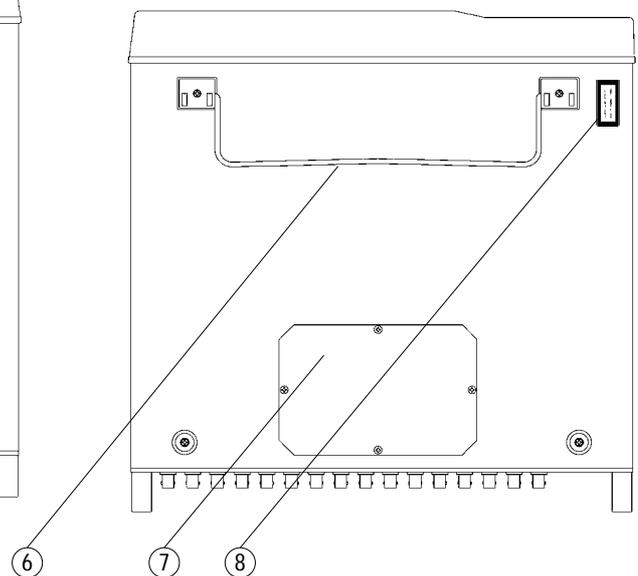


Right side

Left side



Upper



Bottom

- ① Handle • Serves for transporting the 8826.
- ② Ventilation slots
- ③ Blowing slot
- ④ Terminal guard • Guard to the analog input connectors.
- ⑤ Printer
- ⑥ Stand • The unit can also be propped up at an angle using the stand.
- ⑦ Bottom case • Use to attach the 9599 MEMORY BOARD.
- ⑧ A laser warning label

Chapter 2

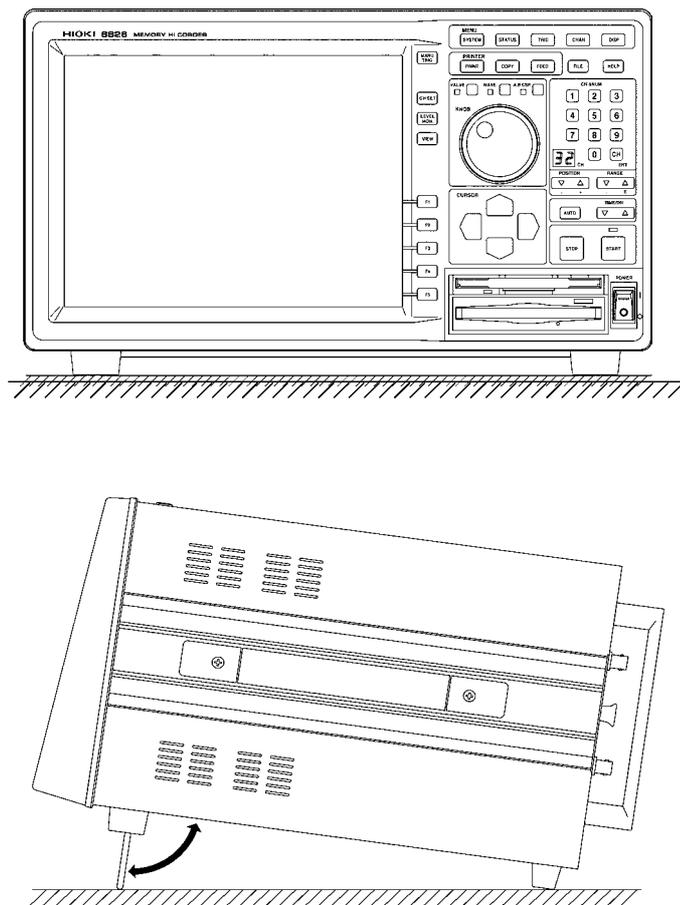
Installation and Preparation

2.1 Installation of the Unit

Installation orientation

Install the unit on a flat, level surface.

The unit can also be propped up at an angle, using the stand.

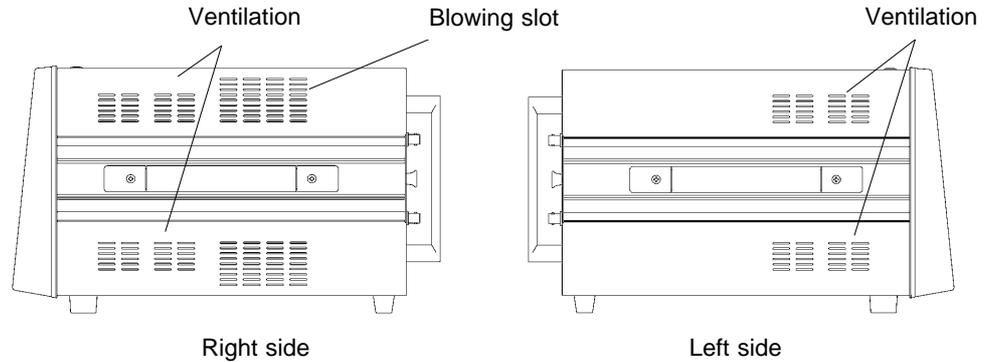


NOTE

- The terminal guard protects the input connectors of the equipment from damages. Do not stand the equipment on this guard; otherwise, the equipment may be damaged.
- The MO drive may not operate properly when the unit is placed front side up.

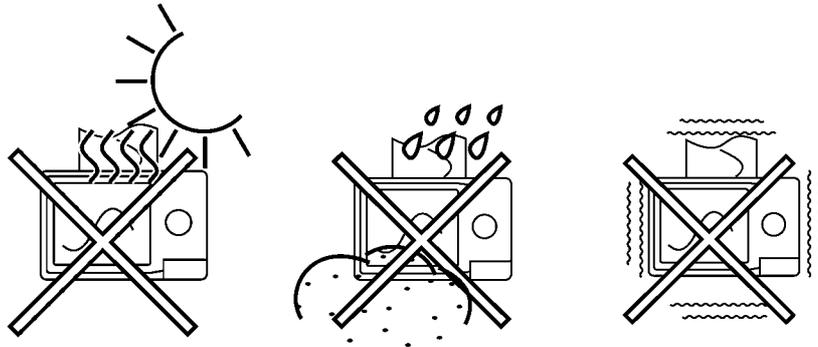
Ambient conditions

- (1) Temperature 5 to 40 °C, 23 ± 5 °C recommended for high-precision measurements.
- (2) Humidity 35 to 80%RH (no condensation); $50 \pm 10\%$ RH (no condensation) recommended for high-precision measurements.
- (3) Ventilation Avoid obstructing the ventilation holes on the sides of the 8826, as it could overheat and be damaged, or cause a fire.



- (4) Avoid the following locations:

- Subject to direct sunlight.
- Subject to high levels of dust, steam, or corrosive gases (Avoid using the equipment in an environment containing corrosive gases (e.g., H_2S , SO_2 , NI_2 , and Cl_2) or substances that generate harmful gasses (e.g., organic silicones, cyanides, and formalins)).
- Subject to vibrations.
- In the vicinity of equipment generating strong electromagnetic fields.



2.2 Power Supply and Ground Connection

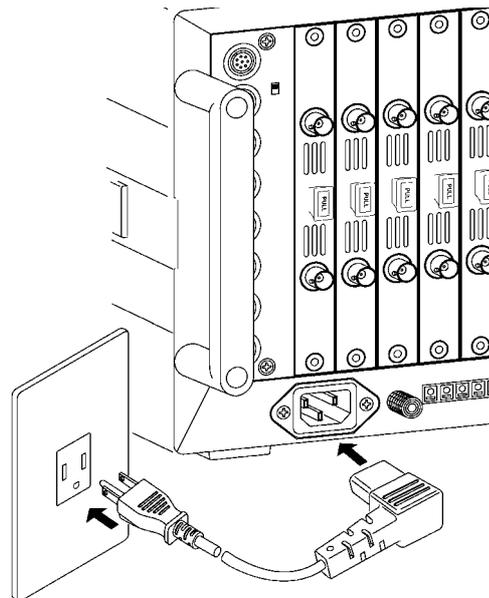
⚠ WARNING

- Check the following points before connecting the unit to a power supply. Take care never to exceed the power supply ratings given below, to avoid the risk of electric shock and damage to the unit.
- ❶ Power supply matches Rated supply voltage (100 to 240 V AC: Voltage fluctuations of 10% from the rated supply voltage are taken into account.) and rated supply frequency (50/60 Hz).
- ❷ The AC power switch of the 8826 are set to OFF.
- ❸ Use only the supplied AC power cord.
- The 8826 has no protective ground terminal, but is intended to be connected to a ground wire via the grounded three-core power cord supplied. In order to avoid electric shock accidents, be sure to connect the grounded three-core power cord supplied to a power supply socket one of whose terminals is properly grounded.

⚠ CAUTION

- The microgap power switch construction necessitates that the product be used near a power outlet. When not in use and while making connections to the circuit to be tested, disconnect the product from the power source by unplugging it from the outlet.

- (1) Verify that the AC power switch of the 8826 is set to OFF.
- (2) Plug the grounded three-core power cord supplied into the AC power connector on the right side of the 8826.
- (3) Plug the power cord into an AC outlet corresponding to the rating of the 8826.

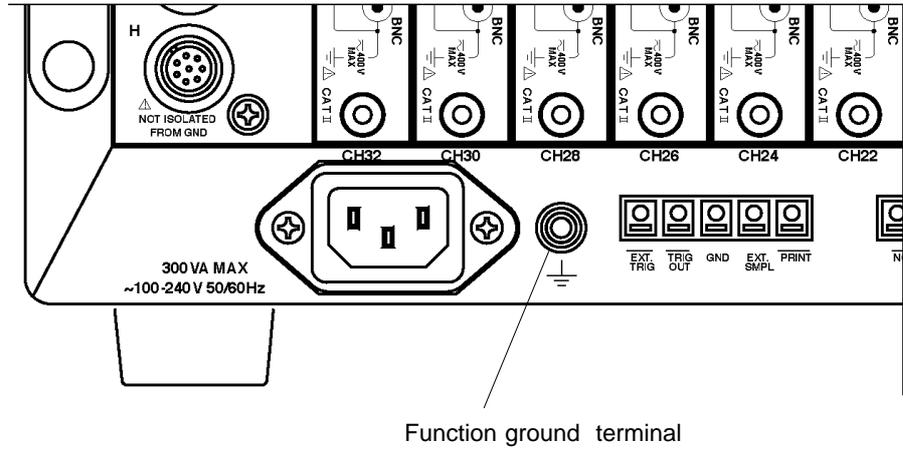


NOTE

The fuse is incorporated in power supply. It is not user-replaceable. If a problem is found, contact your nearest dealer.

Function Ground Terminal

When measuring in a "noisy " environment, noiseproofing can be improved by grounding the function ground terminal.



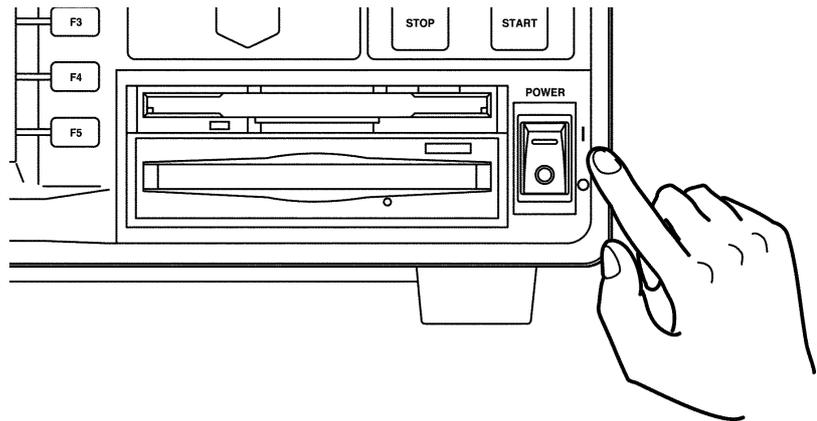
2.3 Power On/Off

2

⚠ WARNING

Check the following points before the power switch is turned on.

- ❶ Power supply matches Rated supply voltage (100 to 240 VAC: Voltage fluctuations of 10% from the rated supply voltage are taken into account.) and rated supply frequency (50/60 Hz).
- ❷ The Unit is correctly installed (Section 2.1).
- ❸ Power cord is correctly connected.
- ❹ The unit is properly grounded (Section 2.2).



NOTE

- After the Power switch is turned on, wait approximately 30 min for the 8936, 8938, 8940 and approximately 1 h for the 8937, 8939, 8947 to stabilize the inside temperature of the connected input unit in order to obtain accurate waveforms. Then, make a zero adjustment of the analog unit or perform an auto balancing of the strain unit prior to measurement.
Zero adjustment See section 9.5.1
Auto balancing See section 9.12
- When the unit is turned off, it memorizes the currently used settings and reestablishes the same settings the next time the unit is turned on again.

2.4 Connection of the Input Unit

2.4.1 8936 ANALOG UNIT / 8938 FFT ANALOG UNIT

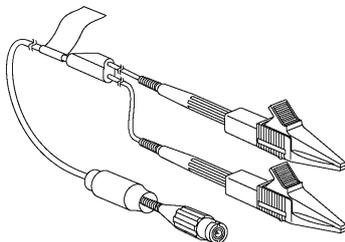
⚠ WARNING

- Never connect the probe to the 8826 while the probe is already connected to the measurement object. Otherwise there is a risk of electric shock.
- Be sure to use the input cord specified by HIOKI for 8826. An insulated BNC is used to prevent electric shock. Note that using a metal BNC may run the risk of electric shock, since the input L-terminal and metal part of the BNC connector have the same potential.

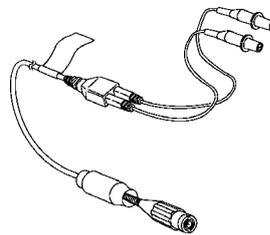
⚠ CAUTION

- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.
- Using an input cord other than that specified by HIOKI may damage the BNC connector or result in measurement errors due to contact failure.

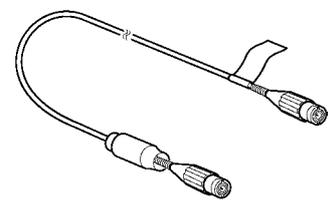
For safety reasons, only use the optional 9197, L9198 or L9217 for connection to the analog input units.



9197 CONNECTION CORD
(Max. input voltage 500 V)



L9198 CONNECTION CORD
(Max. input voltage 300 V)

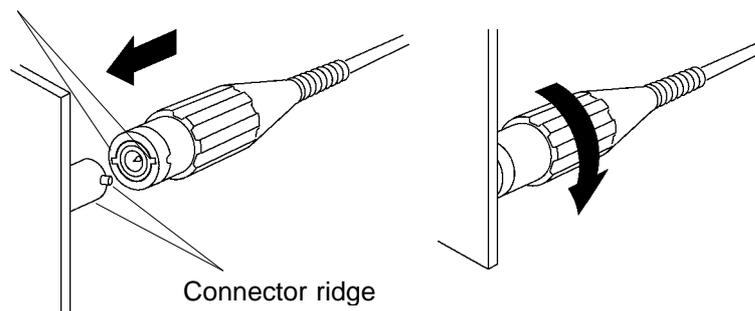


L9217 CONNECTION CORD
(Max. input voltage 300 V)

Connecting to the main unit

- (1) Align the BNC connector with the guide groove of the 8826 input connector, and turn clockwise while pressing in to lock the connector.
- (2) To remove from the unit, turn the BNC connector counterclockwise to release the lock, then pull it.

BNC connector counterclockwise



2.4.2 8937 VOLTAGE/TEMP UNIT

⚠ WARNING

- Never connect the probe to the 8826 while the probe is already connected to the measurement object. Otherwise there is a risk of electric shock.
- A common GND is used for voltage and temperature input on all channels. Never input voltage and temperature simultaneously, since doing so could result in damage to the sample being tested.
- When an uninsulated thermocouple is used to measure temperature at a point carrying electric potential, take care not to touch the terminals and connector screws. Otherwise there is a risk of electric shock.

⚠ CAUTION

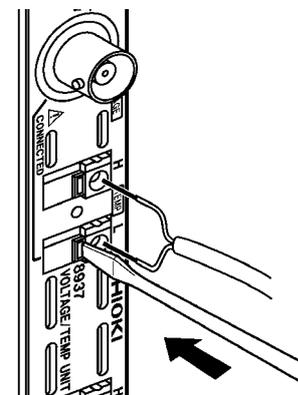
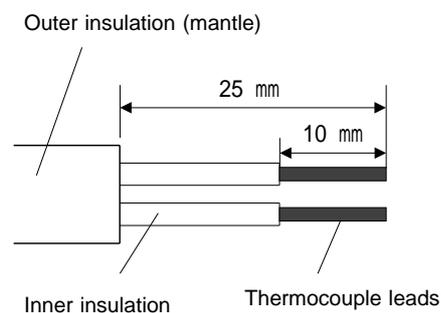
When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.

Connecting to the connector cable (voltage measurement)

- (1) Align the BNC connector with the guide groove of the 8826 input connector, and turn clockwise while pressing in to lock the connector. (Use the L9198 CONNECTION CORD for voltage measurement with the 8937.)
- (2) To remove from the unit, turn the BNC connector counterclockwise to release the lock, then pull it.

Thermocouple connection (temperature measurement)

- (1) Strip off the insulation as shown in the illustration.
- (2) Push the tab with a flatblade screwdriver or similar.
- (3) While keeping the tab depressed, insert a stripped wire into the connector opening.
- (4) Release the tab to lock the wire.



NOTE

- Use an appropriate tool such as a screwdriver to mount and remove thermocouples.
- Do not use thermocouples other than the specified types (K,J,E,T,N,R,S,B).
- If the thermocouple is connected in reverse, the temperature reading will not be correct.

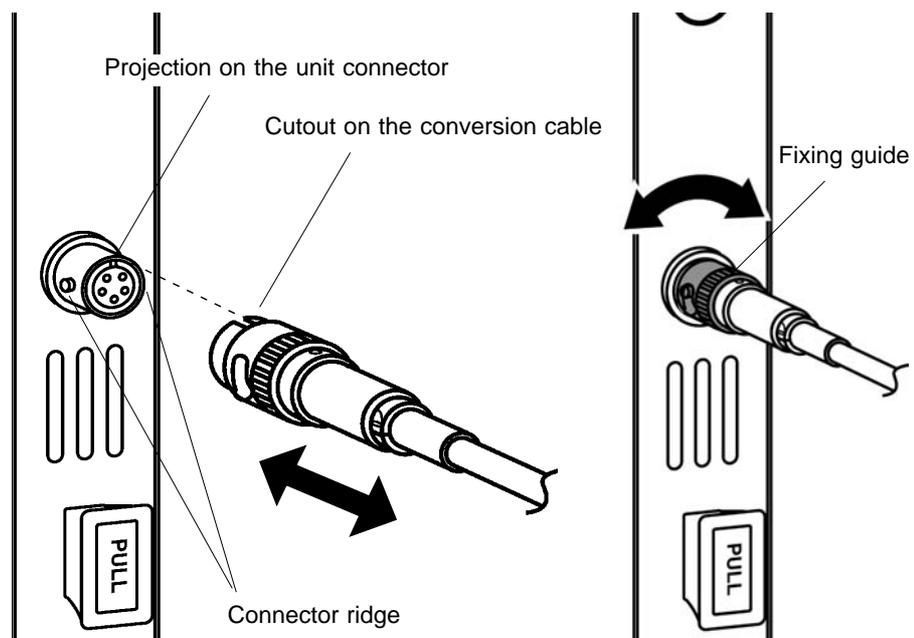
2.4.3 8939 STRAIN UNIT

CAUTION

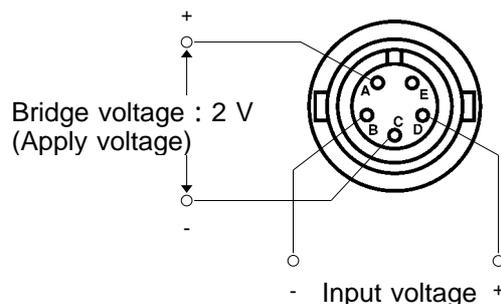
- Connect only the sensor to the conversion cable supplied with the 8939 STRAIN UNIT.
- To disconnect the conversion cable, always unlock the plug and pull out the cable.

Connecting to the main unit

- (1) Align the projection on the unit connector with the cutout on the conversion cable, and insert the plug into the connector.
- (2) Turn the fixing guide (the colored area in the figure below) so that it engages with the connector guides on the unit, fully insert the fixing guide, and turn it clockwise to lock the plug.
- (3) To remove the conversion cable from the unit, turn the fixing guide (the colored area in the figure below) counterclockwise to unlock the plug, and pull out the plug.



Connector



2.4.4 8940 F/V UNIT

⚠ DANGER

- To avoid electrical accidents, make sure that the MEMORY HiCORDER and the equipment being measured are powered off before making connections. Do not make connections with the power turned on.
- When using the 9318, 9319 CONVERSION CABLE, there is no isolation between GND the MEMORY HiCORDER and GND of the clamp on sensor/probe. Exercise extreme care in connection to avoid possible damage to the equipment or personal injury.
- When connecting 8940 F/V UNIT to 3273 or 3273-50, and conductors being measured carry in excess of the safe voltage level (SELV-E) and not more than 300 V, to prevent short circuits and electric shock while the core section is open, make sure that conductors to be measured are insulated with material conforming to (1) Measurement Category (Overvoltage Category) I, (2) Double Insulation (Reinforced insulation) Requirements for Working Voltage of 300 V, and (3) Pollution Degree 2. For safeties sake, never use this sensor on bare conductors. The core and shield case are not insulated.
- When connecting 8940 F/V UNIT to 3273 or 3273-50, do not damage insulation sheathing on testing device.
- Refer to the following standards regarding the meanings of underlined terms. IEC 61010-1, IEC 61010-2-031, IEC 61010-2-032

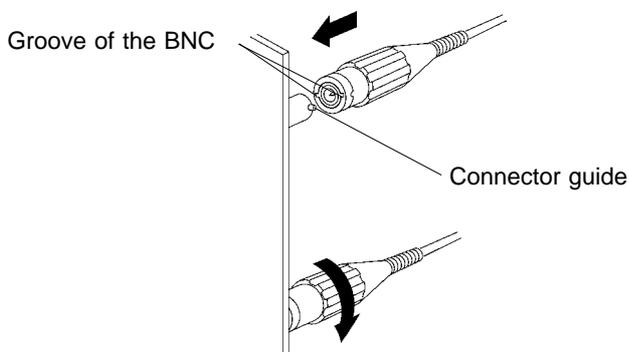
⚠ WARNING

When using the clamp-on sensor or clamp-on probe, be sure to use the optional 9318 or 9319 CONVERSION CABLE.

⚠ CAUTION

- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.
- When using the Model 3273-50 with the 8940, bear in mind that the maximum input of the 3273-50 is 15 Arms. Exceeding this measurement level could damage the instrument.

Connection cable connection (Frequency, count, pulse duty ratio and voltage measurement)



Use the optional L9198 CONNECTION CORD for connection to the F/V UNIT.

- ① Align the BNC connector with the guide groove of the 8826 input connector, and turn clockwise while pressing in to lock the connector.
- ② To remove from the unit, turn the BNC connector counterclockwise to release the lock, then pull it.

Clamp connection (Current measurement)

The following clamp-on sensors and clamp-on probes can be connected using the 9318 and 9319 CONVERSION CABLE.

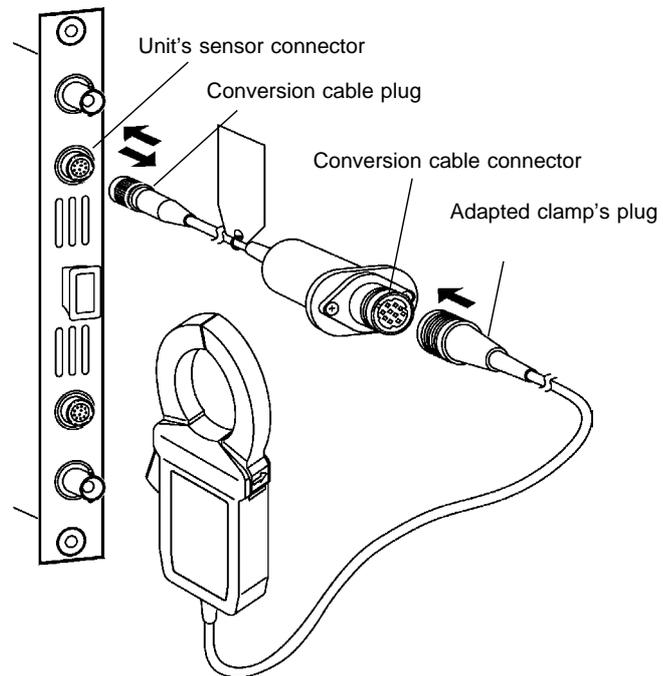
9318 : 9270, 9271, 9272, 9277, 9278, 9279 9319 : 3273, 3273-50

It can be connected to a maximum of 6 channels. (After serial No. 1999-0338386)

(1) Connecting to 9318 CONVERSION CABLE

- ① The MEMORY HiCORDER and the equipment being measured are powered off before making connections.
- ② Align the groove on the conversion cable plug with the sensor connector on the F/V unit and push inward until the connector locks into place.
- ③ Align the groove on the conversion cable connector with the adapted clamp on sensor plug and push inward until the connector locks into place.
- ④ To unplug the cables, slide the lock ring on each plug outward to unlock it, then pull out the plug.

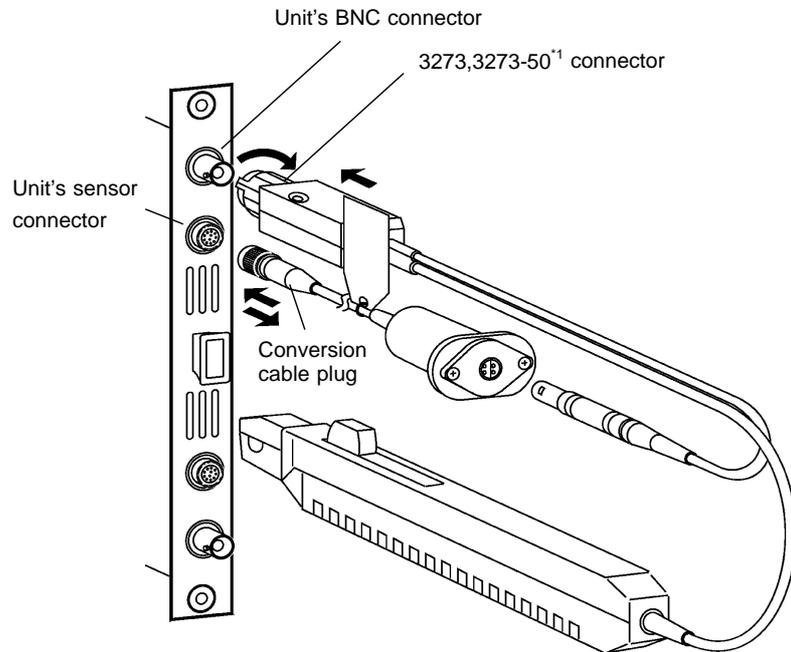
When disconnecting the connector and the plug, hold the connector or the plug, and pull carefully. Pulling on the cable instead of the connector or the plug may damage the connector and cable.



(2) Connecting to 9319 CONVERSION CABLE

- ① The MEMORY HiCORDER and the equipment being measured are powered off before making connections.
- ② Align the groove on the 3273 or 3273-50*¹ CLAMP ON PROBE's termination connector with the pin on the BNC connector on the F/V unit, then slide the termination connector over the BNC connector and turn to lock it in place.
- ③ Align the groove on the conversion cable plug with the sensor connector on the F/V unit and push inward until the connector locks into place.
- ④ To unplug the cables, Unlock the conversion cable connector and the power plug on the 3273 or 3273-50*¹ before unplugging the cable.
- ⑤ Slide the lock ring on each plug outward to unlock it, then pull out the plug.

When disconnecting the connector and the plug, hold the connector or the plug, and pull carefully. Pulling on the cable instead of the connector or the plug may damage the connector and cable.



*1 : When using the Model 3273-50 with the 8940, bear in mind that the maximum input of the 3273-50 is 15 Arms.

2.4.5 8947 CHARGE UNIT

⚠ WARNING

- Never connect the connection cable to the unit while it is connected to the measurement object, to avoid electric shock.
- The BNC connectors for each channel and the miniature connection terminals share a common ground. Do not connect both types of terminals at the same time.
- When the PREAMP measurement mode is selected, voltage (15 V at 2 mA) is applied internally to the BNC connector when measurement starts. To avoid electric shock and damage to measurement objects, select a measurement mode other than PREAMP or turn the unit off when connecting a sensor or probe to the BNC terminals.
- Before using an Internal Preamp Type Acceleration Sensor, be sure that it conforms to the 8947 specifications (15 V at 2 mA). Using a non-conforming sensor could result in damage to the sensor.

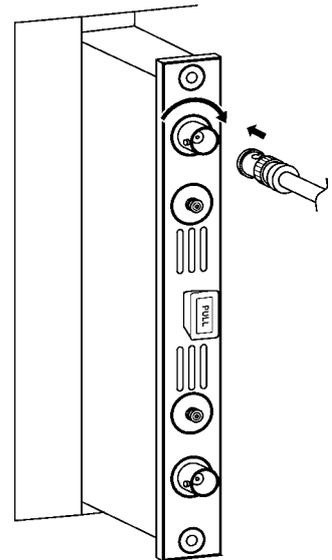
Acceleration sensors compatible with the 8947 CHARGE UNIT are as follows:

- Acceleration sensors with internal preamp (BNC connector with 15 V at 2 mA operating power)
- Charge-output type accelerator sensors (miniature 10-32 connection terminal)

Connecting an Internal Preamp Type Acceleration Sensor (PREAMP and VOLTAGE modes)

Use a cable with BNC connector to connect the pickup sensor to the unit in PREAMP mode. We recommend the Model L9198 CONNECTION CORD for the VOLTAGE mode.

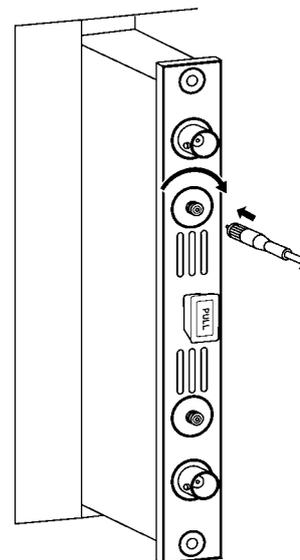
- (1) Push the BNC plug onto the connector on the unit, and turn it clockwise until it locks.
- (2) To remove the BNC plug, push the plug ring and turn it counterclockwise to release the lock, then pull it out.



Connecting a Charge-Output Type Acceleration Sensor (CHARGE mode)

Use a cable with a plug to mate with the miniature connector to connect the pickup sensor to the unit in CHARGE mode (10-32 miniature connection terminal).

- (1) Insert the miniature connector plug into the miniature connector on the unit, and turn it clockwise until tight.
- (2) To remove the miniature connector, turn the plug counterclockwise.

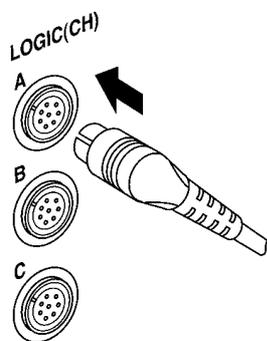
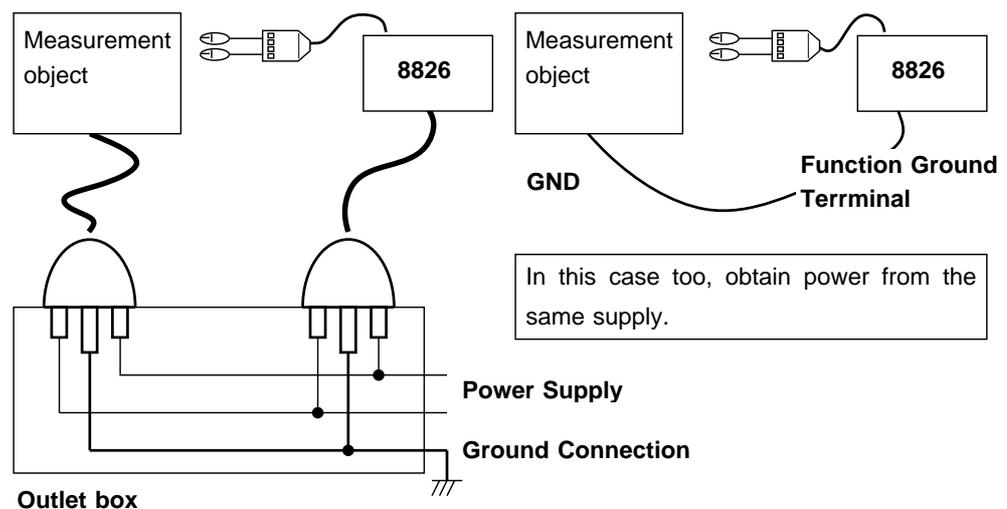


2.5 Logic Probe Connection

⚠ DANGER

The logic input and 8826 Unit share a common ground. Therefore, if power is supplied to the measurement object of the logic probe and to the 8826 from different sources, an electric shock or damage to the equipment may result. Even if power is supplied from the same system, if the wiring is such that a potential difference is present between the grounds, current will flow through the logic probe so that the measurement object and 8826 could be damaged. We therefore recommend the following connection method to avoid this kind of result.

- (1) Before connecting the logic probe to the measurement object, be sure that power is supplied from the same outlet box to the measurement object and the 8826 using the supplied grounded 2-wire power cord.
- (2) Before connecting the logic probe to the measurement object, connect the ground of the measurement object to the 8826 ground terminal. Also in this case, power should be supplied from the same source. Refer to Section 2.2 for grounding terminal details.



- The logic input is located on the top side of the unit. Up to eight probes can be connected.
- Since one logic probe can record 4 channels, the combined maximum recording capability for logic waveforms is 32 channels.
- Connect the probe by aligning the groove on the plug with the ridge on the connector.

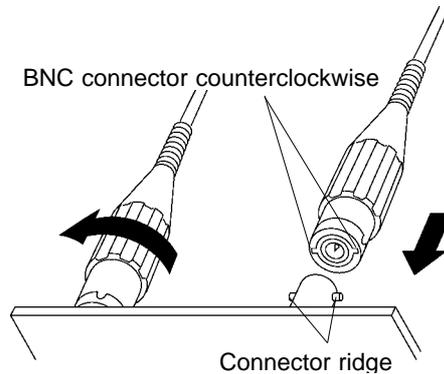
NOTE

- If no logic probe is connected, the corresponding logic waveform is displayed on the screen at high level.
- Carefully read the instruction manual supplied with the probe.

2.6 9018-10, 9132-10 CLAMP ON PROBE Connection

⚠ DANGER

- Clamp-on probe should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.
- Before using the 9018-10, 9132-10 CLAMP ON PROBE, be sure to carefully read its instruction manual and familiarize yourself with the operation principles of this product.



The HIOKI 9018-10, 9132-10 CLAMP ON PROBE can be used to perform current measurement. This probe has a voltage output. The 8826 is designed for voltage input. It cannot be used to perform current measurements by itself.

Connections

Connect the BNC connector of the 9018-10, 9132-10 CLAMP ON PROBE to the analog input of the 8826, as shown in the illustration.

NOTE

- The 8826 will indicate measurement results as voltage.
- Using the scaling function, units can be converted to "A" for display. See Section 9.7.2.
- When the clamp-on probe is used for measurement, the measurement precision will be affected both by the 8826 precision and clamp-on probe precision ratings. The same is true for cases where other clamps are used.
- When using the 9018, 9132 CLAMP ON PROBE, always use the 9199 CONVERSION ADAPTOR.

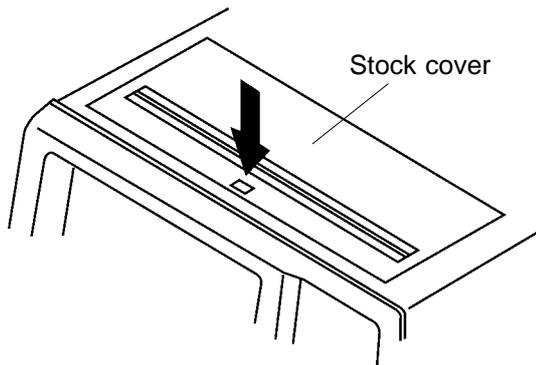
2.7 9322 DIFFERENTIAL PROBE Connection

For details, see the instruction manual of the 9322 DIFFERENTIAL PROBE.

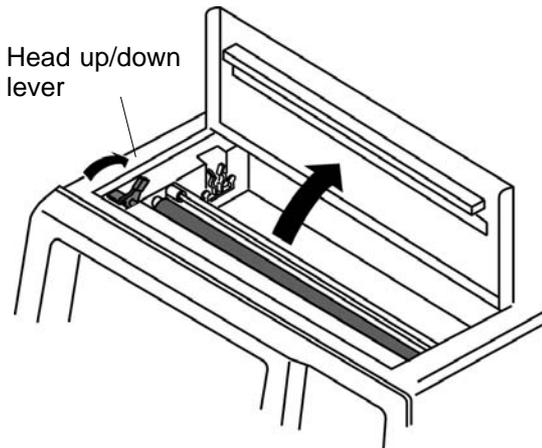
⚠ DANGER

- When using grabber clips, the 9322's maximum rated to-ground voltage is 1,500 V AC or DC; when using alligator clips, it is 1,000 V AC or DC. To avoid electrical shock and possible damage to the unit, never apply voltages greater than these limits between the input channel terminals and chassis, or across the inputs of two 9322s.
- The maximum input voltage of the 9322 is 2000 V DC, 1000 V AC. Attempting to measure voltage in excess of the maximum input could destroy the product and result in personal injury or death.

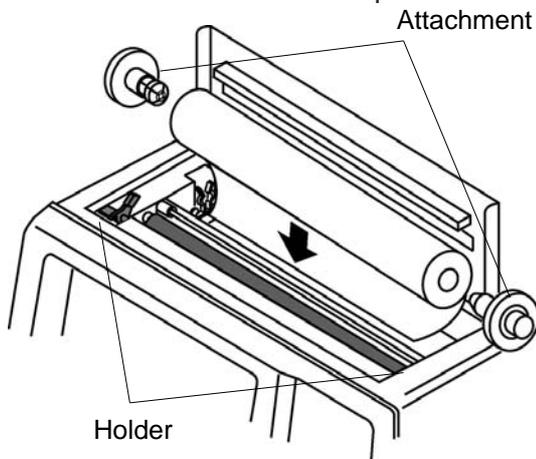
2.8 Loading Recording Paper



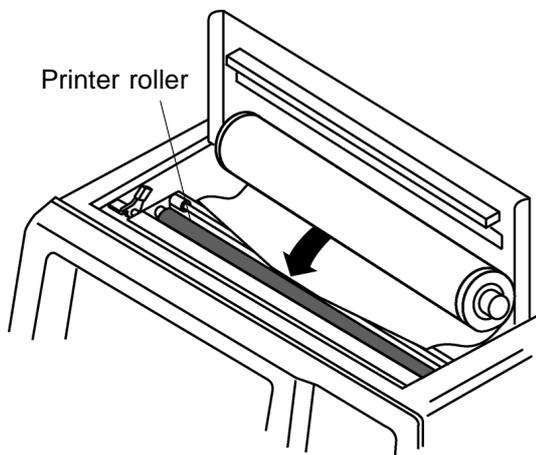
(1) Press the stock cover and open it.



(2) Raise the head up/down lever.

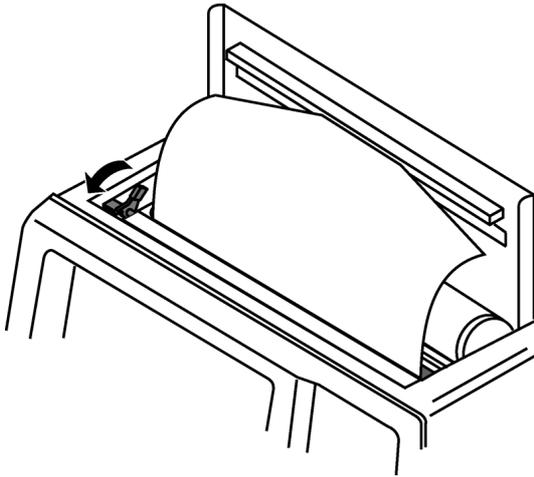


(3) Insert the attachments into the ends of the roll of recording paper and set the paper into its holder.



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

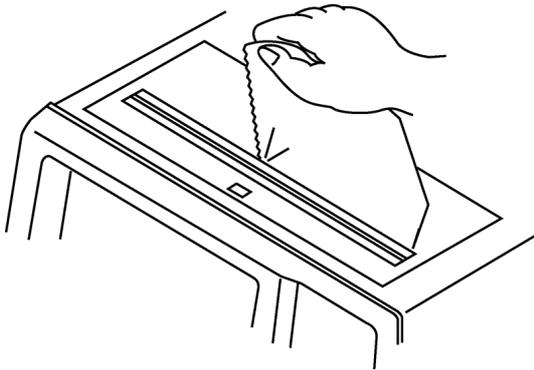
Do not insert it into the gap between the roller and the black sheet metal portion.



(5) Pull the end of the recording paper out at least 10 cm, and make sure that it is positioned quite straight.

(6) Put down the head up/down lever.

(7) Pull the recording paper to the outside through the printer exit slot in the stock cover.



(8) Close the stock cover, and finish by tearing off the recording paper against the edge of the printer exit slot.

NOTE

- The paper may jam if it is not aligned with the roller.
- Always place the product in the head-up condition when it is to be transported or stored for an extended period of time. If the product is left idle for a long time with the head pressing on the roller, the roller may be deformed, resulting in uneven printing.
- Printing is not possible if the recording paper is loaded wrong-side up.

2.9 Care of Recording Paper

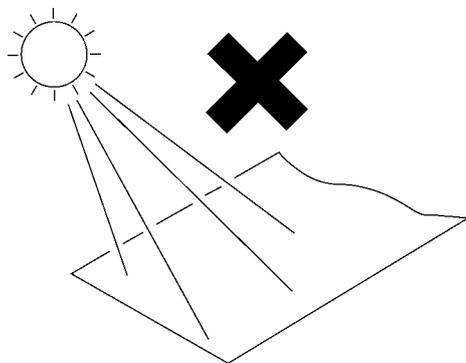
Care of recording paper

- While unopened, thermal paper will not be affected by the environment, provided that ambient temperature and humidity do not exceed normal levels. For long-term storage, temperature should be lower than 40. Low temperatures cause no problem.
- After opening, protect the paper from strong light, to prevent discoloration.

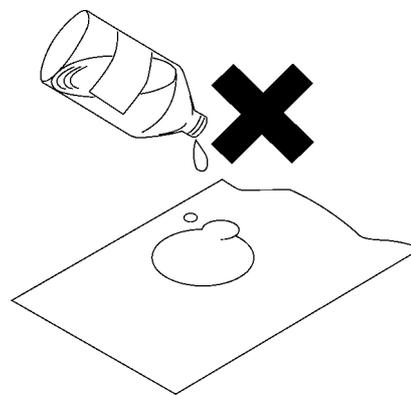
Storing data

The recording paper uses a thermochemical reaction. Note the following points:

- To avoid discoloration, do not leave recording paper in direct sunlight.
- Store at not more than 40 and 90%RH.
- To keep definitive data, make photocopies of the recordings.
- Thermal paper will blacken when brought into contact with alcohol, ester, ketone, or other volatile organic substances.
- If the thermal paper absorbs an organic solvent such as alcohols or ketones it may no longer develop properly, and recorded information may fade. Soft PVC film and transparent contact adhesive tape contain such solvents, so avoid using them with recordings.
- Avoid interleaving the thermal recordings with damp diazo copies.



Direct sunlight



Organic solvent

2.10 Notes on Measurement

⚠ DANGER

- Maximum input voltage ratings for the input units and the input terminals of the 8826 are shown below. To avoid the risk of electric shock and damage to the units, take care not to exceed these ratings.
- The maximum rated voltage to earth of the input units (voltage between input terminals and 8826 frame ground, and between inputs of other analog units) is shown below. To avoid the risk of electric shock and damage to the units, take care that voltage between channels and between a channel and ground does not exceed these ratings.
- The maximum rated voltage to earth rating applies also if an input attenuator or similar is used. Ensure that voltage does not exceed these ratings.
- When measuring power line voltages with the 8936 or 8938, always connect the probe to the secondary side of the circuit breaker. Connection to the primary side involves the risk of electric shock and damage to the units.

Input/output terminal	Maximum input voltage	Maximum rated voltage to earth
8936 inputs	400 V DC max.	370 V AC/DC
8937 inputs	30 V rms or 60 V DC	30 Vrms or 60 V DC
8938 inputs	400 V DC max.	370 V AC/DC
8939 inputs	10 V DC max.	30 V rms or 60 V DC
8940 inputs	30 V rms or 60 V DC (BNC/Sensor connector terminal)	<ul style="list-style-type: none"> • 30 V rms or 60 V DC (BNC terminal) • Not insulated (Sensor connector terminal)
8947 inputs	30 V rms or 60 V DC (BNC terminal)	30 V rms or 60 V DC (BNC terminal)

The maximum allowable charge that can be applied to the miniature connection terminals is 500 pC at the most sensitive of the six ranges, and 50,000 pC at the least sensitive range.

EXT TRIG START · STOP PRINT EXT SMPL	-5 to +10 V DC	Not insulated
TRIG OUT GO NG	-20 V to +30 V DC 500 mA max. 200 mW max.	
9322 DIFFERENTIAL PROBE	2000 V DCmax. 1000 V ACmax.	1500 V AC/DC (when using grabber clips) 1000 V AC/DC (when using alligator clips)

- The external I/O terminal and the unit have a common GND.

⚠ WARNING

- To avoid electric shock accident, before removing or replacing an input module, confirm that the instrument is turned off and that the power cord, connection cords, and thermocouples are disconnected.
- To avoid the danger of electric shock, never operate the product with an input module removed. To use the product after removing an input module, install a blank panel over the opening of the removed module.
- Before using the product, make sure that the insulation on the connection cords is undamaged and that no bare conductors are improperly exposed. Using the product under such conditions could result in electrocution. Replace the connection cords specified by Hioki.

⚠ CAUTION

- When making measurements on an AC power line for example, using a voltage transformer, be sure to connect the voltage transformer ground terminal to ground.

NOTE

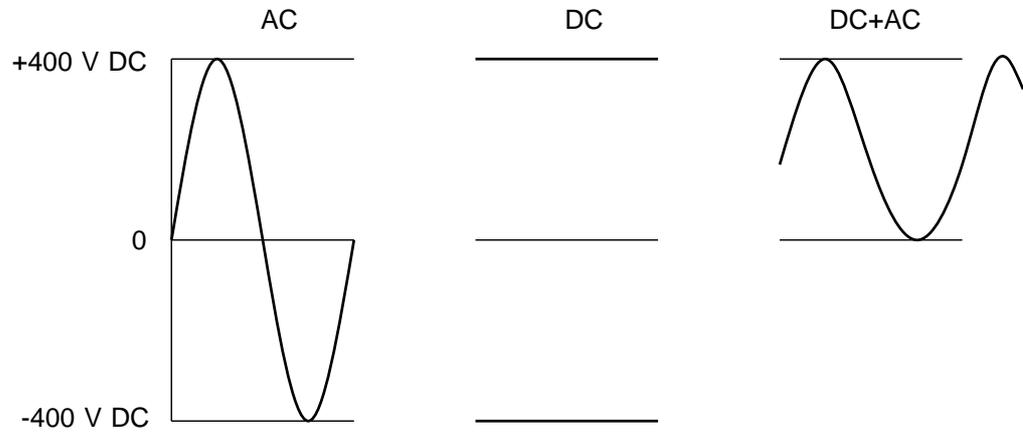
- If the 8937 VOLTAGE/TEMP UNIT's input terminal is exposed to a strong draft, loss of thermal equilibrium at the input may result in measurement error. When taking measurements under such conditions, arrange the unit in such a manner that the input terminal is protected for direct exposure to drafts.
- If ambient temperature changes suddenly, loss of thermal equilibrium can result in measurement error. When this occurs, allow the unit to acclimate to the new temperature for about one hour, then take measurements after thermal equilibrium is reached.

Difference between "370 V AC, DC" and "400 V DC max." indication

370 V AC, DC: RMS value is displayed.

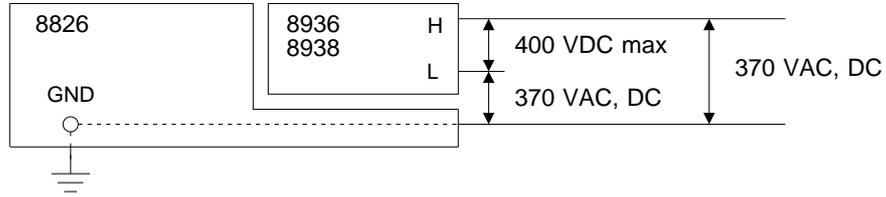
400 V DC max.: Instantaneous value is displayed.

The maximum input voltage (400 V DC max.) is defined as the superposition of DC component and AC peak, as shown in the figure below.

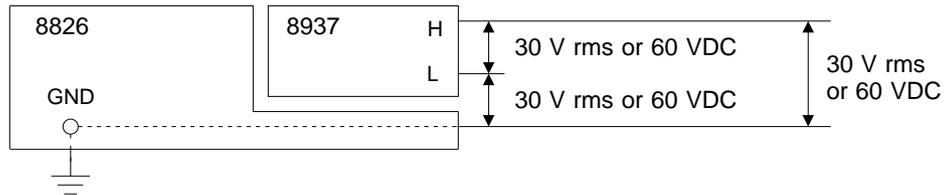


2.10.1 Maximum Input Voltage

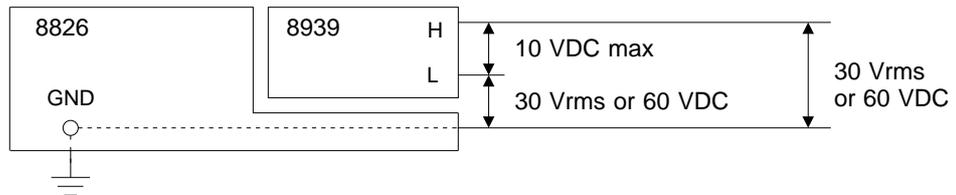
8936 ANALOG UNIT, 8938 FFT ANALOG UNIT



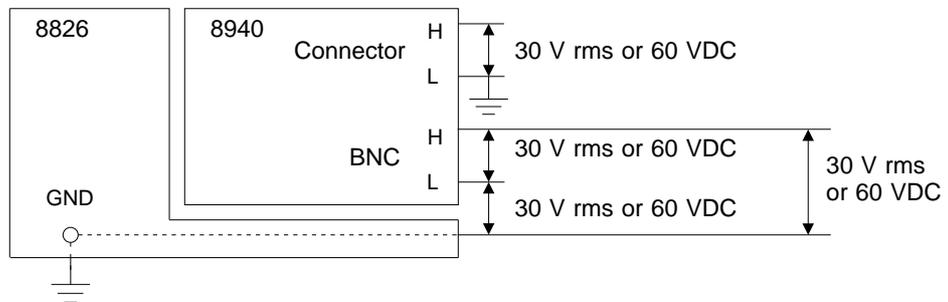
8937 VOLTAGE/TEMP UNIT



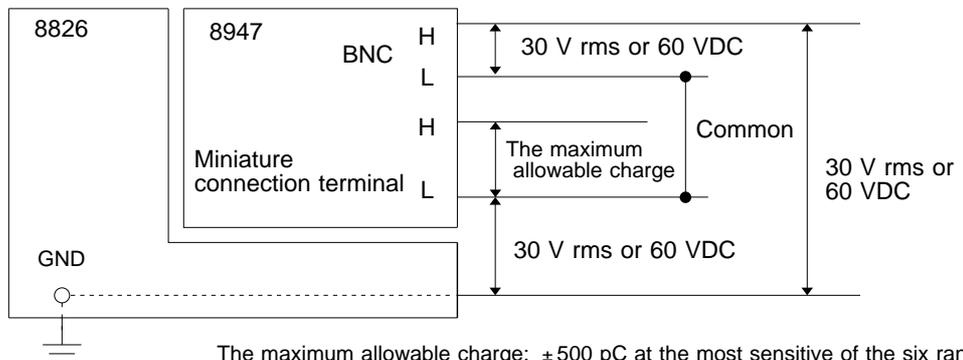
8939 STRAIN UNIT



8940 F/V UNIT



8947 CHARGE UNIT

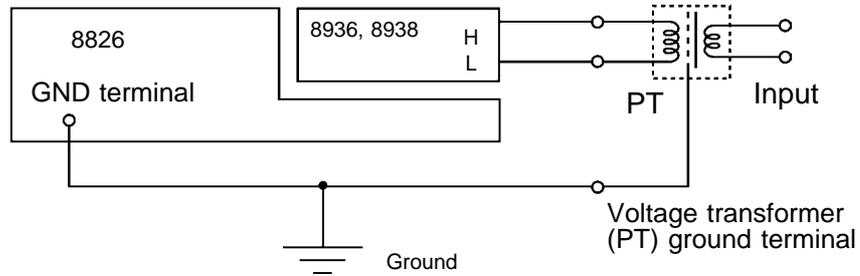


The maximum allowable charge: ± 500 pC at the most sensitive of the six ranges
 $\pm 50,000$ pC at the least sensitive ranges

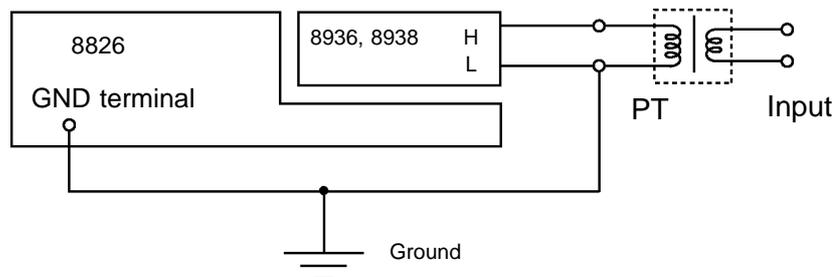
2.10.2 Using a Voltage Transformer

When making measurements on an AC power line for example, using a voltage transformer, be sure to connect the voltage transformer ground terminal to ground.

【 When the voltage transformer has a ground terminal 】



【 When the voltage transformer has no ground terminal 】

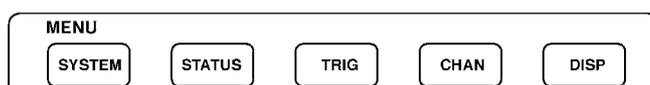


Chapter 3

Basic Key Operation **3**

3.1 Basic Key Operation

3.1.1 Basic Display Operation (MENU)

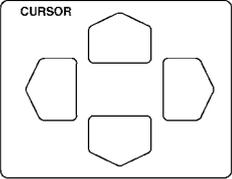


	SYSTEM key	Calls up the SYSTEM screen. Serves to switch pages of the SYSTEM screen. Serves to make common settings for all functions (clock setting, comment input, etc.) on the SYSTEM screen.
	STATUS key	Calls up the STATUS screen. Serves to switch pages of the STATUS screen. Serves to make main settings for various functions on the STATUS screen.
	TRIG key	Calls up the TRIGGER screen and serves to set trigger.
	CHAN key	Calls up the CHANNEL screen. Serves to set measurement range, position, etc. for input channels. Serves to switch pages of the CHANNEL screen.
	DISP key	Calls up the display screen. Serves to display and observe waveforms. The screen size can be changed by pressing the DISP key.

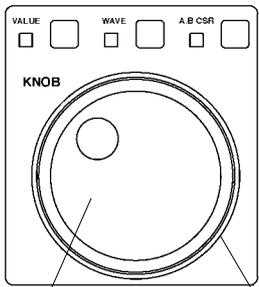
3.1.2 Printer Key Operation

		
	PRINT key	Serves to print out the waveform. Output destination by the PRINT key can be selected. See Section 12.5.2.
	COPY key	Produces a hard copy of the display content. Copy destination by the COPY key can be selected. See Section 12.5.1.
	FEED key	Forwards the paper while the key is held down.

3.1.3 Setting Items

		F1 to F5 (Function key) The respective items are shown in the function key display. Select and set the items.
	CURSOR keys	Serve to move the flashing cursor.

3.1.4 JOG/SHUTTLE Control and Select Key



Use the select key when the screen is in measurement display mode. Selected key lights LED.

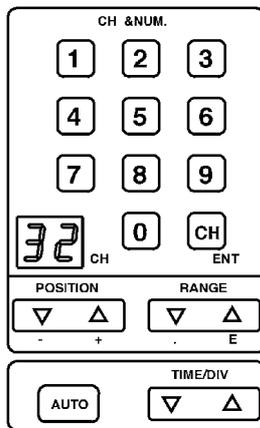
Lit LED	JOG/SHUTTLE control function
VALUE <input type="checkbox"/> <input type="checkbox"/>	Entering the numerical values.
WAVE <input type="checkbox"/> <input type="checkbox"/>	Waveform scrolling See section 11.1
A.B CSR <input type="checkbox"/> <input type="checkbox"/>	Movement of A/B cursors See section 11.2

Entering numbers and setting items

GUI		
	Value up	Move the item selection cursor up in the selection window.
	Value down	Move the item selection cursor down in the selection window.
	Value up, large step	Value up, 10-units
	Value up, small step	Value up, 1-units
	Value down, small step	Value down, 1-units
	Value down, large step	Value down, 10-units

3.1.5 Basic Input Operation

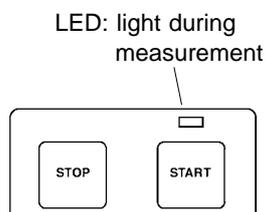
Set the basic settings for analog channels. See Chapter 9.



	CH&NUM key	Sets channels or inputs numerical values <ul style="list-style-type: none"> Channel parameters can be directly input using the POSITION and the RANGE keys. In numerical-value input, these keys are used as numeric keys.
	POSITION key	Determines the zero position of the channel set using the CH&NUM keys. In numerical-value input, "-" and "+" can be input.
	RANGE key	Determines the measurement range for the channel set using the CH&NUM keys. In numerical-value input, "."(decimal point) and "E" can be input.
	AUTO key	Serves to automatically set the time axis range, measurement range and zero position for the input waveform. (only in the memory recorder function) See section 4.6.
	TIME/DIV key	Serves to set the input signal capture speed (how many seconds, minutes, hours for 1 DIV on the time axis).

3

3.2 Measurement Start and Stop



START key	Press the START key to initiate measurement or set the unit to trigger standby.
STOP key	Press the STOP key during measurement and trigger waiting to stop the measurement.

NOTE

The measurement start/stop operation is separately determined by each measurement function. For details, see "Starting and Stopping Measurement," which explains each measurement function.

3.3 Other Keys Operation

MANU TRIG	MANU TRIG key	When the unit is in trigger standby mode, pressing this key causes manual triggering. See section 10.12.
CH.SET	CH. SET key	Enables the measurement conditions for each channel on the display screen to be set or changed. The setup can be performed even during startup. (However, it is disabled during parameter operation setting.) The setup screen for "ch 1 to 16," "ch 17 to 32," or "logic A to H" can be selected on the channel and trigger screens. See Section 9.3.
LEVEL MON.	LEVEL MON. key	Displays the level monitor. See section 11.5.
VIEW	VIEW key	Shows at the bottom of the screen the position with respect to the recording length of the displayed part of the waveform. Call up information about the status of memory block. See Section 11.6.
FILE	FILE key	Calls up the FILE screen. Serves to read and store waveform data on the FILE screen. See Chapter 14.
HELP	HELP key	An explanation of the display screen or the item currently selected by the cursor appears.

On-line Help

A brief explanation of the item currently selected by the flashing cursor is displayed by pressing the **HELP** key.

Press any key to cancel the help screen.

The diagram illustrates the on-line help function. It shows a 'MEMORY' status screen with a cursor on '100µs/DIV'. Pressing the HELP key opens a help screen for 'Time axis range setting'. Pressing any key returns to the status screen.

Press the HELP key →

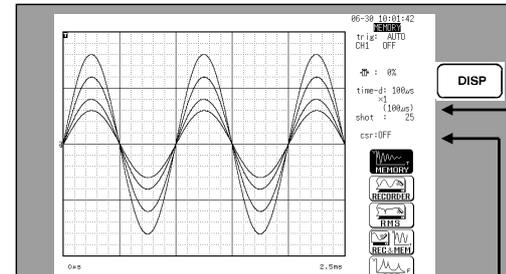
Press any key ←

Time axis range setting

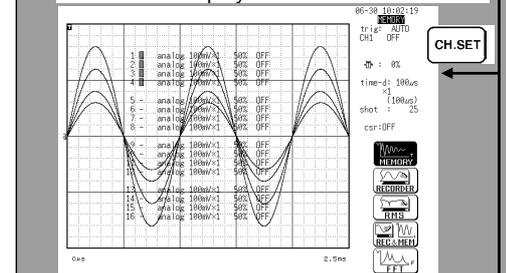
- Set the speed for inputting and storing the input signal.
- Time axis range setting expresses the time for 1 DIV. (100 samples/DIV)
- In the recorder and memory function, set the time axis range for each of the two functions.
- On the Status screen, the TIME/DIV key applies only to the recorder function. The memory recorder time axis range is two steps faster than the recorder time axis range.
- In the FFT function, set the frequency range (frequency axis maximum value). The frequency range corresponds to the time axis range (TIME/DIV) setting of the memory recorder function
- Setting method: Function keys, jog control or TIME/DIV key

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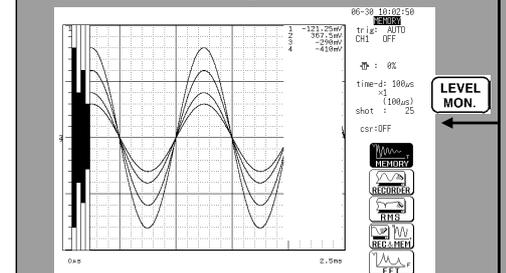
3.4 Screen Configuration



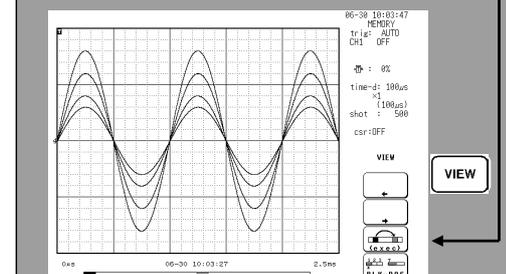
On the Display screen, press the **DISP** key to toggle between normal-screen display and wide-screen display.



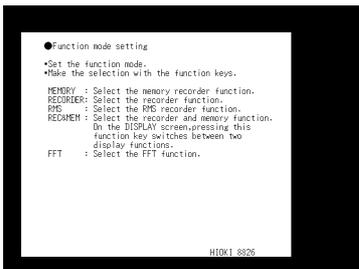
The input channel can be set. Press the **CH.SET** key to change the input channel setting screen.



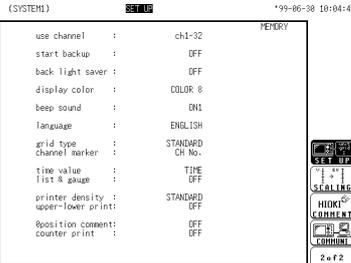
The input level can be viewed and set.



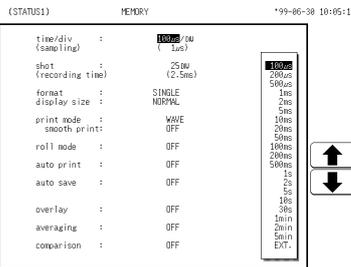
The waveform display position and block occupation status can be viewed.



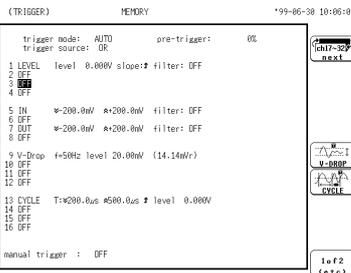
On the Online Help screen, press any key to return to the previous screen.



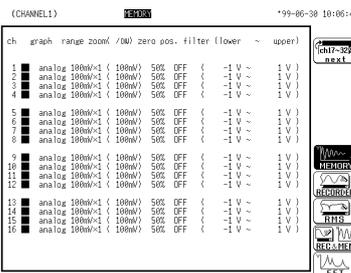
From the System screen, click the **SYSTEM** key to move between the setting screens.



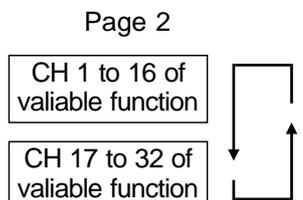
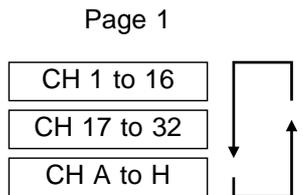
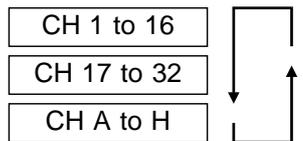
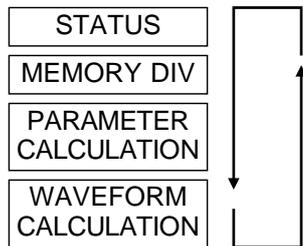
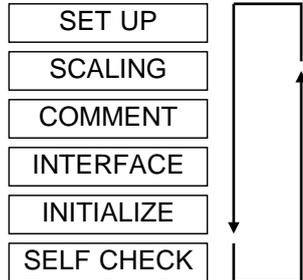
From the Status screen, click the **STATUS** key to move between the setting screens. (MEMORY RECORDER)



From the Trigger screen, press the **CH.SET** key to move between the input channels' setting screens.



From the Channel screen, press the **CHAN** key to move between the setting screens. From each setting screen, press the **CH.SET** key to move between the input channels' setting screens.



3.5 Using the Key Lock Function

- This function disables all front-panel controls of the 8826.
- The function serves to prevent unintended changes to settings during a measurement.

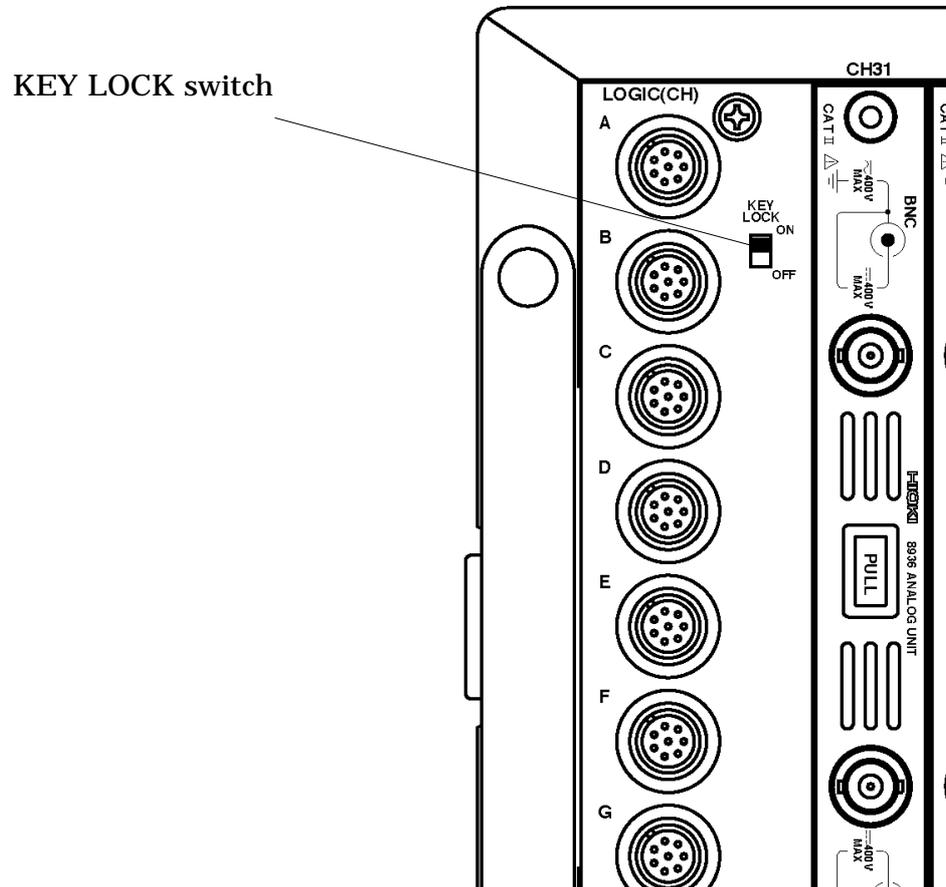
Method

(1) Set the KEY LOCK switch to ON.

(2) To cancel the function, set the KEY LOCK switch to OFF.

(The key lock function will not be canceled by turning the power off and on.)

- When the key lock function is active, the indication "KEY LOCK" is shown on the display.
- If the backlight saver function is used and the display backlight turns off, it can be turned on again by touching any key. The function assigned to the key will not be activated.



NOTE

External input terminals are not disabled.

Chapter 4

Memory Recorder Function

4.1 Outline of the Memory Recorder Function

The memory recorder function has the following features.

- (1) After being stored in the internal memory, input signal data can be displayed and printed.
- (2) All input channel data are recorded on the same time axis.
Since data for all channels can be superimposed, the relative relationship between input signals can be observed visually.
- (3) Time axis setting
100 μ s/DIV to 5 min/DIV
- (4) Time axis resolution 100 points/DIV
- (5) Memory capacity

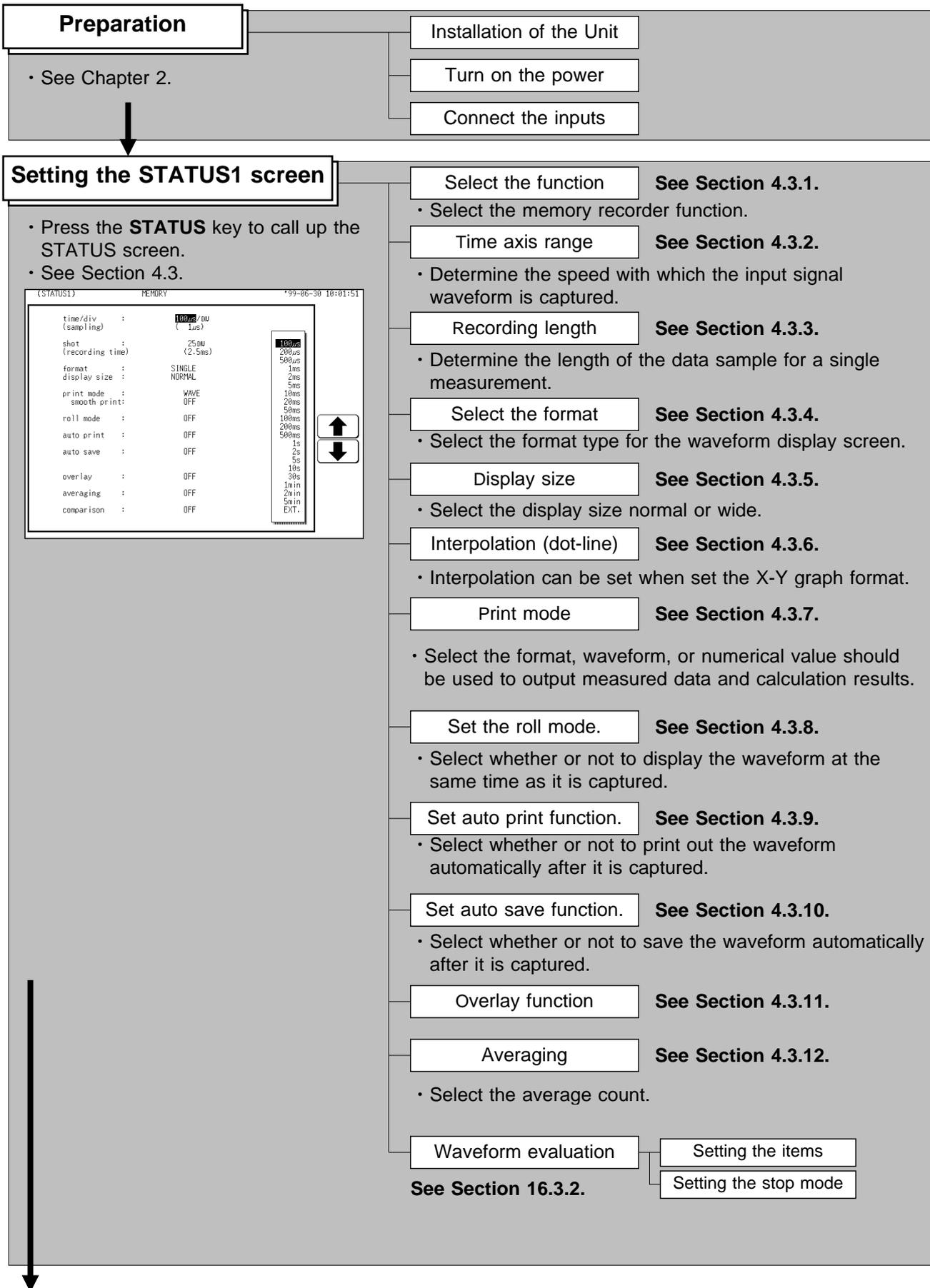
Channel	32 ch	16 ch	8 ch	4 ch
Memory capacity 16 M words	5000 DIV	10000 DIV	20000 DIV	40000 DIV
Memory capacity 64 M words	20000 DIV	40000 DIV	80000 DIV	160000 DIV
- (6) Waveform magnification/compression display and print
 - Time axis direction: $\times 10$ to $\times 1/10000$
 - Voltage axis direction: $\times 10$ to $\times 1/2$ (single, X-Y single screen)
 $\times 5$ to $\times 1/4$ (2 to 16, X-Y4 screen)
 - With the variable function, vernier function, zoom function
- (7) Display format
 - Time axis waveform: single, dual, quad screen display (LCD), oct \cdot hex screen display (printer only)
 - X-Y waveform: dot, line, single \cdot quad screen
- (8) Printing
 - Auto print, Manual print, Partial print, Report (B4 size) print, Screen hard copy.
 - Multiple printing possible.
- (9) High-quality print
Smooth print function approximates analog waveform.
- (10) Logging function
Numeric printout of waveform data
- (11) Memory segmentation function
 - Helps to reduce dead time. (Sequential save function)
 - Memory is divided into blocks which can freely selected by the user for storing measurement data. (Multi-block function)
- (12) Processing function
 - Waveform processing (arithmetic processing, differential processing etc.)
 - Waveform parameter processing (frequency measurement, rms measurement etc.)

(13) Averaging

This makes it possible to eliminate noise and irregular signal components.

(14) Waveform evaluation function detects abnormal waveforms.

4.2 Operation Sequence (MEM)



Advanced function

Memory segmentation

- See Chapter 15.

Sequential Save Function

Multi-Block Function

Waveform operation Function

- See Chapter 16.

Waveform parameter calculation

Calculating Waveform Data

4

Setting the CHANNEL Screen

- Set the waveform display color for each channel, measurement range, input coupling, zero position, and filter.
See Chapter 9.



Setting the TRIGGER Screen

- Set the trigger source, trigger types and conditions, the pre-trigger, etc.
See Chapter 10.



Starts Measurement

- Press the **START** key and the LED lights.
- When the trigger conditions are met, measurement start.
- Press the **STOP** key and the LED goes out after measurement has finished.

Printouts and Saves the data

Printout the measurement data

See Chapter 13.

Save the measurement data

See Chapter 14.

Operating the DISPLAY Screen

Wave scrolling

See Section 11.1.

Using the A/B cursor

See Section 11.2.

Setting the magnification/compression ratio

See Section 11.3.

Zoom function

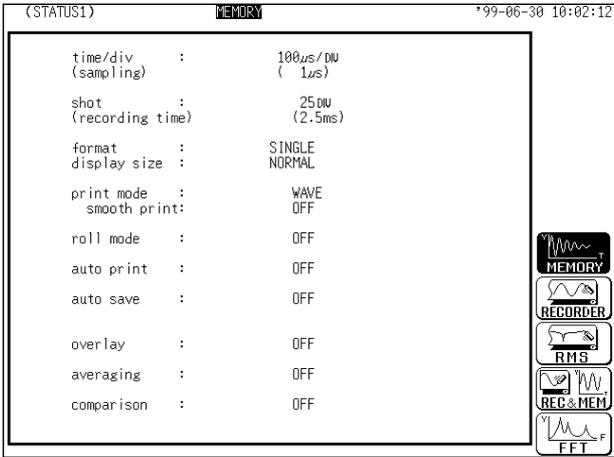
See Section 11.4.

Setting the SYSTEM Screen

- See Chapter 12.

4.3 STATUS Settings (MEM)

4.3.1 Setting the Function Mode



Method

Screen: STATUS1, CHANNEL, DISPLAY

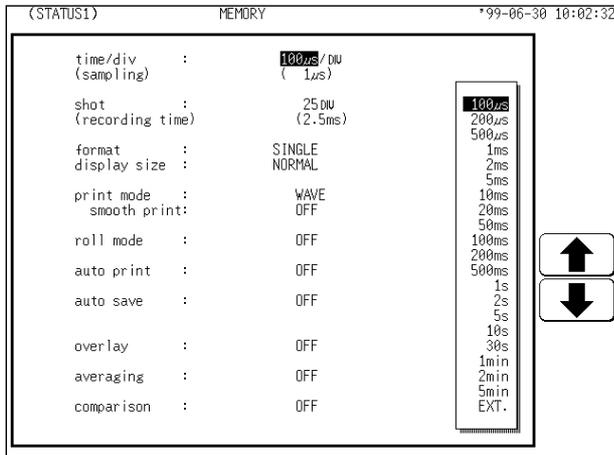
- ① Call up the STATUS1, CHANNEL or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Press the F1 [MEMORY].

Selection

-  : Memory recorder function
-  : Recorder function
-  : RMS recorder function
-  : Recorder and Memory function
-  : FFT function

4.3.2 Setting the Time Axis Range

- Set the speed for inputting and storing the waveform of the input signal.
- Time axis range setting expresses the time for 1 DIV.
- The sampling period is 1/100th of the set value for the time axis range. (100 samples/DIV)



Method-1 Screen: STATUS1, DISPLAY

- ① Call up the STATUS1 or DISPLAY screen.
- ② Move the flashing cursor to the **time/div** item, as shown in the figure on the left.
- ③ Use the JOG control, the function keys or the **TIME/DIV** key to make the selection.

External sampling can be used to set 「EXT.」
External sampling See section 17.4.

Method-2 : Use the TIME/DIV key

- ① Call up the STATUS1 or DISPLAY screen.
- ② Use the **TIME/DIV** key to make the selection.

The **TIME/DIV** key can be used regardless of where the flashing cursor is located.

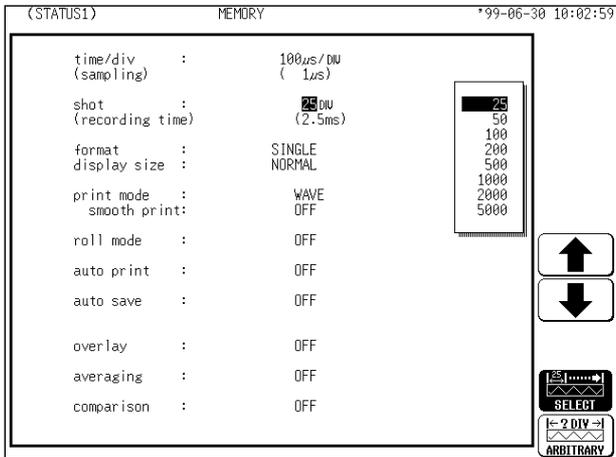
Any number of samples per division can be set when EXTERNAL is selected as the time axis range.

4.3.3 Setting the Recording Length

- The length of recording for one measurement operation (number of DIV) can be set.

SELECT : Select the recording length.

ARBITRARY : Any recording length can be selected by the user.



Method-1 Screen: STATUS1, DISPLAY

Fixed recording length mode

- ① Call up the STATUS1 or DISPLAY screen.
- ② Move the flashing cursor to the **shot** item, as shown in the figure on the left. Select the **SELECT**.
- ③ Use the JOG control or the function keys to make the selection.

Selection



: Move the cursor up in the selection window.



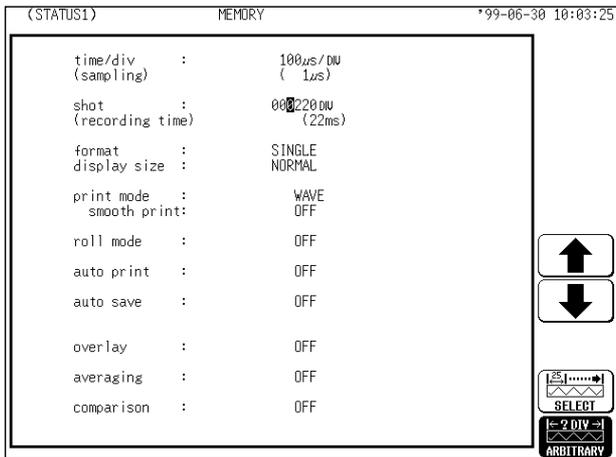
: Move the cursor down in the selection window.



: Set the fixed recording length mode.



: Set the any recording length mode.



Method-2 Screen: STATUS1, DISPLAY

Any recording length mode

- ① Call up the STATUS1 or DISPLAY screen.
- ② Move the flashing cursor to the **shot** item, as shown in the figure on the left. Select the **ARBITRARY**.
- ③ Use the JOG control or the function keys to make the selection. Use the cursor keys to change the column.

Selection



: Value up.



: Value down.



: Set the fixed recording length mode.



: Set the any recording length mode.

NOTE

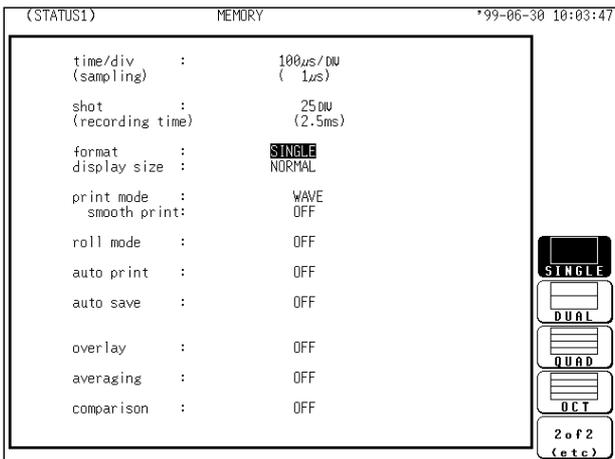
- Depending on the number of channels, the recording length is limited.
- If the recording length is changed during measurement, measurement is restarted using the newly set recording length.

The relation between number of channels and maximum recording length

Memory capacity	Maximum recording length			
	32 ch	16 ch	8 ch	4 ch
16 M words	5000 DIV	10000 DIV	20000 DIV	40000 DIV
64 M words	20000 DIV	40000 DIV	80000 DIV	160000 DIV

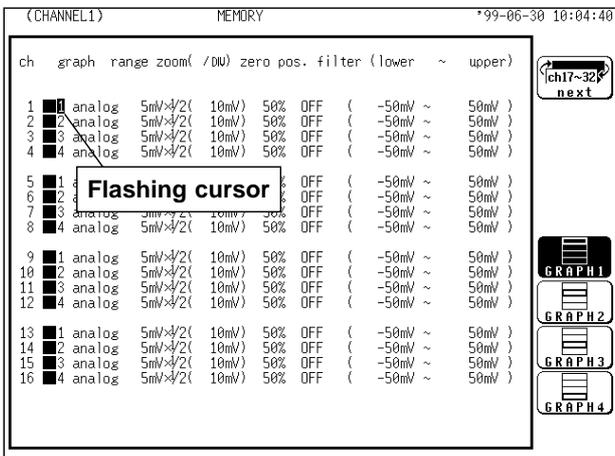
4.3.4 Setting the Format

- The style can be set for showing input signals on the screen display and recording them on the printer.
- The styles single, dual, quad, (DISPLAY screen), oct · hex (Print only, Display quad style) X-Y single · X-Y quad (dot) and (line) are available.
- The voltage per division is automatically changed according to the display format.



Method Screen: STATUS1

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **format** item, as shown in the figure on the left.
- ③ Use the function keys to select the display format.
- ④ Set which graph type to use when display format has been set to DUAL, QUAD, OCT or HEX screen display.
Setting the X-Y screen, see Section 4.4.



- ⑤ Press the **CHAN** key to call up the CHANNEL1 screen.
- ⑥ Move the flashing cursor to the point in the figure on the left. The figure shows the setting for CH1. Setting for CH2 to CH 32 should be made in the same way.
- ⑦ Use the function keys to select the graph.

Selection

-  : Display the waveform on graph 1.
-  : Display the waveform on graph 2.
-  : Display the waveform on graph 3.
-  : Display the waveform on graph 4.

In the cases of OCT and HEX (printer only), as far as the printer recording output is concerned, the waveforms for each channel are automatically distributed on each graph according to the table below:

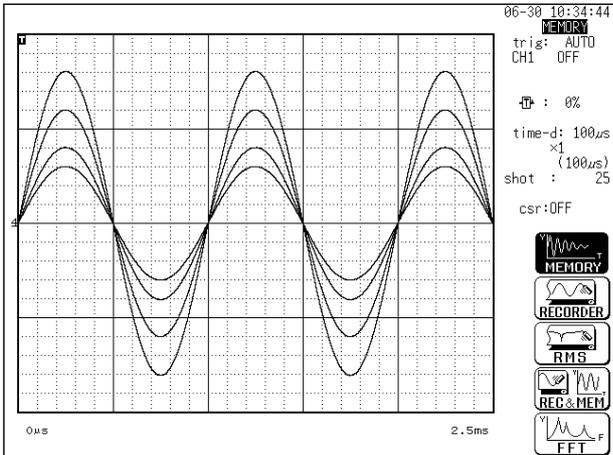
OCT		HEX			
graph	analog	graph	analog	graph	analog
1	CH 1,9,17,25	1	CH 1,17	9	CH 9,25
2	CH 2,10,18,26	2	CH 2,18	10	CH 10,26
3	CH 3,11,19,27	3	CH 3,19	11	CH 11,27
4	CH 4,12,20,28	4	CH 4,20	12	CH 12,28
5	CH 5,13,21,29	5	CH 5,21	13	CH 13,29
6	CH 6,14,22,30	6	CH 6,22	14	CH 14,30
7	CH 7,15,23,31	7	CH 7,23	15	CH 15,31
8	CH 8,16,24,32	8	CH 8,24	16	CH 16,32

NOTE

For details on logic channels, refer to Section 9.3.8.

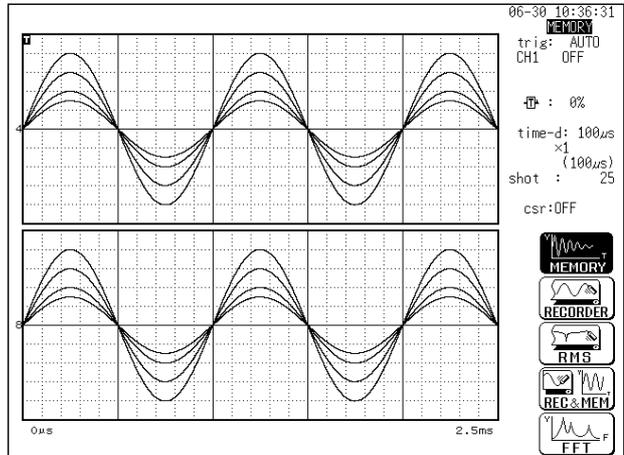
(1) Single graph

Display and record as one graph.
(At the most, 32 analog + 32 logic signals)



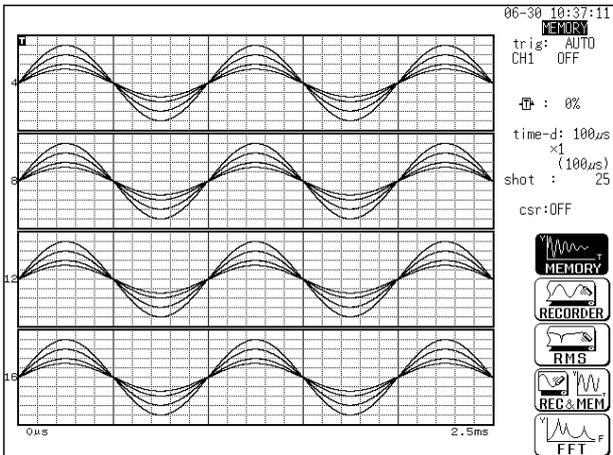
(2) Dual graph

- Display and record as two graphs. (At the most, 32 analog + 16 logic signals)
- Specify which input channel to use for waveform graph display and recording.



(3) Quad graph

- Display and record as four graphs.
- (At the most, 32 analog + 8 logic signals)
- Specify which input channel to use for waveform graph display and recording.



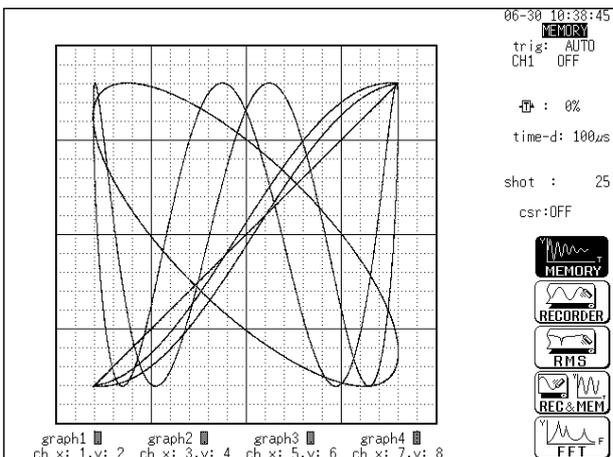
(4) Oct graph (printer only)

- Record as eight graphs.
- (At the most, 4 analog + 4 logic signals)
- Channel positions are automatically distributed.

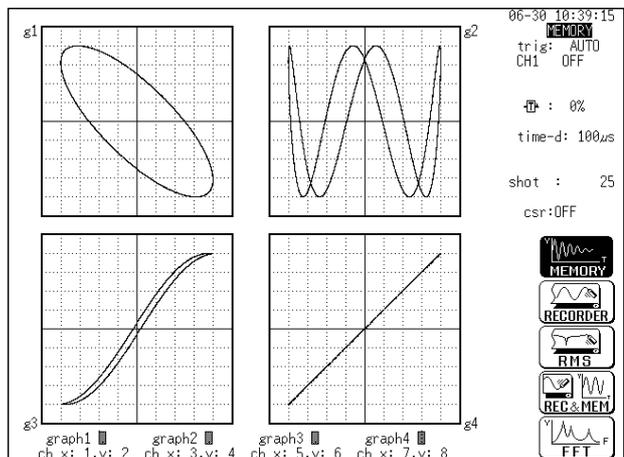
(5) HEX graph (printer only)

- Record as sixteen graphs.
- (At the most, 2 analog + 2 logic signals)
- Channel positions are automatically distributed.

(6) X-Y Single

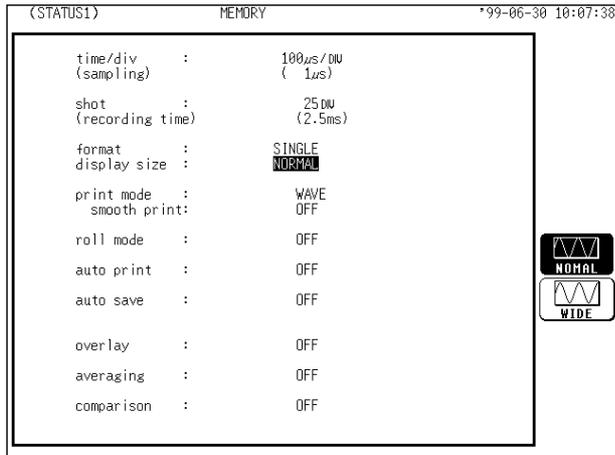


(7) X-Y Quad



4.3.5 Setting the Display Size

The display size can change the normal size or the wide size.



Method Screen: STATUS1

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **display size** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Normal size



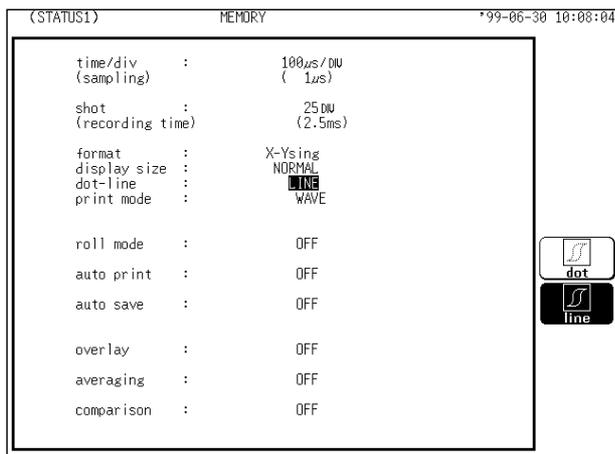
: Wide size

NOTE

The display size can be changed by pressing the **DISP** key on the display screen.

4.3.6 Setting the Interpolation (dot-line)

- Interpolation can be set when set the X-Y graph format.
- This setting determines whether the input waveform (sampling data) is to be displayed and printed as a series of dots or a line using linear interpolation.



Method Screen: STATUS1

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **dot-line** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Linear interpolation is not performed.



: Linear interpolation is performed.

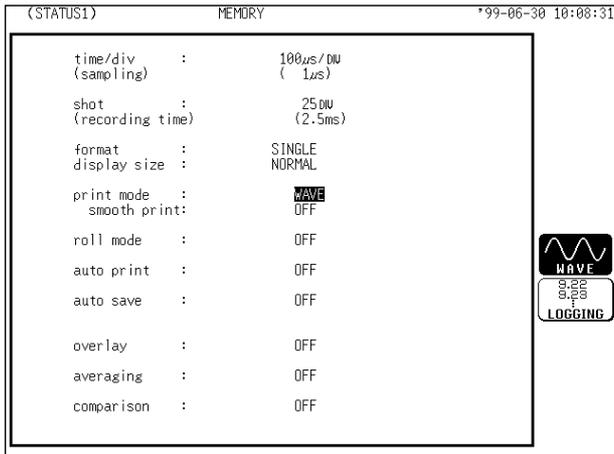
4.3.7 Setting the Print Mode

Select the format, waveform, or numerical value should be used to output measured data and calculation results.

Waveform : The smooth print function can be used, but print speed will decrease.

Numerical value : The data spacing interval also must be set.

Printing as a waveform



Method Screen: STATUS1

(1) Setting the Printer Format

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the print mode item, as shown in the figure on the left.
- ③ Use the function keys to select WAVE.

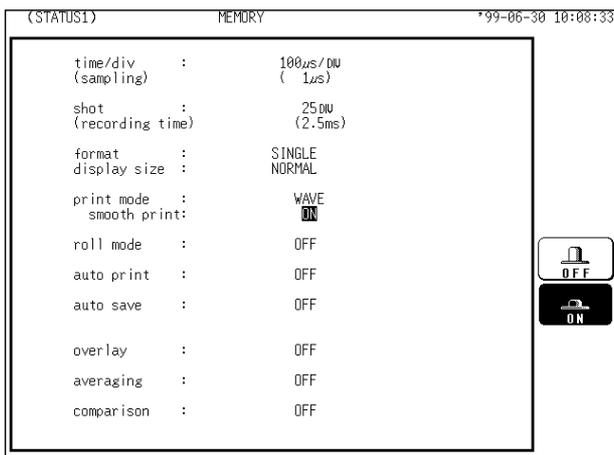
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



- ① When the waveform format is selected, determine whether to use the smooth printing or not.
- ② Move the flashing cursor to the smooth print item.
- ③ Use the function keys to make the selection.

Selection



: Normal printing is carried out.

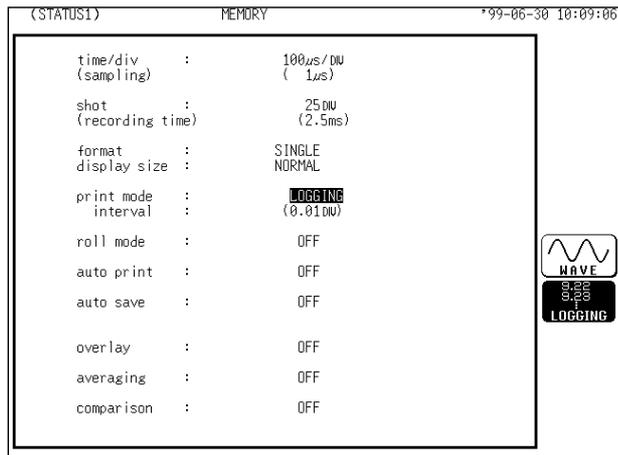


: Smooth printing is enabled.

NOTE

On X-Y screen, smooth printing cannot be specified.

Printing as numeric data



Method Screen: STATUS1

(1) Setting the Printer Format

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the print mode item, as shown in the figure on the left.
- ③ Use the function keys to select LOGGING.

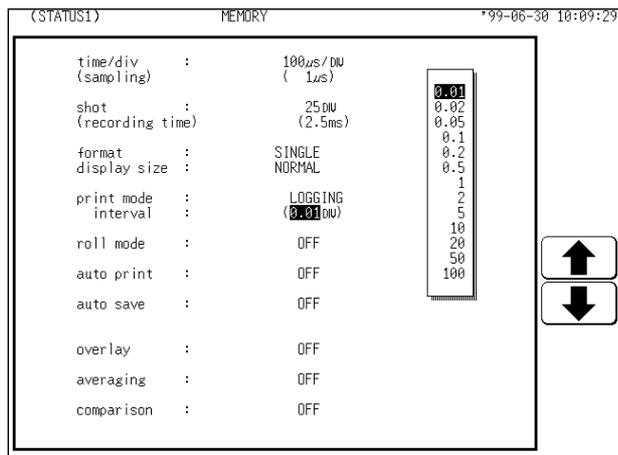
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



(2) Setting the print interval

- ① When the numeric data format is selected, set the print interval.
- ② Move the flashing cursor to the interval item.
- ③ Use the JOG control or the function keys to select the print interval.

Selection



: Move the cursor up in the selection window.



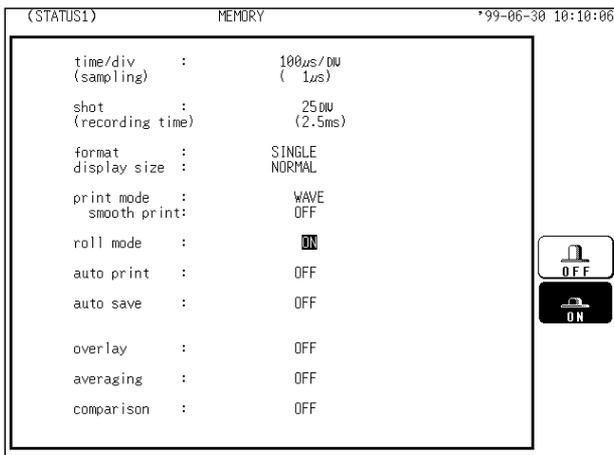
: Move the cursor down in the selection window.

NOTE

- When the print interval longer than the recording length is set, only the first dot is printed.
- Since each division equals 100 samples, the print interval "0.01" indicates one sample (no print interval).

4.3.8 Setting the Roll Mode

- This mode can be used at a time axis range setting of 10 ms/DIV or slower.
- In normal recording, the waveform is displayed only after all data of the recording length have been captured. At low sampling speed settings, this will cause a considerable delay between the start of measurement and the appearance of the waveform on the display.
- When roll mode is set to ON, the waveform is displayed immediately at the start of recording (the screen scrolls).
- When the time axis range of 10 ms/DIV or faster is set, normal recording is carried out even if roll mode is set to ON.



Method Screen: STATUS1

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the roll mode item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Normal recording is carried out.



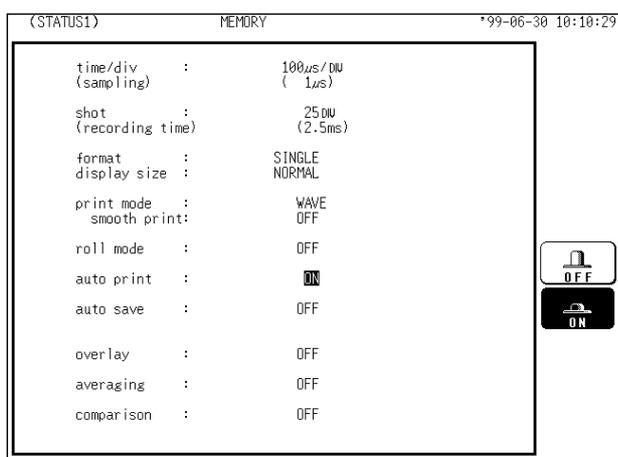
: The waveform is displayed immediately at the start of recording.

NOTE

- Roll mode cannot be set together with the external sampling.
- When Roll Mode is set to ON, the settings for Overlay, Averaging, Sequential Saving, Calculating Waveform data, and Waveform evaluation are automatically turned OFF.
(When the display format is set to "X-Y," you can turn ON Overlay with Roll Mode ON.)

4.3.9 Setting the Auto Print Function

When the function is enabled, printout is carried out automatically after a measurement data is captured.



Method Screen: STATUS1

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the auto print item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Auto print is disabled.



: Auto print is enabled.



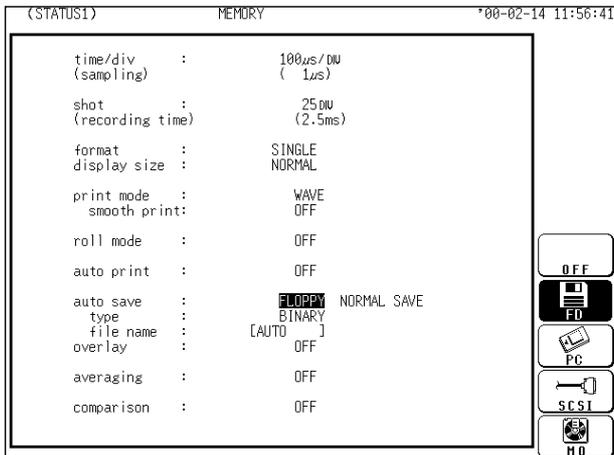
: Print image data can only be transferred to the 9333 LAN COMMUNICATOR when using a LAN card.

NOTE

- When cursor A and B are enabled, partial printing is executed.
- When the roll mode is enabled and the time-axis range is lower than 10 ms/division, data is displayed and printed simultaneously.

4.3.10 Setting the Auto Save Function

- When the function is enabled, measurement data are automatically stored on a floppy disk, PC card, MO disk or connected SCSI device after they are captured.
- The Auto Save function stores a file in the directory currently selected on the file screen. See Section 14.12.2.

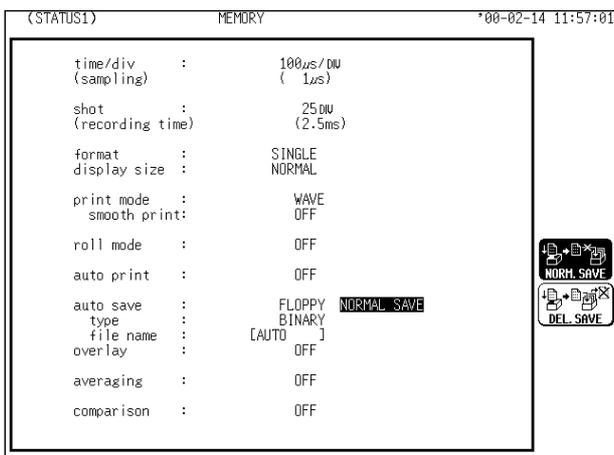


Method Screen: STATUS1

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the auto save item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

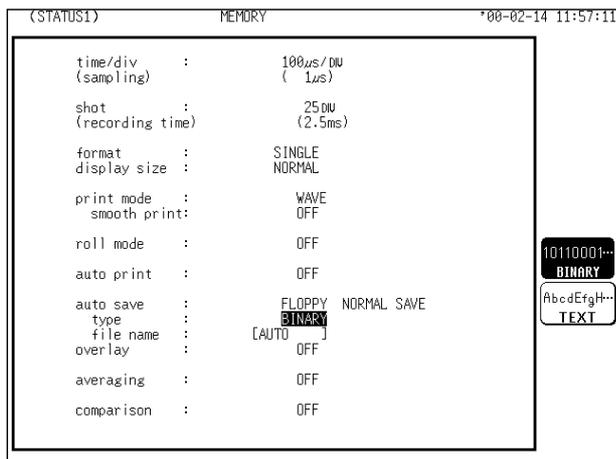
-  : Auto save is disabled.
-  : Automatically stored on floppy disk
-  : Automatically stored on PC card.
-  : Automatically stored on connected SCSI device.
-  : Automatically stored on MO disk.
-  : Data can only be transferred to the 9333 LAN COMMUNICATOR when using a LAN card.



- ④ When Media is selected, the Storage method item appears.

Selection

-  : When the media becomes full, automatic storage stops.
-  : When the media becomes full, old files are deleted to make room for automatic storage. With the binary format selected, the file with the extension 'MEM' is deleted, and if sequential save is selected, files with the extension 'SEQ' are also deleted. With the text format selected, files with the extension 'TXT' are deleted.



- ⑤ Move the flashing cursor to **type**, and select the format.

Selection

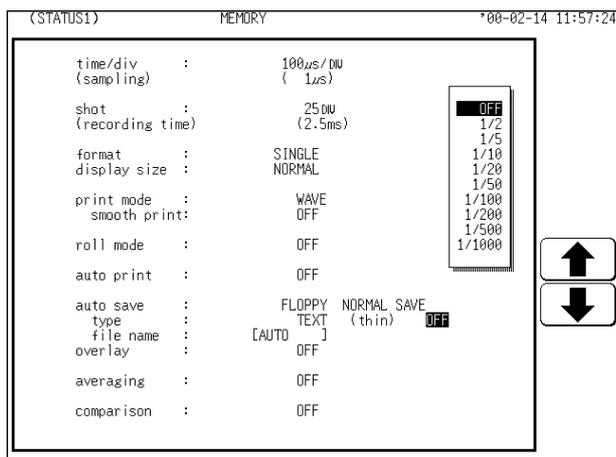
10110001...
BINARY

: Data are stored as binary data.

AbcdEfgH...
TEXT

: Data are stored as text data.
Data stored in the text format is not readable by the 8826.

- ⑥ When the data format to be saved is set to text data, the intermittent setting item is displayed. Use the function keys or Jog control to make a setting.



Selection



: Move the cursor up in the selection window.

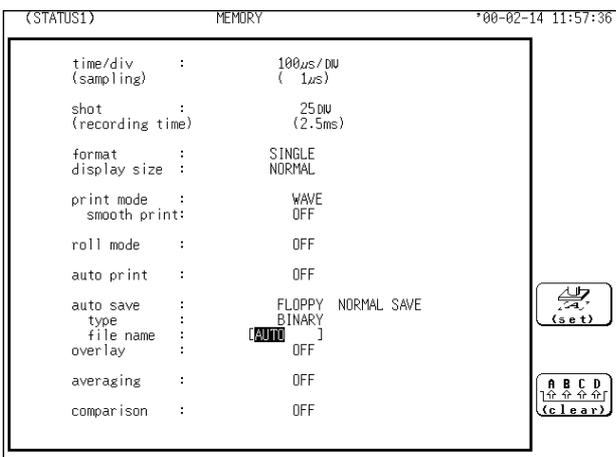


: Move the cursor down in the selection window.

- ⑦ Set the file name. For the input method, refer to Section 9.8.4.

When using auto-save, a number is appended to the name you specify as the file name. This then becomes the file name. If you start procedures before specifying a file name, AUTO is automatically enabled.

- Do not use the characters and symbols below in a file name. A file containing any of these characters/symbols in its file name cannot be processed under Windows 2000 or XP. Half-size symbols: +, =, [,]

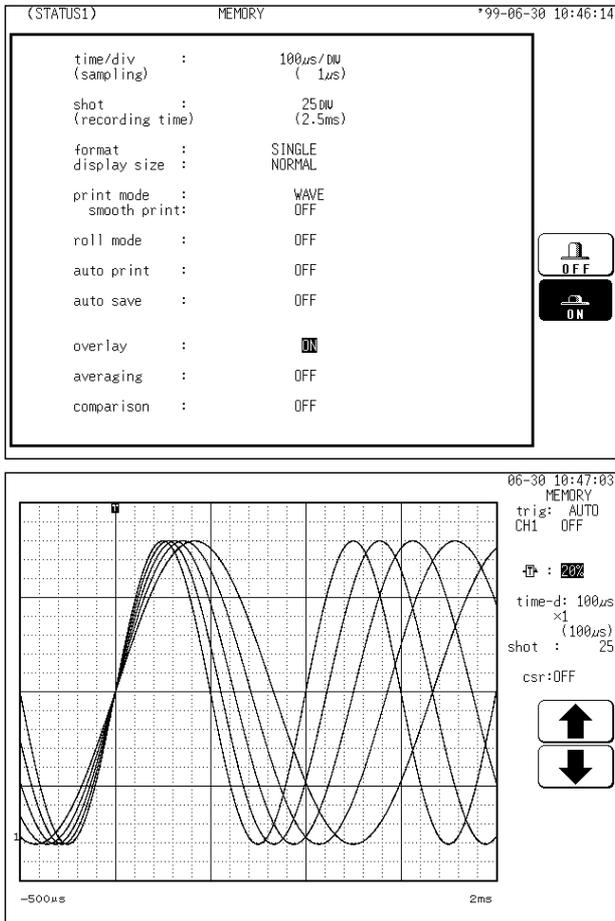


NOTE

- When auto-save is enabled, the storage channel cannot be selected. Data for the channel for which the waveform is displayed is saved.
- For details on auto saving file name, refer to Section 14.7.
- When both auto-print and auto-save are enabled, auto-save usually takes precedence. However, if roll mode is enabled, auto-print will execute first.
- For details on connected SCSI device, refer to Section 14.4.
- When cursor A and B are enabled, partial saving is executed.
- During automatic storage, if the **STOP** key is pressed twice to interrupt measurement, waveforms taken prior to the interruption are stored automatically.
- The directory and the number of files that can be stored in the directory are limited. For details, see Section 14.7.
- When "COMMUNI" (communications) is selected as Media, Storage Method and Type are not displayed.

4.3.11 Setting the Overlay Function

- Overlay is performed without clearing the currently displayed waveform (if trigger mode is REPEAT or AUTO). This allows comparison to the immediately preceding waveform.
- If trigger mode is SINGLE, measurement terminates after one set of data has been collected. Therefore the overlay setting is invalid.



Method Screen: STATUS1

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **overlay** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Overlay is not performed.



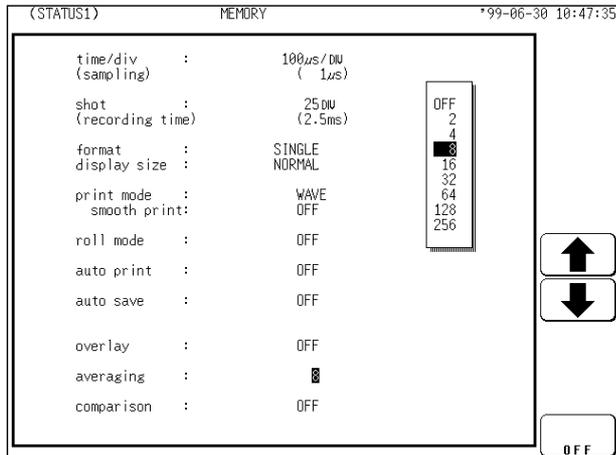
: Overlay is performed.

NOTE

- While overlay is being executed, operations on the display screen (waveform scrolling, change in time-axis magnification/compression ratio, change in zero position, change in display size, and jumping to another display screen using a VIEW function (see Section 11.6)) are disabled.
- When manual printing or trace cursor reading carried out, only the last waveform will be done.
- Use Report Print to print overlaid waveforms. (see Section 13.6.7)
- If one of the following settings is changed, the overlay waveform display terminates and only the last waveform is shown:
 - ① STATUS1: Display format, Display size
 - ② CHANNEL1: Input settings
- The overlay function cannot be set together with roll mode.

4.3.12 Setting the Averaging Function

- The averaging function allows capturing several instances of a waveform and determining the average.
- This makes it possible to eliminate noise and irregular signal components.
- The higher the number of averaging instances, the more effectively will noise be suppressed.



Method Screen: STATUS1

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the averaging item, as shown in the figure on the left.
- ③ Use the JOG control or the function keys to set the averaging count.

Selection

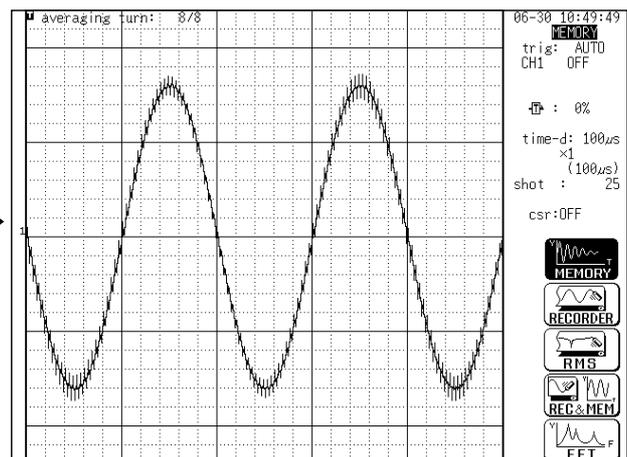
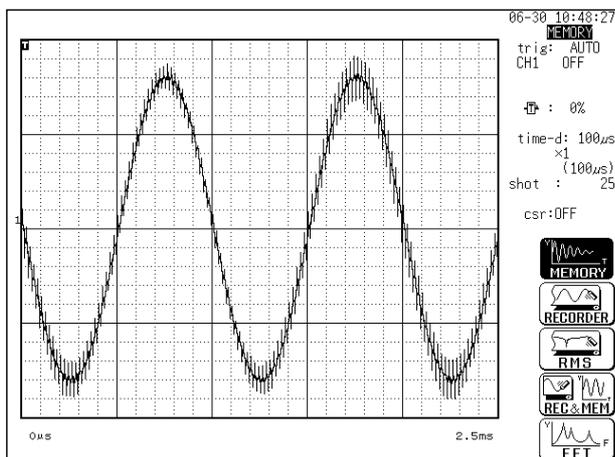


: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

After starting the measurement, the averaging count and the current waveform data count are shown on the screen.



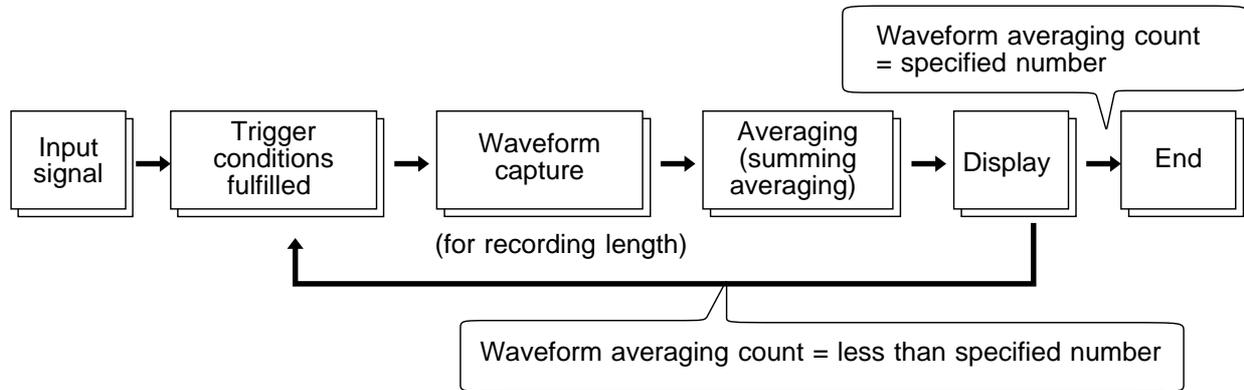
NOTE

- When the averaging function is used, logic waveform is not displayed.
- When the memory segmentation function is used, averaging is not available.
- Averaging and waveform processing cannot be carried out simultaneously.
- The averaged waveform becomes available for waveform processing when the averaging setting is turned OFF following measurement.
- When the averaging function is used, the maximum recording length is reduced to 25% of the normal value.

Averaging and trigger mode

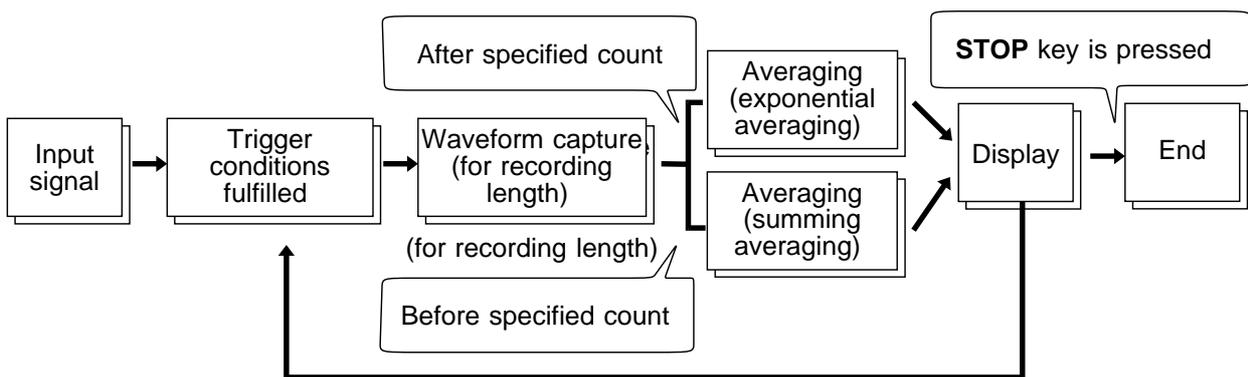
Trigger mode: SINGLE

- (1) After the **START** key was pressed, data are captured whenever the trigger conditions are fulfilled, and summing averaging is carried out.
- (2) When the specified number of data has been captured, measurement stops automatically.
- (3) If the measurement was stopped prematurely with the **STOP** key, the averaging result up to that point is displayed.



Trigger mode: REPEAT

- (1) After the **START** key was pressed, data are captured whenever the trigger conditions are fulfilled, and summing averaging is carried out until the specified averaging count. The averaging result is shown on the display.
- (2) After the specified averaging count was reached, exponential averaging is carried out whenever data are captured, and the averaging result is shown on the display.
- (3) If the measurement was stopped prematurely with the **STOP** key, the averaging result up to that point is displayed.



Trigger mode: AUTO

When the **START** key is pressed, data are captured even if trigger conditions are not fulfilled after a certain interval. If averaging is applied to unsynchronized input signals, the result will be meaningless.

NOTE

For details on summing averaging and exponential averaging, refer to Section 21.3.6.

4.3.13 Setting the Waveform Evaluation

- The Waveform Evaluation function can be used Memory recorder function (single screen and X-Y single screen).
- GO (pass) or NG (fail) evaluation of the input signal waveform can be performed using an evaluation area specified by the user.
- This can serve to detect irregular waveforms.
- After the evaluation result is generated, signals are output from the GO/NG terminal.
- All the channels being displayed are evaluated.

NOTE

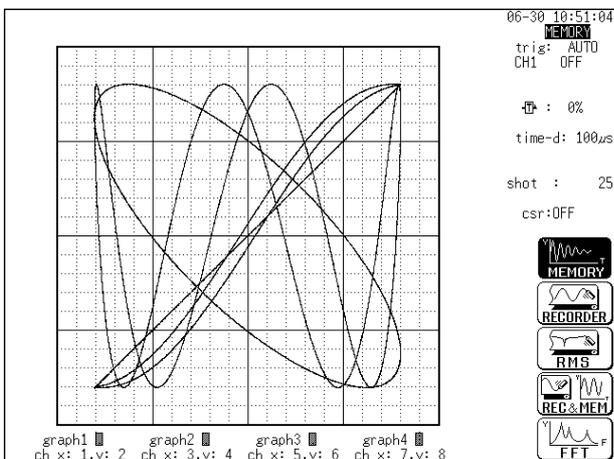
- When the waveform judgment area is created using the memory recorder function, waveform judgment using the FFT function is disabled.
- For details on the waveform evaluation, refer to Section 16.3.

4.4 Using the X-Y Waveform Plots (MEM)

- Setting the display format to X-Y in status screen allows X-Y waveforms to be combined. Any of channels 1 to 32 can be selected for each of the X and Y axis. Up to four X-Y plots can be made simultaneously.
- Voltage axis magnification/compression is active also when using X-Y combined plotting.
- Using the A/B cursors, it is possible to specify the data between the cursors for partial plotting.

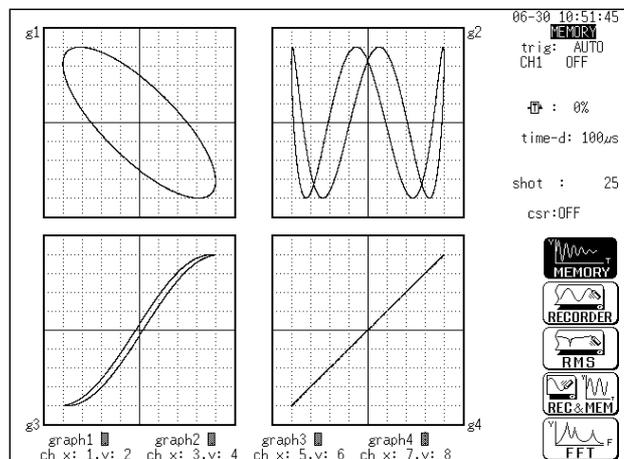
(1) X-Y Single

A single plot is displayed and recorded.



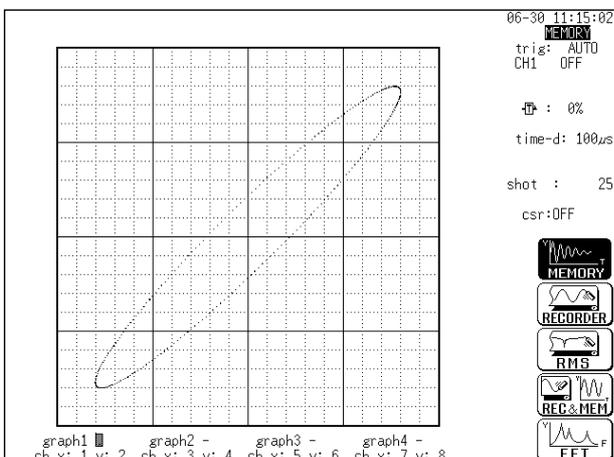
(2) X-Y Quad

Four single plot is displayed and recorded.



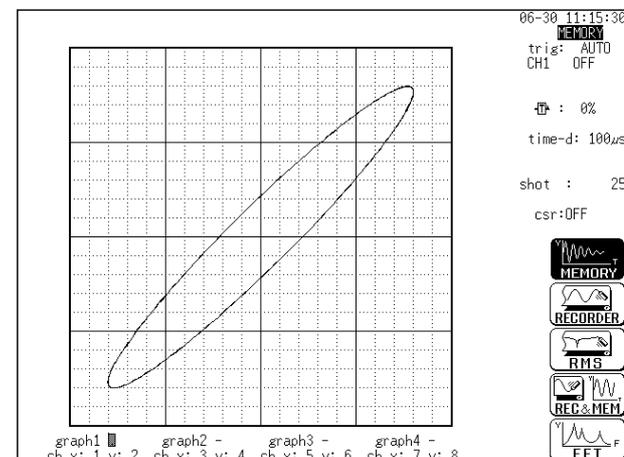
(3) X-Y (dot)

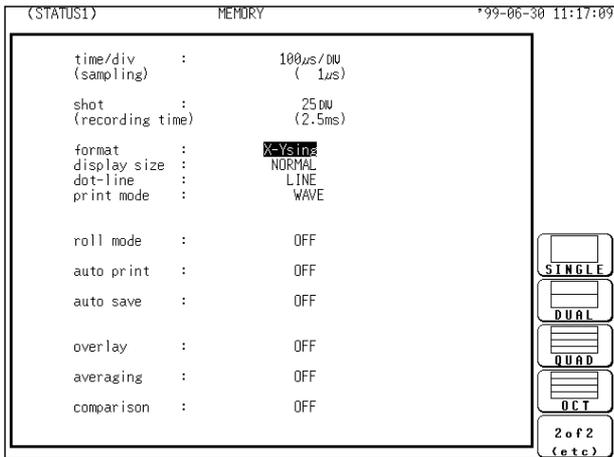
- The sampled data is displayed and recorded just as it comes.
- Linear interpolation is not performed.



(4) X-Y (line)

- Linear interpolation is performed.
- The display becomes easier to read, but display speed is slower compared to dot display.

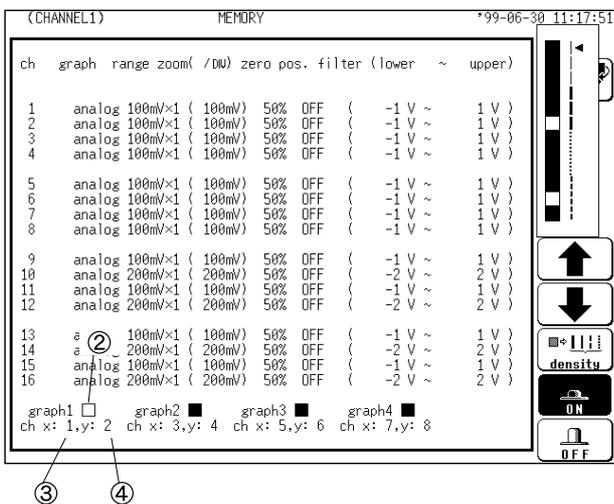




Method Screen: STATUS1, CHANNEL1

(1) Setting the Format

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **format** item, as shown in the figure on the left.
- ③ Use the function keys to select the "X-Y single or "X-Y quad" format.
- ④ Use the function keys to set the interpolation (dot-line). See Section 4.3.6.



(2) Setting the Channel

- ① Press the **CHAN** key to call up the CHANNEL1 screen.
- ② Move the flashing cursor to desired channel, and use the function keys to set the waveform color (including displays waveform ON/OFF).

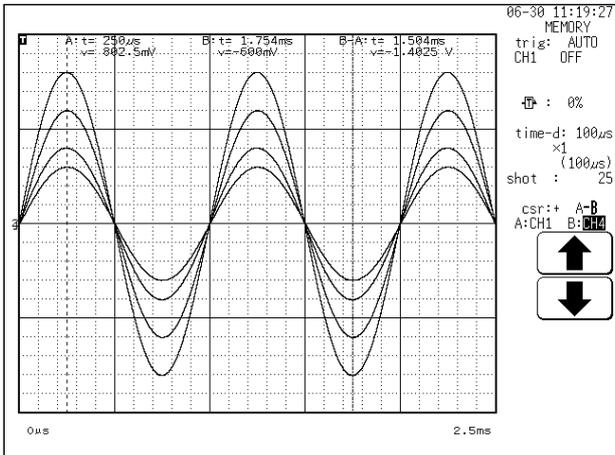
Selection

-  : Move the cursor up in the selection window.
-  : Move the cursor down in the selection window.
-  : Waveform is performed.
-  : Waveform is not performed.

- ③ Specify the X-axis channel.
Move the cursor to the channel to be used as X axis. And use the function keys or the JOG control to select X axis.
- ④ Specify the Y-axis channel.
This is done in the same way as in step ③.
- ⑤ For graph 2 to graph 4, the settings are made in an identical.

Partial X-Y plot

Using the A/B cursors, it is possible to specify a range for partial X-Y plotting. (Normal X-Y plotting covers all data of the recording length.)



Method

Screen: DISPLAY (excluding X-Y1 and X-Y4)

- ① Display the captured waveform data, using a format other than X-Y1 and X-Y4.
- ② Use the A/B cursors to specify the desired portion for plotting, as shown in the figure on the left (see Section 11.2).
- ③ Press the **STATUS** key to call up the **STATUS1** screen.
- ④ Carry out combined plotting as described above.

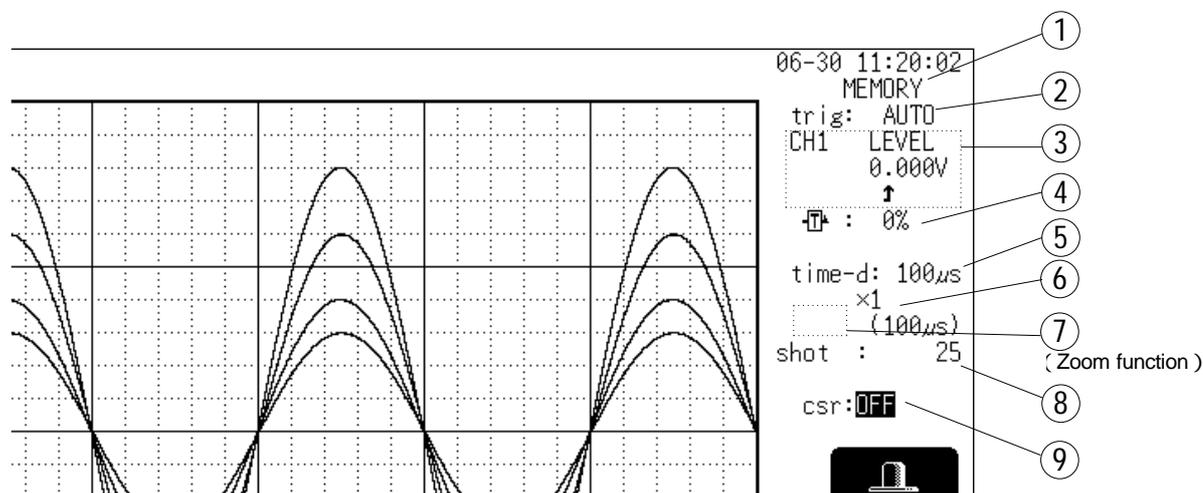
In partial X-Y plot, the screen displays the period of time passed after the completion of the trigger specified using the cursors A and B.

4.5 Settings on the Display Screen (MEM)

Explains the setting items on the Display screen.

For details on setting, refer to Section 4.3.

When want to use the JOG control, press the **VALUE** select key. (The selection window is not displayed.)



① Function	MEM, REC, RMS, REC&MEM, FFT	• Select function.
② Trigger mode	SINGLE, REPEAT, AUTO	• Select trigger mode.
③ Analog trigger	OFF, LEVEL, OUT, IN, V-DROP, CYCLE	• Set the analog trigger.
④ Pre-trigger	0 to 100%, -95%	• Set the Pre-trigger.
⑤ Time Axis Range	100 µs/DIV to 5 min/DIV, EXT	• Set the time 1 scale (1 DIV).
⑥ Magnification /compression along the time axis	× 10 to × 1/10000	• By magnifying the waveform, detailed observations can be made. By compressing the waveform, an entire change can be promptly apprehended.
⑦ Zoom function	× 1/5000 ~ 10	• Display screen into upper and lower windows, so that the regular-size waveform is displayed in the upper window and the waveform enlarged in the time axis direction is displayed in the lower window.
⑧ Recording Length	SELECT : 25 DIV to 5000 DIV ARBITRARY : 1 DIV to 5000 DIV • Using channels : 32 ch • Capacity : 16 M words	• The length of recording for one measurement operation (the number of DIV) can be set.
⑨ Cursor Measurement	OFF, ↔, ↑, +	• The A/B cursors can be used.
Display size	NORMAL, WIDE	• The screen size can be changed by pressing the DISP key.
Input channel settings	• Analog input • Logic input • X, Y axis (X-Y format)	• Enables the measurement conditions for each channel on the display screen to be set or changed. See Section 9.9.
Input level monitor function	Press the LEVEL MON. key.	• See Section 11.5.
VIEW function	Press the VIEW key.	• See Section 11.6.

4.6 Auto Range Function

This function automatically selects the time axis range, measurement range and zero position.

Taking the lowest numbered channel among the channels for which waveform display is on, 1 to 2.5 cycles are automatically set to be recorded as 25 DIV.

Method Screen: DISPLAY

- ① Press the DISP key to call up the DISPLAY screen.
- ② Press the AUTO key.
- ③ Use the function keys to make the selection.



: Execute the Auto Range function.



: Cancel the Auto Range function.

If measurement has started using the auto-range function:

Conditions related to the input units (All Channel) :	
Measurement range, Zero position: value	Set automatically
Magnification/compression ratio along the voltage axis:	Single screen: × 1
Magnification/compression ratio along the time axis:	Other screen: × 1/2
Low-pass filter, Input coupling	OFF, DC
Trigger conditions (For one channel only) :	
AND/OR for internal trigger and external trigger	OR
Trigger mode / Pre-trigger	AUTO / 20%
Internal trigger.	Only ON for the lowest numbered one of the channels for which waveform display is on. OFF for the other channels. (However, only in the case that the difference between the maximum and minimum values is significant.)
Trigger type : Level	Slope: (↑) (rising), Trigger level: value set automatically, Filter: OFF
Status conditions:	
Time axis range (time/div): value set automatically, Memory segmentation: OFF	

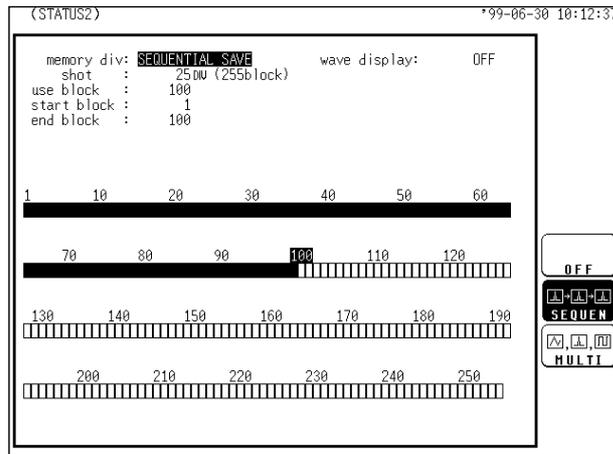
NOTE

- Because the auto-range function performs automatic setting for the input signal present at the time the function is executed, input a signal before executing the function.
- If for the input signal for this channel there is only a small difference between the maximum value and the minimum value in the range of highest sensitivity (5 mV/DIV), the setting is made by taking the next higher channel.
- If the range cannot be determined, for all channels for which the waveform display is on. A warning message appears, and measurement is abandoned.
- When the auto range function is activated by pressing the AUTO key, a trigger output signal is generated. This should be taken into consideration when using both the trigger output and the auto range function.
- The auto-range function does not operate on channels for which the CHARGE or PREAMP measurement mode is selected on the 8947 CHARGE UNIT.

4.7 Other Screen Settings (MEM)

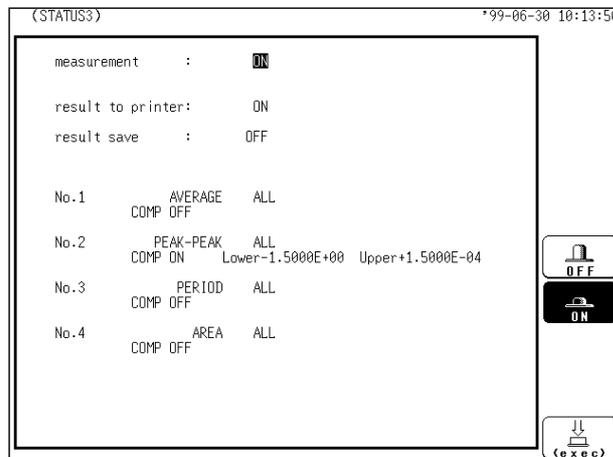
The status screen for the memory recorder function contains three more setup screens. For detailed setup procedures, see the associated sections.

Screen	The associated chapter and sections
STATUS 2 Screen: Memory Segmentation Screen	Chapter 15 Memory Segmentation Function
STATUS 3 Screen: Parameter Calculation Screen	Section 16.1 Parameter Calculation
STATUS 4 Screen: Calculating Waveform Data Screen	Section 16.2 Calculating Waveform Data



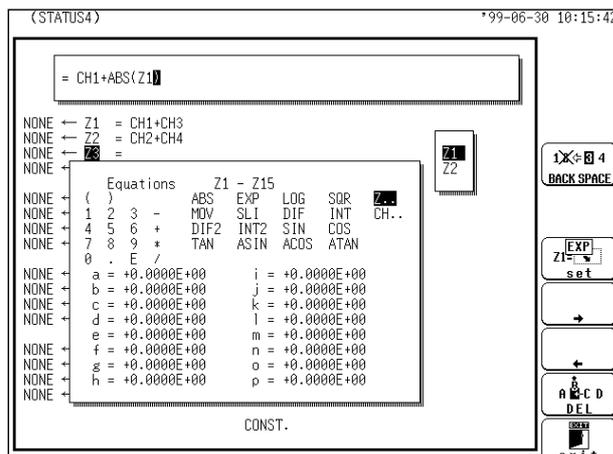
Memory Segmentation Screen

Press the **STATUS** key



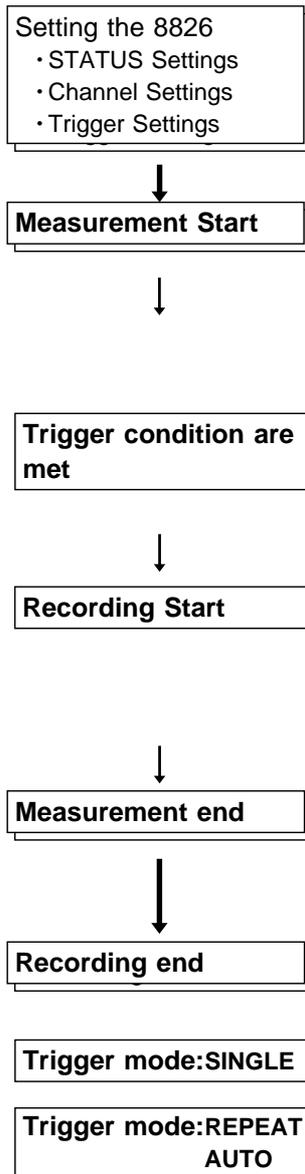
Parameter Calculation Screen

Press the **STATUS** key



Calculating Waveform Data Screen

4.8 Start and Stop Operation (MEM)



- See Section 4.3 STATUS settings
- See Chapter 9 Input channel settings
- See Chapter 10 Trigger Functions

- Press the **START** key and LED light.
- When the pre-trigger is set, the trigger will not be registered for a certain period after the start of measurement. (During this interval, **Pre-trigger standby** is shown on the display.)
- When the trigger can be registered, the indication **Waiting for trigger** is shown on the display.

- Data recording starts when trigger condition are met.
- When trigger mode selected AUTO, unit waits for about 1 second for trigger conditions to be met. After this interval, data recording starts, regardless of trigger state.

- Displays "**Storing**".
- When roll mode is set to ON, the waveform is displayed (scrolling) immediately at the start of recording
- Using the **VIEW** key to display the time (from measurement started time).
- When the **STOP** key is pressed twice during measurement, the 8826 is forcibly stopped. Then the waveform data until the **STOP** key is pressed is displayed and saved. When the auto saving is set to ON, the data until a forced termination is automatically saved. (Auto printout is not executed.)

- Waveform displays after data corresponding to recording length have been stored in memory.
- Auto printout and auto save are executed.

- End of measurement

- Each time when trigger conditions are met, data are recorded and memory contents are overwritten.

【 End of measurement in REPEAT and AUTO trigger modes 】

- When the **STOP** key is pressed once during measurement, the 8826 acquires measurement data in an amount corresponding to the set recording length, and the measurement is stopped. (Waveform display, auto printout, and auto save are executed.)
- When the set time-axis range is longer than 10 ms/DIV, waveforms collected before the **STOP** key is pressed are displayed.
- When the set time-axis range is shorter than 10 ms/DIV, waveforms are not displayed. Those waveforms are displayed only when previously recorded measurement data exists.

Chapter 5

Recorder Function

5.1 Outline of the Recorder Function

The recorder function has the following features.

- (1) Real time display and printing of the input signal
- (2) Real time continuous recording of the input signal
- (3) All input channel data are recorded on the same time axis.
Since data for all channels can be superimposed, the relative relationship between input signals can be observed visually.
- (4) Time axis setting
20 ms/DIV to 1 h/DIV
- (5) Time axis resolution 100 points/DIV (printer)
- (6) Sampling period
1, 10, 100 μ s, 1, 10, 100 ms
(Can be selected, from 1/100 of the time axis setting)
- (7) Memory capacity
 - 16 M words: 2000 DIV
 - 64 M words: 10000 DIV
 - Arbitrarily (Set from 1 division to the maximum number of divisions at 1-division intervals)
- (8) Waveform magnification/compression display and printout
 - Time axis direction: $\times 1$ to $\times 1/500$
 - Voltage axis direction: $\times 10$ to $\times 1/2$ (single, X-Y single)
 $\times 5$ to $\times 1/4$ (dual to hex, X-Y quad)
 - With the variable function, vernier function
- (9) Display format
 - Time axis waveform: single, dual, quad screen display (LCD), oct, hex screen display (printer only)
 - X-Y waveform: dot, line, single • quad screen
Time axis waveform: single, dual, quad screen display
- (10) Scrollable display
 - The most recent 2000 (64 M words: 10000) divisions of the data are stored in memory.
 - It is possible to scroll back for easy review.
- (11) Additional recording function
 - The first set of measurement data is preserved, and recording of the second set of measurement data starts after the first set.
- (12) Logging function
Numeric printout of waveform data.

(13) Reprint function

The most recent 2000 (64 M words: 10000) divisions of the data stored in memory can be printed as many times as required.

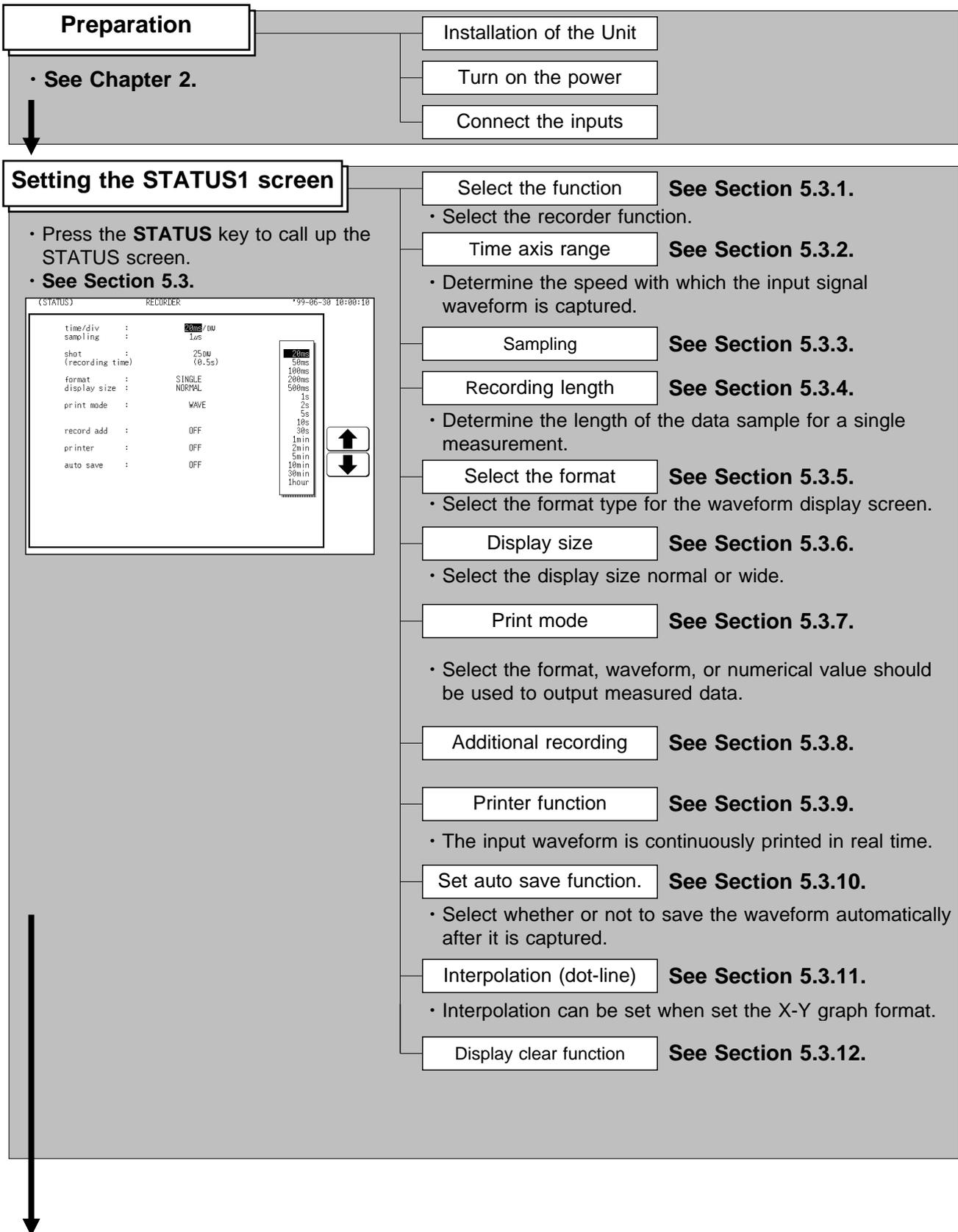
(14) Print

Real-time print, manual print, partial print, report print, screen hard copy can be printed.

(15) X-Y CONT Recorder

This function allows X-Y plot between channels in real time.

5.2 Operation Sequence (REC)



Setting the CHANNEL Screen

- Set the waveform display color for each channel, measurement range, input coupling, zero position, and filter. **See Chapter 9.**

Setting the TRIGGER Screen

- Set the trigger source, trigger types and conditions, the pre-trigger, etc. **See Chapter 10.**

Starts Measurement

- Press the **START** key and the LED lights.
- When the trigger conditions are met, measurement start.
- Press the **STOP** key and the LED goes out after measurement has finished.

Printouts and Saves the data

Printout the measurement data

See Chapter 13.

Save the measurement data

See Chapter 14.**Operating the DISPLAY Screen**

Wave scrolling

See Section 11.1.

Using the A/B cursor

See Section 11.2.

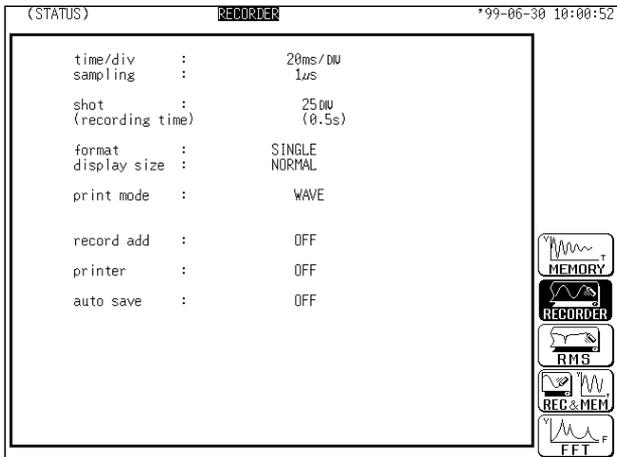
Setting the magnification/compression ratio

See Section 11.3.**Setting the SYSTEM Screen**

- **See Chapter 12.**

5.3 STATUS Settings (REC)

5.3.1 Setting the Function Mode



Method

Screen: STATUS, CHANNEL, DISPLAY

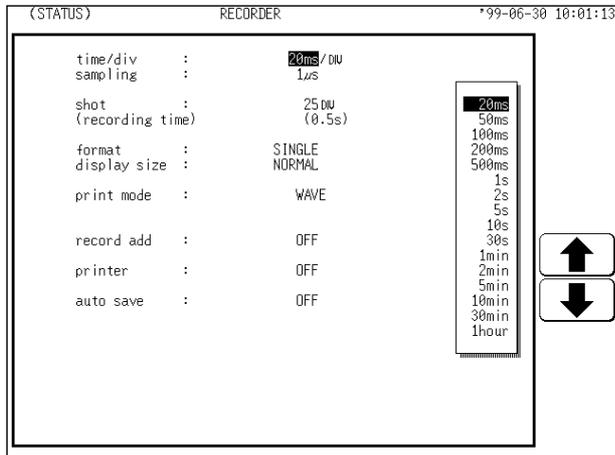
- ① Call up the STATUS, CHANNEL or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Press the F2 [RECORDER].

Selection

-  : Memory recorder function
-  : Recorder function
-  : RMS recorder function
-  : Recorder and Memory function
-  : FFT function

5.3.2 Setting the Time Axis Range

- Set the speed for inputting and storing the waveform of the input signal.
- Time axis range setting expresses the time for 1 DIV.
- The sampling period is 1/100th of the set value for the time axis range. (100 samples/DIV)



Method-1 Screen: STATUS, DISPLAY

- ① Call up the STATUS or DISPLAY screen.
- ② Move the flashing cursor to the **time/div** item, as shown in the figure on the left.
- ③ Use the JOG control, the function keys or the **TIME/DIV** key to make the selection.

Method-2 : Use the TIME/DIV key

- ① Call up the STATUS or DISPLAY screen.
- ② Use the **TIME/DIV** key to make the selection.

The **TIME/DIV** key can be used regardless of where the flashing cursor is located.

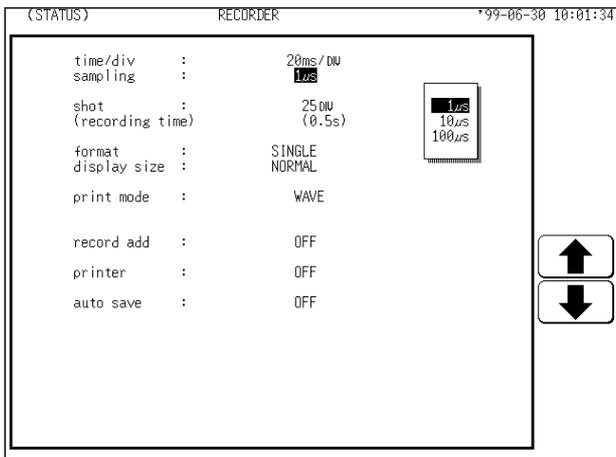
NOTE

While the printer always outputs the data at the measurement magnification in recording mode, the waveform on the screen is reduced in size at the ratio shown in the table below, depending on the time-axis range.

Time-axis range	Magnification
50 ms/DIV	× 1/2
20 ms/DIV	× 1/10

5.3.3 Setting the Sampling Period

The available range depends on the selected time axis range (input signal waveform capture rate).



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **sampling** item, shown in the figure on the left.
- ③ Use the JOG control or the function keys to make the selection.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

NOTE

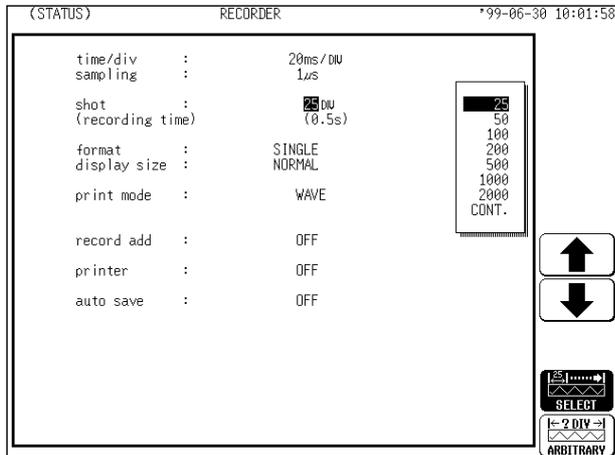
When a short sampling period is set and the input waveform changes slightly, a sudden disturbance such as noise will increase the difference between the maximum and minimum values. To eliminate this phenomenon, set a long sampling period. For details, see Section 21.3.4.

5.3.4 Setting the Recording Length

- The length of recording for one measurement operation (number of DIV) can be set.

SELECT : Select the recording length.

ARBITRARY : Any recording length can be selected by the user.



Method-1 Screen: STATUS, DISPLAY

Fixed recording length mode

- Call up the STATUS or DISPLAY screen.
- Move the flashing cursor to the **shot** item, as shown in the figure on the left. Select the **SELECT**.
- Use the JOG control or the function keys to make the selection.

Selection



: Move the cursor up in the selection window.



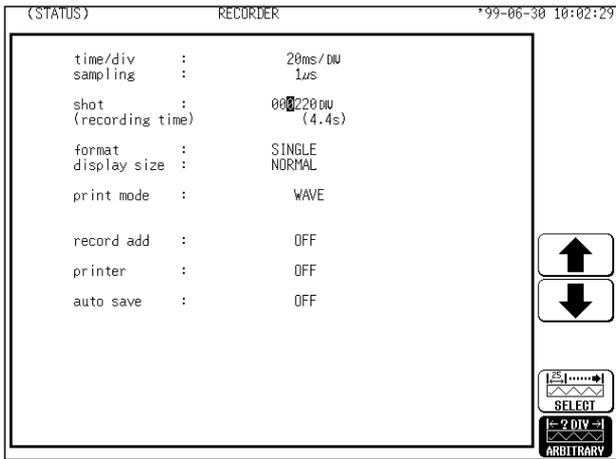
: Move the cursor down in the selection window.



: Set the fixed recording length mode.



: Set the any recording length mode.



Method-2 Screen: STATUS, DISPLAY

Any recording length mode

- ① Call up the STATUS or DISPLAY screen.
- ② Move the flashing cursor to the **shot** item, as shown in the figure on the left. Select the **ARBITRARY**.
- ③ Use the JOG control or the function keys to make the selection. Use the cursor keys to change the column.

Selection



: Value up.



: Value down.



: Set the fixed recording length mode.



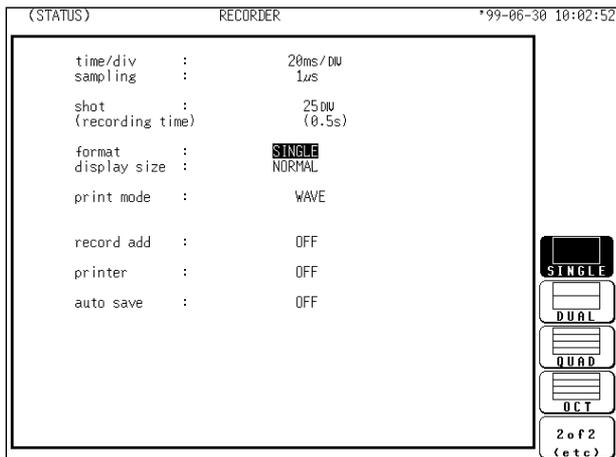
: Set the any recording length mode.

NOTE

- When the recording length is set to "CONT" within the range of 20 to 200 ms/DIV, the printer setting (real-time printing) is automatically disabled.
- When the recording length is set to "CONT," auto saving is automatically disabled.
- The maximum recording length is 2000 divisions for a memory capacity of 16 M words or 10,000 divisions for 64 M words (with additional memory).

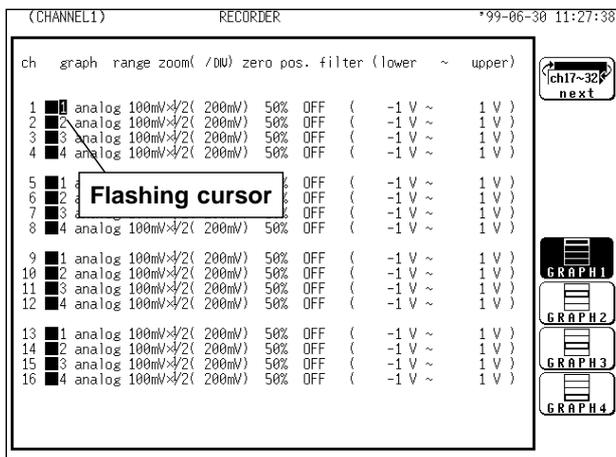
5.3.5 Setting the Format

- The style can be set for showing input signals on the screen display and recording them on the printer.
- The styles single, dual, quad, (DISPLAY screen) oct · hex (Print only, Display quad style) X-Y single · X-Y quad (dot) and (line) are available.
- The voltage per division is automatically changed according to the display format.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **format** item, as shown in the figure on the left.
- ③ Use the function keys to select the display format.
- ④ Set Which graph type to use when display format has been set to DUAL, QUAD, OCT or HEX screen display.
Setting the X-Y screen, see Section 5.4.



- ⑤ Press the **CHAN** key to call up the CHANNEL1 screen.
- ⑥ Move the flashing cursor to the point in the figure on the left. The figure shows the setting for CH1. Setting for CH2 to CH 32 should be made in the same way.
- ⑦ Use the function keys to select the graph.

Selection



: Display the waveform on graph 1.



: Display the waveform on graph 2.



: Display the waveform on graph 3.

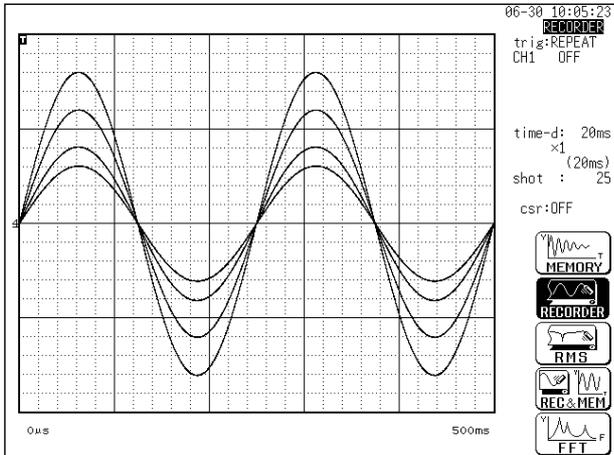


: Display the waveform on graph 4.

In the cases of OCT and HEX (printer only), as far as the printer recording output is concerned, the waveforms for each channel are automatically distributed on each graph. (For details on logic channels, refer to Section 9.3.8.)

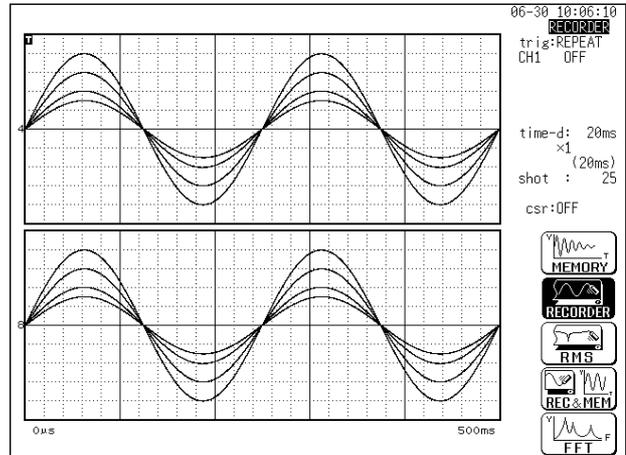
(1) Single graph

Display and record as one graph.
 (At the most, 32 analog + 32 logic signals)



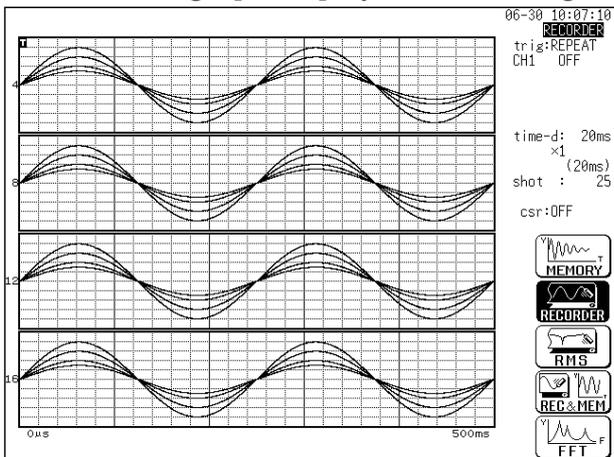
(2) Dual graph

- Display and record as two graphs. (At the most, 32 analog + 16 logic signals)
- Specify which input channel to use for waveform graph display and recording.



(3) Quad graph

- Display and record as four graphs. (At the most, 8 analog + 32 logic signals)
- Specify which input channel to use for waveform graph display and recording.



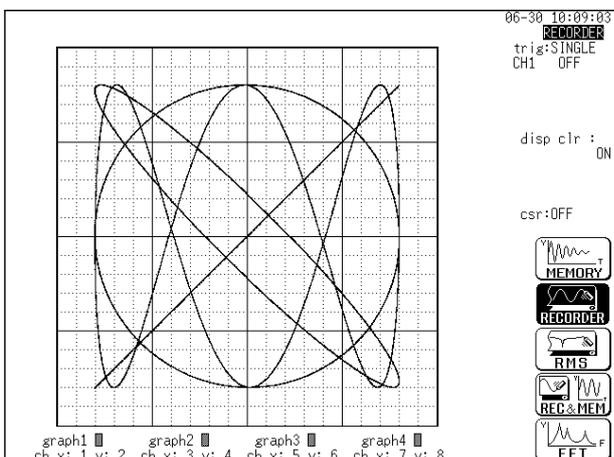
(4) Oct graph (printer only)

- Record as eight graphs. (At the most, 4 analog + 4 logic signals)
- Channel positions are automatically distributed.

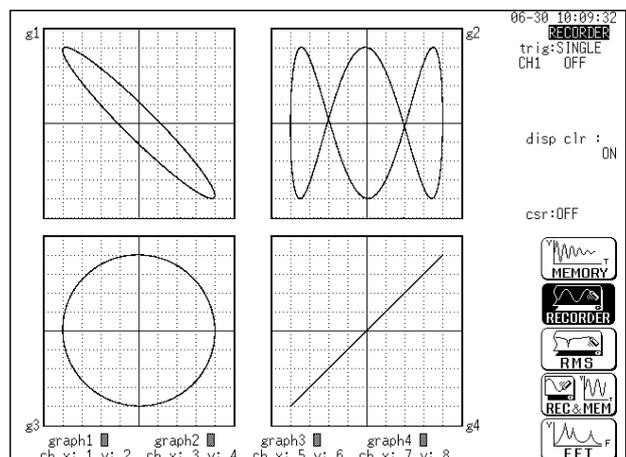
(5) HEX graph (printer only)

- Record as sixteen graphs. (At the most, 2 analog + 2 logic signals)
- Channel positions are automatically distributed.

(6) X-Y Single

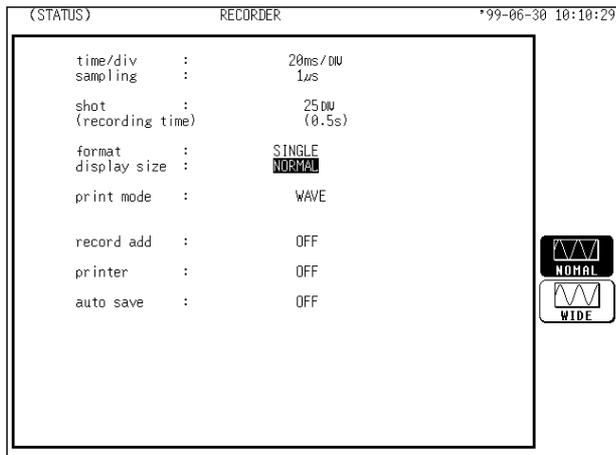


(7) X-Y Quad



5.3.6 Setting the Display Size

The display size can change the normal size or the wide size.

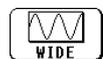


Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **display size** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

 : Normal size

 : Wide size

NOTE

The display size can be changed by pressing the **DISP** key on the display screen.

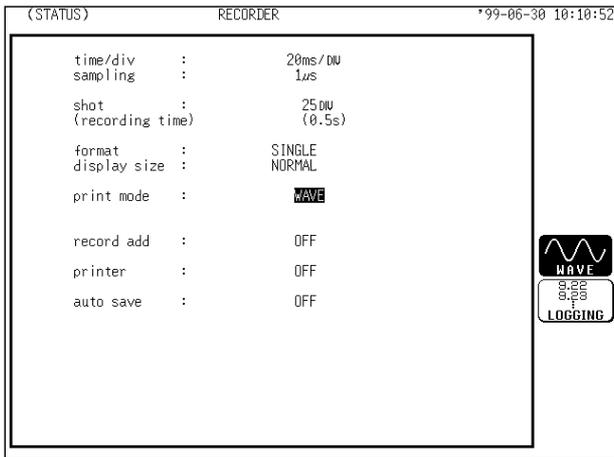
5.3.7 Setting the Print Mode

Select the format, waveform, or numerical value should be used to output measured data.

Waveform : The waveform is printed.

Numerical value : The data spacing interval also must be set.

Printing as a waveform



Method

Screen: STATUS

Setting the Printer Format

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **print mode** item, as shown in the figure on the left.
- ③ Use the function keys to select **WAVE**.

Selection



: Measurement data and the result of calculation are printed as a waveform.

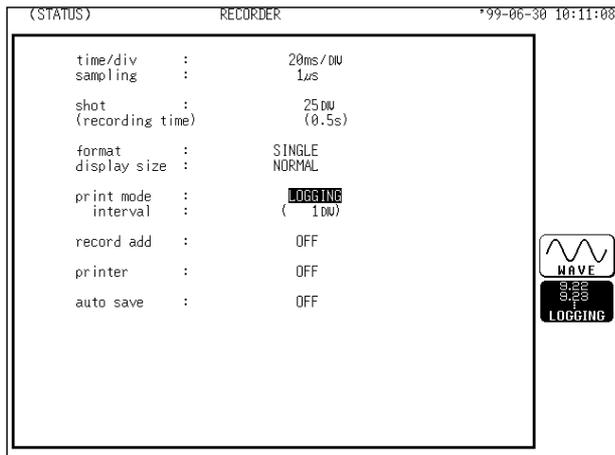


: Measurement data and the result of calculation are printed as numeric data.

NOTE

In the recorder, the trigger mark () is written as the start position mark. In an additional recording, the trigger mark is displayed in front of the most recently entered data.

Printing as numeric data



Method

Screen: STATUS

(1) Setting the Printer Format

- ① Press the STATUS key to call up the STATUS screen.
- ② Move the flashing cursor to the print mode item, as shown in the figure on the left
- ③ Use the function keys to select **LOGGING**.

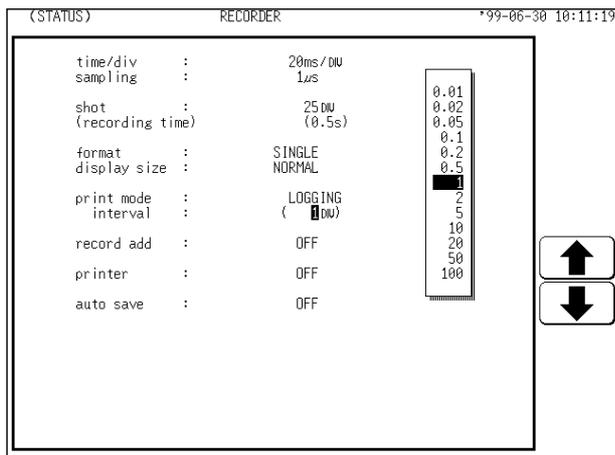
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



(2) Setting the print interval

- ① When the numeric data format is selected, set the print interval.
- ② Move the flashing cursor to the interval item.
- ③ Use the JOG control or the function keys to select the print interval.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

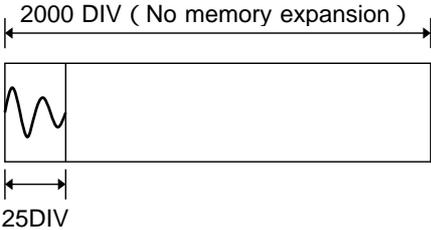
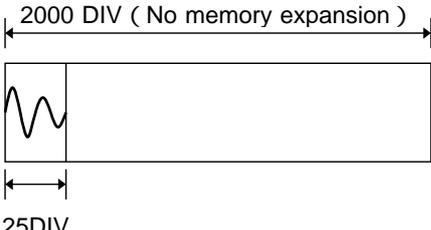
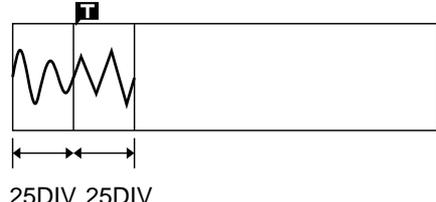
NOTE

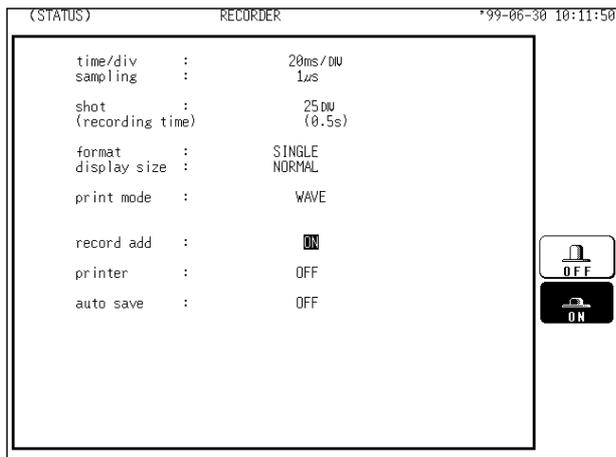
- When the print interval longer than the recording length is set, only the first dot is printed.
- The maximum and minimum values are printed (see Section 21.3.4).
- The print intervals of 0.01 to 0.5 DIV can be selected, only when there are waveform data present.
- When numerical values are output for real-time printing, the minimum print interval is 1 division.

5.3.8 Setting the Additional Recording Function

- This records, regarding the memory as though it were recording paper.
- Without expansion memory, the last 2000 (64 M words: 10000) divisions of waveform can be held in memory.
- The waveform can be scrolled and printed out.

Switching the additional recording on and off affects the use of memory as shown below.

Additional recording: OFF	Additional recording: ON
<p>1. Recording 25 divisions of waveform</p>  <p>2000 DIV (No memory expansion)</p> <p>25DIV</p>	<p>1. Recording 25 divisions of waveform</p>  <p>2000 DIV (No memory expansion)</p> <p>25DIV</p>
<p>2. Recording another 25 divisions of waveform</p> <p>The first set of measurement data is discarded, and recording of the second set of measurement data starts again from the beginning of memory.</p>  <p>25DIV</p>	<p>2. Recording another 25 divisions of waveform</p> <p>The first set of measurement data is preserved, and recording of the second set of measurement data starts after the first set.</p>  <p>25DIV 25DIV</p> <p>The first and second sets of waveforms can be observed by scrolling or printing the waveform.</p>



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **record add** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Additional recording is disabled.



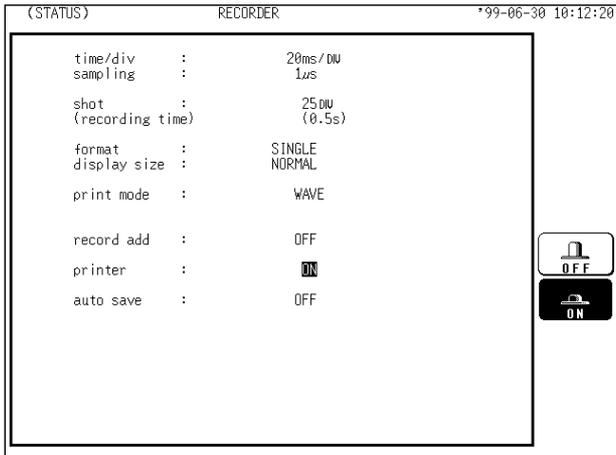
: Additional recording is enabled.

NOTE

- Time values output to the printer and displayed on the screen with the additional recording function enabled are equal to those of the most recently acquired waveforms. Therefore, when measuring waveforms in a different time axis range, always take that difference into consideration.
- When the 2000 (64 M words: 10000) DIV has been reached, old data will be overwritten. When OFF, previous data will be erased. Set to ON if erasing is not desired.
- In the recorder, the trigger mark () is written as the start position mark. In an additional recording, the trigger mark is displayed in front of the most recently entered data.
- If auto-save is enabled, only newly acquired waveforms are saved. Even when A and B cursors appear on the screen, no partial save is performed, because the setting is disabled when the **START** key is pressed.

5.3.9 Setting the Printer Function (Real Time Printing)

The input waveform is continuously printed in real time.



Method **Screen: STATUS**

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the printer item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Printing is disabled.



: Printing is enabled.

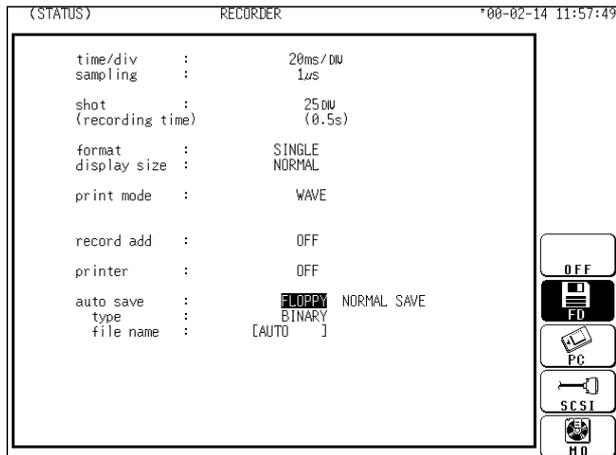
NOTE

- At a time axis range setting of 200 ms/DIV or faster, the waveform data will be printed out later. (See section 18.5)
- While the printer always outputs the data at the measurement magnification in recording mode, the waveform on the screen is reduced in size at the ratio shown in the table below, depending on the time-axis range.

Time-axis range	Magnification
50 ms/DIV	× 1/2
20 ms/DIV	× 1/10

5.3.10 Setting the Auto Save Function

- When the function is enabled, measurement data are automatically stored on a floppy disk, PC card, MO disk or connected SCSI device after they are captured.
- The Auto Save function stores a file in the directory currently selected on the file screen. See Section 14.12.2.

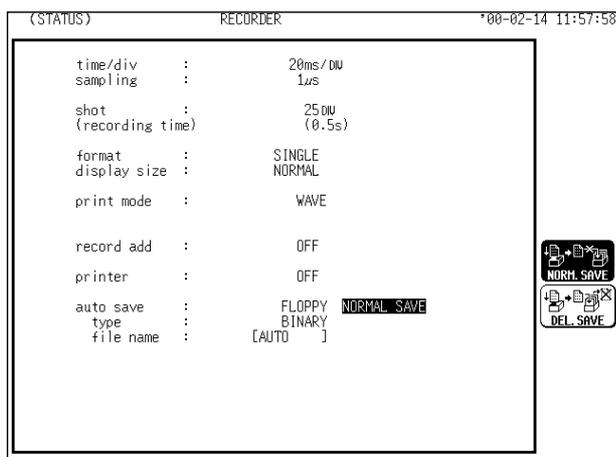


Method Screen: STATUS1

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **auto save** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

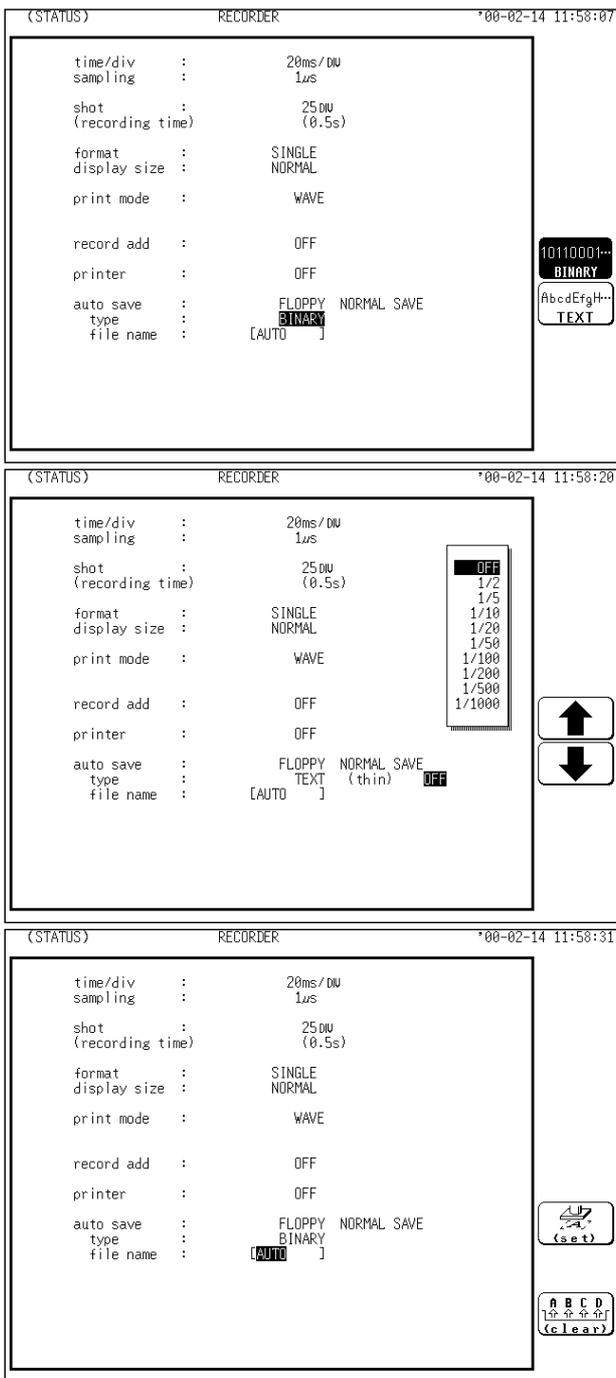
- OFF : Auto save is disabled.
- FD : Automatically stored on floppy disk
- PC : Automatically stored on PC card.
- SCSI : Automatically stored on connected SCSI device.
- MO : Automatically stored on MO disk.
- COMMUNI : Data can only be transferred to the 9333 LAN COMMUNICATOR when using a LAN card.



- ④ When Media is selected, the Storage Method item appears.

Selection

- NORM. SAVE : When the media becomes full, automatic storage stops.
- DEL. SAVE : When the media becomes full, old files are deleted to make room for automatic storage.
With the binary format selected, the file with the extension 'REC' is deleted.
With the text format selected, files with the extension 'TXT' are deleted.



- ⑤ Move the flashing cursor to **type**, and select the format.

Selection

10110001... : Data are stored as binary data.

AbcdEfgH... : Data are stored as text data.
Data stored in the text format is not readable by the 8826.

- ⑥ When the data format to be saved is set to text data, the intermittent setting item is displayed. Use the function keys or Jog control to make a setting.

Selection

↑ : Move the cursor up in the selection window.

↓ : Move the cursor down in the selection window.

- ⑦ Set the file name. For the input method, refer to Section 9.8.4.

When using auto-save, a number is appended to the name you specify as the file name. This then becomes the file name. If you start procedures before specifying a file name, AUTO is automatically enabled.

- Do not use the characters and symbols below in a file name. A file containing any of these characters/symbols in its file name cannot be processed under Windows 2000 or XP. Half-size symbols: +, =, [,]

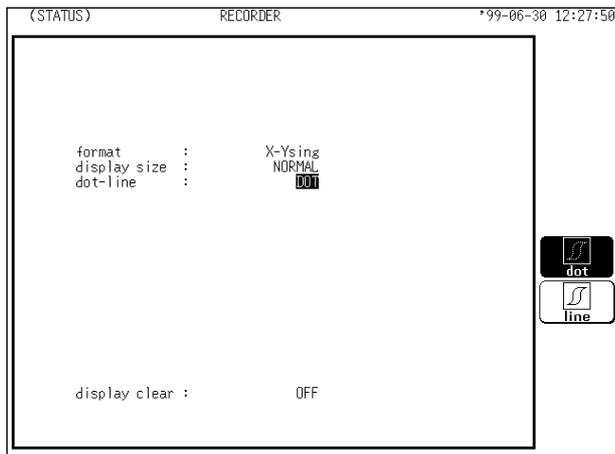
NOTE

- With auto-save enabled, channel selection is disabled. Data for all channels is saved.
- For details on file name of auto saving, refer to Section 14.7.
- When the recording length is "continuous", data are not stored.
- For details on connected SCSI device, refer to Section 14.4.
- When cursor A and B are enabled, partial saving is executed.
- If additional recording is enabled, only newly acquired waveforms are saved. Even when A and B cursors appear on the screen, no partial save is performed.
- During automatic storage, if the measurement is interrupted, waveforms taken prior to the interruption are stored automatically.
- The directory and the number of files that can be stored in the directory are limited. For details, see Section 14.7.
- When "COMMUNI" (communications) is selected as Media, Storage Method and Type are not displayed.

5.3 STATUS Settings (REC)

5.3.11 Setting the Interpolation (dot-line, X-Y only)

- Interpolation can be set when set the X-Y graph format.
- This setting determines whether the input waveform (sampling data) is to be displayed and printed as a series of dots or a line using linear interpolation.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **dot-line** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



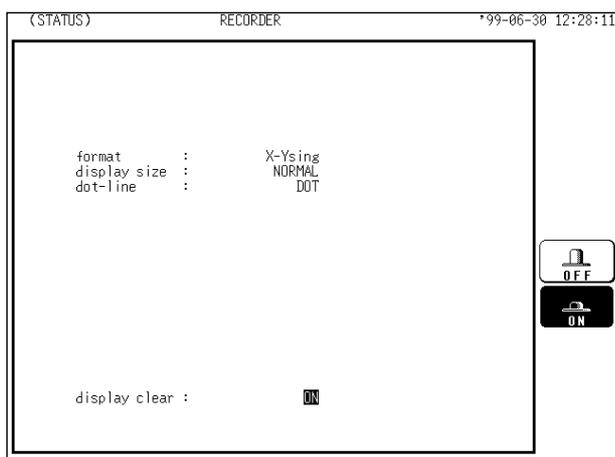
: Linear interpolation is not performed.



: Linear interpolation is performed.

5.3.12 Setting the Display Clear Function (X-Y only)

- It sets whether clear the waveform or not when pressing the **START** key to start measurement and the previous waveform is left.
- If the waveform is not cleared, overlay is performed.



Method Screen: STATUS

- ① Call up the STATUS screen or DISPLAY screen.
- ② Move the flashing cursor to the **display clear** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Display clear is disabled.



: Display clear is enabled.

5.4 Using the X-Y CONT Recorder

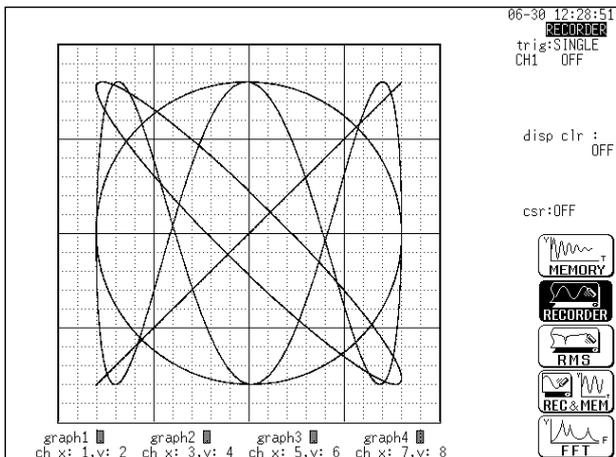
- (1) The same operation as a normal recorder is available to plot between channels (real time X-Y recording).
- (2) Unlike an X-Y plot produced in the memory recorder function mode, the time axis information for each channel is not being recorded.
- (3) Any of channels 1 to 32 can be selected for each of the X and Y axis. Up to four X-Y plots can be made simultaneously.
- (4) For dot display the sampling period is fixed at 500 μ s, while for line display the fastest sampling period is 500 μ s (unfixed).
- (5) There is no limit on the length of a recording because basically the operation is the same as that of a conventional recorder.
- (6) When the waveform clear is OFF, overlay can be performed.
- (7) Measurement data and setting data can be saved to media.

NOTE

- The waveforms with a display format that has been set to screens 1 to 16 cannot be subject to X-Y plotting following measurement. In addition, the waveforms measured by setting their display formats to the X-Y screen cannot be displayed on screens 1 to 16 following measurement.
- Trace cursor can not be used on the X-Y screen.

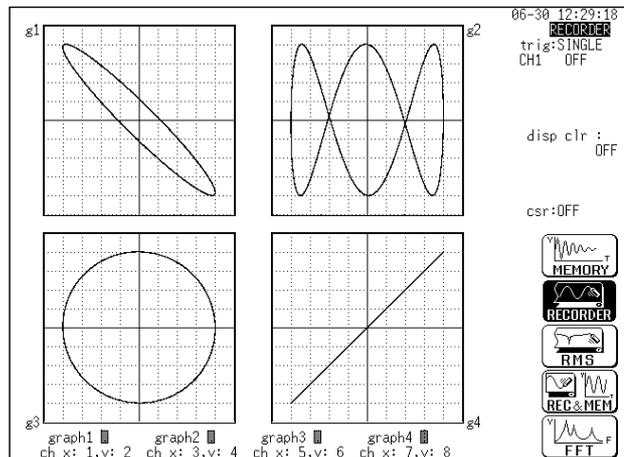
(1) X-Y Single

A single plot is displayed and recorded.

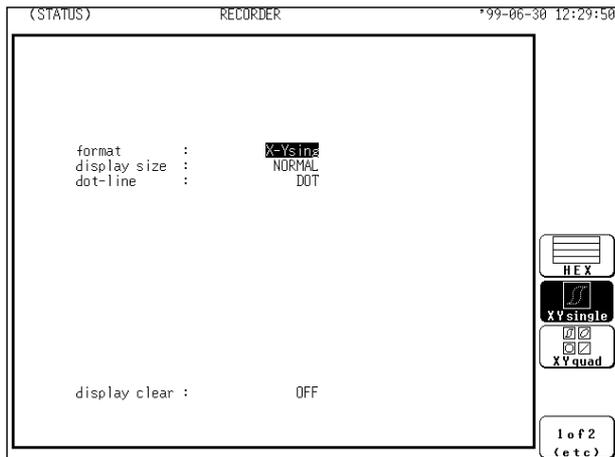


(2) X-Y Quad

Four single plot is displayed and recorded.



Setting the STATUS screen



Setting the Format

Method

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **format** item.
- ③ Use the function keys to select the "X-Y single" or "X-Y quad" format. See Section 5.3.5.

Setting the Display Size

Method

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **display size** item.
- ③ Use the function keys to make the selection. See Section 5.3.6.

Setting the Interpolation (dot-line)

Method

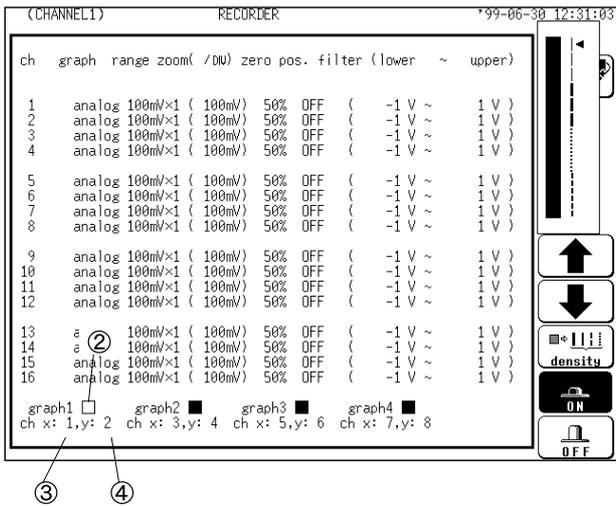
- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **dot-line** item.
- ③ Use the function keys to make the selection. See Section 5.3.11.

Setting the Display Clear Function

Method

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **display clear** item.
- ③ Use the function keys to make the selection. See Section 5.3.12.

Setting the CHANNEL screen



Method Screen: CHANNEL1

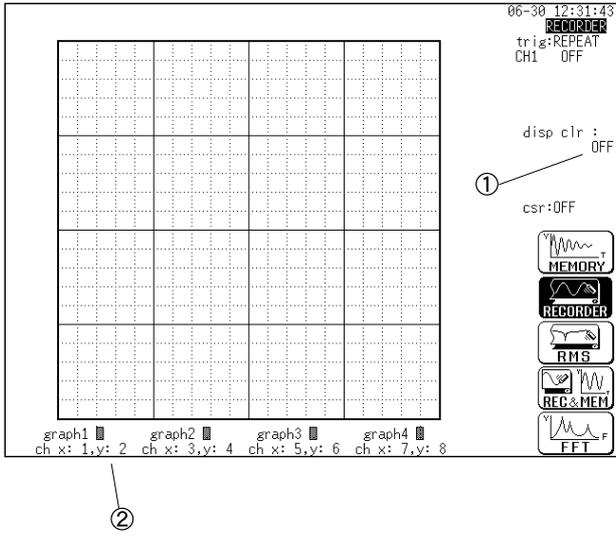
- ① Press the **CHAN** key to call up the CHANNEL1 screen.
- ② Move the flashing cursor to desired channel, and use the function keys to set the waveform color (including displays waveform ON/OFF).

Selection

- : Move the cursor up in the selection window.
- : Move the cursor down in the selection window.
- : Waveform is performed.
- : Waveform is not performed.

- ③ Specify the X-axis channel.
Move the cursor to the channel to be used as X axis. And use the function keys or the JOG control to select X axis.
- ④ Specify the Y-axis channel.
This is done in the same way as in step ③.
- ⑤ For graph 2 to graph 4, the settings are made in an identical.

Setting the DISPLAY screen



Method Screen: STATUS, DISPLAY

Press the **DISP** key to call up the DISPLAY screen.

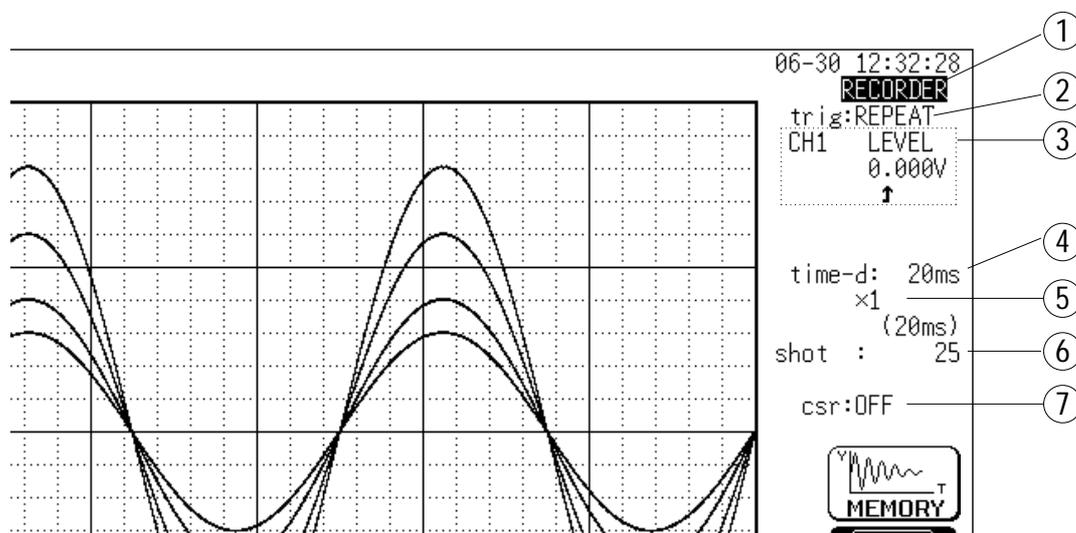
- ① Display clear: ON/OFF
- ② Channel settings:
 - Waveform Color (including displays waveform ON/OFF)
 - Setting the X-axis and Y-axis channels.

5.5 Settings on the Display Screen (REC)

Explains the setting items on the Display screen.

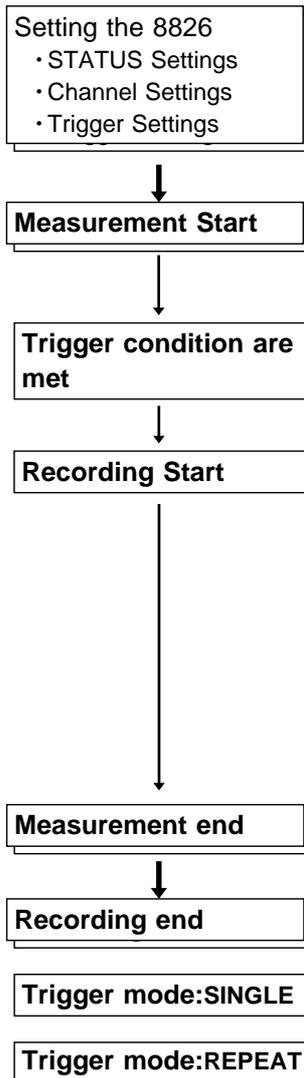
For details on setting, refer to Section 5.3.

When want to use the JOG control, press the **VALUE** select key. (The selection window is not displayed.)



① Function	MEM, REC, RMS, REC&MEM, FFT	• Select function.
② Trigger mode	SINGLE, REPEAT	• Select trigger mode.
③ Analog trigger	OFF, LEVEL, OUT, IN, CYCLE	• Set the analog trigger.
④ Time Axis Range	20 ms/DIV to 1 h/DIV	• Set the time 1 scale (1 DIV).
⑤ Compression along the time axis	×10 to ×1/500 When the time axis is 20 to 50 ms/DIV, the waveforms are compressed and displayed during measurement.	• By compressing the waveform, an entire change can be promptly apprehended.
⑥ Recording Length	SELECT: 25 DIV to CONT ARBITRARY: 1 DIV to 2000 DIV (Capacity: 16 M words)	• The length of recording for one measurement operation (the number of DIV) can be set.
⑦ Cursor Measurement	OFF, ↔, ↑, +	• The A/B cursors can be used.
Display size	NORMAL, WIDE	• The screen size can be changed by pressing the DISP key.
Input channel settings	• Analog input • Logic input • X, Y axis (X-Y format)	• Enables the measurement conditions for each channel on the display screen to be set or changed. See Section 9.9.
Input level monitor function	Press the LEVEL MON. key.	• See Section 11.5.
VIEW function	Press the VIEW key.	• See Section 11.6.

5.6 Start and Stop Operation (REC)



- See Section 5.3 STATUS settings
- See Chapter 9 Input channel settings
- See Chapter 10 Trigger Functions

- Press the **START** key and LED light.
- When the trigger can be registered, the indication **Waiting for trigger** is shown on the display.

- Data recording starts when trigger condition are met.
(Trigger timing: start / start&stop)

- Displays "**Storing**".
- When the time axis is 20 to 50 ms/DIV, the waveforms are compressed and displayed during measurement.
- At a time axis range setting of 200 ms/DIV or faster, the waveform data will be printed out later.
- Using the **VIEW** key to display the time (from measurement started time).
- When Auto Save is on, pressing the **STOP** key during measurement causes measurement data to be saved automatically until the stop.

- Auto save are executed.

- End of measurement

- Each time when trigger conditions are met, data are recorded and memory contents are overwritten.
(Trigger timing: start / start&stop)
- Data recording starts.
(Trigger timing: stop)

【 End of measurement in REPEAT trigger modes 】

- When **STOP** key is pressed, measurement stops after data corresponding to recording length have been stored in memory.
(auto save are not executed.)

Chapter 6

RMS Recorder Function

6.1 Outline of the RMS Recorder Function

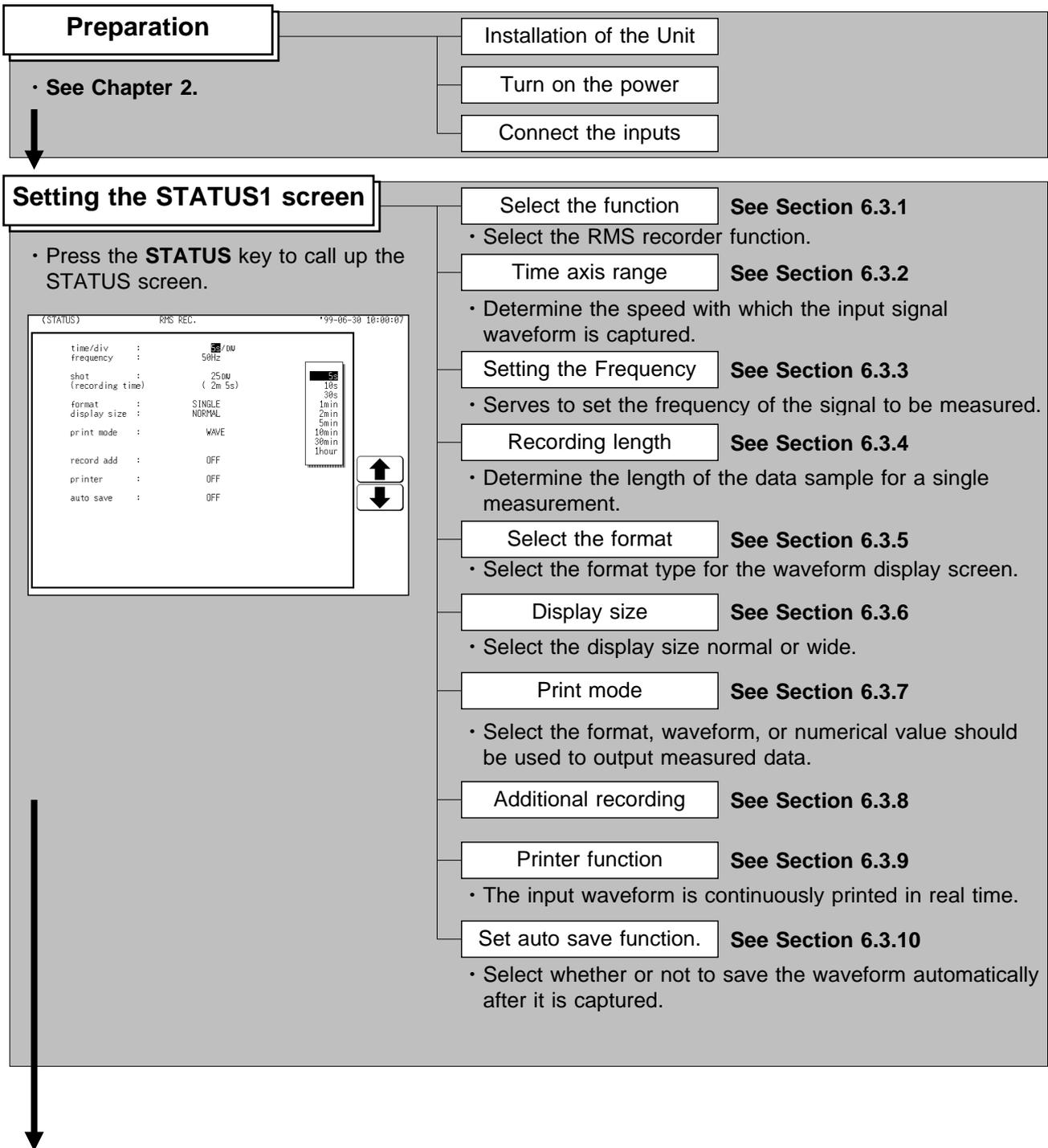
The RMS recorder function has the following features.

- (1) The voltage value and DC signal for the commercial power supplies are displayed and recorded as the rms value.
- (2) Real time continuous recording
- (3) The 8826 is designed to measure commercial power supplies (50/60 Hz) and DC signal.
- (4) RMS accuracy : $\pm 3\%$ f.s.
- (5) Time axis setting
5 s/DIV to 1 h/DIV
- (6) Time axis resolution: 100 points/DIV (printer)
- (7) Sampling speed
20 rms data/s (200 μ s fixed)
- (8) Memory capacity
 - 16 M words: 2000 DIV
 - 64 M words: 10000 DIV
 - Arbitrarily (Set from 1 division to the maximum number of divisions at 1-division intervals)
- (9) Waveform magnification/compression display and printout
 - Time axis direction: $\times 1$ to $\times 1/500$
 - Voltage axis direction: $\times 10$ to $\times 1/2$ (single, X-Y single)
 $\times 5$ to $\times 1/4$ (dual to hex, X-Y quad)
 - With the variable function, vernier function
- (10) Display format
Time axis waveform: single, dual, quad screen display (LCD), oct, hex screen display (printer only)
- (11) Scrollable display
 - The most recent 2000 (64M words: 10000) divisions of the data are stored in memory.
 - It is possible to scroll back for easy review.
- (12) Additional recording function
 - The first set of measurement data is preserved, and recording of the second set of measurement data starts after the first set.
- (13) Logging function
Numeric printout of waveform data
- (14) Reprint function
The most recent 2000 (64 M words: 10000) divisions of the data stored in memory can be printed as many times as required.

(15) Print

Real-time print, manual print, partial print, report print, screen hard copy can be printed.

6.2 Operation Sequence (RMS)



Setting the CHANNEL Screen

- Set the waveform display color for each channel, measurement range, input coupling, zero position, and filter. **See Chapter 9.**

Setting the TRIGGER Screen

- Set the trigger source, trigger types and conditions, the pre-trigger, etc. **See Chapter 10.**

Starts Measurement

- Press the **START** key and the LED lights.
- When the trigger conditions are met, measurement start.
- Press the **STOP** key and the LED goes out after measurement has finished. **See Section 6.5**

Printouts and Saves the data

Printout the measurement data

See Chapter 13.

Save the measurement data

See Chapter 14.**Operating the DISPLAY Screen**

Wave scrolling

See Section 11.1.

Using the A/B cursor

See Section 11.2.

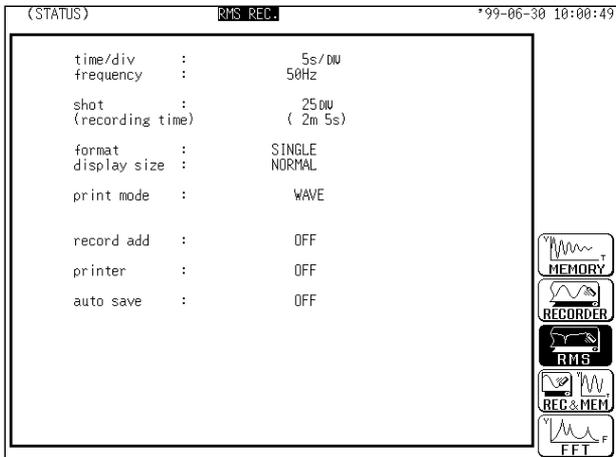
Setting the magnification/compression ratio

See Section 11.3.**Setting the SYSTEM Screen**

- **See Chapter 12.**

6.3 STATUS Settings (RMS)

6.3.1 Setting the Function Mode



Method Screen: STATUS, CHANNEL, DISPLAY

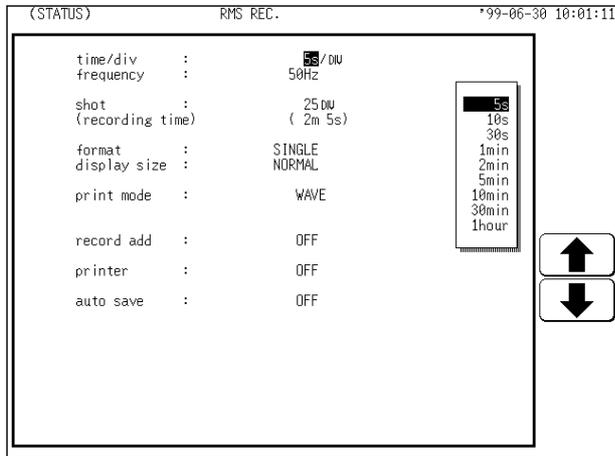
- ① Call up the STATUS, CHANNEL or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Press the **F3** [RMS].

Selection

-  : Memory recorder function
-  : Recorder function
-  : RMS recorder function
-  : Recorder and Memory function
-  : FFT function

6.3.2 Setting the Time Axis Range

- Set the speed for inputting and storing the waveform of the input signal.
- Time axis range setting expresses the time for 1 DIV.
- The sampling interval is constant (200 μ s), regardless of the time axis range.



Method-1 Screen: STATUS, DISPLAY

- ① Call up the STATUS or DISPLAY screen.
- ② Move the flashing cursor to the **time/div** item, as shown in the figure on the left.
- ③ Use the JOG control, the function keys or **TIME/DIV** key to make the selection.

Method-2 : Use the TIME/DIV key

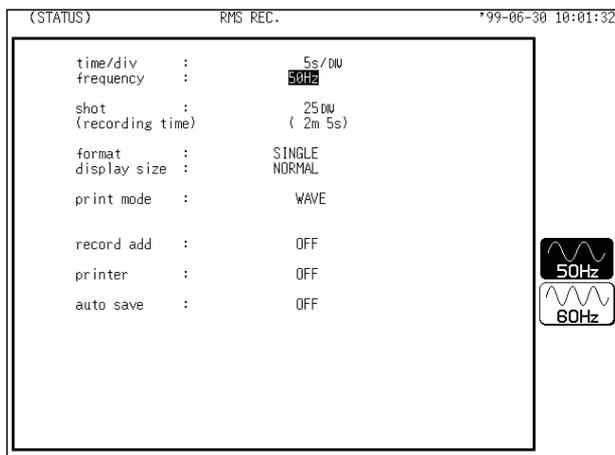
- ① Call up the STATUS or DISPLAY screen.
- ② Use the **TIME/DIV** key to make the selection.
The **TIME/DIV** key can be used regardless of where the flashing cursor is located.

NOTE

For details on sampling period, refer to Section 21.3.5.

6.3.3 Setting the Frequency

Serves to set the frequency of the signal to be measured.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **frequency** item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Measure rms value of 50 Hz signal



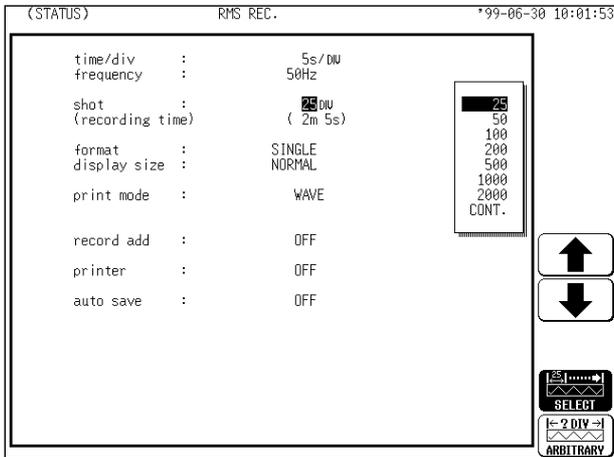
: Measure rms value of 60 Hz signal

6.3.4 Setting the Recording Length

The length of recording for one measurement operation (number of DIV) can be set.

SELECT : Select the recording length.

ARBITRARY : Any recording length can be selected by the user.



Method-1 Screen: STATUS, DISPLAY

Fixed recording length mode

- ① Call up the STATUS or DISPLAY screen.
- ② Move the flashing cursor to the shot item, as shown in the figure on the left. Select the **SELECT**.
- ③ Use the JOG control or the function keys to make the selection.

Selection



: Move the cursor up in the selection window.



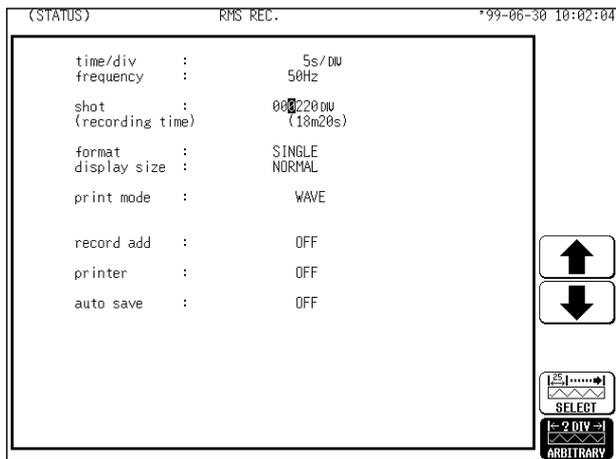
: Move the cursor down in the selection window.



: Set the fixed recording length mode.



: Set the any recording length mode.



Method-2 Screen: STATUS, DISPLAY

Any recording length mode

- ① Call up the STATUS or DISPLAY screen.
- ② Move the flashing cursor to the **shot** item, as shown in the figure on the left. Select the **ARBITRARY**.
- ③ Use the JOG control or the function keys to make the selection. Use the CURSOR keys to change the column.

Selection

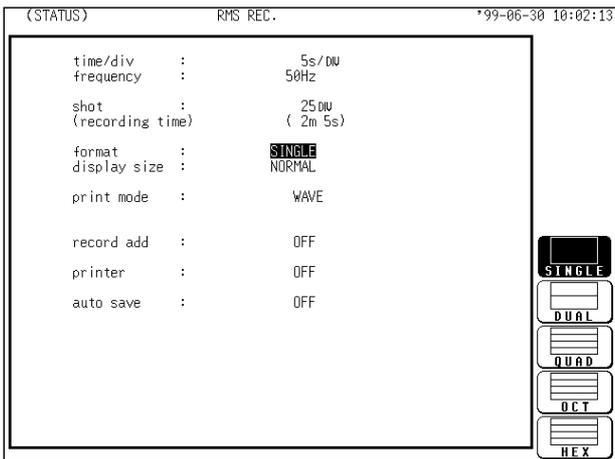
-  : Value up.
-  : Value down.
-  : Set the fixed recording length mode.
-  : Set the any recording length mode.

NOTE

- When the recording length is set to "CONT," auto saving is automatically disabled.
- The maximum recording length is 2000 divisions for a memory capacity of 16 M words or 10,000 divisions for 64 M words (with additional memory).

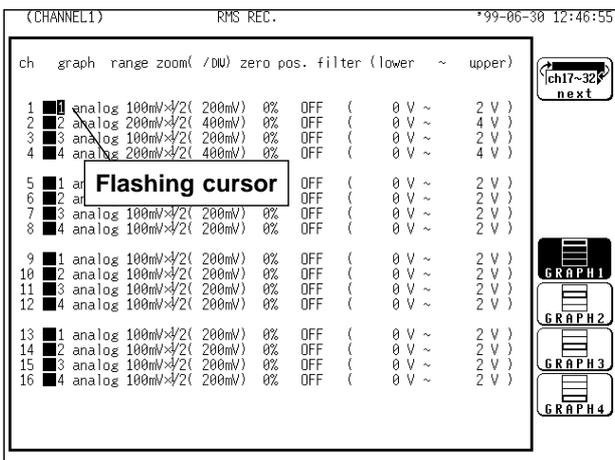
6.3.5 Setting the Format

- The style can be set for showing input signals on the screen display and recording them on the printer.
- The styles single, dual, quad, (DISPLAY screen), oct and hex (Print only, Display quad style) are available.
- The voltage per division is automatically changed according to the display format.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **format** item, as shown in the figure on the left.
- ③ Use the function keys to select the display format.
- ④ Set Which graph type to use when display format has been set to DUAL, QUAD, OCT or HEX screen display.



- ⑤ Press the **CHAN** key to call up the CHANNEL1 screen.
- ⑥ Move the flashing cursor to the point in the figure on the left. The figure shows the setting for CH1. Setting for CH2 to CH 32 should be made in the same way.
- ⑦ Use the function keys to select the graph.

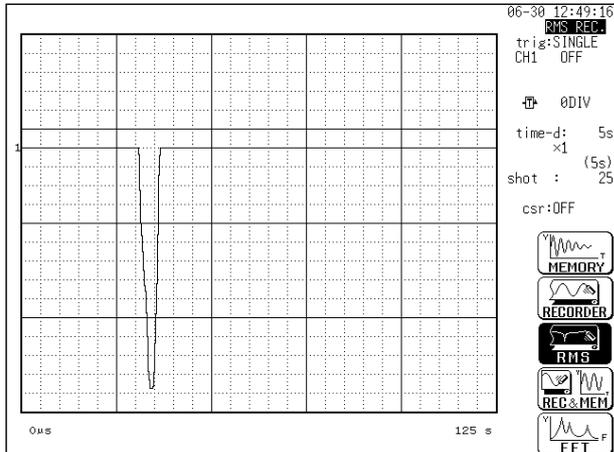
Selection

-  : Display the waveform on graph 1.
-  : Display the waveform on graph 2.
-  : Display the waveform on graph 3.
-  : Display the waveform on graph 4.

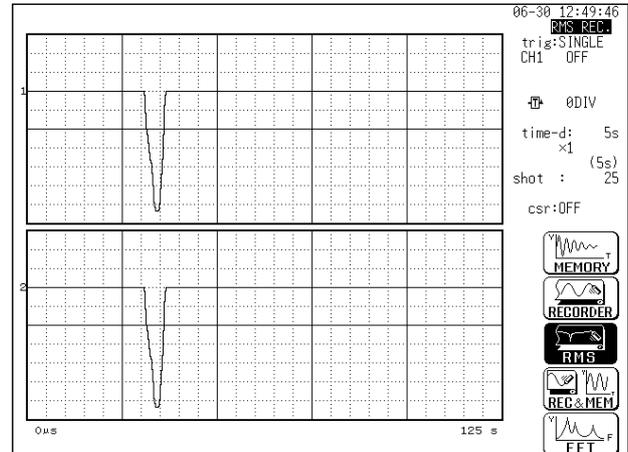
In the cases of OCT and HEX (printer only), as far as the printer recording output is concerned, the waveforms for each channel are automatically distributed on each graph. (For details on logic channels, refer to Section 9.3.8.)

(1) Single graph

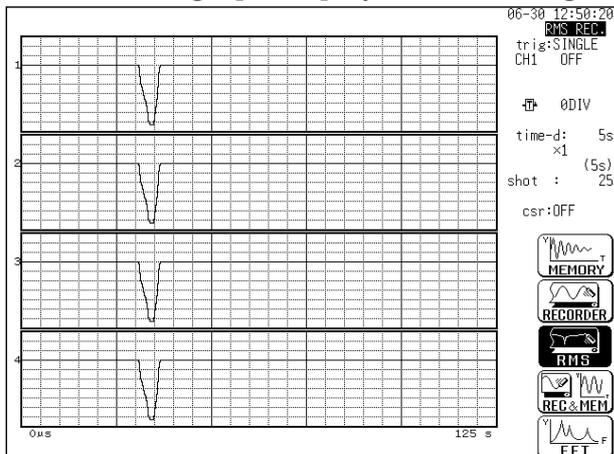
Display and record as one graph.
(At the most, 32 analog + 32 logic signals)

**(2) Dual graph**

- Display and record as two graphs. (At the most, 32 analog + 16 logic signals)
- Specify which input channel to use for waveform graph display and recording.

**(3) Quad graph**

- Display and record as four graphs.
- (At the most, 8 analog + 32 logic signals)
- Specify which input channel to use for waveform graph display and recording.

**(4) Oct graph (printer only)**

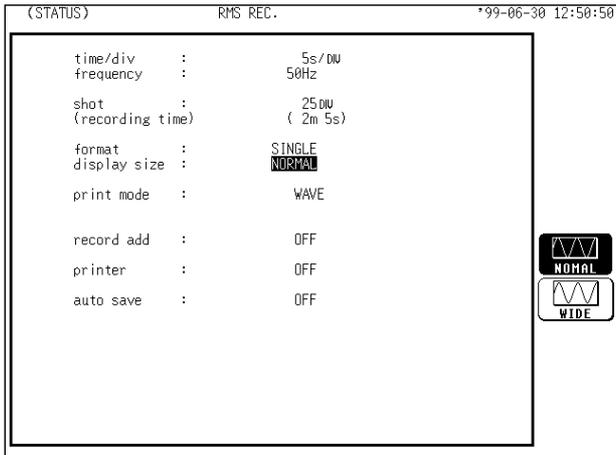
- Record as eight graphs.
- (At the most, 4 analog + 4 logic signals)
- Channel positions are automatically distributed.

(5) HEX graph (printer only)

- Record as sixteen graphs.
- (At the most, 2 analog + 2 logic signals)
- Channel positions are automatically distributed.

6.3.6 Setting the Display Size

The display size can change the normal size or the wide size.



Method

Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **display size** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

 : Normal size

 : Wide size

NOTE

- The display size can be changed by pressing the **DISP** key on the display screen.

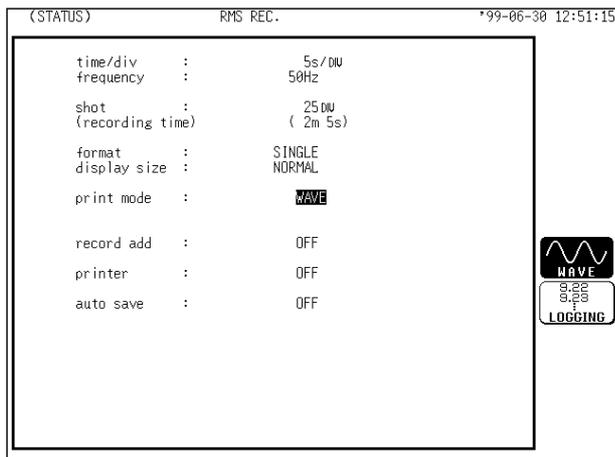
6.3.7 Setting the Print Mode

Select the format, waveform, or numerical value should be used to output measured data.

Waveform : The waveform is printed.

Numerical value : The data spacing interval also must be set.

Printing as a waveform



Method Screen: STATUS

Setting the Printer Format

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **print mode** item, as shown in the figure on the left.
- ③ Use the function keys to select **WAVE**.

Selection

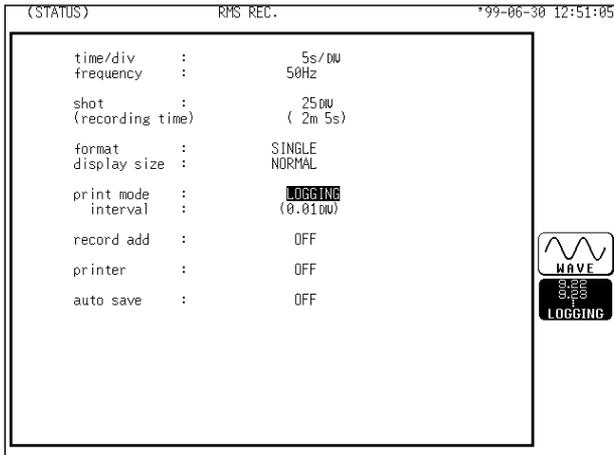


: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.

Printing as numeric data



Method

Screen: STATUS

(1) Setting the Printer Format

- ① Press the **STATUS** key to call up the **STATUS** screen.
- ② Move the flashing cursor to the **print mode** item, as shown in the figure on the left.
- ③ Use the function keys to select **LOGGING**.

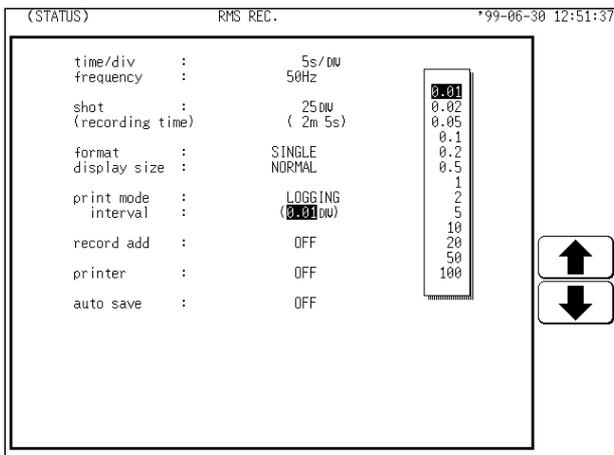
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



(2) Setting the print interval

- ① When the numeric data format is selected, set the **print interval**.
- ② Move the flashing cursor to the **interval** item.
- ③ Use the **JOG** control or the function keys to select the **print interval**.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

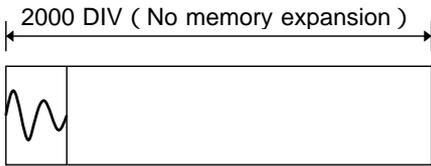
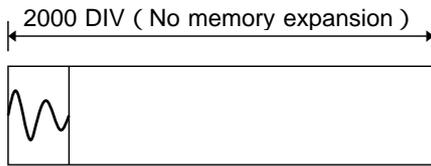
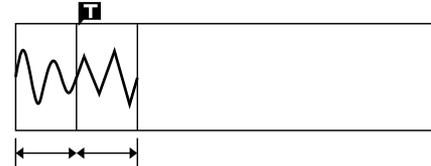
NOTE

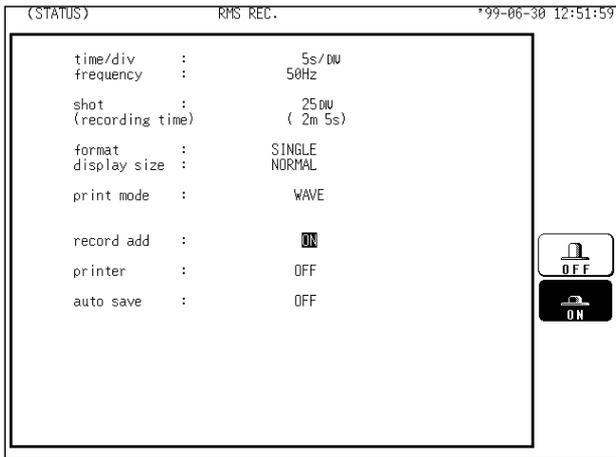
- When the print interval longer than the recording length is set, only the first dot is printed.
- The maximum and minimum values are printed (excluding 5 s/DIV). See Section 21.3.5.
- The print intervals of 0.01 to 0.5 DIV can be selected, only when there are waveform data present.
- When numerical values are output for real-time printing, the minimum print interval is 1 division.

6.3.8 Setting the Additional Recording Function

- This records, regarding the memory as though it were recording paper.
- Without expansion memory, the last 2000 (64 M words: 10000) divisions of waveform can be held in memory.
- The waveform can be scrolled and printed out.

Switching the additional recording on and off affects the use of memory as shown below.

Additional recording: OFF	Additional recording: ON
<p>1. Recording 25 divisions of waveform</p>  <p>2000 DIV (No memory expansion)</p> <p>25DIV</p>	<p>1. Recording 25 divisions of waveform</p>  <p>2000 DIV (No memory expansion)</p> <p>25DIV</p>
<p>2. Recording another 25 divisions of waveform</p> <p>The first set of measurement data is discarded, and recording of the second set of measurement data starts again from the beginning of memory.</p>  <p>25DIV</p>	<p>2. Recording another 25 divisions of waveform</p> <p>The first set of measurement data is preserved, and recording of the second set of measurement data starts after the first set.</p>  <p>25DIV 25DIV</p> <p>The first and second sets of waveforms can be observed by scrolling or printing the waveform.</p>

**Method****Screen: STATUS**

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **record add** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

: Additional recording is disabled.



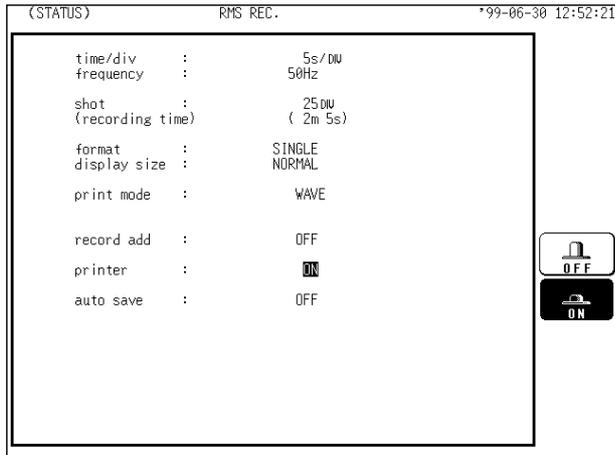
: Additional recording is enabled.

NOTE

- Time values output to the printer and displayed on the screen with the additional recording function enabled are equal to those of the most recently acquired waveforms. Therefore, when measuring waveforms in a different time axis range, always take that difference into consideration.
- When the 2000 (64 M words: 10000) DIV has been reached, old data will be overwritten. When OFF, previous data will be erased. Set to ON if erasing is not desired.
- If auto-save is enabled, only newly acquired waveforms are saved. Even when A and B cursors appear on the screen, no partial save is performed, because the setting is disabled when the START key is pressed.

6.3.9 Setting the Printer Function (Real Time Printing)

The input waveform is continuously printed in real time.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **printer** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



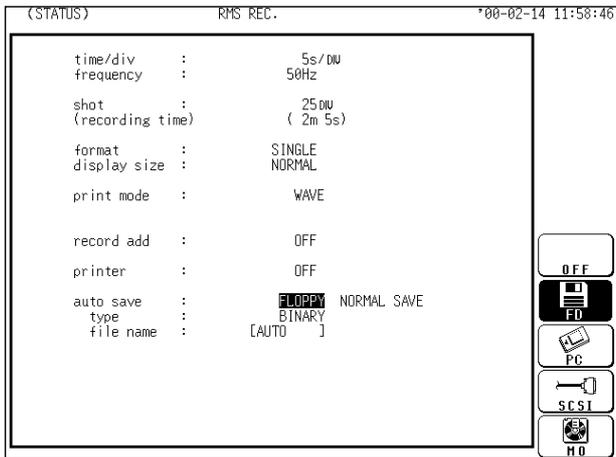
: Printing is disabled.



: Printing is enabled.

6.3.10 Setting the Auto Save Function

- When the function is enabled, measurement data are automatically stored on a floppy disk, PC card, MO disk or connected SCSI device after they are captured.
- The Auto Save function stores a file in the directory currently selected on the file screen. See Section 14.12.2.

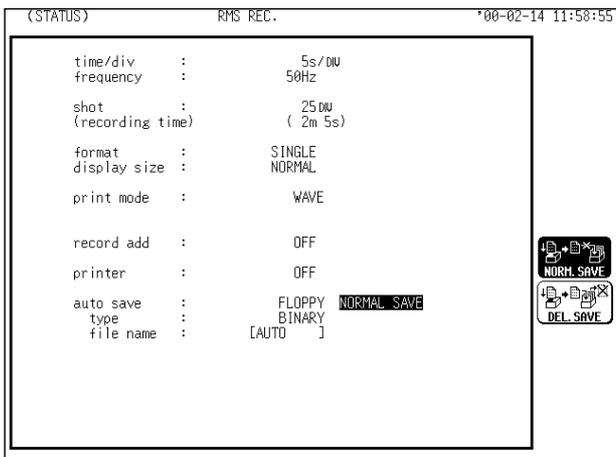


Method Screen: STATUS1

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the auto save item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

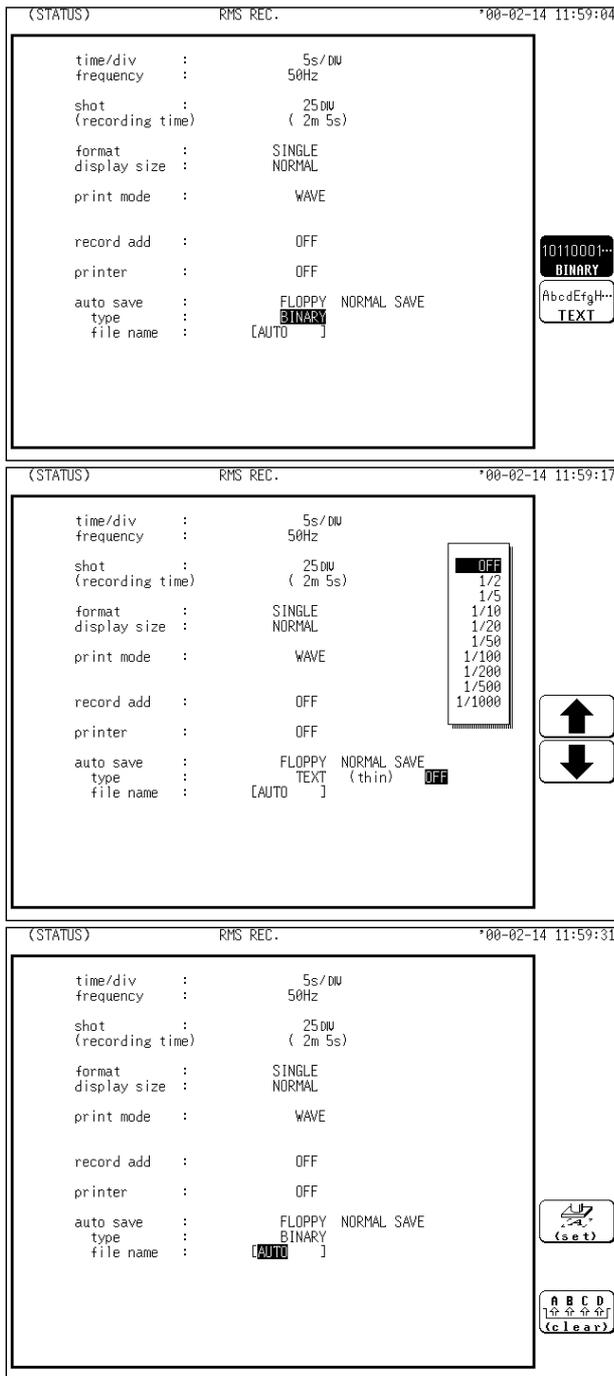
-  : Auto save is disabled.
-  : Automatically stored on floppy disk
-  : Automatically stored on PC card.
-  : Automatically stored on connected SCSI device.
-  : Data can only be transferred to the 9333 LAN COMMUNICATOR when using a LAN card.



- ④ When Media is selected, the Storage method item appears.

Selection

-  : When the media becomes full, automatic storage stops.
-  : When the media becomes full, old files are deleted to make room for automatic storage.
With the binary format selected, the file with the extension 'RMS' is deleted. With the text format selected, files with the extension 'TXT' are deleted.



- ⑤ Move the flashing cursor to **type**, and select the format.

Selection

10110001...
BINARY : Data are stored as binary data.

AbcdEfgH...
TEXT : Data are stored as text data.
Data stored in the text format is not readable by the 8826.

- ⑥ When the data format to be saved is set to text data, the intermittent setting item is displayed. Use the function keys or Jog control to make a setting.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

- ⑦ Set the file name. For the input method, refer to Section 9.8.4.

When using auto-save, a number is appended to the name you specify as the file name. This then becomes the file name. If you start procedures before specifying a file name, AUTO is automatically enabled.

- Do not use the characters and symbols below in a file name. A file containing any of these characters/symbols in its file name cannot be processed under Windows 2000 or XP. Half-size symbols: +, =, [,]

NOTE

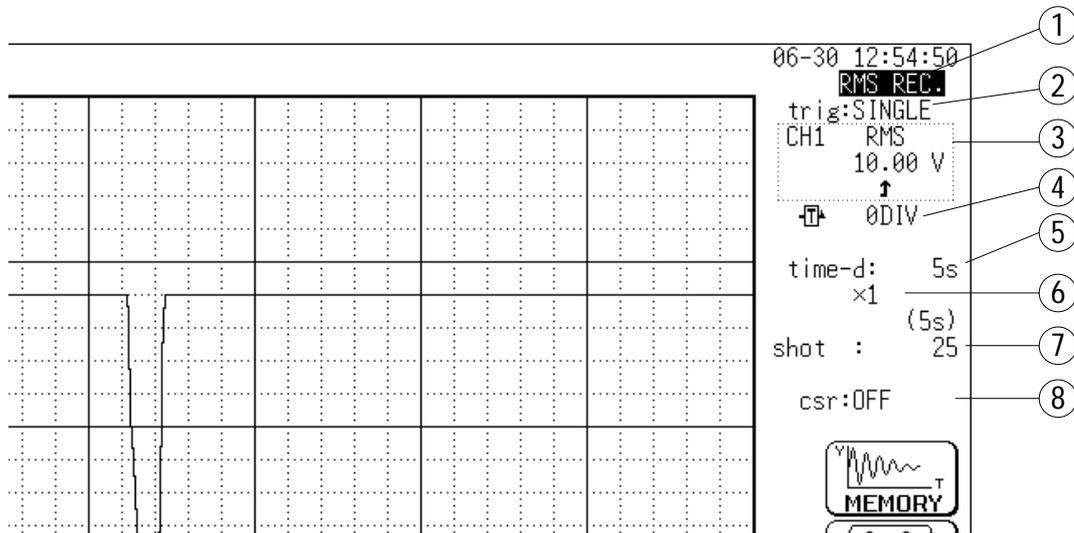
- With auto-save enabled, channel selection is disabled. Data for all channels is saved.
- For details on file name when auto-saving, see Section 14.7.
- When the recording length is "continuous", data are not stored.
- For details on connected SCSI device, refer to Section 14.4.
- When cursor A and B are enabled, partial saving is executed.
- If additional recording is enabled, only newly acquired waveforms are saved. Even when A and B cursors appear on the screen, no partial save is performed.
- During automatic storage, if the measurement is interrupted, waveforms taken prior to the interruption are stored automatically.
- The directory and the number of files that can be stored in the directory are limited. For details, see Section 14.7.
- When "COMMUNI" (communications) is selected as Media, Storage Method and Type are not displayed.

6.4 Settings on the Display Screen (RMS)

Explains the setting items on the Display screen.

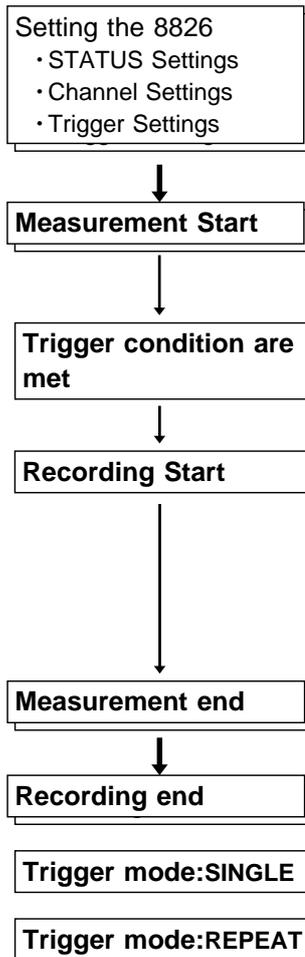
For details on setting, refer to Section 6.3.

When want to use the JOG control, press the **VALUE** select key. (The selection window is not displayed



① Function	MEM, REC, RMS, REC&MEM, FFT	• Select function.
② Trigger mode	SINGLE, REPEAT	• Select trigger mode.
③ Analog trigger	RMS LEVEL	• Set the analog trigger.
④ Pre-trigger	0, 5, 10 DIV	• Set the pre-trigger.
⑤ Time Axis Range	5 s/DIV to 1 h/DIV	• Set the time 1 scale (1 DIV).
⑥ Compression along the time axis	×10 to ×1/500	• By compressing the waveform, an entire change can be promptly apprehended.
⑦ Recording Length	SELECT : 25 DIV to CONT ARBITRARY : 1 DIV to 2000 DIV (Capacity : 16 M words)	• The length of recording for one measurement operation (the number of DIV) can be set.
⑧ Cursor Measurement	OFF, ↔, ↑, +	• The A/B cursors can be used.
Display size	NORMAL, WIDE	• The screen size can be changed by pressing the DISP key.
Input channel settings	• Analog input • Logic input	• Enables the measurement conditions for each channel on the display screen to be set or changed. See Section 9.9.
Input level monitor function	Press the LEVEL MON. key.	• See Section 11.5.
VIEW function	Press the VIEW key.	• See Section 11.6.

6.5 Start and Stop Operation (RMS)



- See Section 6.3 STATUS settings
- See Chapter 9 Input channel settings
- See Chapter 10 Trigger Functions

- Press the **START** key and LED light.
- When the trigger can be registered, the indication **Waiting for trigger** is shown on the display.

- Data recording starts when trigger condition are met.

- Displays "**Storing**".
- Waveform appears on the screen and printout starts.
- Using the **VIEW** key to display the time (from measurement started time).
- When Auto Save is on, pressing the **STOP** key during measurement causes measurement data to be saved automatically until the stop.

- Auto save are executed.

- End of measurement

- Each time when trigger conditions are met, data are recorded and memory contents are overwritten.

【 End of measurement in REPEAT trigger modes 】

- When **STOP** key is pressed, measurement stops after data corresponding to recording length have been stored in memory. (auto save are not executed.)

Chapter 7

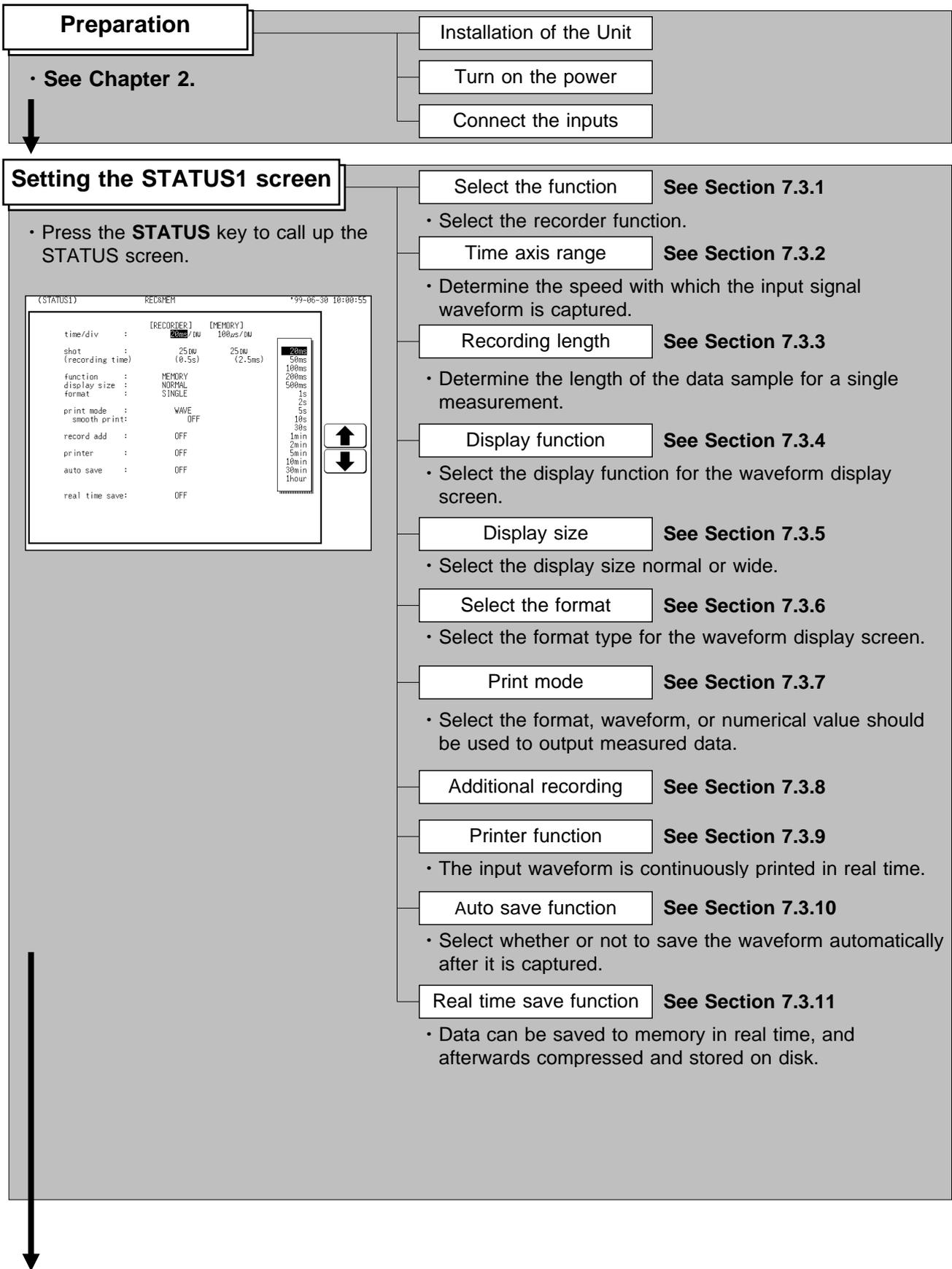
Recorder & Memory Function

7.1 Outline of the Recorder & Memory Function

The Recorder & Memory function has the following features.

- (1) After being stored in the internal memory, input signal data can be displayed and printed.
- (2) All input channel data are recorded on the same time axis.
Since data for all channels can be superimposed, the relative relationship between input signals can be observed visually.
- (3) Time axis setting
20 ms/DIV to 1 h/DIV (REC)
100 μ s/DIV to 5 min/DIV (MEM)
- (4) Time axis resolution 100 points/DIV (printer)
- (5) Memory capacity
 - 16 M words: 1000 DIV (REC), 2000 DIV (MEM)
 - 64 M words: 5000 DIV (REC), 10000 DIV (MEM)
- (6) Display format
Time axis waveform: single, dual, quad screen display (LCD), oct, hex screen display (printer only)
- (7) Printing
Real-time print (REC), Manual print, Partial print, Report (B4 size) print, Screen hard copy.
- (8) High-quality print (MEM)
Smooth print function approximates analog waveform.
- (9) Additional recording function (REC)
The first set of measurement data is preserved, and recording of the second set of measurement data starts after the first set.
- (10) Logging function
Numeric printout of waveform data.

7.2 Operation Sequence (REC&MEM)

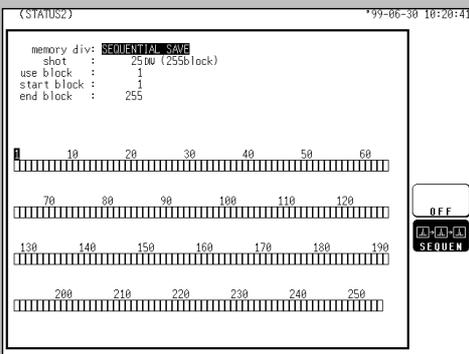


Setting the STATUS2 Screen

- Press the **STATUS** key to call up the STATUS screen.
- See Section 7.4.

Sequential Save Function

- This function divides the memory into separate blocks, each of which can be used for waveform recording.



Setting the CHANNEL Screen

- Set the waveform display color for each channel, measurement range, input coupling, zero position, and filter. See Chapter 9.

Setting the TRIGGER Screen

- Set the trigger source, trigger types and conditions, the pre-trigger, etc. See Chapter 10.

Starts Measurement

- Press the **START** key and the LED lights.
- When the trigger conditions are met, measurement start.
- Press the **STOP** key and the LED goes out after measurement has finished. See Section 7.6.

Printouts and Saves the data

Printout the measurement data See Chapter 13.

Save the measurement data See Chapter 14.

Operating the DISPLAY Screen

Wave scrolling See Section 11.1.

Using the A/B cursor See Section 11.2.

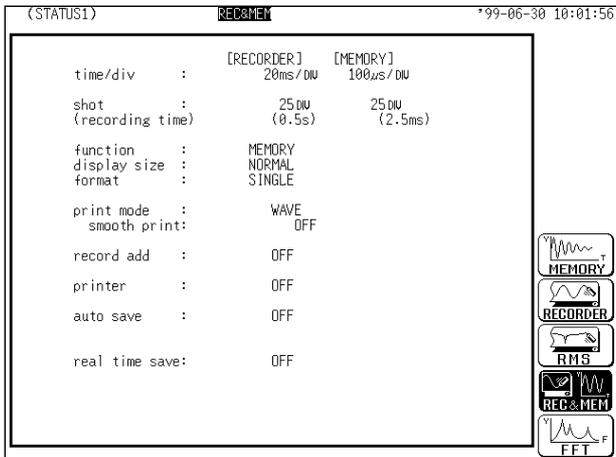
Setting the magnification/compression ratio See Section 11.3.

Setting the SYSTEM Screen

- See Chapter 12.

7.3 STATUS1 Settings (REC&MEM)

7.3.1 Setting the Function Mode



Method Screen: STATUS, CHANNEL, DISPLAY

- ① Call up the STATUS, CHANNEL or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Press the F4 [REC&MEM].

Selection



: Memory recorder function



: Recorder function



: RMS recorder function



: Recorder and Memory function

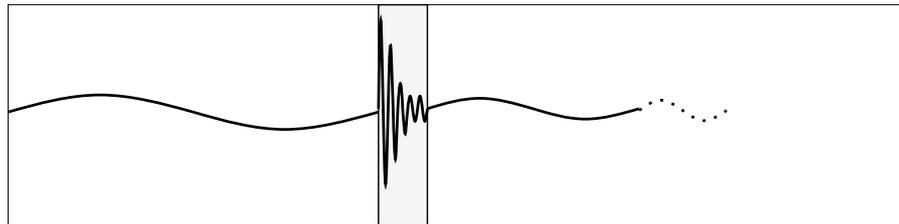


: FFT function

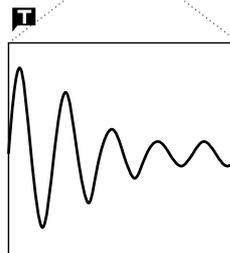
Recorder & Memory function

While using the recorder function for monitoring a real-time signal, an exception event can trigger high-speed sampling for storing data associated with the event in memory. This occurs without interrupting the recorder. The function is highly convenient when wishing to trace both the normal condition and error condition.

Slow speed recording

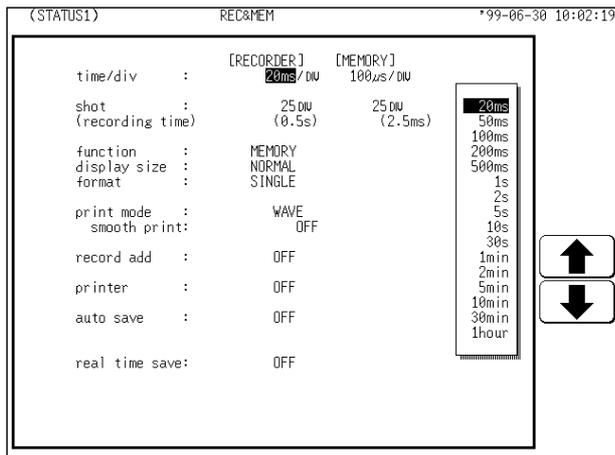


High speed storing in memory



7.3.2 Setting the Time Axis Range

- Set the speed for inputting and storing the waveform of the input signal.
- Time axis range setting expresses the time for 1 DIV.
- The sampling period is 1/100th of the set value for the time axis range. (100 samples/DIV) (See Section 21.3)
- Recorder sampling is performed using the sampling period set by the memory recorder function.



Method-1 Screen: STATUS, DISPLAY

- ① Call up the STATUS or DISPLAY screen.
- ② Move the flashing cursor to the **time/div** item, as shown in the figure on the left.
- ③ Use the JOG control, the function keys or the **TIME/DIV** key to make the selection.

Method-2 : Use the TIME/DIV key

- ① Call up the STATUS or DISPLAY screen.
- ② Use the **TIME/DIV** key to make the selection.

The **TIME/DIV** key can be used regardless of where the flashing cursor is located.

NOTE

- The recorder sampling interval is determined by the sampling interval set in memory. However, some sampling intervals that can be set as a recorder time axis. See the table below for details.
- When the recorder time axis is higher than 200 ms/DIV, the printer setting is automatically disabled.

Combinations of recorder and memory time axis ranges

Vertical axis: Time axis (/DIV) of memory waveform

Horizontal axis: Time axis (/DIV) of recorder waveform

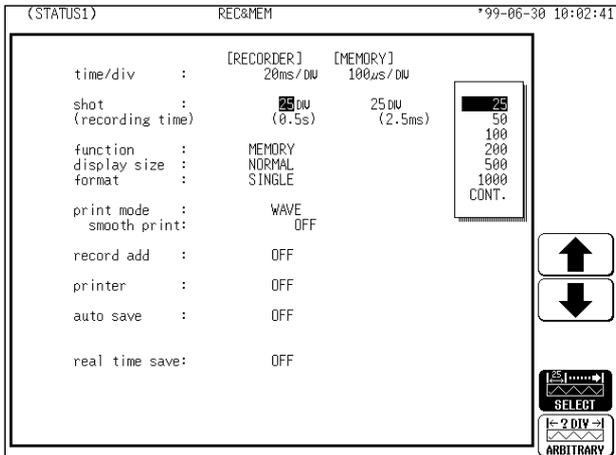
	20ms	50ms	100ms	200ms	500ms	1s	2s	5s	10s	30s	1min	2min	5min	10min	30min	1hour
100 μs																
200 μs																
500 μs																
1ms																
2ms																
5ms																
10ms	x															
20ms	x	x														
50ms	x	x	x													
100ms	x	x	x	x												
200ms	x	x	x	x	x											
500ms	x	x	x	x	x	x										
1s	x	x	x	x	x	x	x									
2s	x	x	x	x	x	x	x	x								
5s	x	x	x	x	x	x	x	x	x							
10s	x	x	x	x	x	x	x	x	x	x						
30s	x	x	x	x	x	x	x	x	x	x	x					
1min	x	x	x	x	x	x	x	x	x	x	x	x				
2min	x	x	x	x	x	x	x	x	x	x	x	x	x			
5min	x	x	x	x	x	x	x	x	x	x	x	x	x	x		

7.3.3 Setting the Recording Length

- For both recorder and memory recorder functions, the length of recording for one measurement operation (number of DIV) can be set.
- Two types of recording length can be set.

SELECT : Select the recording length.

ARBITRARY : Any recording length can be selected by the user.



Method-1 Screen: STATUS, DISPLAY

Fixed recording length mode

- ① Call up the STATUS or DISPLAY screen.
- ② Move the flashing cursor to the **shot** item, as shown in the figure on the left. Select the **SELECT**.
- ③ Use the JOG control or the function keys to make the selection.

Selection



: Move the cursor up in the selection window.



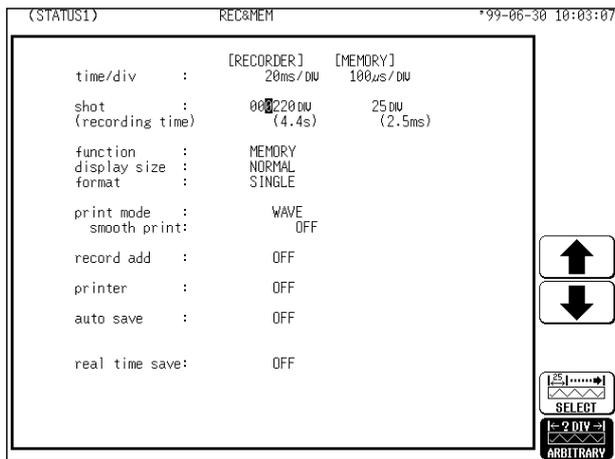
: Move the cursor down in the selection window.



: Set the fixed recording length mode.



: Set the any recording length mode.



Method-2 Screen: STATUS, DISPLAY

Any recording length mode

- ① Call up the STATUS or DISPLAY screen.
- ② Move the flashing cursor to the **shot** item, as shown in the figure on the left. Select the **ARBITRARY**.
- ③ Use the JOG control or the function keys to make the selection. Use the cursor keys to change the column.

Selection

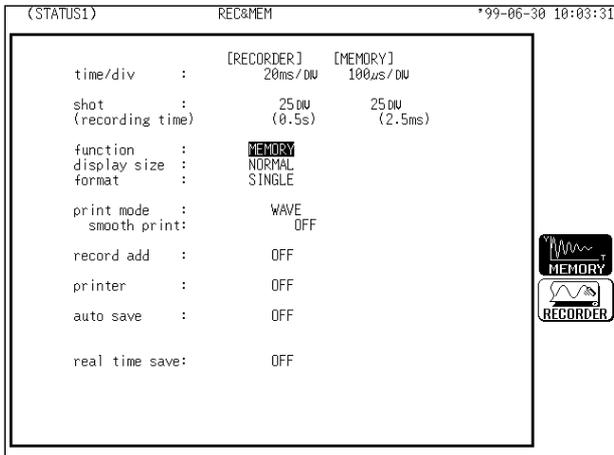
-  : Value up.
-  : Value down.
-  : Set the fixed recording length mode.
-  : Set the any recording length mode.

NOTE

- If the recording length is changed during measurement, measurement is restarted using the newly set recording length.
- When the recording length is set to "CONT," auto saving is automatically disabled.
- The maximum recording length is 1000 DIV (REC) and 2000 DIV (MEM) for a memory capacity of 16 M words. For 64 M words (with additional memory) is 5,000 DIV (REC) and 10,000 DIV (MEM).

7.3.4 Setting the Display function

- Select the waveform function to be used for display.
- During measurement, the display shows the recorder waveform.
- Function switching is used with display screen settings and displayed waveforms.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **function** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Memory recorder function



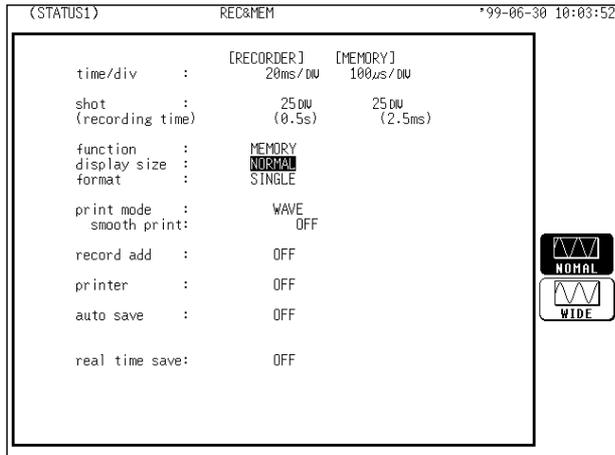
: Recorder function

NOTE

- Upon pressing the "Recorder & Memory" function key, you can switch the display function.
- Memory waveforms of the REC&MEM functions can also be displayed using the memory recorder function.

7.3.5 Setting the Display Size

The display size can change the normal size or the wide size.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **display size** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Normal size



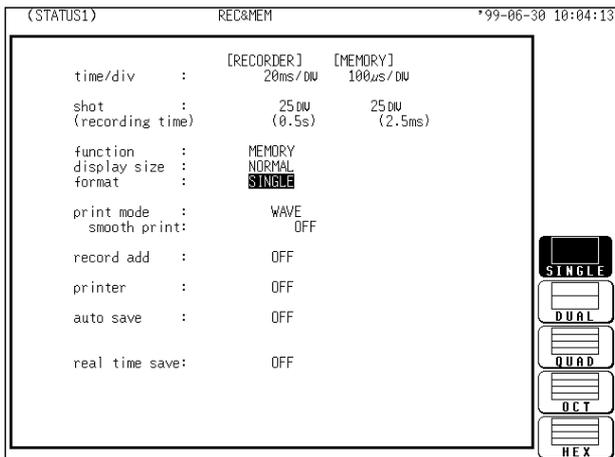
: Wide size

NOTE

The display size can be changed by pressing the **DISP** key on the display screen.

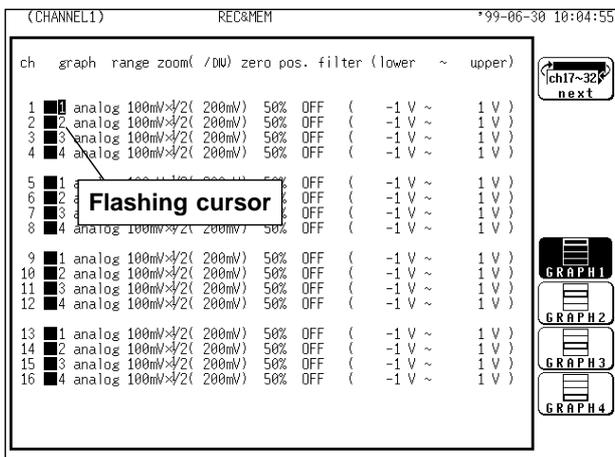
7.3.6 Setting the Format

- The style can be set for showing input signals on the screen display and recording them on the printer.
- The styles single, dual, quad, (DISPLAY screen), oct · hex (Print only, Display quad style) are available.
- The voltage per division is automatically changed according to the display format.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the format item, as shown in the figure on the left.
- ③ Use the function keys to select the display format.
- ④ Set Which graph type to use when display format has been set to DUAL, QUAD, OCT or HEX screen display.



- ⑤ Press the **CHAN** key to call up the CHANNEL1 screen.
- ⑥ Move the flashing cursor to the point in the figure on the left. The figure shows the setting for CH1. Setting for CH2 to CH 32 should be made in the same way.
- ⑦ Use the function keys to select the graph.

Selection

-  : Display the waveform on graph 1.
-  : Display the waveform on graph 2.
-  : Display the waveform on graph 3.
-  : Display the waveform on graph 4.

In the cases of OCT and HEX (printer only), as far as the printer recording output is concerned, the waveforms for each channel are automatically distributed on each graph. (For details on logic channels, refer to Section 9.3.8.)

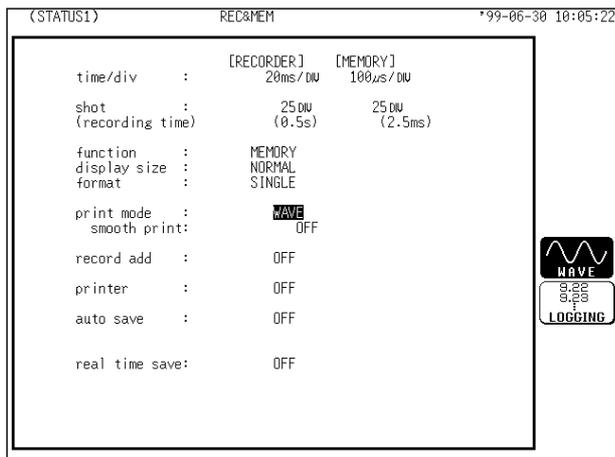
7.3.7 Setting the Print Mode

Select the format, waveform, or numerical value should be used to output measured data.

Waveform : The waveform is printed.

Numerical value : The data spacing interval also must be set.

Printing as a waveform



Method Screen: STATUS1

(1) Setting the Printer Format

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the print mode item, as shown in the figure on the left.
- ③ Use the function keys to select WAVE.

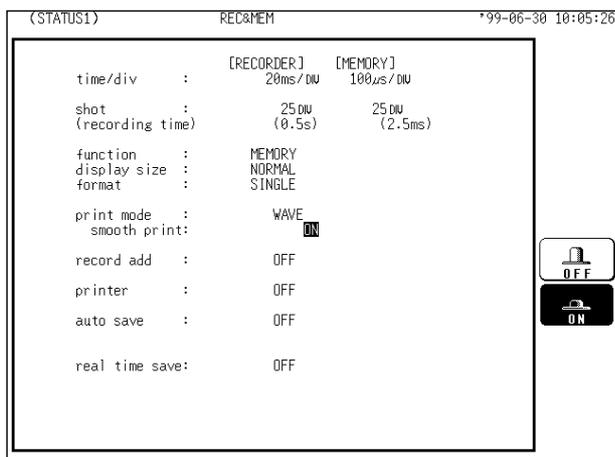
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



(2) Setting the Smooth printing

- ① When the waveform format is selected, determine whether to use the smooth printing or not.
- ② Move the flashing cursor to the smooth print item.
- ③ Use the function keys to make the selection.

Selection



: Normal printing is carried out.

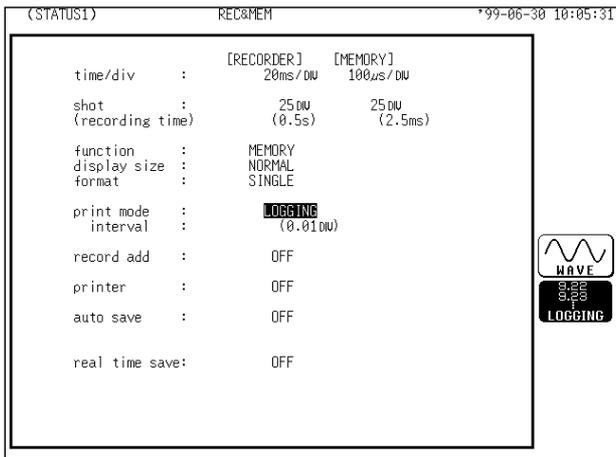


: Smooth printing is enabled.

NOTE

Smooth printing is implemented for waveforms acquired using the memory recorder function.

Printing as numeric data



Method

Screen: STATUS

(1) Setting the Printer Format

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the print mode item, as shown in the figure on the left
- ③ Use the function keys to select **LOGGING**.

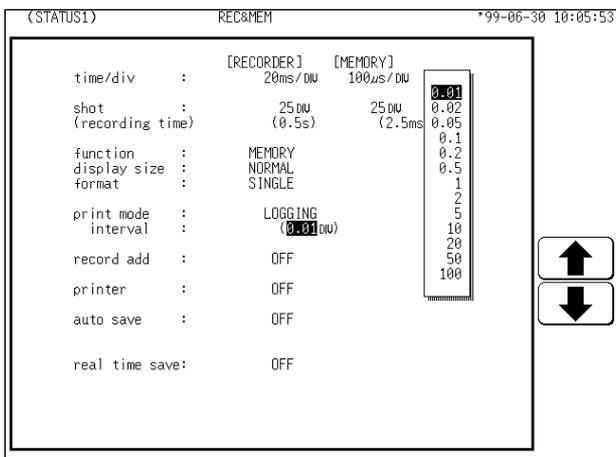
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



(2) Setting the print interval

- ① When the numeric data format is selected, set the print interval.
- ② Move the flashing cursor to the interval item.
- ③ Use the JOG control or the function keys to select the print interval.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

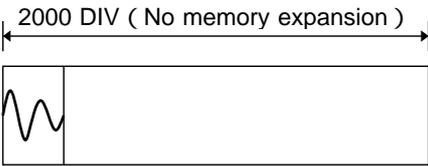
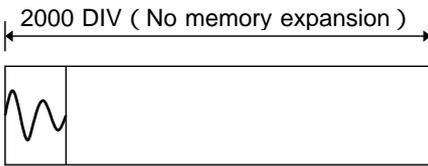
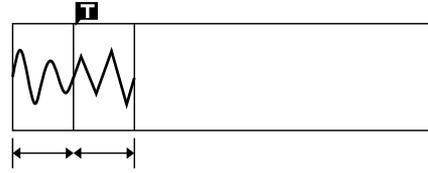
NOTE

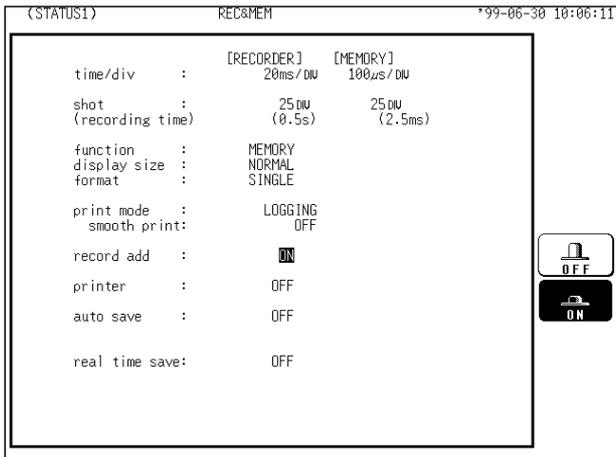
- When the print interval longer than the recording length is set, only the first dot is printed.
- The maximum and minimum values are printed (see Section 21.3.4).
- The print intervals of 0.01 to 0.5 DIV can be selected, only when there are waveform data present.

7.3.8 Setting the Additional Recording Function

- This records, regarding the memory as though it were recording paper.
- Without expansion memory, the last 1000 (64 M words: 5000) divisions of waveform can be held in memory.
- The waveform can be scrolled and printed out.

Switching the additional recording on and off affects the use of memory as shown below.

Additional recording: OFF	Additional recording: ON
<p>1. Recording 25 divisions of waveform</p>  <p>2000 DIV (No memory expansion)</p> <p>25DIV</p>	<p>1. Recording 25 divisions of waveform</p>  <p>2000 DIV (No memory expansion)</p> <p>25DIV</p>
<p>2. Recording another 25 divisions of waveform</p> <p>The first set of measurement data is discarded, and recording of the second set of measurement data starts again from the beginning of memory.</p>  <p>25DIV</p>	<p>2. Recording another 25 divisions of waveform</p> <p>The first set of measurement data is preserved, and recording of the second set of measurement data starts after the first set.</p>  <p>25DIV 25DIV</p> <p>The first and second sets of waveforms can be observed by scrolling or printing the waveform.</p>

**Method****Screen: STATUS**

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **record add** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

: Additional recording is disabled.



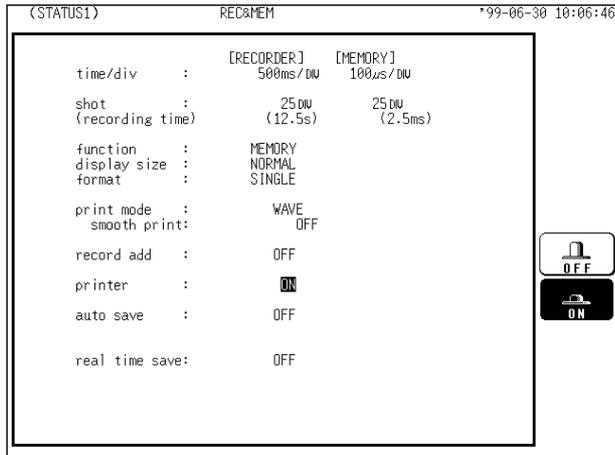
: Additional recording is enabled.

NOTE

- Time values output to the printer and displayed on the screen with the additional recording function enabled are equal to those of the most recently acquired waveforms. Therefore, when measuring waveforms in a different time axis range, always take that difference into consideration.
- When the 1000 (64 M words: 5000) DIV has been reached, old data will be overwritten. When OFF, previous data will be erased. Set to ON if erasing is not desired.
- In the recorder, the trigger mark (■) is written as the start position mark. In an additional recording, the trigger mark is displayed in front of the most recently entered data.
- If auto-save is enabled, only newly acquired waveforms are saved. Even when A and B cursors appear on the screen, no partial save is performed, because the setting is disabled when the START key is pressed.

7.3.9 Setting the Printer Function (Real Time Printing)

The input waveform (REC) is continuously printed in real time.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **printer** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Printing is disabled.



: Printing is enabled.

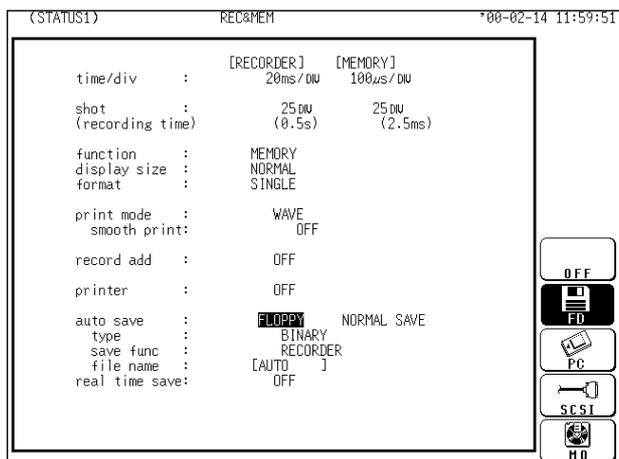
NOTE

- When the recorder time axis is higher than 200 ms/DIV, the printer setting cannot be performed.
- At a time axis range setting of 200 ms/DIV or faster, the waveform data will be printed out later.
- While the printer always outputs the data at the measurement magnification in recording mode, the waveform on the screen is reduced in size at the ratio shown in the table below, depending on the time-axis range.

Time-axis range	Magnification
100 ms/DIV	× 1/2
50 ms/DIV	× 1/5
20 ms/DIV	× 1/10

7.3.10 Setting the Auto Save Function

- When the function is enabled, measurement data are automatically stored on a floppy disk, PC card, MO disk or connected SCSI device after they are captured.
- The Auto Save function stores a file in the directory currently selected on the file screen. See Section 14.12.2.



Method Screen: STATUS1

- ① Press the STATUS key to call up the STATUS1 screen.
- ② Move the flashing cursor to the auto save item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

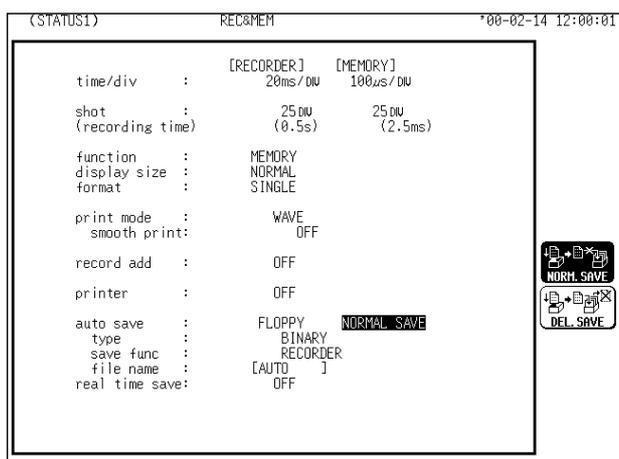
Selection

- : Auto save is disabled.
- : Automatically stored on floppy disk
- : Automatically stored on PC card.
- : Automatically stored on connected SCSI device.
- : Automatically stored on MO disk.
- : Data can only be transferred to the 9333 LAN COMMUNICATOR when using a LAN card.

- ④ When Media is selected, the Storage method item appears.

Selection

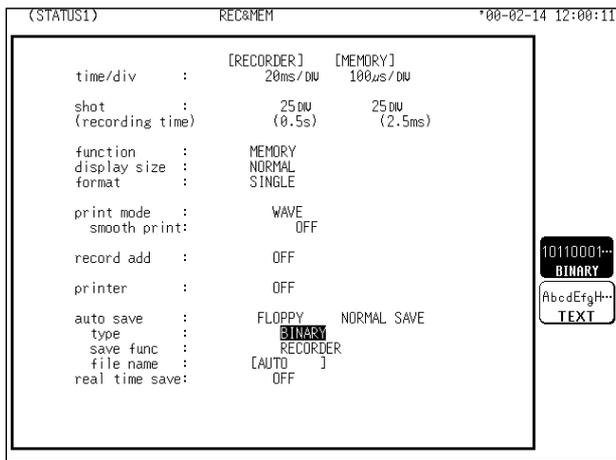
- : When the media becomes full, automatic storage stops.
- : When the media becomes full, old files are deleted to make room for automatic storage.



When 1 BLOCK save is selected with the Binary Format, the memory waveforms with the file extension 'MEM' and the recorded waveforms in the 'REC' file is deleted.

When ALL BLOCKS save is selected with the Binary Format, files with the extensions 'R-M', 'MEM' and 'REC' are deleted.

With the text format selected, files with the extension 'TXT' are deleted.



- ⑤ Move the flashing cursor to **type**, and select the format.

Selection

10110001...
BINARY : Data are stored as binary data.

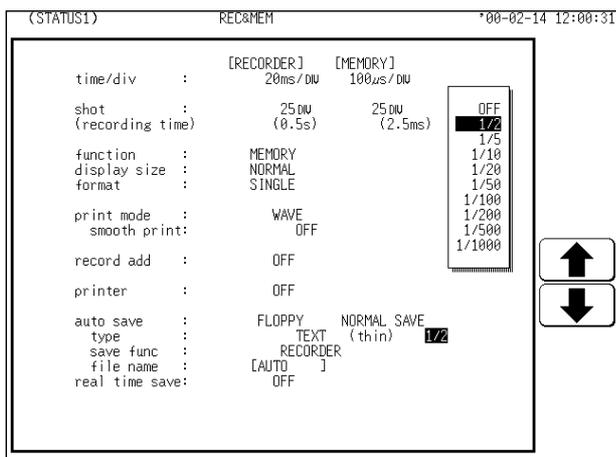
AbcdEfgH...
TEXT : Data are stored as text data.
Data stored in the text format is not readable by the 8826.

- ⑥ When the data format to be saved is set to text data, the intermittent setting item is displayed. Use the function keys or Jog control to make a setting.

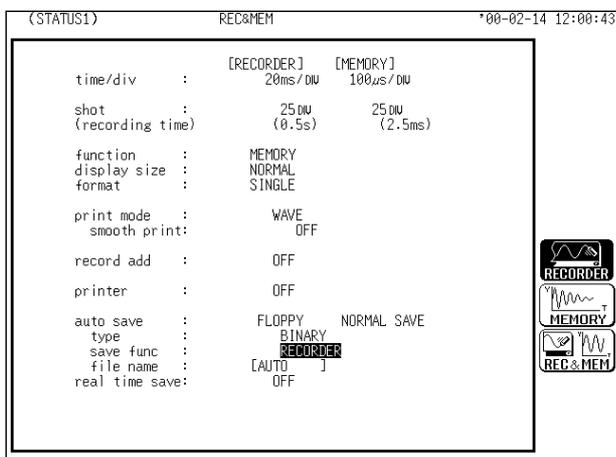
Selection

↑ : Move the cursor up in the selection window.

↓ : Move the cursor down in the selection window.



- ⑦ Select the item to be stored.



Selection

RECORDER : 1 block save of recorder data

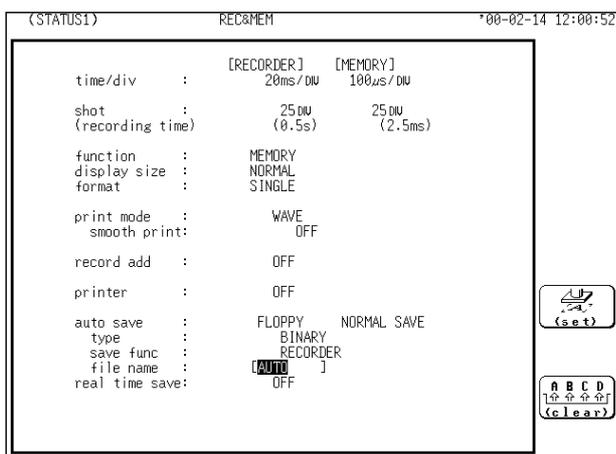
MEMORY : 1 block save of memory data

REC&MEM : All block save both recorder and memory data

- ⑧ Set the file name. For the input method, refer to Section 9.8.4.

When using auto-save, a number is appended to the name you specify as the file name. This then becomes the file name. If you start procedures before specifying a file name, AUTO is automatically enabled.

- Do not use the characters and symbols below in a file name. A file containing any of these characters/symbols in its file name cannot be processed under Windows 2000 or XP. Half-size symbols: +, =, [,]



NOTE

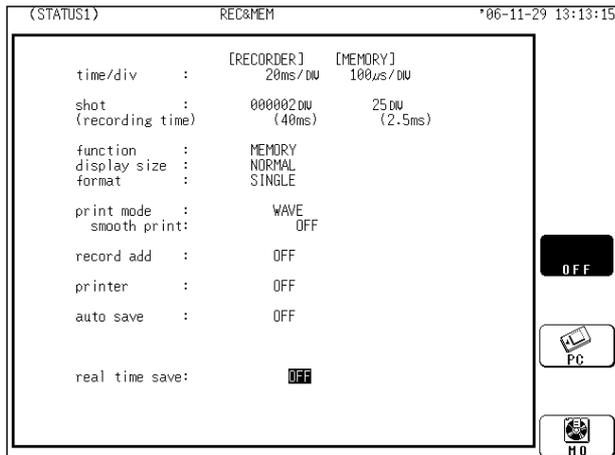
- Auto saving is set to "RECORDER, MEMORY DATA," and batch saving is executed (an index file is created). When either option (i.e., RECORDER or MEMORY DATA) is selected, individual saving is executed.
- When auto-save is enabled, the storage channel cannot be selected. Data for the channel for which the waveform is displayed is saved.
- For details on auto saving file name, refer to Section 14.7.
- When the recording length is "continuous", data are not stored.
- For details on connected SCSI device, refer to Section 14.4.
- When cursor A and B are enabled, partial saving is executed. When "REC& MEM DATA" is set, partial saving is disabled.
- If additional recording is enabled, only newly acquired waveforms are saved. Even when A and B cursors appear on the screen, no partial save is performed.
- The media is common to recorder and memory recorder use the same media. Separate media therefore cannot be selected.
- The directory and the number of files that can be stored in the directory are limited. For details, see Section 14.7.
- During automatic storage, if the **STOP** key is pressed to interrupt measurement, waveforms taken prior to the interruption are stored automatically.

7.3.11 Setting the Real-Time Save

Data can be saved to memory in real time, and afterwards compressed and stored on disk. Real-time save data is stored in binary format on the PC card or internal MO drive.

Trigger settings are not applicable to the memory waveform, and the start of Memory waveform recording coincides with the start of the Recorder waveform.

The time axis of the Real-Time Save waveform may be 100 ms to 5 min/DIV for channels 1 to 16, and 200 ms to 5 min/DIV for channels 17 and above.



Method Screen: STATUS1

- Press the STATUS key to call up the STATUS1 screen.
- Move the flashing cursor to the real time save item, and use the function keys to make the selection.
When Real-Time Save is selected, the time axis must be set to the valid range.

Selection



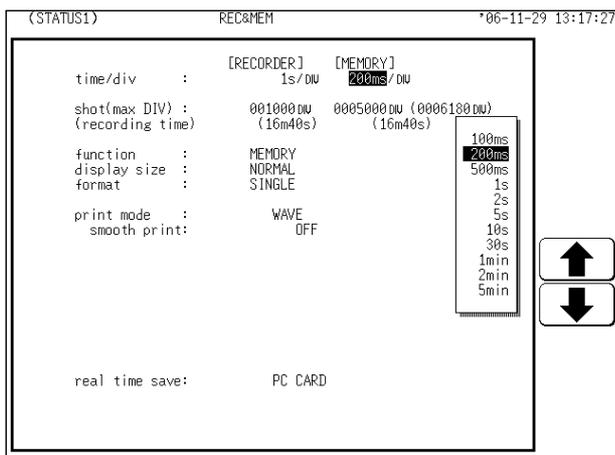
: Real time save is disabled.



: Real time save is enabled on PC card.



: Real time save is enabled on MO disk.



- Move the flashing cursor to "Memory Time Axis", and select using the displayed function keys or jog control.
- Select the "Recording Time Axis" at the same time.

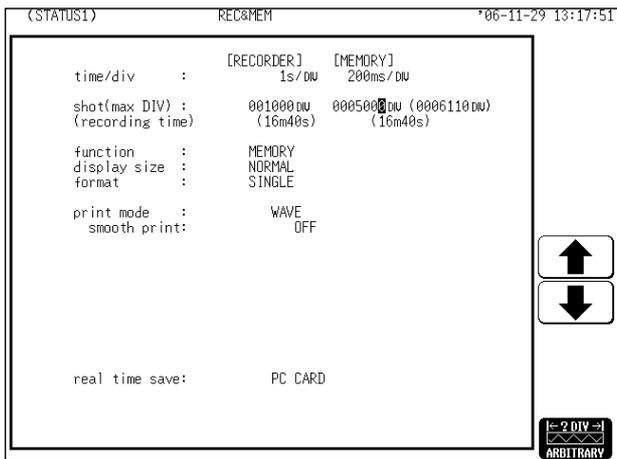
Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.



- ⑤ Move the blinking cursor to "Memory Recording Length", and select using the jog control or function keys.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

NOTE

- The sampling cycle of the recorder is the same as that set for the memory, so depending on the sampling cycle, there are some time axes that cannot be set for the recorder. Refer to Section 7.3.2 for details.
- The recordable time (recording length) is determined by the space available on the PC card or MO disk and the number of channels being saved.
- The recording length of the recorder is determined automatically by the recorder time axis range, memory time axis range and memory recording length.
- Channels cannot be selected for real-time save (all displayed channel data waveforms are saved).
- Partial saving (only between cursors) is not possible even when the A-B cursors are displayed.
- When Real-Time Save is enabled, Auto Save, Auto Print, Additional Recording and Sequential Save settings are ignored.
- When measurement is aborted before the set recording length, the waveforms input prior to the abort are saved.
- Files with extensions MEM, REC and R_M are created during Real-Time Save. Refer to Section 14.7, "SAVE" for file name details.
- Real-Time Save cannot save data in text format ("Text Save").

Maximum Recording Time

The maximum settable recording time is determined by the space available on the PC card or MO disk, the MEM and REC time axes and the selected recording length. However, the maximum REC recording length is limited to 1000 DIV (5000 with expanded memory), so the recording time cannot be set beyond this limit regardless of space available on the PC card or MO disk. The settable recording times for saving the 32 analog channels to PC card (1 GB) are shown below.

(1) MEM time axis settings with the REC time axis set to the fastest value (low compression)

MEM time axis	MEM recording length	REC time axis	REC recording length	Maximum Recording Time
100 ms	5000	500 ms	1000	8m, 20s
200 ms	5000	1 s	1000	16m, 40s
500 ms	4000	2 s	1000	33m, 20s
1 s	5000	5 s	1000	1h, 23m, 20s
2 s	5000	10 s	1000	2h, 46m, 40s
5 s	6000	30 s	1000	8h, 20m, 00s
10 s	6000	1 min	1000	16h, 40m, 00s
30 s	4000	2 min	1000	1d, 09h, 20m, 00s
1 min	5000	5 min	1000	3d, 11h, 20m, 00s
2 min	5000	10 min	1000	6d, 22h, 40m, 00s
5 min	6000	30 min	1000	20d, 20h, 00m, 00s

(2) MEM time axis settings with the REC time axis fixed at 1 h/DIV (high compression)

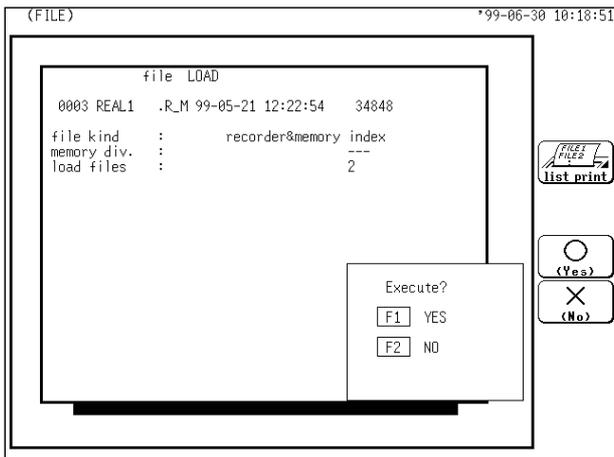
MEM time axis	MEM recording length	REC time axis	REC recording length	Maximum Recording Time
100 ms	319830	1 h	8	8h, 53m, 03s
200 ms	159900	1 h	8	8h, 53m, 00s
500 ms	159880	1 h	22	22h, 12m, 20s
1 s	159830	1 h	44	1d, 20h, 23m, 50s
2 s	159740	1 h	88	3d, 16h, 44m, 40s
5 s	159480	1 h	221	9d, 05h, 30m, 00s
10 s	159040	1 h	441	18d, 09h, 46m, 40s
30 s	120000	1 h	1000	41d, 16h, 00m, 00s
1 min	60000	1 h	1000	41d, 16h, 00m, 00s
2 min	30000	1 h	1000	41d, 16h, 00m, 00s
5 min	12000	1 h	1000	41d, 16h, 00m, 00s

Loading Real-Time Save Data

To load data saved by Real-Time Save, load the index file (R_M). Data loaded by the index file consists of all recorder waveforms and the header (2000 DIV) of the memory waveform. Loading of the memory waveform is specified by use of the A-B cursors within the recorder waveform.

Refer to Section 14.8, "LOAD" regarding loading data saved by Real-Time Save.

When Real-Time Save is finished, the recorder waveforms remain in memory, so it is not necessary to load the saved data.



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Move the flashing cursor to the **media** item, and use the function key to select the "PC card" or "MO".
- ③ Use the jog and shuttle controls or cursor keys to select the index file of the data to be loaded from the file list.
- ④ Move the flashing cursor to the **command** item, and use the function key to select the "LOAD".
- ⑤ Use the function keys to make selection.

Selection



: Determines the data to load.



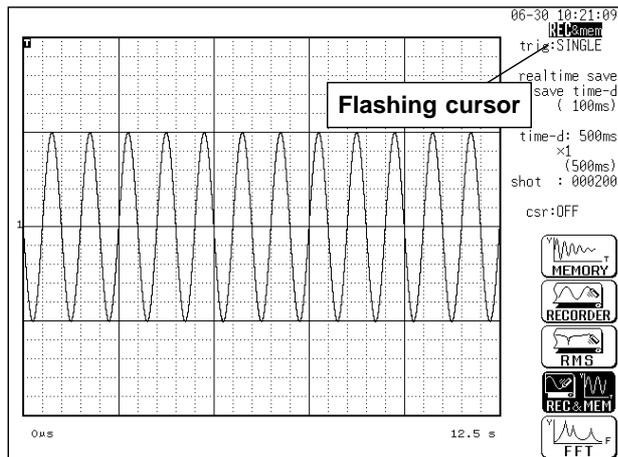
: Cancel the command to load.

NOTE

To load a recorder waveform or memory waveform in the recorder and memory functions, load the files with the REC and MEM extensions, respectively.

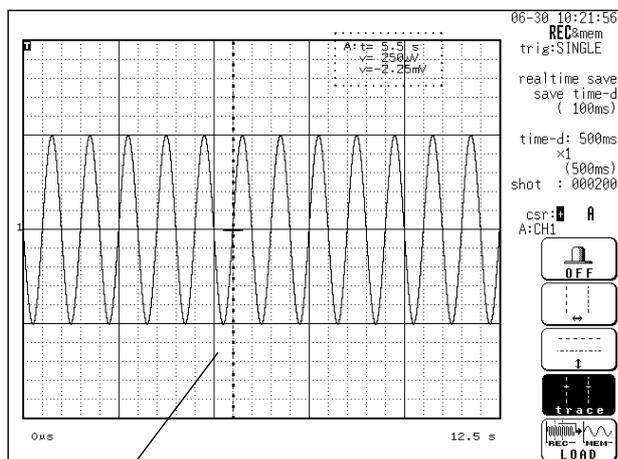
Loading Memory Waveforms

The memory waveform is specified by use of the A-B cursors within the recorder waveform.



Method Screen: STATUS2

- ① Press the **DISP** key to display the **DISPLAY** screen.
- ② Move the blinking cursor to the location indicated in the figure. Press function key F4 (Record & Memory) to display the recorder waveform screen (REC & mem).



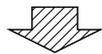
- ③ Specify the area to display as the memory waveform with the A-B cursors.
- ④ Use the function key to select the "LOAD".

Selection

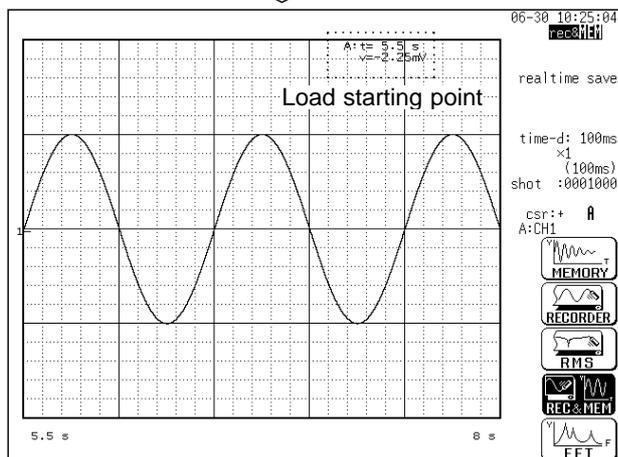


: Loads the memory waveform.

Cursor A



Memory waveform loads



Memory Waveform Loading Example

In the figure at the left, cursor A marks the starting point for memory waveform loading at 5.5 s after trigger occurs. Pressing the LOAD function key loads the memory waveform.

The start of the loaded memory waveform screen is positioned 5.5 s after trigger.

NOTE

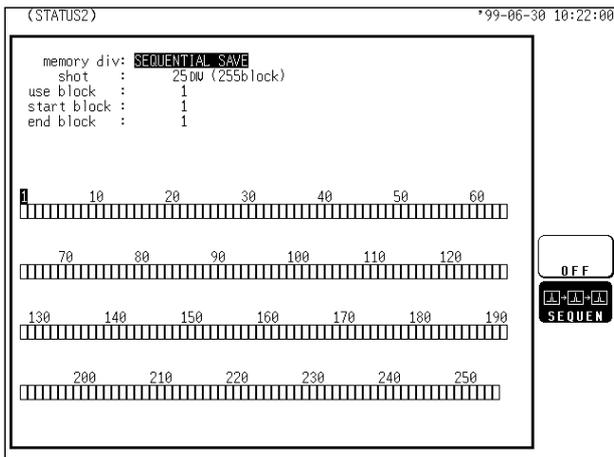
If the area specified by the A or A-B cursors exceeds the loadable area, 2000 DIVs are loaded from the head to the cursor position.

7.4 STATUS2 Settings (REC&MEM)

7.4.1 Using the Sequential Save Function

This function divides the memory into separate blocks, each of which can be used for waveform recording.

Refer to Section 15.1 for details.



Method Screen: STATUS2

- ① Press the **STATUS** key to call up the STATUS2 screen.
- ② Move the flashing cursor to the **memory div** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Disable memory segmentation.



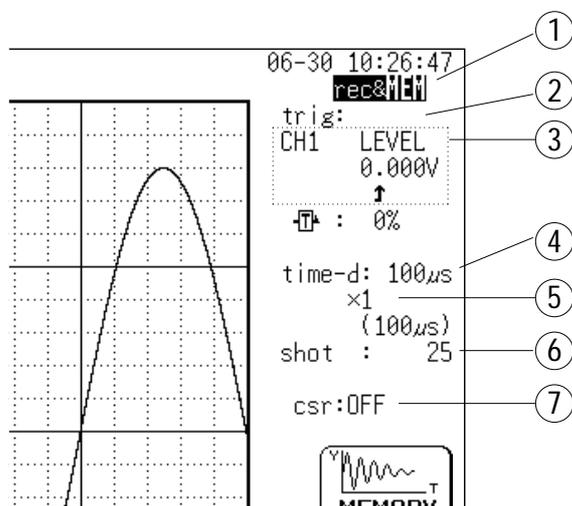
: Enable sequential save function.

7.5 Settings on the Display Screen (REC&MEM)

Explains the setting items on the Display screen.

For details on setting, refer to Section 7.3.

When want to use the JOG control, press the **VALUE** select key. (The selection window is not displayed.)



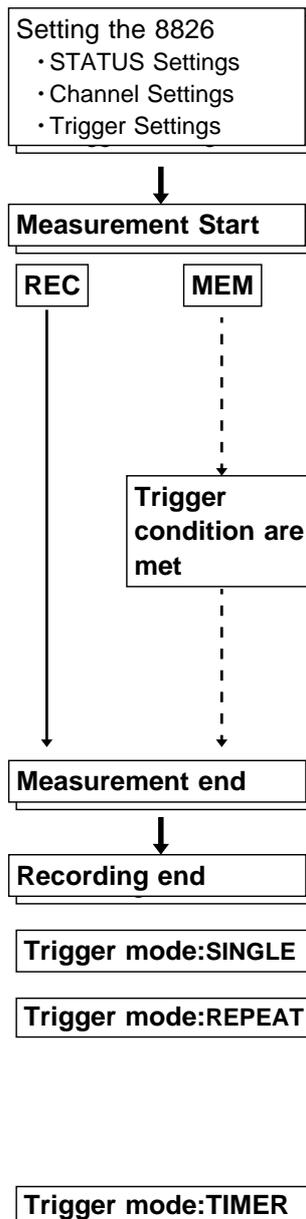
Upon pressing the "Recorder & Memory" function key, the display changes where indicated in the figure, and you can set the waveform to be displayed.

REC&mem : Recorder waveform

rec&MEM : Memory waveform

① Function	MEM, REC, RMS, FFT REC&MEM (REC) REC&MEM (MEM)	• Select function.
② Trigger mode (REC)	SINGLE, REPEAT, TIMER	• Select trigger mode.
③ Analog trigger (MEM)	OFF, LEVEL, OUT, IN, CYCLE	• Set the analog trigger.
④ Pre-trigger (MEM)	0 to 100%, -95%	• Set the pre-trigger.
⑤ Time Axis Range	20 ms/DIV to 1 h/DIV (REC) 100 µs to 5 min/DIV (MEM)	• Set the time 1 scale (1 DIV).
⑥ Compression along the time axis	×1 to ×1/500 (REC) ×10 to ×1/10000 (MEM)	• By compressing the waveform, an entire change can be promptly apprehended.
⑦ Recording Length (Capacity : 16 M words)	SELECT : 25 DIV to CONT (REC) 25 DIV to 2000 DIV (MEM) ARBITRARY : 1 DIV to 1000 DIV (REC) 1 DIV to 2000 DIV (MEM)	• The length of recording for one measurement operation (the number of DIV) can be set.
⑧ Cursor Measurement	OFF, ↔, ↑, +	• The A/B cursors can be used.
Display size	NORMAL, WIDE	• The screen size can be changed by pressing the DISP key.
Input channel settings	• Analog input • Logic input • X, Y axis (X-Y format)	• Enables the measurement conditions for each channel on the display screen to be set or changed. See Section 9.9.
Input level monitor function	Press the LEVEL MON. key.	• See Section 11.5.
VIEW function	Press the VIEW key.	• See Section 11.6.

7.6 Start and Stop Operation (REC&MEM)



- See Section 7.3 STATUS settings
- See Chapter 9 Input channel settings
- See Chapter 10 Trigger Functions

- Press the **START** key and LED light.
- When the trigger mode is set to "TIMER," the system waits until the set time is reached.
- Displays "**Storing**".
- Waveform appears on the screen and printout starts (Auto print: ON).
- Using the **VIEW** key to display the time (from measurement started time).
- Memory data recording starts when trigger condition are met. When the pretrigger has been set for the memory waveform and the trigger conditions are met until the trigger point, the system initiates data acquisition at that time.
- When Sequential Save is enabled, the memory waveform is stored each time a trigger occurs.
- When Auto Save is on, pressing the **STOP** key during measurement causes measurement data to be saved automatically until the stop.

- Autosaving is executed.

- End of measurement

- Each time when trigger conditions are met, data are recorded and memory contents are overwritten.
- When **STOP** key is pressed, measurement stops after data corresponding to recording length have been stored in memory. (auto save are not executed.)

- The measurement is repeated at the set time interval until the stop time is reached.

NOTE

- A stored waveform read by the Recorder & Memory function can be subjected to waveform processing by the Memory function, but doing so erases the Recorder waveform.
- While a waveform is being stored, the storage conditions of the memory waveforms are displayed at the lower part of the screen.
 - 「MEMORY WAVE WAIT TRIG」 - - - Trigger wait condition
 - 「MEMORY WAVE STORING」 - - - Memory waveform is being stored
 - 「MEMORY WAVE STORE END」 - - Memory waveform storage is finished
- During Sequential Save:
 - 「MEMORY WAVE XXX/000」 - - - Displays the storing block (XXX is the last block stored, and 000 is the memory segment number)

Chapter 8

FFT Function

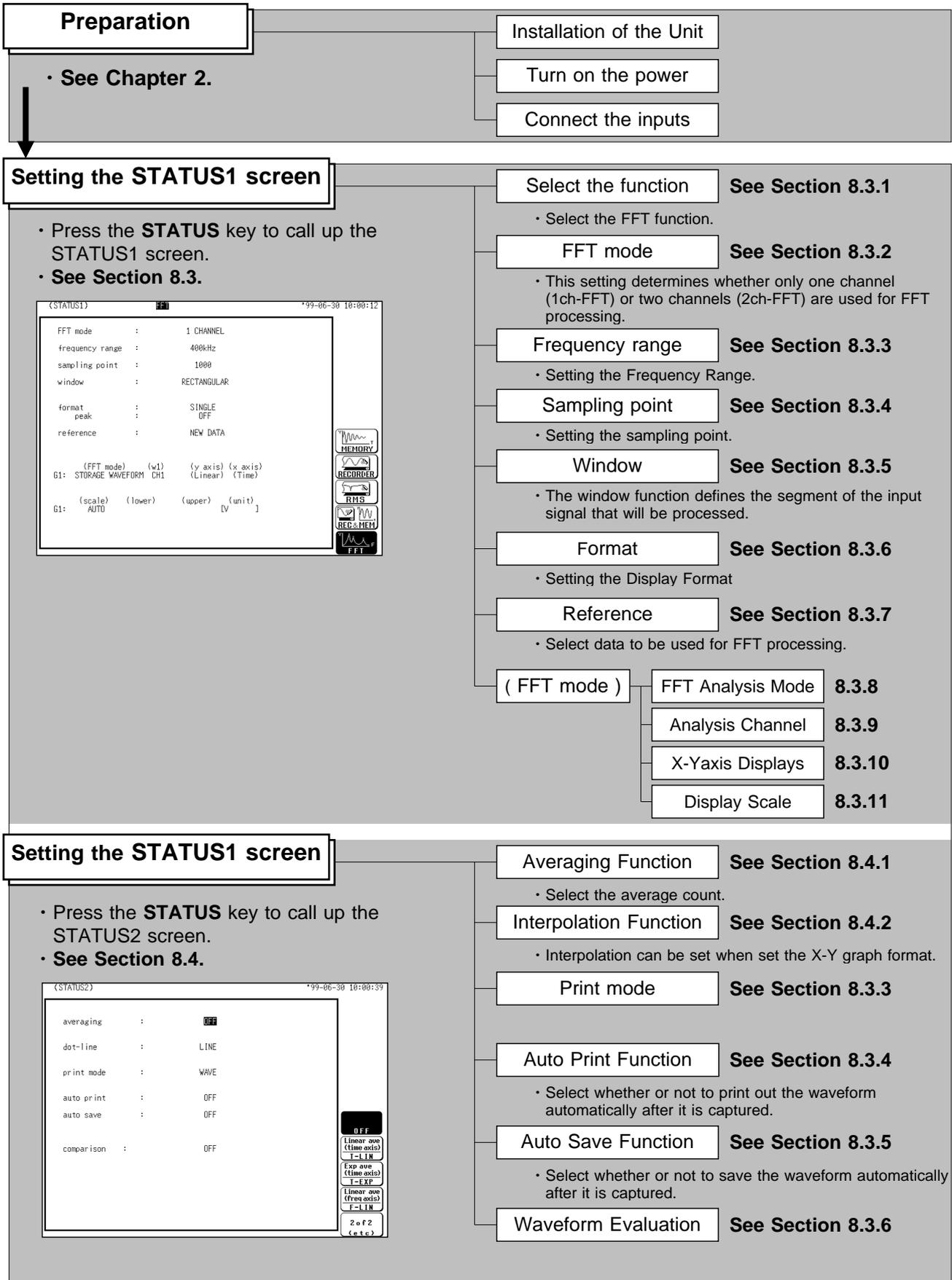
8.1 Outline of the FFT Function

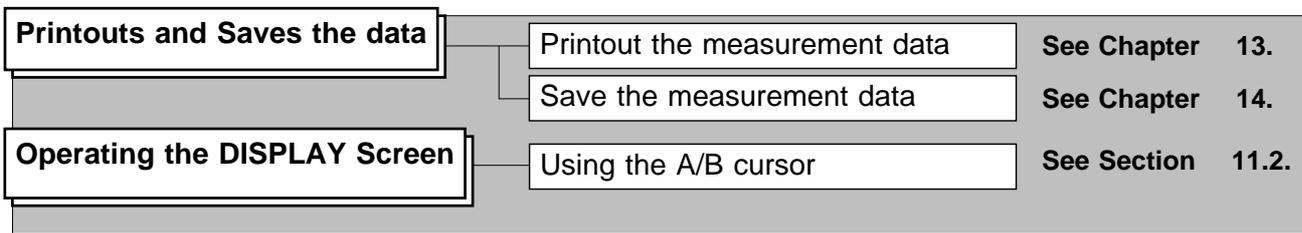
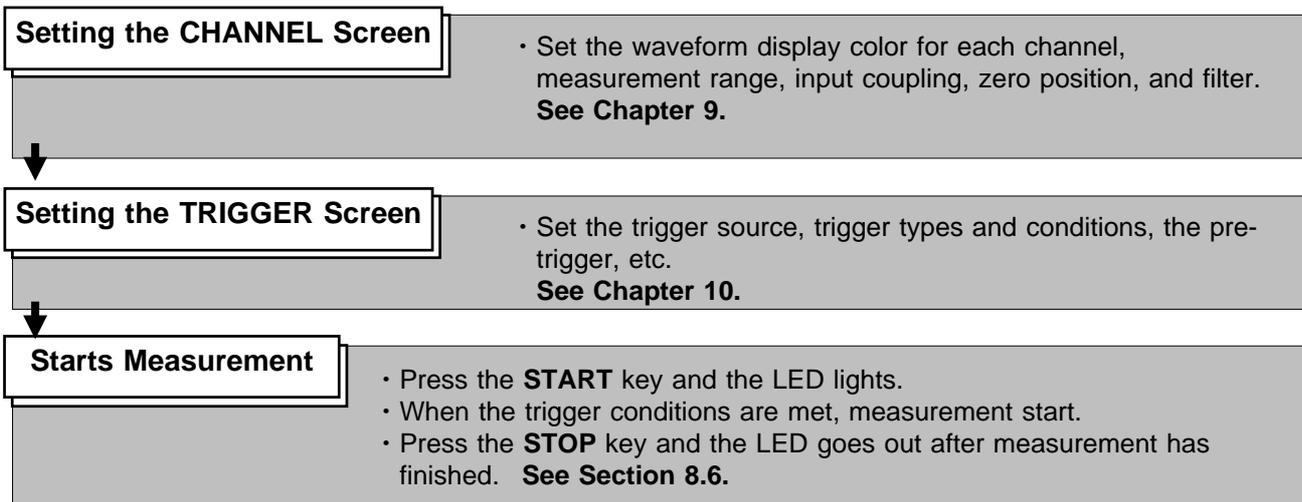
- (1) FFT (Fast Fourier Transform) processing can be performed on input signal data for frequency analysis.
- (2) Frequency range
133 mHz to 400 kHz
- (3) Frequency resolution
1/400, 1/800, 1/2000, 1/4000 of frequency range
- (4) 12 types of analysis functions
Storage waveform, linear spectrum, RMS spectrum, power spectrum, auto-correlation function, histogram, transfer function, cross-power spectrum, cross-correlation function, unit-impulse response, coherence function, octave analysis
- (5) Analysis modes
1-channel FFT, 2-channel FFT
- (6) Analysis of data stored with memory recorder function and recorder and memory function possible
- (7) Switchable antialiasing filter
Automatic selection of cutoff frequency to match frequency range (8938 FFT ANALOG UNIT)

NOTE

- We recommend using an input unit equipped with an anti-aliasing filter that can be enabled to minimize sampling distortions during FFT analysis.
- Refer to Section 21.3.10 for more information about aliasing distortion and anti-aliasing filters.

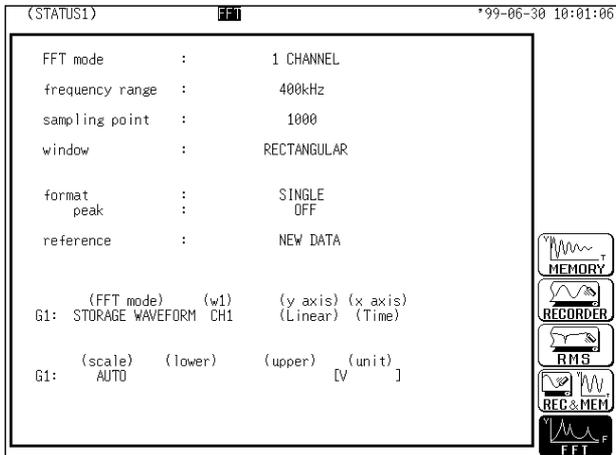
8.2 Operation Sequence (FFT)





8.3 STATUS1 Settings (FFT)

8.3.1 Setting the Function Mode



Method

Screen: STATUS1, CHANNEL, DISPLAY

- ① Call up the STATUS1, CHANNEL or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Press the F5 [FFT].

Selection



: Memory recorder function



: Recorder function



: RMS recorder function



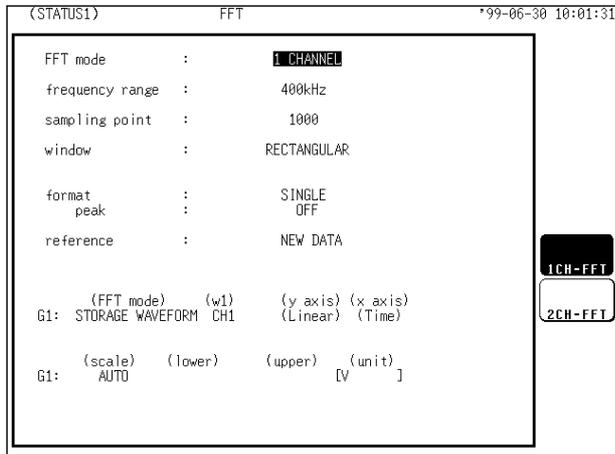
: Recorder and Memory function



: FFT function

8.3.2 Setting the FFT Channel Mode

- This setting determines whether only one channel (1ch-FFT) or two channels (2ch-FFT) are used for FFT processing.
- When "1ch-FFT" is selected, certain FFT analysis modes will not be available.



Method Screen: STATUS1

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the FFT mode item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Used for FFT analysis of signals from one channel.



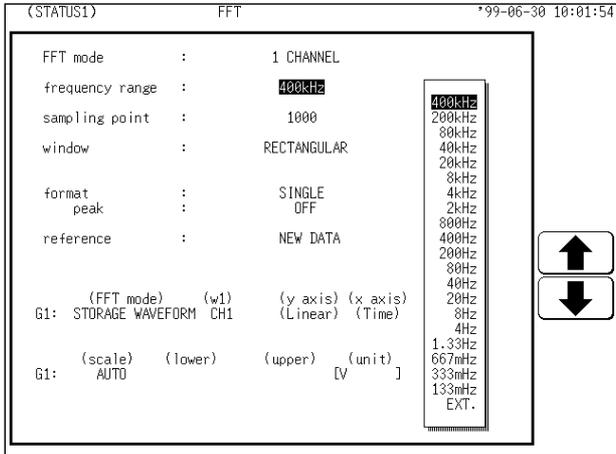
: Used for simultaneous FFT analysis of two channels.

NOTE

- The following analysis functions are not possible in 1-channel FFT mode: Transfer function (TRF), cross-power spectrum (CSP), cross-correlation function (CCR), impulse response (IMP), coherence function (COH)
- The FFT channel mode is displayed at the upper left of the screen.

8.3.3 Setting the Frequency Range

- The frequency range (frequency axis maximum value) can be set as follows.
- The frequency range corresponds to the time axis range (TIME/DIV) setting of the memory function.



Method Screen: STATUS1, DISPLAY

- ① Call up the STATUS1 or DISPLAY screen.
- ② Move the flashing cursor to the **frequency range** item, shown in the figure on the left.
- ③ Use the JOG control or the function keys to make the selection.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

NOTE

- The antialiasing filter (8938 and 8947) cutoff frequency is the same as the selected frequency range.
- When EXT was selected, octave analysis cannot be carried out.
- To use external sampling: See Section 17.4.

Frequency Range, Frequency Resolution, Window Width, Corresponding Time Axis Range (sampling point: 1000)

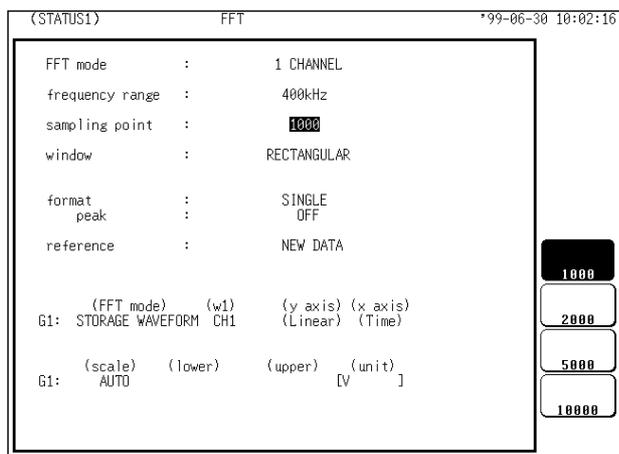
frequency range	Frequency resolution*3	Window width*4	Time axis
400 kHz*1	1 kHz	1 ms	100 μ s/DIV
200 kHz*1	500 Hz	2 ms	200 μ s/DIV
80 kHz*1	200 Hz	5 ms	500 μ s/DIV
40 kHz	100 Hz	10 ms	1 ms/DIV
20 kHz	50 Hz	20 ms	2 ms/DIV
8 kHz	20 Hz	50 ms	5 ms/DIV
4 kHz	10 Hz	100 ms	10 ms/DIV
2 kHz	5 Hz	200 ms	20 ms/DIV
800 Hz	2 Hz	500 ms	50 ms/DIV
400 Hz	1 Hz	1 s	100 ms/DIV
200 Hz	500 mHz	2 s	200 ms/DIV
80 Hz	200 mHz	5 s	500 ms/DIV
40 Hz	100 mHz	10 s	1 s/DIV
20 Hz	50 mHz	20 s	2 s/DIV
8 Hz*2	20 mHz	50 s	5 s/DIV
4 Hz*2	10 mHz	100 s	10 s/DIV
1.33 Hz*2	3.33 mHz	5 min	30 s/DIV
667 mHz*2	1.67 mHz	10 min	1 min/DIV
333 mHz*2	0.83 mHz	20 min	2 min/DIV
133 mHz*2	0.33 mHz	50 min	5 min/DIV

The cutoff frequency of the antialiasing filter is the same as the selected frequency range, except for the cases listed below.

- *1: Antialiasing filter is OFF. *2: Cutoff frequency is 20 Hz.
- *3: When the number of FFT sampling points is 2000, the frequency resolution is half of the values shown in the table. When the number of FFT sampling points is 5000, the frequency resolution is one-fifth of the value shown in the table. When the number of FFT sampling points is 10,000, the frequency resolution is one-tenth of the value shown in the table.
- *4: When the number of FFT sampling points is 2000, the window width is doubled. When the number of FFT points is 5000, the window width is increased by five times. When the number of FFT sampling points is 10,000, the window width is tenfold.

8.3.4 Setting the Sampling Point

When the number of points is increased, the frequency resolution is also increased but the operation time is prolonged.



Method Screen: STATUS1

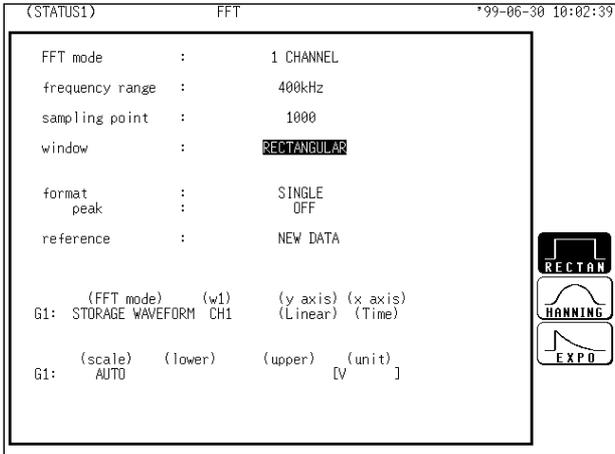
- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **sampling point** item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

- 1000 : 1000
 2000 : 2000
 5000 : 5000
 10000 : 10000

8.3.5 Setting the Window Processing

- The window function defines the segment of the input signal that will be processed.
- Window processing can be used to minimize leakage error.



Method Screen: STATUS1

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **window** item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

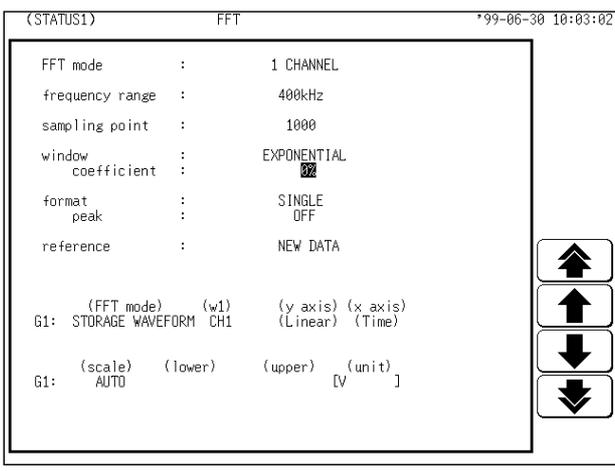
Selection

 : Rectangular: effective on discrete waveforms.

 : Hanning: effective on continuous waveforms.

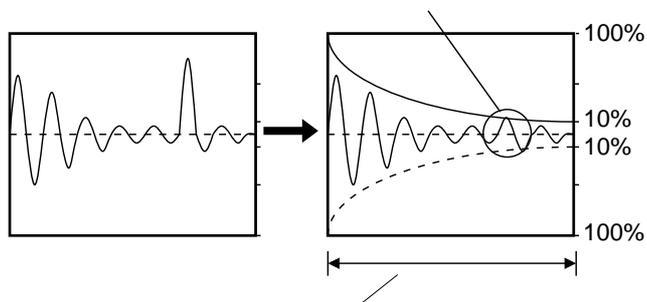
 : Exponential: effective on decaying waveforms.

- ④ If EXPO was selected in step ③, the coefficient item is displayed. Select the attenuation ratio in percent, using the function keys or the JOG control. If coefficient (attenuation ratio) is set to 0%, processing will be carried out as 0.1%.



Exponential window function Attenuation ratio set to 10%

Noise on attenuated waveform is reduced



Waveform captured in one operation (1000 points)

Selection

 : Value up, large step

 : Value up, small step

 : Value down, small step

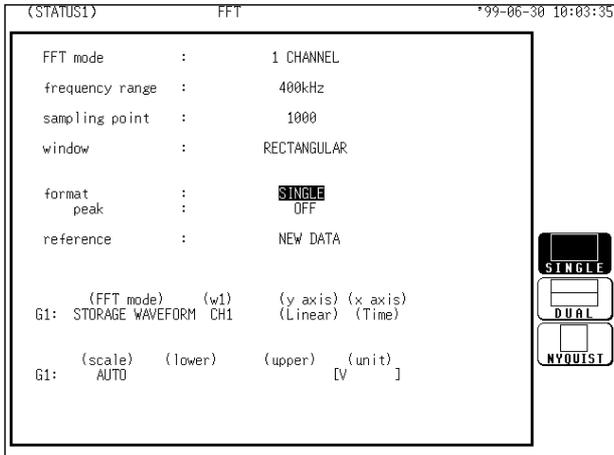
 : Value down, large step

NOTE

When measurements are taken using the Hanning window or exponential window, note that the calculation results in the display of a value that is lower than the amplitude obtained when using a rectangular window.

8.3.6 Setting the Format

- You can set the format for displaying input signal waveforms on the screen and recording them on the printer.
- The SINGLE, DUAL, and NYQUIST formats are available.

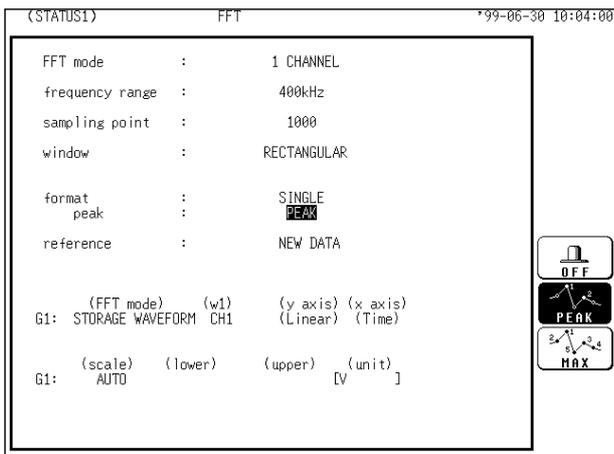


Method Screen: STATUS1

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **format** item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

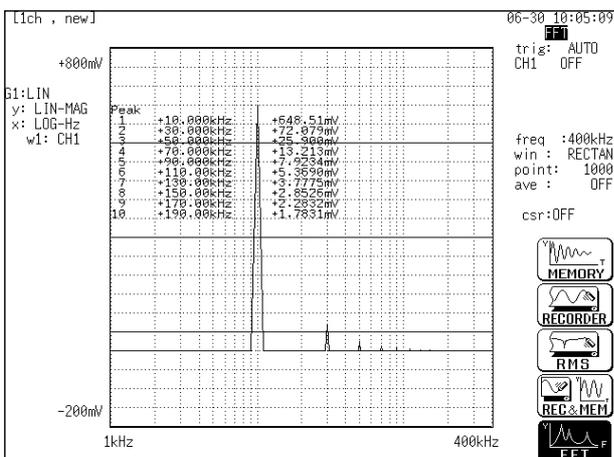
- : Single
- : Dual
- : Nyquist



- ④ If SINGLE or DUAL was selected in step ③, the peak item is displayed. Use the function keys to make the selection.

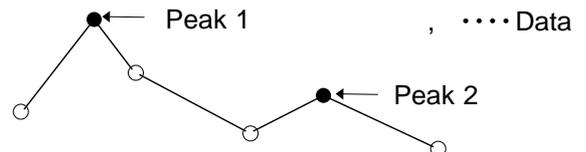
Selection

- : OFF
- : Shows the 10 peak values
- : Shows the 10 highest peaks



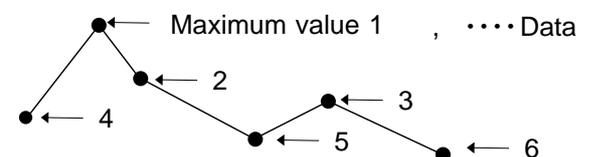
Peak value

- When data at one point are higher than data within the vicinity, the point is a peak. The 10 highest peaks are shown.



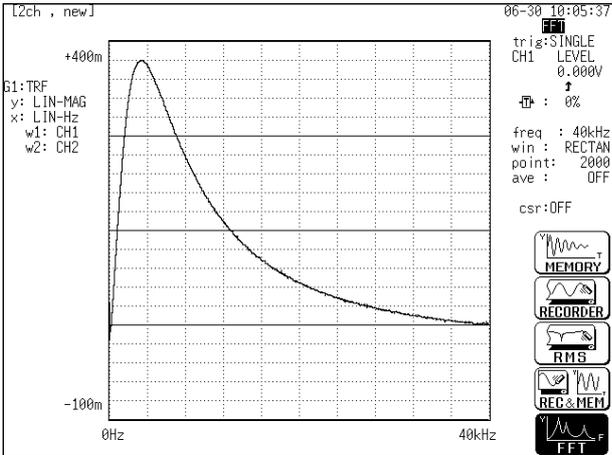
Maximum value

Points with the 10 highest values are shown.



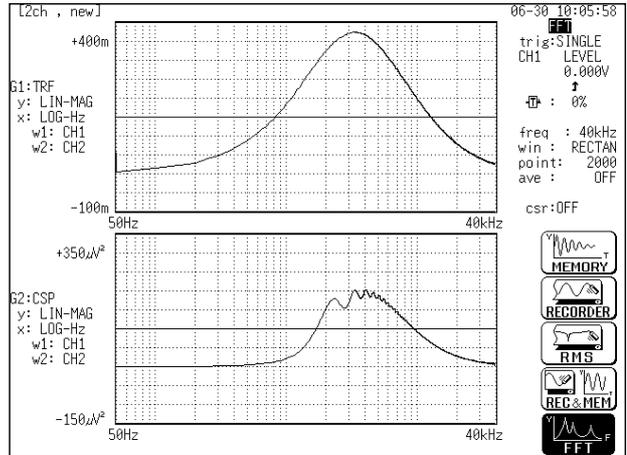
(1) Single graph

Displays the waveform on a single screen.



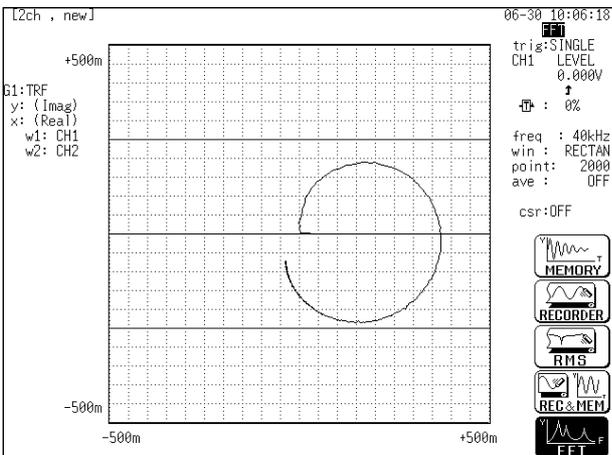
(2) Dual graph

Divides the waveform display screen into upper and lower screens.



(3) Nyquist graph

For the linear spectrum, cross power spectrum, and transfer function, displays the real-number portion of the data for the FFT calculation result on the X-axis, and the imaginary number portion of the data on the Y-axis.

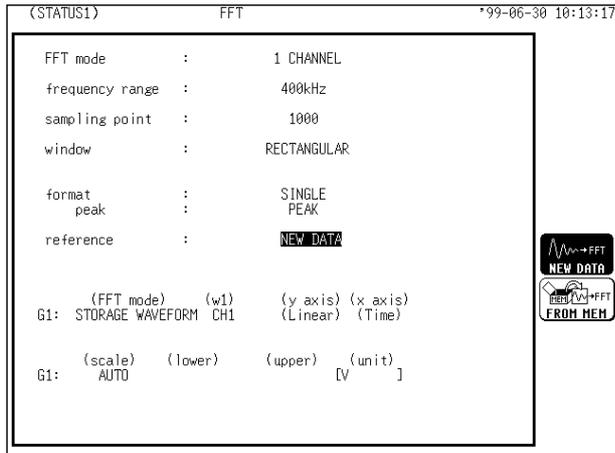


NOTE

The peak value is displayed on the screen and printed out, but it is not recorded as the peak value in data storage.

8.3.7 Selecting Reference Data

Select data to be used for FFT processing.



Method Screen: STATUS1

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the reference item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Capture new waveform data for FFT processing



: Use stored waveform data for FFT processing

New data

When **START** key is pressed, data for setting points are captured and used for FFT processing.

Memory waveform

Pressing the **START** key initiates FFT processing of the specified FFT Number of Points, from the start of the data (Memory Recorder or memorized Recorder & Memory waveform) that has been stored in memory.

The starting point for calculation can be specified using the cursor on the screen with the stored Recorder & Memory waveform displayed.

If the A/B cursors are used, the FFT calculation is performed on the specified FFT Number of Points beginning with whichever cursor is foremost.

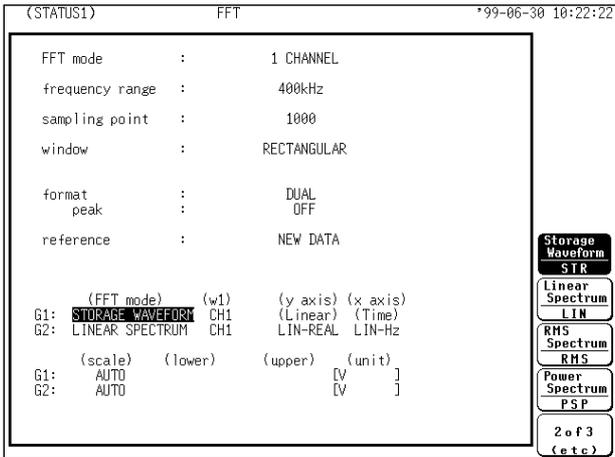
When a memory waveform is selected, the frequency is automatically set to correspond with the time axis as indicated in frequency range setup table in section 8.3.3.

NOTE

- When stored waveform data are used, the trigger setting is not required. But the trigger mode is active, and when REPEAT or AUTO is selected, FFT analysis is performed continuously for the specified number of data at a time, until the end of data. (Calculation is not performed if less than the specified number of points.)
- When new data is acquired, "new" is displayed at the upper left of the screen. For main-unit memory waveforms, "mem" is displayed at the upper left of the screen.

8.3.8 Setting the FFT Analysis Mode

Used to select the FFT calculation method.



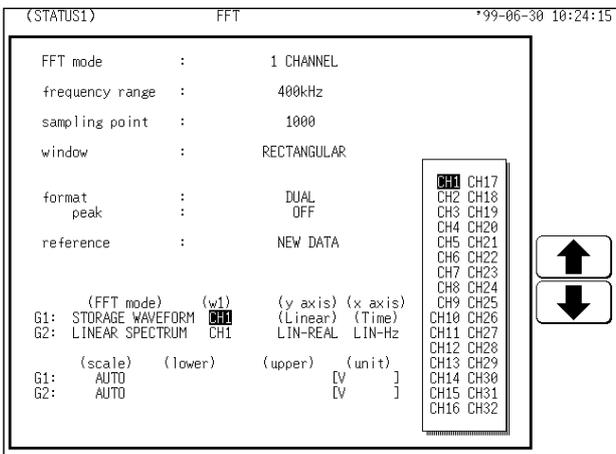
Method Screen: STATUS1, DISPLAY

- ① Call up the STATUS1 or DISPLAY screen.
- ② Move the flashing cursor to the FFT mode item, shown in the figure on the left.
- ③ Use the function keys to make the selection.
For detail on FFT mode, see Section 8.7.

GUI	Mode	GUI	Mode
Storage Waveform STR	Stored waveform (Section 8.7.1)	Transfer TRF	Transfer function (Section 8.7.7)
Linear Spectrum LIN	Linear spectrum (Section 8.7.2)	Cross Power Spectrum CSP	Cross power spectrum (Section 8.7.8)
RMS Spectrum RMS	RMS spectrum (Section 8.7.3)	Cross Correlation CCR	Cross correlation function (Section 8.7.9)
Power Spectrum PSP	Power spectrum (Section 8.7.4)	Impulse Response IMP	Impulse response (Section 8.7.10)
Auto Correlation ACR	Auto correlation function (Section 8.7.5)	Coherence COH	Coherence function (Section 8.7.11)
Histogram HIS	Histogram (Section 8.7.6)	Octave OCT	Octave analysis (Section 8.7.12)

8.3.9 Setting the Analysis Channel

Select the channel for FFT analysis.



Method Screen: STATUS1, DISPLAY

- ① Call up the STATUS1 or DISPLAY screen.
- ② Move the flashing cursor to the w1 item, shown in the figure on the left.
- ③ Use the function keys or the JOG control to select the channel.

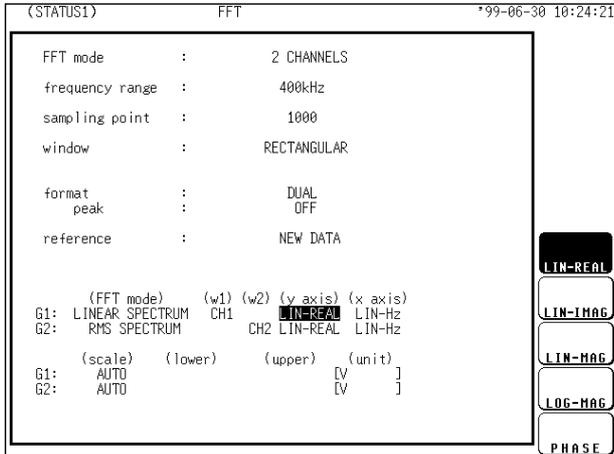
Selection

: Move the cursor up in the selection window.

: Move the cursor down in the selection window.

8.3.10 Setting the X-axis and Y-axis Displays

- Set the X and Y axis for display of FFT calculation results.
- Different units can be selected for the X and Y axis.
- With some FFT analysis modes, one of the axis cannot be set.



Method Screen: STATUS1, DISPLAY

- ① Call up the STATUS1 or DISPLAY screen.
- ② Move the flashing cursor to the **x-axis** item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection Y-axis

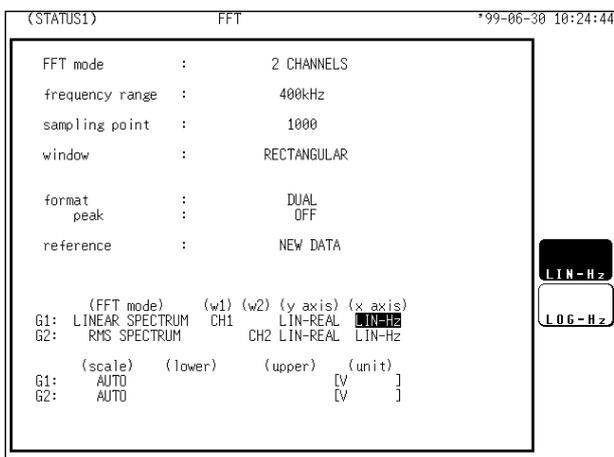
 : Real number part (linear display)

 : Imaginary number part (linear display)

 : Amplitude (linear display)

 : Amplitude (decibel display)

 : Phase (degree display)



- ④ For the x-axis, select in the same way as for y-axis.

Selection X-axis

 : Frequency (linear display)

 : Frequency (logarithm display)

(when octave analysis)

 : 1/3 octave

 : 1/1 octave

X and Y Axis Settings Available with each FFT Analysis Mode

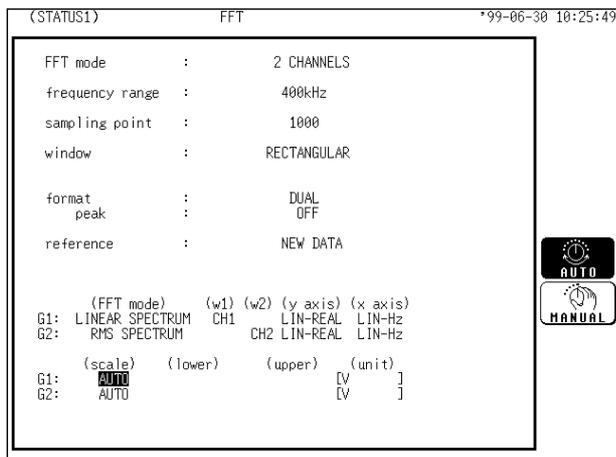
FFT analysis mode		X-axis (horizontal axis)	Y-axis (vertical axis)
STR	Storage Waveform	(Time)	(Linear)
LIN	Linear Spectrum	LIN-Hz LOG-Hz	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE
RMS	RMS Spectrum	LIN-Hz LOG-Hz	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE
PSP	Power Spectrum	LIN-Hz LOG-Hz	LIN-MAG LOG-MAG
ACR	Auto Correlation Function	(Time)	(Linear)
HIS	Histogram	(Volt)	(Linear)
TRF	Transfer Function	LIN-Hz LOG-Hz	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE
CSP	Cross Power Spectrum	LIN-Hz LOG-Hz	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE
CCR	Cross Correlation Function	(Time)	(Linear)
IMP	Unit Impulse Response	(Time)	(Linear)
COH	Coherence Function	LIN-Hz LOG-Hz	(Linear)
OCT	Octave Analysis	1/3 OCT 1/1 OCT	LIN-MAG LOG-MAG

NOTE

When external sampling is used, the X-axis (horizontal axis) expresses the data count.

8.3.11 Setting the Display Scale

The display scale for showing the FFT processing result can either be set manually or automatically.



Method **Screen:** STATUS1

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the scale item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

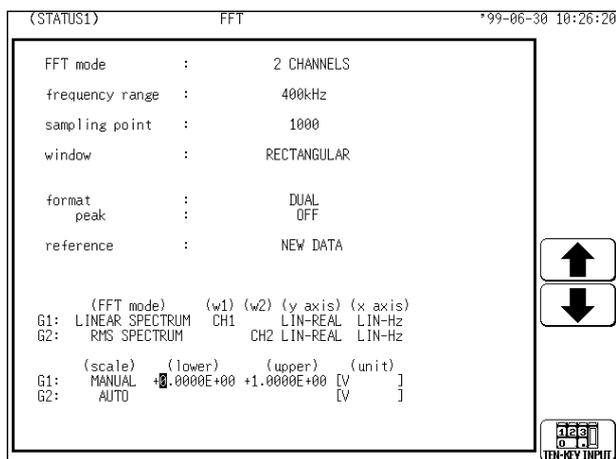
Selection



: The vertical axis (Y-axis) scale is set automatically, depending on the processing result.



: The vertical axis (Y-axis) scale can be set as desired, to match the purpose of the measurement. This is useful for enlarging or reducing the amplitude and for shifting the waveform up or down.



When **MANUAL** is selected

- The upper and lower limits for the display scale can be set by the user.
- Make settings to match processing results.
- Setting range is $-9.9999E+29$ to $9.9999E+29$. (exponent is E-29 to E+29).

- ① Move the flashing cursor to the lower item.
- ② Use the JOG control, the function keys or **CH&NUM** key to select the lower limit for each digits.
- ③ Set the upper limit in the same manner.

Selection



: Increases the value.



: Decreases the value.



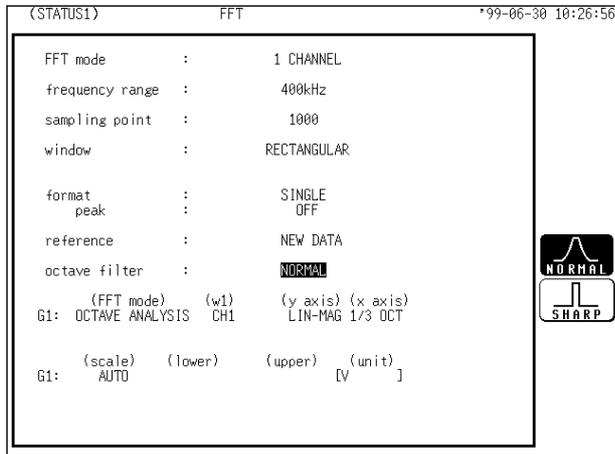
: Use CH&NUM key to enter the value.

NOTE

- Entering the number with CH&NUM key, see Section 9.6.1.
- When the scaling function is enabled for a channel, the unit selected for the channel is displayed.
- The X-axis setting for the histogram can be changed on the Waveform display screen or the CHANNEL1 screen. (If the upper or lower limit value is changed, the x-axis is changed.)
- The unit (eu) setting is affected by the scaling setting. When scaling is turned off, a unit of measurement range is displayed.

8.3.12 Octave Filter Setting

When octave analysis has been selected, two different filter types can be chosen. The characteristics of both filter types are within ANSI CLASS 3 tolerance limits. (1/3-octave only)



Method Screen: STATUS1

- ① When the octave analysis is selected in analysis mode, the oct-filter item is shown.
- ② Move the flashing cursor to the oct-filter item.
- ③ The function key display appears, allowing you to make the selection.

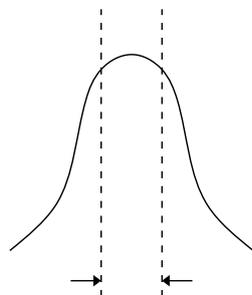
Selection



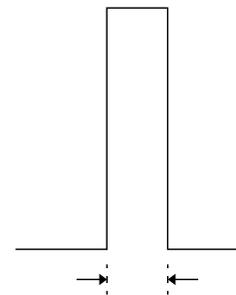
: Filter characteristics approximate the characteristics used for conventional octave analyzers with analog filters.



: Spectrum components outside the octave band are excluded totally and only the spectrum in the octave band is bundled and used for analysis.



1/1-octave (1/3-octave)
normal filter characteristics



1/1-octave (1/3-octave)
sharp filter characteristics

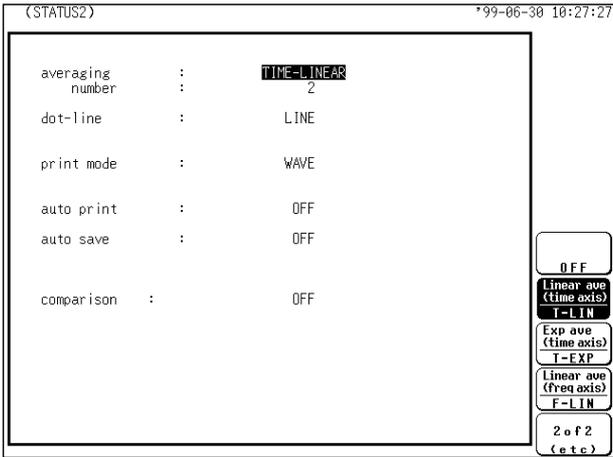
NOTE

This unit does not use analog filters. It first determines the entire power spectrum and then uses weighting by bundling the spectrum to achieve the desired filter characteristics.

8.4 STATUS2 Settings (FFT)

8.4.1 Setting the Averaging Function

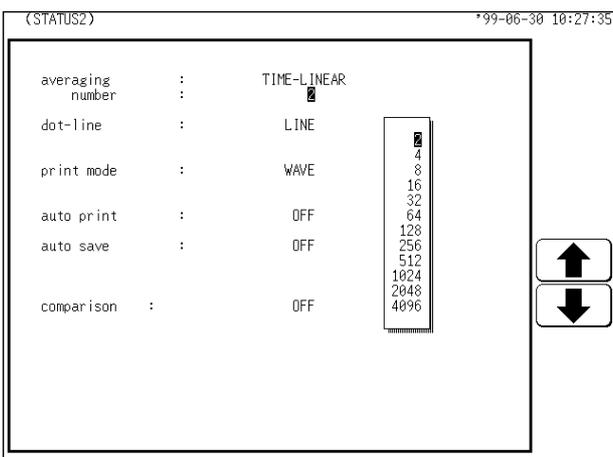
- The averaging function allows capturing several instances of a waveform and determining the average.
- This makes it possible to eliminate noise and irregular signal components.
- The higher the number of averaging instances, the more effectively will noise be suppressed.



Method Screen: STATUS2

- ① Press the STATUS key to call up the STATUS2 screen.
- ② Move the flashing cursor to the averaging item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

GUI	Mode	GUI	Mode
OFF	Disable averaging	Linear ave (freq axis) F-LIN	Perform frequency axis waveform summing averaging
Linear ave (time axis) T-LIN	Perform time axis waveform summing averaging	Exp ave (freq axis) F-EXP	Perform frequency axis waveform exponential averaging
Exp ave (time axis) T-EXP	Perform time axis waveform exponential averaging	Peak Hold (freq axis) F-PEAK	Frequency axis waveform peak hold



- ④ Move the flashing cursor to the count item.
- ⑤ Use the JOG control or the function keys to set the averaging count.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

Time axis waveform averaging

After the **START** key was pressed, data are captured whenever the trigger conditions are fulfilled. After averaging, FFT processing is performed and the result is displayed.

Trigger mode: AUTO and AUTO STOP

When the **START** key is pressed, data are captured even if trigger conditions are not fulfilled after a certain interval. If averaging is applied to unsynchronized input signals, the result will be meaningless.

Frequency axis waveform averaging

Captured data first undergo FFT processing. Then averaging is performed and the result is displayed.

Unlike time axis averaging, results are valid also if no trigger synchronization is used. But if the characteristics of the input waveform allow triggering, using the trigger for synchronization is recommended.

Peak hold (frequency axis)

The specified number of samples are captured, and the peak value is held (stored) for each frequency.

NOTE

- For details on summing averaging and exponential averaging, refer to Section 21.3.6.
- When averaging is used together with the waveform evaluation function, waveform evaluation is carried out after the specified averaging count is completed.
- After averaging was carried out, the scaling setting cannot be changed.
- After averaging, recalculation does not take place even if the analysis channel is changed.

FFT analysis mode and averaging

Symbols in the table have the following meaning

● : Setting is valid

- : Setting is invalid (has no effect)

FFT analysis mode	Y-axis	Time axis averaging	Frequency axis averaging	Peak hold
Storage waveform	(Linear)	●	●	-
Linear spectrum	LIN-REAL	●	●	-
	LIN-IMAG	●	●	-
	LIN-MAG	●	●	●
	LOG-MAG	●	●	●
	PHASE	●	-	-
RMS spectrum	LIN-REAL	●	●	-
	LIN-IMAG	●	●	-
	LIN-MAG	●	●	●
	LOG-MAG	●	●	●
	PHASE	●	-	-
Power spectrum	LIN-MAG	●	●	●
	LOG-MAG	●	●	●
Auto correlation function	(Linear)	●	●	●
Histogram	(Linear)	●	-	-
Transfer function	LIN-REAL	●	-	-
	LIN-IMAG	●	-	-
	LIN-MAG	●	●	●
	LOG-MAG	●	●	●
	PHASE	●	-	-
Cross power spectrum	LIN-REAL	●	●	-
	LIN-IMAG	●	●	-
	LIN-MAG	●	●	●
	LOG-MAG	●	●	●
	PHASE	●	-	-
Cross correlation function	(Linear)	●	●	●
Unit impulse response	(Linear)	●	●	●
Coherence function	(Linear)	●	●	●
Octave analysis	LIN-MAG	●	●	●
	LOG-MAG	●	●	●

* Same for linear spectrum, and cross-power spectrum with Nyquist display.

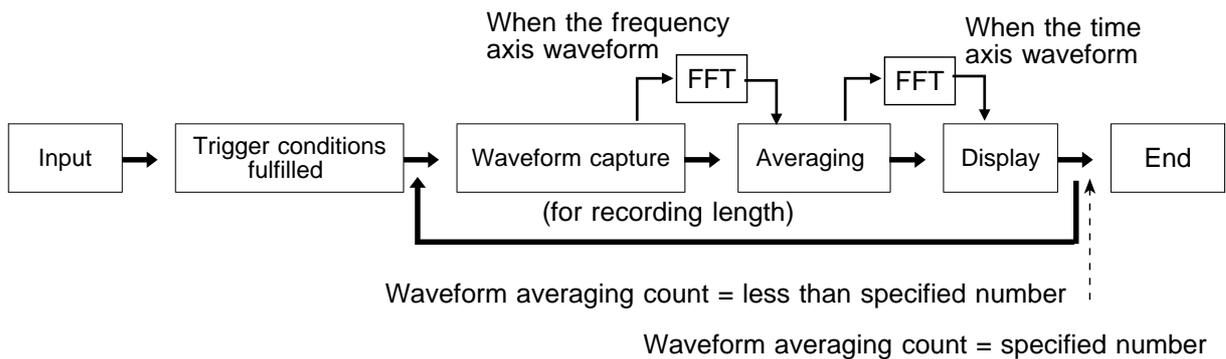
Averaging and trigger mode (FFT)

(1) Trigger mode: SINGLE

1. After the **START** key was pressed, data are captured whenever the trigger conditions are fulfilled, averaging is carried out, and then the waveform is displayed.

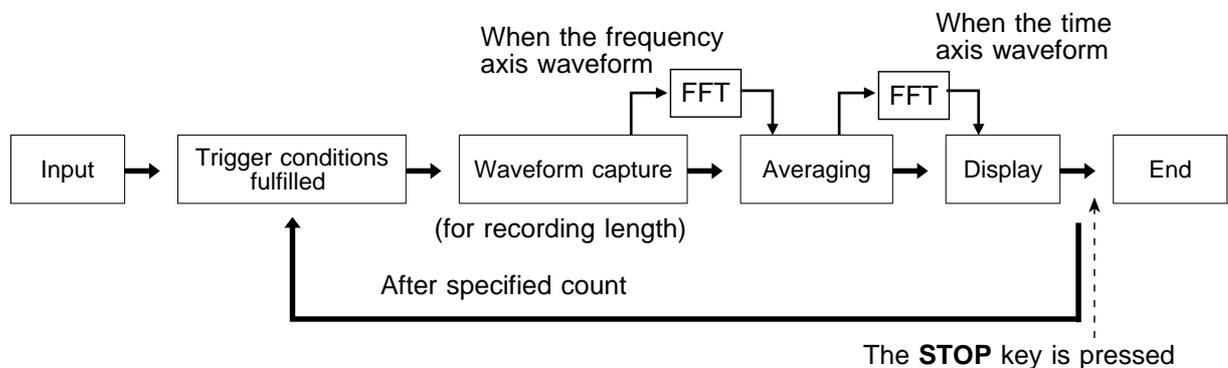
Collected waveform data is averaged with the FFT time axis waveform and FFT processing is performed. FFT processing is performed on the frequency axis and the calculated result is averaged.

2. Trigger occurs when the trigger conditions are fulfilled again.
3. When the specified number of data has been captured, measurement stops automatically. If the measurement was stopped prematurely with the **STOP** key, the averaging result up to that point is displayed.



(2) Trigger mode: REPEAT

1. After the **START** key was pressed, data are captured whenever the trigger conditions are fulfilled, and averaging is carried out until the specified averaging count. The averaging result is shown on the display.
2. Trigger occurs when the trigger conditions are fulfilled again. The waveform data is cleared and the trigger occurs when the trigger conditions are fulfilled again.
3. When the specified averaging count is reached, data up to that point are discarded, and new data are captured for averaging. If the measurement was stopped prematurely with the **STOP** key, the averaging result up to that point is displayed.



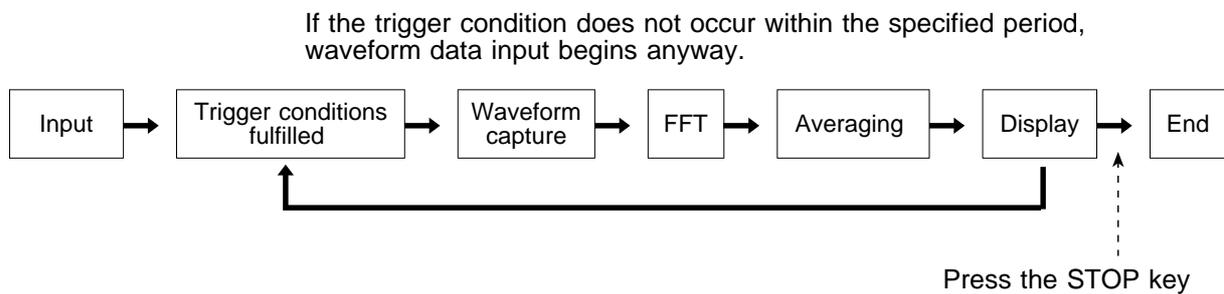
(3) Trigger mode: AUTO

(Time axis waveform)

When the **START** key is pressed, data are captured even if trigger conditions are not fulfilled after a certain interval. If averaging is applied to unsynchronized input signals, the result will be meaningless.

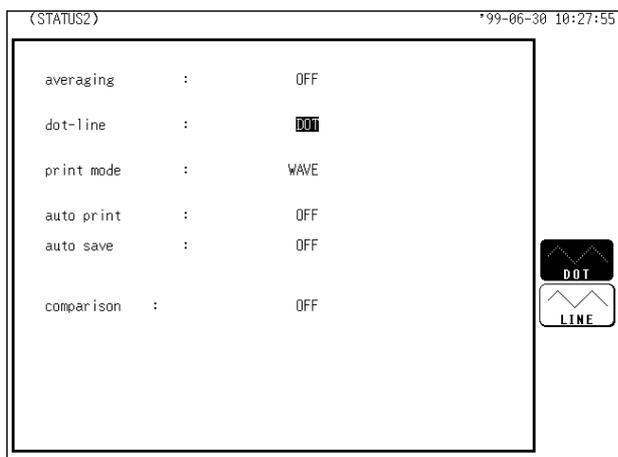
(Frequency axis waveform)

1. After the **START** key was pressed, data are captured whenever the trigger conditions are fulfilled, and averaging is carried out until the specified averaging count. The averaging result is shown on the display.
2. When the specified number of data has been captured, measurement stops automatically.
3. If the measurement was stopped prematurely with the **STOP** key, the averaging result up to that point is displayed.



8.4.2 Setting the Interpolation

The input signal (sampled data) and FFT waveform can be displayed and recorded as is, or after linear interpolation.



Method Screen: STATUS2

- ① Press the **STATUS** key to call up the STATUS2 screen.
- ② Move the flashing cursor to the **dot-line** item, shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



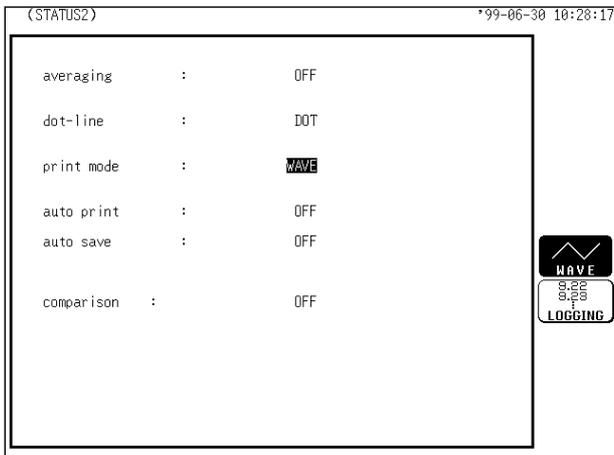
: Linear interpolation is not performed. The sampled data is displayed just as it comes.



: Linear interpolation is performed. The display is easier on the eye.

8.4.3 Setting the Print Mode

Select the format, waveform, or numerical value should be used to output measured data and calculation results.



Method Screen: STATUS2

(1) Setting the Printer Format

- ① Press the STATUS key to call up the STATUS2 screen.
- ② Move the flashing cursor to the print mode item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

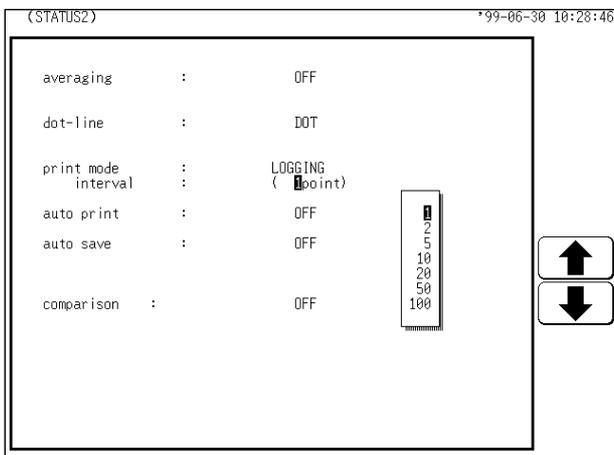
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



(2) Setting the print interval

- ① When the LOGGING data format is selected, set the print interval.
- ② Move the flashing cursor to the interval item.
- ③ Use the JOG control or the function keys to select the print interval.

Selection



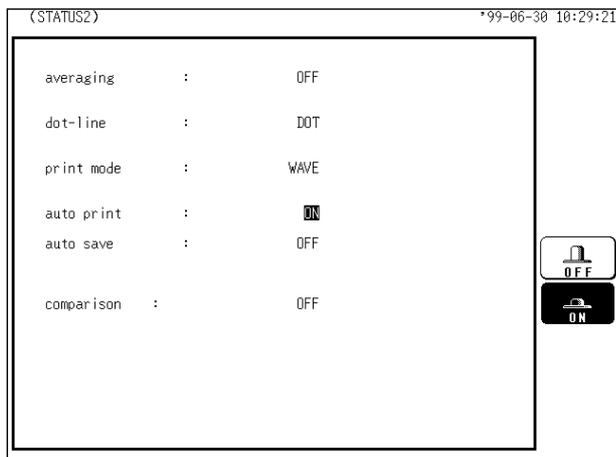
: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

8.4.4 Setting the Auto Print Function

When the function is enabled, printout is carried out automatically after a measurement data is captured.



Method **Screen:** STATUS2

- ① Press the STATUS key to call up the STATUS2 screen.
- ② Move the flashing cursor to the auto print item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Auto print is disabled.



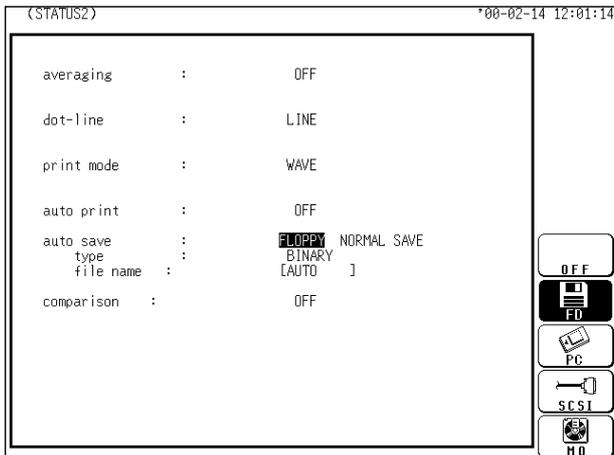
: Auto print is enabled.



: Print image data can only be transferred to the 9333 LAN COMMUNICATOR when using a LAN card.

8.4.5 Setting the Auto Save Function

- When the function is enabled, measurement data are automatically stored on a floppy disk, PC card, MO disk or connected SCSI device after they are captured.
- The Auto Save function stores a file in the directory currently selected on the file screen. See Section 14.12.2.

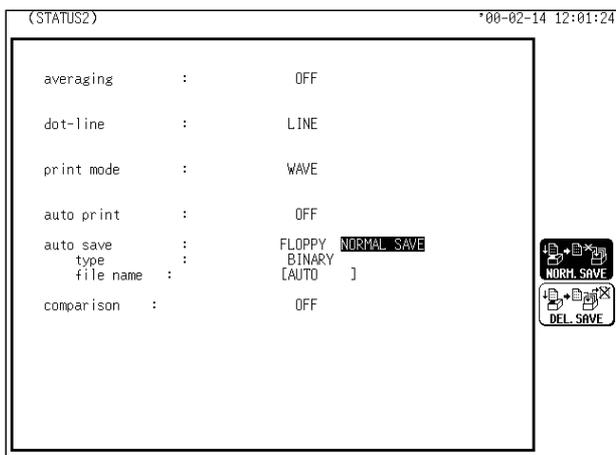


Method Screen: STATUS2

- ① Press the STATUS key to call up the STATUS2 screen.
- ② Move the flashing cursor to the auto save item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

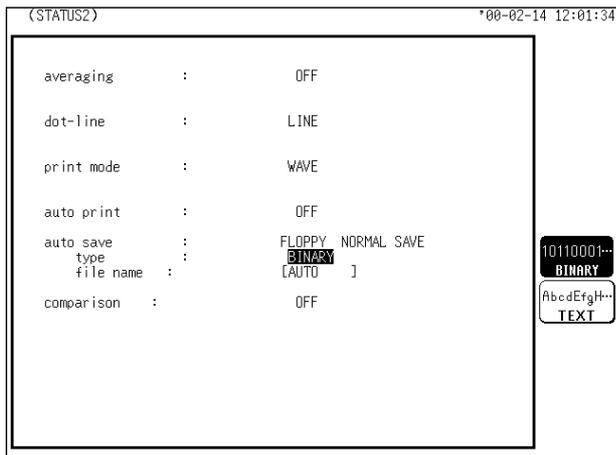
-  : Auto save is disabled.
-  : Automatically stored on floppy disk
-  : Automatically stored on PC card.
-  : Automatically stored on connected SCSI device.
-  : Automatically stored on MO disk.
-  : Data can only be transferred to the 9333 LAN COMMUNICATOR when using a LAN card.



- ④ When Media is selected, the Storage method item appears.

Selection

-  : When the media becomes full, automatic storage stops.
-  : When the media becomes full, old files are deleted to make room for automatic storage. With the binary format selected, the file with the extension 'FFT' is deleted. With the text format selected, files with the extension 'TXT' are deleted.



- ⑤ Move the flashing cursor to type, and select the format.

Selection

10110001... : Data are stored as binary data.

BINARY

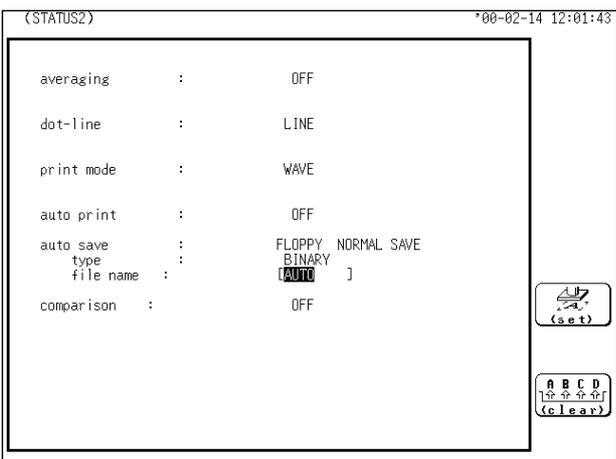
AbcdEfgH... : Data are stored as text data.
Data stored in the text format is not readable by the 8826.

AbcdEfgH...
TEXT

- ⑥ Set the file name. For the input method, refer to Section 9.8.4.

When using auto-save, a number is appended to the name you specify as the file name. This then becomes the file name. If you start procedures before specifying a file name, AUTO is automatically enabled.

- Do not use the characters and symbols below in a file name. A file containing any of these characters/symbols in its file name cannot be processed under Windows 2000 or XP. Half-size symbols: +, =, [,]

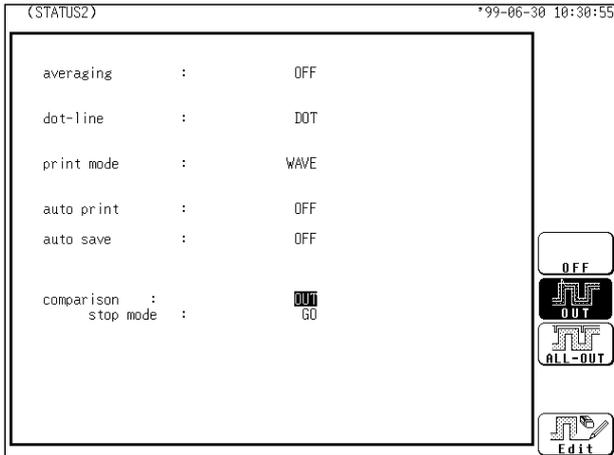


NOTE

- When auto-save is enabled, the storage channel cannot be selected. Data for the channel for which the waveform is displayed is saved.
- For details on auto saving file name, refer to Section 14.7.
- When auto save is used together with the auto print, auto save is carried out after auto print is completed.
- For details on connected SCSI device, refer to Section 14.4.
- The directory and the number of files that can be stored in the directory are limited. For details, see Section 14.7.
- Thinning is not applied with FFT data text format storage.
- When "COMMUNI" (communications) is selected as Media, Storage Method and Type are not displayed.

8.4.6 Setting the Waveform Evaluation

- The Waveform Evaluation function can be used single screen and Nyquist screen.
- GO (pass) or NG (fail) evaluation of the input signal waveform can be performed using an evaluation area specified by the user.
- This can serve to detect irregular waveforms.
- After the evaluation result is generated, signals are output from the GO/NG terminal.



Method Screen: STATUS2

- ① Press the STATUS key to call up the STATUS2 screen.
- ② Move the flashing cursor to the **wave comparison** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Disable waveform evaluation.
Disable waveform evaluation.



: Return NG if any part of the waveform leaves the evaluation area.



: Return NG if the entire waveform leaves the evaluation area.



: Evaluation area is created.

NOTE

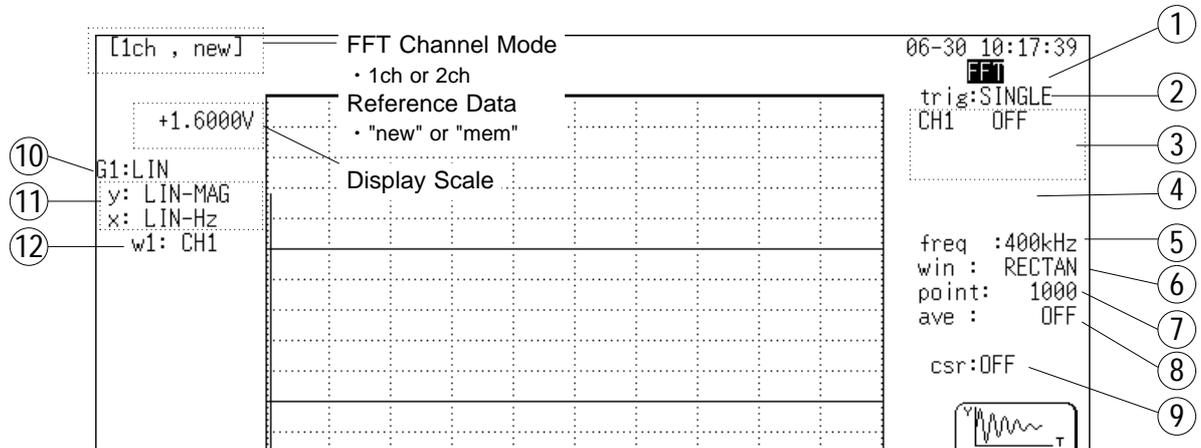
- Only one waveform evaluation area is saved in the internal memory. For example, when the memory recorder function is changed to the FFT function and the waveform evaluation area of the FFT is saved, the waveform evaluation area created using the memory recorder function is erased.
- For details on the waveform evaluation, refer to Section 16.3.

8.5 Settings on the Display Screen (FFT)

Explains the setting items on the Display screen.

For details on setting, refer to Section 8.3 and 8.4.

When want to use the JOG control, press the **VALUE** select key. (The selection window is not displayed.)



① Function	MEM, REC, RMS, REC&MEM, FFT	• Select function.
② Trigger mode	SINGLE, REPEAT, AUTO	• Select trigger mode.
③ Analog trigger	OFF, LEVEL, OUT, IN, V-DROP, CYCLE	• Set the analog trigger.
④ Pre-trigger	0 to 100%, -95%	• Set the Pre-trigger.
⑤ Frequency Range	100 μ s/DIV to 5 min/DIV, EXT	• Set the time 1 scale (1 DIV).
⑥ Window	Rectangular, Hanning, Exponential	• The window function defines the segment of the input signal that will be processed.
⑦ Sampling point	1000, 2000, 5000, 10000	• Set the sampling point.
⑧ Averaging	OFF, T-LIN, T-EXP, F-LIN, F-EXP, F-PEAK	• The averaging function allows capturing several instances of a waveform and determining the average.
⑨ Cursor Measurement	OFF, +	• The A/B cursors can be used.
⑩ FFT analysis mode	• Used to select the FFT calculation method. See Section 8.7.	
⑪ X-axis and Y-axis Displays	<ul style="list-style-type: none"> • Set the X and Y axis for display of FFT calculation results. • Different units can be selected for the X and Y axis. • With some FFT analysis modes, one of the axis cannot be set. 	
⑫ Analysis Channel	• Select the channel for FFT analysis.	
Input channel settings	• Analog input	• Enables the measurement conditions for each channel on the display screen to be set or changed.
Input level monitor function	Press the LEVEL MON. key.	• See Section 11.5.

8.6 Start and Stop Operation (FFT)

Setting the 8826
 • STATUS Settings
 • Channel Settings
 • Trigger Settings



Measurement Start



Trigger condition are met



Recording Start



Measurement end



Recording end

Trigger mode:SINGLE

Trigger mode:REPEAT
 AUTO

- See Section 8.3 STATUS1 settings
- See Section 8.4 STATUS2 settings
- See Chapter 9 Input channel settings
- See Chapter 10 Trigger Functions

- Press the **START** key and LED light.
- When the pre-trigger is set, the trigger will not be registered for a certain period after the start of measurement. (During this interval, **Pre-trigger standby** is shown on the display.)
- When the trigger can be registered, the indication **Waiting for trigger** is shown on the display.

- Data recording starts when trigger condition are met.
- When trigger mode selected AUTO, unit waits for about 1 second for trigger conditions to be met. After this interval, data recording starts, regardless of trigger state.

- Displays "**Storing**".
- When roll mode is set to ON, the waveform is displayed (scrolling) immediately at the start of recording

- When the **STOP** key is pressed twice during measurement, the 8826 is forcibly stopped.(Auto printout and auto save are not executed.)

- Waveform displays after data corresponding to sampling point have been stored in memory.
- Auto printout and auto save are executed.

- End of measurement

- Each time when trigger conditions are met, data are recorded and memory contents are overwritten.

【 End of measurement in REPEAT and AUTO trigger modes 】

- When the **STOP** key is pressed once during measurement, the 8826 acquires measurement data in an amount corresponding to the set recording length, and the measurement is stopped. (Waveform display, auto printout, and auto save are executed.)

8.7 Analysis Function

8.7.1 Storage Waveform [STR]

Displays the time domain waveform of the input signal. Displays the time domain waveform of the input signal.

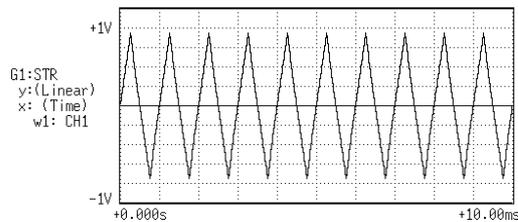
Function `fa`

Horizontal cursor **Time** **Time axis display**
Indicates the value of the specified TIME/DIV frequency range. (Refer to the table of the frequency range and time axis in Section 8.3.3.)

Vertical cursor **Linear** **Indicates the value of the measurement range of the input unit in voltage units.**

Vertical axis	Display
LIN-REAL (real-number part)	-
LIN-IMAG (imaginary-number part)	-
LIN-MAG (amplitude)	<code>fa</code>
LOG-MAG (logarithmic amplitude)	-
PHASE (phase)	-

Example **Stored waveform**



8.7.2 Linear Spectrum [LIN]

- The frequency domain waveform of the input signal, including magnitude and phase information.
- Major applications include:
 - Determining the peaks of waveform frequency components
 - Determining the levels of high and low harmonics

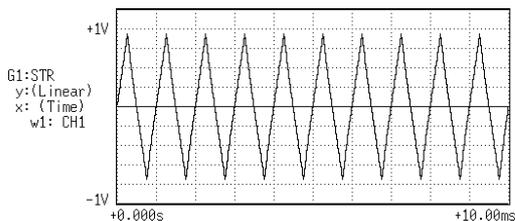
Function $F_a = \mathcal{F}(f_a)$
 $= |F_a| \exp(j \theta_a)$
 $= |F_a| (\cos \theta_a + j \sin \theta_a)$

Horizontal cursor	LIN-Hz	Frequency spectrum display as linear units. The range is from DC to the maximum frequency range value.
	LOG Hz	Frequency spectrum display as logarithmic units. The range is from 1/400 to 1/4000 the maximum frequency range value to the maximum frequency range value.
	Real	Linear display of real-number part of the data as voltage (Nyquist mode)
Vertical cursor	LIN-REAL	Linear display of real-number part of the data as voltage
	LIN-IMAG	Linear display of imaginary-number part of the data as voltage
	LIN-MAG	Linear display of analysis data as voltage
	LOG-MAG	Logarithmic display of analysis data as dB (0dB reference value: 1 V peak= V p-p)
	PHASE	Degrees (deg) display of phase component of data
	Imag	Linear display of imaginary-number part of the data as voltage (Nyquist mode)

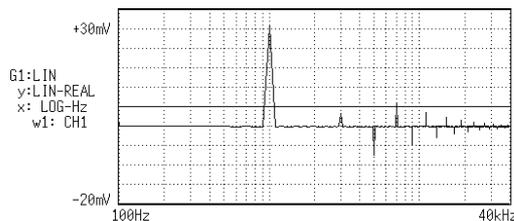
Vertical axis	Display
LIN-REAL (real-number part)	$|F_a| \cdot \cos \theta_a$
LIN-IMAG (imaginary-number part)	$|F_a| \cdot \sin \theta_a$
LIN-MAG (amplitude)	$|F_a|$
LOG-MAG (logarithmic amplitude)	$20 \cdot \log |F_a|$
PHASE (phase)	θ_a

Examples Linear spectra waveforms

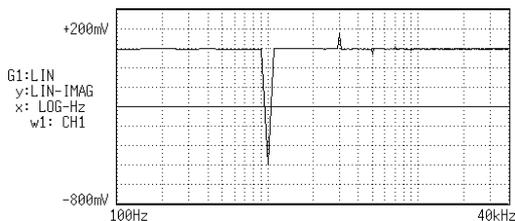
Stored waveform



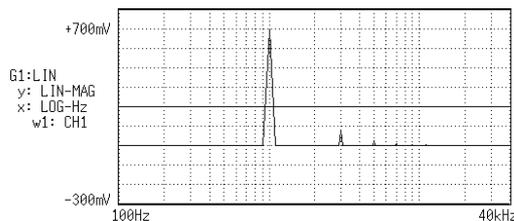
Y-axis: LIN-REAL (X-axis: LOG-Hz)



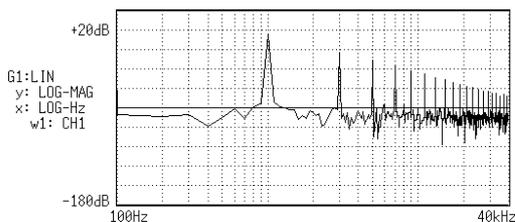
Y-axis: LIN-IMAG (X-axis: LOG-Hz)



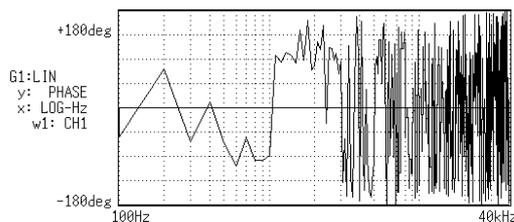
Y-axis: LIN-MAG (X-axis: LOG-Hz)



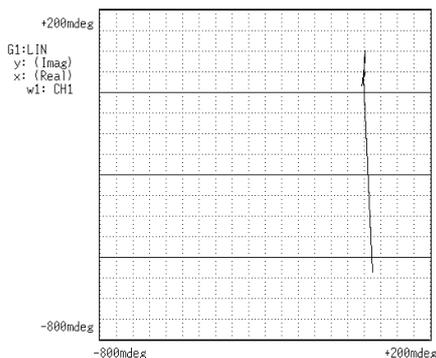
Y-axis: LOG-MAG (X-axis: LOG-Hz)



Y-axis: PHASE (X-axis: LOG-Hz)



Nyquist



8.7.3 RMS Spectrum [RMS]

- Displays the frequency domain waveform of the input signal, including magnitude (effective value) and phase information.
- Major applications include:
 - Determining the peaks of waveform frequency components.
 - Determining the effective values of frequency components.

Function

$$R_a = \frac{1}{\sqrt{2}} F_a$$

DC components: $R_a = F_a$

$$= |R_a| \exp(j a)$$

$$= |R_a| (\cos a + j \sin a)$$

Horizontal cursor

LIN-Hz Frequency spectrum display as linear units. The range is from DC to the maximum frequency range value.

LOG-Hz Frequency spectrum display as logarithmic units. The range is from 1/400 to 1/4000 the maximum frequency range value to the maximum frequency range value.

Vertical cursor

LIN-REAL Linear display of real-number part of the data as voltage

LIN-IMAG Linear display of imaginary-number part of the data as voltage

LIN-MAG Linear display of analysis data as voltage

LOG-MAG Logarithmic display of analysis data as dB (0dB reference value: 1 Vrms)

PHASE Degrees (deg) display of phase component of data

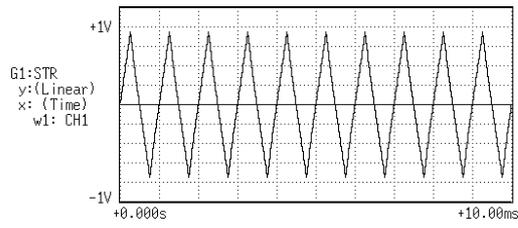
Vertical axis	Display
LIN-REAL (real-number part)	$|R_a| \cdot \cos a$
LIN-IMAG (imaginary-number part)	$|R_a| \cdot \sin a$
LIN-MAG (amplitude)	$|R_a|$
LOG-MAG (logarithmic amplitude)	$20 \cdot \log |R_a|$
PHASE (phase)	a

NOTE

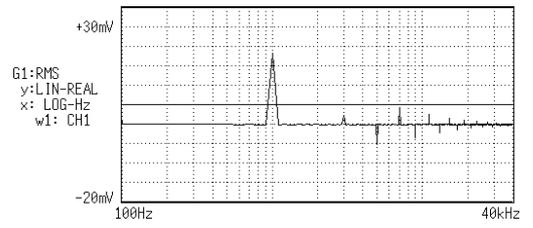
The RMS spectrum display and the LOG-MAG display express the same processing result.

Example RMS spectra waveform

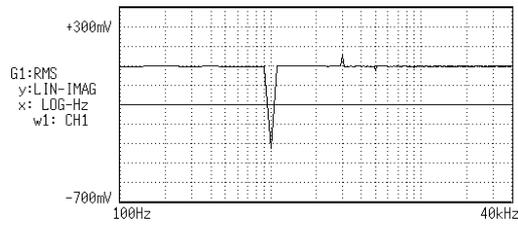
Stored waveform



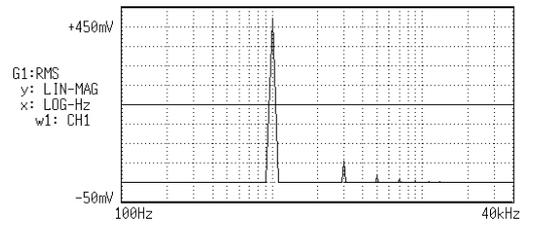
Y-axis: LIN-REAL (X-axis: LOG-Hz)



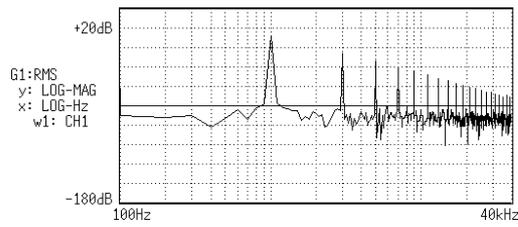
Y-axis: LIN-IMAG (X-axis: LOG-Hz)



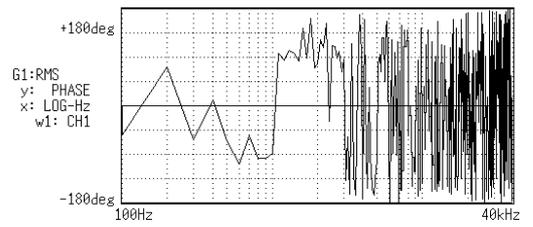
Y-axis: LIN-MAG (X-axis: LOG-Hz)



Y-axis: LOG-MAG (X-axis: LOG-Hz)



Y-axis: PHASE (X-axis: LOG-Hz)



8.7.4 Power Spectrum [PSP]

- Displays the energy spectrum of the input signal, consisting of only magnitude information.
- Major applications include:
 - Determining the peaks of waveform frequency components
 - Determining the energy levels of high and low harmonics

Function

$$G_{aa} = \frac{1}{2} F_a^* \cdot F_a$$

F_a^* : complex conjugate of F_a

$$= \frac{1}{2} \{ \text{Re}^2(F_a) + \text{Im}^2(F_a) \}$$

$\text{Re}(F_a)$: real number component of F_a

$\text{Im}(F_a)$: imaginary number component of F_a

$$= \frac{1}{2} |F_a|^2$$

DC component:

$$G_{aa} = F_a^* \cdot F_a$$

$$= \{ \text{Re}^2(F_a) + \text{Im}^2(F_a) \}$$

$$= |F_a|^2$$

Horizontal cursor	LIN-Hz	Frequency spectrum display as linear units. The range is from DC to the maximum frequency range value.
	LOG Hz	Frequency spectrum display as logarithmic units. The range is from 1/400 to 1/4000 the maximum frequency range value to the maximum frequency range value.
Vertical cursor	LIN-MAG	Linear display of analysis data as binary exponential voltage. This expresses the energy component.
	LOG-MAG	Logarithmic display of analysis data as dB (0dB reference value: 1 V ² rms)

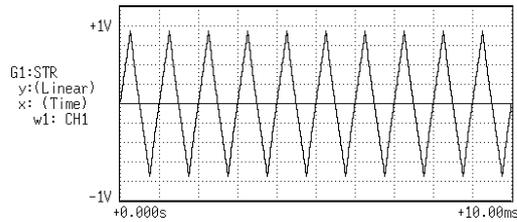
Vertical axis	Display
LIN-REAL (real-number part)	-
LIN-IMAG (imaginary-number part)	-
LIN-MAG (amplitude)	G _{aa}
LOG-MAG (logarithmic amplitude)	10 log |G _{aa}|
PHASE (phase)	-

NOTE

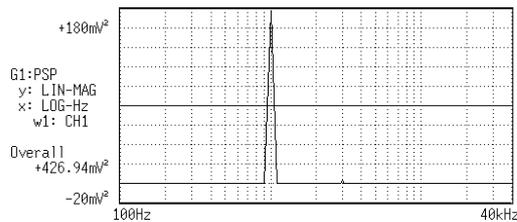
The LOG-MAG display and the RMS spectrum display express the same processing result.

Example Power spectra waveforms

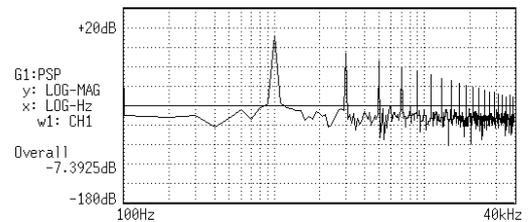
Stored waveform



Y-axis: LIN-MAG (X-axis: LOG-Hz)



Y-axis: LOG-MAG (X-axis: LOG-Hz)



Overall value

The overall value is obtained by taking the square root of the total of power spectra for all frequencies.

$$(\text{Overall value}) = \sqrt{PSP_0 + \sum_{i=1} PSP_i} \quad (\text{Vrms})$$

PSP₀ DC component

PSP_i ith AC component

NOTE

Compensation is applied to data for 1000 points captured before starting FFT processing, to achieve the same overall value, also when a window function other than rectangular window is used.

Window compensation value:

Square wave: = 1

Hanning: = $\sqrt{\frac{8}{3}}$

Exponential: = $\sqrt{\frac{2 \log(\% / 100)}{(\% / 100)^2 - 1}}$

(% is a percentage with a range of 0 < 100.)

If % is set to 0 with the exponential window function, processing will be carried with = 0.1.

8.7.5 Auto Correlation [ACR]

- Displays the degree of similarity between two points in the input signal separated by time difference ().
- Major applications:
 - Detecting a periodic signal contained in a noisy signal with an improvement in signal-to-noise ratio.
 - Checking the periodic signal components contained in a noisy waveform, and periodic noise.

Function $R_{aa}(\tau) = \mathfrak{F}^{-1} (G_{aa})$

$$= \frac{1}{2\pi} \int_{-\infty}^{+\infty} G_{aa}(\omega) \exp(j\omega\tau) d\omega$$

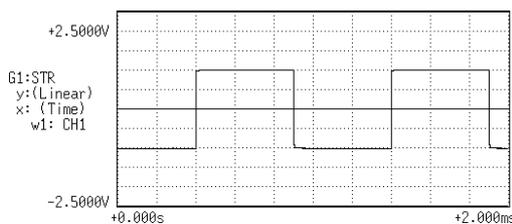
Horizontal cursor Time Time display. The center indicates the reference ($\tau = 0$), the right side indicates time lag ($+$), and the left side indicates time lead ($-$).

Vertical cursor Linear Readings are between +1 and -1 (without units).
 +1: the highest similarity for time differential
 0: the lowest similarity, -1: the polarity is completely opposite.
 Due to the characteristics of the function, $\tau = 0$ always results in +1.

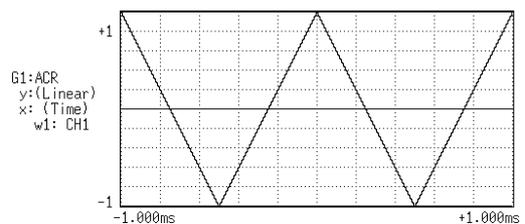
Vertical axis	Display
LIN-REAL (real-number part)	-
LIN-IMAG (imaginary-number part)	-
LIN-MAG (amplitude)	Raa
LOG-MAG (logarithmic amplitude)	-
PHASE (phase)	-

Example Auto correlation function waveforms

Stored waveform



Auto correlation function



8.7.6 Histogram [HIS]

- Displays the frequencies of the magnitudes of sampled points.
- Major applications include:
 - Determining waveform imbalance
 - Determining whether a waveform is artificial or natural from the waveform distribution (most natural waveforms are regular sine waves).

Function Pa

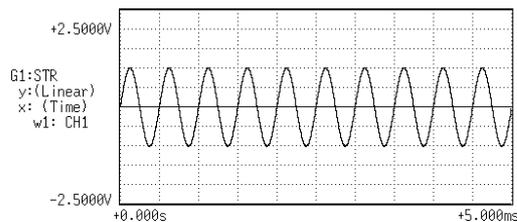
Horizontal cursor Volt Linear display of the measurement range of the input unit.

Vertical cursor Linear Number of sample points for the time axis data (total: 1000 points).

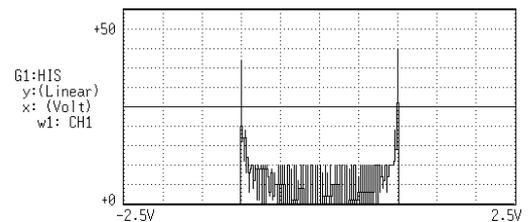
Vertical axis	Display
LIN-REAL (real-number part)	-
LIN-IMAG (imaginary-number part)	-
LIN-MAG (amplitude)	Pa
LOG-MAG (logarithmic amplitude)	-
PHASE (phase)	-

Example Histogram function waveforms

Stored waveform



Histogram function



8.7.7 Transfer Function [TRF]

- Displays the transfer function (frequency characteristics) of the system being measured calculated from input and output signals.
- Nyquist diagrams can also be displayed, including magnitude and phase information.
- Major applications include:
 - Determining filter frequency characteristics.
 - Determining feedback control system stability through Nyquist diagrams.
 - Determining the physical resonant frequency using an impulse hammer and pick-up sensor.

Function

$$H_{ab} = \frac{F_b}{F_a} = \frac{F_b \cdot F_a^*}{F_a \cdot F_a^*} = \frac{G_{ab}}{G_{aa}}$$

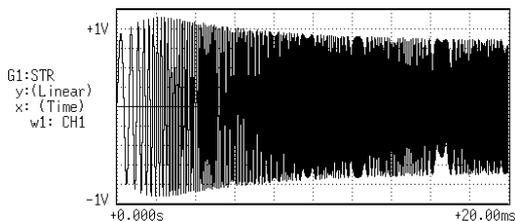
$$= \frac{|G_{ab}|}{|G_{aa}|} \{ \cos(\quad b - \quad a) + j \sin (\quad b - \quad a) \}$$

Horizontal cursor	LIN-Hz	Frequency spectrum display as linear units. The range is from DC to the maximum frequency range value.
	LOG-Hz	Frequency spectrum display as logarithmic units. The range is from 1/400 to 1/4000 the maximum frequency range value to the maximum frequency range value.
	Real	Linear display of the real-number part of the input-to-output ratio (Nyquist mode)
Vertical cursor	RIN-REAL	Linear display of the real-number part of the input-to-output ratio (no units).
	LIN-IMAG	Linear display of the imaginary-number part of the input-to-output ratio (no units).
	LIN-MAG	Linear display of input-to-output ratio (no units) This expresses the amplitude component.
	LOG-MAG	Logarithmic display of input-to-output ratio as dB (no units) This expresses the amplitude component.
	PHASE	Degrees (deg) display of phase component of data of input-to-output ratio
	Imag	Linear display of the imaginary-number part of the input-to-output ratio (Nyquist mode).

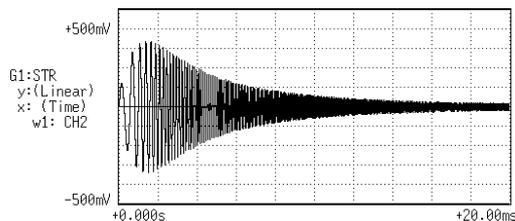
Vertical axis	Display
LIN-REAL (real-number part)	$|H_{ab}| \cdot \cos \quad b - \quad a$
LIN-IMAG (imaginary-number part)	$|H_{ab}| \cdot \sin \quad b - \quad a$
LIN-MAG (amplitude)	$|H_{ab}|$
LOG-MAG (logarithmic amplitude)	$20 \log |H_{ab}|$
PHASE (phase)	$b - \quad a$

Example Transfer function spectra waveform

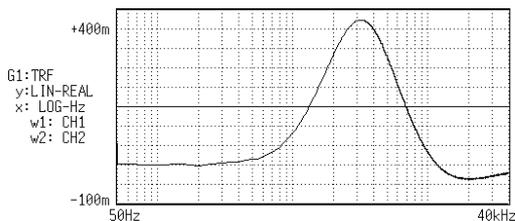
Stored waveform (input signal)



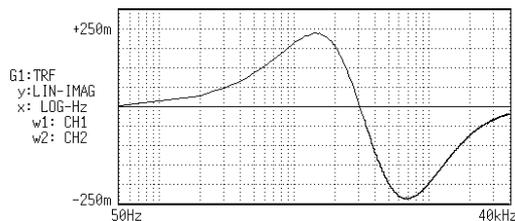
Stored waveform (output signal)



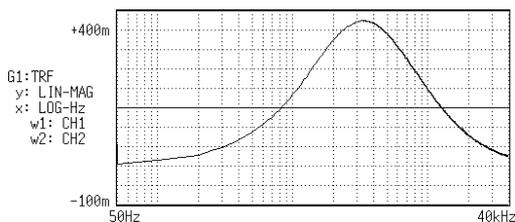
Y-axis: LIN-REAL (X-axis: LOG-Hz)



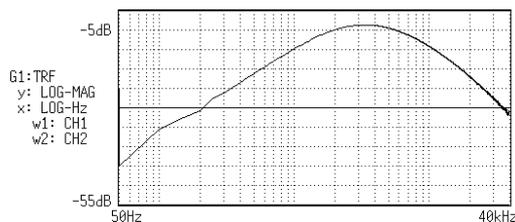
Y-axis: LIN-IMAG (X-axis: LOG-Hz)



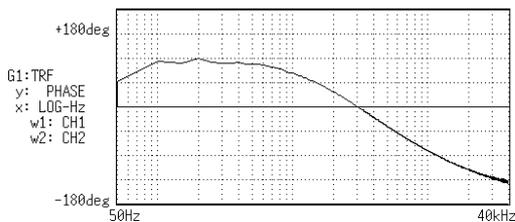
Y-axis: LIN-MAG (X-axis: LOG-Hz)



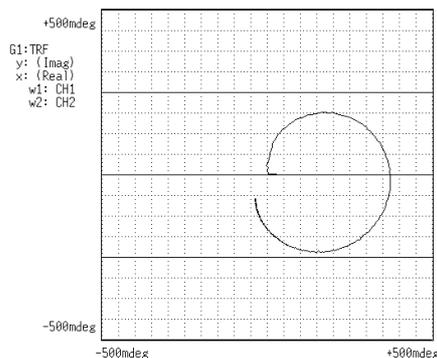
Y-axis: LOG-MAG (X-axis: LOG-Hz)



Y-axis: PHASE (X-axis: LOG-Hz)



Nyquist



8.7.8 Cross Power Spectrum [CSP]

- Displays the product of the spectra of two input signals.
- The magnitude and phase information of the frequency components that are common to both signals can be displayed.
- Major applications:
Obtaining frequency components common to two signals.

Function $G_{ab} = \frac{1}{2} F_a^* \cdot F_b$

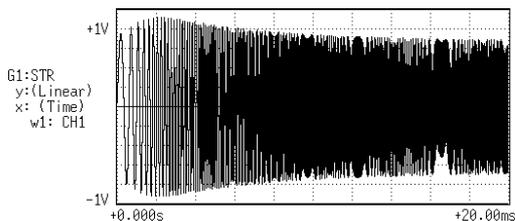
$$= \frac{1}{2} |F_a| \cdot |F_b| \{ \cos(b - a) + j \sin(b - a) \}$$

Horizontal cursor	LIN-Hz	Frequency spectrum display as linear units. The range is from DC to the maximum frequency range value.
	LOG Hz	Frequency spectrum display as logarithmic units. The range is from 1/400 to 1/4000 the maximum frequency range value to the maximum frequency range value.
	Real	Linear display of real-number part of the data as voltage (Nyquist mode).
Vertical cursor	LIN-REAL	Linear display of real-number part of the data as binary exponential voltage
	LIN-IMAG	Linear display of imaginary-number part of the data as binary exponential voltage
	LIN-MAG	Linear display of amplitude component as binary exponential voltage
	LOG-MAG	Logarithmic display of the amplitude component as dB (0dB reference value; 1V ² rms.)
	PHASE	Degrees (deg) display of phase component of data
	Imag	Linear display of imaginary-number part of the data as binary exponential voltage (Nyquist mode)

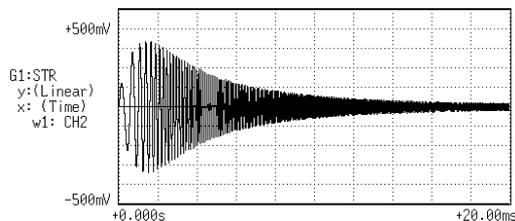
Vertical axis	Display
LIN-REAL (real-number part)	|G _{ab}| • cos b - a
LIN-IMAG (imaginary-number part)	|G _{ab}| • sin b - a
LIN-MAG (amplitude)	|G _{ab}|
LOG-MAG (logarithmic amplitude)	10 log |G _{ab}|
PHASE (phase)	b - a

Example Cross power spectra waveforms

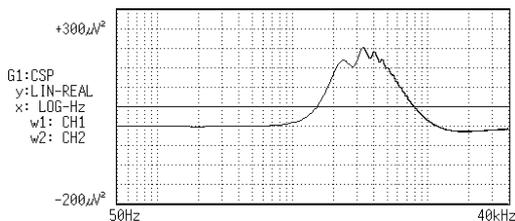
Stored waveform 1



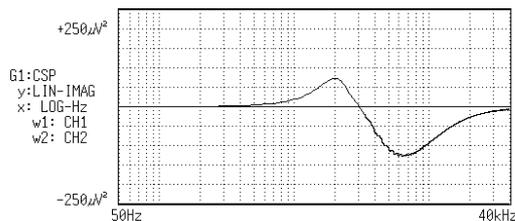
Stored waveform 2



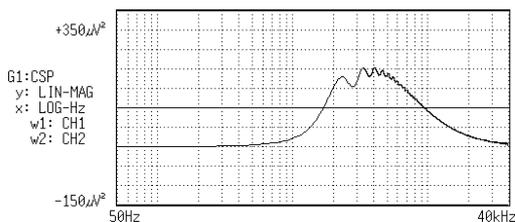
Y-axis: LIN-REAL (X-axis: LOG-Hz)



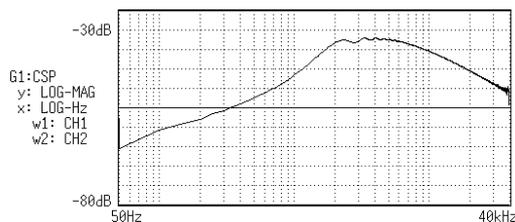
Y-axis: LIN-IMAG (X-axis: LOG-Hz)



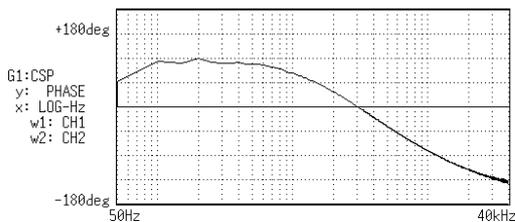
Y-axis: LIN-MAG (X-axis: LOG-Hz)



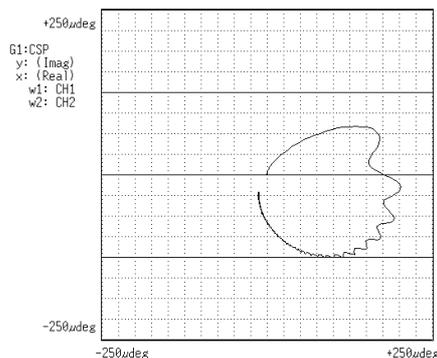
Y-axis: LOG-MAG (X-axis: LOG-Hz)



Y-axis: PHASE (X-axis: LOG-Hz)



Nyquist



8.7.9 Cross Correlation [CCR]

- Displays the degree of similarity between two points separated by a time difference () on two signals.
- The degree of similarity is expressed as a function of the time difference ().
- Major applications:
 - Obtaining the phase difference between two signals in time units.
 - Obtaining a speed or distance by measuring the time delay.

Function $R_{ab}(\tau) = \mathcal{F}^{-1}(G_{ab})$

$$= \frac{1}{2\pi} \int_{-\infty}^{+\infty} G_{ab}(\omega) \exp(j\omega\tau) d\omega$$

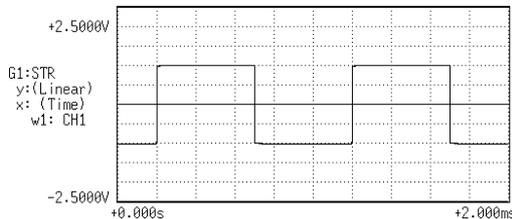
Horizontal cursor Time Time display. The center indicates the reference (=0), the right side indicates time lag (+), and the left side indicates time lead (-).

Vertical cursor Linear Readings are from +1 to -1 (no units).
 +1: the highest similarity between the input and output signals for time differential , 0: the lowest similarity, -1: the polarity is completely opposite

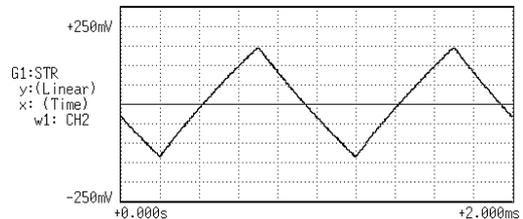
Vertical axis	Display
LIN-REAL (real-number part)	-
LIN-IMAG (imaginary-number part)	-
LIN-MAG (amplitude)	Rab
LOG-MAG (logarithmic amplitude)	-
PHASE (phase)	-

Example Cross correlation function waveforms

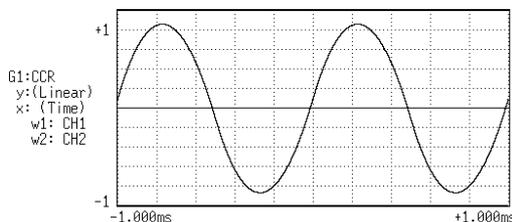
Stored waveform (input waveform)



Stored waveform (output waveform)



Cross correlation function



8.7.10 Unit Impulse Response [IMP]

- Displays the frequency response of a system in the time domain.
- A response waveform equivalent to the unit impulse function is obtained by analyzing the input and output signals of the system being measured.
- Major applications
Checking circuit time constants.

Function $\text{IMP} = \mathcal{F}^{-1}(\text{Hab})$

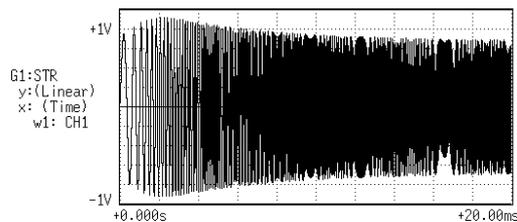
Horizontal cursor Time Time display. The center indicates the reference ($t=0$), the right side indicates time lag ($+t$), and the left side indicates time lead ($-t$).

Vertical cursor Linear Inverse Fourier conversion value of the transfer function (Hab) (no units).

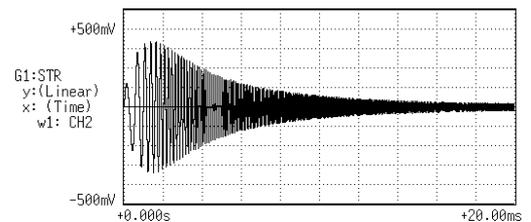
Vertical axis	Display
LIN-REAL (real-number part)	-
LIN-IMAG (imaginary-number part)	-
LIN-MAG (amplitude)	IMP
LOG-MAG (logarithmic amplitude)	-
PHASE (phase)	-

Example Unit impulse response waveforms

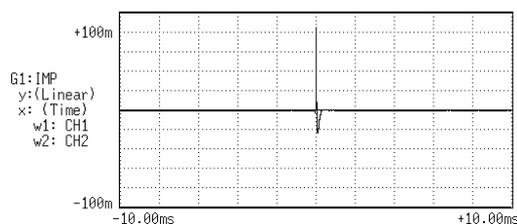
Stored waveform (input signal)



Stored waveform (output signal)



Unit impulse response



8.7.11 Coherence [COH]

- Displays the output signal component that is coherent (interference possible) to the input signal, yielding a value from 0 to 1.
- Major applications include:
 - Evaluation of transfer functions.
 - Determining the contribution of individual input lines to the output of multi-input systems.

Function

$$\text{COH} = \frac{G_{ab}^* \cdot G_{ab}}{G_{aa} \cdot G_{bb}}$$

Horizontal cursor	LIN-Hz	Frequency spectrum display as linear units. The range is from DC to the maximum frequency range value.
	LOG-Hz	Frequency spectrum display as logarithmic units. The range is from 1/400 to 1/4000 the maximum frequency range value to the maximum frequency range value.
Vertical cursor	Linear	The relationship between the two input signals. The degree of relationship is indicated from 0 to 1 on a linear scale (no units).

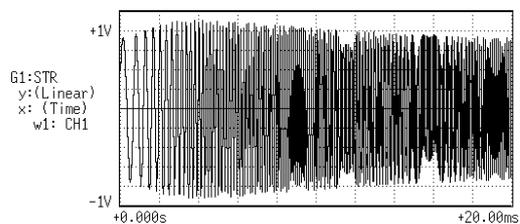
Vertical axis	Display
LIN-REAL (real-number part)	-
LIN-IMAG (imaginary-number part)	-
LIN-MAG (amplitude)	COH
LOG-MAG (logarithmic amplitude)	-
PHASE (phase)	-

NOTE

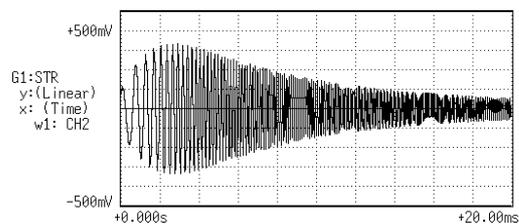
For a single measurement, the coherence function returns 1 for all frequencies. When measuring, be sure to use frequency averaging.

Example Coherence function waveforms

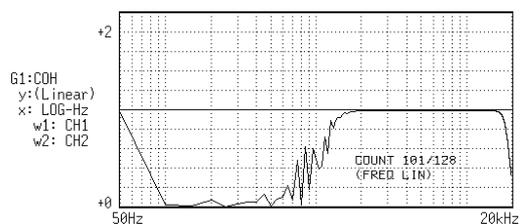
Stored waveform (input signal)



Stored waveform (output signal)



Coherence



8.7.12 Octave Analysis [OCT]

- This function displays the spectrum of a noise signal or other signal, using 1/1-octave or 1/3-octave band filters with fixed ratio.
- Main uses
Frequency analysis of noise

Function OCT

Horizontal cursor
1/1 OCT 1/1-octave band filtering
1/3 OCT 1/3-octave band filtering

Vertical cursor
LIN-MAG Linear display of octave analysis value as voltage
LOG-MAG Logarithmic display of octave analysis value as dB

Vertical axis	Display
LIN-REAL (real number)	-
LIN-IMAG (imaginary number)	-
LIN-MAG (amplitude)	OCT
LOG-MAG (logarithmic amplitude)	10log (OCT)
PHASE	-

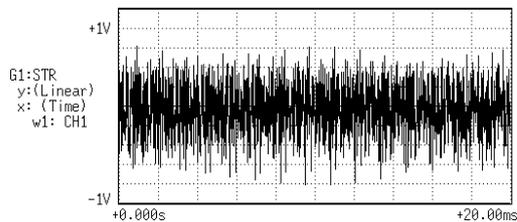
- For frequency analysis of a noise signal or similar, the signal is passed through fixed-ratio band filters with 1/1-octave or 1/3-octave bandwidth.
- As opposed to the power spectrum function, where the signal is divided into bands of identical width and the power in each band is displayed, octave analysis divides the frequency axis evenly on a logarithmic scale and expresses the level as a bar for each band.
- In analog octave analysis, the octave band center frequencies and filter characteristics are determined according to the ANSI CLASS 3 standard. In the 8826, the power spectrum is measured first and bundling is then used to perform 1/1-octave or 1/3-octave analysis. This allows the following analysis functions:
 - 5-band 1/1-octave analysis
 - 15-band 1/3-octave analysis
- 15-band 1/3-octave analysis and filter characteristics of the 8826 correspond to the ANSI CLASS 3 standard. However, in the upper bands of frequency analysis, there are no leak components from higher frequencies.
For example, the 20 kHz band contains no leak components from the 25 kHz band or other bands.
- 15-band 1/3-octave analysis
In this mode, the 400 spectrum lines of regular frequency analysis are bundled into 1/3 octave bands and shown as a bar graph.

• 5-band 1/1-octave analysis

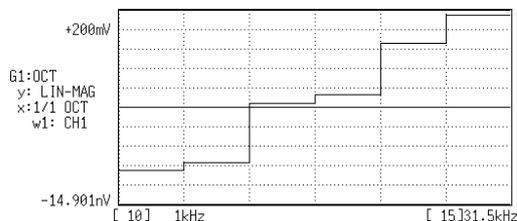
In this mode, the 400 spectrum lines of regular frequency analysis are bundled into 1/1 octave bands and shown as a bar graph.

Example Octave analysis waveforms

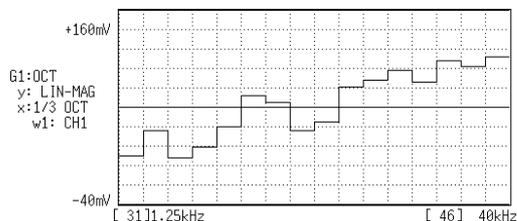
Stored waveform



1/1 octave analysis



1/3 octave analysis



Frequency ranges and measurable range widths (0: 1/3 OCT, X: 1/1 OCT)

1/1	1/3	Center frequency (Hz)	133 m	333 m	667 m	1.33	4	8	20	40	80	200	400	800	2k	4k	8k	20k	40k	80k	200k	400k	
-8	-24 -23	4 m 5 m																					
-7	-22 -21 -20	6.3 m 8 m 10 m																					
-6	-19 -18 -17	12.5 m 16 m 20 m																					
-5	-16 -15 -14	25 m 31.5 m 40 m																					
-4	-13 -12 -11	50 m 63 m 80 m																					
-3	-10 -9 -8	100 m 125 m 160 m																					
-2	-7 -6 -5	200 m 250 m 315 m																					
-1	-4 -3 -2	400 m 500 m 630 m																					
0	-1 0 1	800 m 1 1.25																					
1	2 3 4	1.6 2 2.5																					
2	5 6 7	3.15 4 5																					
3	8 9 10	6.3 8 10																					
4	11 12 13	12.5 16 20																					
5	14 15 16	25 31.5 40																					
6	17 18 19	50 63 80																					
7	20 21 22	100 125 160																					
8	23 24 25	200 250 315																					
9	26 27 28	400 500 630																					
10	29 30 31	800 1 k 1.25 k																					
11	32 33 34	1.6 k 2 k 2.5 k																					
12	35 36 37	3.15 k 4 k 5 k																					
13	38 39 40	6.3 k 8 k 10 k																					
14	41 42 43	12.5 k 16 k 20 k																					
15	44 45 46	25 k 31.5 k 40 k																					
16	47 48 49	50 k 63 k 80 k																					
17	50 51 52	100 k 125 k 160 k																					
18	53 54 55	200 k 250 k 315 k																					
19	56 57	400 k 500 k																					

8.7 Analysis Function

Chapter 9

Input Channel Settings

9.1 Setting Items for Input Channel

Setting items	Screen	Channel	Display	Status	System
Waveform Display Color			*12	-	-
Measurement Range		*11	*12	-	-
Input Coupling		*11		-	-
Magnification/Compression Ratio				-	-
Zero Position			*6	-	-
Zero Adjustment				-	-
Zero Offset ^{*1}				-	-
Anti-aliasing filter ^{*2}			*13	-	-
Auto balancing ^{*3}				-	-
Digital filter ^{*4}				-	-
Drift compensation ^{*5}				-	-
Hold ^{*6}				-	-
Pull-up Resistor ^{*7}				-	-
Threshold Value ^{*8}			-	-	-
Clamp Check ^{*9}			-	-	-
Sensor Sensitivity ^{*10}			-	-	-
Low-Pass Filter				-	-
Logic display color				-	-
Logic display position				-	-
Variable Function ^{*14}				-	-
Selecting Functions				-	-
Format		-	-	-	-
Scaling function		-	-	-	*11
Comment function		-	-	-	*11

^{*1}: Only voltage and current measurement, ^{*2}: Only 8939, ^{*3}: Only 8939

^{*4}: Only 8937 (Voltage), ^{*5}: Only 8937 (Temperature), ^{*6}: Only 8940 (Frequency)

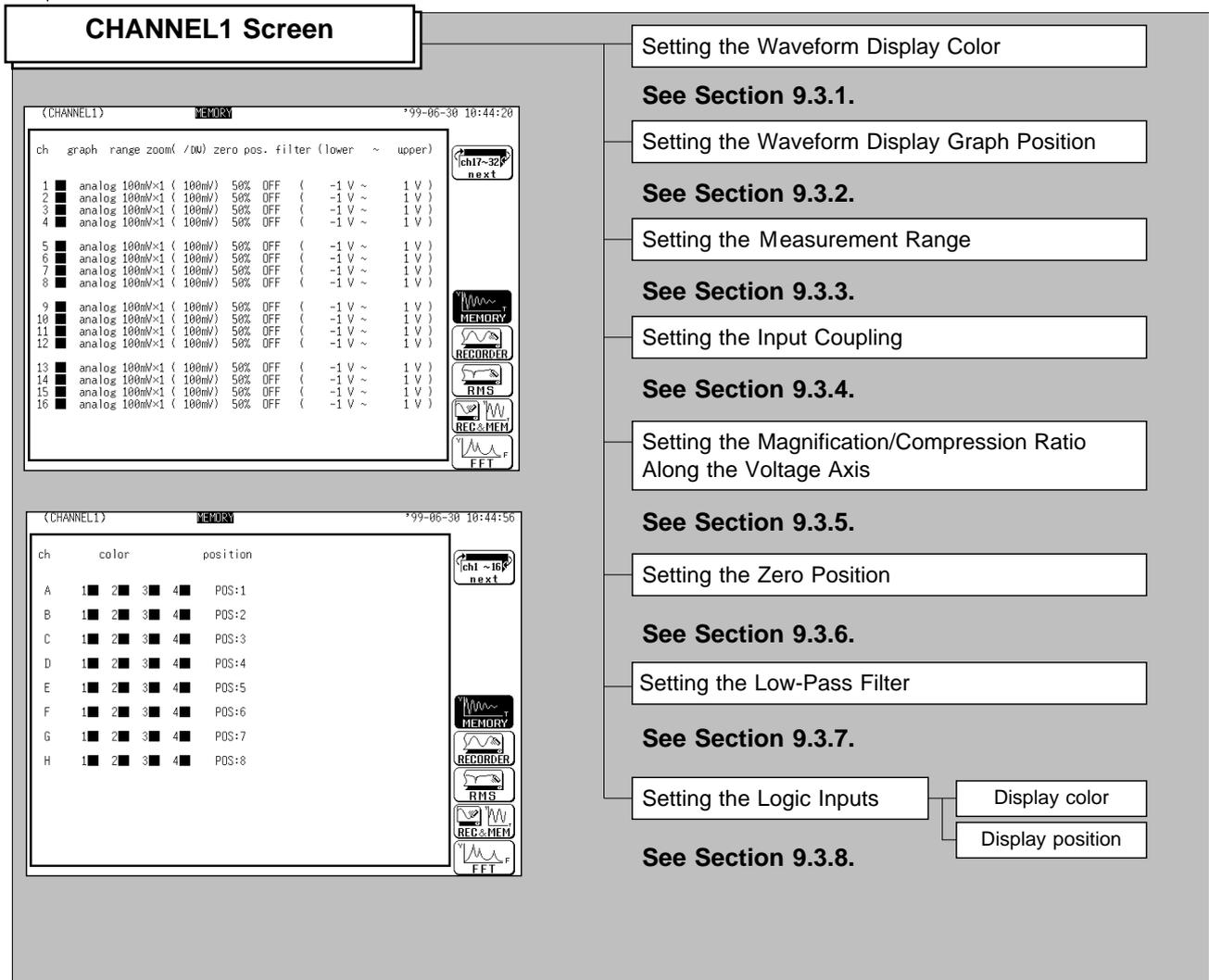
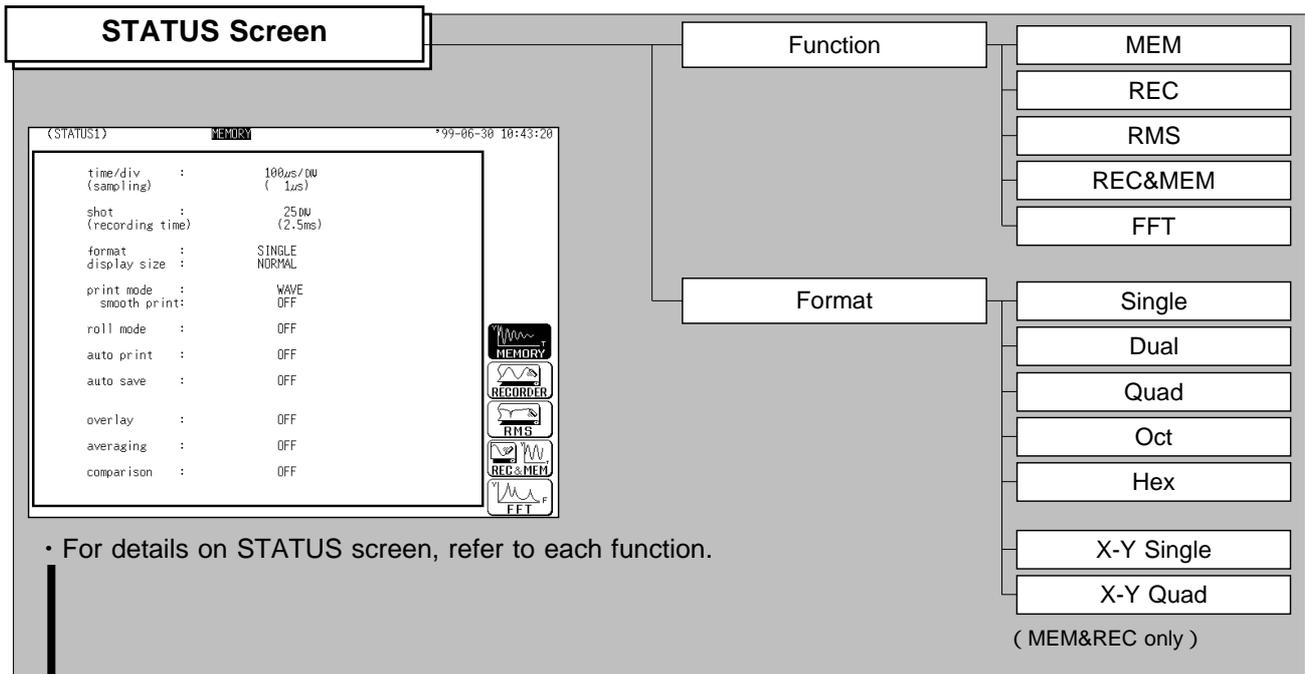
^{*7}: Only 8940 (Frequency, Count, Duty, voltage), ^{*8}: Only 8940 (Frequency, Count, Duty)

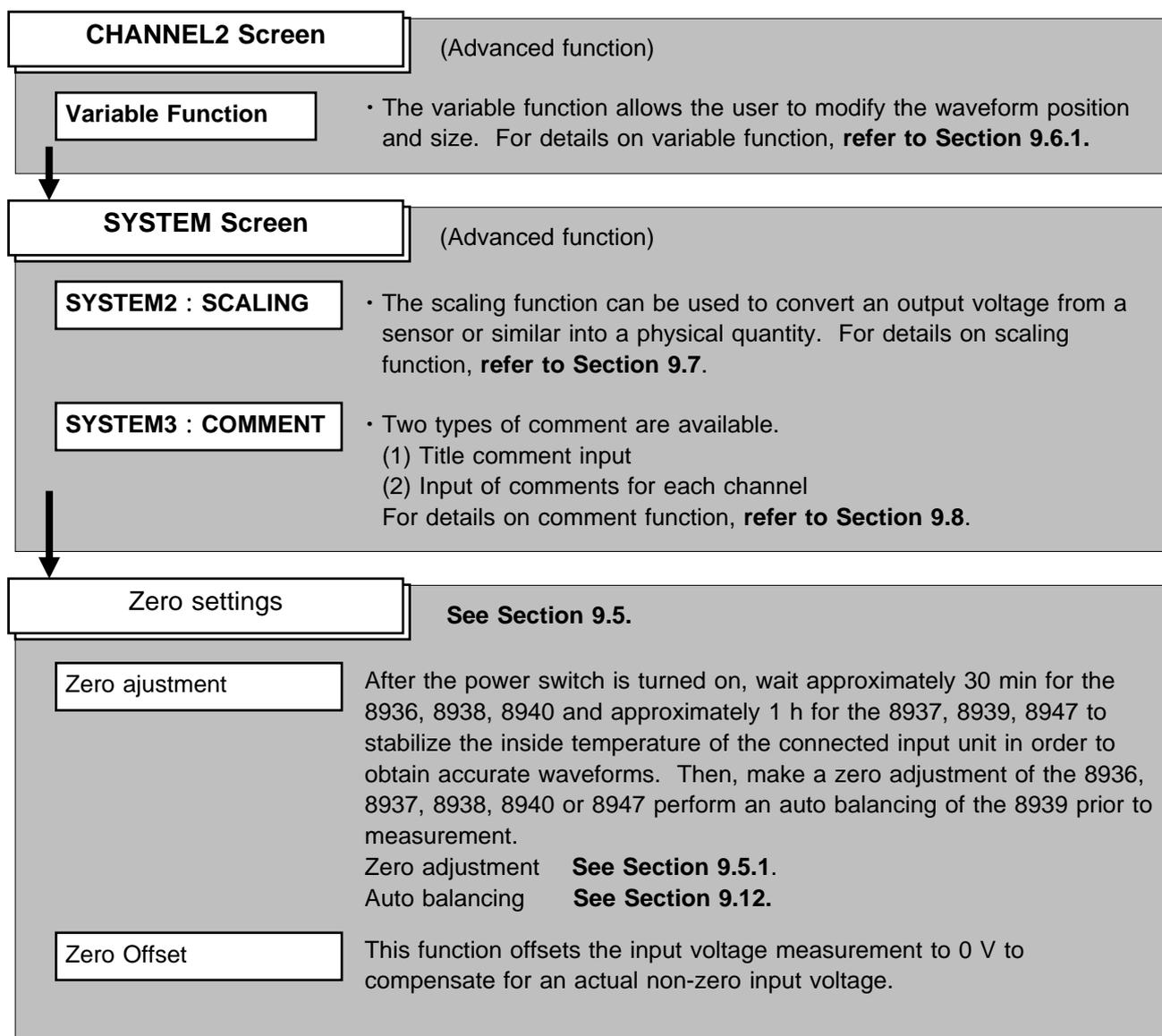
^{*9}: Only 8940 (Current), ^{*10}: 8947 (Pre-AMP, Charge), ^{*11}: The settings can be copied.

^{*12}: Direct channel setting can be performed for this item on the display screen.

^{*13}: Setting only possible from 8938 display. ^{*14}: Changing numeric values and on/off setting are not possible from the display screen.

9.2 Input Channel Setting Procedure



**NOTE**

The "Input Channel Setting Procedure" corresponds to the 8936 ANALOG UNIT description.

Refer to each item for particular descriptions related to each input unit.

8937 VOLTAGE / TEMP UNIT Refer to Section 9.10.

8938 FFT ANALOG UNIT Refer to Section 9.11.

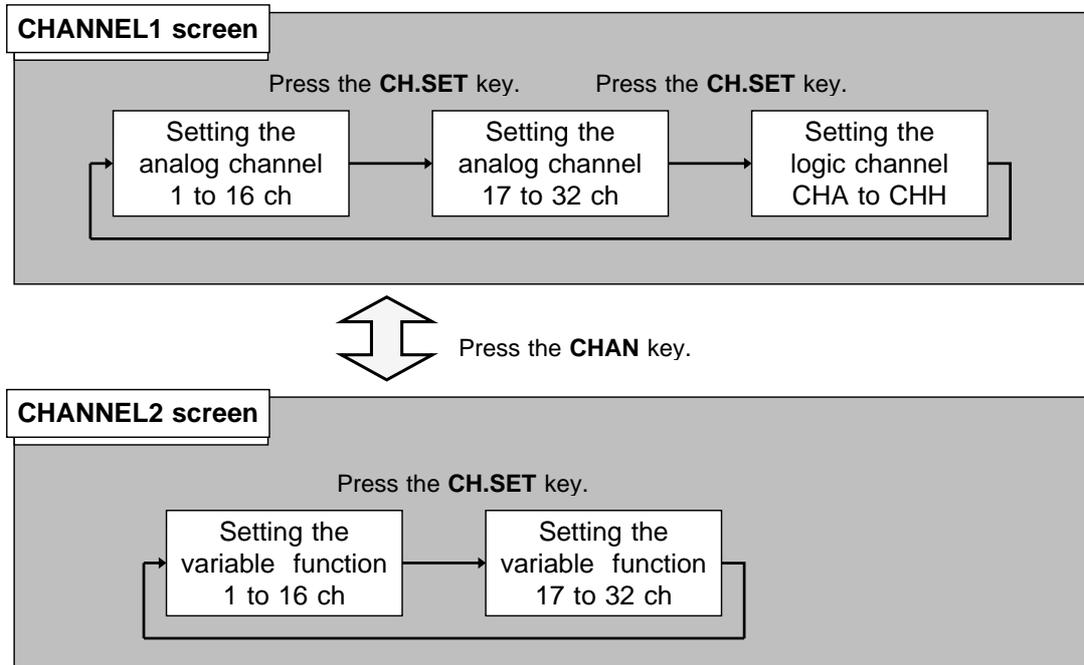
8939 STRAIN UNIT Refer to Section 9.12.

8940 F/V UNIT Refer to Section 9.13.

8947 CHARGE UNIT Refer to Section 9.14.

9.3 Setting the CHANNEL1 Screen

Indicates the CHANNEL screen organization. Press the **CHAN** key to call up the CHANNEL screen.



Press the **CHAN** key to toggle the CHANNEL1 screen and CHANNEL2 screen. Press the **CH.SET** key to toggle "analog channel 1 to 16", "analog channel 17 to 32" and "logic channel CHA to CHH".

Using the CH&NUM key

(CHANNEL1) MEMORY *99-06-30 10:45:29

ch	graph	range	zoom(/00)	zero	pos.	filter (lower ~ upper)
1	■	analog	100mV×1 (100mV)	50%	OFF	(-1 V ~ 1 V)
2	■	analog	100mV×1 (100mV)	50%	OFF	(-1 V ~ 1 V)
3	■	analog	100mV×1 (100mV)		OFF	(-1 V ~ 1 V)
4	■	analog	100mV×1 (100mV)	5m	OFF	(-1 V ~ 1 V)
5	■	analog	100mV×1 (100mV)	10m	OFF	(-1 V ~ 1 V)
6	■	analog	100mV×1 (100mV)	20m	OFF	(-1 V ~ 1 V)
7	■	analog	100mV×1 (100mV)	50m	OFF	(-1 V ~ 1 V)
8	■	analog	100mV×1 (100mV)	100m	OFF	(-1 V ~ 1 V)
9	■	analog	100mV×1 (100mV)	200m	OFF	(-1 V ~ 1 V)
10	■	analog	100mV×1 (100mV)	500m	OFF	(-1 V ~ 1 V)
11	■	analog	100mV×1 (100mV)	1	OFF	(-1 V ~ 1 V)
12	■	analog	100mV×1 (100mV)	2	OFF	(-1 V ~ 1 V)
13	■	analog	100mV×1 (100mV)	5	OFF	(-1 V ~ 1 V)
14	■	analog	100mV×1 (100mV)	10	OFF	(-1 V ~ 1 V)
15	■	analog	100mV×1 (100mV)	20	OFF	(-1 V ~ 1 V)
16	■	analog	100mV×1 (100mV)		OFF	(-1 V ~ 1 V)

Setting the CHANNEL1 screen

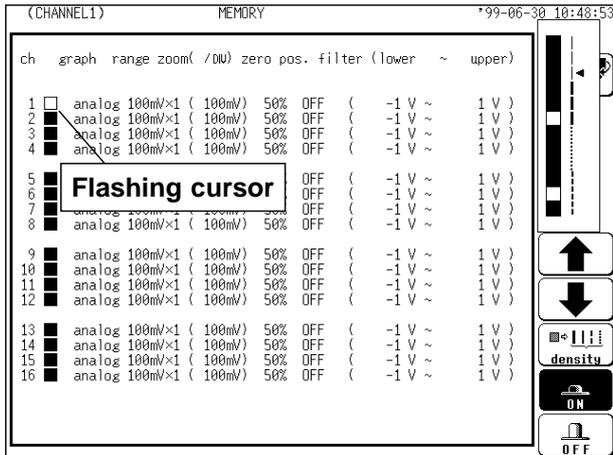
The **POSITION** key and the **RANGE** key can be set the zero position and measurement range on selected channel. The **POSITION** key and the **RANGE** key can be used regardless of where the flashing cursor is located.

Setting the CHANNEL2 screen

Using the **CH&NUM** key can be set the numerical data.

9.3.1 Setting the Waveform Display Color

Set the display color for the waveform.



Method Screen: CHANNEL1, DISPLAY

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Press the **CH.SET** key to call the desired channel screen.
- ③ Move the flashing cursor to the position shown in the figure on the left.
- ④ Use the function keys to make the selection.

Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



: The waveform density of the output from the internal printer can be set. See Section 13.3.1.



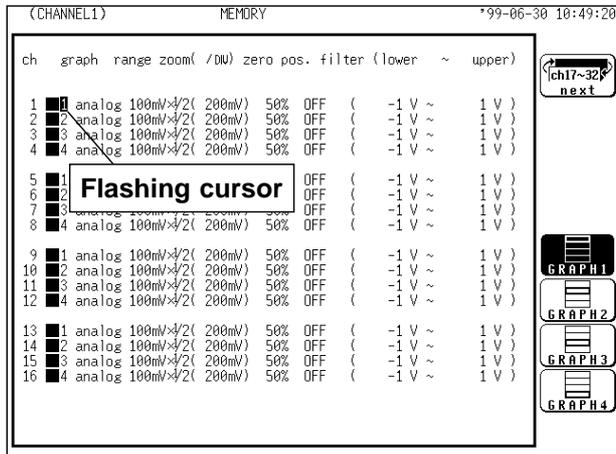
: Waveform display is enabled.



: Waveform display is disabled.

9.3.2 Setting the Waveform Display Graph Position

Set which graph type to use when display format has been set to DUAL, QUAD, OCT or HEX screen display on the STATUS screen.



Method

Screen: CHANNEL1, DISPLAY

- Call up the CHANNEL1 or DISPLAY screen.
- Use the CH.SET key to display the desired channel screen.
- Move the flashing cursor to the position shown in the figure on the left.
- Use the function keys to make the selection.

Selection



: Display the waveform on graph 1.



: Display the waveform on graph 2.



: Display the waveform on graph 3.



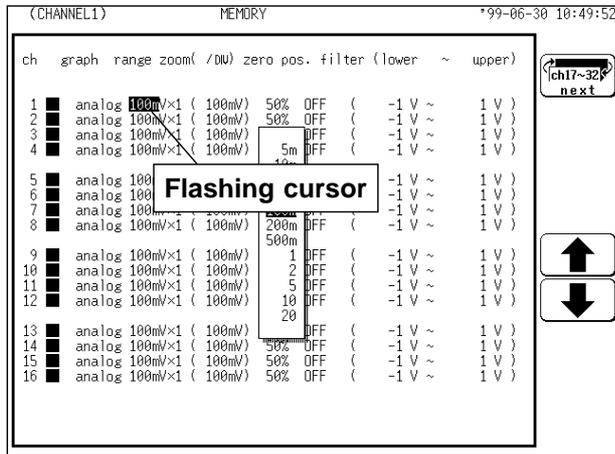
: Display the waveform on graph 4.

NOTE

For the X-Y screen display format (memory recorder, recorder), refer to the X-Y recorder settings of each function.

9.3.3 Setting the Measurement Range

- The measurement range for each channel is set.
- The set value denotes the voltage value for 1 DIV along the measurement range (vertically).



Method Screen: CHANNEL1, DISPLAY

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the **CH.SET** key to display the desired channel screen.
- ③ Move the flashing cursor to the position shown in the figure on the left.
- ④ Use the function keys, the JOG control or the **RANGE** key to make the selection.

Selection



: Move the arrow up in the selection window.



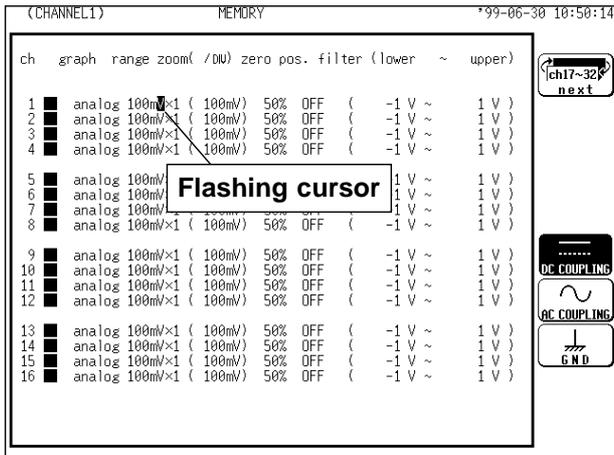
: Move the arrow down in the selection window.

NOTE

- The **RANGE** key can be used regardless of where the flashing cursor is located, if the CHANNEL1 or DISPLAY screen is displayed.
- If the variable function is enabled, the size of a waveform on the screen does not change, even if the measurement range is changed.
- When the waveform is out of range, the color of the displayed waveform on the screen is changed.
- When using the RMS recorder function, you cannot set the lowest sensitivity range of each unit (20 V/DIV for the 8936).

9.3.4 Setting the Input Coupling

The input coupling for the input signal is set.



Method

Screen: CHANNEL1, DISPLAY

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the CH.SET key to display the desired channel screen.
- ③ Move the flashing cursor to the position shown in the figure on the left.
- ④ Use the function keys to make the selection.

Selection



: DC coupling



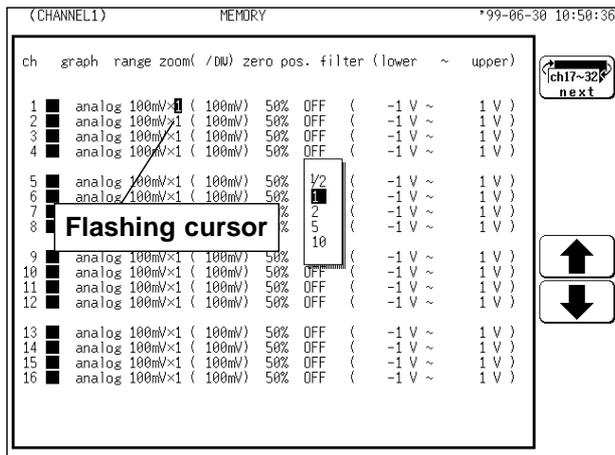
: AC coupling



: The input signal is not connected.
This allows the zero position to be checked.

9.3.5 Setting the Magnification/Compression Ratio Along the Voltage Axis

- Specifies the magnification/compression ratio for each channel to be used for display and recording.
- Performs magnification/compression using the center of the screen as reference.



Method

Screen: CHANNEL1, DISPLAY

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the **CH.SET** key to display the desired channel screen.
- ③ Move the flashing cursor to the position shown in the figure on the left.
- ④ Use the function keys to make the selection.

Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.

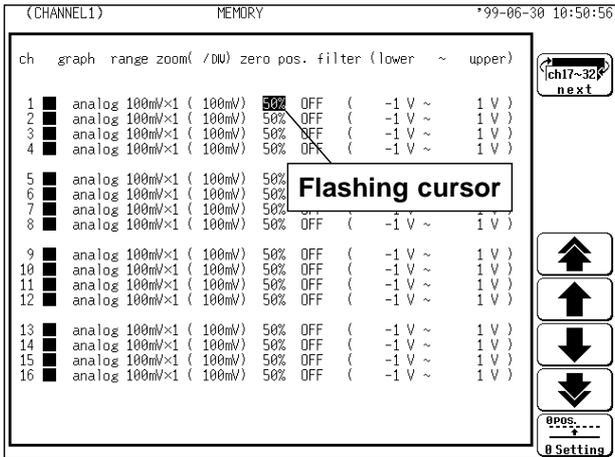
NOTE

- The measurable area for each voltage range is about ± 1.25 times the full-scale voltage axis. The display area on the waveform screen depends on the magnification and compression settings, but the measurable area is not affected. So even if seemingly displayable on the screen, any part of a waveform that exceeds the measurable area of the voltage range cannot be read.
- Magnification/compression along the measurement range is performed using the center of the screen as reference, if the Magnification/compression ratio is changed.
- Depends on display format, magnification/compression ratio is changed as below:

Format	Display Size		Magnification/ compression
	Normal	Wide	
Single, X-Y single screen	20 DIV	24 DIV	$\times 1/2$, $\times 1$, $\times 2$, $\times 5$, $\times 10$
2, 4, 8, 16, X-Y4 screen	10 DIV	12 DIV	$\times 1/4$, $\times 1/2$, $\times 1$, $\times 2.5$, $\times 5$

9.3.6 Setting the Zero Position

The position of the zero voltage is set.



Method **Screen: CHANNEL1, DISPLAY**

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the CH.SET key to display the desired channel screen.
- ③ Move the flashing cursor to the position shown in the figure on the left.
- ④ Use the function keys, the JOG control or the POSITION key to make the selection.

Selection

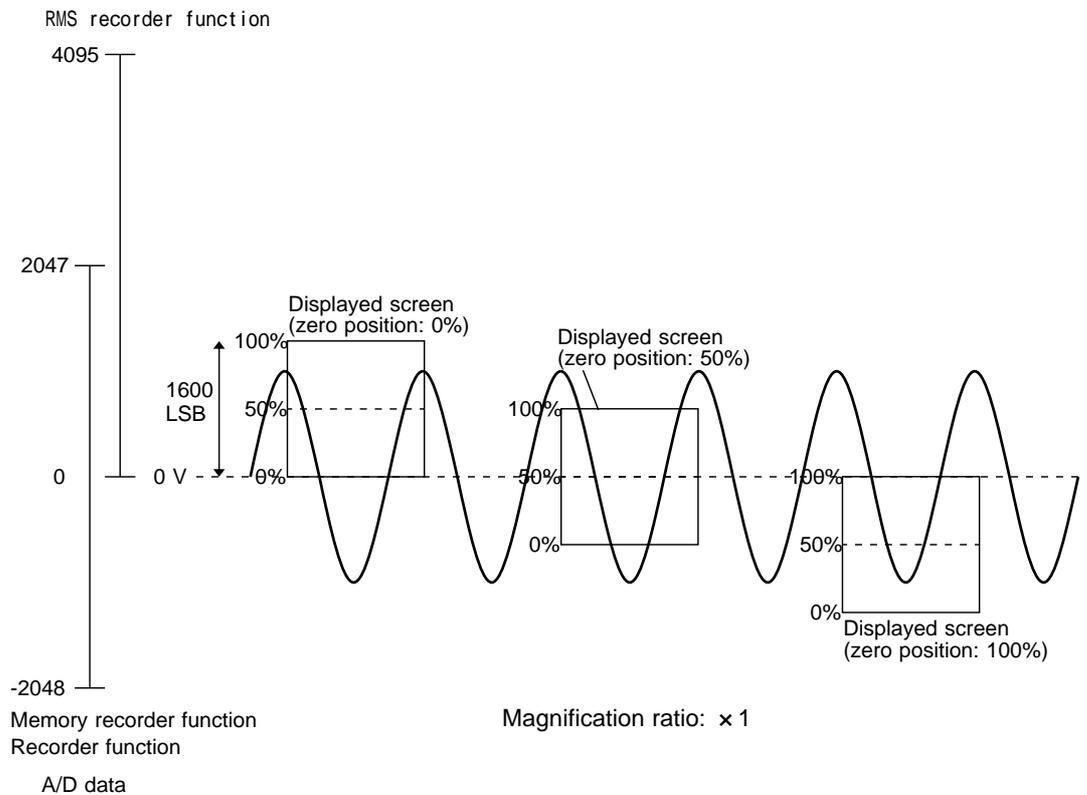
- : Changes the +10% zero position.
- : Changes the +1% zero position.
- : Changes the -1% zero position.
- : Changes the -10% zero position.

NOTE

- The **POSITION** key can be used regardless of where the flashing cursor is located, if the CHANNEL1 or DISPLAY screen is displayed.
- Magnification/compression along the measurement range is performed using the center of the screen as reference, even if the magnification/compression ratio is changed.

Reference

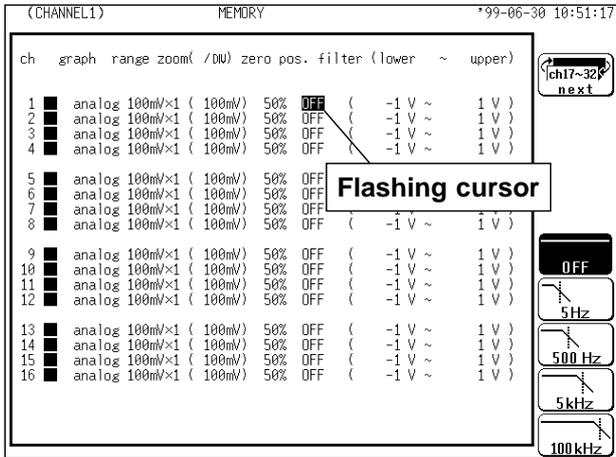
- The zero positions are shown in the figure below.
- It is possible to display the hidden portion of the waveform by setting "0 V" to a proper percentage on the display.



Single, X-Y single screen format	x 1/2	x 1	x 2	x 5	x 10
2 to 16, X-Y 4 screen format	x 1/4	x 1/2	x 1	x 2.5	x 5
No. of full-scale LSBs	3200	1600	800	320	160
Zero position adjustment area (MEM and REC)	0 to 100	-50 to 150	-150 to 250	-450 to 550	-950 to 1050
Zero position adjustment area (RMS)	-50 to 100	-150 to 150	-350 to 250	-950 to 550	-1950 to 1050

9.3.7 Setting the Low-Pass Filter

- Low-pass filters internal to the input units are set.
- Effective for removing unneeded high-frequency components.



Method Screen: CHANNEL1, DISPLAY

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the CH.SET key to display the desired channel screen.
- ③ Move the flashing cursor to the point shown in the figure on the left.
- ④ Use the function keys to make the selection.

Selection (Ex: 8936 ANALOG UNIT)

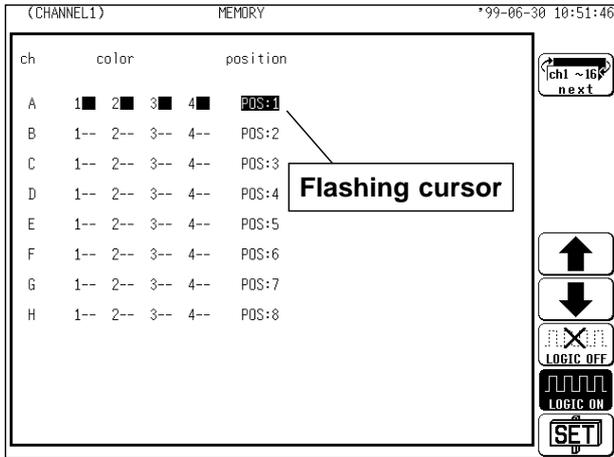
-  : No low-pass filter is connected.
-  : Connect a filter with a cutoff frequency of 5 Hz
-  : Connect a filter with a cutoff frequency of 500 Hz
-  : Connect a filter with a cutoff frequency of 5 kHz
-  : Connect a filter with a cutoff frequency of 100 kHz

Types of Low-Pass Filters in Each Unit

Input Unit	Low-Pass Filter	
8936	OFF, 5, 500, 5 k, 100 k (Hz)	
8937	Voltage	OFF, 5, 500, 5 k, 100 k (Hz)
	Temperature	OFF, 5, 500 (Hz)
8938	OFF, 5, 500, 5 k, 100 k (Hz)	
8939	OFF, 10, 30, 300, 3 k (Hz)	
8940	OFF, 5, 500, 5 k, 100 k (Hz)	
8947	Voltage	OFF, 5, 500, 5 k, 100 k (Hz)
	Charge, Pre-AMP	OFF, 500, 5 k (Hz)

9.3.8 Setting the Logic Inputs

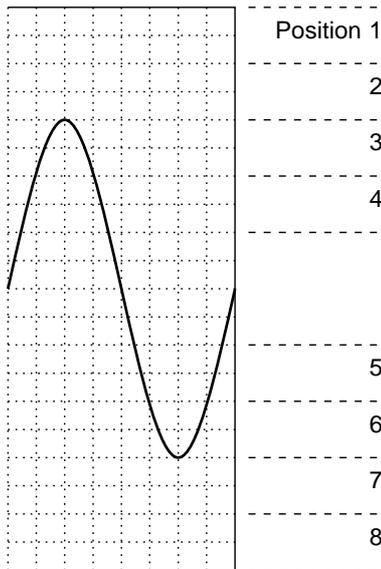
- Select the display positions for CHA - CHH (1 probe).
- Select the display color for the logic waveform.



Method **Screen:** CHANNEL1, DISPLAY

- ① Call up the CHANNEL1 or DISPLAYscreen.
- ② Use the **CH.SET** key to display the logic channel screen.
- ③ Move the flashing cursor to the **Position** point of the channel to be set, as shown in the figure on the left.
- ④ Use the function keys to set the position.
- ⑤ Press the **[F5] [SET]** key to change the display position.

The logic waveform display positions are as follows.



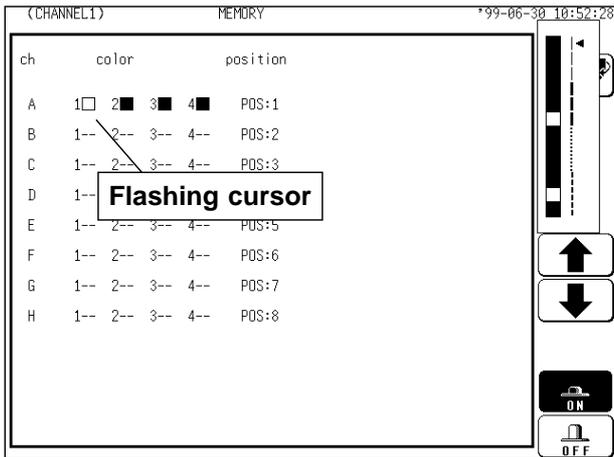
Selection

- : Change the display position.
- : Change the display position.
- : Logic waveforms are not displayed.
- : All logic waveforms are displayed.
- : Set to the displayed position number.

When the display format is set to "oct" or "hex," the display position is automatically adjusted.

For oct:
The logic waveform set at positions 1 through 8 is printed in graphs 1 through 8.

For hex:
A two-channel logic waveform is printed on a single graph. (The logic waveform at position 1 is printed on graphs 1 and 2.)



⑥ Move the flashing cursor to the "1, 2, 3, 4" item of the channel for which the display color is to be set, as shown in the figure on the left.

⑦ Use the the function keys to make the selection.

Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



: Waveform display is enabled.

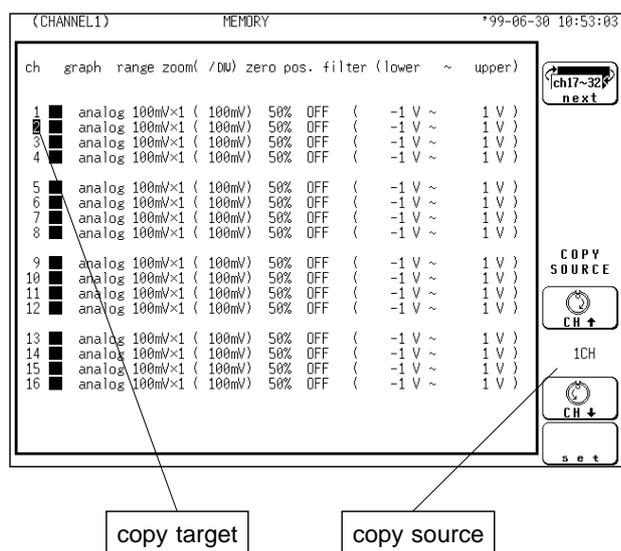


: Waveform display is disabled.

9.4 Copying Channel Settings

Copies any of input channel settings (voltage axis range, input coupling, and low-pass filter), variable function settings, scaling function settings, or comment function settings to another channel.

Copying is not possible if the copy source and destination are different, or if the measurement mode is different when copying from and to the same unit.



Method Screen: CHANNEL1, DISPLAY

- ① Press the **CHAN** key to call up the CHANNEL1 screen.
- ② Move the flashing cursor to the number of the channel to be used as copy target.
- ③ Use the function keys or the JOG control to specify the copy source channel.

Selection



: Increase channel number



: Decrease channel number

Selection of "for ALL" enables the settings (comments) for the channel with the flashing cursor to be copied to all channels.

- ④ When the **F5** [set] is pressed, the settings of the copy source channel are copied to the copy target channel.

For variable function and scaling function, the settings are copied in an identical.

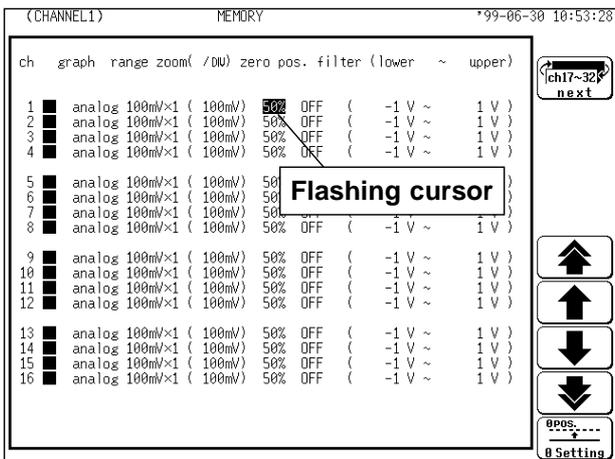
NOTE

- Magnification and zero position are copied to the desired destination only when the copy source is set to "for ALL" when copying is performed in the "input channel settings."
- It is not possible to copy the settings of input channels and variable function in a single operation.

9.5 Zero Setting

9.5.1 Zero Adjustment

- This function calibrates the 0 V position (ground position) to the selected zero position. Use it to assure precise results.
- Allow the unit to warm up for at least 30 minutes to ensure that the internal temperature of the input units has stabilized.
- Compensation for the measurement range is performed.

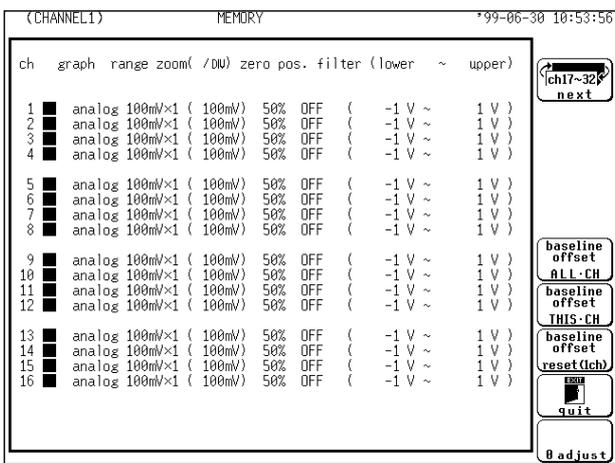


Method **Screen: CHANNEL1, DISPLAY**

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Move the flashing cursor to the zero pos. item.
- ③ Press the **F5** [0 Setting].

Selection

0pos.... : Displays the Zero Offset and Zero Adjust setup screen.



- ④ Press the **F5** [0 ajust].
All channels (all units installed) will be calibrated together.

Selection

- baseline offset ALL-CH** : Activates zero offset on all channels.
- baseline offset THIS-CH** : Activates zero offset on specified channels.
- baseline offset reset (ch)** : Disables zero offset on specified channels.
- quit** : Exits Zero setup.
- 0 adjust** : Performs zero adjustment. Disables zero offset on all channels.

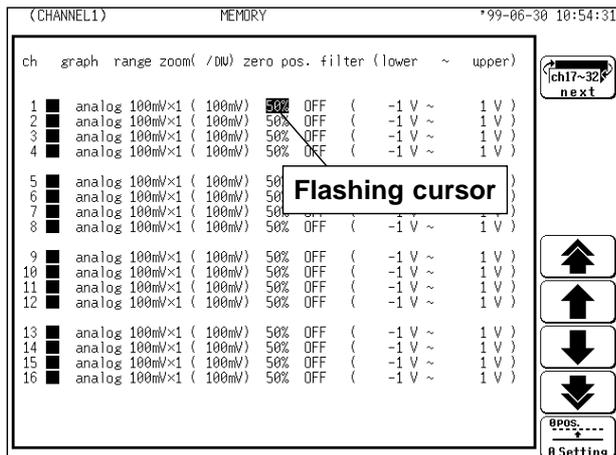
NOTE

- Zero adjustment cannot be performed during measurement.
- Repeat the zero adjustment when the input unit was changed, when the power is on/off, or when the system is set to reset, when the measurement range is change.
- When there is a sudden change in ambient temperature the zero position may drift. To assure continued measurement precision, perform the zero adjustment again.

9.5.2 Zero Offset

This function offsets the input voltage measurement to 0 V to compensate for an actual non-zero input voltage. If the actual input voltage exceeds ± 10 DIVs, zero offset cannot be performed. This function is for the voltage and current measurement only.

The zero offset is active when power is off, but if the input unit configuration is changed while power is on, the zero offset must be reset.



Method

Screen: CHANNEL1, DISPLAY

- Call up the CHANNEL1 or DISPLAY screen.
- Move the flashing cursor to the zero pos. item.
- Press the **F5** [0 Setting].

Selection

0 pos.
0 Setting : Displays the Zero Offset and Zero Adjust setup screen.

- Use the function keys to make the selection.

Selection

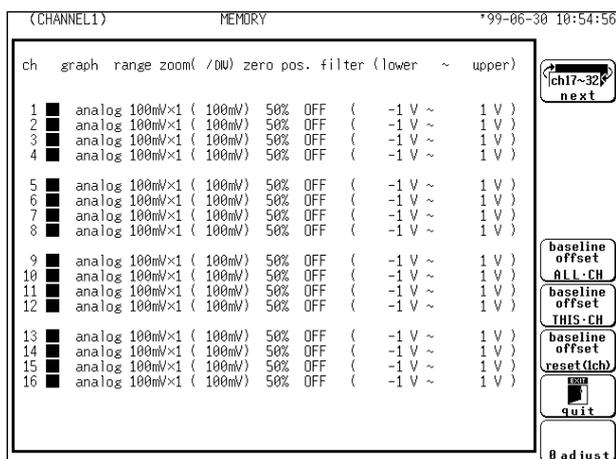
baseline offset ALL-CH : Activates zero offset on all channels.

baseline offset THIS-CH : Activates zero offset on specified channels.

baseline offset reset(ch) : Disables zero offset on specified channels.

quit : Exits Zero setup.

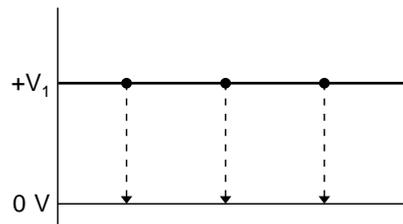
0 adjust : Performs zero adjustment.
Disables zero offset on all channels.



Input Voltage During Zero Offset

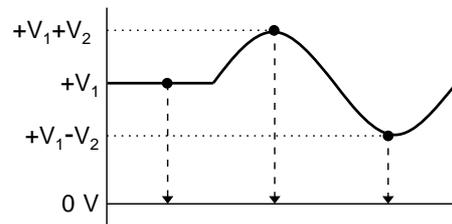
To set the zero offset, the input voltage must be stable. Otherwise, the zero offset depends on the timing of the zero offset setting.

With Fixed Input Voltage



$+V_1$ is set to 0 V regardless of timing.

With Variable Input Voltage



The setting value to establish the 0 V level is determined at the moment of setting.

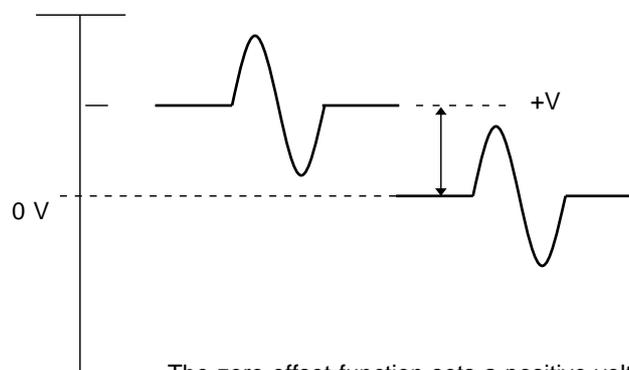
NOTE

- The zero offset function can be performed only for the input voltage measurement.
- The input voltage will be set to 0 V , so before executing zero offset setting, apply the signal that is to be offset to zero.
- When the input voltage is offset to 0 V by the zero offset function, the maximum input voltage and maximum constant voltage relative to ground are unaffected, so care should be observed to ensure that the limits of these voltages are not exceeded.
- When zero offset on all channels is performed, 'Warning' is displayed if zero offset cannot be set on any channel (the input voltage exceeds $\pm 10\text{ DIVs}$). In this case, the zero offset on channels which can be performed is active.

Difference Between Zero Offset and Zero Adjust

The zero offset function forces the actual input voltage to be offset to 0 V for measurement purposes. That is, if there is a potential difference between the standard potential of the measurement object and the standard potential of this device (0 V), this function causes the standard potential of the measurement object to be interpreted as 0 V .

The zero-adjust function compensates for the difference between the input unit potential and 0 V , so that it appears as 0 V . This function causes the basic potential of this device to be 0 V .



The zero offset function sets a positive voltage as the basic potential.

9.6 Setting the CHANNEL2 Screen

9.6.1 Setting the Variable Function

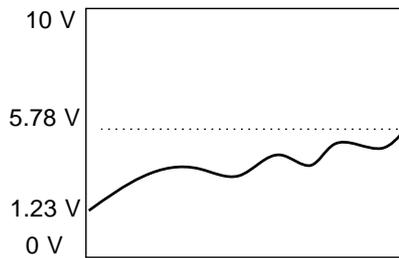
- The variable function allows the user to modify the waveform position and size.
- The variable screen serves for setting the lower and upper limit of the waveform display range.
- The allowable waveform display range between the upper and lower limits is 10000 times larger or smaller the currently set range. If the variable function is used, the magnification is limited to 1000 times.
- The variable function can be set to ON or OFF for each channel individually.
- If the variable function is enabled, the size of a waveform on the screen does not change, even if the measurement range is changed.

The function can also be combined with the scaling function.

This is useful when wishing to display the sensor output over the full range (full-span display).

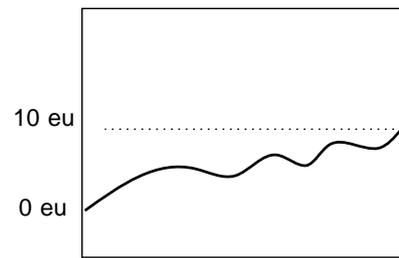
Example:

Output from sensor
1.23 V min, 5.78 V max.



Scaling

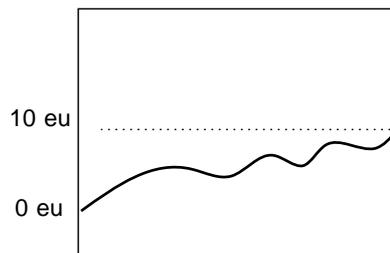
After conversion
0 [eu] min, 10 [eu] max.



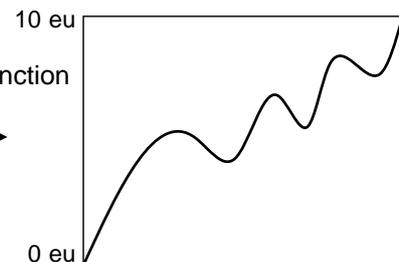
The scaling function allows conversion of the voltage output by the sensor into a desired physical quantity.

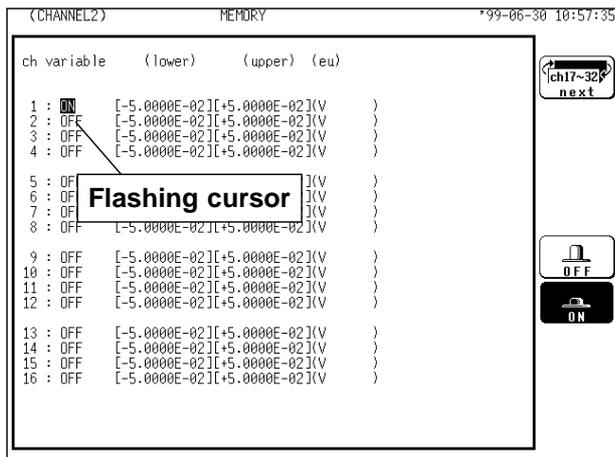
But unless the setting is changed as shown below, the display will continue to show the waveform of the sensor output voltage (with the measurement range and zero position as set on the channel screen). To use the full-span display, make the following setting:

Lower limit: 0 [eu], Upper limit: 10 [eu]



Variable function
ON





Method Screen: CHANNEL2, DISPLAY

- ① Call up the CHANNEL2 or DISPLAY screen.
- ② Use the **CH.SET** key to display the desired channel screen.
- ③ Use the cursor key to move the flashing cursor to the desired channel.
- ④ Use the function keys to make the selection.

Selection

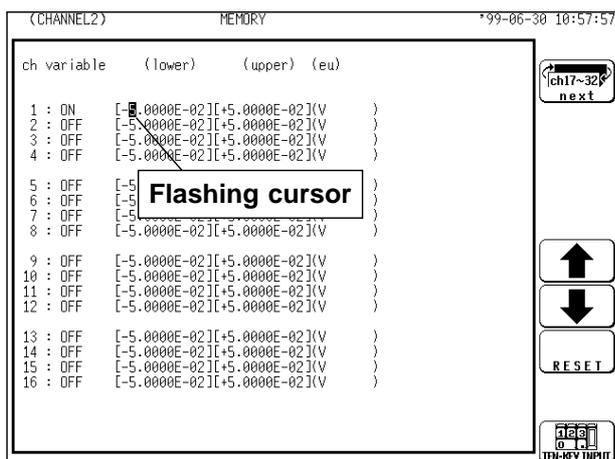


: Variable function is disabled.



: Variable function is enabled.

Move the flashing cursor to the position shown in the figure on the left, and set the lower and upper limits.



Method-1 Screen: CHANNEL2, DISPLAY

Using the function key or the JOG control

- ① Move the flashing cursor to the desired channel.
- ② Move the flashing cursor to the respective columns and select columns individually with the JOG control, the function keys or the **CH&NUM** key. (Move the column with the cursor keys.)

The unit (eu) sets the SYSTEM2 (SCALING) screen.

Selection



: Value up



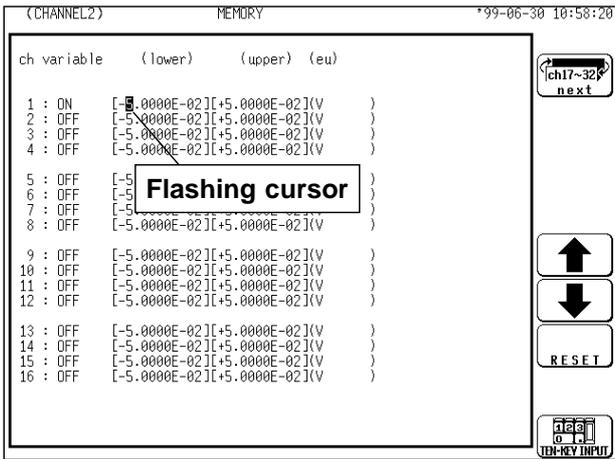
: Value down



: Reset. The reset value is determined by the measurement range, zero position, and magnification ratio.



: Enter the value using the **CH&NUM** keys.



Method-2 Screen: CHANNEL2

Using the **CH&NUM** key

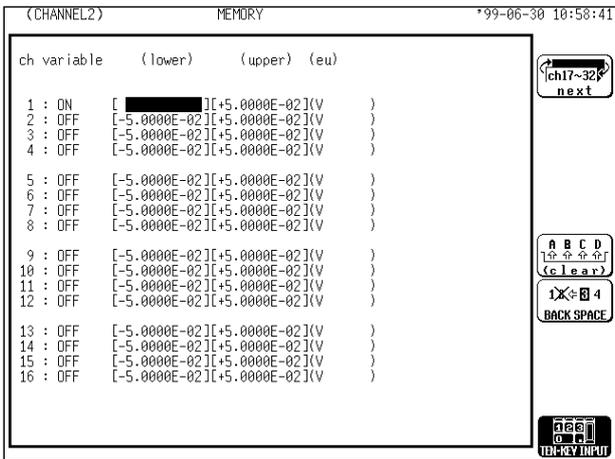
- ① Move the flashing cursor to the desired channel. Move the flashing cursor to the lower or upper limit.
- ② Use the function key to select the **TEN-KEY INPUT**.

Selection

: Value up : Value down

: Reset. The reset value is determined by the measurement range, zero position, and magnification ratio.

: Enter the value using the **CH&NUM** keys.



- ③ Use the **CH&NUM** key to enter the parameter. The unit (eu) sets the **SYSTEM2 (SCALING)** screen.

Selection

: Clear the currently displayed comments.

: Performs backspacing. The value that has been input most recently will be displayed if the backspace function is used without entering new data.

: Enable the input value and escape from the ten-key input screen.

CH&NUM key Enter the numerical value
POSITION key Enter the " - ", "+ "
RANGE key Enter the ". " ,"E"

- ④ Press the **CH_{ENT}** key to fix the entering.

NOTE

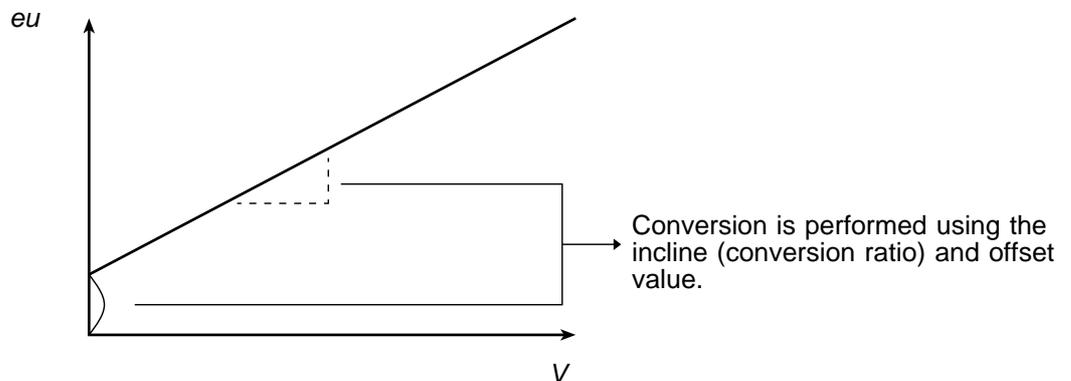
- When the screen size (normal/wide) is changed, the upper and lower limits are also changed.
- Variable function and scaling function processing can be carried out simultaneously.
- Settings made for one channel can be copied to another channel. See section 9.4.
- Although the variable function cannot be enabled or disabled on the display screen, the values of the enabled channels can be changed.

9.7 Scaling Function (SYSTEM2)

- The scaling function can be used to convert an output voltage from a sensor or similar into a physical quantity.
- The gauge scale (maximum and minimum values of horizontal axis) and A/B cursor measurement values are displayed in the scaled units.
- Scaling can be performed for every channel.
- Two types of scaling functions are available.

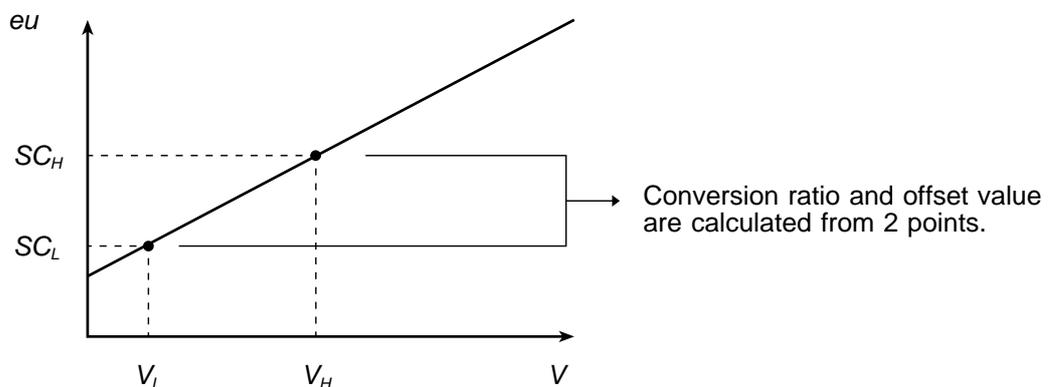
Method-1 (conversion ratio method)

Scaling is performed by specifying a physical quantity to correspond to a 1V input signal (conversion ratio: eu/v), an offset value, and the unit (eu: engineering units). This will cause the measurement voltage to be converted into the selected units.



Method-2 (2-point method)

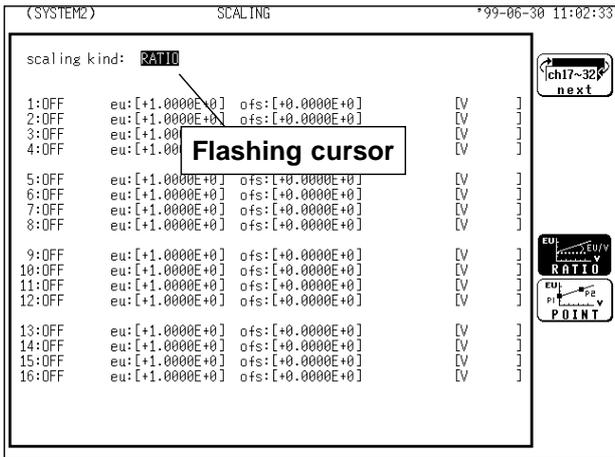
Scaling is performed by specifying two input signal points (voltage values) and the conversion values for these two points in engineering units (eu). This will cause the measurement voltage to be converted into the selected units.



V_H : Voltage high point
 V_L : Voltage low point

SC_H : Scaling high point
 SC_L : Scaling low point

9.7.1 Setting the Scaling Function



Method Screen: SCALING (SYSTEM2)

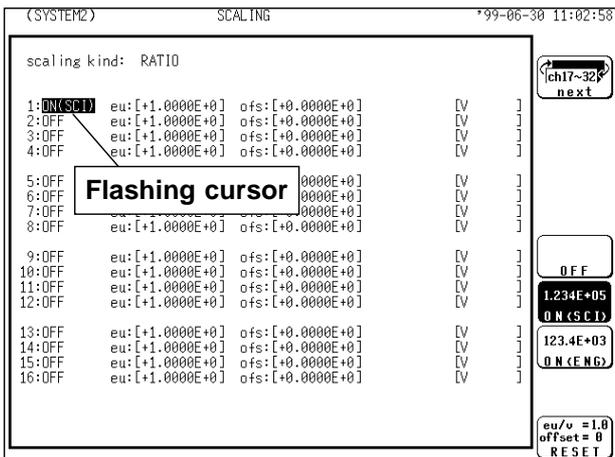
(1) Select the Scaling method

- ① Press the **SYSTEM** key to call up the SYSTEM2 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

 : Use conversion ratio method

 : Use 2-point method



(2) Setting the scaling function

- ① Use the **CH.SET** key to display the desired channel screen.
- ② Use the cursor key to move the flashing cursor to the desired channel.
- ③ Use the function keys to make the selection.

Selection

 : Scaling not used

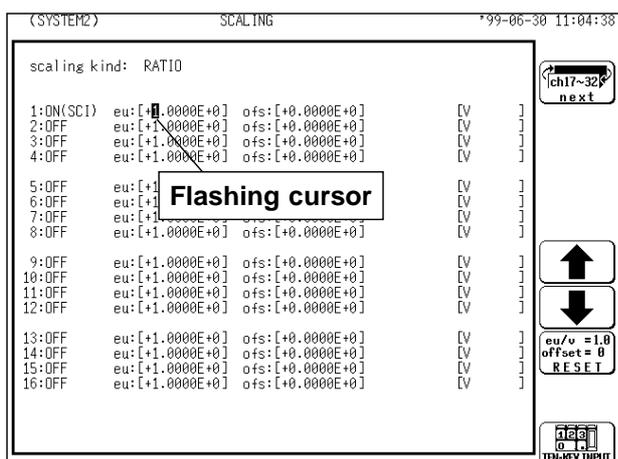
 : Scaling used (specify exponent as integer)

 : Scaling used (specify exponent as multiple of 3)

 : Reset.

NOTE

If the exponents of data are integers (SCI), the numeral used as the cursor value or the value to be printed out will be expressed as it is rather than in exponential form, provided that it is less than 100,000.



(3) Entering the numerical value

Using the function key and the JOG control

- ① Move the flashing cursor to the desired channel.
- ② Move the flashing cursor to each digit and use the JOG control, the function keys or the **CH&NUM** key to enter individual digits.

(Use the cursor keys to move the column.)

Conversion ratio method

The setting range for both these items is -9.9999E+9 to +9.9999E+9.

2-point method

The setting range is -9.9999E+29 to +9.9999E+29.

Selection



: Value up



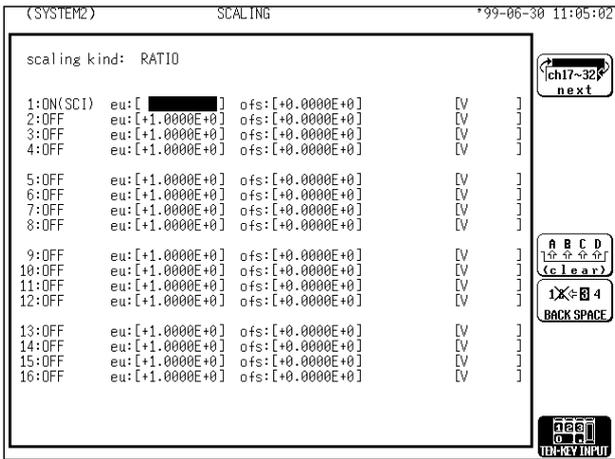
: Value down



: Reset (when specified at conversion ratio method)



: Enter the value using the **CH&NUM** keys.



(3) Entering the numerical value

Using the CH&NUM key

- ① Move the flashing cursor to the desired item.
- ② Use the function key to select the **TEN-KEY INPUT**.
- ③ Use the **CH&NUM** key to enter the numerical value.

Selection



: Clear the currently displayed comments.



: Performs backspacing. The value that has been input most recently will be displayed if the backspace function is used without entering new data.



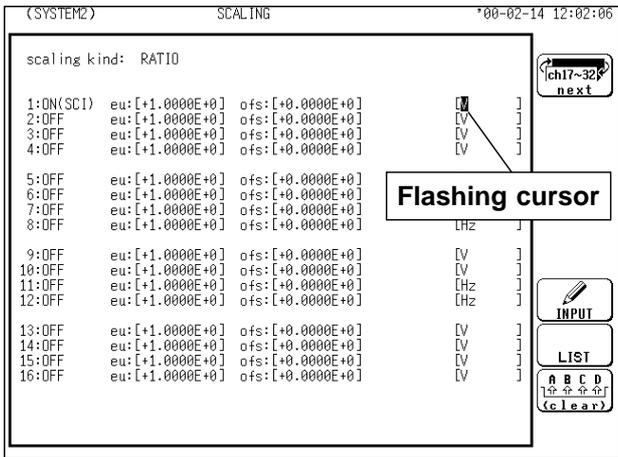
: Enable the input value and escape from the ten-key input screen.

CH&NUM key Enter the numerical value

POSITION key Enter the " - ", " + "

RANGE key Enter the ". ", "E"

- ④ Press the **CH_{ENT}** key to fix the entering.



(4) Enter the "Unit name: eu"

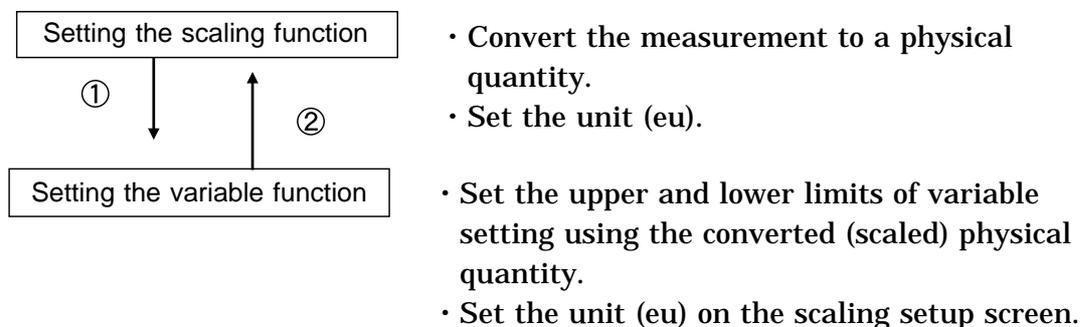
Move the flashing cursor to the position shown in the figure on the left and enter the required unit. See Section 9.8.4.

NOTE

- Settings made for one channel can be copied to another channel. See section 9.4.
- When the scaling and waveform processing are simultaneously specified, the scaling function is not applied to the results of the waveform processing stored in the internal memory.

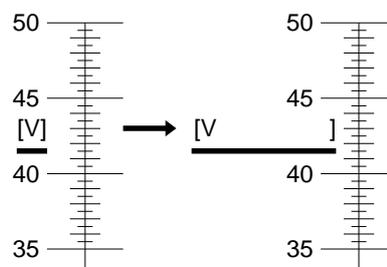
Combination of the scaling and variable functions

The scaling function can be combined with the variable function. If both the scaling and variable functions are to be used in the order of "Variable" "Scaling," it is necessary to use the previously converted physical quantity (after scaling) to set the upper and lower limits of variable setting .



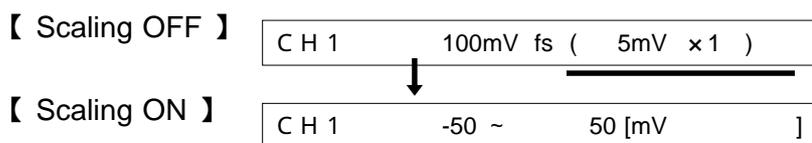
How to identify scaled data output

(1) The gauge unit indication [] is widened (when the gauge is set to ON).



【 Scaling OFF 】 【 Scaling ON 】

(2) The input channel is represented in full-span mode instead of full-scale mode, and the unit is displayed in [].



9.7.2 Scaling Setting Example

```
(SYSTEM2) SCALING *99-06-30 11:10:56
scaling kind: POINT
( volt P1 , volt P2 ) ( scale P1 , scale P2 )
1:ON(SCI)+1.2000E+03,+0.0000E+00+3.0000E+00,+0.0000E+00[G ]
2:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
3:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
4:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
5:ON(ENG)+1.2000E+03,+0.0000E+00+3.0000E+00,+0.0000E+00[G ]
6:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
7:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
8:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
9:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
10:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
11:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
12:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
13:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
14:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
15:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
16:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
```

The example below shows the scaling function of the strain unit.

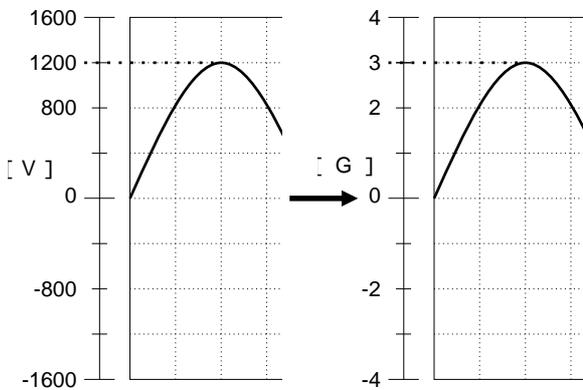
When a sensor (the conversion ratio is characterized as "3G = 1200 μ (micro strain)") is used:

Scaling method : 2-point method

Setting : SCI or ENG

Converting value : 1200 (μ) 3 (scale)
0 (μ) 0 (scale)

unit (eu) : G



Through the use of the scaling function, the signal from the sensor can be obtained in the form of a physical quantity.

- Cursor values A and B, respectively, show the physical quantities.
- If the gauge is turned on before the printout is made, the gauge is output in a physical quantity.

```
(SYSTEM2) SCALING *99-06-30 11:09:43
scaling kind: POINT
( volt P1 , volt P2 ) ( scale P1 , scale P2 )
1:ON(SCI)+2.0000E-01,+0.0000E+00+1.0000E+01,+0.0000E+00[A ]
2:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
3:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
4:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
5:ON(ENG)+2.0000E-01,+0.0000E+00+1.0000E+01,+0.0000E+00[A ]
6:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
7:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
8:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
9:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
10:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
11:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
12:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
13:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
14:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
15:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
16:OFF +5.0000E-02,-5.0000E-02+5.0000E-02,-5.0000E-02[V ]
```

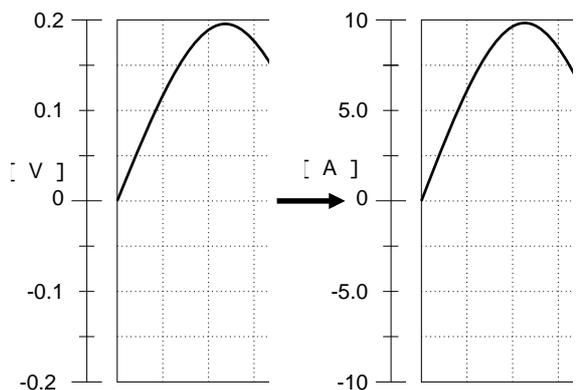
The example below shows the type of scaling when the measurement range is set to 10 A using the 9018 CLAMP ON PROBE.

Scaling method : 2-point method

Setting : SCI or ENG

Converting value : 0.2 (V) 10 (scale)
0 (V) 0 (scale)

unit (eu) : A



Through the use of the scaling function, the signal from the sensor can be obtained in the form of a current value.

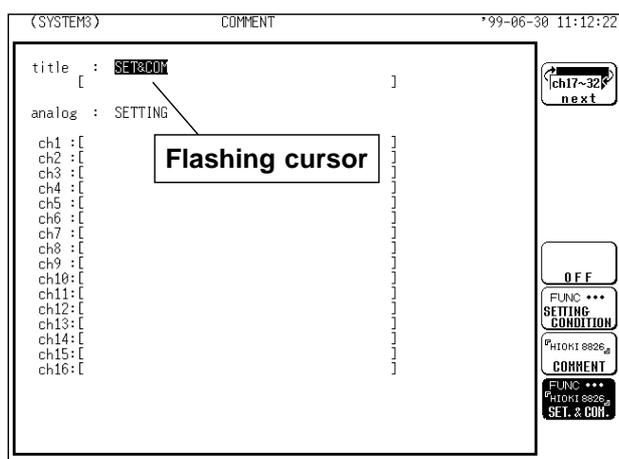
- Cursor values A and B, respectively, show the current values.
- If the gauge is turned on before the printout is made, the gauge is output in a current value.

9.8 Comment Function (SYSTEM 3)

9.8.1 Title Comment Input

- Title comment input is described.
- Three types of title comment are available.

- (1) SET: Function, time axis range, magnification/compression ratio along the time axis, date and time of trigger
- (2) COMMENT: Comment of up to 40 characters
- (3) SET & COMMENT: Both (1) and (2)

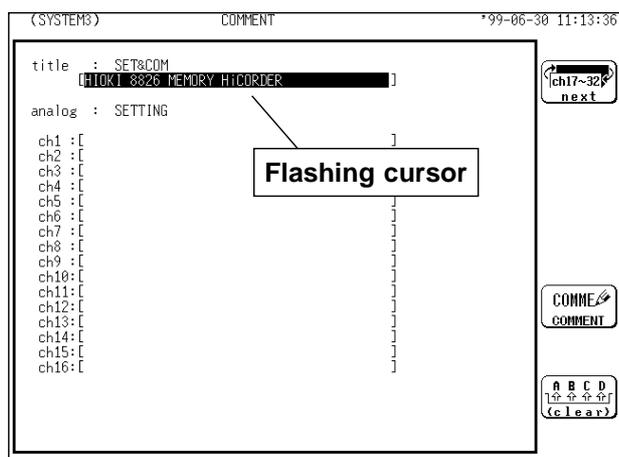


Method Screen: COMMENT (SYSTEM3)

- ① Press the **SYSTEM** key to call up the SYSTEM3 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection

- OFF** : Standard printout is performed.
- FUNC ... SETTING CONDITION** : Setting item is printed.
- FUNC ... COMMENT** : Comment is printed.
- FUNC ... SET. & CON.** : Both item and comment are printed.



- ④ When the flashing cursor is moved with the CURSOR keys, the following function key indication appears.

Selection

- COMME COMMENT** : Display the comment input window.
- A B C D CLEAR** : Clear the currently displayed comments.

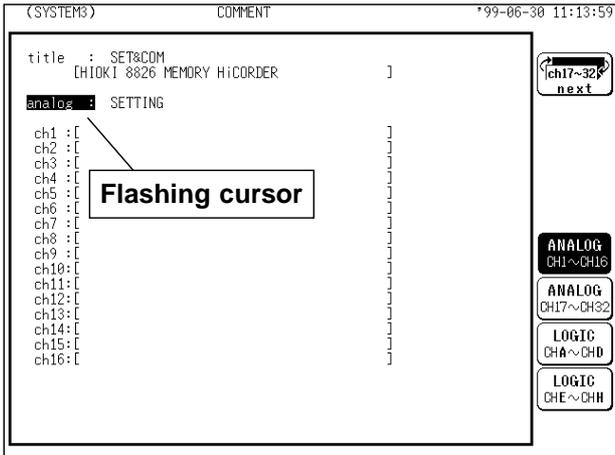
For details on comment input, see Section 9.8.4.

When "COMMENT" or "SET & COMMENT" is selected, the comments are printed. (see Section 13.5).

9.8.2 Analog Channel Comment Input

- Analog channel comment input is described.
- Three types of analog channel comment are available.

- (1) SET: Full-span voltage for each channel, measurement range, magnification/compression ratio along the measurement range, zero position, low-pass filter setting
- (2) COMMENT: Comment of up to 40 characters
- (3) SET & COMMENT: Both (1) and (2)

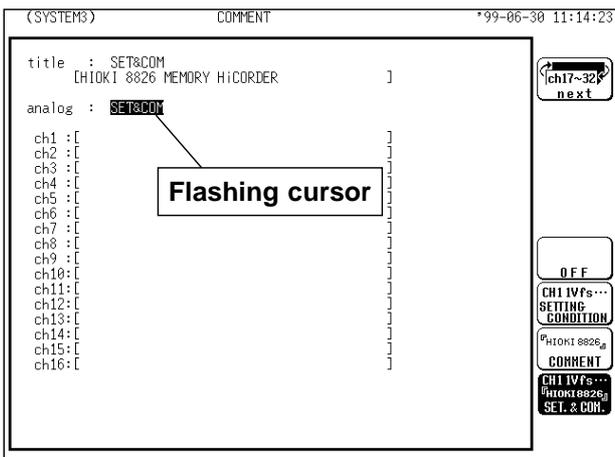


Method Screen: COMMENT (SYSTEM3)

- ① Press the **SYSTEM** key to call up the SYSTEM3 screen.
- ② Move the flashing cursor to the position shown in the figure on the left. Use the function keys to select the desired channel screen. (Press the **CH.SET** key can change screen.)

Selection

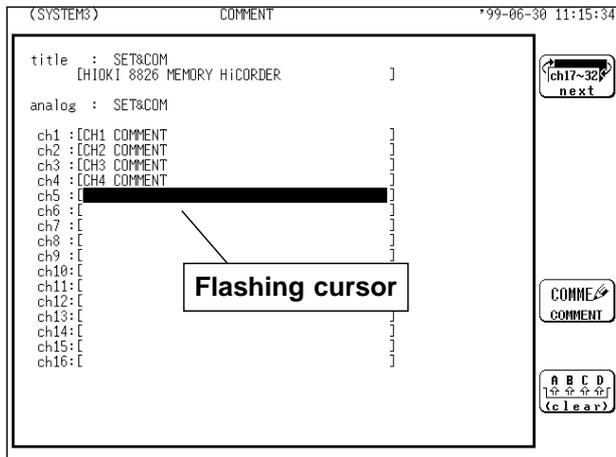
- ANALOG CH1~CH16** : Analog CH1 to 16: COMMENT
- ANALOG CH17~CH32** : Analog CH17 to 32: COMMENT
- LOGIC CHA~CHD** : Logic CHA to D: COMMENT
- LOGIC CHE~CHH** : Logic CHE to H: COMMENT



- ③ Move the flashing cursor to the desired channel. Use the function keys to make the selection.

Selection

- OFF** : Standard printout is performed.
- CH1 IVfs... SETTING CONDITION** : Setting item is printed.
- HIOKI 8826 COMMENT** : Comment is printed.
- CH1 IVfs... HIOKI8826 SET. & CON.** : Both item and comment are printed.



- ④ When the flashing cursor is moved with the CURSOR keys, the following function key indication appears.

Selection

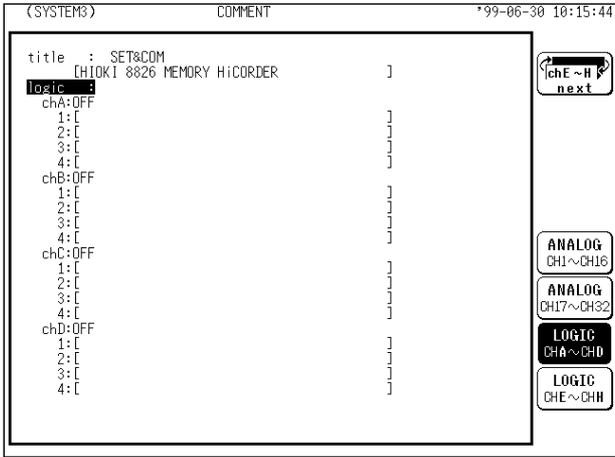
- COMMENT COMMENT : Display the comment input window.
- A B C D [clear] : Clear the currently displayed comments.

For details on comment input, see Section 9.8.4.

When "COMMENT" or "SET & COMMENT" is selected, the comments are printed. (see Section 13.5).

9.8.3 Logic Channel Comment Input

- Logic channel comment input is described.
 - One type of logic channel comment is available.
- (1) COMMENT: Comments can be entered separately for every channel.

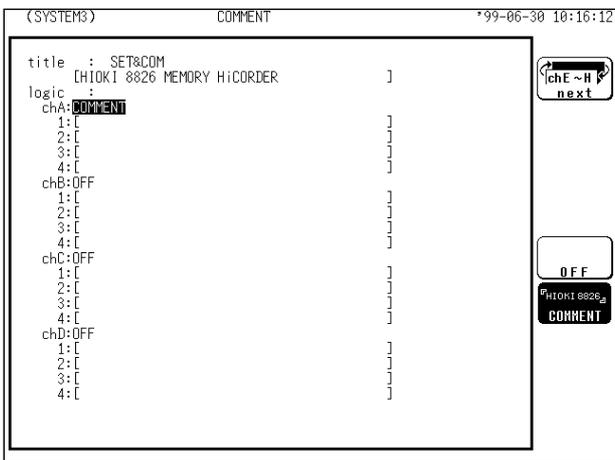


Method Screen: COMMENT (SYSTEM3)

- ① Press the **SYSTEM** key to call up the SYSTEM3 screen.
- ② Move the flashing cursor to the position shown in the figure on the left. Use the function keys to select the desired channel screen. (Press the **CH.SET** key can change screen.)

Selection

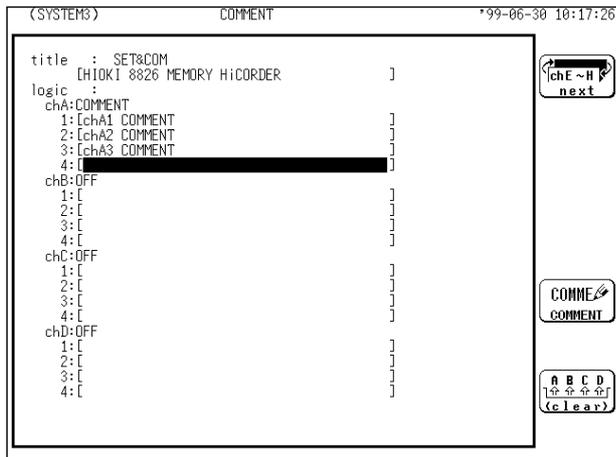
- ANALOG CH1~CH16** : Analog CH1 to 16: COMMENT
- ANALOG CH17~CH32** : Analog CH17 to 32: COMMENT
- LOGIC CHA~CHD** : Logic CHA to CHD: COMMENT
- LOGIC CHE~CHH** : Logic CHE to CHH: COMMENT



- ③ Move the flashing cursor to the desired channel. Use the function keys to make the selection.

Selection

- OFF** : Standard printout is performed.
- HIOKI 8826 COMMENT** : Comment is printed.



- ④ When the flashing cursor is moved with the CURSOR keys, the following function key indication appears.

Selection

COMMENT : Display the comment input window.

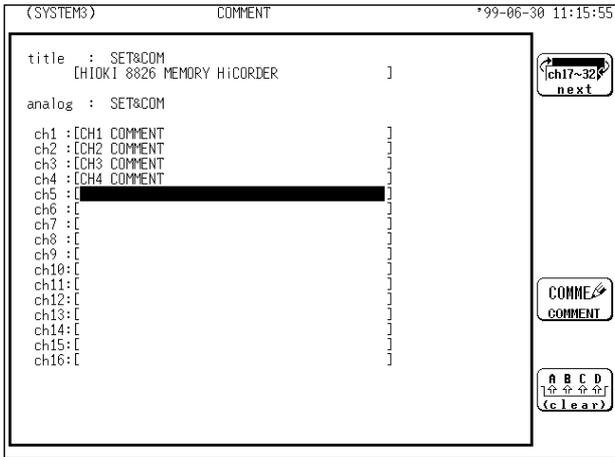
A B C D [clear] : Clear the currently displayed comments.

For details on comment input, see Section 9.8.4.

When "COMMENT" is selected, the comments are printed. (see Section 13.5).

9.8.4 Character Entry Procedure

The procedure for entering the characters for the comments, units, etc. is described.



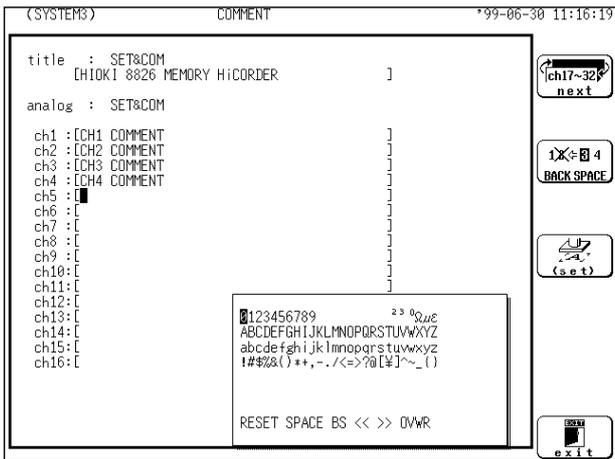
Method Screen: COMMENT (SYSTEM3)

- ① Move the flashing cursor to the position in which you want to enter the comment. Move the flashing cursor to the desired position.
- ② Use the function keys to make the selection.

Selection

 : Enter a comment.

 : Clear a comment (unit).

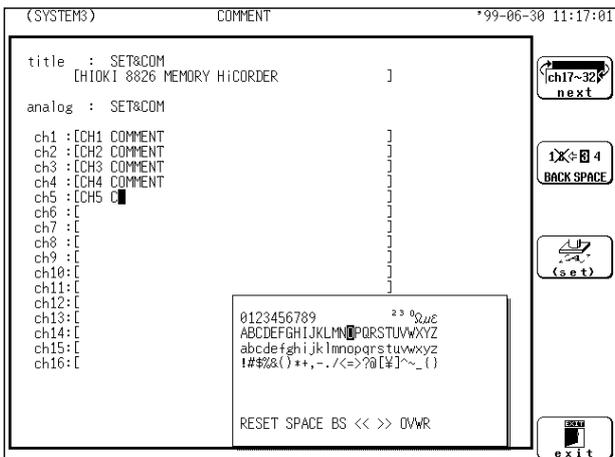


- ③ Use the CURSOR keys to select the character.

Selection

 : Enter selected character

 : Confirm entry and terminate input mode



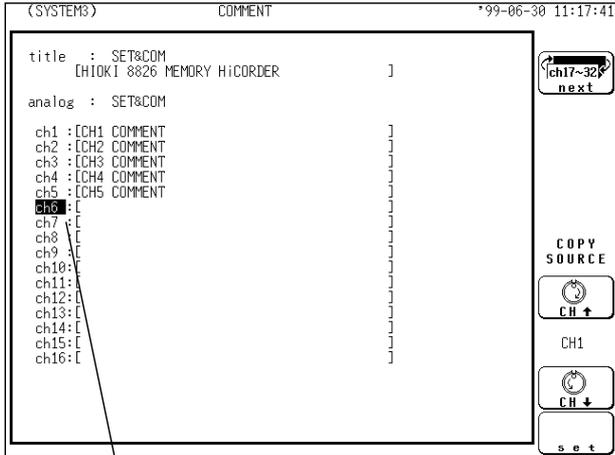
- ④ Press the **F1** 「SET」 key to enter it.

- ⑤ Repeat Steps ③ and ④ to enter a comment (using characters).

The file and directory names cannot include spaces.

Comment copy

A comment made on one channel can be copied to another channel. This can be done for either an analog or logic channel.



Copy target

Method

Screen: COMMENT (SYSTEM3)

- ① Press the **SYSTEM** key to call up the SYSTEM3 screen.
- ② Move the flashing cursor to the channel for which you want to copy the comment.
- ③ Use the function keys to select the channel to be copied.

Selection



: Channel number up

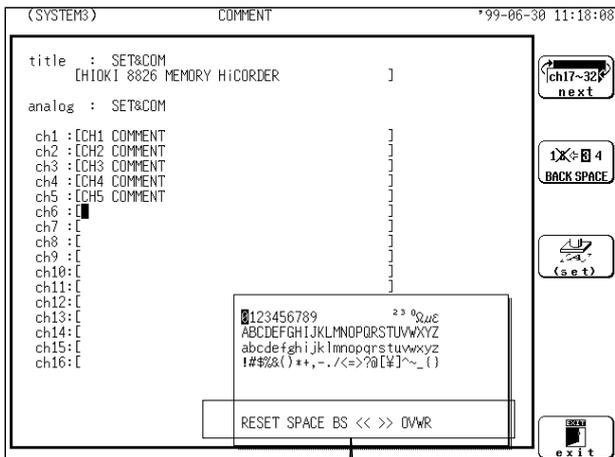


: Channel number down

- ④ Press the **F5** [SET] key to copy the comments for the selected channel.

Selection of "for ALL" enables the comments for the channel with the flashing cursor to be copied to all channels.

Description of Window Contents



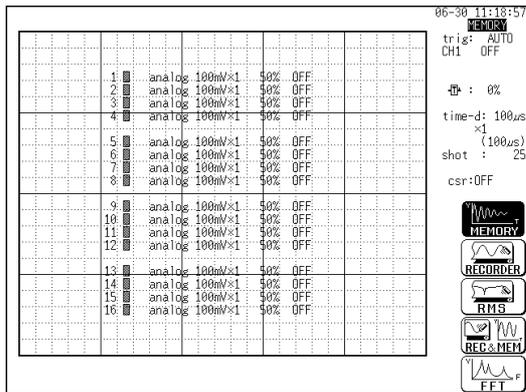
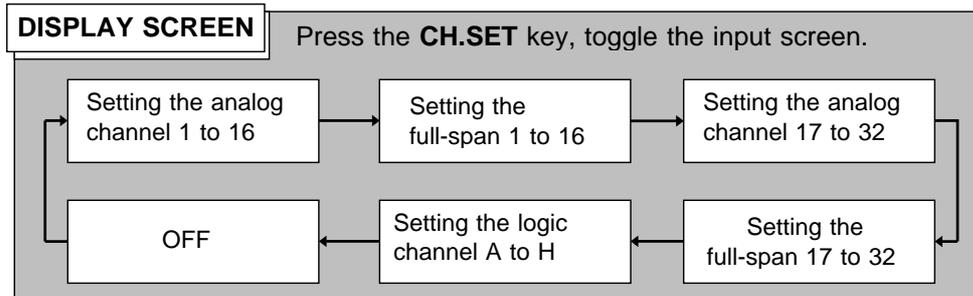
RESET SPACE BS << >> OVWR

- RESET : Recalls an unedited comment in comment input mode. Recalls the default units in unit input mode.
- SPACE : Enter a space.
- BS : Performs backspacing (same as the **BACK SPACE** key).
- << : Moves the input position to the left (same as the JOG control).
- >> : Moves the input position to the right (same as the JOG control).
- OVWR/INS : Switches the mode between overwrite and insert.

9.9 Setting the Display Screen

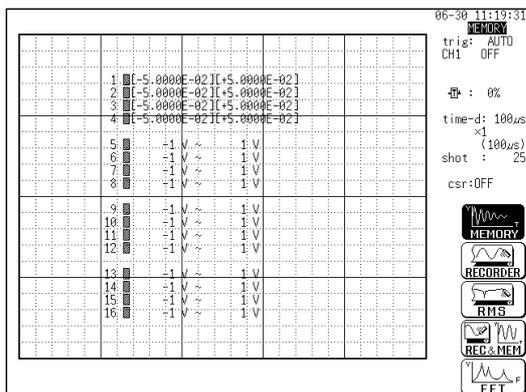
9.9.1 Entering by CH.SET key

Pressing the CH.SET key, enables the measurement conditions for each channel on the display screen to be set or changed. It is possible to make the settings, while monitoring the waveforms in real time on the DISPLAY screen . For details on settings, refer to section 9.3.



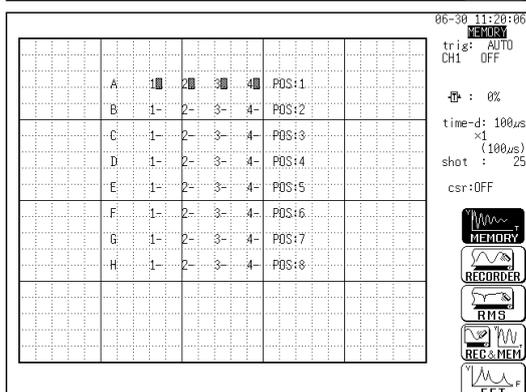
Setting the analog channels

- 1 Waveform Display Color
 - 2 Waveform Display Graph Position
 - 3 Unit name
 - 4 Measurement Range
 - 5 Magnification/Compression Ratio Vernier function
 - 6 Zero Position
 - 7 Low-Pass Filter
 - 8 Full span
- (Channel copy can not be carried out)



Setting the Variable Function

- 1 Full span display
 - 2 Variable Function
- (Input value can be changed)
can not set function ON/OFF

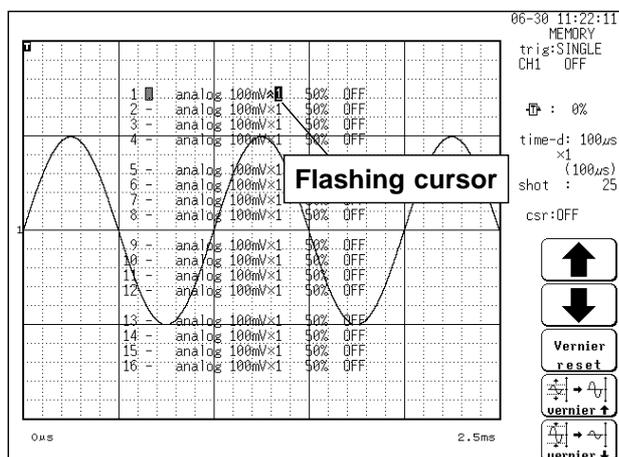


Setting the logic channels

- 1 Waveform Display Color
- 2 Waveform Display Graph position

9.9.2 Vernier Function

- Using fine adjustment, the input voltage can be matched to a desired reading.
- For example, an actual input voltage of 1.8 V can be converted to a 2.0 V reading.



⌘	Displays the magnified waveform.
×	Displays the waveform with no vernier scaling.
⌘	Displays the compressed waveform.

Method

- ① Press the **DISP** key to call up the **DISPLAY** screen.
- ② Use the **CH.SET** key to display the desired channel screen and use the cursor key to move the flashing cursor to the desired channel.
- ③ Use the function keys to select the vernier function.
Use ⌘ to magnify and ⌘ to compress.
The adjustment range is from 1/2 to 2 times of the original waveform.

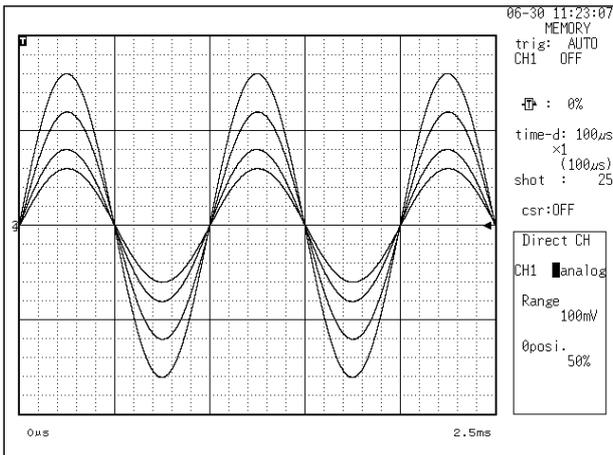
Selection

- Vernier reset** : Cancels the vernier function. (The original waveform returns.)
- vernier ↑** : Magnifies the waveform.
- vernier ↓** : Compresses the waveform.

NOTE

- The vernier function is not applicable to a waveform after waveform processing.
- The ratio of the waveform's enlargement or compression is not displayed.
- The vernier function ON/OFF setting can be checked after the **CH.SET** key is pressed to display each channel setting on the screen. This setting cannot be checked using the printout or list print function.

9.9.3 Direct Channel Setting



Method

- ① Press the **DISP** key to call the DISPLAY screen.
- ② Enter the Channel No. using the **CH&NUM** key, then press the **CH_{ENT}** key, the **POSITION** key, or the **RANGE** key to display the input window for the selected channel.
- ③ The zero position and measurement range can be set for the selected channel using the **POSITION** and **RANGE** keys.
- ④ Using the JOG control, the display can be turned on and off and the waveform display color can be set.
- ⑤ Press the **CH_{ENT}** key to finalize the inputs. When a channel number is entered using the **CH&NUM** key before the **CH_{ENT}** key is pressed, the screen shifts to Direct Channel Setting display for the next channel as soon as the inputs are finalized.

NOTE

When input channels are to be set using the **CH.SET** key, the following operations cannot be provided:

- ① Copying channel settings
- ② Variable function: ON/OFF (Input value can be changed)

9.10 Setting the 8937 VOLTAGE/TEMP UNIT

**WARNING**

A common GND is used for voltage and temperature input on all channels. Never input voltage and temperature simultaneously, since doing so could result in damage to the sample being tested.

NOTE

- Digital filter and drift compensation settings cannot be determined from the DISPLAY or CHANNEL screen. Check through the function display that appears when the flashing cursor is moved to the "range" item.
- Measurement conditions for the measured waveform data can be determined from the printed listing. The settings for the digital filter, drift compensation, reference contact compensation and the type of thermocouple can be determined. See Section 13.5.

The 8937 VOLTAGE/TEMP UNIT allows measurement of voltage or temperature on any channel.

Refer to Section 9.3 for the common settings.

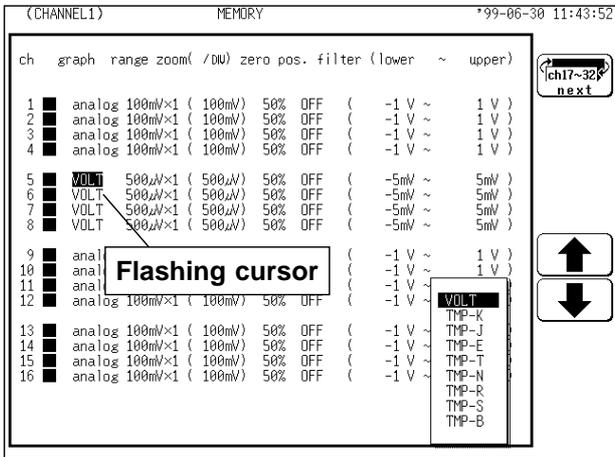
Voltage Measures the waveform voltage.

Temperature

TMP-	Measurement range	TMP-	Measurement range
K	-200 to 1350	N	-200 to 1300
E	-200 to 800	R	0 to 1700
J	-200 to 1100	S	0 to 1700
T	-200 to 400	B	300 to 1800

9.10.1 Making the Settings of Voltage Measurement

The digital filter can be configured when the measurement range is 500 μ V to 2 mV. The digital filter is a function which eliminates the noise component by additive averaging inside the amplifier. This results in a data update rate of about 100 μ s.



Method

Screen: CHANNEL1, DISPLAY

(1) Setting the measurement mode

- Call up the CHANNEL1 or DISPLAY screen.
- Use the **CH.SET** key to display the desired channel screen.
- Use the **CURSOR** key to move the flashing cursor to the **graph** position.
- Use the function keys, the JOG control to select the **VOLT**.

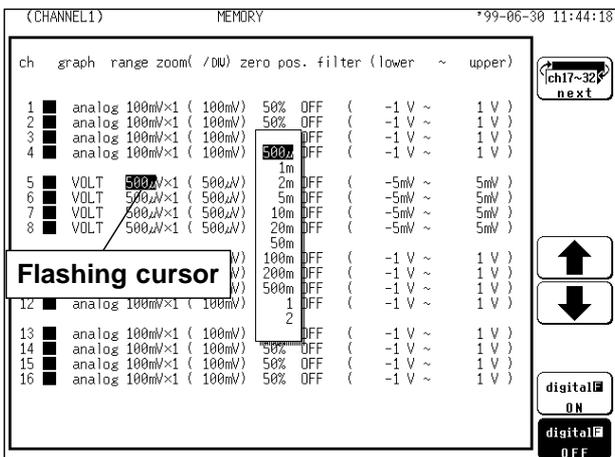
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



(2) Setting the measurement range

- Move the flashing cursor to the position shown in the figure on the left.
- Use the JOG control, the function keys or the **RANGE** key to set the measurement range.

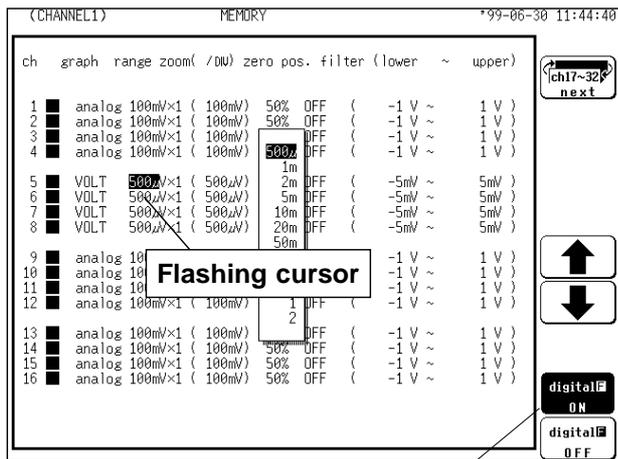
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



Digital filter : ON

(3) Setting the digital filter

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to set the digital filter.

Selection

digital ON

: Digital filter is enabled.
(Measurement range: 500 μ to 2 mV)

digital OFF

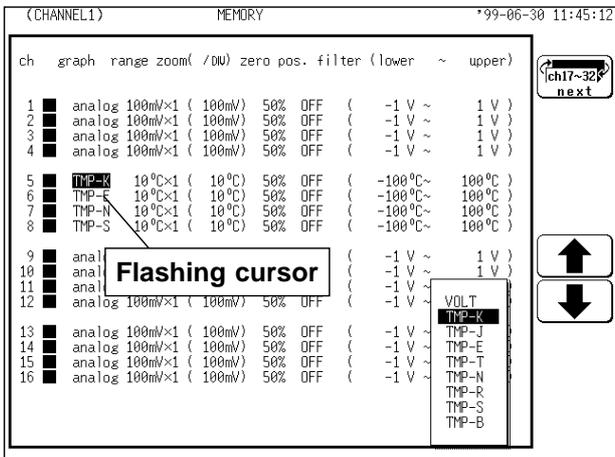
: Digital filter is disabled.

NOTE

When the digital filter has been set to ON and the measurement range is changed to one other than 500 μ V/DIV to 2 mV/DIV, the digital filter is automatically turned off. To turn on the digital filter, perform the setup procedure from the beginning.

9.10.2 Making the Settings of Temperature Measurement

Select the thermocouple type, drift correction and reference junction compensation to be used.



Method Screen: CHANNEL1, DISPLAY

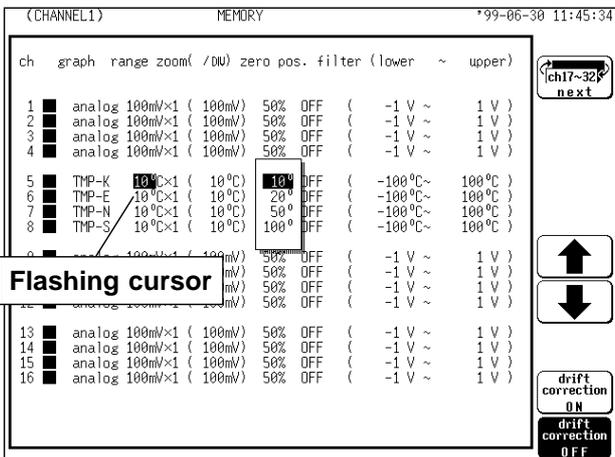
(1) Setting the measurement mode

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the **CH.SET** key to display the desired channel screen.
- ③ Use the **CURSOR** key to move the flashing cursor to the **graph** position.
- ④ Use the function keys, the JOG control to select the **TEMP-**.

The thermocouple used is selected at the same time.

Selection

-  : Move the arrow up in the selection window.
-  : Move the arrow down in the selection window.

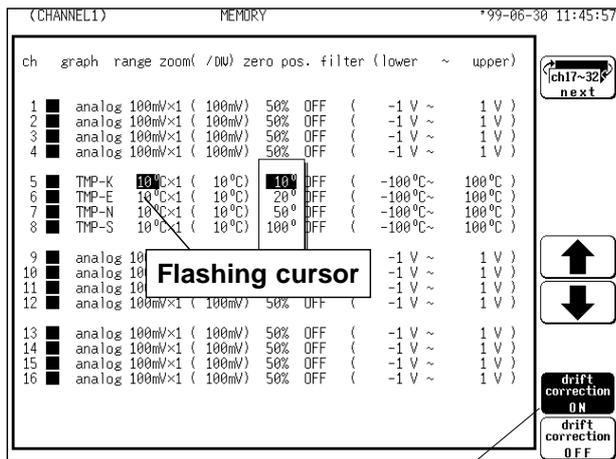


(2) Setting the measurement range

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to set the measurement range.

Selection

-  : Move the arrow up in the selection window.
-  : Move the arrow down in the selection window.



Drift compensation : ON

(3) Setting the drift compensation

Drift compensation is a function that periodically (about once per second) cancels the variances in the reference voltage that accumulate over time.

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys \uparrow and \downarrow to set the drift compensation.

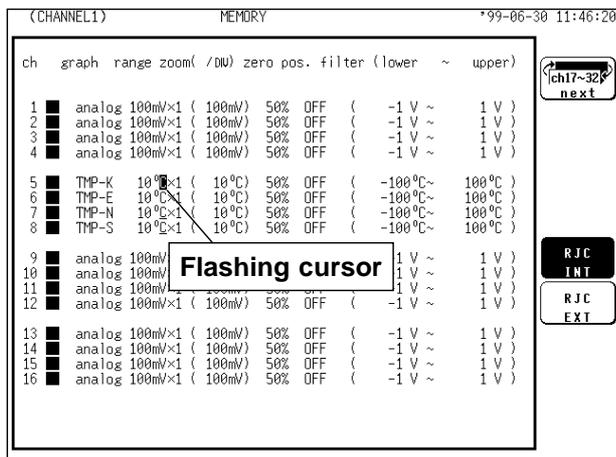
Selection

drift correction ON

: Drift compensation is enabled.

drift correction OFF

: Drift compensation is disabled.



(4) Setting the reference junction compensation

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys \uparrow and \downarrow to set the reference junction compensation.

Selection

RJC INT

: Reference junction compensation is performed internally by the 8937. (Measurement accuracy is the sum of the accuracy of temperature measurement plus reference junction compensation accuracy.)

RJC EXT

: Reference junction compensation is not performed by the 8937. Select this option when using an external reference junction compensation unit. (Measurement accuracy refers only to the accuracy of temperature measurement.)

Discriminating between internal and external reference junction compensation

10°C

Internal: No underbar appears below C.

$10^{\circ}\underline{\text{C}}$

External: The underbar appears below C.

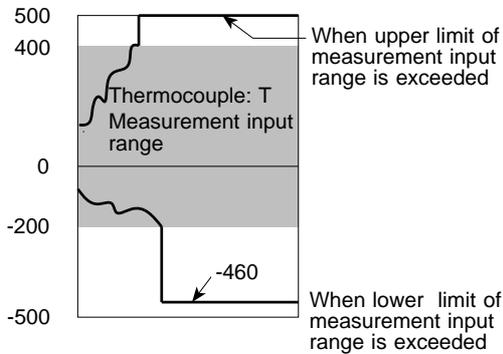
Measurement range and upper and lower limits of measurement input

Note that the upper and lower limits of measurement input vary according to measurement range. Waveform saturation will result if the limits indicated in the table below are exceeded.

Measurement range	10 /DIV	20 /DIV	50 /DIV	100 /DIV
Upper limit of measurement input	400	800	2000	4000
Lower limit of measurement input	-92	-184	-460	-920

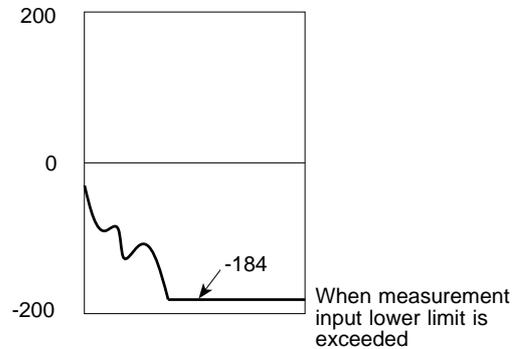
Examples of waveform display measurement according to measurement range
(Position: 50%, magnification/compression ratio: $\times 1$, NORMAL screen, thermocouple: T)

When thermocouple measurement range is exceeded



When the measurement range is 50 /DIV and the thermocouple measurement input range (-200 to 400) is exceeded

Within thermocouple measurement range



When the measurement range is 20 /DIV and the temperature is within the thermocouple measurement input range, but the 20 /DIV measurement input lower limit (-184) is exceeded

NOTE

- If ambient temperature changes suddenly, loss of thermal equilibrium can result in measurement error. When this occurs, allow the unit to acclimate to the new temperature for about one hour, then take measurements after thermal equilibrium is reached.
- It is recommended that drift compensation be turned ON when using a thermocouple with small thermoelectromotive force (sensor R, S or B) to record over an extended period of time in an environment where ambient temperature fluctuates.
- If the temperature input terminal is exposed to a strong draft, loss of thermal equilibrium at the input may result in measurement error. When taking measurements under such conditions, arrange the unit in such a manner that the input terminal is protected for direct exposure to drafts.
- Upon resetting the system, the "Input Selection" item is set to Analog.

9.11 Setting the 8938 FFT ANALOG UNIT

The 8938 FFT ANALOG UNIT contains an internal anti-aliasing filter required for FFT analysis. Enable the anti-aliasing filter when doing FFT analysis.

Refer to Section 9.3 for the common settings.

ch	graph	range	zoom(/DU)	zero	pos.	filter	(lower	~	upper)
1	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
2	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
3	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
4	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
5	■	■	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
6	■	■	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
7	■	■	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
8	■	■	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
9	■	analo				(	-1 V	~	1 V)
10	■	analo				(	-1 V	~	1 V)
11	■	analo				(	-1 V	~	1 V)
12	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
13	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
14	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
15	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)
16	■	analog	100mV×1 (100mV)	50%	OFF	(	-1 V	~	1 V)

Flashing cursor

Method Screen: CHANNEL1, DISPLAY

Setting the Anti-aliasing Filter

- Call up the CHANNEL1 or DISPLAYscreen.
- Use the CH.SET key to display the desired channel screen.
- Move the flashing cursor to the position shown in the figure on the left.
- Use the function keys to make the selection.

Selection



: Anti-aliasing filter is disabled.



: Anti-aliasing filter is enabled.

NOTE

- We recommend using an input unit equipped with an anti-aliasing filter that can be enabled to minimize sampling distortions during FFT analysis.
- Refer to Section 21.3.10 for more information about aliasing distortion and anti-aliasing filters.
- If the anti-aliasing filter is on, "A" is printed at the end of the filter settings page during list printing. Refer to Section 13.5.
- Refer to Section 8.3.3 for details about the relationship between the anti-aliasing filter cutoff frequency and the frequency range and time axis range.

9.12 Setting the 8939 STRAIN UNIT

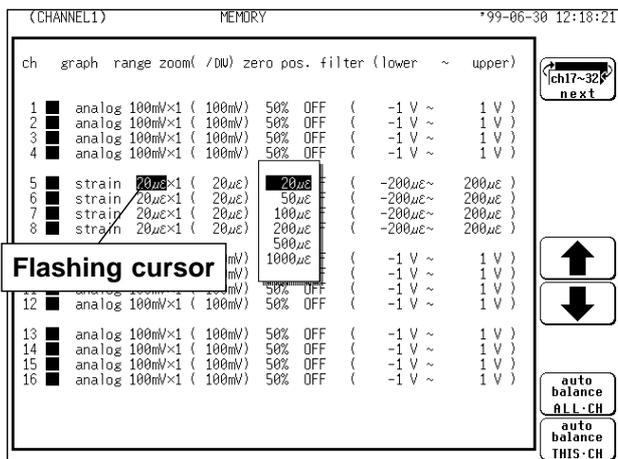
For the channel to which the 8939 STRAIN UNIT is assigned, an auto balancing must be executed through the range setup menu.

Auto balancing is a function by which the reference output level of the converter is adjusted to the specified zero position.

Before the auto balancing is performed, the strain unit must be warmed up for approximately 1 hour after power-on to stabilize its internal temperature.

The scaling function can be used to convert an output voltage from a sensor or similar into a physical quantity. See Section 9.7.2.

Refer to Section 9.3 for the common settings.



Method

Screen: CHANNEL1, DISPLAY

(1) Setting the measurement range

- Call up the CHANNEL1 or DISPLAY screen.
- Use the **CH.SET** key to display the desired channel screen.
- Move the flashing cursor to the position shown in the figure on the left.
- Use the function keys, the JOG control or the **RANGE** key to make the selection.

Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.

(2) Setting the auto balancing

- Move the flashing cursor to the point shown in the figure on the left.
- Use the function keys to set the auto balancing.

Selection



: All strain channels execute the auto balancing.



: Only selected channel execute the auto balancing.

NOTE

- Connect the sensor, make sure there is no input, and execute auto balancing.
- Auto balancing is disabled during measurement.
- The key manipulation is rejected during measurement.
- Repeat the auto balancing when the input unit was changed, when the power is on/off, or when the system is set to reset, when the measurement range is change, when the strain gauge adapter is change.
- When there is a sudden change in ambient temperature the zero position may drift. To assure continued measurement precision, perform the auto balancing again.

9.13 Setting the 8940 F/V UNIT

The 8940 F/V UNIT can measure frequency, count, pulse duty ratio, voltage and current on each channel (with one measurement type per channel). Refer to Section 9.3 for the common settings.

Measurement Mode Selection

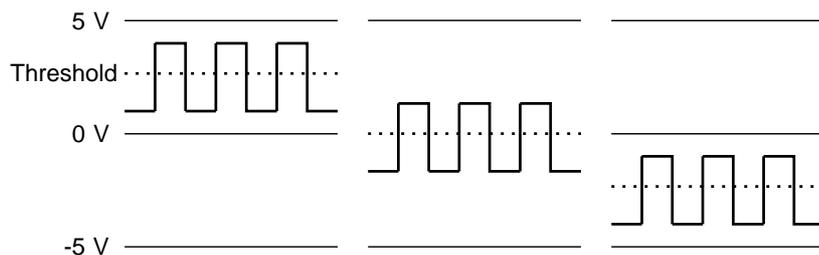
Select the measurement mode from the following:

Frequency	Obtains the frequency of the input pulse corresponding to the measured waveform.
Count	Counts the number of input pulses.
Pulse Duty Ratio	Obtains the duty ratio of the measured waveform.
Voltage	Measures the waveform voltage.
Current	Measures the waveform current.

NOTE

- Hold and pull up settings cannot be determined from the DISPLAY or CHANNEL screen. Check through the function display that appears when the flashing cursor is moved to the "range" item.
- During list printing, Hold and Pull-Up on/off selections are printed. Refer to Section 13.5 for details.
- The input coupling is fixed at DC for Frequency, Count and Pulse Duty Ratio measurement modes.
- Measurement results may differ depending on the threshold setting. To obtain the correct measurement, set the threshold to match the input waveform.

Threshold Setting Example

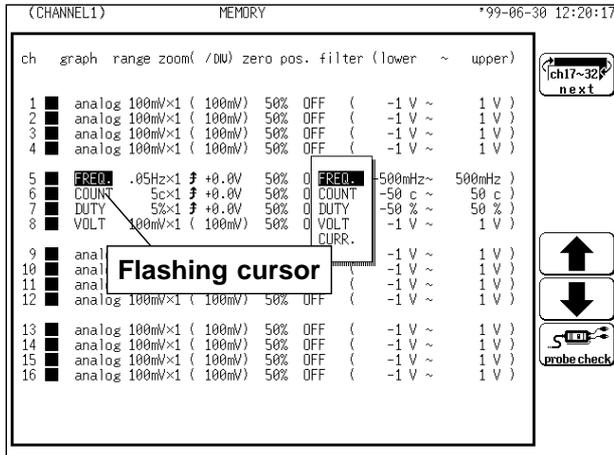


- Probe check function is available only when using the 9322 DIFFERENTIAL PROBE. For details on operating procedure, refer to the "9322 DIFFERENTIAL PROBE" Instruction Manual.

9.13.1 Setting Frequency Mode

Select the measurement range. For the Frequency mode, three types of measurement can be performed depending on the measurement range.

Frequency can be measured from 0.05 Hz to 5 kHz, RPM can be measured from 5 to 500 rpm, or commercial power can be measured at P50 or P60 Hz.



Method Screen: CHANNEL1, DISPLAY

(1) Setting the measurement mode

- Call up the CHANNEL1 or DISPLAY screen.
- Use the **CH.SET** key to display the desired channel screen.
- Use the **CURSOR** key to move the flashing cursor to the **graph** position.
- Use the function keys or the JOG control to set the **FREQ.**

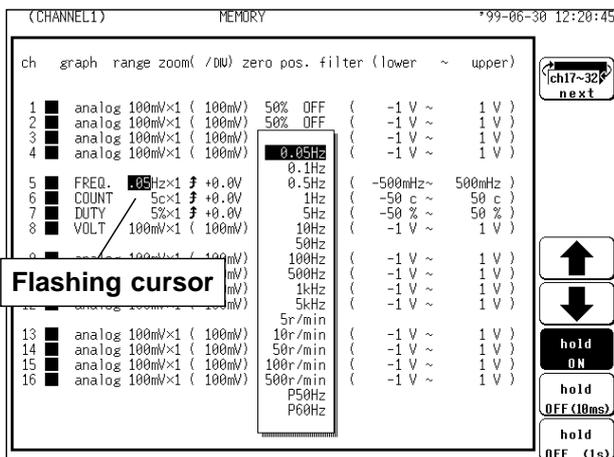
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



(2) Setting the measurement range

- Move the flashing cursor to the position shown in the figure on the left.
- Use the function keys, the JOG control or the **RANGE** key to make the selection.

Selection



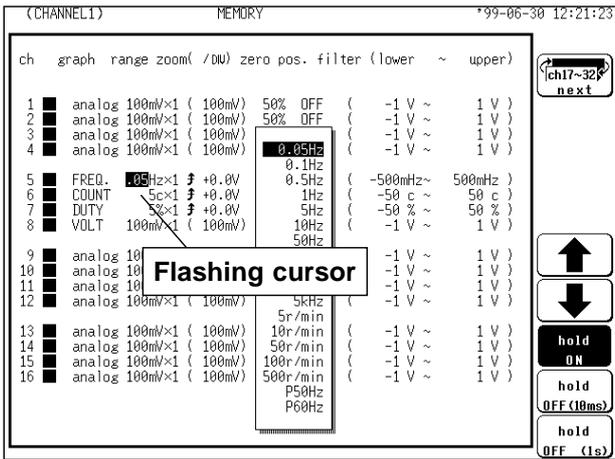
: Move the arrow up in the selection window.



: Move the arrow down in the selection window.

NOTE

In the Frequency mode, the measurement range can be set to P50Hz or P60Hz for commercial power. Although 0 Hz is the usual zero position, in this case 50 or 60 Hz becomes the zero position.



(3) Setting the hold function

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to set the digital filter.

Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



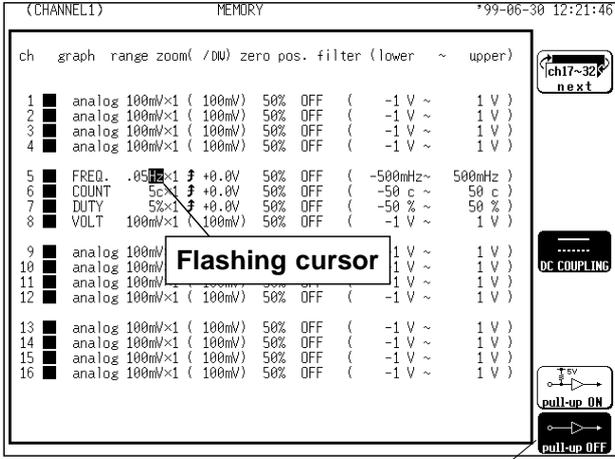
: Holds the last value until the next frequency measurement is confirmed.



: Half of the last value is displayed if the next frequency measurement is not confirmed within 10 ms.



: Half of the last value is displayed if the next frequency measurement is not confirmed within 1 s.



Pull-up resistance: OFF

(4) Setting the pull-up resistance

Set the pull-up resistance on or off. Pull-up resistance is used when connecting to an open collector output signal. For normal measurements, disable the pull-up resistance (set to OFF).

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

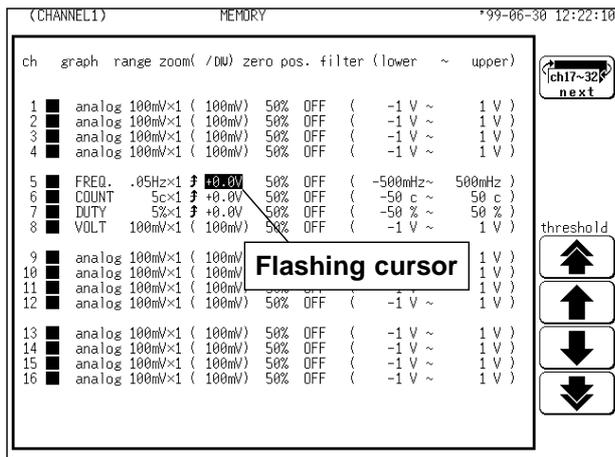
Selection



: Pull-up resistance is enabled (ON). (for connection to open collector output)



: Pull-up resistance is disabled (OFF).



(5) Setting the threshold value

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Selection

-  : Value up, large step
-  : Value up, small step
-  : Value down, small step
-  : Value down, large step

About Hold ON/OFF

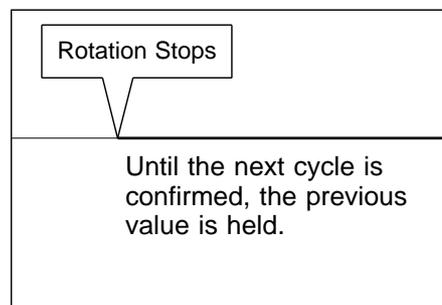
(1) Difference by ON and OFF of hold in stopping condition.

For Frequency and RPM measurement, results are displayed after one confirmation cycle.

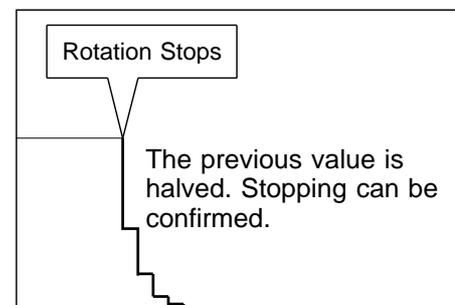
When measuring phenomena such as stopping of a rotating body, if Hold is ON, stopping cannot be detected because there is no confirmation cycle.

When Hold is OFF, half of the previous measurement value is displayed if the confirmation cycle does not occur within the specified time (10 ms or 1 s).

Therefore, a condition such as stopping can be estimated by gradually approaching zero.



【 HOLD : ON 】

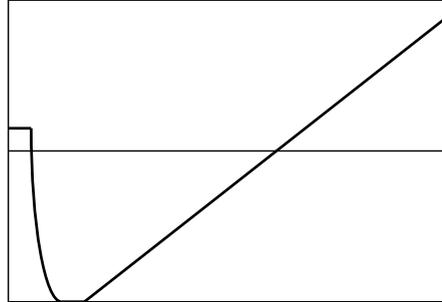


【 HOLD : OFF 】

(2) The following are differences depending on whether Hold is ON or OFF when the frequency drops to 0 Hz from a certain frequency, then increases from that point.

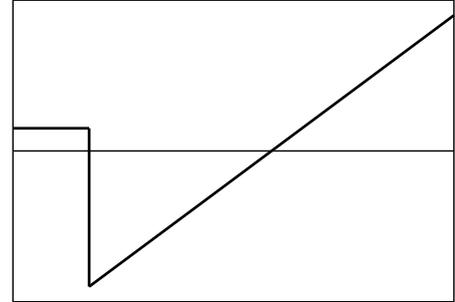
【 Actual Event 】

Frequency drops to 0Hz from a certain frequency, then increases from that point



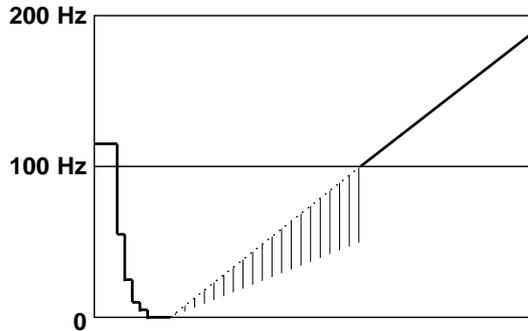
【 When Hold is ON 】

The initial value is held (the signal is not halved), so the result is as shown in the diagram below.



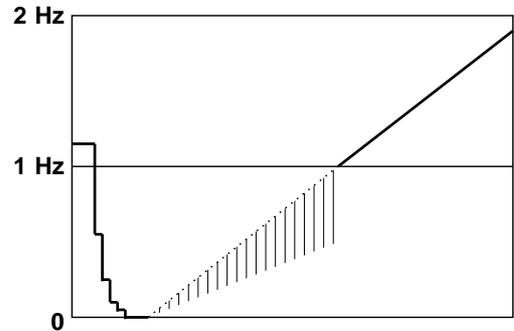
【 When Hold is OFF (10 ms) 】

At frequencies of less than 100 Hz, the signal is halved.



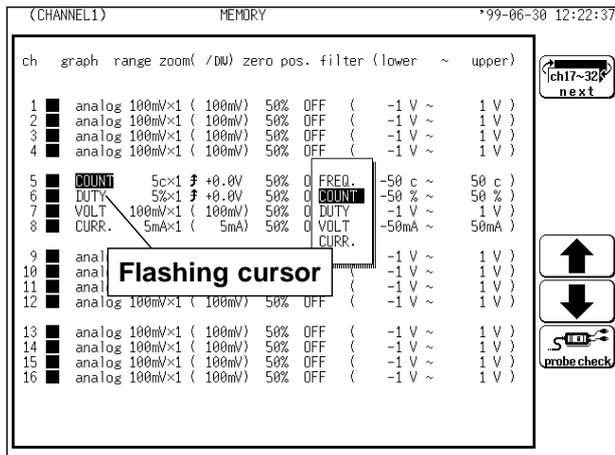
【 When Hold is OFF (1 s) 】

At frequencies of less than 1 Hz, the signal is halved.



9.13.2 Setting the Count Mode

For count mode, the unit of measurement is 'c' (counts).



Method Screen: CHANNEL1, DISPLAY

(1) Setting the measurement mode

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the **CH.SET** key to display the desired channel screen.
- ③ Use the **CURSOR** key to move the flashing cursor to the **graph** position.
- ④ Use the function keys or the JOG control to set the **COUNT**.

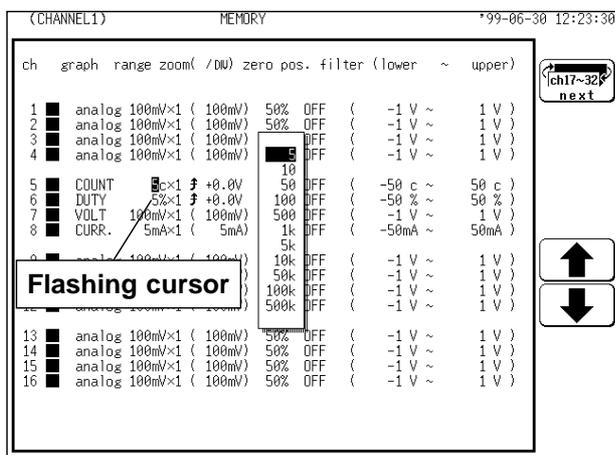
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



(2) Setting the measurement range

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys, the JOG control or the **RANGE** key to make the selection.

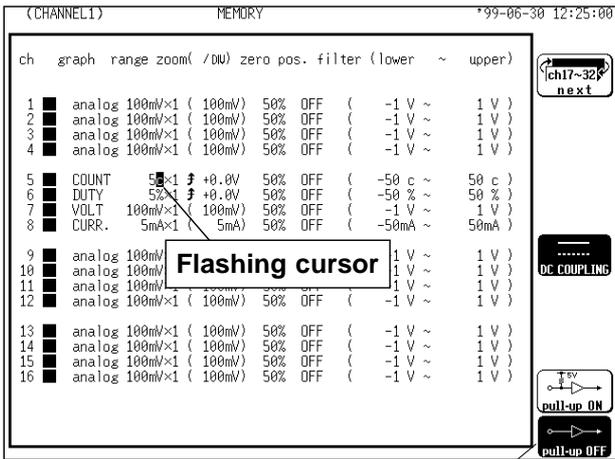
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



Pull-up resistance: OFF

(3) Setting the pull-up resistance

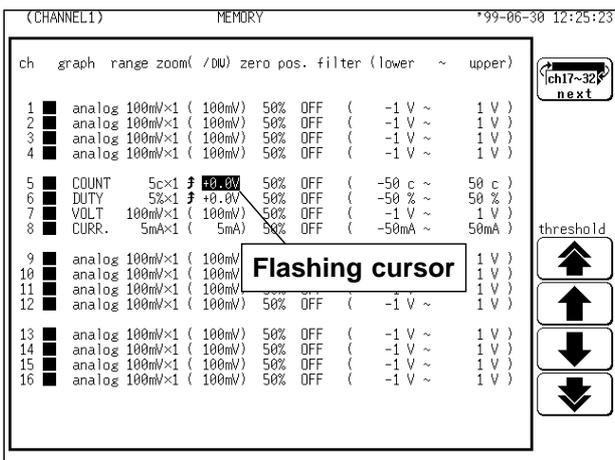
Set the pull-up resistance on or off. Pull-up resistance is used when connecting to an open collector output signal. For normal measurements, disable the pull-up resistance (set to OFF).

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Selection

 : Pull-up resistance is enabled (ON). (for connection to open collector output)

 : Pull-up resistance is disabled (OFF).



(4) Setting the threshold value

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Selection

 : Value up, large step

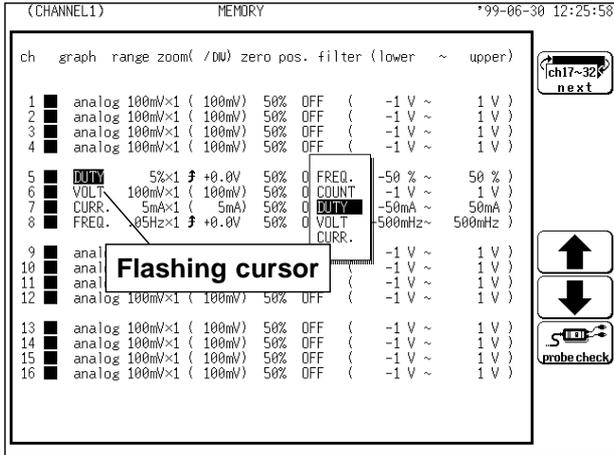
 : Value up, small step

 : Value down, small step

 : Value down, large step

9.13.3 Setting the Pulse Duty Ratio Mode

The pulse duty ratio measures the ratio of single High pulses.



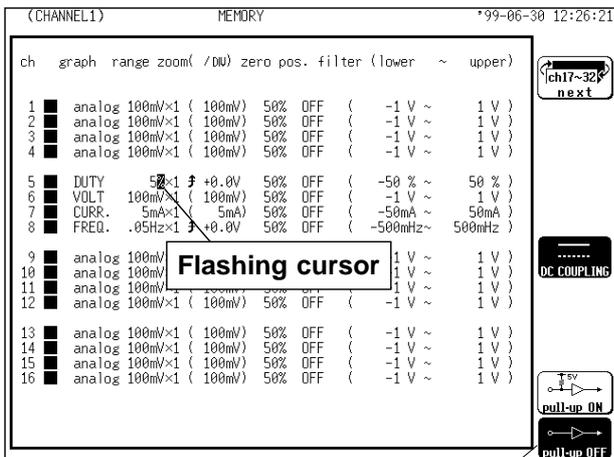
Method Screen: CHANNEL1, DISPLAY

(1) Setting the measurement mode

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the CH.SET key to display the desired channel screen.
- ③ Use the CURSOR key to move the flashing cursor to the **graph** position.
- ④ Use the function keys or the JOG control to set the **DUTY**.

Selection

-  : Move the arrow up in the selection window.
-  : Move the arrow down in the selection window.



(2) Setting the pull-up resistance

Set the pull-up resistance on or off. Pull-up resistance is used when connecting to an open collector output signal. For normal measurements, disable the pull-up resistance (set to OFF).

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Pull-up resistance: OFF

Selection

-  : Pull-up resistance is enabled (ON). (for connection to open collector output)
-  : Pull-up resistance is disabled (OFF).

ch	graph	range	zoom(/DU)	zero	pos.	filter	(lower	~	upper)
1	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
2	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
3	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
4	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
5	■ COUNT	5c×1	(10.0V)	50%	OFF	(	-50 c	~	50 c)
6	■ DUTY	5%×1	(+0.0V)	50%	OFF	(	-50 %	~	50 %)
7	■ VOLT	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
8	■ CURR.	5mA×1	(5mA)	50%	OFF	(	-50mA	~	50mA)
9	■ analog	100mV×1	(100mV)						1 V)
10	■ analog	100mV×1	(100mV)						1 V)
11	■ analog	100mV×1	(100mV)						1 V)
12	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
13	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
14	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
15	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)
16	■ analog	100mV×1	(100mV)	50%	OFF	(	-1 V	~	1 V)

(3) Setting the threshold value

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Selection



: Value up, large step



: Value up, small step

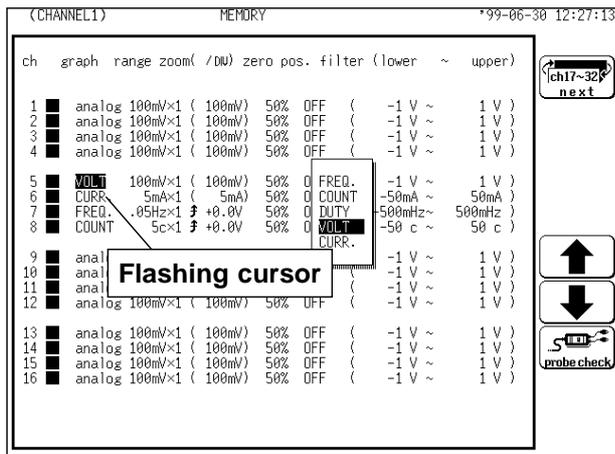


: Value down, small step



: Value down, large step

9.13.4 Setting the Voltage Mode



Method Screen: CHANNEL1, DISPLAY

(1) Setting the measurement mode

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the **CH.SET** key to display the desired channel screen.
- ③ Use the **CURSOR** key to move the flashing cursor to the **graph** position.
- ④ Use the function keys or the JOG control to set the **VOLT**.

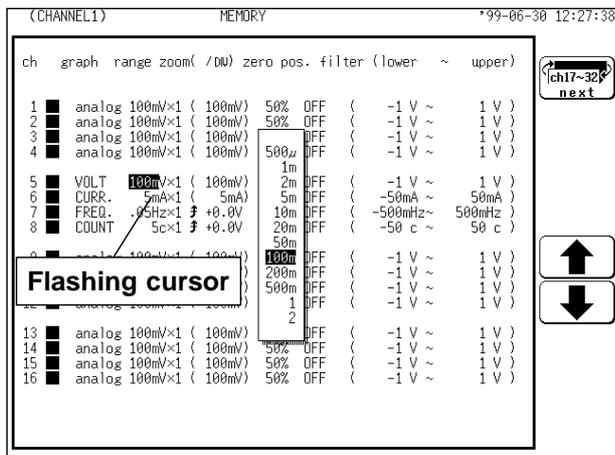
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



(2) Setting the measurement range

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys, the JOG control or the **RANGE** key to make the selection.

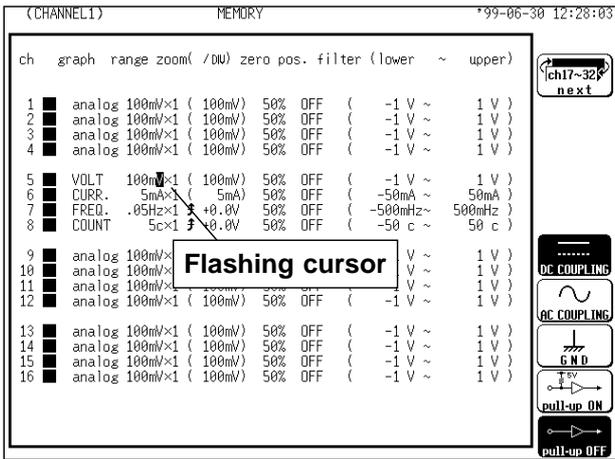
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.

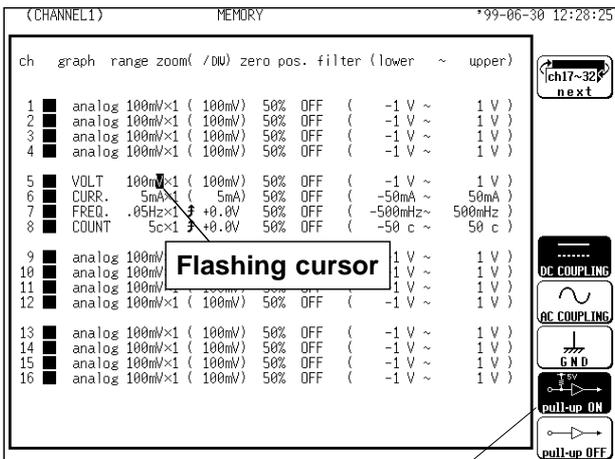


(3) Setting the input coupling

- 1 Move the flashing cursor to the position shown in the figure on the left.
- 2 Use the function keys to make selection.

Selection

-  : DC coupling
-  : AC coupling
-  : The input signal is not connected.



(2) Setting the pull-up resistance

Set the pull-up resistance on or off. Pull-up resistance is used when connecting to an open collector output signal. For normal measurements, disable the pull-up resistance (set to OFF).

- 1 Move the flashing cursor to the position shown in the figure on the left.
- 2 Use the function keys to make selection.

Selection

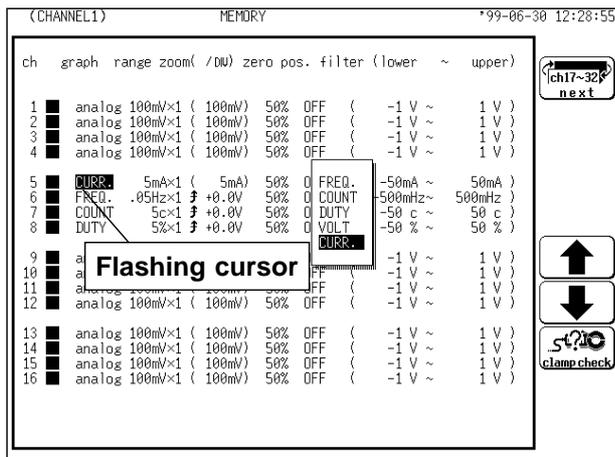
-  : Pull-up resistance is enabled (ON). (for connection to open collector output)
-  : Pull-up resistance is disabled (OFF).

Pull-up resistance: ON

9.13.5 Setting the Current Mode

Current measurement is possible by connecting a clamp-on sensor/probe using the Model 9318 or 9319 CONVERSION CABLE. The following table shows which Cable to use with each sensor/probe model. Refer to Section 2.4.4 for connection methods.

Conversion cable	Clamp on sensor / probe
9318	9270, 9271, 9272, 9277, 9278, 9279
9319	3273



Method Screen: CHANNEL1, DISPLAY

(1) Setting the measurement mode

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the **CH.SET** key to display the desired channel screen.
- ③ Use the **CURSOR** key to move the flashing cursor to the **graph** position.
- ④ Use the function keys or the JOG control to set the **CURR.**

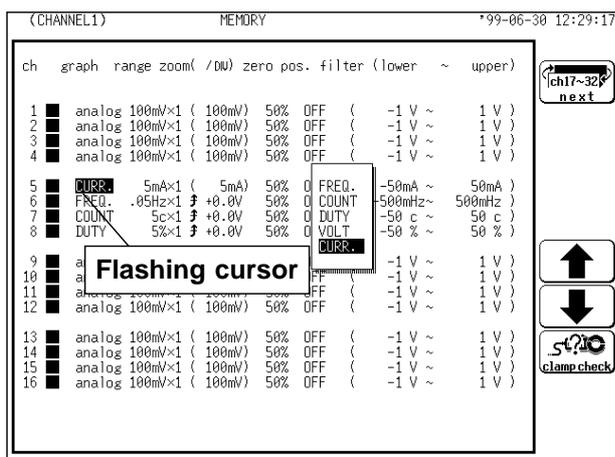
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



(2) Checking the Clamp

The clamp check identifies the clamp sensor (probe) for use by the 8940. It must be performed before current measurement. Up to 6 channels can be selected for current measurement at the same time on the 8826.

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Connect the clamp to be used and select Clamp Check from the displayed function keys.

Selection



: Clamp check is carried out.

NOTE

- Up to six channels can be selected for current measurement at the same time on the 8826. However, the clamp check does not work correctly when more than six clamps are installed. Remove any extra clamps so that no more than six are installed before attempting the clamp check.

9.14 Setting the 8947 CHARGE UNIT

The 8947 CHARGE UNIT can measure either voltage or acceleration on each channel (one channel per measurement type). Refer to Section 9.3 for the common settings.

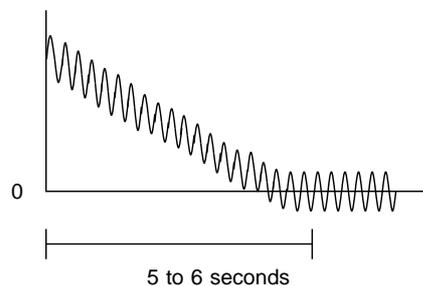
CHARGE	Measures using charge-output type voltage acceleration pickup sensor
Preamp	Measures using internal-preamp type acceleration pickup sensor
Voltage	Measures voltage waveforms

Notes regarding measurement

Auto-ranging cannot be used on a channel set for Charge or Preamp measurement mode.

In the following cases, five to six seconds should be allowed for input to stabilize:

- (1) In the Charge measurement mode, after switching between the six high-sensitivity ranges and the six low-sensitivity ranges.
- (2) When starting a new measurement after selecting the Preamp measurement mode.

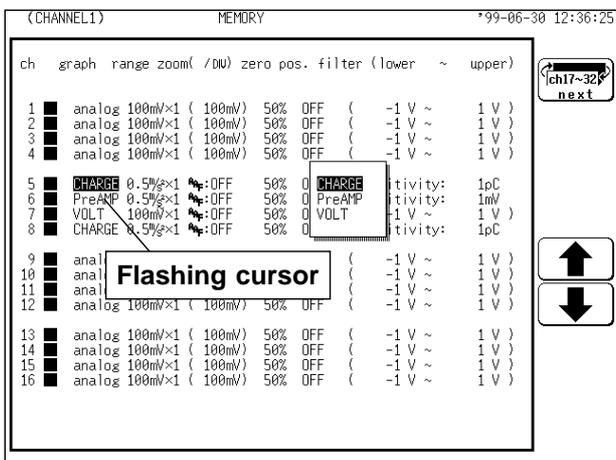


9.14.1 Setting the Acceleration Measurement (Charge/Preamp)

WARNING

When the PREAMP measurement mode is selected, voltage (15 V at 2 mA) is applied internally to the BNC connector when measurement starts. To avoid electric shock and damage to measurement objects, select a measurement mode other than PREAMP or turn the unit off when connecting a sensor or probe to the BNC terminals.

When the Preamp measurement mode is selected, or when power is turned on with the Preamp mode previously selected, a message appears to confirm whether the first operation is initiated by pressing the START key. Press the "exec" function key on the display to proceed.



Method

Screen: CHANNEL1, DISPLAY

(1) Setting the measurement mode

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the CH.SET key to display the desired channel screen.
- ③ Use the CURSOR key to move the flashing cursor to the **graph** position.
- ④ Use the function keys or the JOG control to set the **CHARGE** or **PreAMP**.

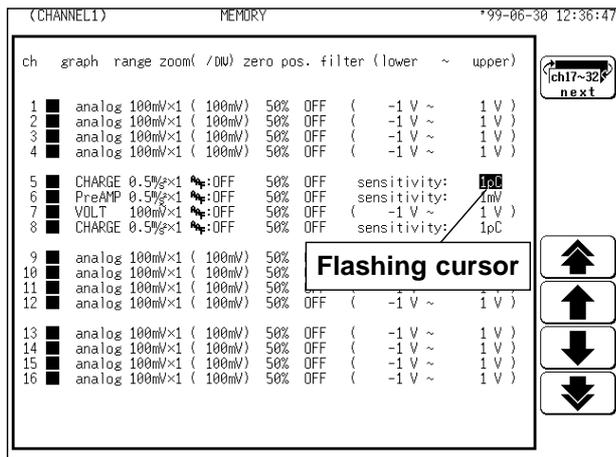
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



(2) Setting the sensor sensitivity

Set the sensor sensitivity. Sensor sensitivity is the value of the acceleration sensor. The measurement range varies according to sensor sensitivity. Set the sensor sensitivity before you set the measurement range. Refer to Section 9.14.2.

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Selection



: Value up, large step



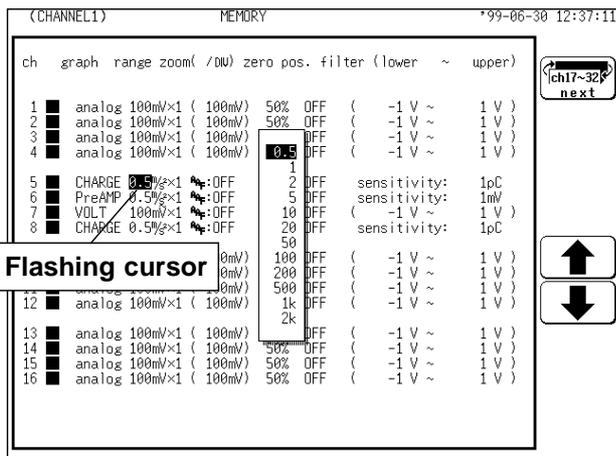
: Value up, small step



: Value down, small step



: Value down, large step



(3) Setting the measurement range

The measurement range varies according to sensor sensitivity. Set the sensor sensitivity before you set the measurement range.

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Selection



: Value up, large step



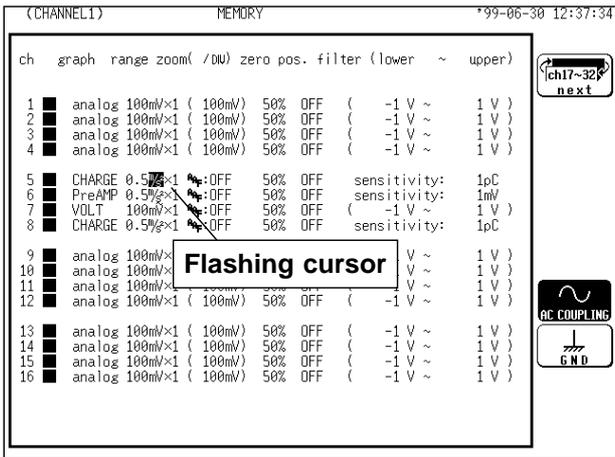
: Value up, small step



: Value down, small step



: Value down, large step



(4) Setting the input coupling

DC coupling is not available in the Charge and Preamp modes.

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

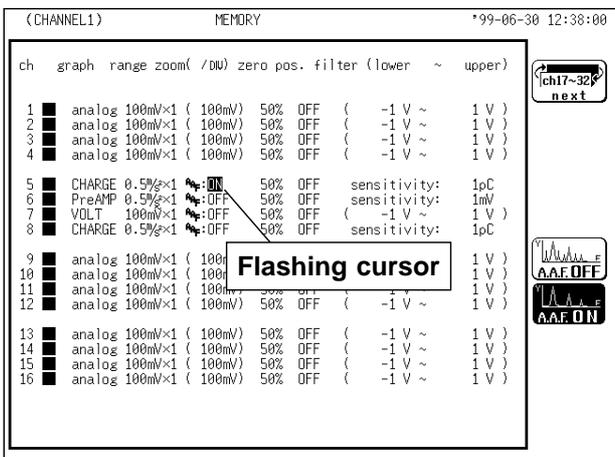
Selection



: AC coupling



: The input signal is not connected.



(5) Setting the Anti-aliasing Filter

Enable the anti-aliasing filter to prevent aliasing distortion. The cut-off frequency changes automatically when setting the frequency and time axis ranges.

The anti-aliasing filter can only be selected from the CHANNEL screen.

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Selection



: Anti-aliasing filter is disabled.



: Anti-aliasing filter is enabled.

NOTE

Refer to Section 8.3.3 for details about the relationship between the anti-aliasing filter cutoff frequency and the frequency range and time axis range.

9.14.2 Setting the Sensor Sensitivity

Sensor sensitivity is set in meters-per-second squared (m/s^2) units. However, some acceleration sensors use G (gravitational constant) units, in which case the read value should be divided by 9.8 (m/s^2).

Example 1

If specified sensor sensitivity is written as 1.08 ($pC/(m/s^2)$); sensor sensitivity level should be set to 1.08.

Example 2

If specified sensor sensitivity is written as 64.0(pC/G);

$$64.0 / 9.8 = 6.53 \text{ (pC/(m/s}^2\text{))}$$

sensor sensitivity level should be set to 6.53.

About Units

This device normally measures in units of charge level per m/s^2 , but the units can be changed to charge level per G by the scaling function. Scaling can be set as follows:

Conversion ratio method	2-point method
EU/V : 1/9.8 = 0.1020E+00	9.8000E+00 1.0000E+00
Offset : 0.0000E+00	0.0000E+00 0.0000E+00
EU : G	EU : G

Refer to Section 9.7 for the detail settings.

Using a sensor outside of the setting range

The setting range of sensor sensitivity is 0.1 to 10 $pC/(m/s^2)$ or 0.1 to 10 $mv/(m/s^2)$, but a sensor operating outside of this range can be used by enabling scaling.

- (1) Display the CHANNEL1 screen, and set the sensor sensitivity. Multiply the actual sensor sensitivity to be used by the appropriate factor to produce a settable number (0.1 to 10), and enter that factor.
- (2) Display the SCALING screen, and turn on Charge or Preamp mode for the channel using the sensor that is outside of the setting range.
- (3) Set the same conversion ratio as the sensor sensitivity factor.

Example 1

Sensor sensitivity is 23.4 $pC/(m/s^2)$:

- Multiply sensor sensitivity by 1/2.34 and set 10 $pC/(m/s^2)$ as the sensor sensitivity.
- Set the scaling.

Conversion ratio method	2-point method
EU/V : 10/23.4 = 0.4274E+00	2.3400E+01 1.0000E+01
Offset : 0.0000E+00	0.0000E+00 0.0000E+00
EU : m/s^2	EU : m/s^2

Example 2

Sensor sensitivity is 0.05 pC/(m/s²):

- Multiply sensor sensitivity by 2 and set 0.1 pC/(m/s²) as the sensor sensitivity.
- Set the scaling.

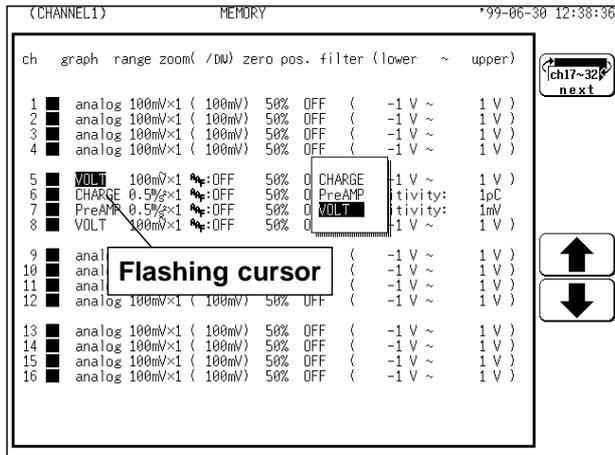
Conversion ratio method

EU/V : 0.1/0.05 = 2.0000E+00
Offset : 0.0000E+00
EU : m/s²

2-point method

0.0500E+00 0.1000E+00
0.0000E+00 0.0000E+00
EU : m/s²

9.14.3 Setting the Voltage Mode



Method Screen: CHANNEL1, DISPLAY

(1) Setting the measurement mode

- ① Call up the CHANNEL1 or DISPLAY screen.
- ② Use the **CH.SET** key to display the desired channel screen.
- ③ Use the **CURSOR** key to move the flashing cursor to the **graph** position.
- ④ Use the function keys or the JOG control to set the **VOLT**.

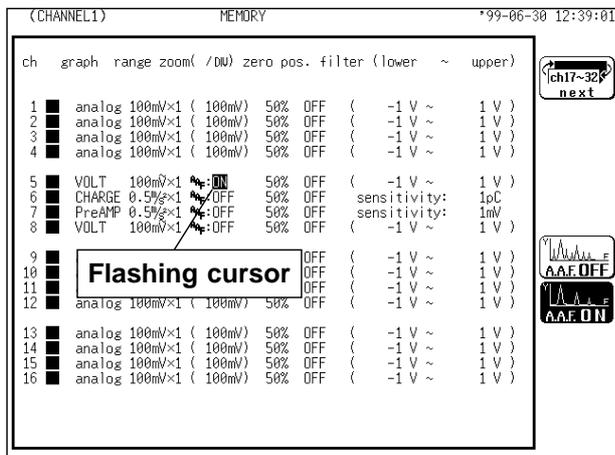
Selection



: Move the arrow up in the selection window.



: Move the arrow down in the selection window.



(2) Setting the Anti-aliasing Filter

The anti-aliasing filter can only be selected from the CHANNEL screen.

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make selection.

Selection



: Anti-aliasing filter is disabled.



: Anti-aliasing filter is enabled.

NOTE

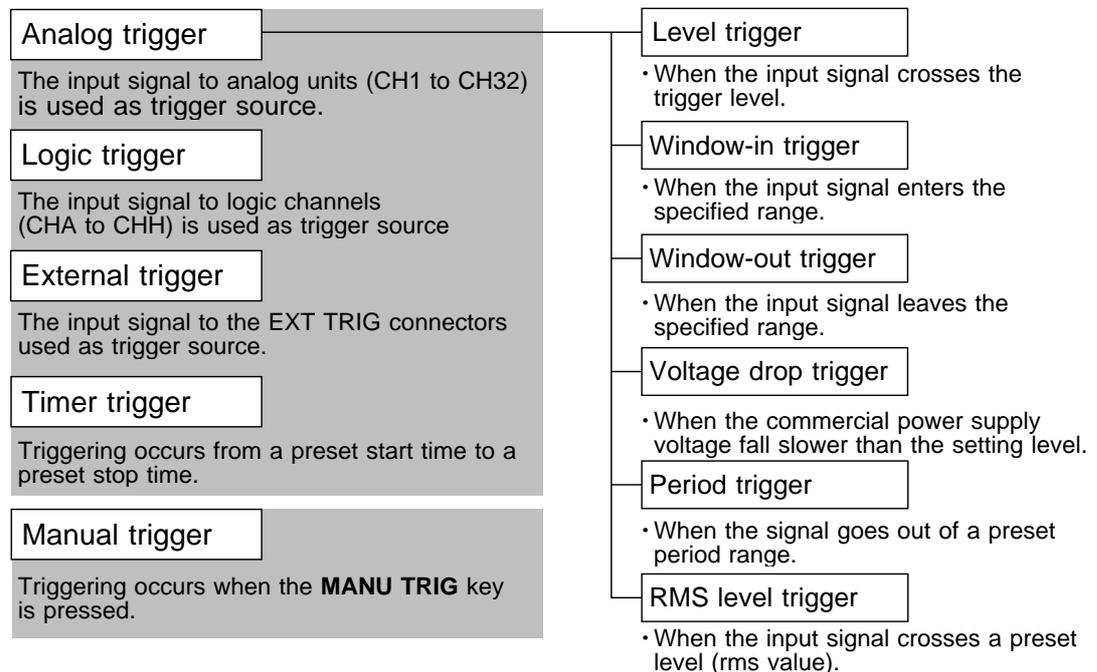
- We recommend using an input unit equipped with an anti-aliasing filter that can be enabled to minimize sampling distortions during FFT analysis.
- Refer to Section 21.3.10 for more information about aliasing distortion and anti-aliasing filters.
- If the anti-aliasing filter is on, "A" is printed at the end of the filter settings page during list printing. Refer to Section 13.5.
- Refer to Section 8.3.3 for details about the relationship between the anti-aliasing filter cutoff frequency and the frequency range and time axis range.

Chapter 10

Trigger Functions

10.1 Outline of the Trigger Function

- The term "trigger" refers to a signal which is used to control the timing for recording start or stop.
- The term "triggering has occurred" refers to the state when such a signal has activated recording start or stop.
- Trigger parameters for the various functions are set using the TRIGGER screen or the DISPLAY screen.



NOTE

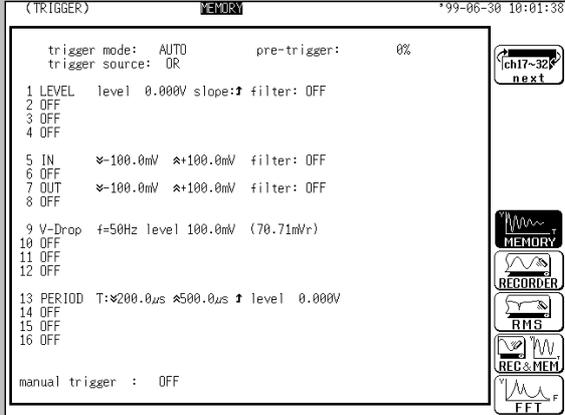
- The manual trigger is always activated when the **MANU TRIG** key is pressed, regardless of other trigger source settings.
- If the trigger settings (trigger source parameters, pre-trigger) are changed during recording, the measurement is restarted, using the new settings.

10.2 Operation Sequence (Trigger mode setting)

Setting the Trigger Mode

See Section 10.4.

This determines whether the trigger is accepted repeatedly after once completing a measurement operation.



SINGLE

Trigger is registered only once. After START key was pressed, unit starts waveform recording when triggering occurs and continues for preset recording length. Measurement then ends automatically.

REPEAT

Trigger is registered continuously. Unit is in trigger standby condition when trigger conditions are not met. Measurement ends when STOP key is pressed.

AUTO

(MEM and FFT only)

Trigger is registered continuously. If trigger conditions are not met within 1 second, waveform recording starts automatically and continues for preset recording length. Measurement ends when STOP key is pressed

TIMER

(REC&MEM only)

Activate recording at preset times. Triggering can be performed at constant intervals within a preset start time and end time.

Setting the Pre-trigger

See Section 10.5.

Memory Recorder :
REC & MEM, FFT

In the memory recorder function, using the recording start point as 0% and the recording end point as 100%, the trigger point can be specified in percent.

RMS Recorder :

In the RMS recorder function, using the recording start point as 0 DIV , the trigger point can be specified in DIV (0, 5, 10 DIV).

Setting the Trigger Timing

See Section 10.6.

Recorder :

The moment the trigger occurs, the time related to the waveform being recorded can be set.

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.

START&STOP

Recording starts when the trigger is applied, and stops when the trigger is applied next.

Setting Trigger Source AND/OR Linking

The analog trigger, logic trigger, and timer trigger can be linked with the AND/OR logical operators.

See Section 10.7.

OR

Triggering occurs when conditions for one trigger are met.

AND

Triggering occurs when conditions for all triggers are met.

Select the Trigger Type

Analog Trigger

- The analog signal input channels can be used as trigger source.
- The type of trigger that can be used for the various functions is limited.

Level Trigger

See Section 10.8.1.

Triggering occurs when the input signal crosses the preset trigger level (voltage) with the preset trigger slope (\uparrow , \downarrow).
(MEM, REC, REC&MEM, FFT)

Window-in Trigger

See Section 10.8.2.

Set upper limit level and lower limit level and activated when the input signal enters the range between these limits.
(MEM, REC, REC&MEM, FFT)

Window-out Trigger

See Section 10.8.2.

Set upper limit level and lower limit level and activated when the input signal leaves this range.
(MEM, REC, REC&MEM, FFT)

Voltage drop Trigger

See Section 10.8.3.

- This unit designed to measure commercial power supplies (50/60 Hz).
- This unit detects momentary voltage drops in commercial power supplies.
- When the peak of the voltage falls lower than the setting level, the trigger will occur.
(MEM, REC&MEM, FFT)

Period Trigger

See Section 10.8.4.

This function sets both the period reference voltage and the period range, and measures the rise (fall) period of the set reference voltage. When the measured period deviates from the specified range, triggering occurs.
(MEM, REC, REC&MEM, FFT)

RMS level Trigger

See Section 10.8.5.

- The commercial power supplies, 50/60 Hz and the DC signals can be measured.
- This trigger occurs when the input signal crosses a predetermined trigger level (rms value) in a particular direction ("slope": \uparrow or \downarrow).
(RMS Only)

Logic Trigger

See Section 10.9.

- The signal of a logic channel can be used as trigger source.
- A trigger pattern and logical operator (AND/OR) are specified, and triggering occurs when the trigger conditions are met.

External Trigger

See Section 10.10.

- An external signal can be used as trigger source.
- The external trigger is activated by either shorting the EXT TRIG terminal or applying a falling edge signal going below 2.5 V.

Timer Trigger

See Section 10.11.

This function serves to activate recording at preset times. Triggering can be performed at constant intervals within a preset start time and end time.

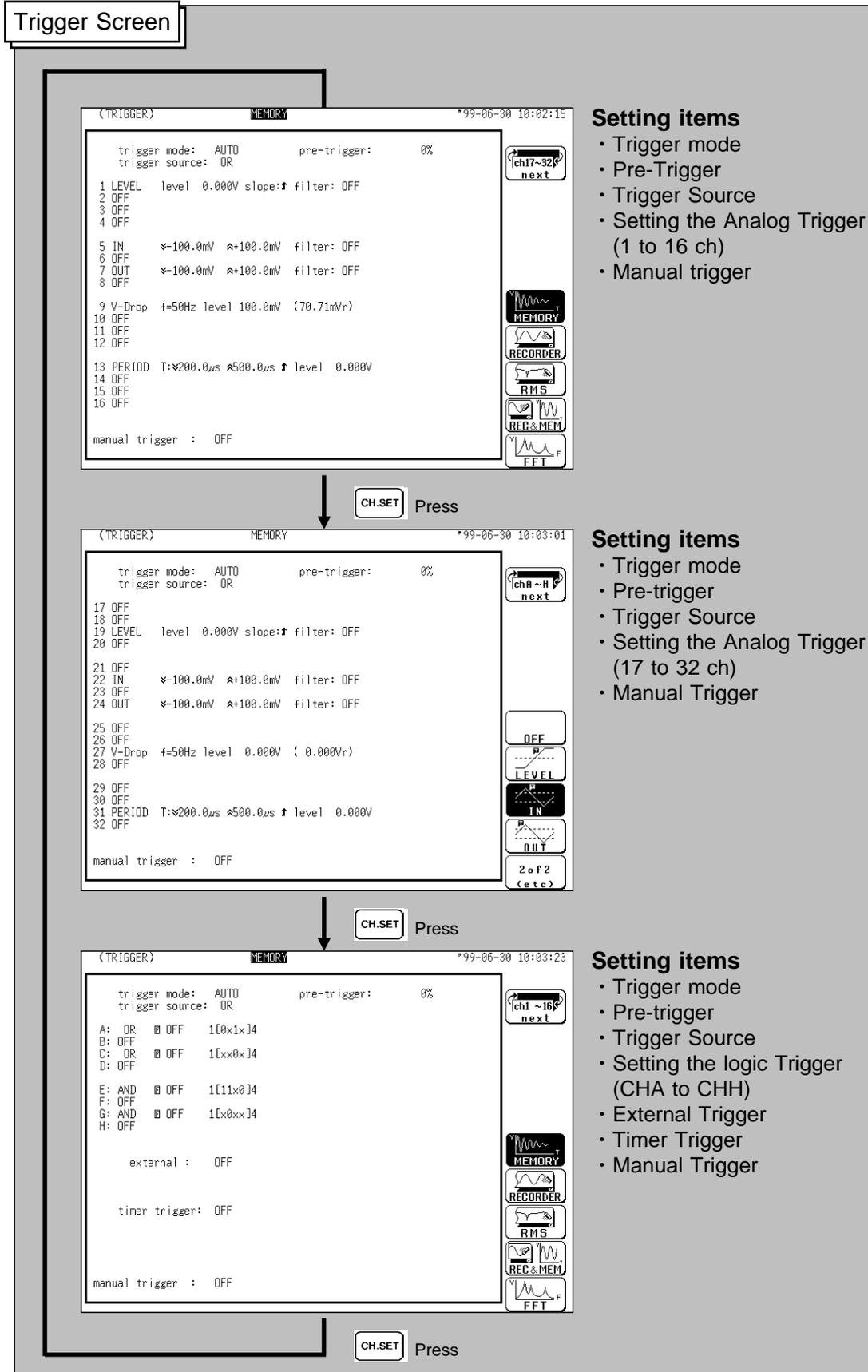
Manual Trigger

See Section 10.12.

The manual trigger is always activated when the **MANU TRIG** key is pressed, regardless of trigger source AND/OR linking setting.

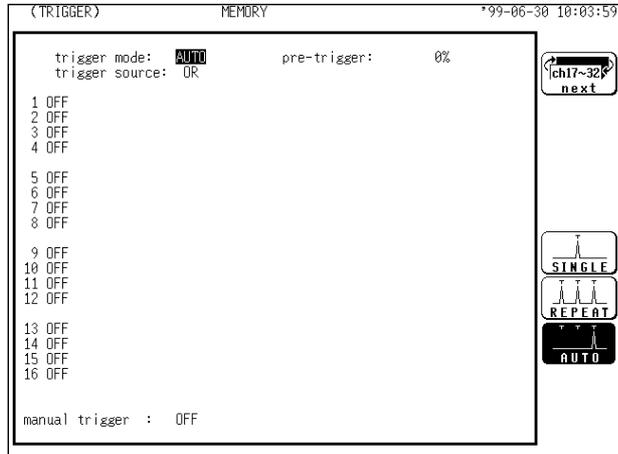
10.3 Trigger Screen Organization

Indicates the Trigger screen organization. Press the TRIG key to call up the TRIGGER screen.

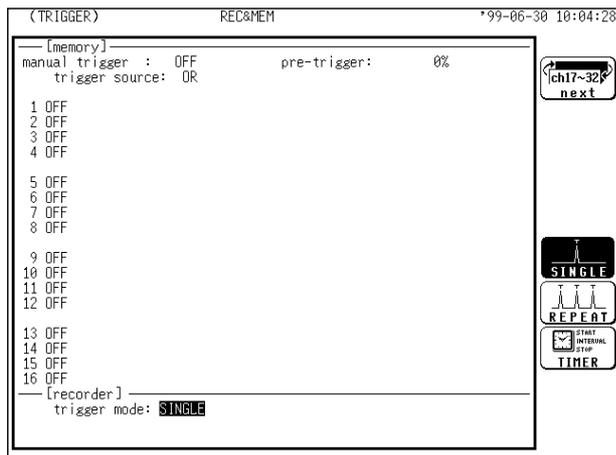


10.4 Trigger Mode

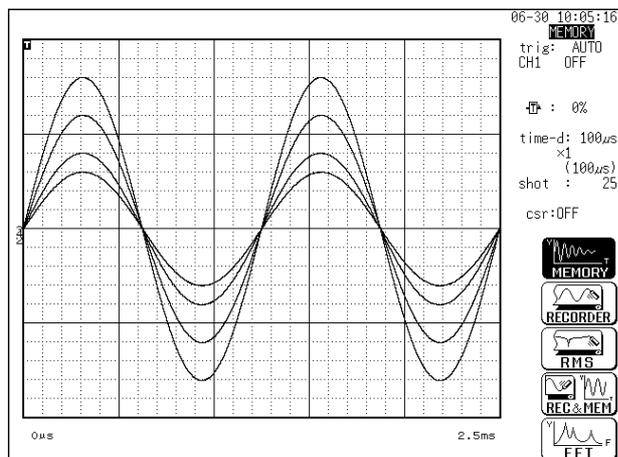
- The trigger mode determines the way triggering is used to control operation of the 8826.
- When all trigger sources are OFF, a recording operation begins immediately (free-run operation).



TRIGGER screen (MEM etc.)



TRIGGER screen (REC&MEM)



DISPLAY screen

NOTE

- The trigger mode setting of the recorder and memory function (REC&MEM) is available on the recorder waveform screen (REC&mem).
- When the trigger mode is set to [Repeat], triggering is disabled during the end of recording processing (auto save, auto print, waveform display processing and calculation) before going to the next trigger standby status. Therefore, it is not triggered if the trigger condition occurs during this processing period.

Method

Screen: TRIGGER, DISPLAY

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the trigger mode item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Trigger is registered only once. After START key was pressed, unit starts waveform recording when triggering occurs and continues for preset recording length. Measurement then ends automatically.



: Trigger is registered continuously. Unit is in trigger standby condition when trigger conditions are not met. Measurement ends when STOP key is pressed.



: Trigger is registered continuously. If trigger conditions are not met within 1 second, waveform recording starts automatically and continues for preset recording length. Measurement ends when STOP key is pressed (memory recorder function only).



: Activate recording at preset times. Triggering can be performed at constant intervals within a preset start time and end time.

Trigger mode settings for the Record & Memory function display screen are made on the Recorder Waveform screen (REC & mem).

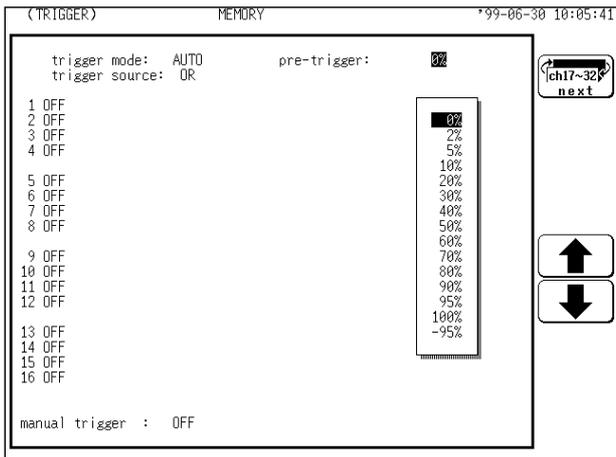
10.5 Pre-trigger

The pre-trigger function serves to record the waveform not only after but also before triggering has occurred.

MEM, REC&MEM, FFT Function

Using the recording start point as 0% and the recording end point as 100%, the trigger point can be specified in percent.

When all trigger sources are set to OFF, pre-trigger cannot be set.

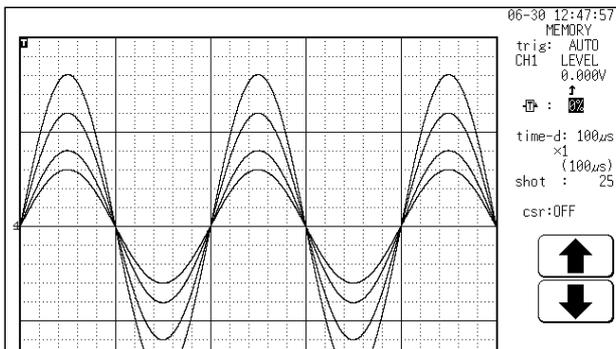


Method Screen: TRIGGER, DISPLAY

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the pre-trigger item, as shown in the figure on the left.
- ③ Use the JOG control or the function keys to make the selection.

Selection

- ↑ : Move the cursor up in the selection window.
- ↓ : Move the cursor down in the selection window.



- The selection window is not displayed.
- The pre-trigger cannot be set to "-95%" at a recording length of 160,000 DIV. In addition, if the recording length is set to 160,000 DIV after the pre-trigger is set to "-95%," the pre-trigger is automatically reset to "0%." (MEM)

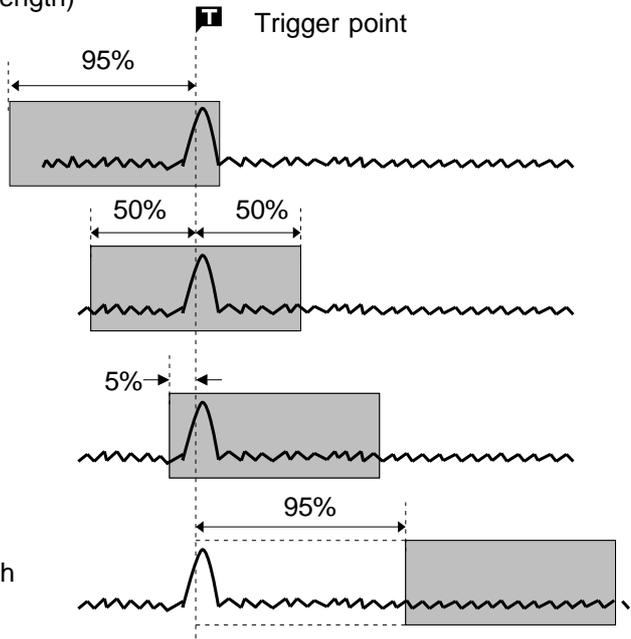
recording range (recording length)

[95%] : 95% before and 5% after the trigger

[50%] : 50% before and 50% after the trigger

[5%] : 5% before and 95% after the trigger

[-95%] : Recording is about one recording length after the trigger



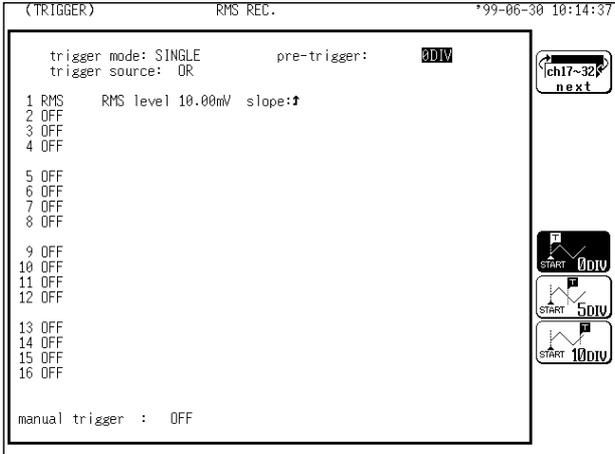
NOTE

- When the pre-trigger is set, the trigger will not be registered for a certain period after the start of measurement. (During this interval, Pre-trigger standby is shown on the display.)
- When the trigger can be registered, the indication *Waiting for trigger* is shown on the display.
- In the memory recorder function and FFT function, pre-trigger cannot be set, when the time axis range sets "EXT".
- A stored Recorder & Memory waveform can be triggered simultaneously with the start of the Recorder waveform, in which case the preset trigger level for recording is ignored.
- When Real-Time Save is enabled for Recorder and Memory, trigger settings for the Memory waveform are ignored (free-run operation).

RMS Function

In the RMS recorder function, using the recording start point as 0 DIV, the trigger point can be specified in DIV (0, 5, 10 DIV).

When all trigger sources are set to OFF, the pre-trigger setting is invalid.



Method

Screen: TRIGGER, DISPLAY

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the **pre-trigger** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



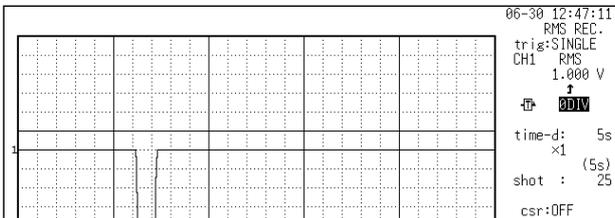
: Record from the trigger.



: Record from 5 DIV before the trigger.



: Record from 10 DIV before the trigger.

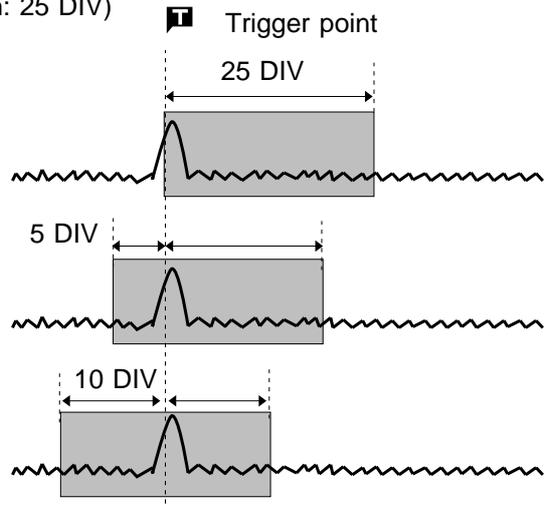


recording range (recording length: 25 DIV)

[0 DIV] :
Does not record the waveform before the trigger

[5 DIV] :
5 DIV of the recording before the trigger

[10 DIV] :
10 DIV of the recording before the trigger

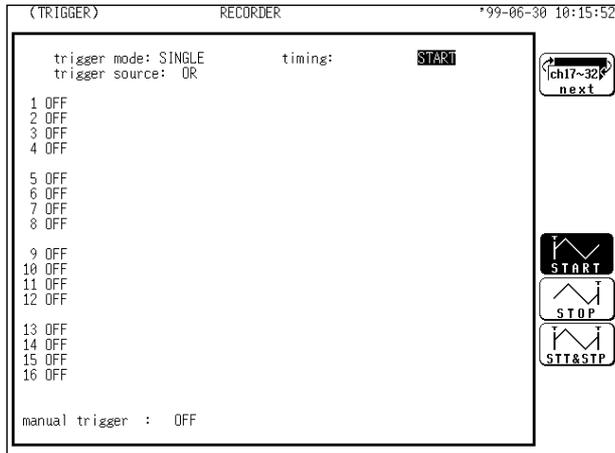


NOTE

- In the RMS recorder function, a trigger can be accepted immediately from the start time. In some cases, therefore, the pre-trigger portion of a recording may not be available.
- In the RMS recorder function, pre-trigger cannot be carried out, because the additional recording sets ON.

10.6 Trigger Timing (REC only)

- The moment the trigger occurs, the time related to the waveform being recorded can be set.
- Not only the waveform after the trigger but also the waveform before the trigger can be recorded.



Method Screen: TRIGGER, DISPLAY

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the **timing** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Recording starts when the trigger is applied.



: Recording starts only when the **START** key is pressed, and stops when the trigger is applied.



: Recording starts when the trigger is applied, and stops when the trigger is applied next.

NOTE

When the trigger timing is set to "Stop" or "Start & Stop," measured waveform data equivalent to the recording length is saved if the stop triggering is not generated between the initiation of measurement and the end of the set recording length.

Trigger mode and stop mode:

SINGLE : Stop measurement.

REPEAT (STOP) : Start measurement again.

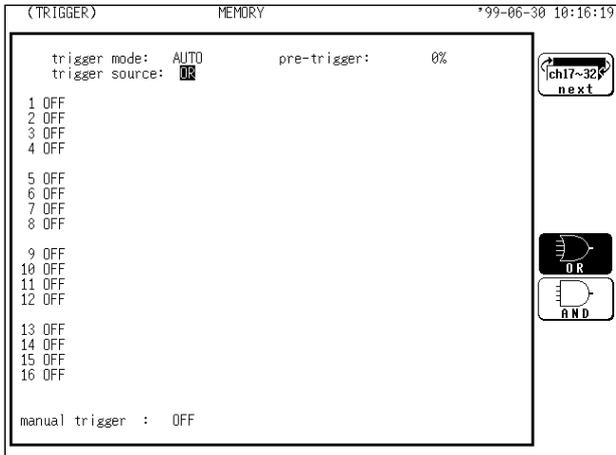
REPEAT (START&STOP) : Wait for trigger.

10.7 Trigger Source AND/OR Linking

The analog trigger, logic trigger, external trigger, and timer trigger can be linked with the AND/OR logical operators.

OR: Triggering occurs when conditions for one trigger are met.

AND: Triggering occurs when conditions for all triggers are met.



Method Screen: TRIGGER

- ① Press the **TRIG** key to call up the TRIGGER screen.
- ② Move the flashing cursor to the trigger source item, as shown in the figure on the left.
- ③ Use the function keys to select the AND or OR.

Selection



: Link trigger sources with logical operator OR.



: Link trigger sources with logical operator AND.

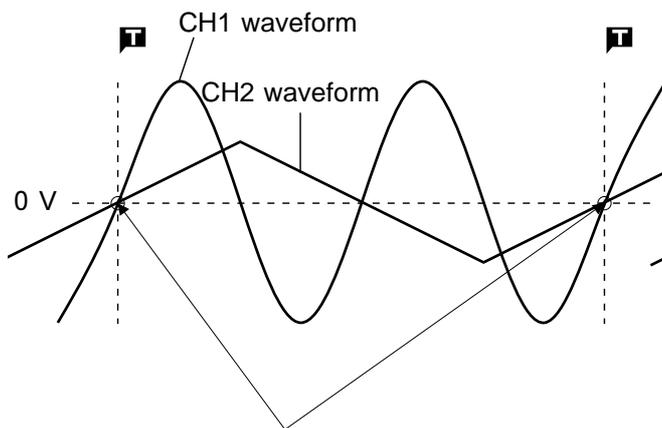
NOTE

If the trigger source is set to AND, and the trigger source setting conditions have already been met when the **START** key is pressed, triggering does not occur. When the conditions are not met once but met subsequently, triggering occurs.

Example The figures below show the difference between the effect of AND/OR linking.

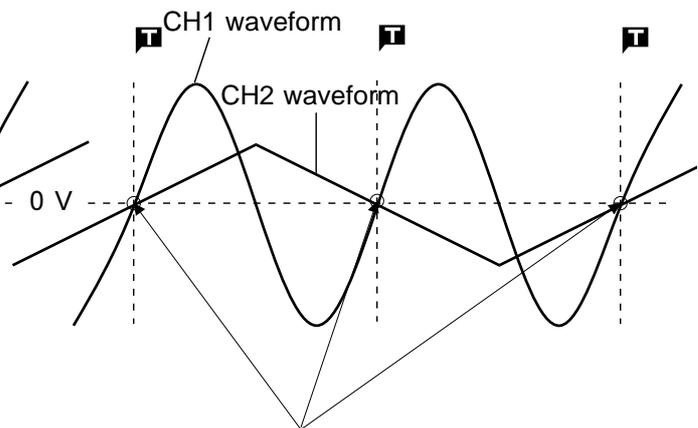
Channel	Trigger	Trigger level	Slope	Filter
CH1	Level	0.00 V	↓	OFF
CH2	Level	0.00 V	↓	OFF

[AND linking]



CH1 and CH2 level both intersect 0 V line from below

[OR linking]



CH1 or CH2 level intersects 0 V line from below

10.8 Analog Trigger

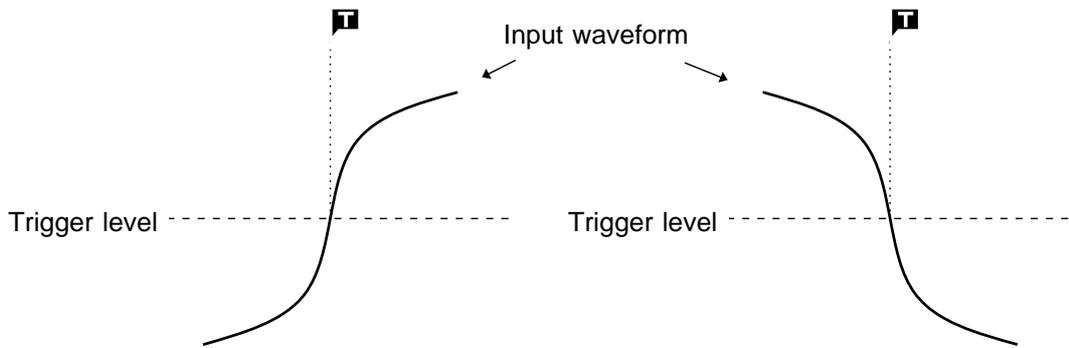
- The analog signal input channels can be used as trigger source.
- The type of trigger that can be used for the various functions is limited.

Available trigger types for each function

Function Trigger	Memory recorder	Recorder	RMS recorder	REC&MEM	FFT
Level	Yes	Yes	No	Yes	Yes
Window	Yes	Yes	No	Yes	Yes
Voltage drop	Yes	No	No	Yes	Yes
Period	Yes	Yes	No	Yes	Yes
RMS level	No	No	Yes	No	No

10.8.1 Level Trigger (MEM and REC only)

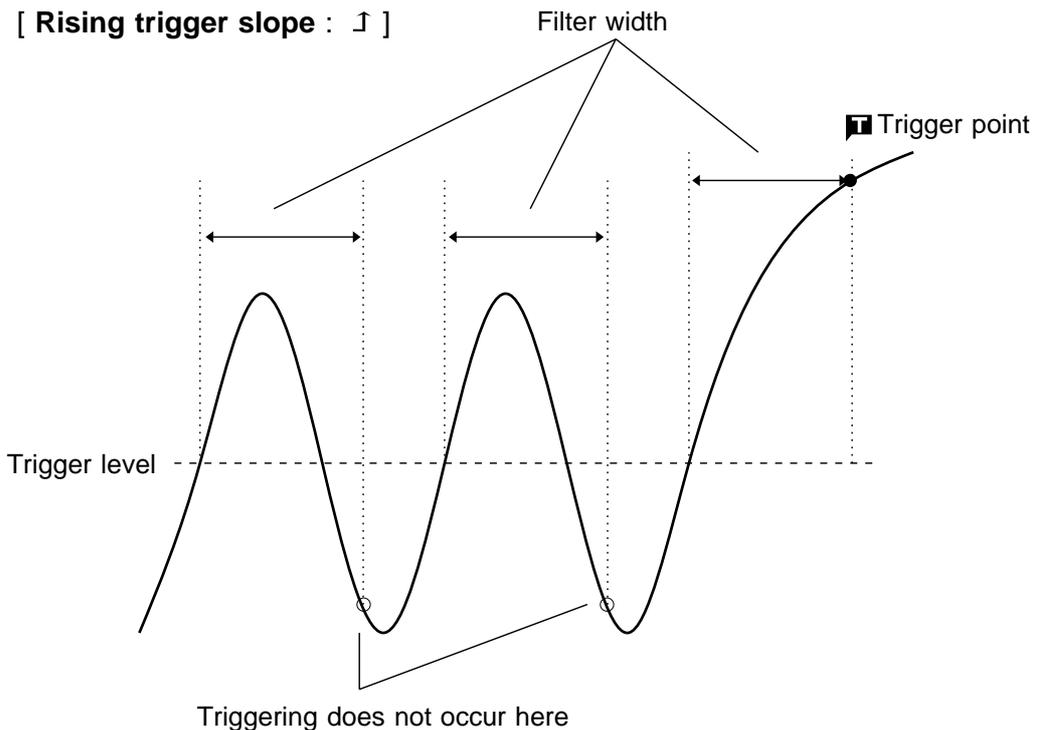
- Triggering occurs when the input signal crosses the preset trigger level (voltage) with the preset trigger slope (\uparrow , \downarrow).
- When a trigger filter is used, triggering occurs only within the filter width. This is useful to exclude noise.

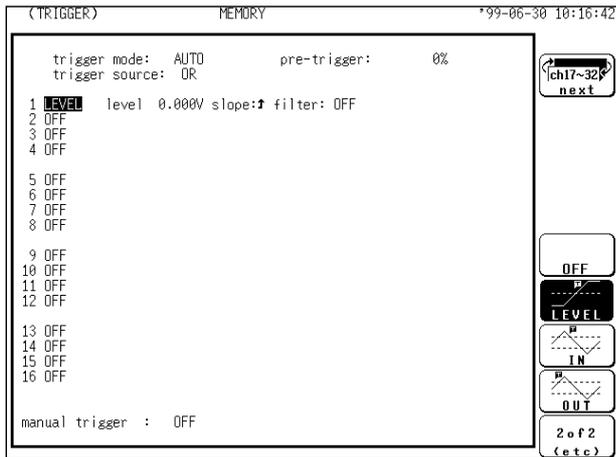


[Upward trigger direction (slope : \uparrow)] [Downward trigger direction (slope : \downarrow)]

Trigger Filter

- Triggering occurs when the trigger conditions are met within the filter width.
- This is useful to prevent spurious triggering by noise.
- The filter width is specified by the number of divisions of the memory recorder function and FFT function, while it is fixed to 10 ms, which is enabled and disabled using the ON/OFF keys, for the recorder function.

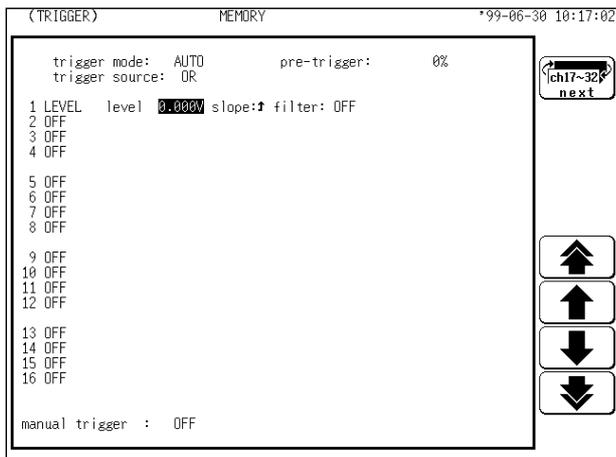




Method Screen: TRIGGER, DISPLAY

(1) Select the level trigger

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to select LEVEL.



(2) Set the trigger level.

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the JOG control or the function keys to make the selection.

Selection



: Value up, large step



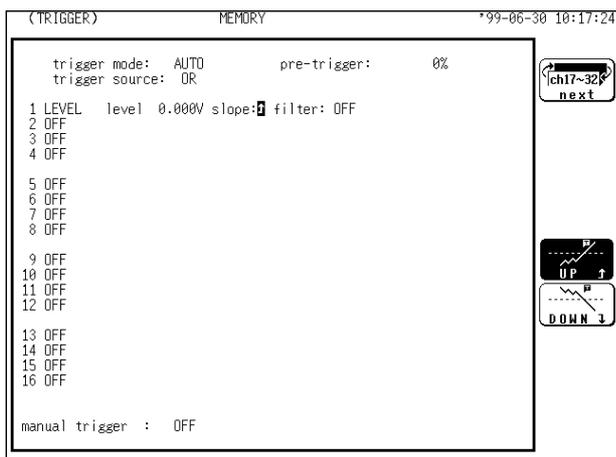
: Value up, small step



: Value down, small step



: Value down, large step



(3) Select the trigger direction (slope).

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make the selection.

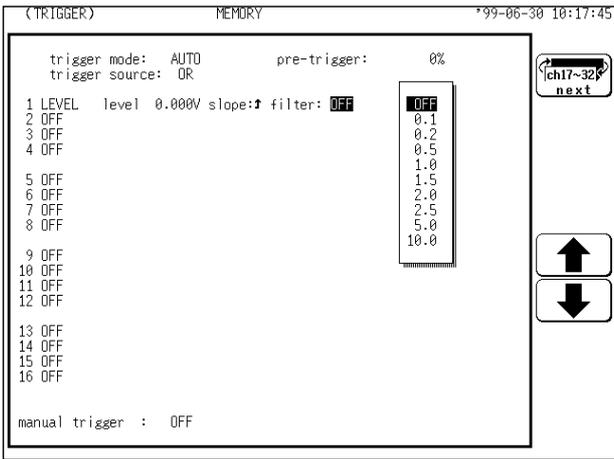
Selection



: Enables triggering on the rising edge.



: Enables triggering on the falling edge.



(4) Set the trigger filter

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the JOG control or the function keys to make the selection.

In the MEM, REC&MEM, FFT Function
 OFF : Trigger filter is disabled
 0.1 to 10.0 : Trigger filter is enabled.
 Filter width is specified using divisions.

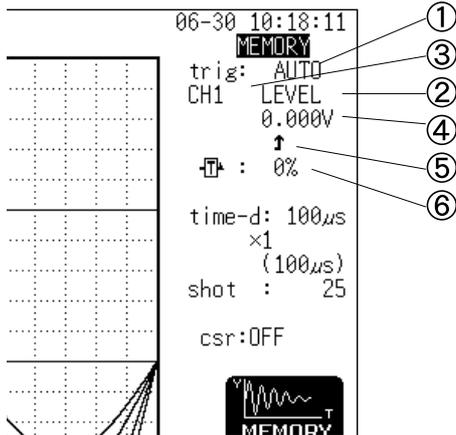
In the Recorder Function

Selection

: Trigger filter is disabled.

: Trigger filter is enabled.
 Filter width is 10 ms.

Settings on the DISPLAY screen



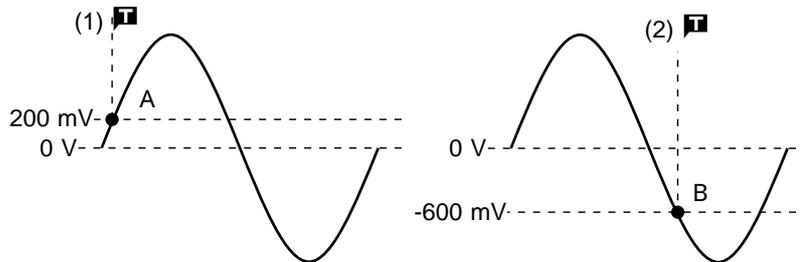
	Setting Item	Setting Method
①	Trigger mode	Function key
②	Trigger type	Function key
③	Channel	Function key, Jog (VALUE select key)
④	Trigger level	Function key, Jog (VALUE select key)
⑤	Trigger slope	Function key
⑥	Pre-trigger	Function key, Jog (VALUE select key)

Restriction : The trigger filter cannot be set.
 The selected window is not displayed in the pre-trigger setting.

Example for Level Trigger

To cause triggering at point A or point B with the sine wave shown below, make the following settings.

- (1) Point A trigger level: 200 mV, trigger direction (slope): rising (↑)
- (2) Point B trigger level: -600 mV, trigger direction (slope): falling (↓)



NOTE

When the trigger source is set to AND, the trigger is not enabled when the trigger slope crosses the set trigger level, but is enabled below or above the trigger level.

10.8.2 Window-In, Window-Out Trigger

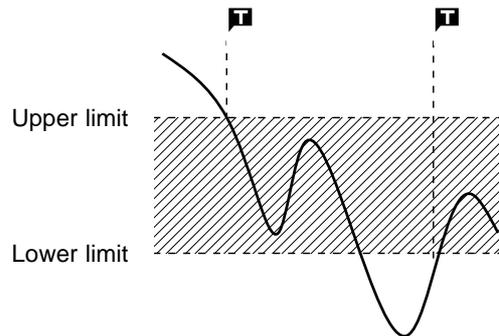
Window-In Trigger

Set upper limit level and lower limit level and activated when the input signal enters the range between these limits.

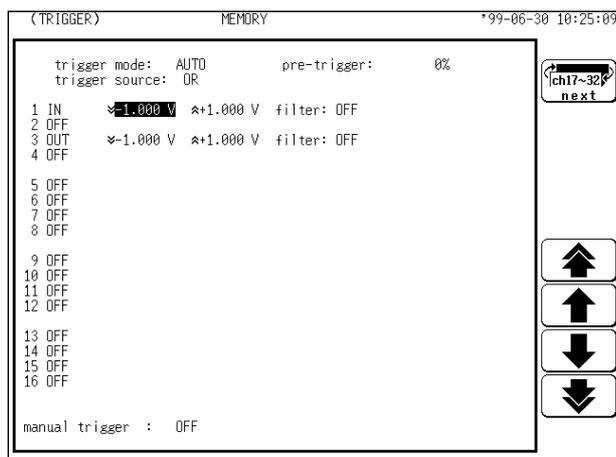
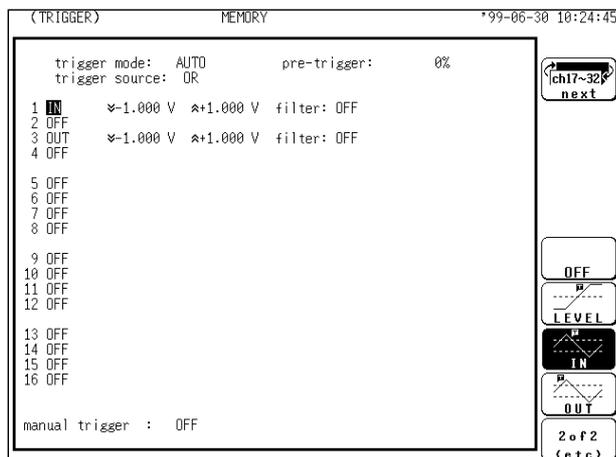
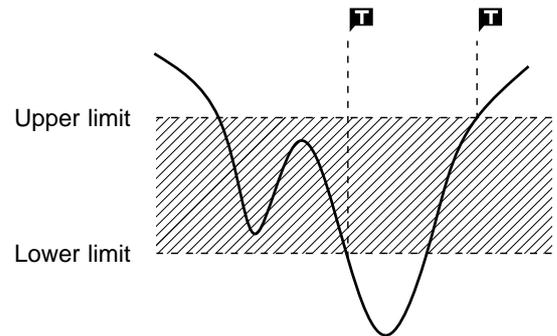
Window-Out Trigger

Set upper limit level and lower limit level and activated when the input signal leaves this range.

【 Window-in-trigger 】



【 Window-out-trigger 】



Method Screen: TRIGGER, DISPLAY

(1) Select the window-in or window-out trigger.

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to select IN or OUT.

(2) Set the lower and upper trigger levels.

- ① Move the flashing cursor to the position shown in the figure on the left, and use the function keys or the JOG control to set the lower trigger level.
- ② Set the upper trigger level same method. The upper trigger level must not be smaller than the lower trigger level, or the lower trigger level must not be larger than the upper trigger level.



: Value up, large step



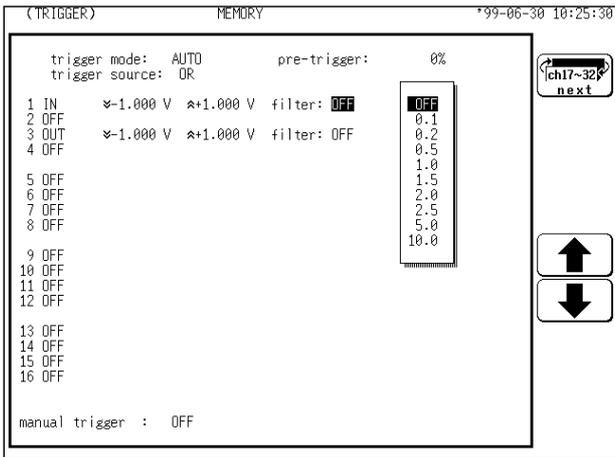
: Value up, small step



: Value down, small step



: Value down, large step



(3) Set the trigger filter

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the JOG control or the function keys to make the selection.

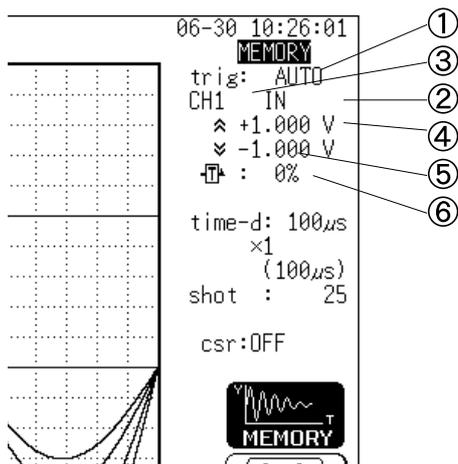
In the MEM, REC&MEM, FFT Function
 OFF : Trigger filter is disabled
 0.1 to 10.0 : Trigger filter is enabled.
 Filter width is specified using divisions.

In the Recorder Function

Selection

-  : Trigger filter is disabled.
-  : Trigger filter is enabled.
Filter width is 10 ms.

Settings on the DISPLAY screen



	Setting Item	Setting Method
①	Trigger mode	Function key
②	Trigger type	Function key
③	Channel	Function key, Jog (VALUE select key)
④	Upper level	Function key, Jog (VALUE select key)
⑤	Lower slope	Function key, Jog (VALUE select key)
⑥	Pre-trigger	Function key, Jog (VALUE select key)

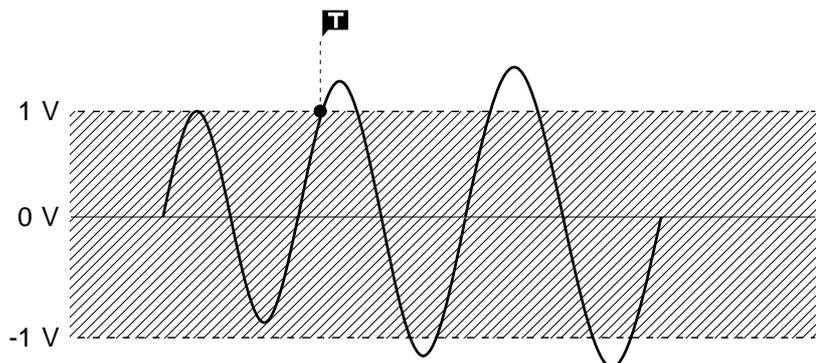
Restriction : The trigger filter cannot be set.
 The selected window is not displayed in the pre-trigger setting.

Example for Window-out Trigger

In order to cause triggering when the signal as shown in the figure below leaves the hatched area, the following settings are made:

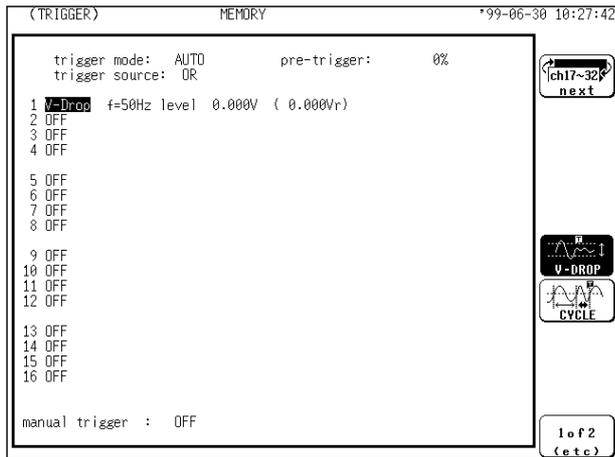
Window-out trigger

Upper limit : 1 V, lower limit: -1 V



10.8.3 Voltage Drop Trigger (MEM Only)

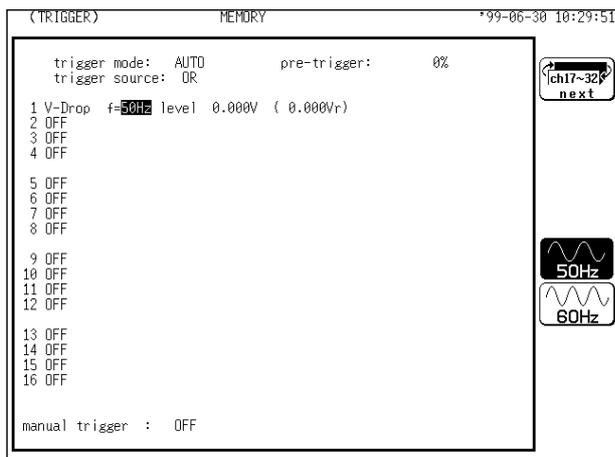
- The time axis ranges that can be used are 100 μ s to 50 ms/DIV. For the FFT function, the frequency axis range is 800 Hz to 400 kHz.
- The 8826 is designed to measure commercial power supplies (50/60 Hz).
- This unit detects momentary voltage drops in commercial power supplies.
- When the peak of the voltage falls lower than the setting level, the trigger will occur.
- The trigger levels of upper and lower limit cannot be set separately.



Method Screen: TRIGGER, DISPLAY

(1) Select the voltage drop trigger.

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to select V-Drop.



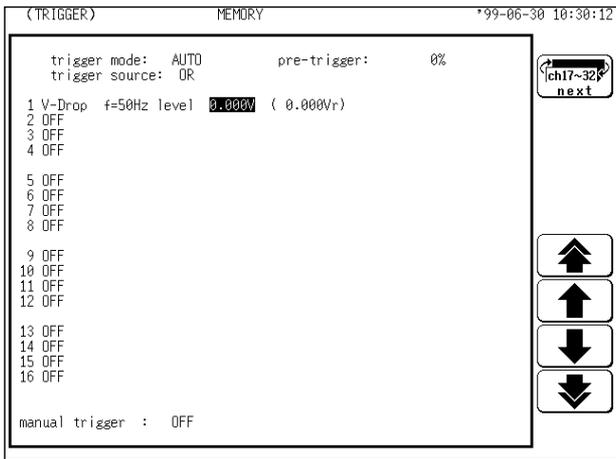
(2) Select the frequency of the measuring object.

- ① Move the flashing cursor to the position shown in the figure.
- ② Use the function keys to select the frequency.

Selection

 : 50 Hz

 : 60 Hz



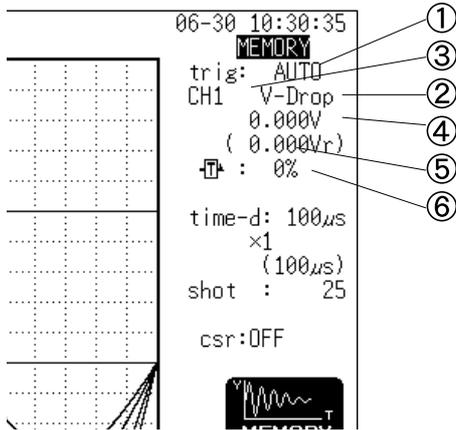
(3) Set the trigger level.

- ① Move the flashing cursor to the position shown in the figure.
- ② Use the function keys or the JOG control to set the trigger level. The rms value as well as the trigger level are displayed.

Selection

- : Value up, large step
- : Value up, small step
- : Value down, small step
- : Value down, large step

Settings on the DISPLAY screen



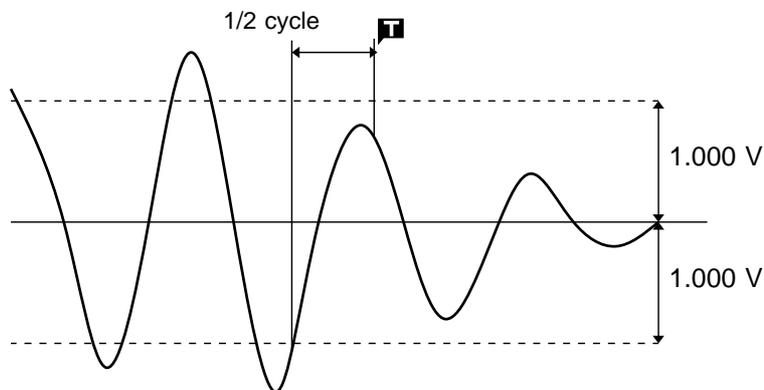
	Setting Item	Setting Method
①	Trigger mode	Function key
②	Trigger type	Function key
③	Channel	Function key, Jog (VALUE select key)
④	Trigger level	Function key, Jog (VALUE select key)
⑤	RMS value	
⑥	Pre-trigger	Function key, Jog (VALUE select key)

Restriction : The frequency cannot be set.
The selected window is not displayed in the pre-trigger setting.

Example for Voltage Drop Trigger

For a signal such as shown in the illustration (frequency 50 Hz), the following applies:

$V_{max} < 1.000\text{ V}$ (RMS < 707.1 mV rms)

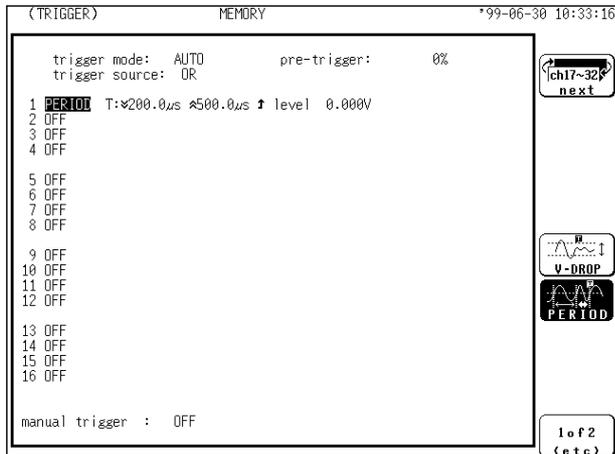


To perform trigger measurement under the above conditions, make the following setting.

Voltage drop $f = 50\text{ Hz}$ Level = 1.000 V (707.1 mV rms)

10.8.4 Period Trigger

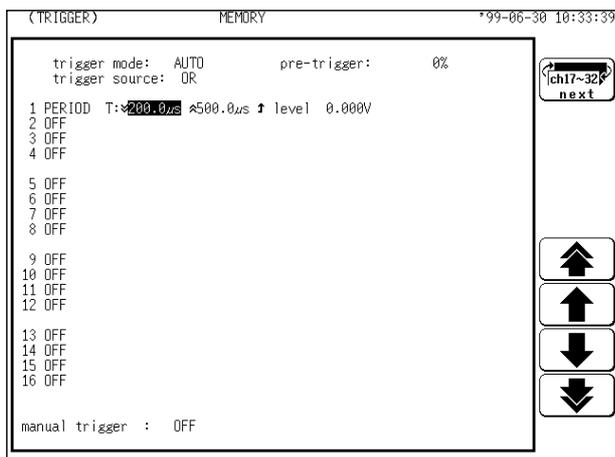
This function sets both the period reference voltage and the period range, and measures the rise (fall) period of the set voltage. When the measured period deviates from the specified range, triggering occurs.



Method Screen: TRIGGER, DISPLAY

(1) Select the period trigger.

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to select PERIOD.



(2) Set the period range.

- ① Move the flashing cursor to the position shown in the figure.
- ② Use the JOG control or the function keys to set the lower limit of the period.

The setting for the period range of the period trigger changes depending on the sampling period.

Lower limit: More than 10 times the sampling period.

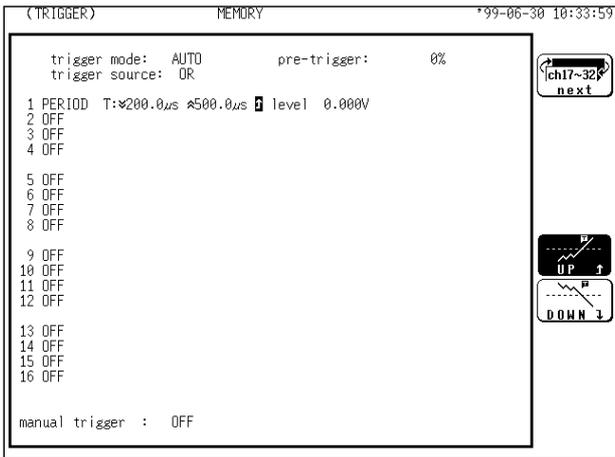
Upper limit: Less than 20000 times the sampling period.

The upper trigger level must not be smaller than the lower trigger level, or the lower trigger level must not be larger than the upper trigger level.

-  : Value up, large step
-  : Value up, small step
-  : Value down, small step
-  : Value down, large step

NOTE

- In the memory recorder function, check the time axis range setting when using the period trigger.
- In the recorder function, check the sampling period setting when using the period trigger.

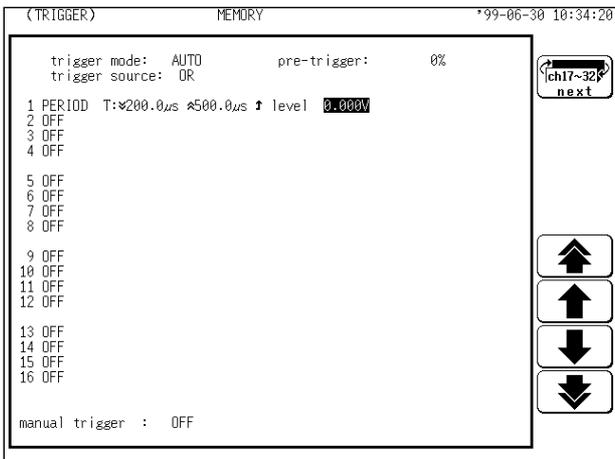


(3) Select the trigger direction (slope).

- ① Move the flashing cursor to the position shown in the figure.
- ② Use the function keys to select the trigger direction (slope).

Selection

- : Enables triggering on the rising period.
- : Enables triggering on the falling period.



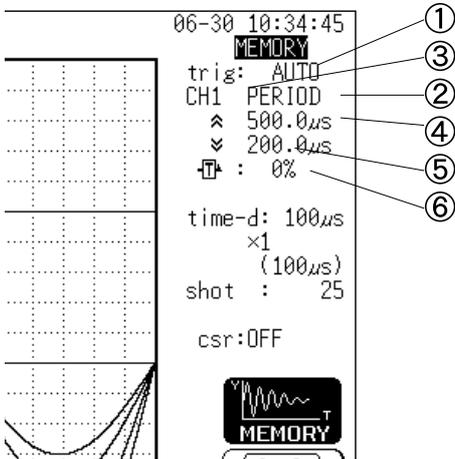
(4) Set the reference voltage value.

- ① Move the flashing cursor to the position shown in the figure.
- ② Use the JOG control or the function keys to make the setting.

Selection

- : Value up, large step
- : Value up, small step
- : Value down, small step
- : Value down, large step

Settings on the DISPLAY screen



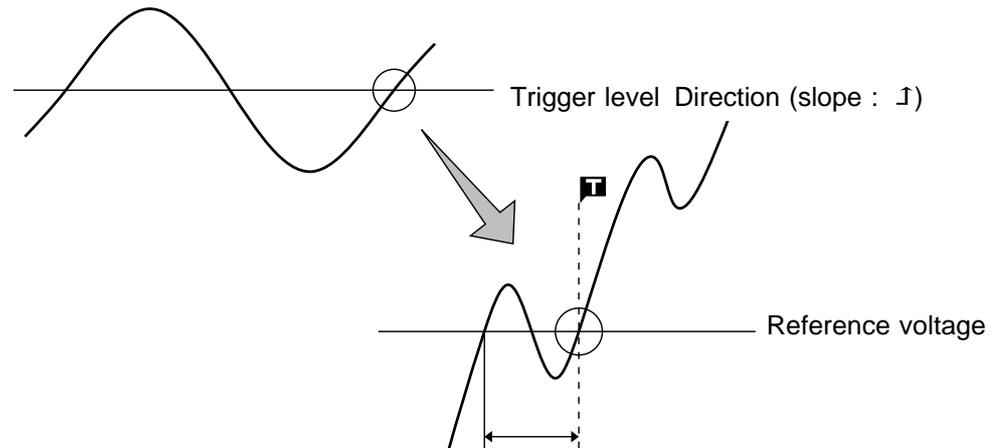
	Setting Item	Setting Method
①	Trigger mode	Function key
②	Trigger type	Function key
③	Channel	Function key, Jog (VALUE select key)
④	Upper level	Function key, Jog (VALUE select key)
⑤	Lower slope	Function key, Jog (VALUE select key)
⑥	Pre-trigger	Function key, Jog (VALUE select key)

Restriction : The trigger slope and reference voltage cannot be set.
The selected window is not displayed in the pre-trigger setting.

NOTE

Since a trigger filter is not prepared for the period trigger, triggering may mistakenly occur due to noise (see the figure below).

To prevent such an event, use an appropriate low-pass filter.

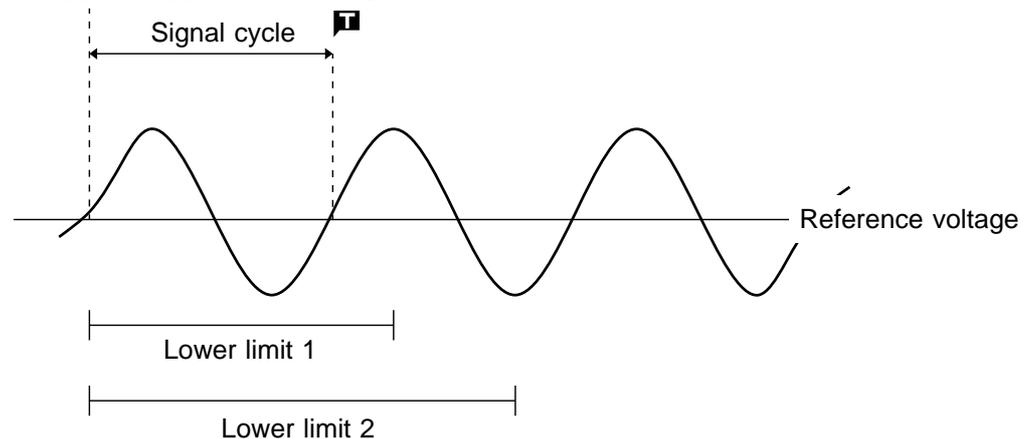


Triggering occurs, since the system judges that the period deviates from the specified range.

Triggering point of the period trigger

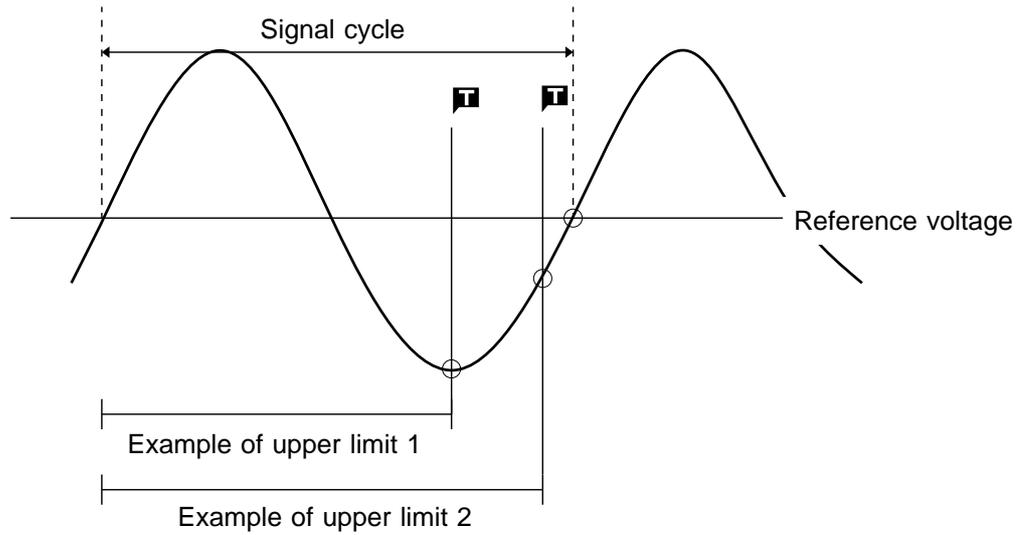
The system monitors the period of the signal that crosses the set reference voltage. When the monitored period deviates from the set range, triggering occurs. The trigger position is determined by the set period range and the measurement signal period.

[Signal with a period to be measured that is smaller than the lower limit of the period trigger (trigger slope: 1):]



When the signal crosses the reference voltage at the set trigger slope before the lower limit of the set period range appears on the screen, the intersection is always defined as the triggering position.

[Signal with a period to be measured that is larger than the upper limit of the period trigger (trigger slope: \downarrow):]

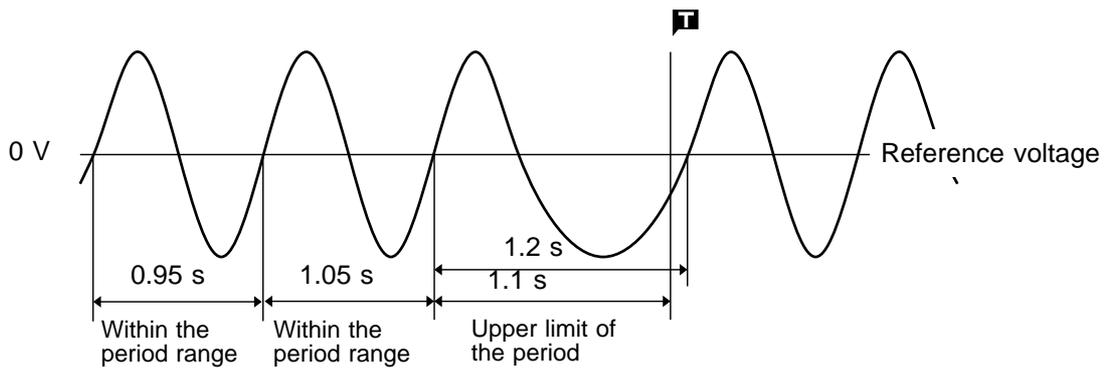


When the upper limit of the set period range appears on the screen before the signal crosses the reference voltage at the set trigger slope, the upper limit is defined as the triggering position. The triggering position is determined by the position of the upper limit in the period range, as shown in the figure above.

Example for Period Trigger

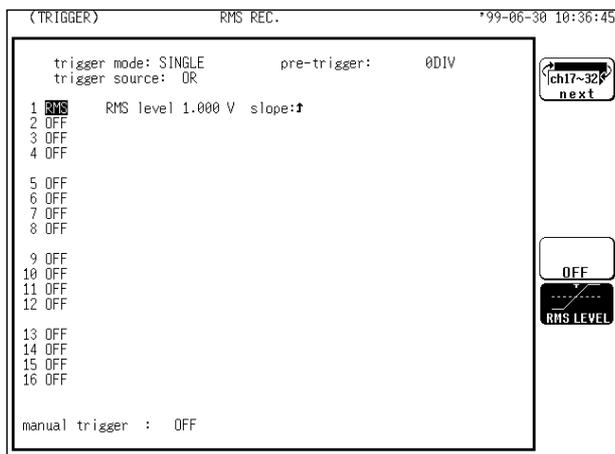
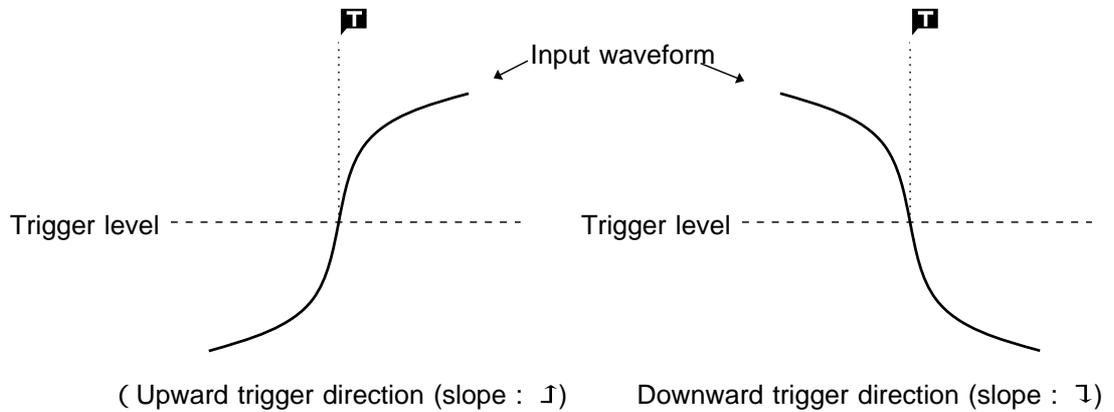
In order to cause triggering when the signal as shown in the figure below leaves the period range of 0.9 to 1.1 s, the following settings are made:

Lower limit of the period: 900 ms, Upper limit of the period: 1.1 s, Reference voltage: 0.000 V



10.8.5 RMS Level Trigger

- The commercial power supplies, 50/60 Hz and the DC signals can be measured.
- This trigger occurs when the input signal crosses a predetermined trigger level (rms value) in a particular direction ("slope": \uparrow or \downarrow).

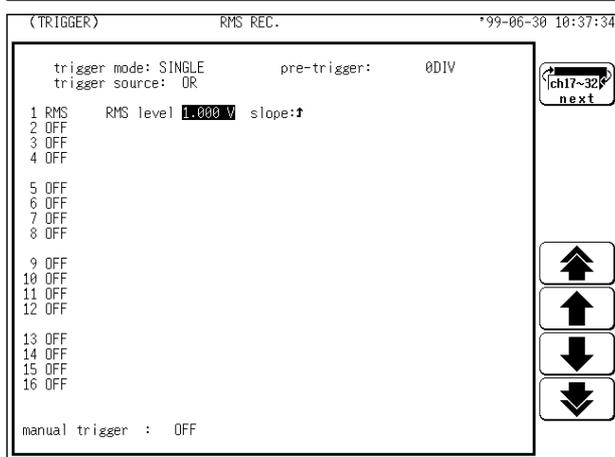


Method

Screen: TRIGGER, DISPLAY

(1) Select the RMS level trigger.

- ① Call up the TRIGGER or DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to select **RMS LEVEL**.



(2) Set the trigger level.

- ① Move the flashing cursor to the position shown in the figure.
- ② Use the JOG control or the function keys to set the trigger level.
Set the trigger level by RMS value.

Selection



: Value up, large step



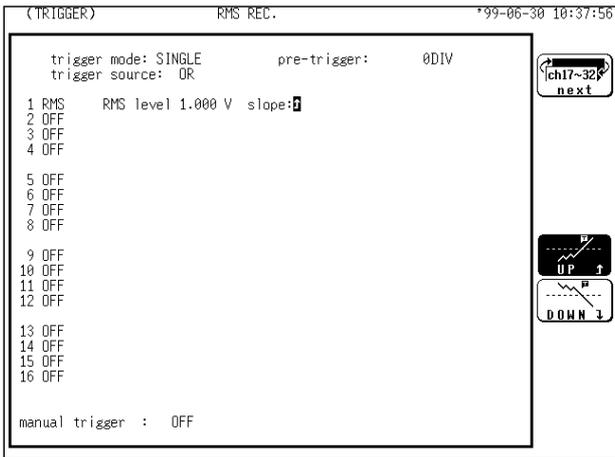
: Value up, small step



: Value down, small step



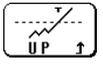
: Value down, large step



(3) Select the trigger direction (slope).

- ① Move the flashing cursor to the position shown in the figure.
- ② Use the function keys to select the trigger direction (slope).

Selection



: Enables triggering on the leading edge.

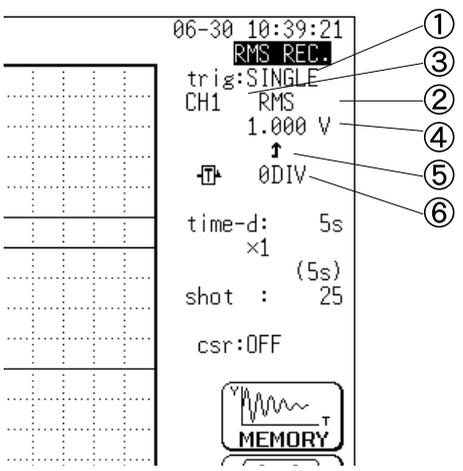


: Enables triggering on the falling edge.

NOTE

- Set the frequency of the measuring object on the STATUS screen.
- 'AND' cannot be set between the trigger sources using the RMS level trigger and the logic trigger. When a shift is made from "OR" to "AND," the logic trigger setting is turned OFF.
- When the trigger source is set to AND, the trigger slope is rising, (↗) and the input signal is higher than the trigger level, or when the trigger slope is falling (↘) and the input signal is lower than the trigger level, the trigger is enabled upon startup.

Settings on the DISPLAY screen



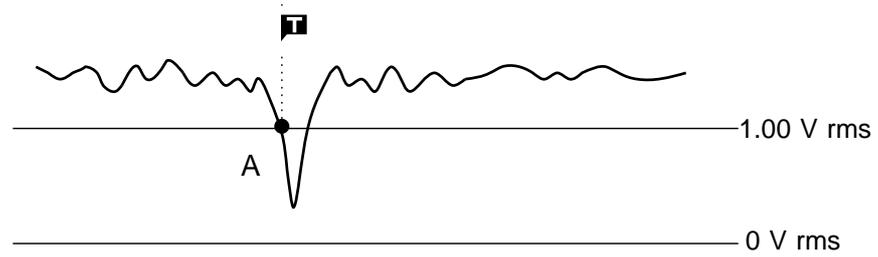
	Setting Item	Setting Method
①	Trigger mode	Function key
②	Trigger type	Function key
③	Channel	Function key, Jog (VALUE select key)
④	Trigger level	Function key, Jog (VALUE select key)
⑤	Trigger slope	Function key
⑥	Pre-trigger	Function key

Restriction : The frequency cannot be set.
The selected window is not displayed in the pre-trigger setting.

Example for RMS Level Trigger

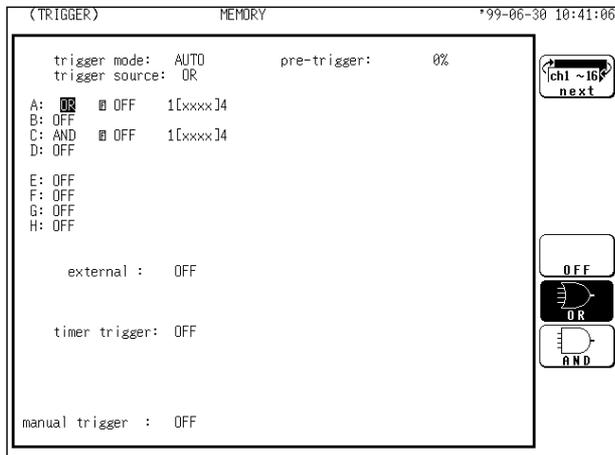
To cause triggering at point A with the signal as shown in the figure below, make the following settings.

RMS level: 1.000 V, trigger direction (slope): (↘)



10.9 Logic Trigger

- The signal of a logic channel can be used as trigger source.
- A trigger pattern and logical operator (AND/OR) are specified, and triggering occurs when the trigger conditions are met.
- A trigger filter can be specified, so that triggering occurs only when the trigger conditions are met within the filter width.



Method Screen: TRIGGER

(1) Set the logic trigger AND/OR linking.

- ① Use the **TRIG** key and the **CH.SET** key to call up the screen shown in the figure.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to select the setting.

Selection



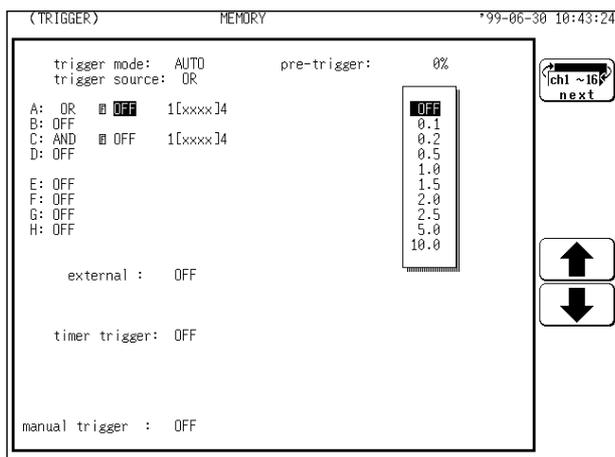
: Logic trigger is not used.



: Triggering occurs if any one of the logic input signals conforms to the trigger pattern.



: Triggering only occurs if all of the logic input signals conforms to the trigger pattern.



(2) Set the trigger filter

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the JOG control or the function keys to make the selection.

In the MEM, REC&MEM, FFT Function

OFF : Trigger filter is disabled

0.1 to 10.0 : Trigger filter is enabled.

Filter width is specified using divisions.

In the REC and RMS Function

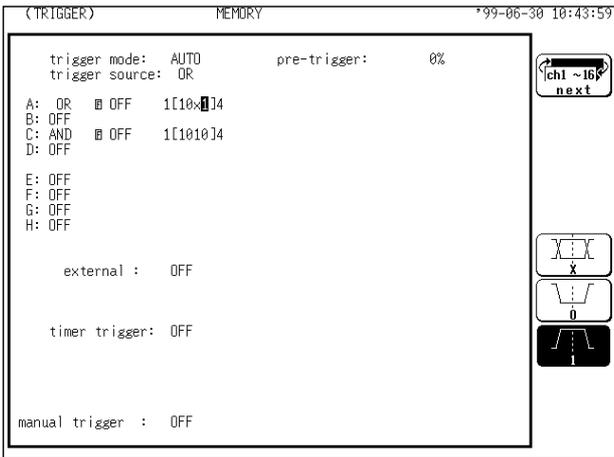
Selection



: Trigger filter is disabled.



: Trigger filter is enabled.
Filter width is 10 ms.



(3) Set the trigger pattern

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Select 1 - 4 with the function key display. Make the setting with the function keys. When "CH A" is selected, the setting is for logic input CH A1 - CH A4 from left to right.

Selection

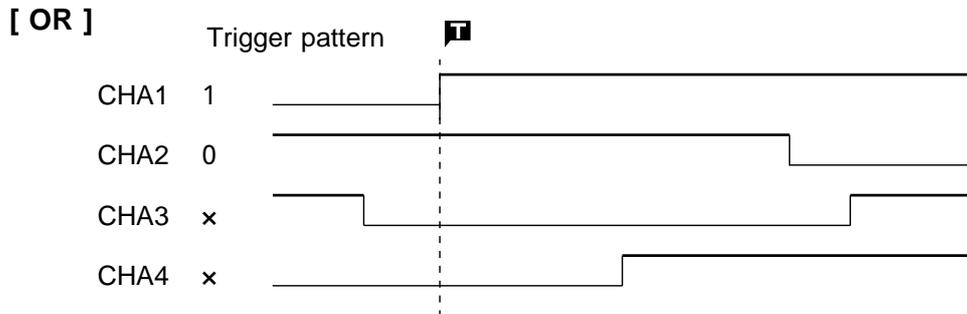
-  : Signal disregarded
-  : Low level signal
-  : High level signal

NOTE

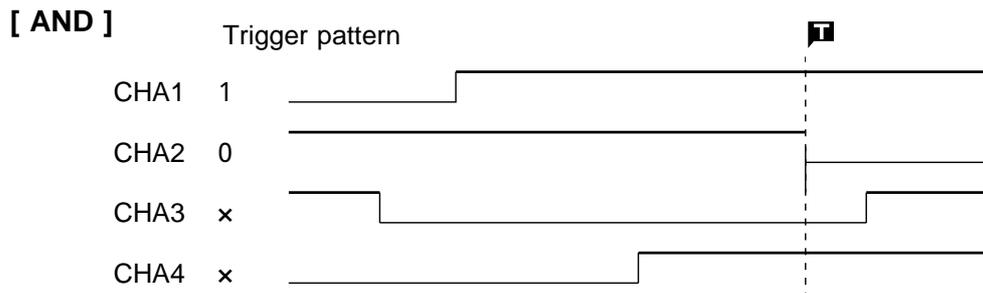
- If the conditions are met already when measurement is started (AND: all trigger patterns are met, OR: one trigger pattern is met), triggering does not occur at this slope. Triggering only occurs if the conditions are removed and then met again.
- 'AND' cannot be set between the trigger sources using the RMS level trigger and the logic trigger. When a shift is made from "OR" to "AND," the logic trigger setting is turned OFF.

Setting example of the Logic Trigger

(1) If the trigger pattern has been set to "10 x x" with the operator OR, then triggering occurs as shown in the figure below.

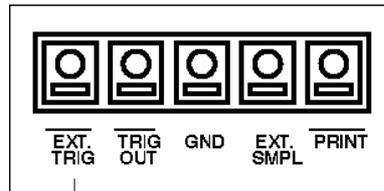


(2) If the trigger pattern has been set to "10 x x" with the operator AND, then triggering occurs as shown in the figure below.

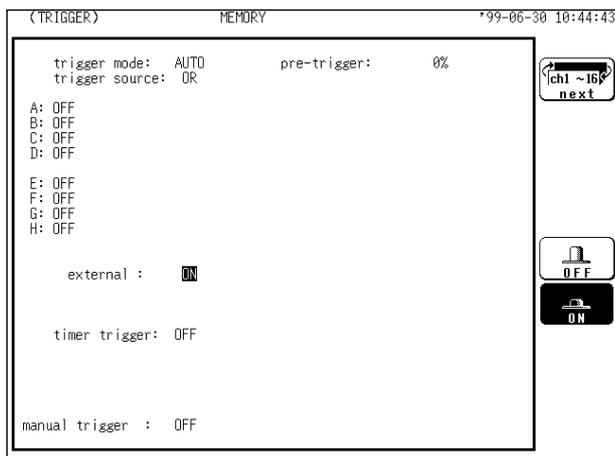


10.10 External Trigger Function

- An external signal can be used as trigger source.
- The external trigger is activated by either shorting the EXT TRIG terminal and GND terminal or applying a falling edge signal going below 2.5 V.
- The external trigger facility can be used to synchronize a number of the 8826 units for parallel operation.
- For details for connection, refer to 17.



External trigger terminal



TRIGGER screen (MEM)

Method

Screen: TRIGGER

- ① Use the **TRIG** key and the **CH.SET** key to call up the screen shown in the figure.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to make the selection.

Selection



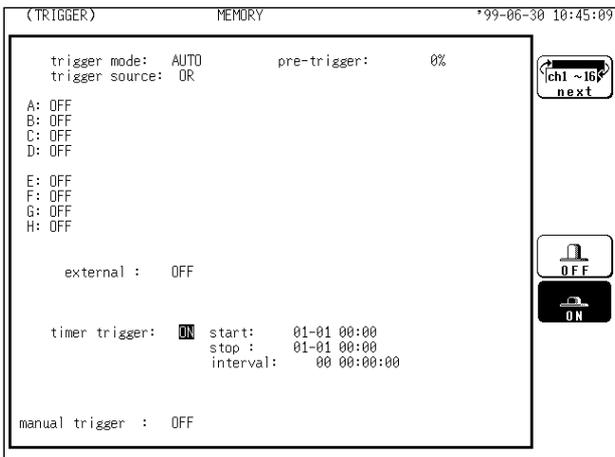
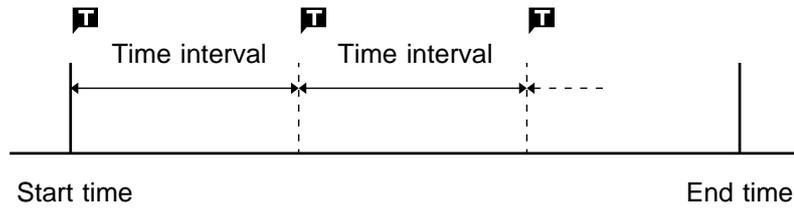
: External trigger is not used.



: External trigger is used.

10.11 Timer Trigger Function

- This function serves to activate recording at preset times.
- Triggering can be performed at constant intervals within a preset start time and end time.



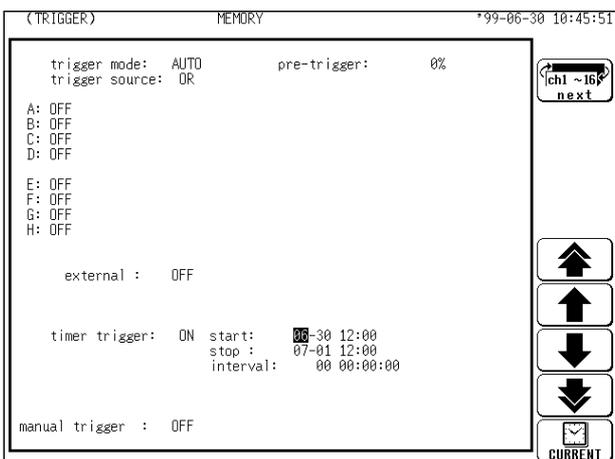
Method Screen: TRIGGER

(1) Set the timer trigger.

- ① Use the **TRIG** key and the **CH.SET** key to call up the screen shown in the figure.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to select the setting.

Selection

- : Timer trigger is disabled.
- : Timer trigger is enabled.



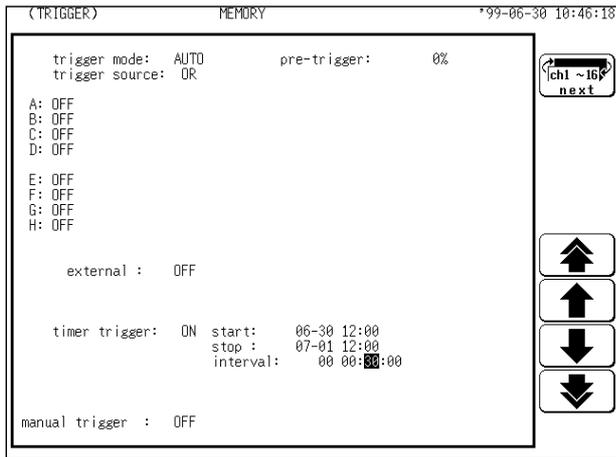
(2) Set the start and end time.

- ① Move the flashing cursor to the **start** item.
- ② Use the function keys or the JOG control to make the setting.

Selection

- : Value up, 10-units
- : Value up, 1-units
- : Value down, 1-units
- : Value down, 10-units
- : Use current time as start time or end time.

- ③ Move the flashing cursor to the **stop** item.
- ④ Use the function keys or the JOG control to make the setting.



(3) Set the trigger interval.

- ① Move the flashing cursor to the interval item, as shown in the figure on the left.
- ② Use the function keys or the JOG control to make the setting.

Selection



: Value up, 10-units



: Value up, 1-units



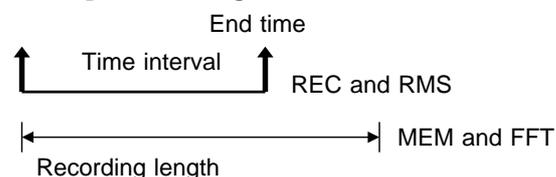
: Value down, 1-units



: Value down, 10-units

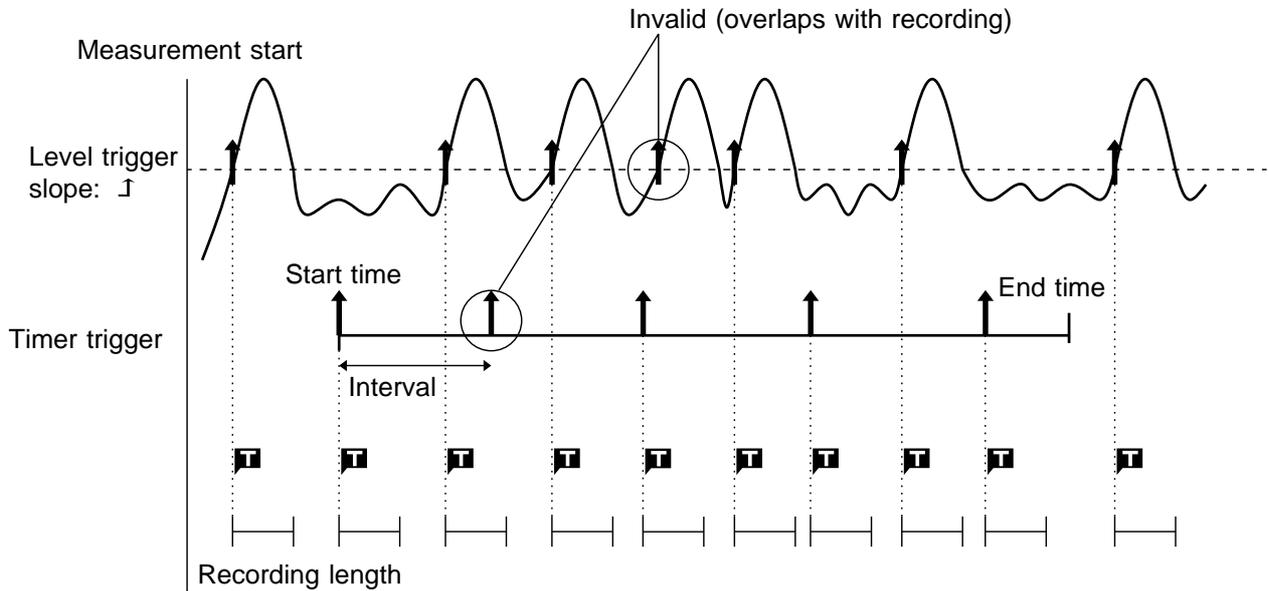
Note on use for the timer trigger

- (1) Set the present time on the system screen first, then set the timer trigger.
- (2) Set the start time and end time to a point after the pressing of the START key.
- (3) When the trigger mode is set to "SINGLE", only one trigger event is valid for the start time. The settings for time interval and end time are invalid (when timer trigger only is ON).
- (4) To perform recording at regular intervals, establish the following settings.
Trigger mode: continuous. Other trigger sources: all OFF
Between end of recording and standby, triggers are invalid while processing is taking place (auto save, auto print, waveform display process, calculation process) and therefore data may not be recorded at regular intervals with some measurement setting.
- (5) When trigger sources have been linked with OR
All trigger sources are valid. Therefore triggering may occur even before the start time, and trigger standby and measurement may continue even after the stop time.
- (6) When trigger sources have been linked with AND
 - Trigger standby is enabled at the measurement start time and at each time interval, and triggering will occur when all trigger conditions other than timer trigger are met simultaneously.
 - Set the time interval to 0 can be made active for the preset time interval only.
 - When the recording length (recording time) is longer than the time interval:
 - ① Timer trigger, which is determined from the time interval during recording, is disabled.
 - ② End time
MEM, FFT : Retrieve measured data equivalent to the recording length and discontinue measurement.
REC, RMS : Stop retrieving measured data at the set stop time.



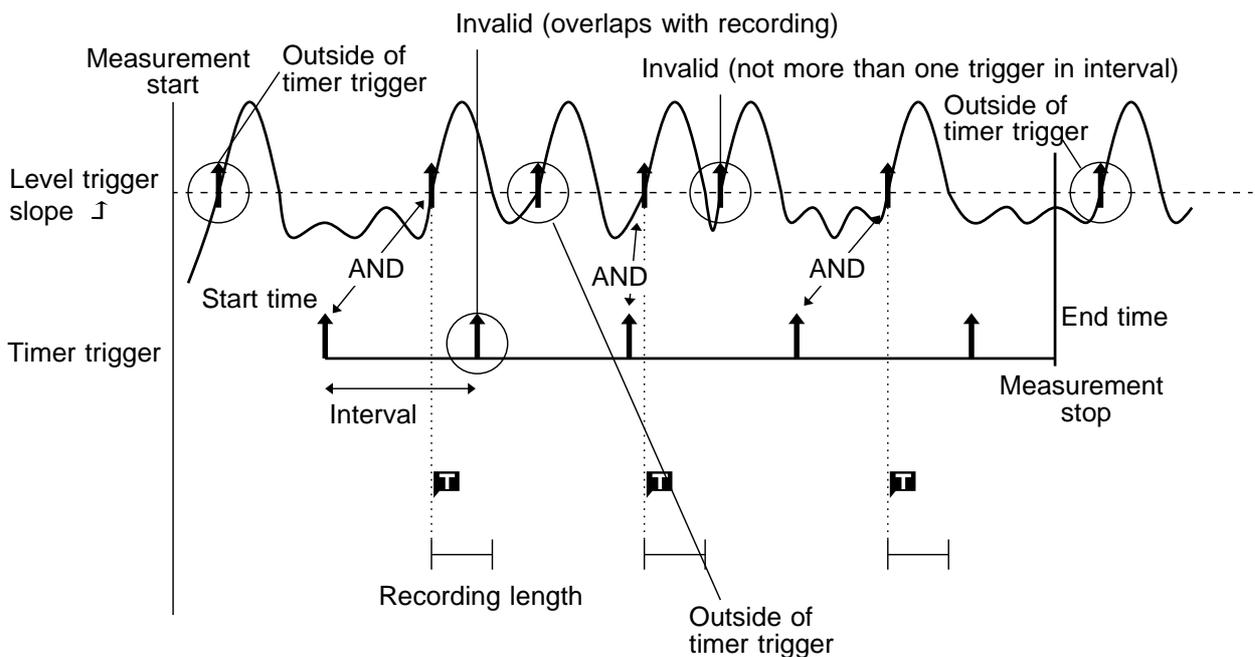
Relation between timer trigger and AND/OR linking

When trigger sources are set to OR
 All trigger sources are valid. If other trigger sources have been set, triggering can also occur before the start time or after the end time.



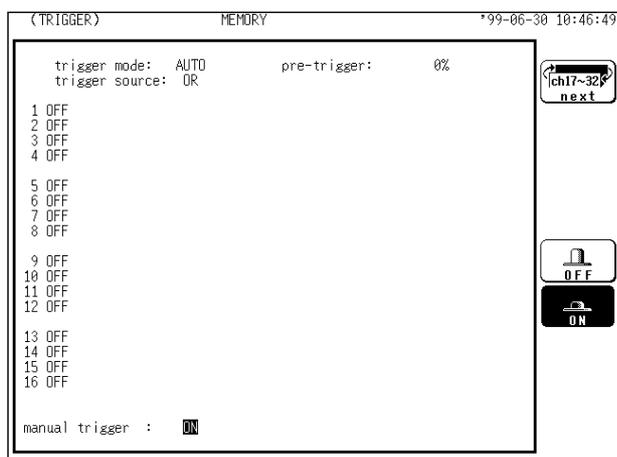
When trigger sources are set to AND

- Measurement is carried out from the start time to the end time. Triggering occurs at the preset intervals if the conditions for the other trigger sources are also met at these points.
- If the interval has been set to 0s, triggering occurs at any point between the start and end time, if the conditions for the other trigger sources are met.



10.12 Manual Trigger

- Triggering occurs when the MANU TRIG key is pressed.
- The manual trigger is always activated when the MANU TRIG key is pressed, regardless of trigger source AND/OR linking setting.



TRIGGER screen (MEM)

Method Screen: TRIGGER

- ① Press the **TRIG** key to call up the TRIGGER screen.
- ② Move the flashing cursor to the position shown in the figure.
- ③ Use the function keys to make the selection.

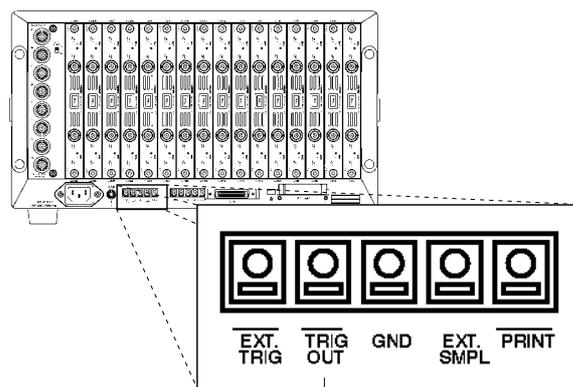
Selection

-  : Manual trigger is disabled.
-  : Manual trigger is enabled.

10.13 Trigger Output Terminal

- When triggering occurs, a signal is output from the TRIG OUT terminal.
- This can be used to synchronize several 8826 units.
- For details, see Section 17.3.

【 Rear panel 】



Trigger Output terminal

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 11

Display Screen Operation

Indicates the DISPLAY screen operation.

Setting the Input channel

See Section 9.9.

- To set a numerical value using the JOG control on the display screen, press the **VALUE** select key. (The selection window is not displayed.)
- Pressing the **CH.SET** key, enables the measurement conditions for each channel on the display screen to be set or changed.

Scrolling the Waveform

See Section 11.1.

- To scroll the waveform on the display screen, press the **WAVE** select key. Use the JOG/SHUTTLE control to scroll the waveform.

Using the A/B Cursors

See Section 11.2.

Line cursor (vertical)

Line cursor (horizontal)

Trace cursor

- When want to use the A/B Cursors, press the **A·B CSR** select key.

The magnification/compression ratio along the time axis

See Section 11.3.

- MEM, REC&MEM : magnification and compression
REC, RMS, REC&MEM : compression only

Zoom function

See Section 11.4.

- This function divides the memory recorder function display screen into upper and lower windows, so that the regular-size waveform is displayed in the upper window and the waveform enlarged in the time axis direction is displayed in the lower window.

Input Level Monitor Function

See Section 11.5.

- Press the **LEVEL MON.** key on the DISPLAY screen, waveform input level can be monitored.

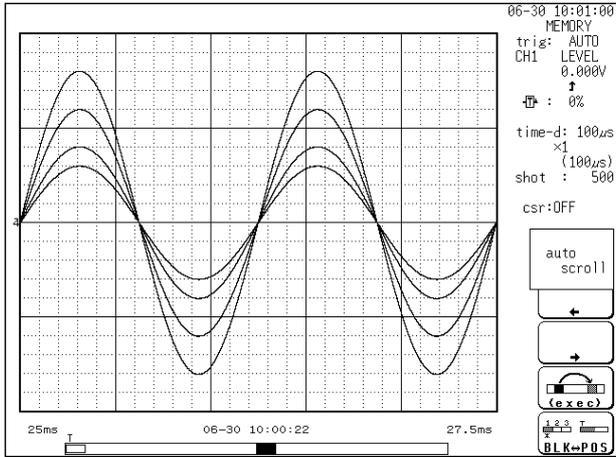
View function

See Section 11.6.

- Shows the position of the currently displayed waveform within the entire recording length (MEM and REC).
- Shows the memory segmentation status (MEM).

11.1 Scrolling the Waveform

The waveform on the display can be scrolled horizontally.



Method **Screen:** DISPLAY

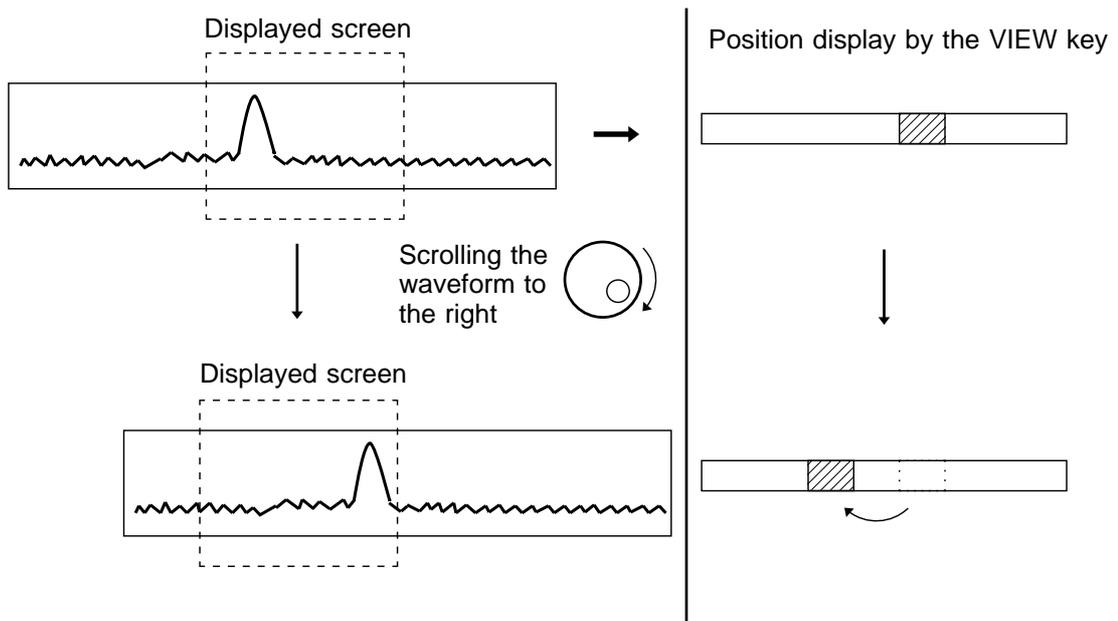
- ① Press the **WAVE SELECT** key so that the **WAVE LED** lights up.
- ② Use the **JOG/SHUTTLE** control to scroll the waveform.

Auto-scroll

- If turning the the **SHUTTLE** control fully and holding the control for about five seconds, the indication **Auto scroll** appears on the function key display and the waveform continues to scroll even if releasing the control.
- Auto-scroll is canceled by pressing any key.

Waveform scrolling

When the waveform is scrolled, the screen status and waveform position are as illustrated below.



NOTE

In the FFT function, Waveform scrppling cannot be carried out.

11.2 Using the A/B Cursors

The A/B cursors can be used to read a time difference, frequency, or potential difference on screen. (When scaling is used, the difference is displayed in the scaling value. See Section 9.7.)

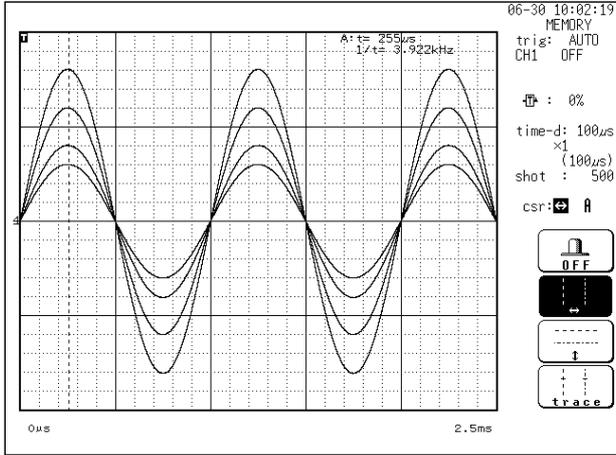
Cursors	Function			
Line cursor	The value at cursor A and cursor B, and the value between the two cursors can be determined.			
Trace cursor	MEM, REC&MEM, FFT <ul style="list-style-type: none"> • The value at the point where the cursor crosses the waveform can be determined. • The trace point moves on the waveform of the specified channel. REC, RMS, REC&MEM <ul style="list-style-type: none"> • The intersection between the cursor and the waveform is displayed midway between of the maximum and minimum values. 			
Value	A or B	B - A		
Line cursor (Vertical)	t	Time from the trigger point (MEM, RMS, REC&MEM) Time from the measurement start point (REC, REC&MEM)	t	Time difference between the trace points
	1/t	Frequency taking t as the period	1/t	Frequency taking t as the period
Line cursor (Horizontal)	v	Voltage value of the specified channel	v	Voltage difference between the A and B cursors.
Trace Cursor	t	Time from trigger point to trace point (MEM,RMS,REC&MEM,FFT) Time from the measurement start point (REC, REC&MEM)	t	Time difference between the trace points
	v	Voltage value of the specified channel (MEM,REC&MEM,FFT) Max. and min. value of the specified channel (REC,RMS,REC&MEM)	v	Potential difference between the trace points
	f	Frequency (FFT)	f	Frequency difference between the trace points

NOTE

- For the effective value recorder, when the time axis range is other than 5 s/DIV, the 'v' level of the trace cursor indicates the maximum and minimum values.
- When external sampling is being performed, a "t" is included in the sampling number.
- While the settings are made on the Waveform display screen (displaying the input channel), the value between A and B cursors is no displayed. A/B cursor measurements are enabled even if the line cursor (vertical) or trace cursor are off the screen. When the cursor is set to A&B and either the A or B cursor is moved, both A and B cursors are shifted onto the screen.

11.2.1 Using the Line Cursors (Vertical)

The line cursor (vertical) displays the time and period starting from the trigger position. On the recorder, the line cursor (vertical) displays the time and period starting from the initiation of recording.

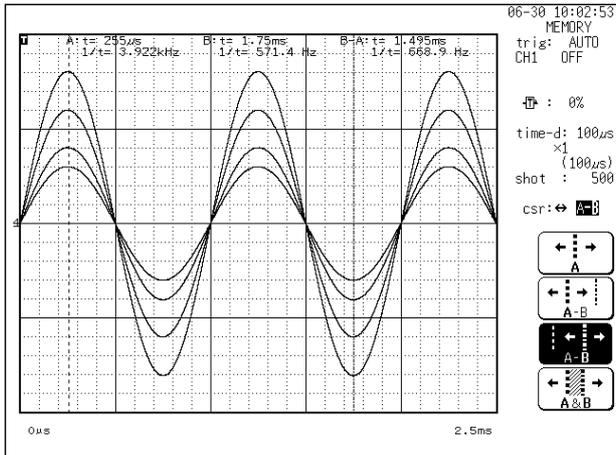


Method Screen: DISPLAY

- ① Move the flashing cursor to the csr item.
- ② Use the function keys to select the "Line cursor (vertical: t, 1/t)".

Selection

-  : Disable A/B cursors
-  : Line cursor (vertical: t, 1/t)
-  : Line cursor (horizontal: v)
-  : Trace cursor (the point where the cursor crosses the waveform)



- ③ Use the function keys to select the cursor to be moved.

Selection

-  : Use A cursor only
-  : Move the A cursor only
-  : Move the B cursor only
-  : Move both the A and B cursors

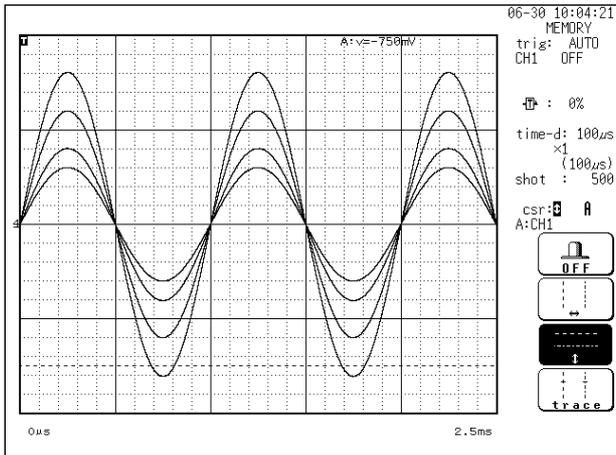
- ④ Press the **A·B CSR SELECT** key so that the A.B CSR LED lights up.
- ⑤ Rotate the **JOG/SHUTTLE** control to move the cursor.

NOTE

- When the **A·B CSR SELECT** key is used to activate the A/B cursor mode, the trace cursor (X-Y CONT: line cursor) can be used, also if it was set to OFF.
- When the vertical cursor or trace cursor is used, cursor measurements are possible also when one of the cursors is currently off screen. When the cursor is set to A&B and either the A or B cursor is moved, both A and B cursors are shifted onto the screen.
- When the vertical cursor or the trace cursor is off screen, the **VIEW** key can be used to check the cursor position within the total recording length.
- When the cursor is moved to the edge of the screen, the waveform is scrolled.
- If turning the the SHUTTLE control fully and holding the control for about five seconds, the indication **Auto scroll** appears on the function key display and the waveform continues to scroll even if releasing the control. Auto-scroll is canceled by pressing any key.
- In additional recording (REC, RMS, REC&MEM), the junction between data is invalid data.

11.2.2 Using the Line Cursors (Horizontal)

Used to read a voltage value of the specified channel. A/B cursor can be specified a different channel.

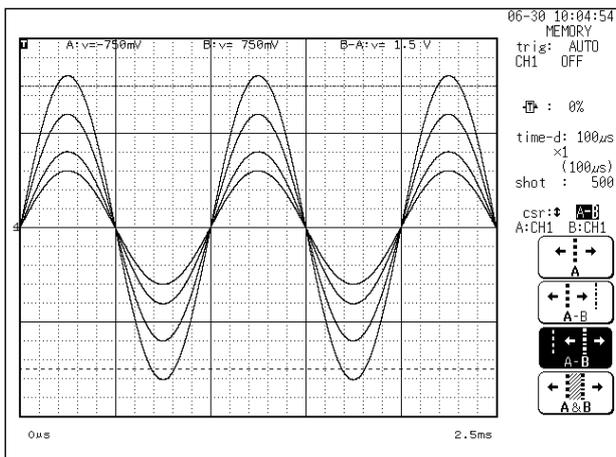


Method Screen: DISPLAY

- ① Move the flashing cursor to the csr item.
- ② Use the function keys to select the "Line cursor (horizontal: v)".

Selection

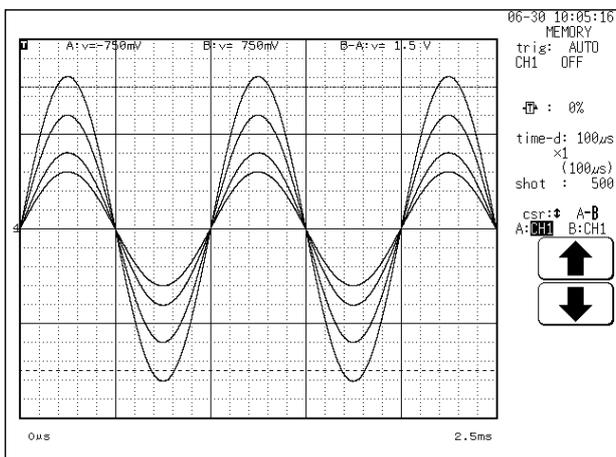
-  : Disable A/B cursors
-  : Line cursor (vertical: t, 1/t)
-  : Line cursor (horizontal: v)
-  : Trace cursor (the point where the cursor crosses the waveform)



- ③ Use the function keys to select the cursor to be moved.

Selection

-  : Use A cursor only
-  : Move the A cursor only
-  : Move the B cursor only
-  : Move both the A and B cursors



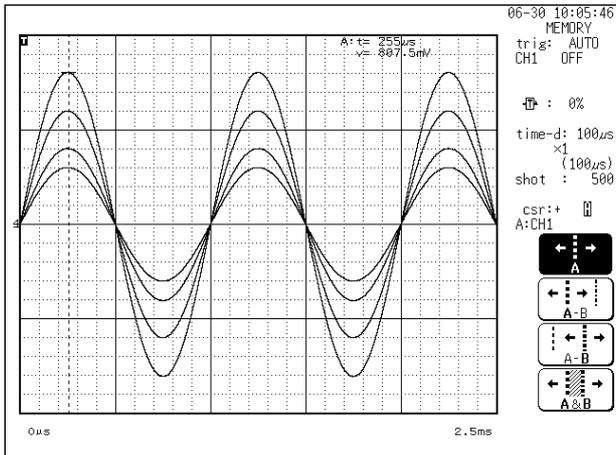
- ④ The channel setup menu appears below the cursor. Using the function keys or the JOG control, move the flashing cursor to set the channel of the waveform for which the voltage is to be read. This channel setting must be performed for both cursors A and B.
- ⑤ Press the **A·B CSR SELECT** key so that the A.B CSR LED lights up.
- ⑥ Rotate the JOG/SHUTTLE control to move the cursor.

NOTE

- When the **A·B CSR SELECT** key is used to activate the A/B cursor mode, the trace cursor (X-Y CONT: line cursor) can be used, also if it was set to OFF.
- Only channels for which a waveform is being displayed can be specified.
- By specifying a different channel for the A and B cursors, a potential difference between the waveforms in the respective channels can be determined.

11.2.3 Using the Trace Cursors

Used to read the value at point where the cursor crosses the waveform of the specified channel. A/B cursor can be specified a different channel.

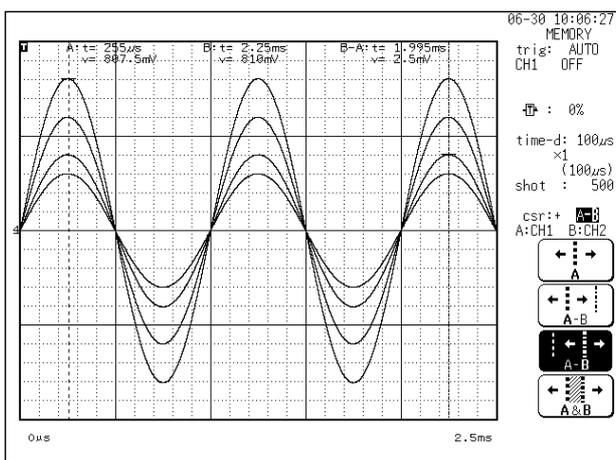


Method **Screen: DISPLAY**

- ① Move the flashing cursor to the csr item.
- ② Use the function keys to select the "Trace cursor".

Selection

- : Disable A/B cursors
- : Line cursor (vertical: t, 1/t)
- : Line cursor (horizontal: v)
- : Trace cursor (the point where the cursor crosses the waveform)



- ③ Use the function keys to select the cursor to be moved.

Selection

- : Use A cursor only
- : Move the A cursor only
- : Move the B cursor only
- : Move both the A and B cursors

- ④ The channel setup menu appears below the cursor. Using the function keys or the JOG control, move the flashing cursor to set the channel of the waveform for which the value is to be read. This channel setting must be performed for both cursors A and B.

Using A cursor only

When ALL is selected, the values of all channels are read.

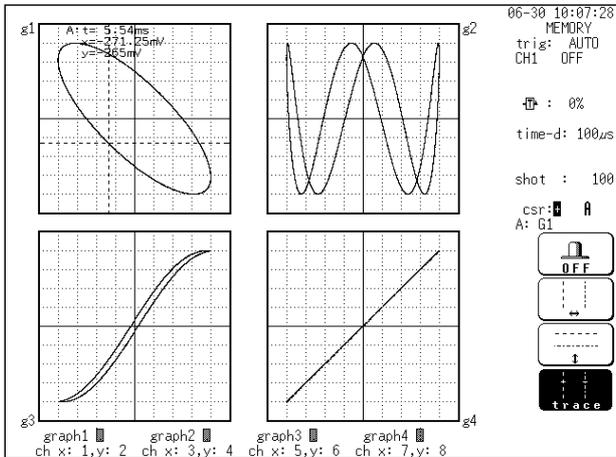
- ⑤ Press the **A·B CSR SELECT** key so that the A.B CSR LED lights up.
- ⑥ Rotate the JOG/SHUTTLE control to move the cursor.

NOTE

- When the **A·B CSR SELECT** key is used to activate the A/B cursor mode, the trace cursor can be used, also if it was set to OFF.
- When the vertical cursor or trace cursor is used, cursor measurements are possible also when one of the cursors is currently off screen. When the cursor is set to A&B and either the A or B cursor is moved, both A and B cursors are shifted onto the screen.
- When the vertical cursor or the trace cursor is off screen, the **VIEW** key can be used to check the cursor position within the total recording length.
- Only channels for which a waveform is being displayed can be specified.
- By specifying a different channel for the A and B cursors, a potential difference between the waveforms in the respective channels can be determined.
- When the cursor is moved to the edge of the screen, the waveform is scrolled.
- If turning the the SHUTTLE control fully and holding the control for about five seconds, the indication **Auto scroll** appears on the function key display and the waveform continues to scroll even if releasing the control. Auto-scroll is canceled by pressing any key.

11.2.4 Using the A/B Cursors (X-Y Screen)

The cursor can be used on the X-Y screen. Partial X-Y plotting enables operation of the A/B cursors.

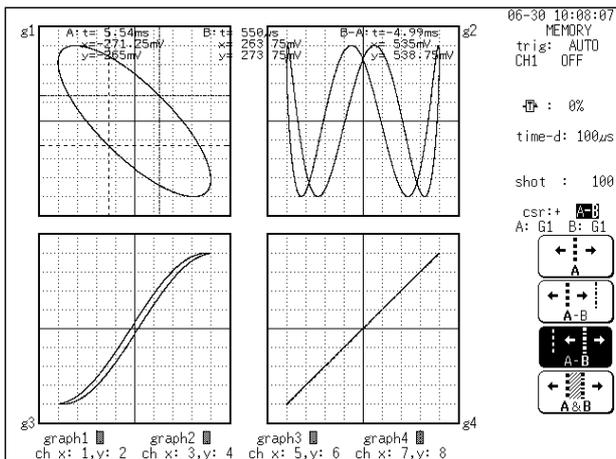


Method Screen: X-Y DISPLAY

- 1 Move the flashing cursor to the csr item.
- 2 Use the function keys to make selection.

Selection

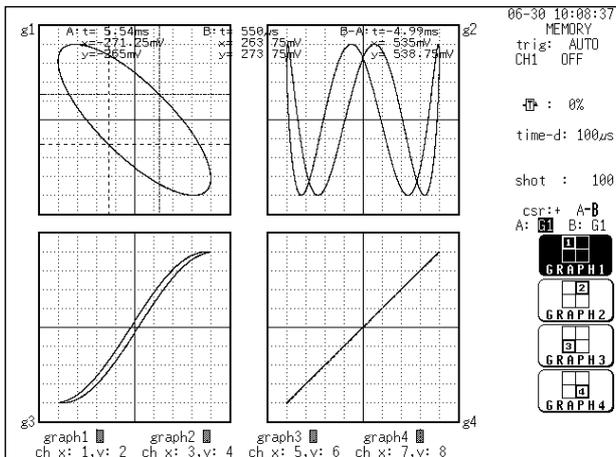
- : Disable A/B cursors
- : Line cursor (vertical: t, 1/t)
- : Line cursor (horizontal: v)
- : Trace cursor (the point where the cursor crosses the waveform)



- 3 Use the function keys to select the cursor to be moved.

Selection

- : Use A cursor only
- : Move the A cursor only
- : Move the B cursor only
- : Move both the A and B cursors



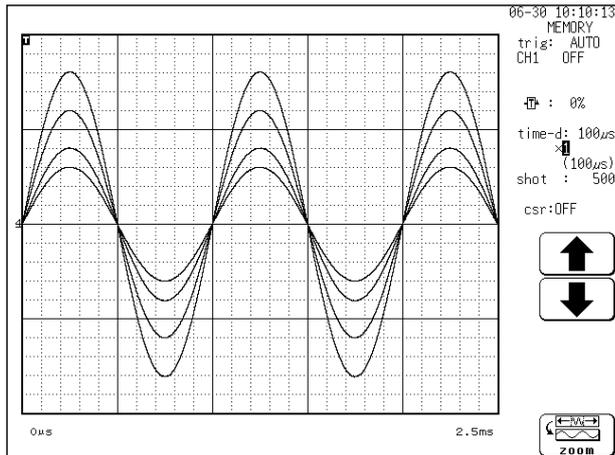
- 4 The graph setup menu appears below the cursor. Using the function keys or the JOG control, move the flashing cursor to set the graph of the waveform for which the voltage is to be read. This channel setting must be performed for both cursors A and B.
- 5 Press the **A·B CSR SELECT** key so that the A·B CSR LED lights up.
- 6 Rotate the JOG/SHUTTLE control to move the cursor.

NOTE

By specifying a different graph for the A and B cursors, a potential difference between the waveforms in the respective channels can be determined.

11.3 The Magnification/Compression Ratio Along the Time Axis

- The magnification/compression ratio along the time axis can be set. (MEM and REC&MEM)
- By magnifying the waveform, detailed observations can be made. By compressing the waveform, an entire change can be promptly apprehended.
- Magnification/compression of the screen uses the left edge as reference, regardless of the status of the A/B cursor.
- The magnification/compression factor can be changed also after measurement is completed.



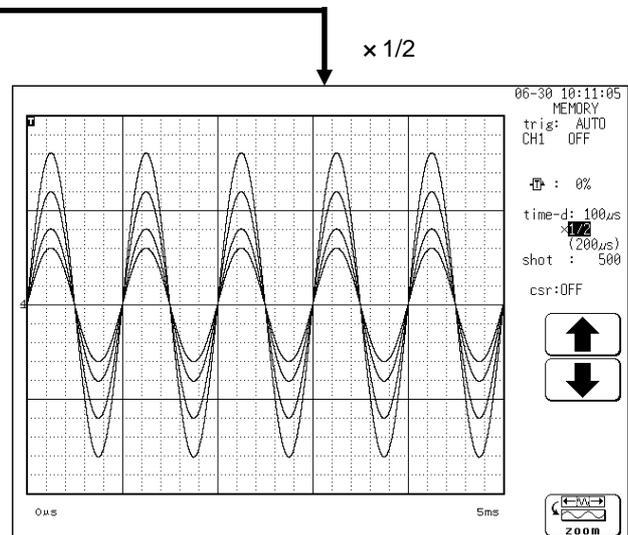
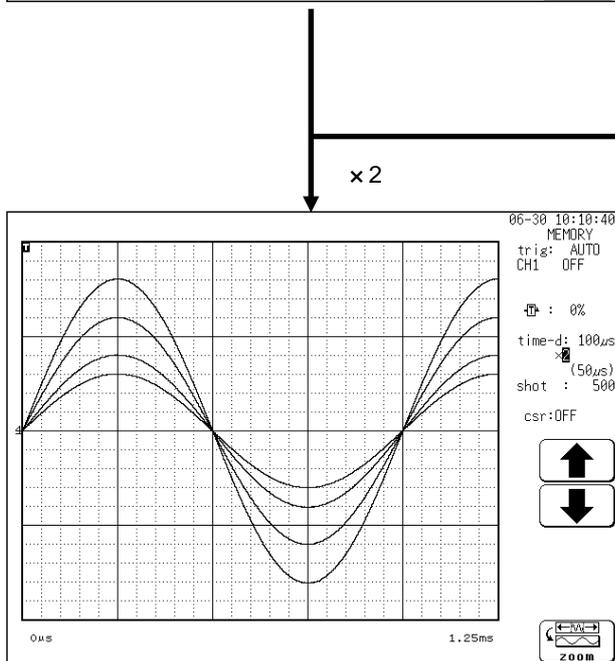
Method Screen: DISPLAY, CHANNEL

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys or the JOG control to select the magnification/compression ratio.

Selection

 : Ratio up

 : Ratio down



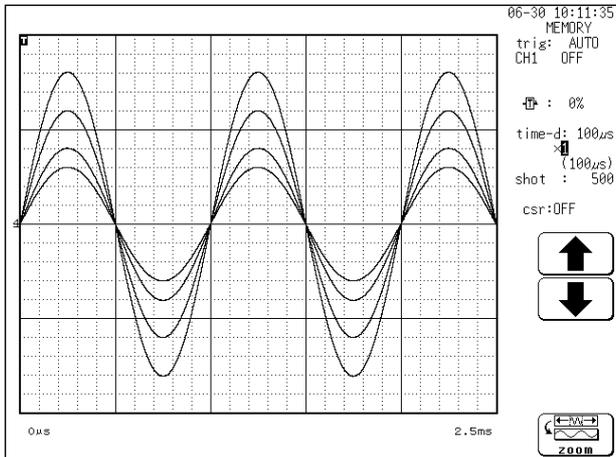
Function	Magnification/Compression ratio
MEM REC&MEM	$\times 10, \times 5, \times 2, \times 1, \times 1/2, \times 1/5, \times 1/10, \times 1/20, \times 1/50, \times 1/100, \times 1/200, 1/500, \times 1/1000, \times 1/2000, \times 1/5000, \times 1/10000$
REC, RMS REC&MEM	$\times 1, \times 1/2, \times 1/5, \times 1/10, \times 1/20, \times 1/50, \times 1/100, \times 1/200, \times 1/500$

NOTE

The magnification or compression ratio along the voltage axis is set on the Channel or Waveform Display screen. Refer to Section 9.3.5 for details.

11.4 Zoom Function

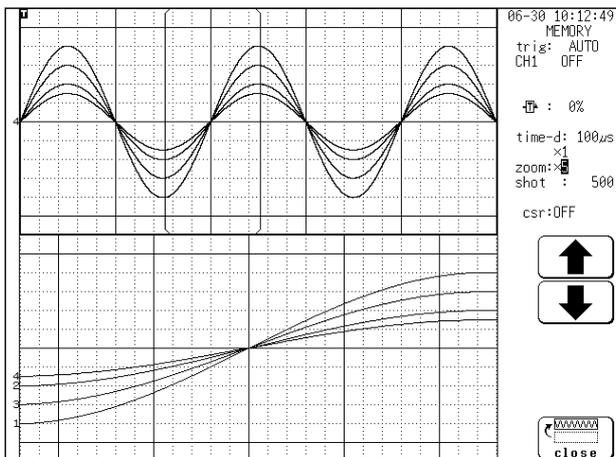
This function divides the memory recorder function display screen into upper and lower windows, so that the regular-size waveform is displayed in the upper window and the waveform enlarged in the time axis direction is displayed in the lower window.



Method

Screen: DISPLAY

- ① Press the **DISP** key to call up the DISPLAY screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Use the function keys to select the [zoom]. When the zoom function is selected, the display is split into two horizontally tiled screens. The waveform before the zoom mode was activated is displayed on the upper screen (standard screen). The lower screen shows the zoomed waveform (zoom screen).



- ④ Move the flashing cursor to the **zoom** position shown in the figure on the left.
- ⑤ Use the JOG control or the function keys to set the magnification ratio. The lower screen's display magnification is always larger than the upper screen's display magnification. [] brackets on the upper screen indicate the waveform range displayed on the lower screen.

Selection

-  : Time axis direction magnification up
-  : Time axis direction magnification down

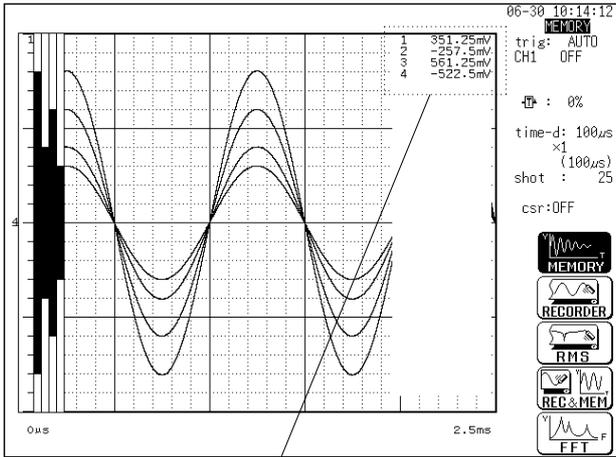
- ⑥ To terminate the zoom function, press the function key [close].

NOTE

- The A/B cursors can be used only for the waveform on the lower screen.
- During the zoom function, pressing the **PRINT** key prints the waveform on the lower screen. (The waveform becomes that of the one screen display. If the A/B cursors are used, partial print is applied.)
- When the logic waveform is set so as to be displayed in a position from 5 to 8, it is not displayed.
- When you intend to use the zoom function for the REC&MEM memory waveform, change the current function to the memory recorder function.

11.5 Input Level Monitor Function

- The levels of all input waveforms can be monitored in real time.
- Levels are displayed separately for CH1 - CH32 and logical CH A - CH H.
- To select the input channel, use the CH.SET key. See Section 9.9.
- This function is available in all modes.
- The input levels can not be confirmed at FTT function.
- During measurement, the input levels can not be confirmed at RMS function.



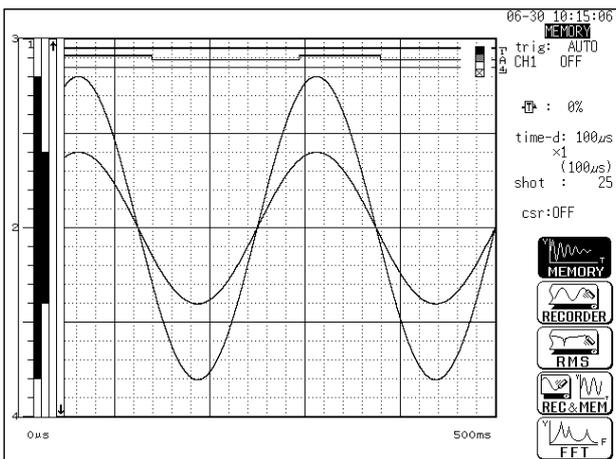
Method **Screen: DISPLAY**

- ① Press the **LEVEL.MON.** key.
- ② The **CH.SET** key can be used to select the input channel while using the input level monitor function.
- ③ Press the **LEVEL MON.** key once more to terminate the function.

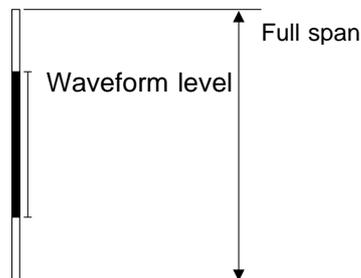
When the X-Y screen has been set, only those channels assigned to graphs 1 to 4 are displayed.

All the logic displays are set to OFF, and the instantaneous value of the input level is displayed at the right of the screen (except for the X-Y screen and FFT).

An instantaneous value for the analog channel is displayed. In RMS recorder function, however, the RMS value is not displayed.



【 Analog channel 】



【 Logic channel 】

- ... The input is stabilized at the HI level.
- ... The input varies drastically between the HI and LOW levels.
- ... The input is stabilized at the LOW level.
- ... The display is disabled.

【 The input level is not displayed on the screen display range: 】

- ↑ ... The input level exceeds the upper limit.
- ↓ ... The input level exceeds the lower limit.

NOTE

For the following channels, analog input level is not displayed:

- Channels where no unit is installed.
- A channel that deviates from the set active channel range (example: 5 ch or subsequent channels when the number of set active channels is four).

11.6 View Function (VIEW key)

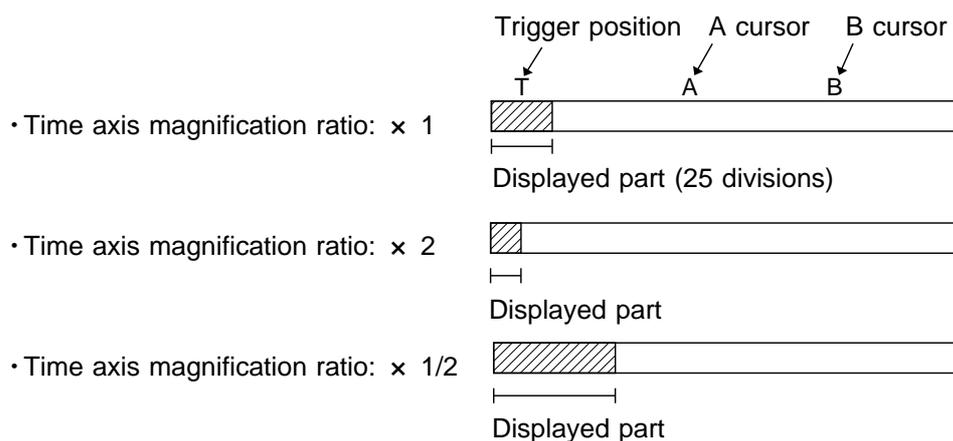
The view function performs the following operations. It is not available with the FFT function.

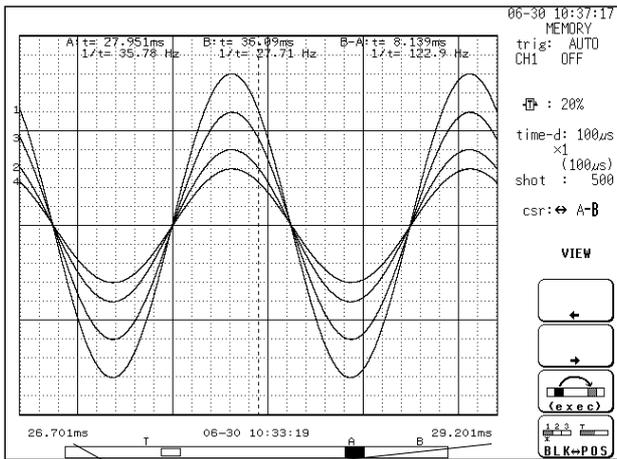
Position display	Shows the position of the currently displayed waveform within the entire recording length.
Block display	Shows the memory segmentation status (MEM).

Position display

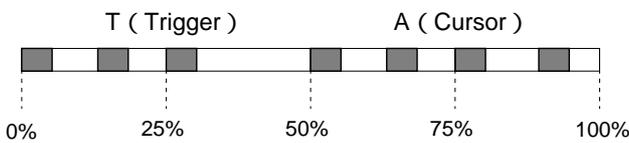
- Indicates the position of the currently displayed waveform within the entire recording length.
- Displays the trigger time and position and A-B cursor positions (when vertical or trace cursors are used).

[When the recording length is 200 divisions]





Time from trigger point (MEM, RMS, REC&MEM)
 Time from measurement start (REC, REC&MEM)



Method **Screen: DISPLAY**

- ① Press the **VIEW** key on the display screen shows at the bottom of the screen the position with respect to the recording length of the displayed part of the waveform.
- ② Move the () mark to the desired point with function key.

Selection

-  : Shifts the destination to the left.
-  : Shifts the destination to the right.
-  : Executes the dislocation.
-  : Toggles block display.

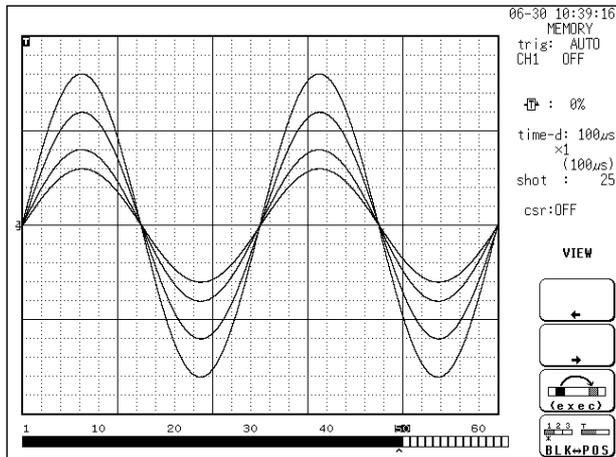
- ③ Using the function key to select "exec". high-speed shift is carried out and the display position changes.

NOTE

- While the view function is active, the flashing cursor is not displayed and the settings cannot be changed.
- Even during measurement, the position of the waveform can be displayed by pressing the **VIEW** key.
- If the recording length is equal to or less than four times the width of the waveform display screen, the dislocation function is not enabled.
- When the recording length is set to "CONT" on the recorder or RMS recorder and at least 2000 divisions (10,000 divisions for 64 M words) are recorded, the time displayed does not represent the value counted from the trigger point (Recorder function: recording start point).
- When the recording length of recorder waveform in REC&MEM is set to "CONT." and at least 1000 divisions (5000 divisions for 64 M words) are recorded, the time displayed does not represent the value counted from the recording start point.
- In the FFT function, view function cannot be carried out.

Block display (MEM only)

- When memory segmentation is being used, the memory block status is shown.
- Sequential save and multi-block function can be used block display.
- Any block in which an input signal is recorded can be called up on the display.



Method Screen: DISPLAY

- ① Press the **VIEW** key on the display screen shows at the bottom of the screen the position with respect to the recording length of the displayed part of the waveform.
- ② Using the function key to select "block display".

Selection



: Shifts the destination to the left.



: Shifts the destination to the right.



: Toggles block display.



: Toggles position display.

- ③ In the case of 127 or 255 divisions, select a bar graph using the up and down cursor keys.
- ④ Use the function keys to move the "^" mark and specify the memory block you wish to display.
- ⑤ Using the function key to select the "exec".

NOTE

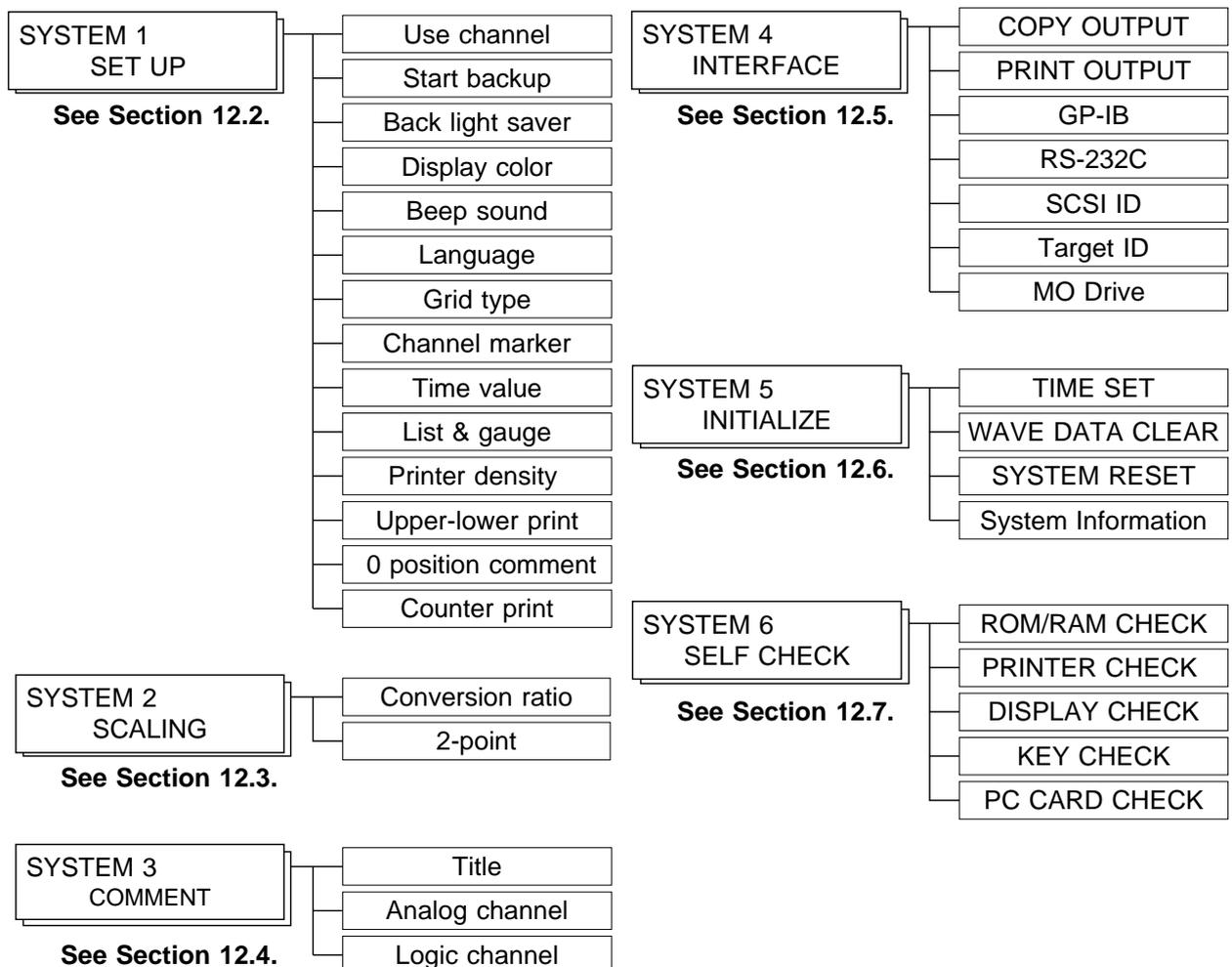
- Memory segmentation can be carried out with the memory recorder function.
- While the view function is active, the flashing cursor is not displayed and the settings cannot be changed.

Chapter 12

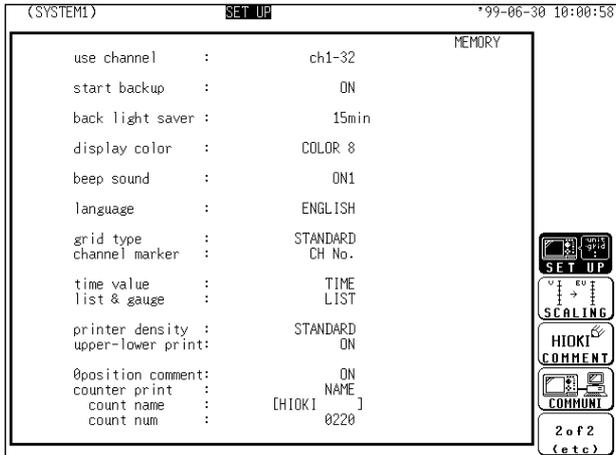
SYSTEM Screen Settings

12.1 Overview

The SYSTEM screen serves to set the following items which are common to all functions.



12.2 SET UP Screen (SYSTEM 1)



Method

Screen: SET UP (SYSTEM1)

- ① Press the **SYSTEM** key to call up the SYSTEM1 screen.
- ② Move the flashing cursor, want to set the item.
- ③ Use the function keys to make the selection.

The item of channel marker, time value display, upper and lower limits of printer, zero position comment, counter printing cannot be used in FFT function.

12.2.1 Use Channel (MEM only)

- Select whether the memory for measurement data is used by being divided up.
- The smaller the number of channels in use, the longer will be settable recording length.

Selection

ch1-4

: Allocates the memory for measurement data to channels 4. Measurement cannot be made on channels 5 to 32 and logic CHE to CHH.

ch1-8

: Allocates the memory for measurement data to channels 8. Measurement cannot be made on channels 9 to 32.

ch1-16

: Allocates the memory for measurement data to channels 16. Measurement cannot be made on channels 17 to 32.

ch1-32

: Allocates the memory for measurement data to channels 32.

NOTE

Settings for the use channel are displayed only when the "Memory Recorder" function has been set.

12.2.2 Start Backup

- When this function is enabled, the unit will operate as follows: If the power supply is interrupted during recording operation (while the START key LED is lit), and then the power supply is restored, the 8826 goes back into the measurement operation mode, and recording is restarted immediately.
- If the trigger function is used, the unit goes into trigger standby mode. However, this is disabled with the timer trigger.

Selection  : The start key backup function is not used.

 : The start key backup function is used.

12.2.3 Back Light Saver

- When this function is enabled, LCD back lighting is turned off automatically if no key is pressed for the preset interval.
- Pressing any key will turn the display on again.
- This increases the service life of the back light.

Selection  : Increase time (1 to 30).
The display automatically goes off after the preset interval (minutes).

 : Decrease time (1 to 30).

 : The display is shown continuously.

12.2.4 Display Color

- Serves to set the display color.
- The display color can be selected from among the display colors 1 to 8 and the customer color 9 which can be set as desired.

Selection  : Display color number up

 : Display color number down

 : Make the customer color.

Custom setting (setting the color as desired)

Change the R.G.B. setting values of each item on the screen.

Move the flashing cursor to the item for which you want to change the setting values, and use the JOG control or the function keys to make the settings.

The setting values inside the window applies to the colors of the particular window. When a value is changed, the color of the area corresponding to this item changes.

When system reset is executed, set colors are initialized and become the same color as that of display color 1.

- Selection**  : value up
-  : value down
-  : Exit from the custom setting screen

12.2.5 Beep Sound

This function indicates the operating status by a beep sound. The beep can be selected from two types. Performing a system reset sets the ON1 beep type.

- Selection**  : Beep is not heard.
-  : The beep sounds with error messages (error or warning display) and when a waveform is evaluated as NG.
-  : The beep sounds upon start, trigger, stop and when data storage finished, as well as with error messages (error or warning display) and when a waveform is evaluated NG.

12.2.6 Language

Serves to set the display language.

- Selection**  : The display language is Japanese.
-  : The display language is English.

12.2.7 Grid Type

- Selects the type of grid shown on the display screen and drawn on the recording paper.
- On the waveform display screen, the standard and fine grids are defined as the standard, and the standard (dark) and fine (dark) grids are defined as the standard (dark) grids.
- "Time" and "Time (dark)" can be set only during printing.



NOTE

In printing in the X-Y screen format or FFT function, the standard time axis and the standard time axis (dark) are applied.

12.2.8 Channel Marker

The channel numbers or the comments are printed together with the waveform on the recording paper.

- | | | |
|------------------|--|--|
| Selection | | : Channel numbers will not be printed for the waveform on the recording paper. |
| | | : Channel numbers will be printed for the waveform on the recording paper. |
| | | : Comments will be printed for the waveform on the recording paper. |

12.2.9 Time Value

The time from the trigger point and other information can be printed.

- | | | |
|------------------|--|---|
| Selection | | : Displays the time from the trigger point (unit: fixed). |
| | | : Displays the time from the trigger point (unit: base 60). |
| | | : Displays the number of DIV from trigger point. |
| | | : Displays the time when a waveform is captured. |

12.2.10 List & Gauge

When a waveform is printed out (except for screen hard copies), the gauge can be printed out at the beginning, and a listing can be printed out at the end. On the wide X-Y screen, the horizontal axis gauge is not printed out.

Selection	OFF	: No gauges or listing
		: Print listing only
		: Print gauges only
		: Print both gauges and listing

12.2.11 Printer Density

Serves to set the printer density. Select the setting which yields the most easy to read printout.

Selection					
------------------	---	---	---	---	--

12.2.12 Upper-lower Print

In waveform printing, the upper and lower values of each channel are printed first. When the scaling function is being used, the scaled values are printed.

Selection		: Upper-lower print is not used.
		: Upper-lower print is used.

12.2.13 0 Position Comment

In waveform printing, comments are printed out in the zero position of each channel. This comment printing is valid only for the analog channels. Comments can be set on SYSTEM3 (COMMENT) screen.

Selection		: 0 position comment is not used.
		: 0 position comment is used.

12.2.14 Counter Print

In waveform printing, the counter can be printed out. This function is useful to distinguish between similar waveforms.

Selection



: Counter Print is not printed.



: Counter Print is printed with date.

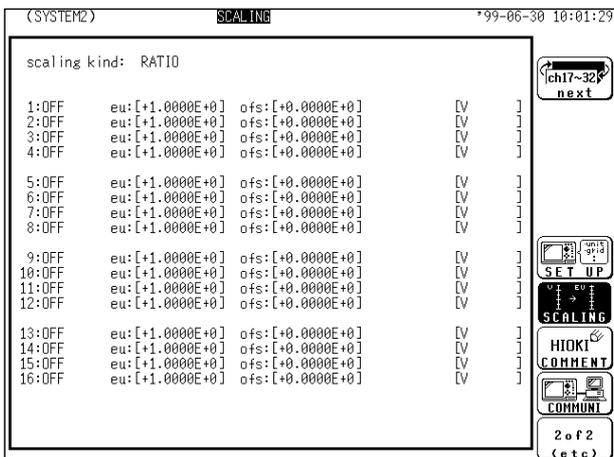


: Counter Print is printed with counter name.

- A counter name of up to ten characters can be specified. For information on how to enter the counter name, see Section 9.8.4.
- After the unit is turned on, the counter is reset to 0 (zero), and the counter value is increased each time a waveform is retrieved. (The maximum counter value is 9999.) To initiate waveform acquisition from an arbitrary count value, move the flashing cursor to the counter-value entry field and specify the desired value using the function keys, the JOG control or the **CH&NUM** key.

12.3 SCALING Screen (SYSTEM 2)

- The scaling function can be used to convert an output voltage from a sensor or similar into a physical quantity.
- Two types of scaling functions are available.
- The gauge scale (maximum and minimum values of horizontal axis) and A/B cursor measurement values are displayed in the scaled units.
- Scaling can be performed for every channel.



(1) Conversion ratio method

Scaling is performed by specifying a physical quantity to correspond to a 1 V input signal (conversion ratio: eu/v), an offset value, and the unit (eu: engineering units). This will cause the measurement voltage to be converted into the selected units.

(2) 2-point method

Scaling is performed by specifying two input signal points (voltage values) and the conversion values for these two points in engineering units (eu). This will cause the measurement voltage to be converted into the selected units.

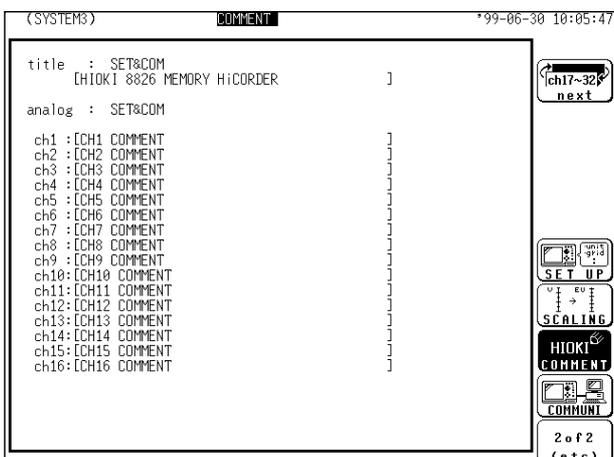
NOTE

Refer to Section 9.7.

12.4 COMMENT Screen (SYSTEM 3)

Three types of comment are available.

If "COMMENT" or "SET & COMMENT" is selected, this comment will be included on the recording paper in all functions.



(1) Title comment input

Title comments of up to 40 characters can be included on the recording paper.

(2) Input of comments for analog channel

Comments of up to 40 characters can be included on the recording paper on each channel.

(3) Input of comments for logic channel

Comments of up to 40 characters can be included on the recording paper on each channel.

NOTE

Refer to Section 9.8.

12.5 INTERFACE Screen (SYSTEM 4)

(SYSTEM4) **INTERFACE** *00-02-14 12:16:27

COPY OUTPUT : FLOPPY DISK MONO
 file name : CIMAGE J
 PRINT OUTPUT: EXTERNAL PRINTER COLOR
 control code : ESC/P

interface : NO USE

SCSI ID: 7
 target ID: 5
 MO Drive controlled by PC OFF

SET UP
 SCALING
 HIOKI COMMENT
 COMMENT
 2 of 2
 (etc)

Method Screen: INTERFACE (SYSTEM4)

- ① Press the **SYSTEM** key to call up the SYSTEM4 screen.
- ② Move the flashing cursor, want to set the item.
- ③ Use the function keys to make the selection.

Setting the 8910 CAN ADAPTER

You can edit the 8910 CAN ADAPTER setting when the 8910 CAN ADAPTER is connected via the RS-232C interface.

Press the <CH.SET> key to switch between the interface and 8910 setting screens.

For details, refer to the instruction manual provided with the 8910 CAN ADAPTER.

(SYSTEM4) **INTERFACE** *03-04-17 10:28:30

BLOCK NO.	8910 CH	LABEL NAME	D/A 8826 TYPE	CH	8910 CH	LABEL	BP 8826 CH
ID TRIGGER OFF ID FILTER CAN1:NON CAN2:NON	1	OFF			A0	OFF	
	2	OFF			A1	OFF	
	3	OFF			A2	OFF	
	4	OFF			A3	OFF	
	5	OFF			B0	OFF	
	6	OFF			B1	OFF	
	7	OFF			B2	OFF	
	8	OFF			B3	OFF	
	9	OFF			C0	OFF	
	10	OFF			C1	OFF	
	11	OFF			C2	OFF	
	12	OFF			C3	OFF	

INTERFACE
 CH.SET
 LIST
 SET UP
 SCALING
 HIOKI COMMENT
 COMMENT
 2 of 2
 (etc)

12.5.1 Output Destination by the COPY key

The screen data output destination when the **COPY** key is pressed is specified.

- | | | |
|------------------|---|--|
| Selection |  | : Output to internal printer |
| |  | : Output to external printer |
| |  | : Output to floppy disk (BMP format) |
| |  | : Output to PC card (BMP format) |
| |  | : Output using the interface (BMP format) |
| |  | : Output to connected SCSI interface. (BMP format) |
| |  | : Output to MO drive. (BMP format) |

When the external printer is the output destination, select the control code.

- | | | |
|------------------|---|---|
| Selection |  | : Uses ESC/P as the control code |
| |  | : Uses ESC/P raster as the control code |

When the internal printer is not the output destination, select the color of the output destination.

- Selection**  : Output color data
-  : Output gray-scale data
-  : Output monochrome data
-  : Output reverse monochrome data

When floppy disk, PC card, interface, SCSI, or MO drive is selected as the output destination, specify a file name for saving data in BMP format.

NOTE

- When the output destination specified excluding internal and external printer and the color is set to monochrome, the screen is displayed in monochrome while data saving is in progress.
- Stores a file in the directory currently selected on the file screen. See Section 14.12.2.
- Refer to the printer operating manual for the control codes.
- Files stored in BMP format cannot be read by the 8826.

12.5.2 Output Destination by the PRINT key

The measurement data output destination when the **PRINT** key is pressed is specified.

- Selection**  

When the external printer is the output destination, select the control code.

- Selection**  : Uses ESC/P as the control code
-  : Uses ESC/P raster as the control code

When the external printer is the output destination, select the color of the output destination.

- Selection**  : Output color data
-  : Output monochrome data

NOTE

- Even if the information that has been input using the **PRINT** key is to be output to the external printer, automatic printing or real-time printing is performed on the internal printer rather than the external printer.
- Refer to the printer operating manual for the control codes.

12.5.3 Setting the Interface

GP-IB interface Settings

When the GP-IB interface has been selected, and the 9558 GP-IB CARD is connected, the following items must be set.

Mode: ADDRESSABLE / TALK ONLY / DISABLE

Address: 0 to 30

Header: OFF/ON

RS-232C Interface Settings

When the RS-232C interface has been selected, and the 9557 RS-232C CARD is connected, the following items must be set.

Transfer rate: 1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200

Data word length: 8 bit / 7 bit

Parity: NONE / EVEN / ODD

Stop bit: 1 bit / 2 bit

Delimiter: LF / CR + LF

Header: OFF / ON

Flow control: NONE / Xon/Xoff / HARD

NOTE

For details, refer to the "9558 GP-IB CARD" or "9557 RS-232C CARD" Instruction Manual.

LAN interface Settings

IP address

Host name

Port No.

Subnet Mask

Gate way ON/OFF and IP address

Delimiter and Header ON/OFF

FTP Access Control

DHCP ON/OFF

DNS ON/OFF and IP address

Server (9333)

FTP user name and Password

NOTE

For details, refer to the "9333 LAN COMMUNICATOR" Instruction Manual.

12.5.4 Setting the SCSI ID and Target ID

Set the SCSI interface. For details, refer to 14.4.

SCSI ID

Set the ID number of the 8826 on the SCSI bus.

The available value range is 0 to 7.

Target ID

Set the ID number of the MO drive, which will be connected to the 8826, on the SCSI bus. The ID number of the internal MO drive (optional) is set to 4.

Therefore, if the internal MO drive has been mounted, the ID number 4 cannot be specified. The available value range is 0 to 7.

NOTE

- Do not set the SCSI ID and target ID to the same number.
- When "SCSI" or "MO" is selected as the output destination, separate destinations cannot be set for the auto save, parameter calculation result save, and **COPY** key output.

12.5.5 Setting the MO Drive

The 8826 internal MO drive can be used as an MO drive on a PC.

Internal MO drive settings are valid only when the optional 9598 MO Unit is installed. For details, refer to 14.2.1.

NOTE

- The ID of the internal MO drive is fixed at 4, and cannot be changed.
- When the internal MO setting is ON, the "Internal MO" media selection is not available.
- When the internal MO setting is ON and if "Internal MO" is selected as the destination for automatic saving, Auto Save settings are OFF.

12.5.6 Setting the LAN Interface

LAN Interface

The 8826 MEMORY HiCORDERS provide the LAN functions below by using a LAN card inserted in the PC card slot.

Supporting the 9333

When using the HIOKI 9333 LAN COMMUNICATOR, you can remotely control the 8826 on a PC or use the Auto Save function to save 8826 data on a PC via the 9333. For details, refer to the instruction manual provided with the 9333.

FTP Server

The 8826 use an FTP (File-Transfer-Protocol, compliant with the RFC959) server. You can access files on 8826 internal media from a PC by using FTP client software.

Each medium appears as a directory on the FTP server as shown below.

/FD a Floppy disk

/MO a Internal MO drive

/SCSI a External MO drive

/STORAGE/MEM a binary files in storage memory

/STORAGE/TEXT a text files in storage memory

/ By accessing STORAGE, you can access measurement data in storage memory, such as binary/text files. (/STORAGE is read-only.)

For example, to access from an IE or other browsers (assuming a recorder IP of 192.168.0.2), enter "ftp://192.168.0.2" in the Location field. When the data is protected by a user name and password, enter the user name in NAME and the password in PASS of "ftp://NAME:PASS@192.168.0.2."

Please note that there are some restrictions.

- You cannot access a file while the 8826 is conducting measurement or standing by for a trigger. In such case, you must first stop measurement operation. Use one of the methods below.

* Wait until measurement is completed.

* Use the 9333 to stop measurement by remote control.

* Use one of the following SITE commands of FTP:

SITE START : Starts measurement.

SITE STOP : Stops measurement.

SITE ABORT : Aborts measurement.

SITE STAT : Responds with the status.

("211 START" is returned when measurement is in progress and "211 STOP" when measurement is not in progress.)

Use of the SITE commands requires an FTP client that can directly send arbitrary commands to a sever.

For example, with a command-line FTP from a Windows command prompt, you can send a SITE command by using a literal command (e.g., FTP> literal SITE STOP).

- Only one connection at a time is allowed. Therefore, do not use a high-speed download tool that employs multiple connections.
- File exchange format is not specified for FTP. With some FTP clients, data in a file may not be displayed correctly or correct date and time information may not be obtained.
- The 8826 only support generally used FTP commands. Thus, the function of any other command used by an FTP client may not be available.

Communications Command

The 8826 can be operated using common RS/GPIB communications commands. The 8802 port is set as the command input port by default. To control the 8826, create a program and connect TCP via this port. For details about the communications commands, see the supplied Application Disk(CD-R).

Compatible LAN Card

The LAN cards below are compatible with the 8826. (As of April 2003)

HIOKI 9578 10BASE-T LAN CARD*¹

NETGEAR, Inc. FA411

For the latest information, visit the HIOKI website.

NOTE

*1 Sales of the HIOKI 9578 10BASE-T LAN CARD have been discontinued.

Please use the commercially available LAN cards recommended by HIOKI.

Setting

This section describes the setting procedure.

Set up the 8826 and connect the cable in the sequence below.

1. Insert a LAN card.
2. Set up the LAN parameters in "SYSTEM 4." (Do not connect the cable yet.)
For details, see "Setting Individual Parameters" below.
3. After setting all the parameters, press [Enter].
4. Connect the LAN cable to the 8826 and the network.

Be sure to make the settings above before connecting the 8826 to the network. Note that making these settings with the 8826 connected to the network may result in illegal information being sent to the network—for example, if the same IP address as that of another device on the network is selected.

- **Preparations for Setting Parameters**

When connecting to an existing network, the following parameters must be set up. Ask the administrator (department) of the network system to assign the following in advance:

- DHCP: Used/not used

- Host name and address of the 8826

Host name (up to 12 characters): _____

IP address: ._._._.

Subnet mask : ._._._.

(When using DHCP, the IP address and subnet mask are not needed.)

- DNS setting

DNS: Used/not used

IP address (when using DNS): ._._._.

(The setting that can be obtained from DHCP has priority.)

- Gateway

Gateway: Used/not used

IP address (when using gateway): ._._._.

(The setting that can be obtained from DHCP has priority.)

- TCP/IP Port No.: _X (default: 880X)

(Specify the three leftmost digits of the four digits. Numbers 0 to 9 in the least significant digit are used by the 8826 or reserved. Specify the port No. when default numbers 8800 to 8809 are not available.)

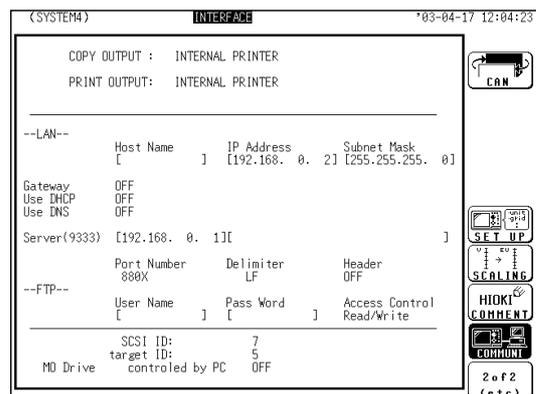
When setting up a network when only using a PC and recorders, not connecting to an existing network, for example, set the parameters as shown below.

IP address of PC : 192.168.0.1
 IP address of 1st recorder : 192.168.0.2
 2nd : 192.168.0.3
 3rd : 192.168.0.4
 4th : 192.168.0.5

Host name : Enter the desired name (each host name must be unique).
 Subnet mask : 255.255.255.0
 Gateway : OFF
 DHCP : OFF
 DNS : OFF
 Port No. : 880x

- **Setting Individual Parameters**

Once the LAN card is inserted, setting parameters appear on the SYSTEM 4 INTERFACE screen as shown below. Move the cursor to a parameter you want to set up. After making all necessary setting changes, press **F5** [Enter] to confirm. Otherwise, the changes will not be reflected.



Host Name

Set the name to represent the 8826 on the network. Choose a unique name that is different from those of other devices on the network. When using the 9333 LAN COMMUNICATOR, note that the host name is used to identify a directory on the PC.

Dynamic DNS is not supported and therefore the set host name will not be registered in DNS.

IP Address

Set the IP address of the 8826.

The IP address is used to identify individual devices on a network. Set a unique address that is different from those of other devices on the network. When DHCP is ON, it automatically sets the IP address.

Subnet Mask

Subnet mask is used to divide an IP address into a network address and host address. Set the subnet mask the same way that subnet masks of other devices on the network are set up.

Gateway ON/OFF and IP Address

Set the default gateway (default router).

Turn this ON and specify the IP of the device serving as a gateway when the 8826 communicates with a device (PC) on a network other than its own network. When the PC is on the same network, use the default gateway of the PC. When the 8826 is connected one-to-one with a PC or both are connected to the same hub, a gateway is not necessary. Turn it off.

When DHCP is ON, any gateway information obtained from DHCP has priority.

DHCP ON/OFF

Set whether to use DHCP.

DHCP enables a device to obtain its IP address or other information automatically.

When DHCP is ON and a DHCP server is running on the same network, the 8826 obtains its IP address and subnet mask, then is automatically set up.

Any available DNS and gateway information are also obtained. (The information obtained from DHCP has priority over manually entered settings.)

When DHCP is ON, it automatically sets the subnet mask.

DNS ON/OFF and IP Address

Set DNS.

The IP address is a series of numbers that may be difficult to remember.

Thus, it would be easier to use a name to represent the address.

In a network with a server that searches IP addresses from names, you can request this server to look up an IP address from a name and thus specify a device by name and not by address.

There are two such servers: DNS and WINS. The 8826 only supports DNS.

However, these units cannot perform the dynamic registration of names and IP addresses with DNS.

When DNS is ON, you can specify a device you communicate with by using a name.

When DHCP is ON, any DNS information obtained from DHCP has priority.

Server (9333)

Specify the PC that runs the 9333 LAN COMMUNICATOR, with which the 8826 communicates. This setting is required for acquiring data using the 9333 LAN COMMUNICATOR.

When specifying with the IP address (when not using DNS), use the IP address of the PC.

When DNS is ON and you specify the PC with a name, set IP to 0.0.0.0, enter the host name of the device for which data is being collected in the name field.

When the host name is "collect.hioki.co.jp," for example, do not omit ".hioki.co.jp." Otherwise, your request may not be granted. (Note that the part shown as ".hioki.co.jp" may vary depending on your network environment.)

When acquiring data using the 9333:

- To send measurement data (saved by using the Auto Save function) to the 9333, set Media on Status 1 screen to **COMMUNI** (LAN). (Real-time transfer of measurement data is not available.)
- To send an Auto Print image to the 9333, set Auto Print destination on Status 1 screen to **COMMUNI** (LAN).
- To send parameter calculation results to the 9333, set Result Save on Status 3 screen to **COMMUNI** (LAN).
- To send a screen image by using the **COPY** key, set Copy Destination on System 4 screen to **COMMUNI** (interface).

- To send a print image by using the **PRINT** key, set Output Destination on System 4 screen to **COMMUNI** (interface).

Port No.

The 8826 uses TCP/IP for communications. TCP/IP allows multiple connections for different types of communications. A port number identifies each connection. The 8826 uses port numbers 8800 to 8809.

- 8800 (8826 as the server.): Used by the 9333 remote control application.
- 8801 (8826 as the client): Used by the 9333 data acquisition application.
- 8803 (8826 as the server): Used with communications commands.
- 8802 to 8809: Reserved

You need not edit the port number setting, unless some ports are not available due to security reasons or not available on the PC with which the 8826 communicates.

This sets the three leftmost digits only. The rightmost digit (from 0 to 9) is used by the 8826 or reserved.

Delimiter and Header ON/OFF

Used when applying control by using communications commands.

Header ON/OFF sets whether to add a header in the response to a command.

Delimiter sets whether to use LF or CR+LF for the response to a command.

Both LF and CR+LF are accepted in command transmission. Communications commands are transmitted by connecting to port 8802 (default) of the 8826 using TCP and sending a character string.

FTP User Name and Password

Used for authentication when logging into FTP of the 8826. When a user name and password are set, you cannot log in unless the user name and password are correct.

If you leave these settings blank, authentication will not be performed and anyone can log in.

Also leave both settings blank when using an anonymous FTP client.

FTP Access Control

This controls access from an external source. Select from the following:

"Read-only": An external device can only read files.

"Read/write-enable": An external device can read, write, or delete files.

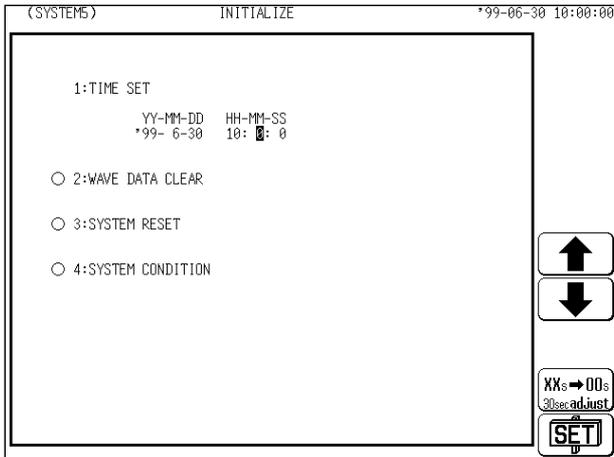
Connection

After completing the setting above, connect the devices.

- Connect the LAN connector of the 8826 to the hub using a straight LAN cable or the 9642 LAN CABLE.
- Connecting the 8826 to a PC one-to-one
A cross cable or straight cable and a cross connector are required. (The 9642 straight cable is supplied with a cross connector.)
A 100BASE cable is required for connecting to a 100BASE network using the 100BASE card. _____

12.6 INITIALIZE Screen

Setting the clock (TIME SET), clearing waveform data (DATA INITIALIZE), and initialization of setting items (SYSTEM RESET) are available.



Method

Screen: INITIALIZE (SYSTEM5)

- ① Press the **SYSTEM** key to call up the SYSTEM5 screen.
- ② Move the flashing cursor, want to set the item.
- ③ Use the function keys to make the selection.

12.6.1 TIME SET (Setting the Clock)

- This unit incorporates a calendar with automatic leap year compensation and 24-hour clock.
- The clock is used for the following functions:
 - Display of year/month/day/hour/minutes/seconds on all screens
 - Timer trigger function
 - Trigger time list printout

Method

- ① Move the flashing cursor to the year, month, day, hour, minute items of 1: TIME SET, and use the JOG control or the function keys to make the settings.
- ② Press the **F5** [SET] to start the clock. Seconds are reset to 00.
- ③ For correcting errors of less than 1 minute. Press the **F4** [30 s adjustment] to make the setting. When 30 s adjustment is pressed, the seconds are handled as follows.
 - 00 to 29 seconds: Minutes are unchanged and seconds are reset to 00.
 - 30 to 59 seconds: Minutes are advanced by 1 and seconds are reset to 00.

12.6.2 WAVE DATA CLEAR (DATA INITIALIZE)

Clears and initializes waveform data stored in memory.

Method

- ① Move the flashing cursor to 2: WAVE DATA CLEAR, and make the setting.
- ② Press the **F1** [exec].

12.6.3 SYSTEM RESET

- Resets all settings, which except for communications settings (GP-IB, RS-232C, SCSI, LAN), to the factory default values.
- The same effect can be achieved by turning power to the unit on while holding down the **STOP** key.

Method

- ① Move the flashing cursor to the 3: SYSTEM RESET item, and make the setting.
- ② Press the **F1** [exec].

- To return all settings including communications settings to the original factory settings, turn on power while holding down both the **START** key and **STOP** key

12.6.4 System Information

Displays the configuration of installed options and the software version.

```
* hard ware  memory board: 9599 64Mword
             MD unit: 9598
             POWER unit: power-unit for FV

* soft ware  version: V 2.20

* units     ch1 - ch2 : 8936 ANALOG
            ch3 - ch4 : 8936 ANALOG
            ch5 - ch6 : 8936 ANALOG
            ch7 - ch8 : 8936 ANALOG

            ch9 - ch10: 8936 ANALOG
            ch11- ch12: 8936 ANALOG
            ch13- ch14: 8937 VOLT/TEMP
            ch15- ch16: 8937 VOLT/TEMP

            ch17- ch18: 8938 FFT ANALOG
            ch19- ch20: 8938 FFT ANALOG
            ch21- ch22: 8939 STRAIN
            ch23- ch24: 8939 STRAIN

            ch25- ch26: 8940 F/V
            ch27- ch28: 8940 F/V
            ch29- ch30: 8947 CHARGE
            ch31- ch32: 8947 CHARGE

                                     PUSH ANY KEY TO RETURN
```

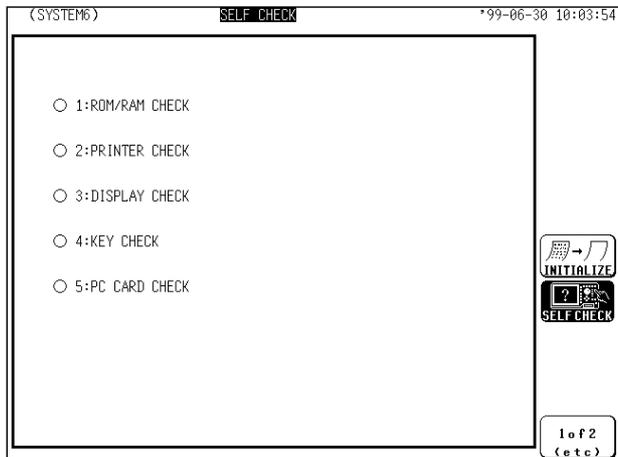
Method

Screen: INITIALIZE (SYSTEM5)

- ① Press the **SYSTEM** key to call up the **SYSTEM5** screen.
- ② Move the flashing cursor to the 4:SYSTEM **CONDITION** item.
- ③ Press the **F1** [exec].
- ④ Pressing a key returns to the initial setting screen.

12.7 SELF CHECK

The self-check routine of this unit includes the following five items.



Method

Screen: SELF CHECK (SYSTEM6)

- ① Press the **SYSTEM** key to call up the **SYSTEM6** screen.
- ② Move the flashing cursor, want to set the item.
- ③ Use the function keys to make the selection.

12.7.1 ROM/RAM CHECK

- This test checks the internal memory (ROM and RAM) of the 8826.
- The test is non-destructive; it does not affect the contents of RAM.
- The result is displayed as follows. OK: Passed, NG: Failed

Method

- ① Move the flashing cursor to the 1: ROM/RAM CHECK item.
- ② Press the **F1** [exec] to check the ROM and RAM. During the test, all keys are disabled.
The software version is displayed at the upper right of the screen during ROM/RAM check.
- ③ When the test is completed, press any key to return to the self-test setting screen.

12.7.2 PRINTER CHECK

- This test checks the printer operation.
- The printer head is cleaned.

Method

- ① Move the flashing cursor to the 2: PRINTER CHECK item.
- ② Press the **F1** [exec] to check the check the printer operation.
To cancel the test pattern printout, press the **STOP** key.
- ③ Press the **F5** [CLEANING] to clean the printer head. Hold down this key for approx. five seconds.

12.7.3 DISPLAY CHECK

- This test checks the display.
- Two check patterns (solid-color display check and gradation check) are available.

Method

- ① Move the flashing cursor to the 3: DISPLAY CHECK item.
- ② Press the **F1** [exec] to check the display.
Press any key to move to the next check.
- ③ When the test is completed, press any key to return to the self-test setting screen.

12.7.4 KEY CHECK

This test checks the key operation.

Method

- ① Move the flashing cursor to the 4: KEY CHECK item.
- ② Press the **F1** [exec] to start the test.
- ③ Press any key on the front panel, and the corresponding field on the display changes to reverse. Turn the JOG and the SHUTTLE controls at least one turn fully clockwise and counterclockwise and press each of the keys at least once, and the test is completed.

NOTE

- If any key is defective, the key test cannot be completed normally.
- In this case, press the START key and the STOP key together to return to the self-test setting screen.
- The START key, Select key and number display also serve for testing the LED function.

12.7.5 PC CARD CHECK

This test checks the PC card.

Method

- ① Move the flashing cursor to the 5: PC CARD CHECK item.
- ② Press the **F1** [exec] to check the PC card. During the test, all keys are disabled.
Check the type, and capacity of the card.
- ③ When the test is completed, press any key to return to the self-test setting screen.

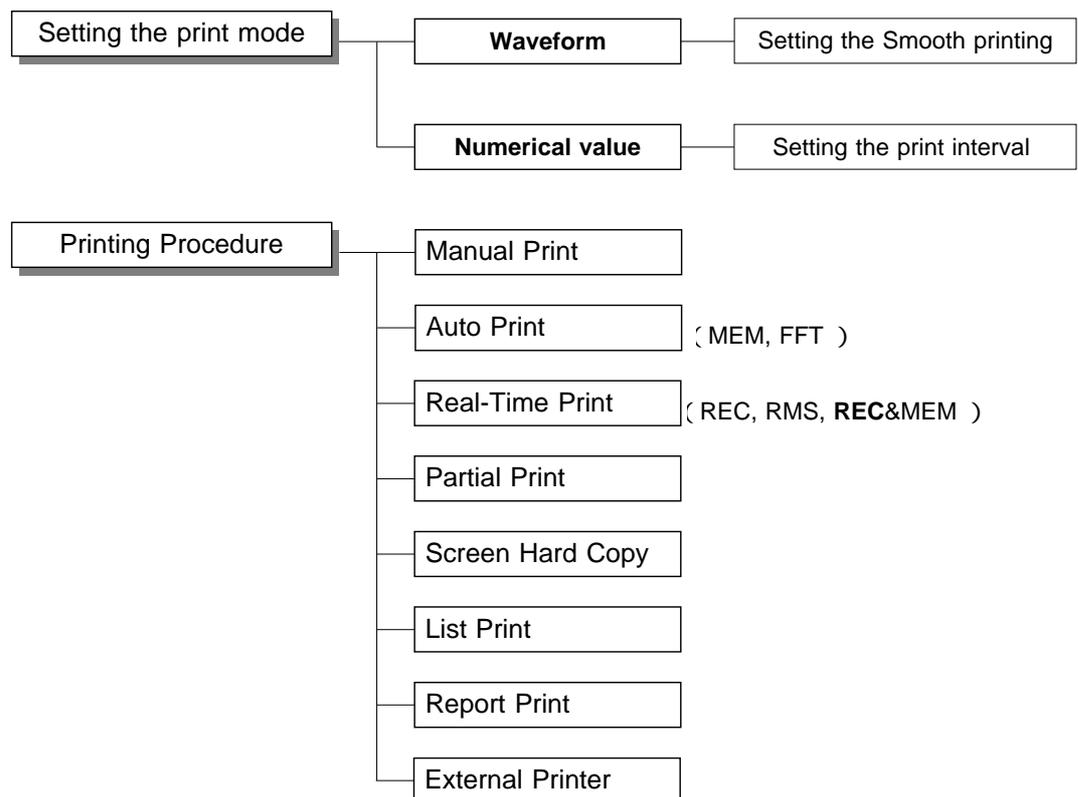
NOTE

- In the case of the interface card, its identification is displayed.

Chapter 13

Printout of Measurement Data

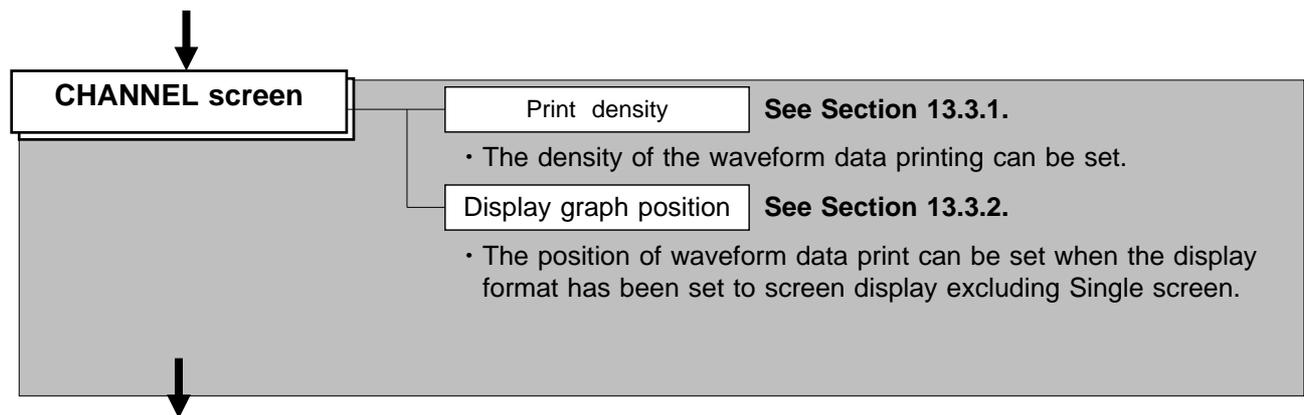
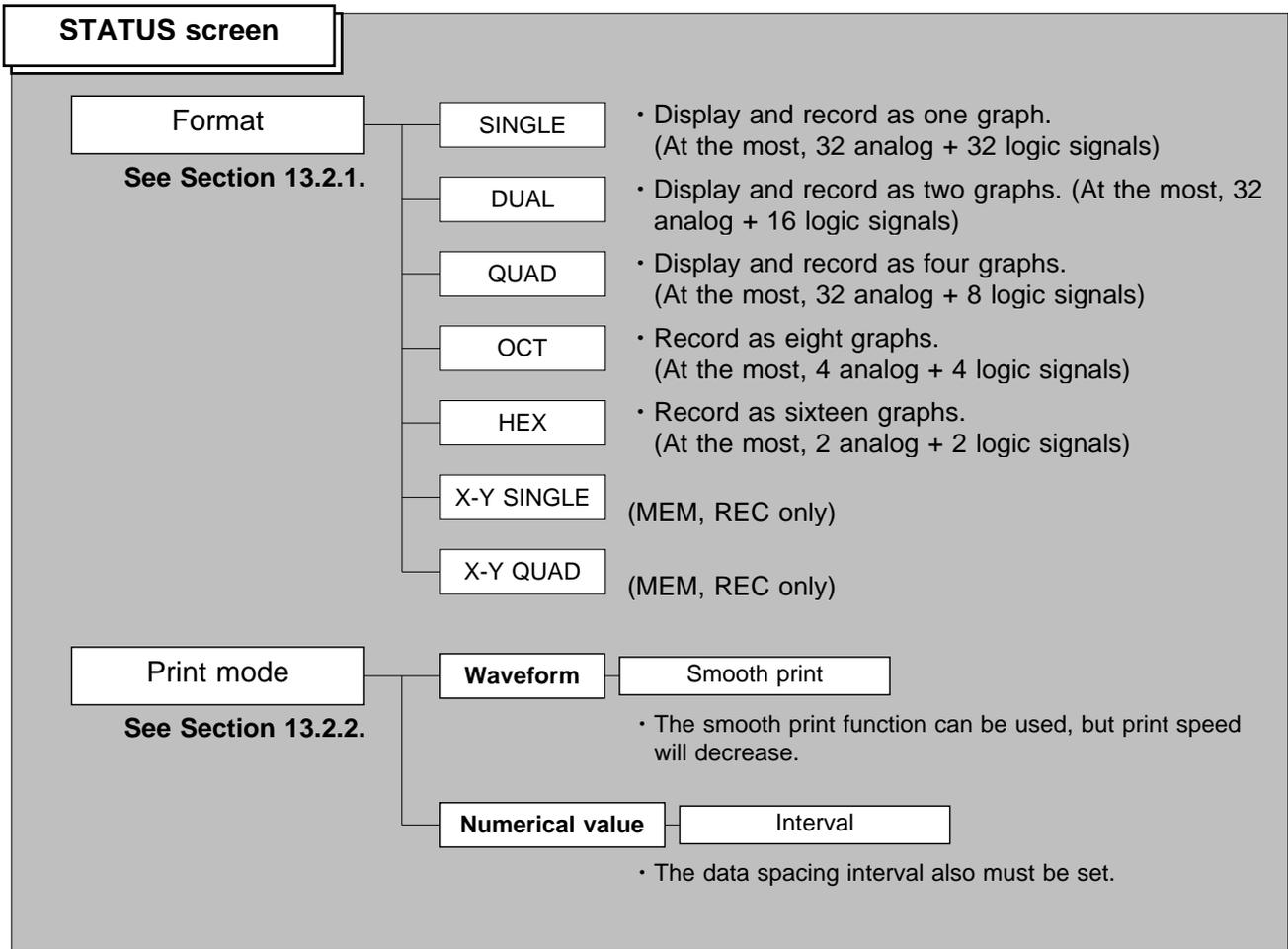
Waveform data can be printed out in two formats: waveform or numeric. Seven different procedures can be used to print out the measured waveforms. On the printer, the print density can be changed in five steps.

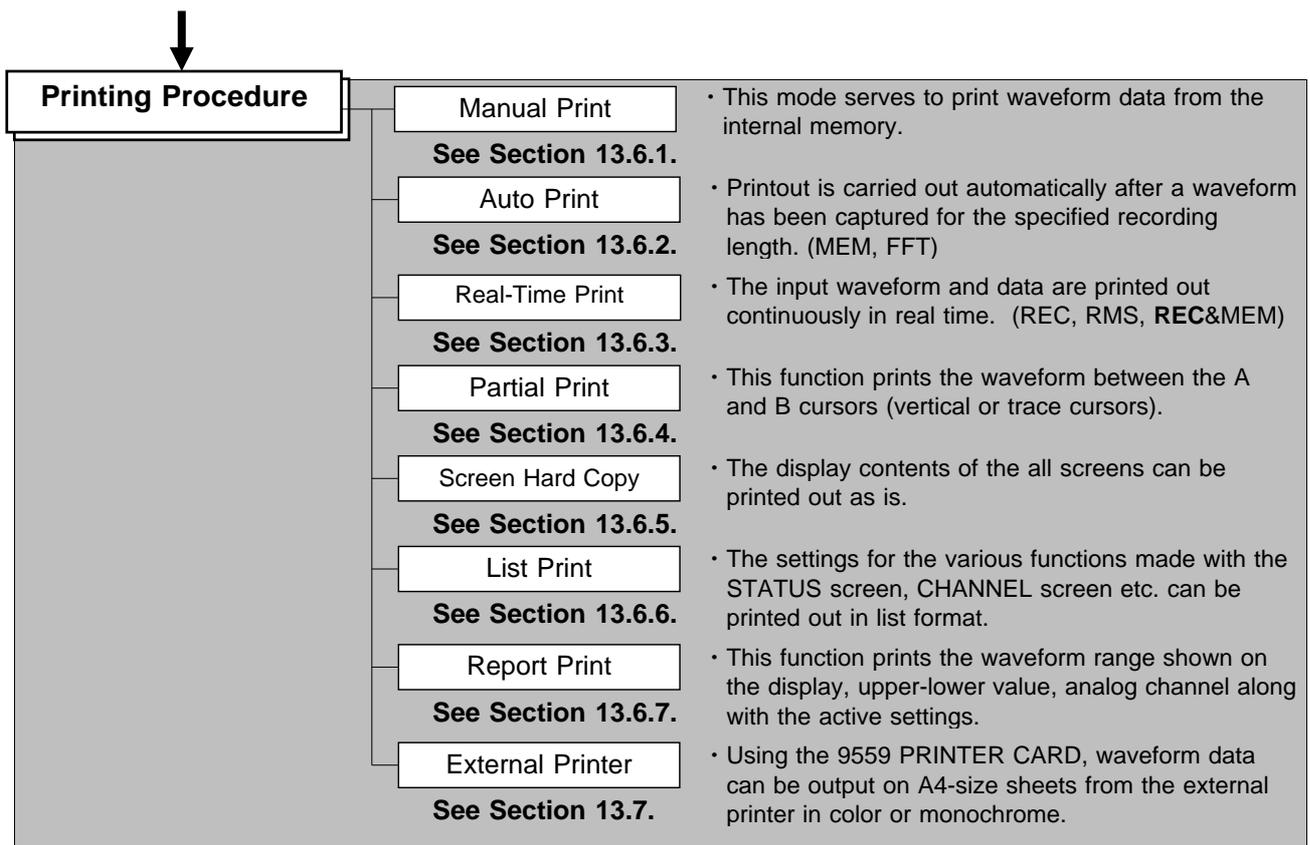
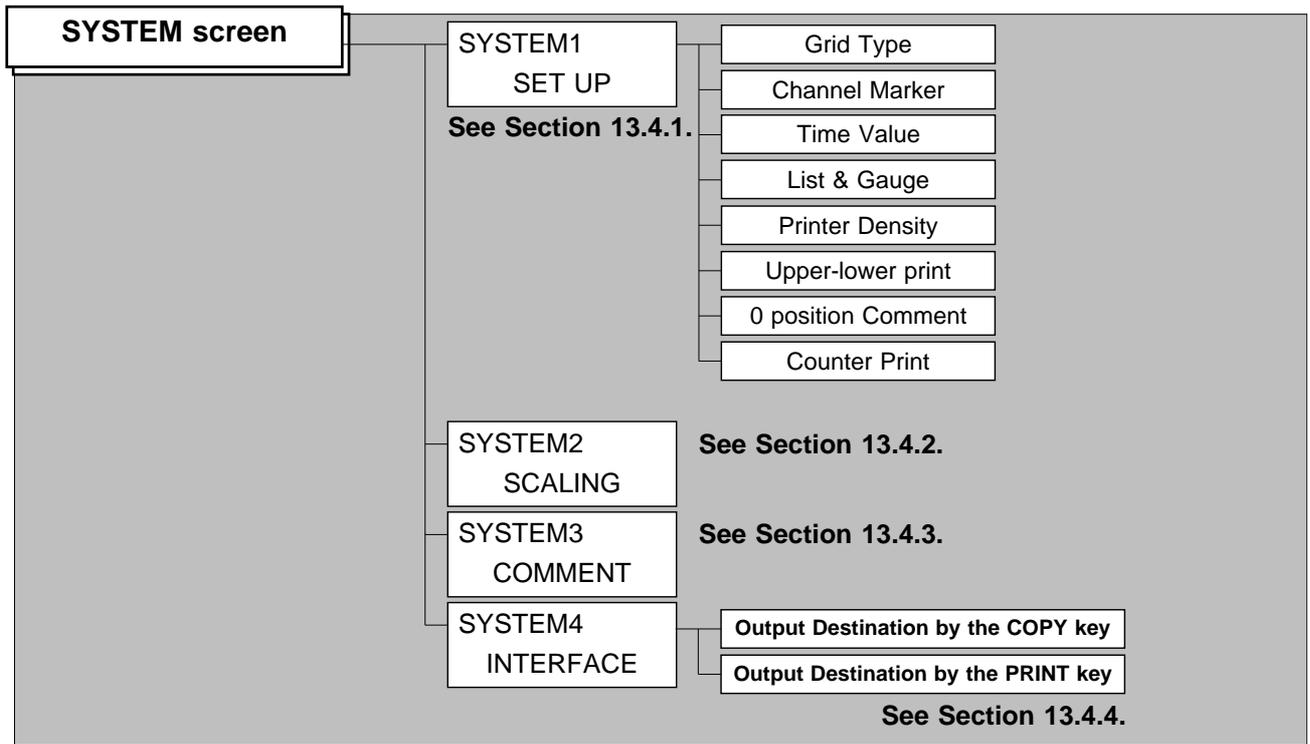


NOTE

- For an example of printout, see Section 13.5.
- The device from which the screen data is printed out can be selected using Interface (SYSTEM4).

13.1 Printout of Measurement Data Operating Procedure

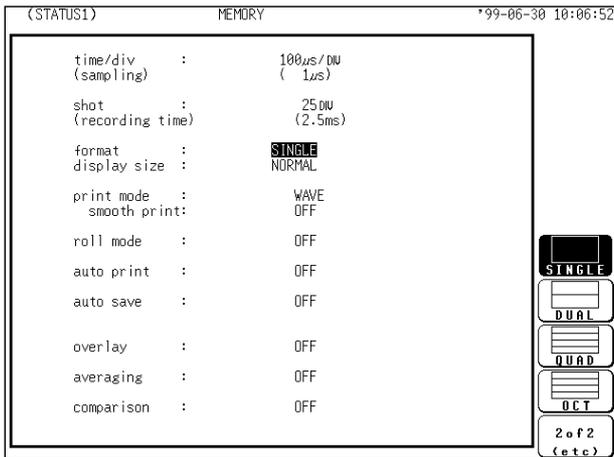




13.2 Setting the STATUS Screen (printout)

13.2.1 Setting the Format

- The style can be set for showing input signals on the screen display and recording them on the printer.
- The styles single, dual, quad, (DISPLAY screen), oct · hex (Print only, Display quad style) X-Y single · X-Y quad (dot) and (line) are available.



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **format** item, as shown in the figure on the left.
- ③ Use the function keys to select the display format.

Selection



: Single (one division only)



: Dual (divided into two)



: Quad (divided into four)



: Oct (print only divided into eight)



: Hex (print only divided into 16)



: X-Y single



: X-Y quad

NOTE

X-Y screen can be set the memory recorder function and Recorder function.

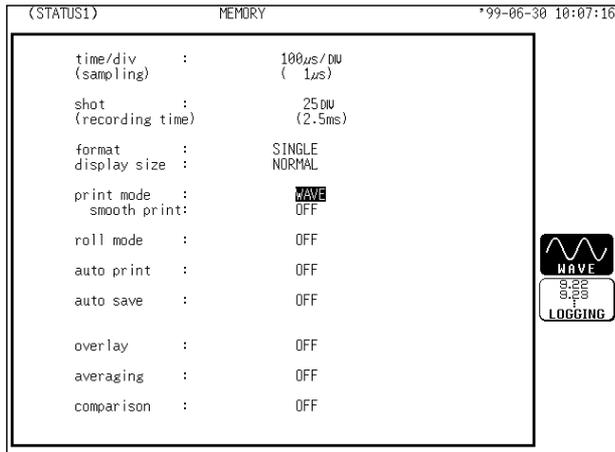
13.2.2 Setting the Print Mode

Select the format, waveform, or numerical value should be used to output measured data and calculation results.

Waveform : The smooth print function can be used, but print speed will decrease. (MEM and REC&MEM only)

Numerical value : The data spacing interval also must be set.

Printing as a waveform



Method Screen: STATUS

(1) Setting the Print mode

- ① Press the STATUS key to call up the STATUS screen.
- ② Move the flashing cursor to the print mode item, as shown in the figure on the left.
- ③ Use the function keys to select WAVE.

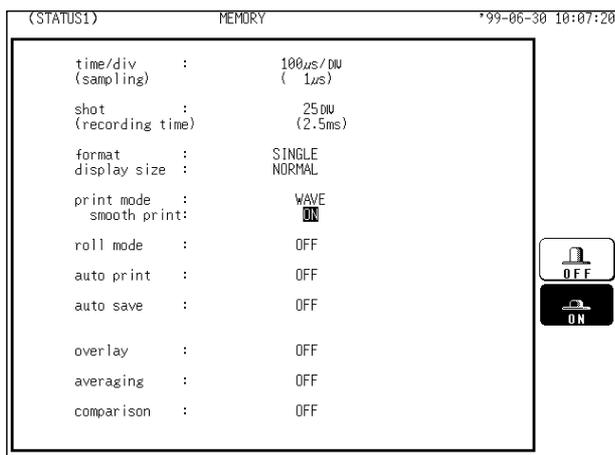
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



(2) Setting the Smooth printing

- ① When the waveform format is selected, determine whether to use the smooth printing or not.
- ② Move the flashing cursor to the smooth print item.
- ③ Use the function keys to make the selection.

Selection



: Normal printing is carried out.

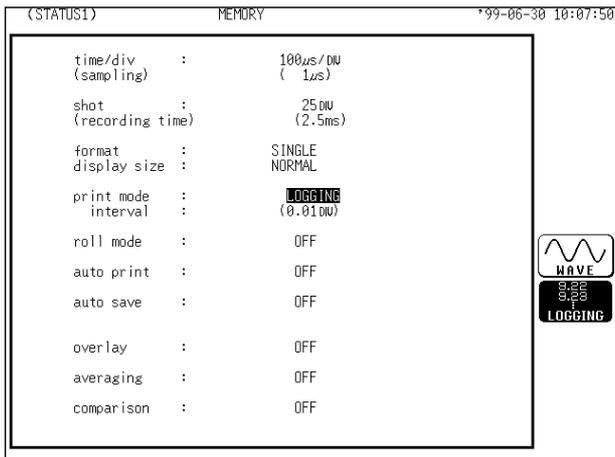


: Smooth printing is enabled.

NOTE

- On X-Y screen, smooth printing cannot be specified.
- In the REC and REC&MEM, the trigger mark () is written as the start position mark. In an additional recording, the trigger mark is displayed in front of the most recently entered data.

Printing as numeric data



Method Screen: STATUS

(1) Setting the Print mode

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the **print mode** item, as shown in the figure on the left
- ③ Use the function keys to select **LOGGING**.

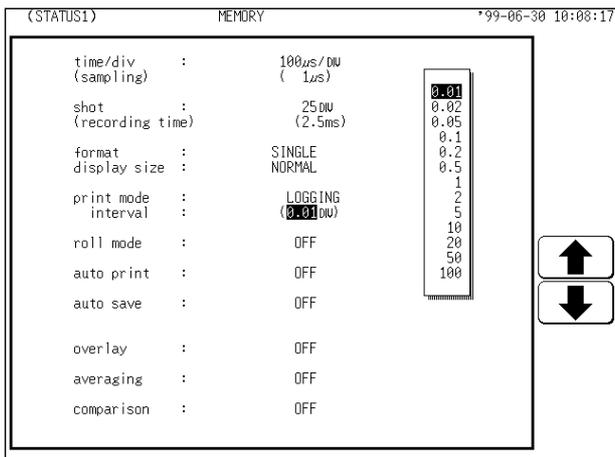
Selection



: Measurement data and the result of calculation are printed as a waveform.



: Measurement data and the result of calculation are printed as numeric data.



(2) Setting the print interval

- ① When the numeric data format is selected, set the print interval.
- ② Move the flashing cursor to the **interval** item.
- ③ Use the **JOG** control or the function keys to select the print interval.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

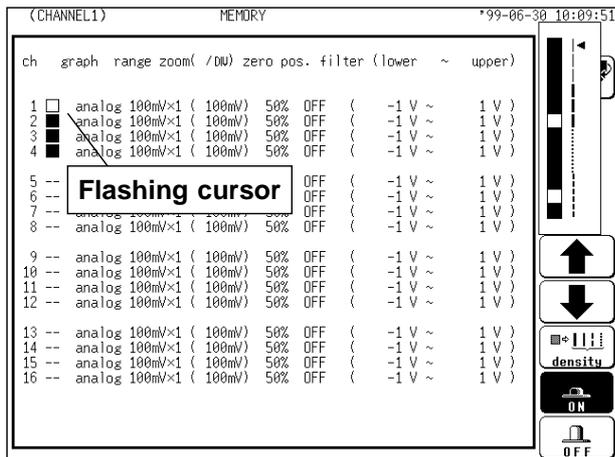
NOTE

- When the print interval longer than the recording length is set, only the first dot is printed.
- Since each division equals 100 samples, the print interval "0.01" indicates one sample (no print interval).
- When recorder function or RMS recorder function, the maximum and minimum values are printed (see Section 21.3.4 or 21.3.5).
The print intervals of 0.01 to 0.5 DIV can be selected, only when there are waveform data present.

13.3 Setting the CHANNEL Screen (printout)

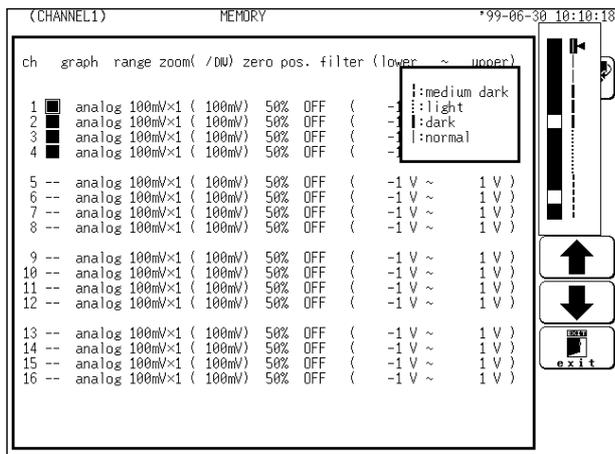
13.3.1 Setting the Print Density

When data is to be output from the internal printer, the print density (four types) can be set for the waveform color (12 colors). After the desired density is set, the waveform density is changed for the printout or hard-copy run.



Method Screen: CHANNEL1

- ① Press the CHAN key to call up the CHANNEL1 screen.
- ② Move the flashing cursor to the item, as shown in the figure on the left
- ③ Use the function keys to select the [density].



- ④ Use the function keys or JOG control to select the print density.

Selection



: Select the print density.



: Return to CHANNEL screen.

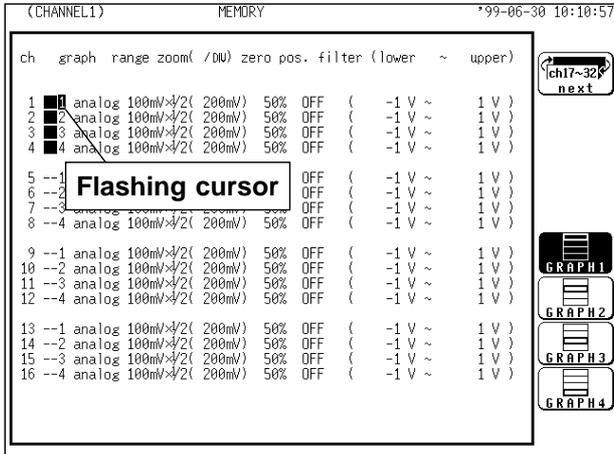
- ⑤ For CH2 to 32, the settings are made in an identical.

NOTE

- After the system is reset, the print density returns to the previously set value.
- When the analog channel comment is set to "Setting" or "Setting & Comment," printouts are provided in the print display color (■) of the analog channel.

13.3.2 Setting the Waveform Display Graph Position

Set which graph type to use when display format has been set to DUAL, QUAD, OCT or HEX screen display on the STATUS screen.



Method

Screen: CHANNEL1, DISPLAY

- 1 Press the **CHAN** key to call up the CHANNEL1 screen.
- 2 Move the flashing cursor to the position shown in the figure on the left.
- 3 Use the function keys to make the selection.

Selection



: Display the waveform on graph 1.



: Display the waveform on graph 2.

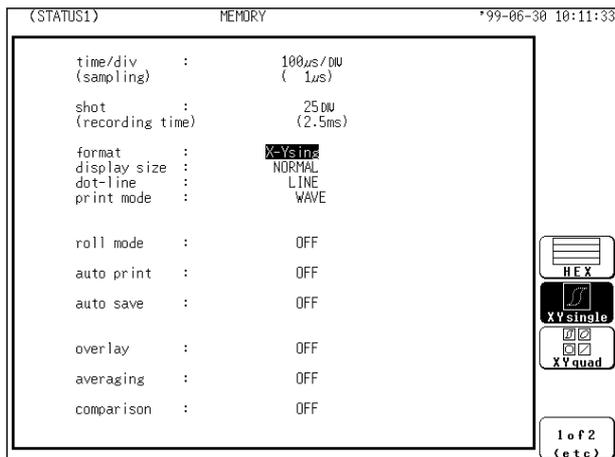


: Display the waveform on graph 3.



: Display the waveform on graph 4.

Set which graph type to use when display format has been set to X-Y screen display on the STATUS screen. (MEM and REC only)



Method Screen: CHANNEL1, DISPLAY

- ① Press the **CHAN** key to call up the CHANNEL1 screen.
- ② Move the flashing cursor to desired channel, and use the function keys to set the waveform color (including displays waveform ON/OFF).

Selection



: Move the arrow up in the selection window.



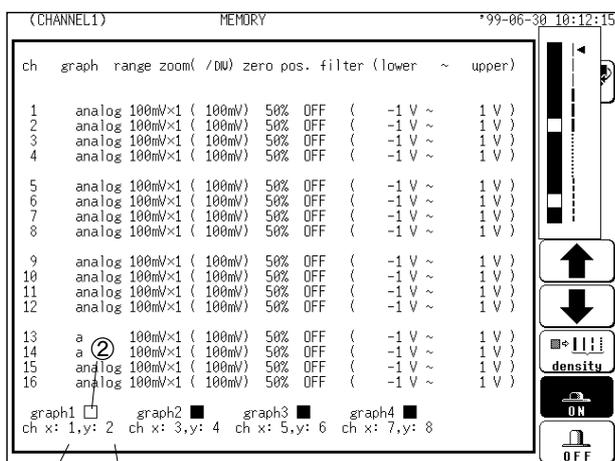
: Move the arrow down in the selection window.



: Waveform display is enabled.



: Waveform display is disabled.



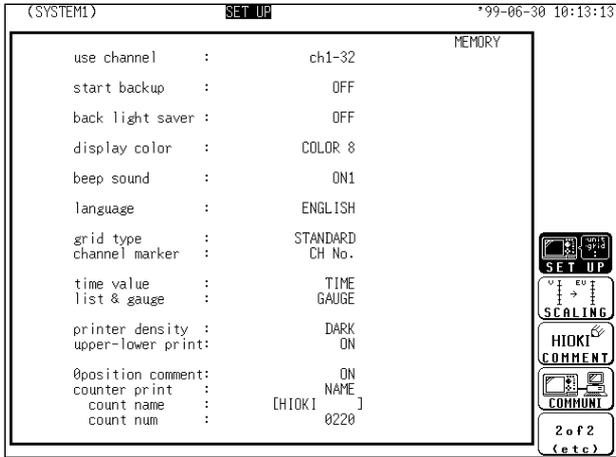
③

④

- ③ Specify the X-axis channel.
Move the cursor to the channel to be used as X axis. And use the function keys or the JOG control to select X axis.
- ④ Specify the Y-axis channel.
This is done in the same way as in step ③.
- ⑤ For graph 2 to graph 4, the settings are made in an identical.

13.4 Setting the SYSTEM Screen (printout)

13.4.1 SET UP Screen (SYSTEM 1)

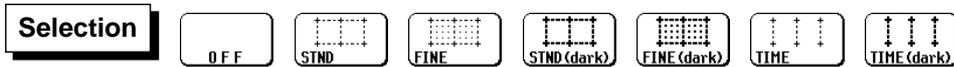


Method Screen: SET UP (SYSTEM1)

- ① Press the **SYSTEM** key to call up the SYSTEM1 screen.
- ② Move the flashing cursor, want to set the item.
- ③ Use the function keys to make the selection.

Grid Type

- Selects the type of grid shown on the display screen and drawn on the recording paper.
- On the waveform display screen, the standard and fine grids are defined as the standard, and the standard (dark) and fine (dark) grids are defined as the standard (dark) grids.
- "Time" and "Time (dark)" can be set only during printing.



NOTE

In printing in the X-Y screen format, the standard time axis and the standard time axis (dark) are applied.

Channel Marker

The channel numbers or the comments are printed together with the waveform on the recording paper.

Comments can be set on SYSTEM3 (COMMENT) screen.

- Selection** OFF : Channel numbers will not be printed for the waveform on the recording paper.
- CH-NUMBER : Channel numbers will be printed for the waveform on the recording paper.
- COMMENT : Comments will be printed for the waveform on the recording paper.

Time Value

The time from the trigger point and other information can be printed.

- Selection**  : Displays the time from the trigger point (unit: fixed).
-  : Displays the time from the trigger point (unit: base 60).
-  : Displays the number of DIV from trigger point.
-  : Displays the time when a waveform is captured.

List & Gauge

When a waveform is printed out (except for screen hard copies), the gauge can be printed out at the beginning, and a listing can be printed out at the end. On the wide X-Y screen, the horizontal axis gauge is not printed out.

- Selection**  : No gauges or listing
-  : Print listing only
-  : Print gauges only
-  : Print both gauges and listing

Printer Density

Serves to set the printer density. Select the setting which yields the most easy to read printout.

- Selection**     

Upper-lower Print

In waveform printing, the upper and lower values of each channel are printed first. When the scaling function is being used, the scaled values are printed.

- Selection**  : Upper-lower print is not used.
-  : Upper-lower print is used.

0 Position Comment

In waveform printing, comments are printed out in the zero position of each channel. This comment printing is valid only for the analog channels. Comments can be set on SYSTEM3 (COMMENT) screen.

- Selection**  : 0 position comment is not used.
-  : 0 position comment is used.

Counter Print

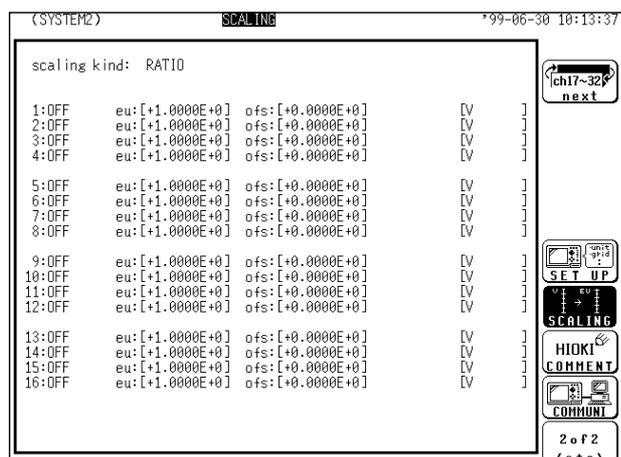
In waveform printing, the counter can be printed out. This function is useful to distinguish between similar waveforms.

- | | | |
|------------------|----------------------|---|
| Selection | OFF | : Counter Print is not printed. |
| | 9992-20-0001
DATE | : Counter Print is printed with date. |
| | HI001-0001
NAME | : Counter Print is printed with counter name. |

- A counter name of up to ten characters can be specified. For information on how to enter the counter name, see Section 9.8.4.
- After the unit is turned on, the counter is reset to 0 (zero), and the counter value is increased each time a waveform is retrieved. (The maximum counter value is 9999.) To initiate waveform acquisition from an arbitrary count value, move the flashing cursor to the counter-value entry field and specify the desired value using the function keys, the JOG control or the **CH&NUM** key.

13.4.2 SCALING Screen

- The scaling function can be used to convert an output voltage from a sensor or similar into a physical quantity.
- Two types of scaling functions are available.
- The gauge scale (maximum and minimum values of horizontal axis) and A/B cursor measurement values are displayed in the scaled units.
- Scaling can be performed for every channel.



(1) Conversion ratio method

Scaling is performed by specifying a physical quantity to correspond to a 1V input signal (conversion ratio: eu/v), an offset value, and the unit (eu: engineering units). This will cause the measurement voltage to be converted into the selected units.

(2) 2-point method

Scaling is performed by specifying two input signal points (voltage values) and the conversion values for these two points in engineering units (eu). This will cause the measurement voltage to be converted into the selected units.

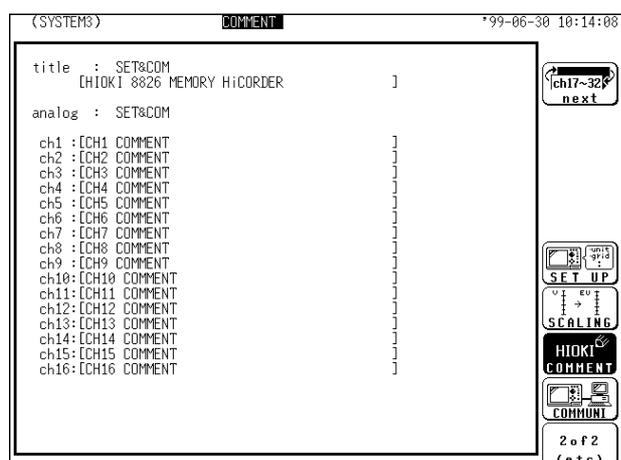
NOTE

Refer to Section 9.7.

13.4.3 COMMENT Screen

Three types of comment are available.

If "COMMENT" or "SET & COMMENT" is selected, this comment will be included on the recording paper in all functions.



(1) Title comment input

Title comments of up to 40 characters can be included on the recording paper.

(2) Input of comments for analog channel

Comments of up to 40 characters can be included on the recording paper on each channel.

(3) Input of comments for logic channel

Comments of up to 40 characters can be included on the recording paper on each channel.

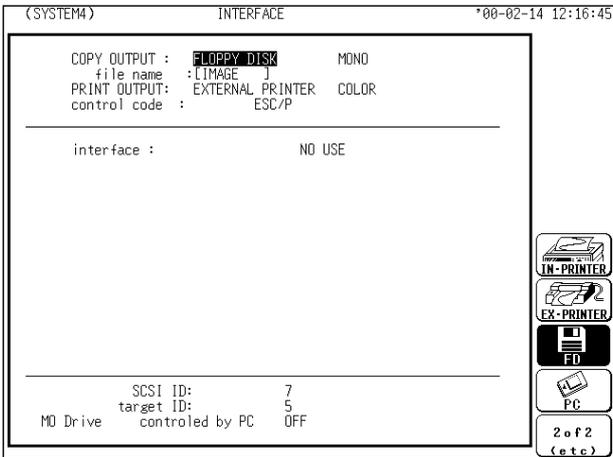
NOTE

Refer to Section 9.8.

13.4.4 INTERFACE Screen

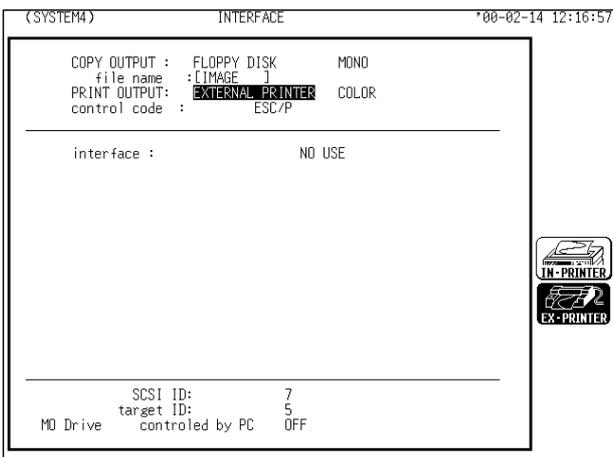
Select the output destination for the **PRINT** and **COPY** key functions.
When using the printer of the 8826, set the output destination to **INTERNAL PRINTER**.

See Section 13.7 for details when using an external printer.



Method Screen: INTERFACE (SYSTEM4)

- ① Press the **SYSTEM** key to call up the SYSTEM4 screen.
- ② Move the flashing cursor to "COPY OUTPUT".
- ③ Use the function keys to make the selection. See Section 12.5.1.
- ④ Move the flashing cursor to "PRINT OUTPUT". Then Use the function keys to make the selection. See Section 12.5.2.
- ⑤ When the external printer is the output destination, select the control code and the color. See Section 12.5.



Control code



Color

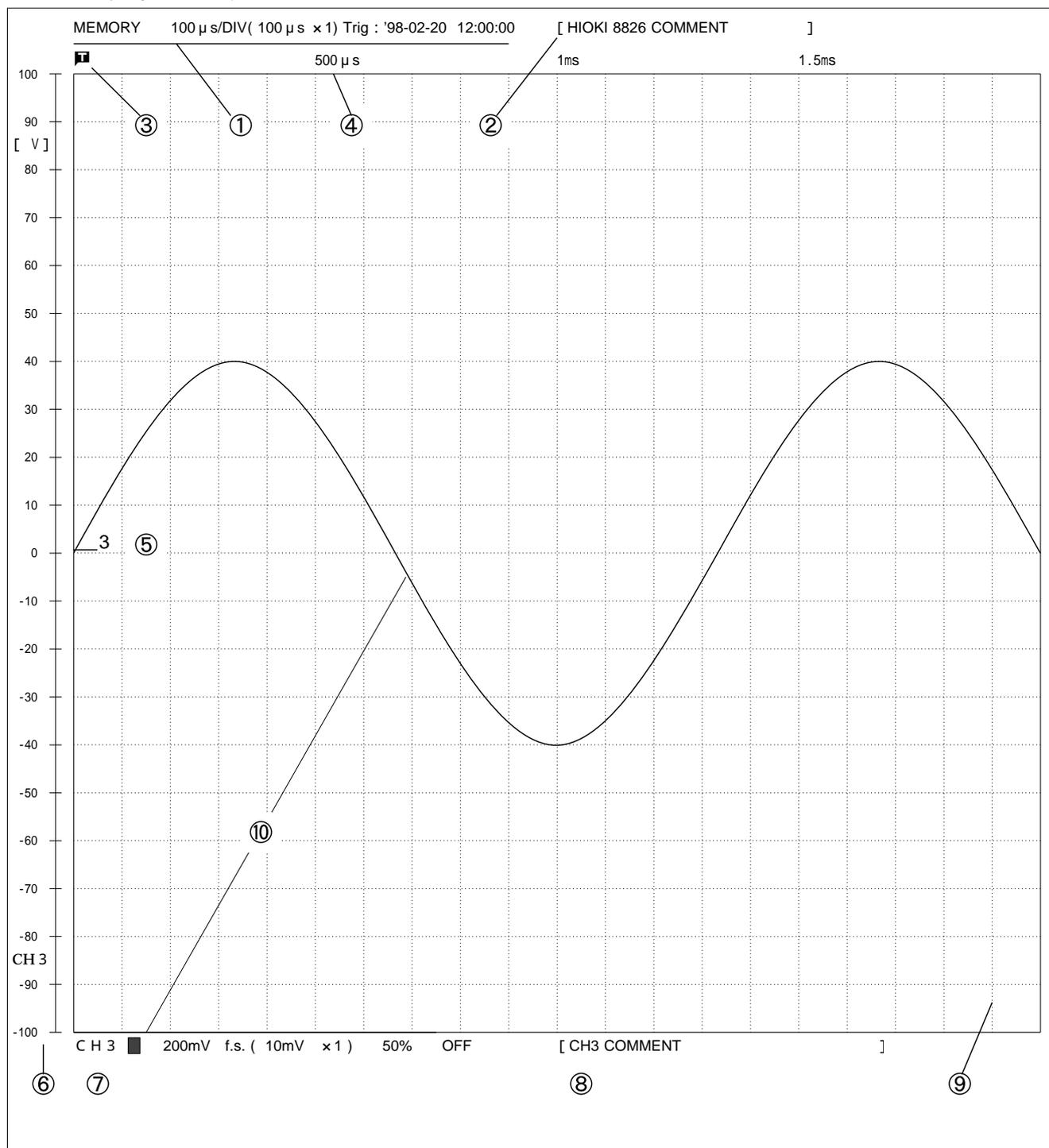


NOTE

- When the output destination specified excluding internal and external printer and the color is set to monochrome, the screen is displayed in monochrome while data saving is in progress.
- Using the **COPY** key, output may be set to the internal printer, external printer, floppy disk, PC card, interface, MO disk, or external SCSI storage device.
- Refer to the printer operating manual for the control codes.
- Automatic and real-time printing cannot be done on an external printer, even when it is selected for the **PRINT** key output destination. The internal printer must be used for these functions.
- Files stored in BMP format cannot be read by the 8826.

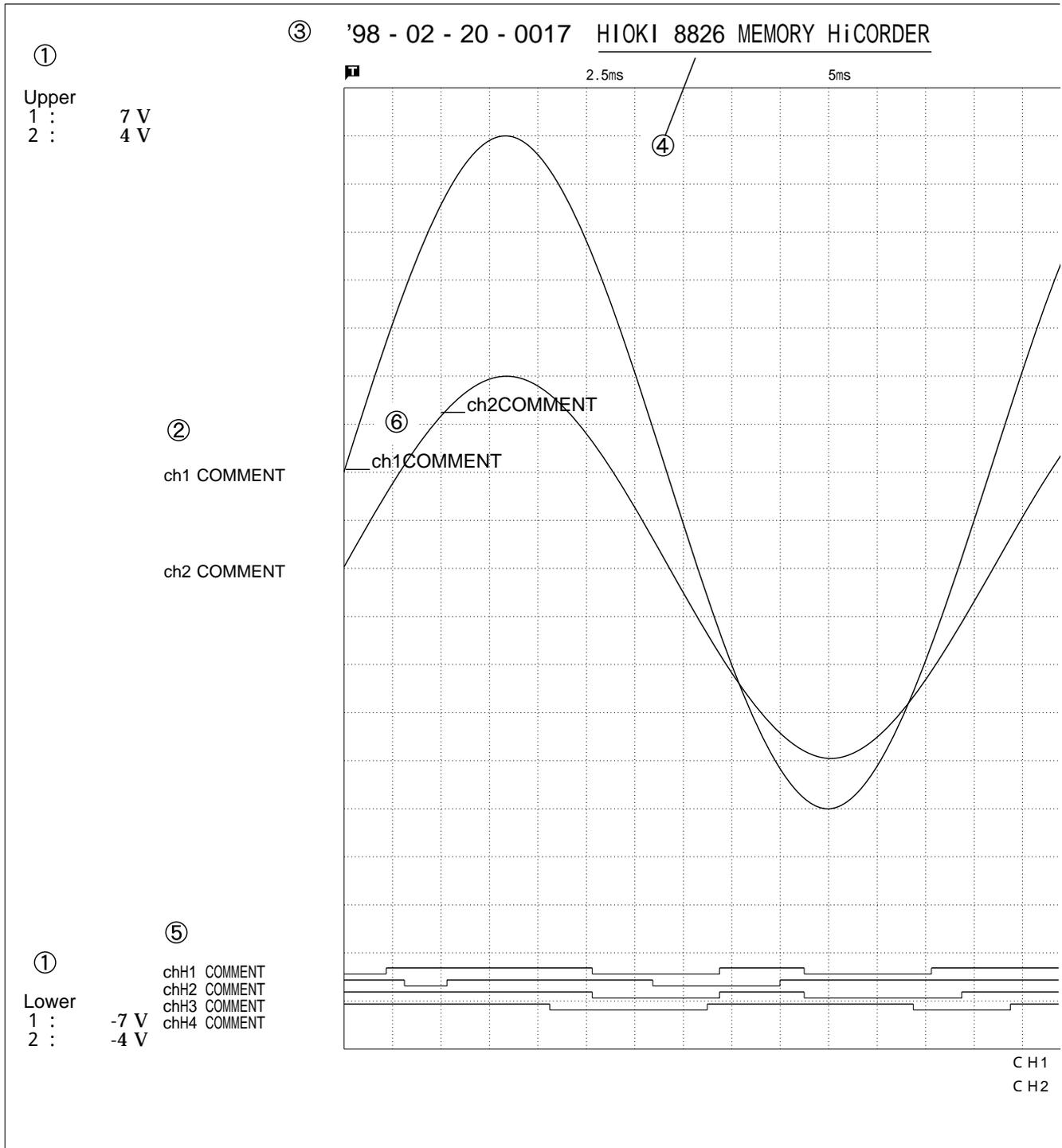
13.5 Example of Printer Output

This section explains the printer type and how to read the printout (in the case of a SINGLE format display screen).



Item	See section	Item	See section
① Title (SETTING)	9.8	⑥ Gauge (List & gauge)	13.4.1
② Title (COMMENT)	9.8	⑦ Analog (SETTING)	9.8
③ Trigger mark	10.5	⑧ Analog (COMMENT)	9.8
④ Time value (TIME)	13.4.1	⑨ Grid type (STANDARD)	13.4.1
⑤ Channel marker (CH.No.)	13.4.1	⑩ Print density	13.3.1

Advanced settings



Item	See section	Item	See section
① Upper-lower print (ON)	13.4.1	④ Title (COMMENT)	9.8
② 0 position comment (ON)	13.4.1	⑤ Logic (COMMENT)	9.8
③ Counter print (DATE)	13.4.1	⑥ Channel marker (COMMENT)	13.4.1

- NOTE**
- The gauge, upper and lower limits, and 0 position comments are printed out in this order. Since the 0 position and logic channel comments are printed out in the same space, the positions must be specified so that these comments will not overlap each other.
 - If 0 position comments are printed on channels having the same 0 position, the printed comments will overlap each other.

13.5 Example of Printer Output

Printing the List (MEM)

HIOKI 8826MEMORY HiCORDER

Trig-time : ' 98-02-20 12:00:00

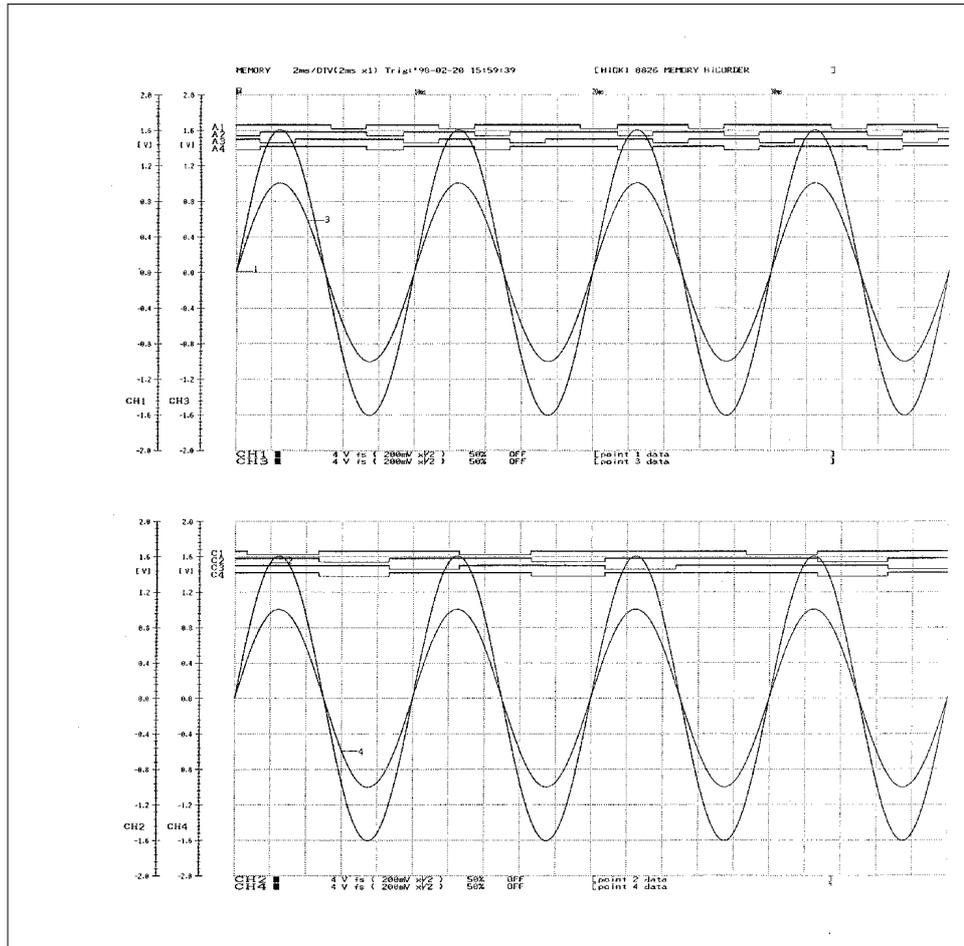
STATUS				SYSTEM			
Function :	MEMORY	Memory div :	OFF	Use channel :	ch1-32	Grid type :	STANDARD
Time/DIV :	100 μs			Start back up :	OFF	Channel maker :	COMMENT
Shot :	20DIV	Averaging :	OFF	Back light saver :	OFF	Time value :	TIME
Format :	SINGLE	Wave comparison :	OFF	Display color :	COLOR 8	List & Gauge :	OFF
Roll mode :	OFF	Measurement :	OFF	Beep sound :	ON	Print density :	STANDARD
Print mode :	WAVE	Wave calculation :	OFF	Language :	ENGLISH	Upper-lower print :	OFF
Smooth print :	OFF					0 position comment :	OFF
Auto print :	OFF					Counter print :	OFF
Auto save :	OFF						
Overlay :	OFF						

CHANNEL						TRIGGER			
ch.	draw graph	range	zoom (/DIV)	zero pos.	filter (lower ~ upper)	Trig-mode :	AUTO	Pre-trig :	0%
						Trig-source :	OR		
1 :	OFF					1 :	OFF		
2 :	OFF					2 :	OFF		
3 :	C 3	- 10mV	x 1(10mV)	50%	OFF (-100mV ~ 100mV)	3 :	LEVEL	level : 0.000V	slope : filter : OFF
4 :	C 2	- 500 μV	x 1(500 μV)	50%	500Hz [D] (-5mV ~ 5mV)	4 :	OFF		
5 :	OFF					5 :	OFF		
6 :	C 5	- 10 $\frac{mV}{\sqrt{2}}$	x 1(10mV)	50%K	OFF (-100mV ~ 100mV)	6 :	OFF		
7 :	OFF					7 :	OFF		
8 :	OFF					8 :	OFF		
9 :	OFF					9 :	OFF		
10 :	OFF					10 :	OFF		
11 :	OFF					11 :	OFF		
12 :	OFF					12 :	OFF		
13 :	OFF					13 :	OFF		
14 :	OFF					14 :	OFF		
15 :	OFF					15 :	OFF		
16 :	C 2	- 500 μV	x 1(500 μV)	50% [A]	500Hz [A] (-5mV ~ 5mV)	16 :	OFF		
17 :	OFF					17 :	OFF		
18 :	OFF					18 :	OFF		
19 :	OFF					19 :	OFF		
20 :	OFF					20 :	OFF		
21 :	OFF					21 :	OFF		
22 :	OFF					22 :	OFF		
23 :	OFF					23 :	OFF		
24 :	OFF					24 :	OFF		
25 :	OFF					25 :	OFF		
26 :	OFF					26 :	OFF		
27 :	OFF					27 :	OFF		
28 :	OFF					28 :	OFF		
29 :	OFF					29 :	OFF		
30 :	OFF					30 :	OFF		
31 :	OFF					31 :	OFF		
32 :	OFF					32 :	OFF		

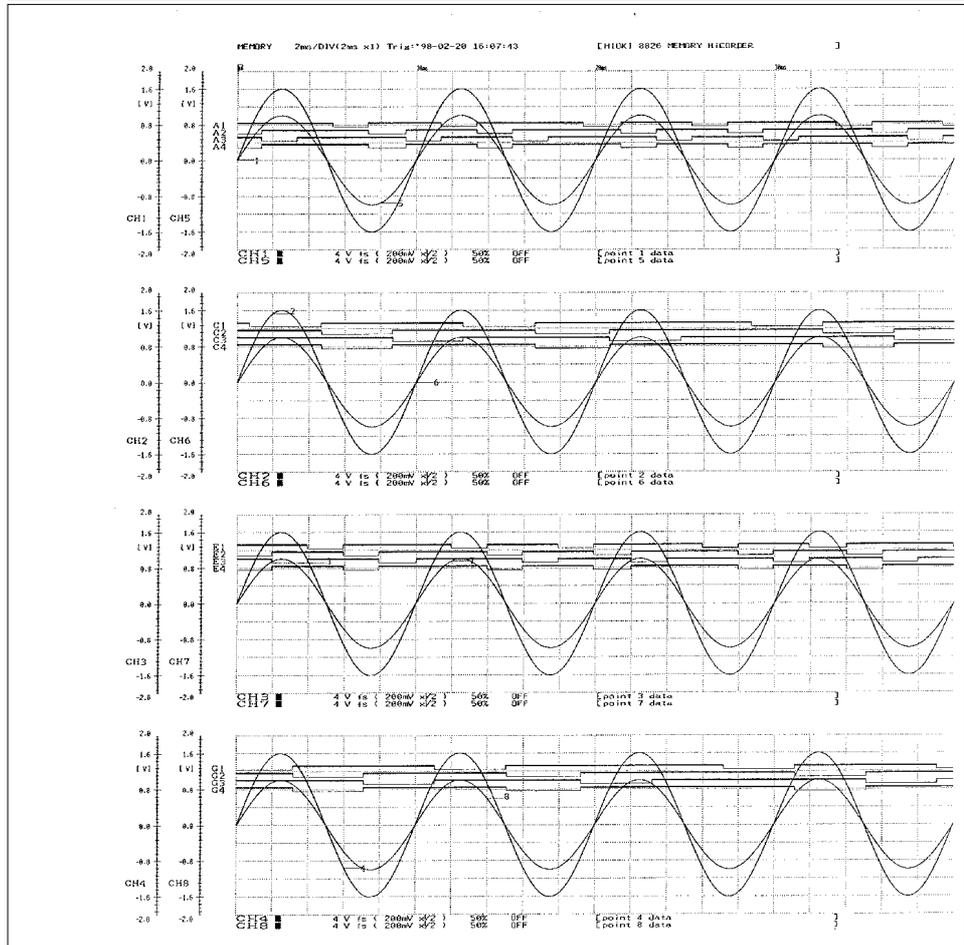
Logic	position	display color	Logic	position	display color
A :	POS. 1	----	B :	POS. 2	----
C :	POS. 3	----	D :	POS. 4	----
E :	POS. 5	----	F :	POS. 6	----
G :	POS. 7	----	H :	POS. 8	8 8 8 8

A :	OFF	B :	OFF
C :	OFF	D :	OFF
E :	OFF	F :	OFF
G :	OFF	H :	OFF
External :	OFF	Manual :	OFF
Timer-trig :	OFF		

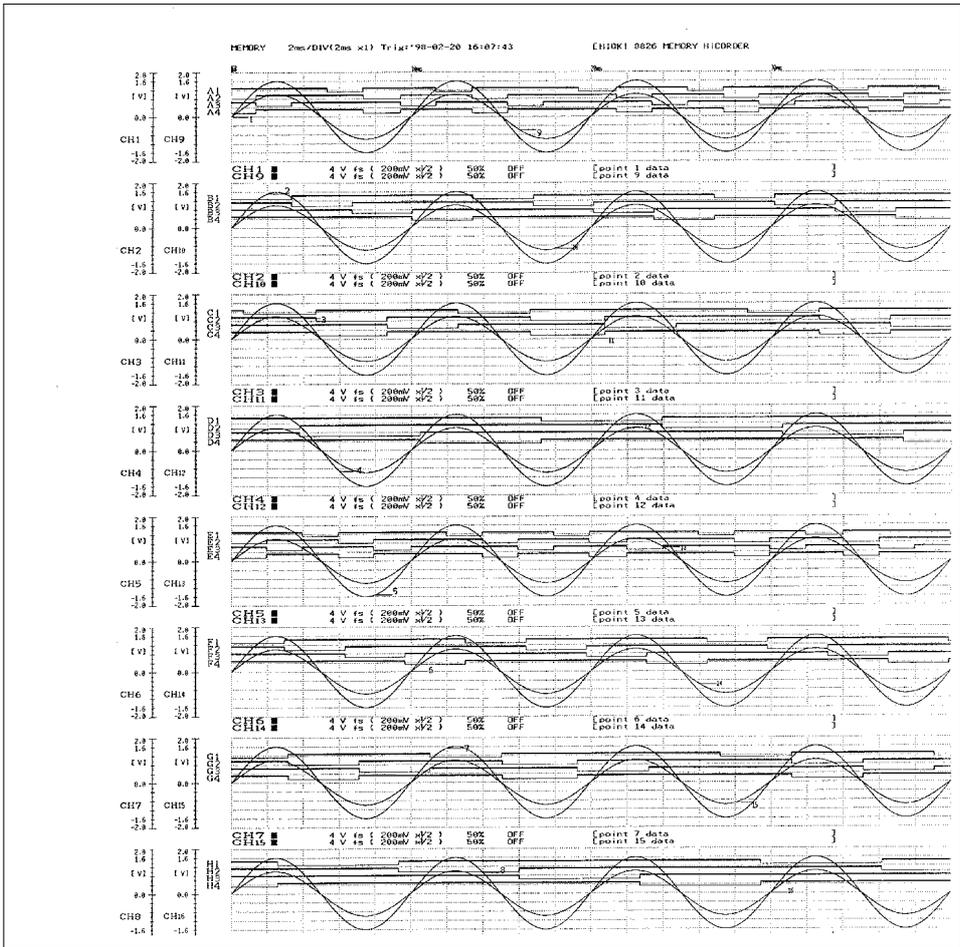
Dual



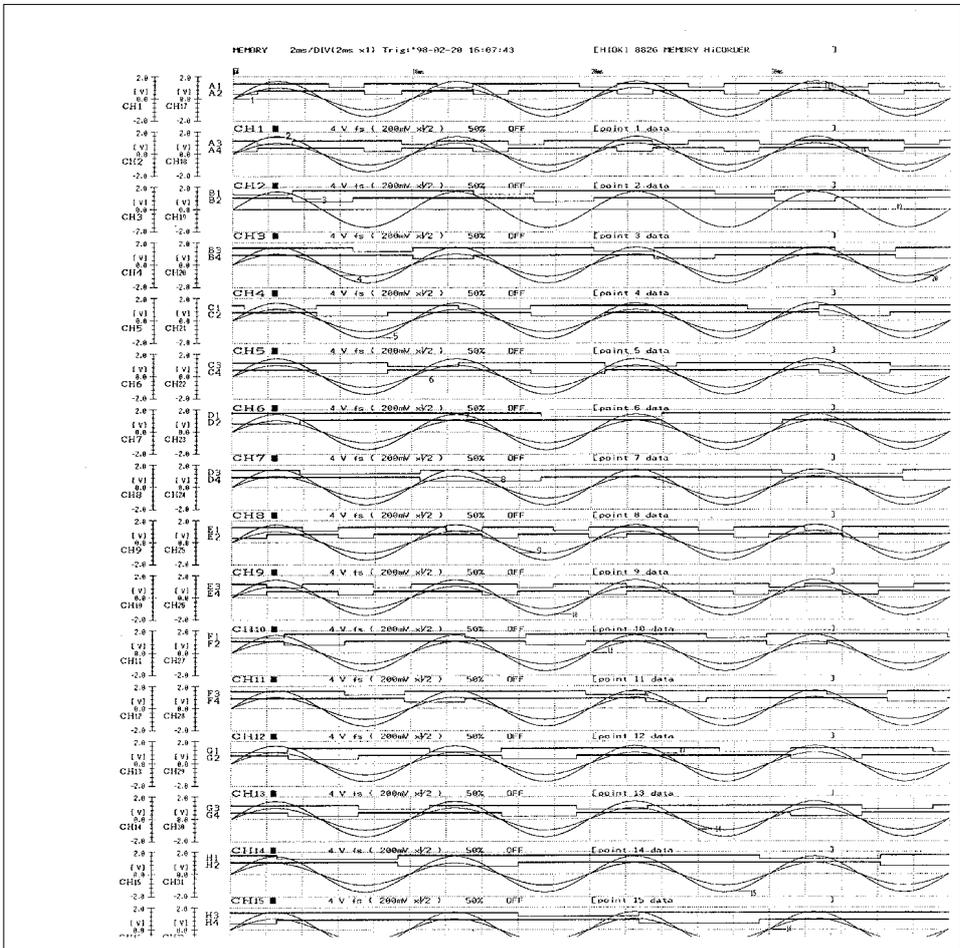
Quad



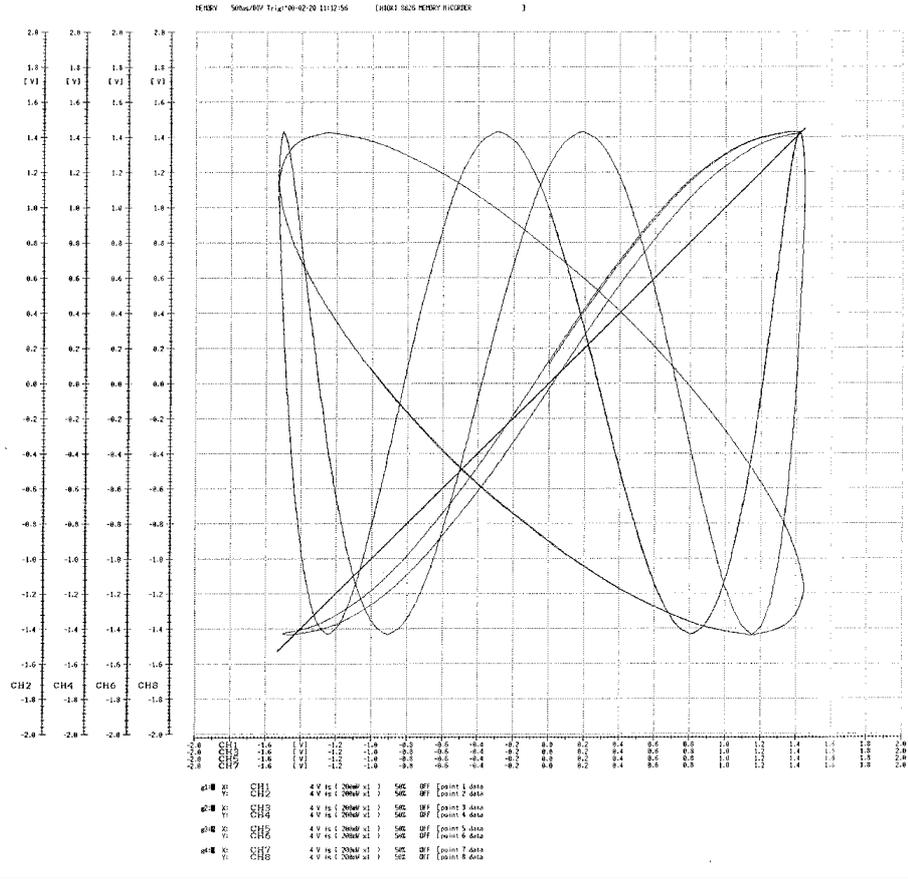
Oct



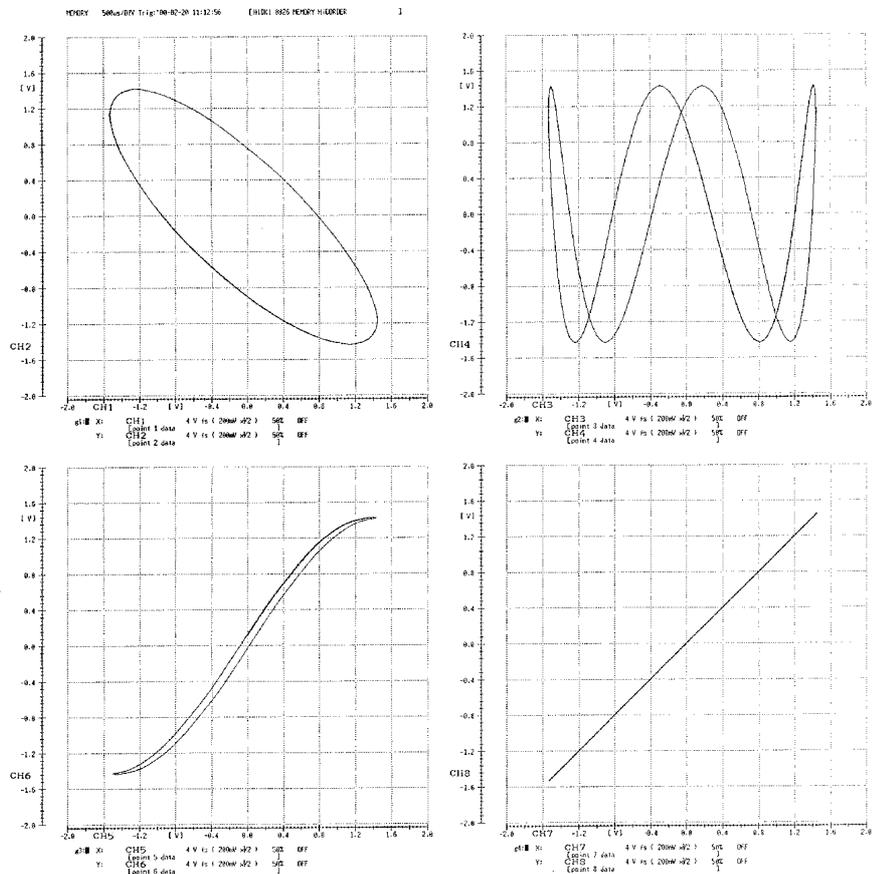
Hex



X-Y Single



X-Y Quad



13.6 Printing Procedure

	Internal printer	External printer	See Section
Manual Print			13.6.1
Auto Print		-	13.6.2
Real-Time Print		-	13.6.3
Partial Print			13.6.4
Screen Hard Copy			13.6.5
List Print		-	13.6.6
Report Print		-	13.6.7
Color print	-		13.7

13.6.1 Manual Print

This mode serves to print waveform data from the internal memory.

MEM, REC&MEM

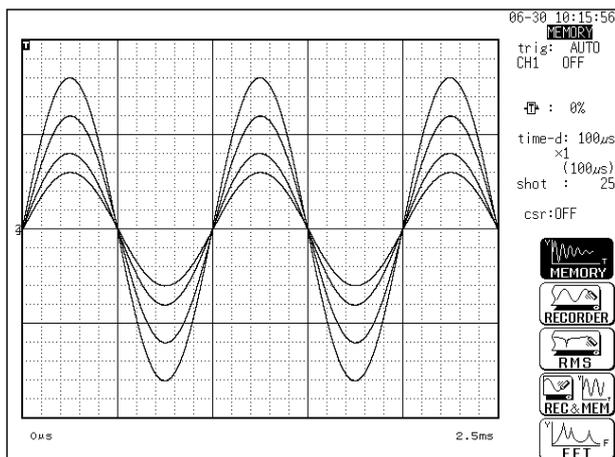
Measurement data from one measurement (entire recording length) are printed.

REC, RMS, REC&MEM

The measurement data most recently stored in memory is printed out in up to 2000 divisions (10,000 divisions for 64 M words). In the REC&MEM mode, data in up to 1000 divisions (5000 divisions for 64 M words) can be printed out.

FFT

For data recorded in one measurement, all the results of FFT operation are printed out in their entirety.



Method

Screen: DISPLAY

① After the measurement is completed, press the **PRINT** key.

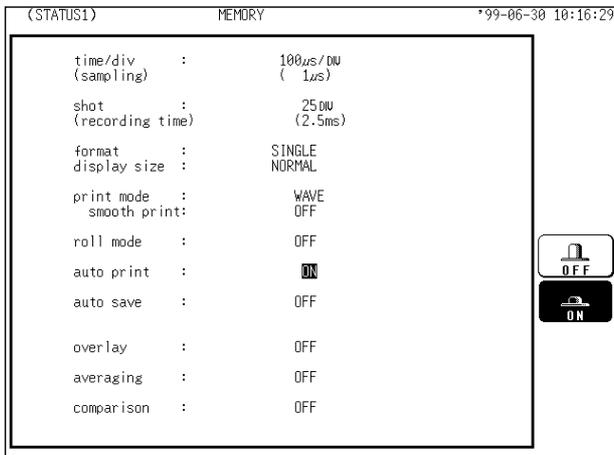
- Since data are stored, they can be printed as often as desired.
- When magnification/compression was used, the printout reflects this condition.
- If you want to stop the printing, press the **STOP** key.

NOTE

- When cursors A and B are enabled, partial printing is executed. (excluding FFT)
- When the recording length is set to "CONT" and at least 2000 divisions (10,000 for 64 M words) are recorded by the recorder or RMS recorder, or at least 1000 divisions (5000 for 64 M words) are recorded by the REC&MEM recorder, the time displayed does not represent the value counted from the trigger point if the time value of "the system 1" is set to "TIME". When it is set to "DATE," the time at which printing is initiated is printed out.
- In waveform evaluation setting (MEM), printing is performed for a single display screen (25 DIV). To print a waveform with a recording length of over 25 DIV, compress the time axis. See section 11.3.

13.6.2 Auto Print

Printout is carried out automatically after a waveform has been captured for the specified recording length (MEM and FFT).



Method

Screen: STATUS1 (MEM)
: STATUS2 (FFT)

- ① Press the **STATUS** key to call up the STATUS1 screen.
- ② Move the flashing cursor to the **auto print** item, as shown in the figure on the left.
- ③ Use the function keys to make the selection

Selection



: Disable auto print



: Enable auto print

- ④ Press the **START** key to start the measurement.
Printout is carried out automatically after a waveform has been captured for the specified recording length.

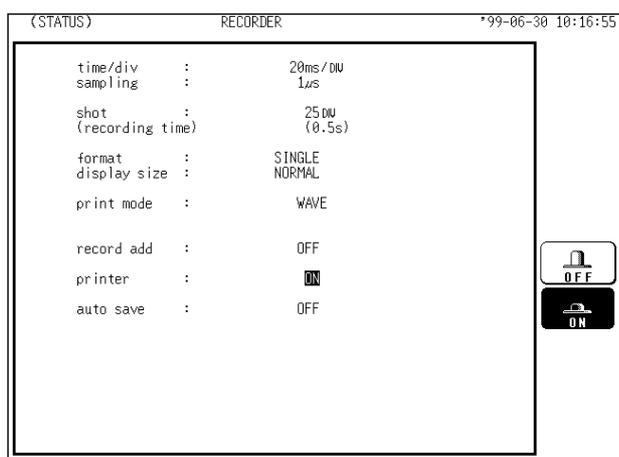
- When COMMUNI is selected, you can transfer print images to the 9333 LAN COMMUNICATOR.

NOTE

- When cursors A and B are enabled, partial printing is executed (MEM).
- When the local mode is enabled and the time-axis range is lower than 10 ms/division, data is displayed and printed simultaneously (MEM).
- When both auto-print and auto-save are enabled in memory recorder function, auto-save usually takes precedence. However, if roll mode is enabled, auto-print will execute first.

13.6.3 Real-Time Print

The input waveform and data are printed out continuously in real time (REC, RMS, and REC&MEM).



Method Screen: STATUS

- ① Press the **STATUS** key to call up the STATUS screen.
- ② Move the flashing cursor to the printer item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Disable real-time print print



: Enable real-time print print

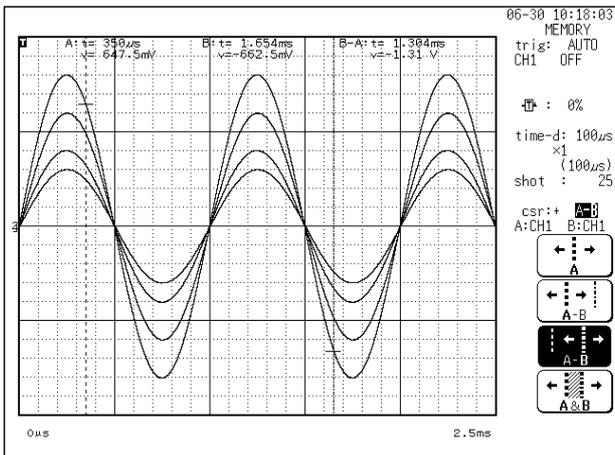
- ④ When measurement starts, waveform appears on screen and printout starts.

NOTE

- In the REC and RMS function, at a time axis range setting of 200 ms/DIV or faster, the waveform data will be printed out later. (See Section 18.5)
- In the REC&MEM function, at a time axis range setting of 20 ms/DIV to 200 ms/DIV, the waveform data will be printed out later.
- While the printer always outputs the data at the measurement magnification in recording mode, the waveform on the screen is reduced in size at the ratio shown below, depending on the time-axis range.
 REC: 50 ms/DIV × 1/2, 20 ms/DIV × 1/10
 REC&MEM: 100 ms/DIV × 1/2, 50 ms/DIV × 1/5, 20 ms/DIV × 1/10

13.6.4 Partial Print

- This function prints the waveform between the A and B cursors (vertical or trace cursors).
MEM, REC&MEM
Specified range (out of entire data recorded from a measurement) is printed.
REC, RMS
Specified range (out of last 2,000 (expended 64 M is 10,000) divisions (magnification: $\times 1$) of data in memory) is printed.
REC&MEM
Specified range (out of last 1,000 (expended 64 M is 5,000) divisions is printed.
- The function is available also when the A/B cursors are currently outside the range displayed on screen.
- For details regarding the use of the A/B cursors, refer to Section 11.2.
- Printing is possible also when the print format is currently set to "numeric".



Method Screen: DISPLAY

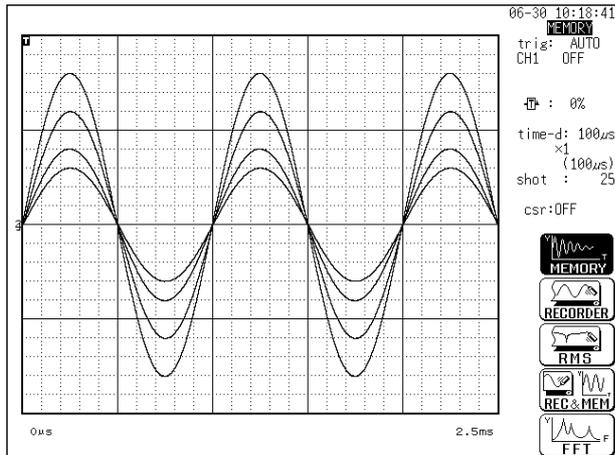
- ① Press the **DISP** key to call up the **DISPLAY** screen.
- ② Position cursor A at the start point of the range to be printed.
- ③ Specify the end point of the range with cursor B. (Move cursor B (or A) to the right. When the cursor is at the rightmost edge of the screen, the waveform scrolls to the left, and cursor A (or B) scrolls with it.)
- ④ Specify the end point of the range with cursor B. Then press the **PRINT** key. The specified range is printed, also if cursor A is currently off screen.

NOTE

- The range is printed also if the positions of cursor A and cursor B are reversed.
- When only the cursor A is used, the waveform data from the position of cursor A to the end of the data is printed.
- On the waveform evaluation screen, cursors A and B are available, but partial printing cannot be performed.
- On the X-Y screen and in FFT function, the partial printing cannot be performed.

13.6.5 Screen Hard Copy

The display contents of the all screens can be printed out as is.



Method **Screen: All**

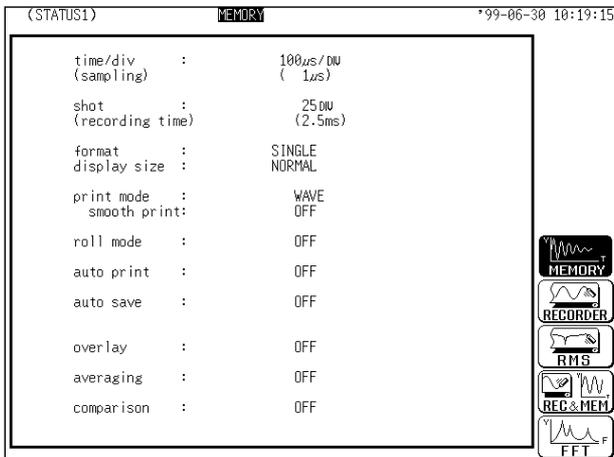
- ① Call up the desired screen.
- ② Press the **COPY** key.

NOTE

- Even if the gauge is set to the List & Gauge function, the gauge is not printed out in the screen copy mode.
- The screen hard copy function is not available during measurement.
- Output destination by the **COPY** key can be selected. See Section 12.5.1.

13.6.6 List Print

The settings for the various functions made with the STATUS screen, CHANNEL screen etc. can be printed out in list format.



Method Screen: Excluding DISPLAY

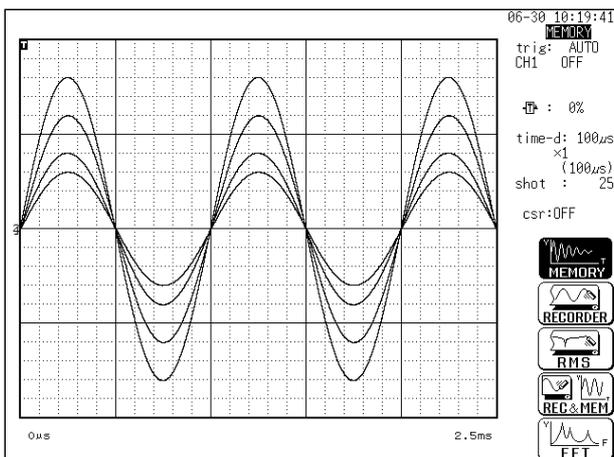
- ① While the setting screen (excluding DISPLAY) is displayed, press the **PRINT** key.

NOTE

The list to be printed contains the setup conditions for the acquired waveforms. Even if the settings are changed following wave acquisition, the contents of the list remain unchanged.

13.6.7 Report Print

- This function prints the waveform range shown on the display, upper-lower limits, analog channel along with the active settings.
- If the A and B cursors are displayed on the screen, they are also printed.
- When "COMMENT" or "SET & COMMENT" is set, the comments are also printed (See Section 9.8).



Method Screen: DISPLAY

- ① Press the **DISP** key to call up the DISPLAY screen.
- ② Press the **FEED** key and **COPY** key simultaneously.
(Press and hold the **FEED** key and then press the **COPY** key.)

NOTE

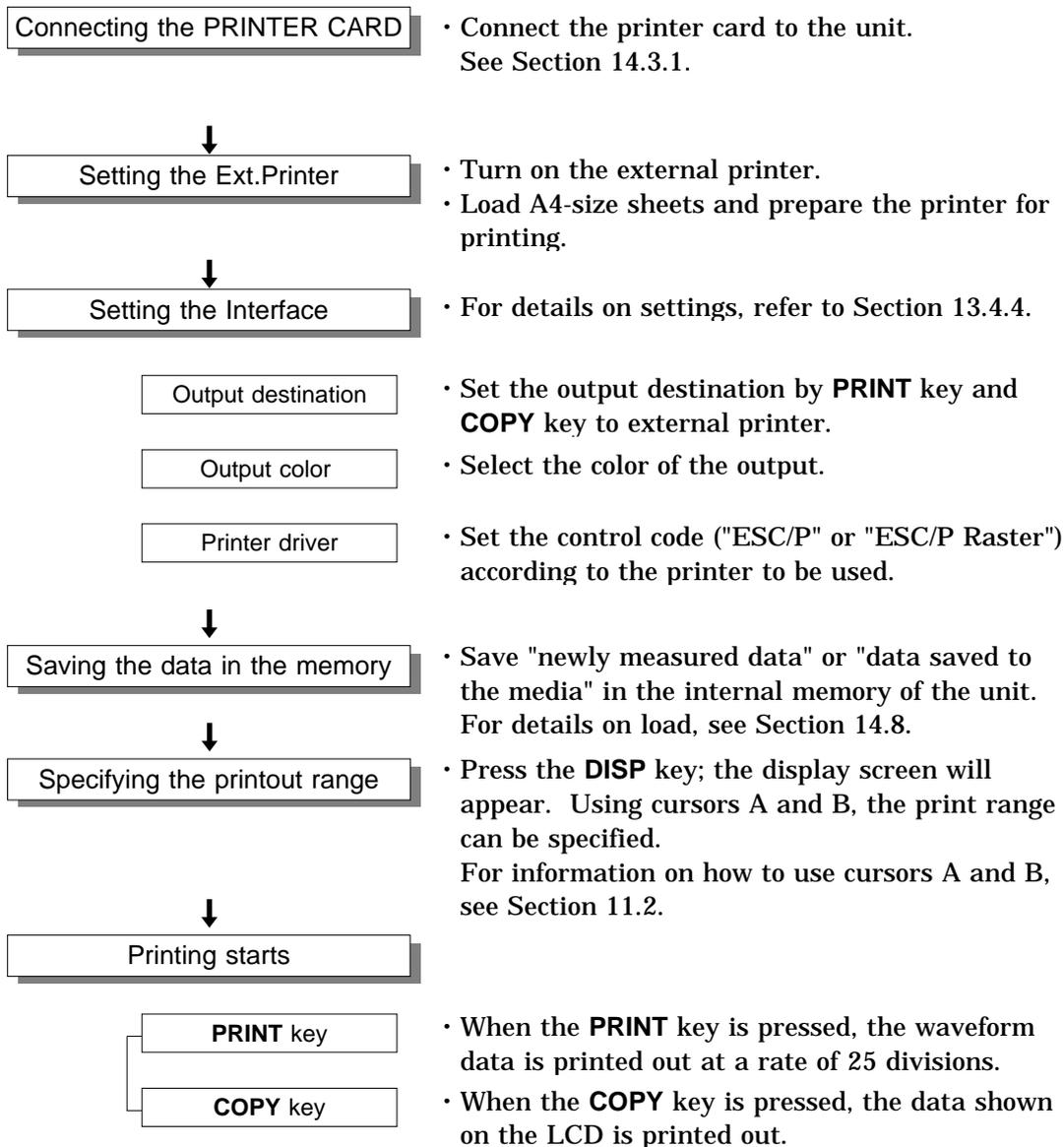
In the FFT function, report print cannot be carried out.

13.7 External Printer (Color Print)

Using the 9559 PRINTER CARD, waveform data can be output on A4-size sheets from the external printer in color or monochrome.

PRINT key: Prints out equivalent to 25 divisions waveform data or numerical data.

COPY key: Prints out the screen hard copy.

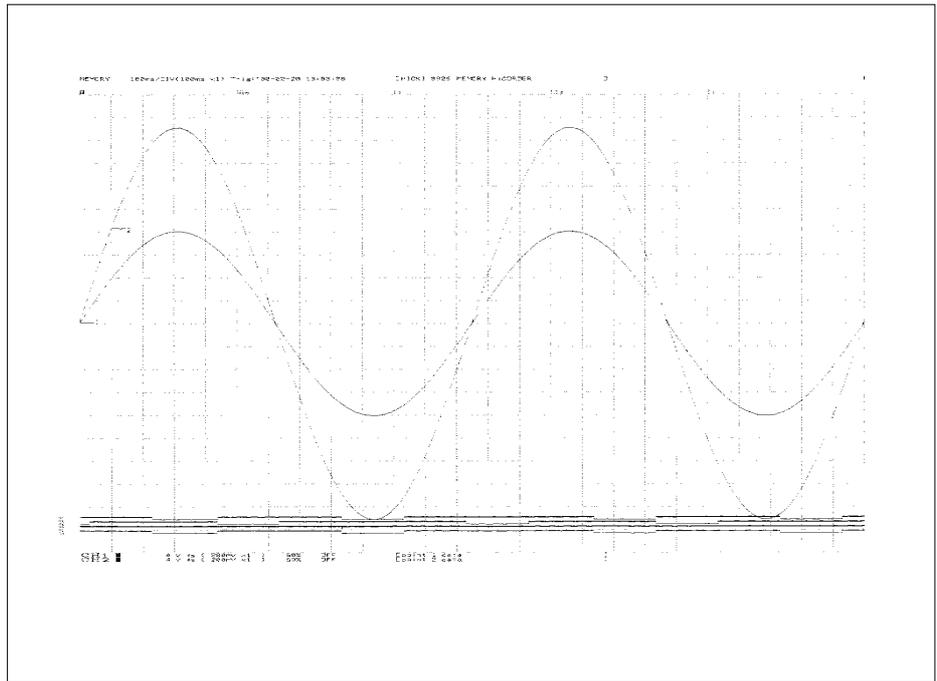


NOTE

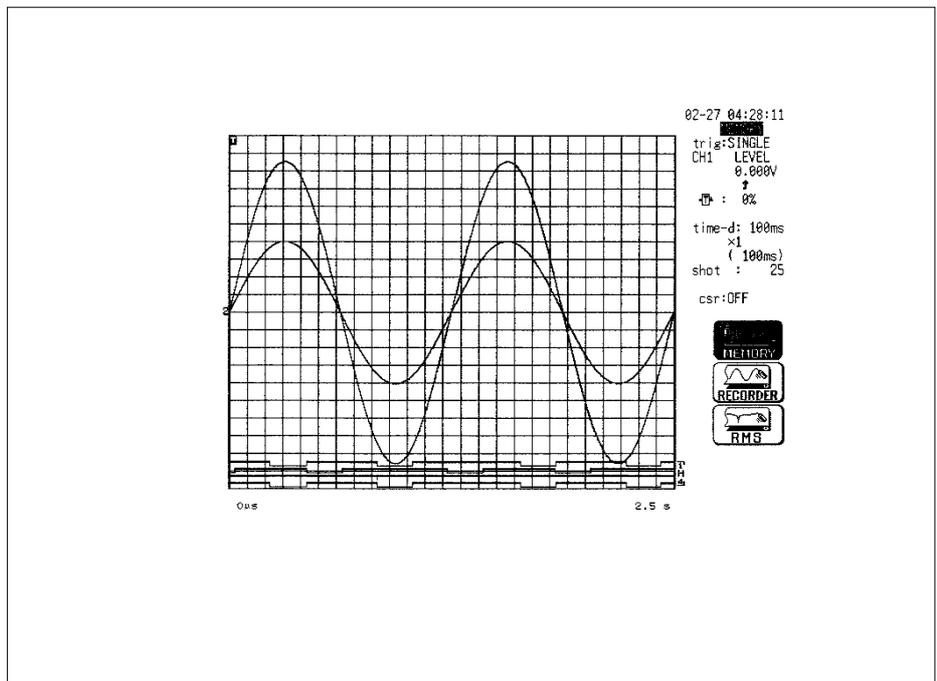
With respect to the following items, the external printer differs from the internal printer:

- (1) For the list and gauge functions, the list is printed out but the gauge is not output. If the display format is the X-Y screen, however, the gauge is also printed out.
- (2) The upper and lower limits are printed out for every page.
- (3) When both the upper-lower print function and 0 position comment function are enabled, the upper-lower print function is performed first.

Waveform print



Screen Hard Copy

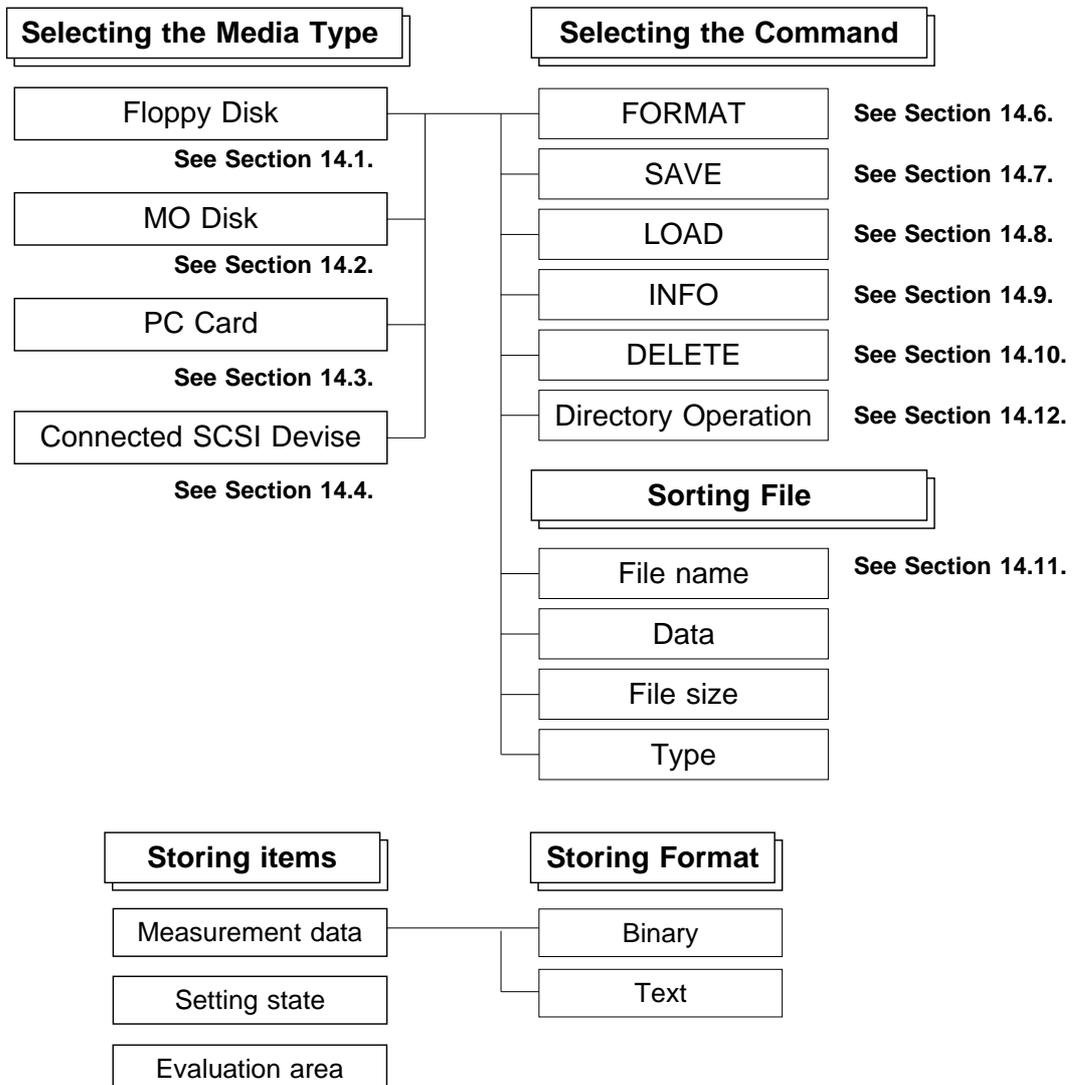


Chapter 14

Storing Measurement Data

A floppy disk, PC card, MO disk, or connected SCSI device can be used to store and retrieve measurement and setting data.

This chapter explains how to use the **SAVE**, **LOAD**, **INFO**, **DELETE** and **FORMAT** commands and how to create a directory and perform other related functions.



* While the memory segmentation enabled, it can be specified whether one or all blocks are to be saved.

14.1 Floppy Disk

CAUTION

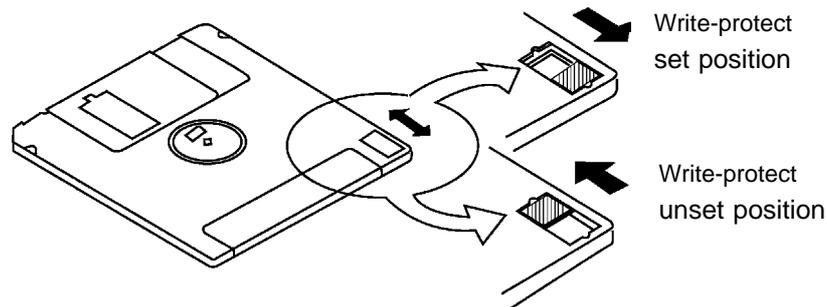
- If a floppy disk is inserted upside down, backwards, or in the wrong direction, the floppy disk or the unit may suffer damage. Before shipping the unit, always remove the floppy disk.
- 2DD floppy disks formatted in PC9801 640 K-byte format cannot be used.
- Do not remove the floppy disk while the floppy disk unit is operating (the LED on the floppy disk unit is on).
- The number of bytes depends on the floppy disk format.
- If the write-protect tab on the floppy disk is in the set position, the operations can not be performed.
- The floppy disk must be initialized (formatted) before using it.

3.5 inch 2HD or 2DD floppy disks can be used.

The following floppy disk formats can be used:

720 KB (IBM PC/AT compatible), 1.2 MB (NEC PC-9801 series), 1.44 MB (IBM PC/AT compatible or NEC PC-9801 series with 3-mode drive)

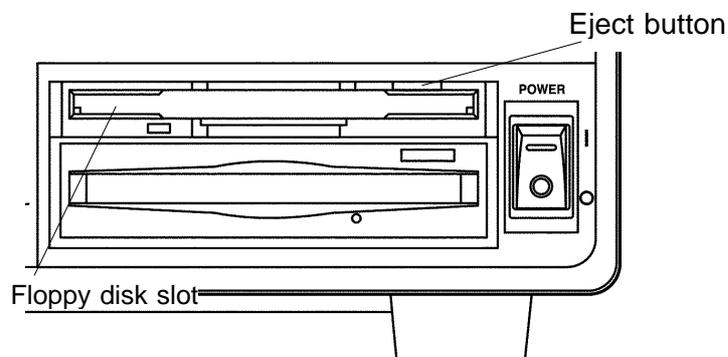
Write protection



How to set a floppy disk:

With the label side up, note the direction of the disk, and insert it all the way in.

To remove the floppy disk, press the eject button.



14.2 MO Disk (Option)

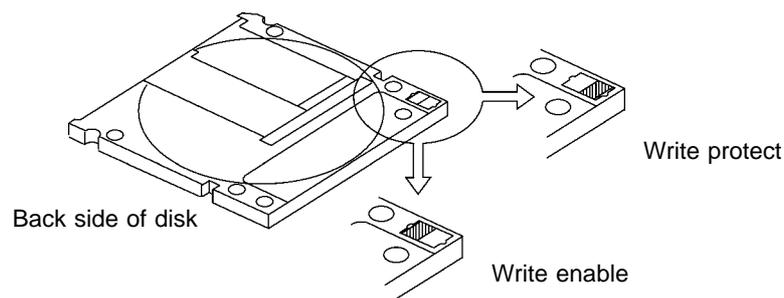
CAUTION

- Avoid operation at above 35 °C as far as possible. (If operated at above 35 °C, the disk protection function is activated, and it is not possible to save or read data.)
- If a MO disk is inserted upside down, backwards, or in the wrong direction, the MO disk or the unit may suffer damage. Before shipping the unit, always remove the MO disk.
- Do not remove the MO disk while the MO disk unit is operating (the LED on the MO disk unit is on).
- The number of bytes depends on the MO disk format.
- If the write-protect tab on the MO disk is in the set position, the operations can not be performed.
- The MO disk must be initialized (formatted) before using it.
- The MO drive may not operate properly when the unit is placed front side up.

MO type

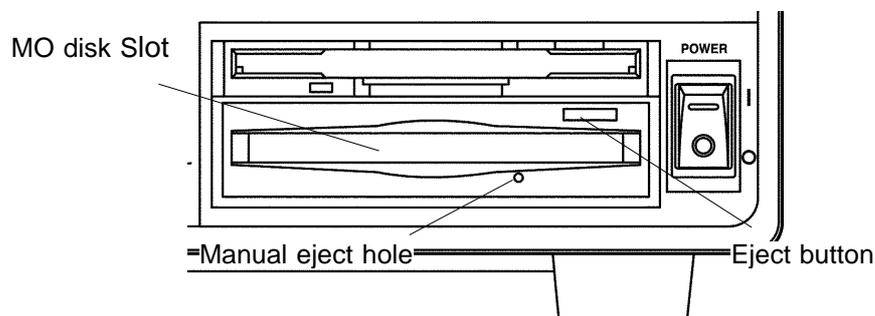
Use 3.5-inch MO disks (128, 230, 540, 640 MB: rewritable and overwrite) with this unit.

Write protection



Inserting/Removing the MO disk

With the label side up, note the direction of the disk, and insert it all the way in. To remove the MO disk, press the eject button.



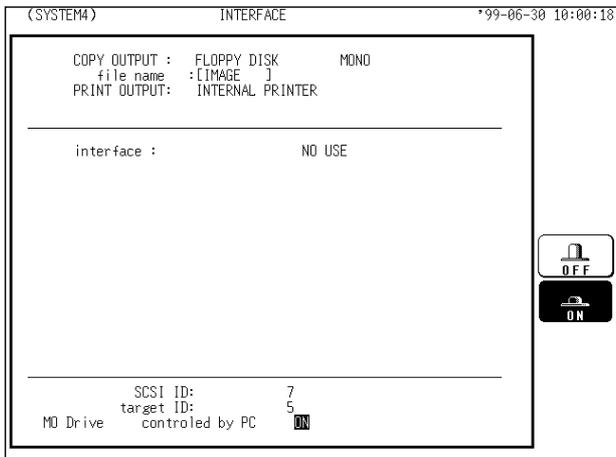
NOTE

If for any reason it should be impossible to remove the disk, use the following procedure.

- ① During powering on, press continuously the eject button of the MO drive to eject the disk.
- ② Power off the unit and insert a pin of diameter approximately 1 mm into the manual eject hole of the MO drive, to eject the disk.

14.2.1 Setting the MO Drive

The internal MO drive can be treated as an MO drive in the PC. This can be selected only when the optional 9607 MO Unit is installed.



Method Screen: INTERFACE (SYSTEM4)

- ① Press the **SYSTEM** key to call up the SYSTEM4 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: The MO drive is not treated as a drive in the PC.



: The MO drive is treated as a drive in the PC.

NOTE

- The ID of the internal MO is fixed at 4.
- When the internal MO setting is enabled (ON), the internal MO media selection cannot be selected.
- When the internal MO setting is enabled (ON) and the storage destination for automatic storage is set to Internal MO, automatic storage setup is disabled.

14.3 PC Card

⚠ WARNING

- Use only PC Cards sold by HIOKI.
- Compatibility and performance are not guaranteed for PC cards made by other manufacturers. You may be unable to read from or save data to such cards.

⚠ CAUTION

- Fully insert the PC card into the slot, making sure the side with printed text is facing up.
- If a PC card is inserted upside down, backwards, or in the wrong direction, the PC card or the unit may suffer damage. Before shipping the unit, always remove the PC card.
- Do not remove the PC card while the PC card unit is operating.
- The number of bytes depends on the PC card format.
- The PC card must be initialized (formatted) before using it. Some types of PC cards are not acceptable.
- When formatting a PC card on a PC, use the FAT-16 format. Formatting a card in FAT-32 format may result in incompatibility problems.

- The following five PC card types can be used in the 8826: flash ATA card, RS-232C interface card, GP-IB card, printer card, and LAN card.
- Flash ATA cards can be used as external storage.

HIOKI options

PC cards (includes adapter)

9626 PC CARD 32M

9627 PC CARD 64M

9726 PC CARD 128M

9727 PC CARD 256M

9728 PC CARD 512M

9729 PC CARD 1G

14.3.1 Using the PC Card Slot (PC Card with a Cable Only)

CAUTION

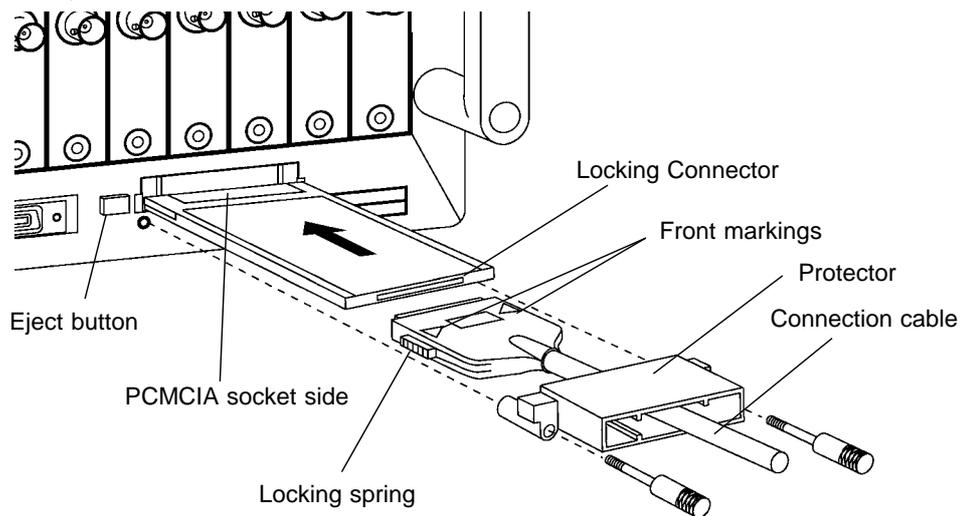
If a PC card is inserted upside down, backwards, or in the wrong direction, the PC card or the unit may suffer damage.

To avoid damage to the PC card or connector, observe the cautions listed below.

- Inserting the card with the wrong orientation or in other ways than described above.
- Inserting the card while attached to the connection cable.
- Moving the 8826 while the connection cable is connected to the card.
- Pulling the card out by the cable or exerting excessive force on the connector.
- Placing objects on the connection cable connector.

Cable and PC card connection

- (1) Pass the PC card protector through the connection cable, as shown below.
- (2) Plug the PC card end of the connection cable into the PC card. The top side of the cable connector (marked with a ) should match the top side of the PC card, as shown below.



- (3) Insert the PC card in the PC card slot on the 8826. Verify that the  mark on the card points in the correct direction as shown below, and make sure that the card is properly seated in the slot. The PC card is keyed to prevent wrong insertion, but exerting excessive force may damage the card or the slot.
- (4) Attach the PC card protector to the 8826 as shown below.

Removing the PC card

- (1) Remove the PC card protector.
- (2) To remove the PC card, press the eject button.
Do not press the eject button before removing the PC card protector.

14.4 SCSI Interface

The unit complies with the SCSI standard, and can therefore be used with a wide selection of commercially 3.5-inch MO disk drives.

14.4.1 SCSI Interface Specifications

General specifications

See Section 18.2.

Electrical specifications

Input signals	
Receiver	CMOS receiver with hysteresis
Input signal levels	Low level: 0 to 0.8 VDC High level: 2.0 to 5.25 VDC
Maximum load current	$\pm 10 \mu\text{A}$ (excluding terminator)
Minimum hysteresis	0.2 VDC
Output signals	
Driver	Open-drain CMOS driver
Output signal levels	Low level: 0 to 0.8 VDC High level: 2.0 to 5.25 VDC
Driver sink current	48 mA
Terminator power signal	
Output voltage	4 to 5.25 VDC
Maximum output current	1.2 A

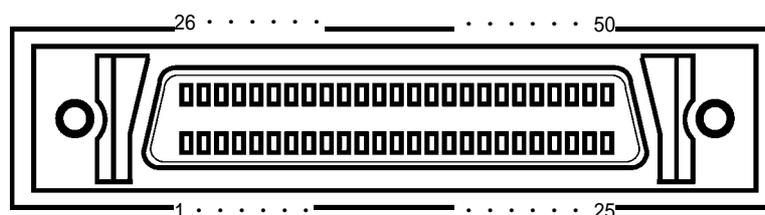
Connector

(1) Recommended connector:

Socket used : High density (pin type) (D-Sub half-pitch 50 P)

(2) SCSI connector pin outs

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	GND	11	GND	21	GND	31	-DB5	41	-ATN
2	GND	12	GND	22	GND	32	-DB6	42	GND
3	GND	13	GND	23	GND	33	-DB7	43	-BSY
4	GND	14	GND	24	GND	34	-DBP	44	-ACK
5	GND	15	GND	25	GND	35	GND	45	-RST
6	GND	16	GND	26	-DB0	36	GND	46	-MSG
7	GND	17	GND	27	-DB1	37	GND	47	-SEL
8	GND	18	GND	28	-DB2	38	TERMPWR	48	-C/D
9	GND	19	GND	29	-DB3	39	GND	49	-REQ
10	GND	20	GND	30	-DB4	40	GND	50	-I/O



NOTE

- The SCSI cable is not supplied.
- Check the connection types on both the 8826 and the connected device. Use commercially-available SCSI cables.

14.4.2 Setting the MO Drive

**WARNING**

Do not power off while the MO disk is being accepted.

Connection to a MO disk drive

- Select a SCSI cable with a connector corresponding to that of the disk drive.
- Check that both the 8826 and the MO disk drive are powered off.
- Connect firmly the SCSI connector on the rear panel of the 8826 and the MO disk drive.

Powering on

- Always power on the MO disk drive before powering on the 8826.
- Always power off the MO disk drive after powering off the 8826.

System configuration

- A maximum of seven SCSI interfaces can be connected, but the 8826 can only access either of one MO disk drive.
- It is not possible to 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.

MO disk drive

- Within the SCSI standard, some commands are left for manufacturer-dependent use. A MO disk drive which requires such commands cannot be used with the 8826.
- 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 MO disk drive from operating normally.

MO type

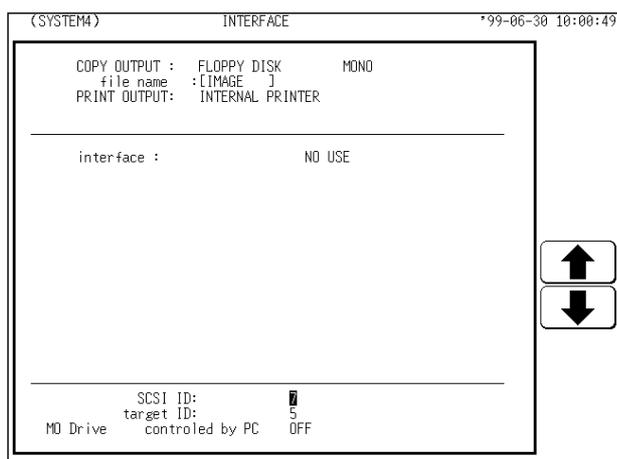
Use 3.5-inch MO disks (128, 230, 540, 640 MB: rewritable and overwrite) with this unit.

The following MO drives have been used satisfactorily by HIOKI.
(As of April, 2001)

640 MB	I · O DATA	MOF-RM640 MOF-SM640
	LOGITEC	LMO-A636S
	FUJITSU	FMO-640W3 FMO-640WL3

Note that the MO may not be compatible should the MO drive specifications be changed, even if the model No. remains the same.

14.4.3 Setting the SCSI Number



Method Screen: INTERFACE (SYSTEM4)

- ① Press the **SYSTEM** key to call up the SYSTEM4 screen.
- ② Move the flashing cursor to the desired item.
- ③ Use the function keys or jog control to make the setting.

Selection



: Value up



: Value down

SCSI ID

Set the ID number of the 8826 on the SCSI bus.
The available value range is 0 to 7.

Target ID

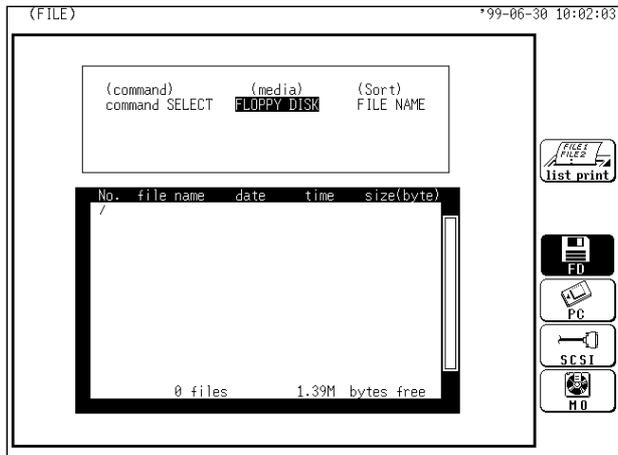
Set the ID number of the MO drive, which will be connected to the 8826, on the SCSI bus. The ID number of the internal MO drive (optional) is set to 4. Therefore, if the internal MO drive has been mounted, the ID number 4 cannot be specified. The available value range is 0 to 7.

NOTE

- Do not set the SCSI ID and the target ID to the same number.
- When "SCSI" or "MO" is selected as the output destination, separate destinations cannot be set for the auto save, parameter calculation result save, and the **COPY** key output.

14.5 Selecting the Media Type

The media type is specified.



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Move the flashing cursor to the (media) item, as shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Floppy disk media are used.



: PC card media are used.



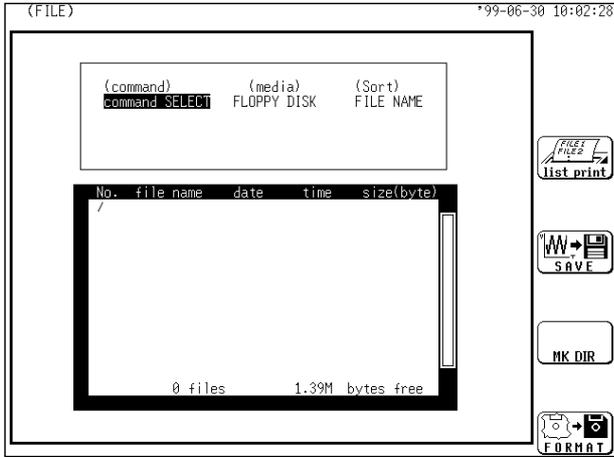
: Select the external storage connected to the SCSI interface as the recording medium.



: MO disk media are used.

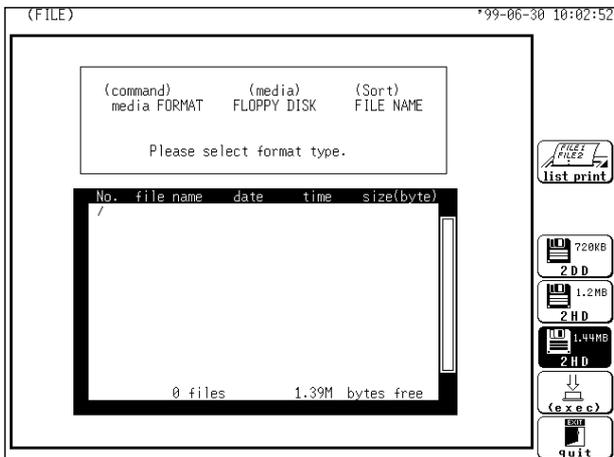
14.6 FORMAT (Initializing)

Initialization (formatting) method is described below.



Method **Screen: FILE**

- ① Press the **FILE** key to call up the FILE screen. And use the function keys to select the media.
- ② Move the flashing cursor to the (Command) item, as shown in the figure on the left.
- ③ Use the function keys to select the **FORMAT**.



- ④ When the format selected the floppy disk, modes appear on the function key display. Use the function keys to select the floppy disk format mode.

Selection

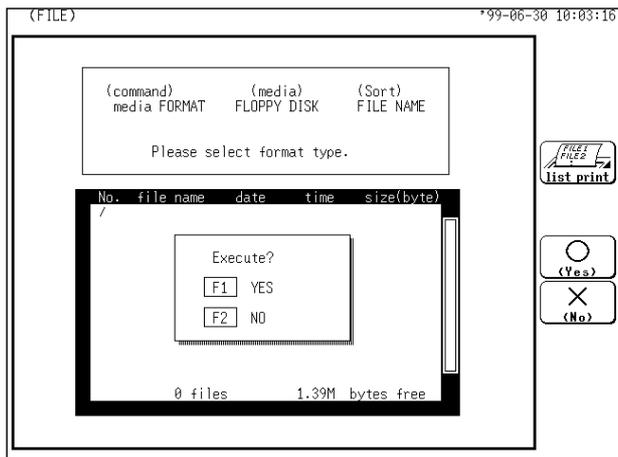
-  : Format in 2DD (720 KB) format.
-  : Format in 2HD (1.2 MB) format.
-  : Format in 2HD (1.44 MB) format.

When the format selected the MO disk, modes appear on the function key display. Use the function keys to select the MO disk format mode.

Normally, the "FORMAT" is used. Use the "FORMAT (phy)" only for disks that cannot be read from the 8826.

Selection

-  : Logical format is enabled.
-  : Logical format and physical format is enabled.



- ⑤ Use the function keys to select the exec.
Use the function keys to select whether to execute or not.

Selection

- (Yes) : Execute the format procedure.
- (No) : Cancel the format procedure.

Formatting time (approx.) the MO disk

	REWITABLE	OVERWRITE
128 MB	7 min	
230 MB	10 min	6 min
640 MB	11 min	8 min

NOTE

- Use the MS-DOS format for floppy disks and PC cards.
- The MO-disk format conforms to the super floppy format.

14.7 SAVE

- Stores a file in the directory currently selected on the file screen.
- The waveform data can be stored as binary or text data. Data stored in the text format is not readable by the 8826.

What can be recorded and how much

(1) Setting state (SET)

- ① It is possible to record the setting state for each of the functions. When a multiblock is used, the setup conditions of the use blocks are stored.
- ② When a setting state is read into the 8826, it is restored in the unit. (See Section 14.8)
Size of recording for the setting state: 512×69 bytes = 35328 bytes

(2) Measurement data (MEM, REC, XYC, RMS, FFT, TXT)

- ① It is possible to save the measurement data of a waveform which has been captured.
- ② Use of cursors A and B enables partial saving (excluding XYC, FFT).
- ③ When measurement data is read into the 8826, the waveform data recorded on the media is put into the designated memory channel.
- ④ When the measurement data of a waveform is recorded, its setting state (the recording length, time axis, measurement range, scaling and comments) is also simultaneously recorded. Because when this is loaded the unit is set to the condition when the measurement data was recorded, it can be checked by being listed.
- ⑤ Logic channels ch1 to ch4 are considered as one channel in any function.
- ⑥ For the size of a file, see Section 21.4.1 and 21.4.2.

(3) Recorder and memory (R_M)

- ① In this function, the recorder waveform and memory waveform can be saved.
- ② These waveforms can be saved in a single operation.

(4) Memory block (SEQ: sequential, MUL: multiblock)

- ① Using the memory segmentation function, the recorded waveform data can be saved to the memory block.
- ② Batch saving of all blocks can be selected.

(5) Evaluation area (AREA)

- ① The area created using the waveform evaluation editor can be saved.
- ② The setup conditions are saved together with the evaluation area.
- ③ The recording capacity varies depending on the evaluation area.

(6) Hard copy (BMP)

The each screen display of the 8826 can be stored in the bit map file (BMP) format.

Color Setting	File size
Color, Gray	Approx. 308,278 bytes
Mono, Mono (rev)	Approx. 38,462 bytes

- The bit map file is one of the standard graphic type of the Windows*¹, therefore by using the graphic software, this file format can be used.
- For details on saving the hard copy, refer to Section 12.5.1.

(7) Partical Save

- ① When the A cursor is used to specify, the data from the position specified by the A cursor to the end is saved.
- ② When the A and B cursors are used to specify, the data between A and B cursors is saved.

Number of directories and files to be saved

Media	Format	Limit	
		Root	Sub
FD	720 K	112	5000
	1.2 M	192	5000
	1.44 M	224	5000
PC	Flash ATA	512 to 1024	5000
MO	—	512	5000

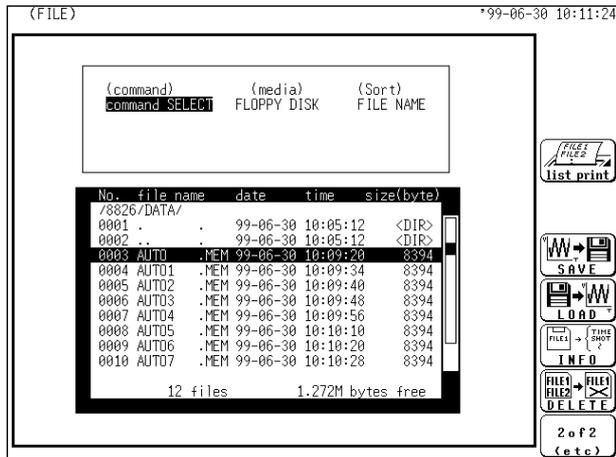
NOTE

- Data stored in the text format is not readable by the 8826.
- In FFT function, the partial saving is not possible.
- Waveforms that are displayed by the recorder function in X-Y format cannot be saved in text format.

(*1): The Windows is a registered trademark of Microsoft Corporation.

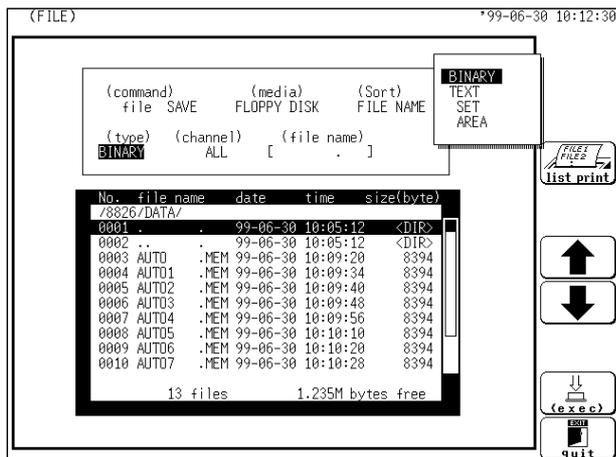
14.7.1 Setting the Saving Items

Selecting the Command


Method
Screen: FILE

- ① Press the **FILE** key to call up the FILE screen. And use the function keys to select the media.
- ② Move the flashing cursor to the (command) item, as shown in the figure on the left.
- ③ Use the function keys to select the **SAVE**.

Selecting the store format.



- ① Use the **CURSOR** key to move the flashing cursor to the (type) item, shown in the figure on the left.
- ② Use the function keys or the **JOG** control to select the store format.

Selection
BINARY

: The waveform data or FFT analysis result is saved in binary format.

TEXT

 : The waveform data or FFT analysis result is saved in text format.
 Data stored in the text format is not readable by the 8826.

SET

: The settings are saved.

AREA

: The evaluation area in memory is saved.

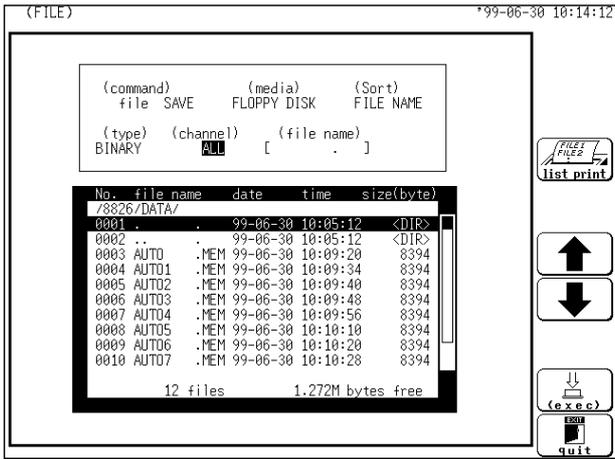


: determines the data to store.



: Cancel the command to be saved.

Selecting the channel for storing data

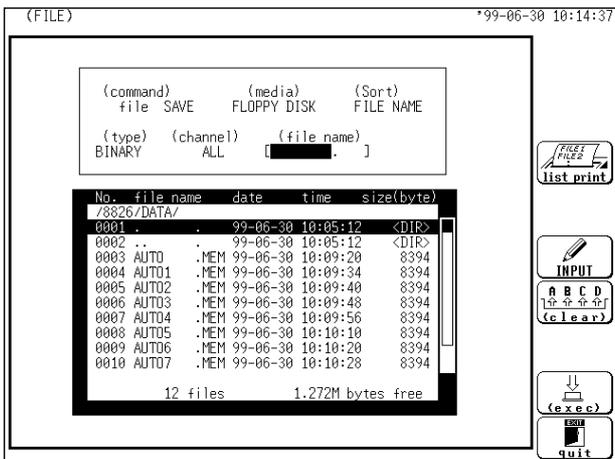


- ① Use the CURSOR key to move the flashing cursor to the (channel) item, shown in the figure on the left.
- ② Use the function keys or the JOG control to select the channel.

Selection

- ALL** : Store data for all displayed channels (displayed data only).
- CH1** : Store waveform data for channel 1.
- ⋮
- CH32** : Store waveform data for channel 32.
- LOGIC** : Store logic waveform data (all data).
- : determines the data to store.
- : Cancel the command to be saved.

Entering the file name



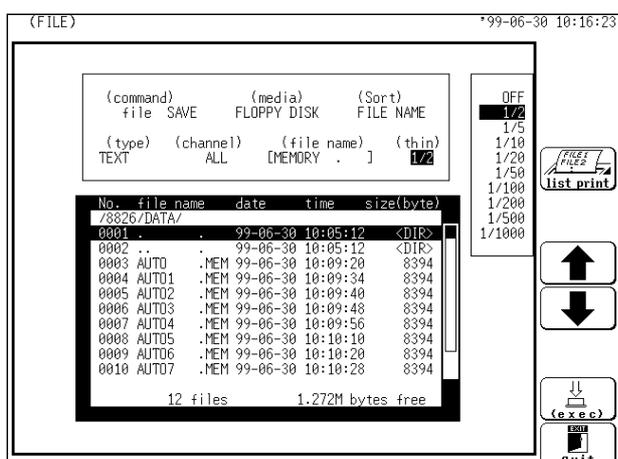
- ① Use the CURSOR key to move the flashing cursor to the (channel) item, shown in the figure on the left.
- ② Use the function keys to select the **F1 [INPUT]**.
For character entry procedure, see Section 9.8.4.
 - Do not use the characters and symbols below in a file name. A file containing any of these characters/symbols in its file name cannot be processed under Windows 2000 or XP. Half-size symbols: +, =, [,]

File name extension

If no file name extension (3 characters after period) is entered, the following extensions are automatically assigned, according to the stored data type.

Extension	Meaning	Data load by 8826
MEM	Memory recorder binary data file	YES
REC	Recorder binary data file	YES
RMS	RMS recorder binary data file	YES
XYC	X-Y CONT recorder binary data file	YES
SEQ	Sequential save index file	YES
MUL	Multiblock index file	YES
TXT	Text data file	NO
SET	Setting data file	YES
ARE	Evaluation area	YES
BMP	Bit map (.bmp) file	NO
FFT	FFT binary data file	YES
R_M	REC&MEM index file	YES
CMU	Setting data files (read-only) for 8910 CAN ADAPTER	YES

Intermittent setting



① When the store format is set to text data, spacing can be set. Unit is data number. Use the function keys or the JOG control to make selection.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.



: determines the data to store.

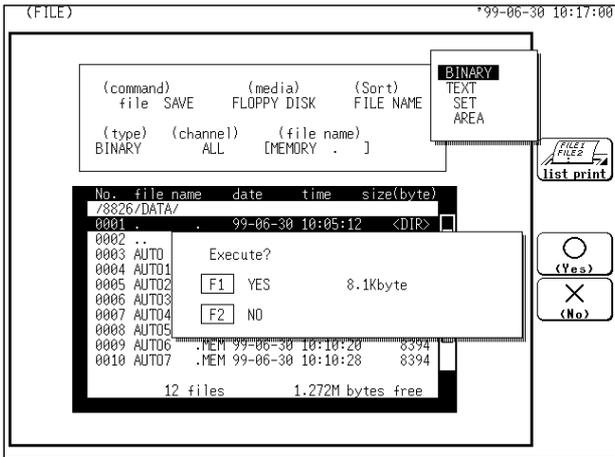


: Cancel the command to be saved.

NOTE

- Thinning is not applied with FFT data text format storage.
- Recorder XY data cannot be saved as text.
- The size of files that have been saved with data thinning selected are the same as would be the case if recording length were shortened proportionately. For example, when the recorded length is 500 DIV and cropping is 1/5, the file size is the same as a file whose recorded length is 100 DIV with no cropping.

Executing the saving



① Use the function key to select the Yes.

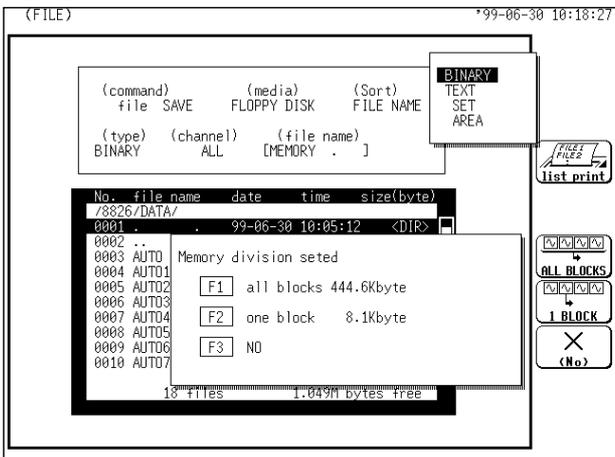
Selection



: Determines the data to save.



: Cancel the command to be saved.



② When the waveform data is selected and the memory segmentation function is used, select block saving.

Selection



: In sequential saving, all data, from the starting block through the ending block, is saved. (In the multi-block function, excludes empty blocks)



: Save the waveform data on the selected blocks (displayed block, use block)

③ In the REC&MEM function, select the storing form.

Selection



: Batch saving is enabled. files for all blocks as well as a index file



: Displayed block is saved.

NOTE

- When "ALL BLOCKS" is selected, files for all blocks as well as a index file for reading the data in one operation are created.
- When batch saving with the Recorder & Memory function, a directory with the same name as the filename is created, and in the directory the measurement data (with REC, MEM extensions) are created together with an index file (R_M).
- In the batch saving, partial saving cannot be carried out.
- After the "Yes" function key is selected, the size of the file to be saved is displayed.
- The directory and the number of files that can be stored in the directory are limited. For details, see Section 14.7.
- Data stored in the text format is not readable by the 8826.
- Waveforms that are displayed by the recorder function in X-Y format cannot be saved in text format.

Automatic file name assignment

If the file name is entered as a blank [.], it is assigned automatically according to the following principle.

Auto save	Real time save	Waveform data, screen data	Parameter calculation result
[AUTO .EXT]	[REAL .EXT]	[NONAME .EXT]	[MEASURE .TXT]
[AUTO0001 .EXT]	[REAL0001 .EXT]	[NONAME01 .EXT]	[MEASURE1 .TXT]
[AUTO0010 .EXT]	[REAL0010 .EXT]	[NONAME10 .EXT]	[MEASUR10 .TXT]
[AUTO0100 .EXT]	[REAL0100 .EXT]	[NONAM100 .EXT]	[MEASU100 .TXT]
[AUTO5000 .EXT]	[REAL5000 .EXT]	[NONA5000 .EXT]	[MEAS5000 .TXT]

File contents

The file contents depend on the file type.

	WAVE (Binary)				SET
	MEM	REC	RMS	FFT	
STATUS1 screen	*1	/	/	/	
STATUS2 screen					
STATUS3 screen					
STATUS4 screen					
STATUS screen	x				
TRIGGER screen					
CHANNEL 1 screen					
CHANNEL 2 screen					
Scaling settings					
Comment settings					
SET UP (SYSTEM1)	x	x	x	x	

: The data is saved to the file. Settings for the 8826 are always enabled during reading.

x : The data is not saved to the file.

*1 : The data is saved to the index file.

14.7.2 Text data store example

When comment setting is not OFF, the text data are stored as follows.

```

"COMMENT", "8826 MEM DATA"
"DATE", "03-28-2001"
"TIME", "10:10:00"
"NUM_SIGS", 3
"INTERVAL", 1.000E-06
"HORZ_UNITS", "s"
"VERT_UNITS", "s", "V", "V"
"SIGNAL", "TIME", "ACH 1", "ACH 2"
"DATA"
+0.000000000E+00, -5.9375E-03, +9.3750E-04

```

: Comment character string, Data type
: Date
: Time
: Number of signals
: Horizontal axis interval
: Horizontal axis unit
: Vertical axis unit
: Signal name
: Start of Data

Any set comment on each channel is shown.

Any set title comments are shown.

Example 1

When the data for analog 4 channels and logic 4 channels is stored in Memory recorder function (Memory recorder function, memory data in Recorder&memory function, FFT function)

```

"COMMENT", "8826 MEM DATA"
"DATE", "01-01-1999"
"TIME", "10:10:00"
"NUM_SIGS", 9
"INTERVAL", 1.000E-06
"HORZ_UNITS", "S"
"VERT_UNITS", "S", "V", "V", "V", "V", "Bit", "Bit", "Bit", "Bit"
"SIGNAL", "TIME", "ACH 1", "ACH 2", "ACH 3", "ACH 4", "LCHA1", "LCHA2", "LCHA3",
"LCHA4"
"DATA"
+0.000000E+00, -5.9375E-03, +9.3750E-04, +2.3500E-03, -9.3750E-04, 1,1,1,1
+1.000000E-06, -5.6875E-03, +7.5000E-04, +2.4125E-03, -1.0312E-03, 1,1,1,1
+2.000000E-06, -5.5000E-03, +6.2500E-04, +2.3688E-03, -1.0437E-03, 1,1,1,1
+3.000000E-06, -5.5000E-03, +6.2500E-04, +2.4000E-03, -1.1750E-03, 1,1,1,1
+4.000000E-06, -5.3750E-03, +4.3750E-04, +2.4000E-03, -1.1687E-03, 1,1,1,1
+5.000000E-06, -5.6250E-03, -5.1875E-03, +1.0250E-03, -1.2187E-03, 1,1,1,1
+6.000000E-06, +4.3750E-04, -7.6875E-03, -1.1250E-03, -9.3750E-05, 1,1,1,1
+7.000000E-06, +2.1875E-03, -6.1875E-03, -1.6875E-03, +8.0000E-04, 1,1,1,1
+8.000000E-06, +1.5625E-03, -6.5000E-03, -2.0687E-03, +1.1687E-03, 1,1,1,1
+9.000000E-06, +1.3750E-03, -6.3750E-03, -2.2500E-03, +1.3125E-03, 1,1,1,1
+1.000000E-05, +1.3750E-03, -6.2500E-03, -2.2875E-03, +1.4250E-03, 1,1,1,1

```

Example 2

When the data is stored in Recorder function (Recorder function, RMS recorder function, recorder data in Recorder&memory function)

```
"COMMENT", "8826 REC DATA"
"DATE", "01-01-1999"
"TIME", "10:10:00"
"NUM_SIGS", 13
"INTERVAL", 1.000E-04
"HORZ_UNITS", "S"
"VERT_UNITS", "S", "V", "V", "V", "V", "Bit", "Bit", "Bit", "Bit", "Bit", "Bit",
"Bit", "Bit"
"SIGNAL", "TIME", "ACH 1(Max)", "ACH 1(Min)", "ACH 2(Max)", "ACH 2(Min)",
"LCHA1(Max)", "LCHA2(Max)", "LCHA3(Max)", "LCHA4(Max)", "LCHA1(Min)", "LCHA2(Min)",
"LCHA3(Min)", "LCHA4(Min)"
"DATA"
+0.000000E+00, +2.5000E-03, -8.5000E-03, +1.8125E-03, -8.9375E-03, 1,1,1,1, 0,0,0,0
+1.000000E-04, +2.2500E-03, -8.8125E-03, +1.8750E-03, -9.1250E-03, 1,1,1,1, 0,0,0,0
+2.000000E-04, +2.5000E-03, -8.7500E-03, +1.8125E-03, -9.2500E-03, 1,1,1,1, 0,0,0,0
+3.000000E-04, +2.4375E-03, -8.5000E-03, +2.0000E-03, -9.1250E-03, 1,1,1,1, 0,0,0,0
+4.000000E-04, +2.5625E-03, -8.6875E-03, +1.9375E-03, -9.3125E-03, 1,1,1,1, 0,0,0,0
+5.000000E-04, +2.3750E-03, -8.3750E-03, +1.9375E-03, -8.9375E-03, 1,1,1,1, 0,0,0,0
+6.000000E-04, +2.5000E-03, -8.8750E-03, +2.0625E-03, -8.8750E-03, 1,1,1,1, 0,0,0,0
+7.000000E-04, +2.3750E-03, -8.8125E-03, +1.8750E-03, -9.0625E-03, 1,1,1,1, 0,0,0,0
+8.000000E-04, +2.5000E-03, -8.6250E-03, +2.0625E-03, -9.3125E-03, 1,1,1,1, 0,0,0,0
+9.000000E-04, +2.3750E-03, -8.3750E-03, +2.0000E-03, -9.1875E-03, 1,1,1,1, 0,0,0,0
```

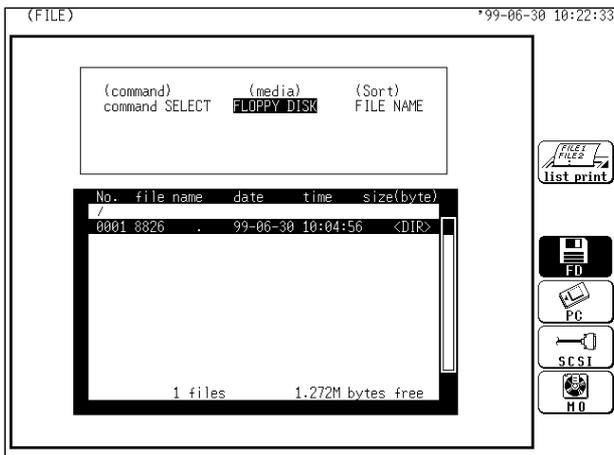
NOTE

The recorder, RMS recorder, and recorder & memory functions sample waveforms at a rate that exceeds that indicated by the time axis on the screen. Data captured is converted to sampling data for display according to the range being displayed on screen, and the maximum and minimum values during the sampling period are stored in memory. However, if data is thinned out, the thinned data is simply saved in thinned form.

14.8 LOAD

- The unit settings or the measurement data are transferred from the media to the memory of the unit.
- When loading measurement data, the channel can be specified.
- Measurement data stored by the 8825 can be loaded into the 8826.

Selecting the media to load



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Move the flashing cursor to the (media) item, shown in the figure on the left.
- ③ Use the function keys to make selection.

Selection



: Floppy disk media are used.



: PC card media are used.

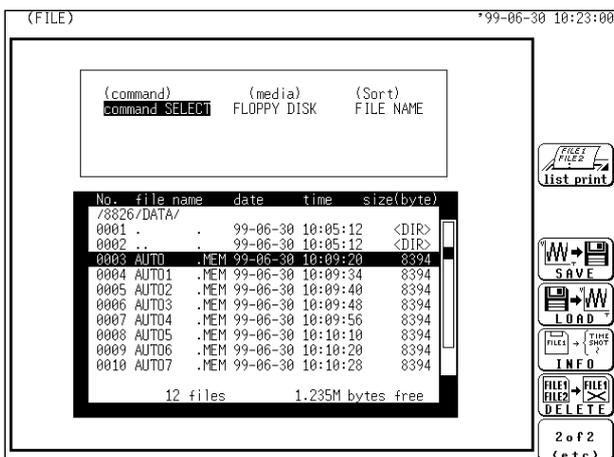


: Select the external storage connected to the SCSI interface as the recording medium.



: MO disk media are used.

Selecting the Command



- ① Use the JOG/SHUTTLE control or **CURSOR** key to select the desired file. To load all the files stored in the batch save mode at once, select the index file.
- ② Move the flashing cursor to the (command) item, shown in the figure on the left.
- ③ Use the function keys to select the **LOAD**.

NOTE

- In case of "OVERWRITE," the settings in the unit are given preference. When the data in the unit differs from the file functions or time-axis range, the data cannot be loaded.
- "OVERWRITE" is not possible with data measured using external sampling.
- The data loading turn: CH1 32, CHA H
- If the plural data are loaded in the same channel, the data most recently sent remains in the memory.
- When batch saving with the Recorder & Memory function, the measurement data (with REC, MEM extensions) are created together with an index file (R_M). When only the measurement data are read, these are read to the respective functions. To read to the Recorder & Memory, read the index file.
- Do not change or delete the name of a file to be batch read (R_M). The batch reading may not be executed correctly.
- Data stored in the text format is not readable by the 8826.

Auto setup function

When the power is switched on with a floppy disk or a PC card inserted, the setting up of the 8826 is performed automatically by reading the setting data file called "STARTUP.SET" and the evaluation area file called "STARTUP.ARE" on the floppy disk.

Waveform evaluation settings depend on "STARTUP.ARE"

The same measurement conditions can be simply established by using this function.

Method

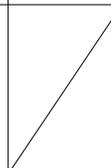
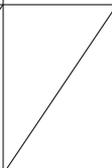
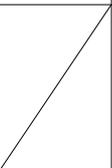
Define the setup data file name as "STARTUP.SET" and area data file name as "STARTUP.ARE". Save the file to the root directory of the floppy disk or a PC card. The file is read to the 8826 when the equipment is turned on.

- If "STARTUP.SET" is present on both the floppy disk and PC cards, the FD file is used

Note on OVERWRITE loading

To load the measured data file into the 8826 when it already contains previously measured data, the previous data takes precedence over the new data (in such an event,  is displayed).

Therefore, to reflect all the settings for the waveform data to be loaded, select "REFRESH." When the functions of the new data differ from those of the previous data (i.e., when the data exists in the memory recorder but you want to load the recorder data), the above operation is unnecessary.

	WAVE (Binary)				SET
	MEM	REC	RMS	FFT	
STATUS1 screen					
STATUS2 screen	*1				
STATUS3 screen					
STATUS4 screen	x				
STATUS screen				x	
TRIGGER screen	*2	*2	*2	x	
CHANNEL 1 screen	*3	*3	*3	x	
CHANNEL 2 screen	*3	*3	*3	x	
Scaling settings	*3	*3	*3	x	
Comment settings	*3	*3	*3	x	
SET UP (SYSTEM1)	x	x	x	x	

 : Set by the saving data  : Set by the unit setting

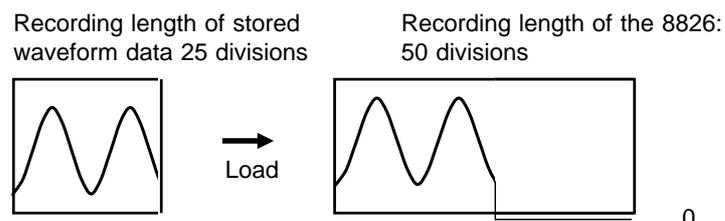
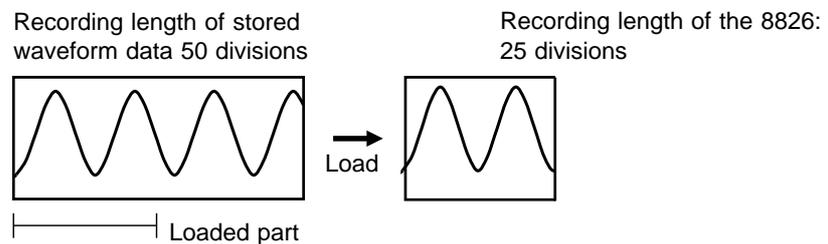
x : No data

*1 : When the index file is loaded, overwrite load is disabled.

*2 : While the trigger setting of each channel (internal trigger) is reflected, other trigger settings (such as the pre-trigger and external trigger) are not reflected.

*3 : In the case of "OVERWRITE," only the settings of loaded channels are reflected.

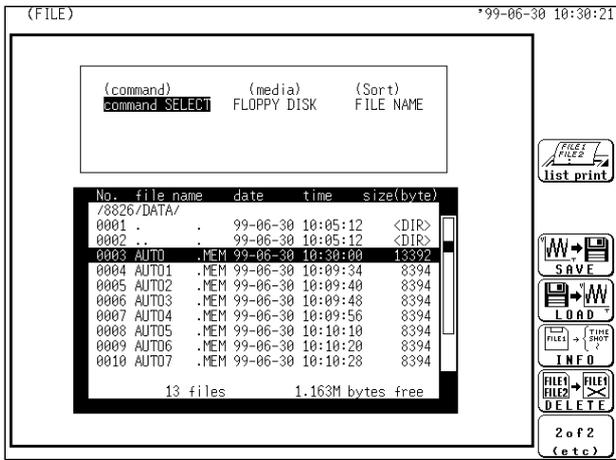
【 EX: Recording length 】



(0 : Bottom edge data value when no zoom function is applied to the voltage axis.)

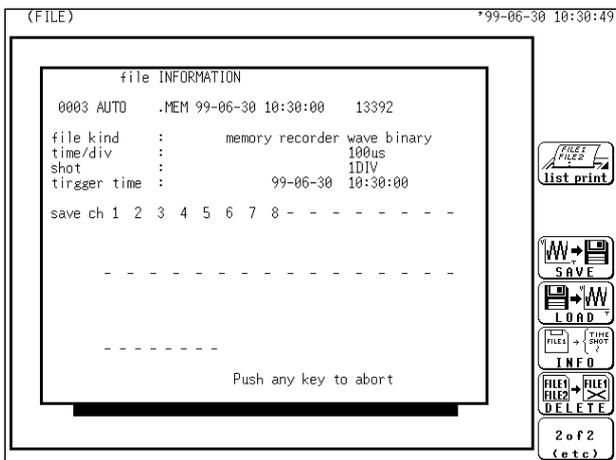
14.9 INFO

File information is displayed.



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Select the media.
- ③ Use the JOG/SHUTTLE control or the CURSOR keys to select the desired file name.
- ④ Move the flashing cursor to the (command) item, shown in the figure on the left.

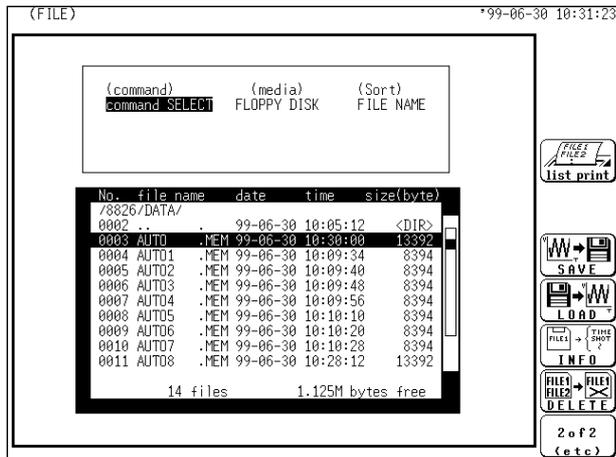


- ⑤ Use the function keys to select the **INFO**. Information about the selected file is displayed.

Only the information in the files loaded to the 8826 is displayed.

14.10 DELETE

Unit settings or measurement data are deleted from the file on selected media.



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Select the media.
- ③ Move the flashing cursor to the (command) item, shown in the figure on the left.
- ④ Use the JOG control or the CURSOR keys to select the file name.
- ⑤ Use the function keys to select the DELETE.
- ⑥ Multiple files can be selected for deletion, in which case ">" appears to the left of the file number for each file selected to be deleted.

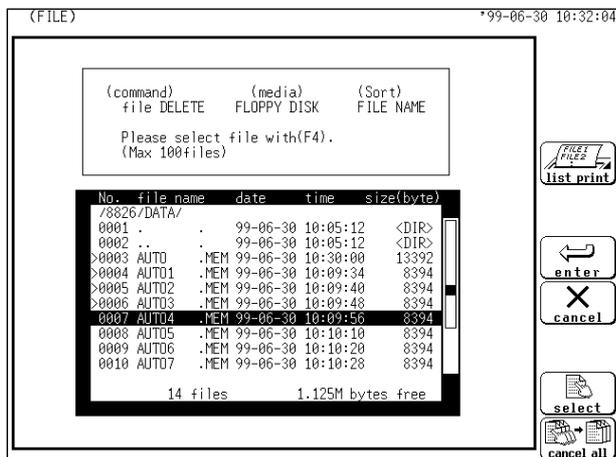
Selection



: Press to select a file to be deleted, or press again to deselect. Selected files appear in a different color. Up to 100 files can be deleted at once.



: Deletes all selected files.



- ⑦ Use the function keys to select the "enter".

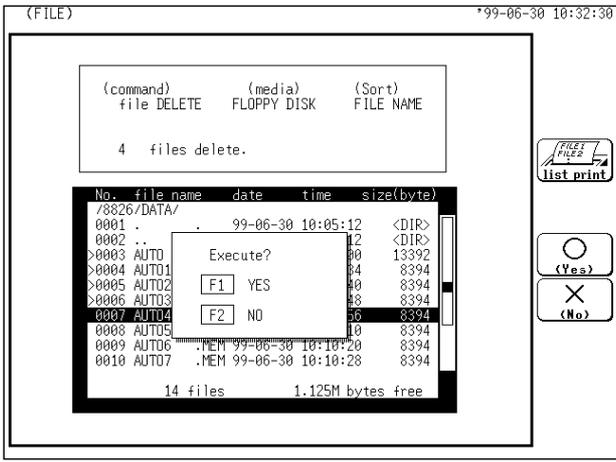
Selection



: Determines the data to delete.



: Cancel the command to be deleted.



⑦ Use the function keys to select the "YES".

Selection



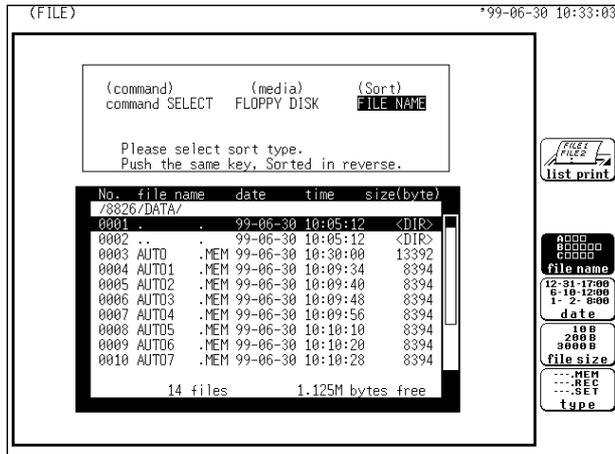
: Executes the data to delete.



: Cancel the command to be deleted.

14.11 Sorting File (SORT)

The file screen is sorted by type. The sort order can be selected from file name, date, file size and type (file extension).



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Select the media.
- ③ Move the flashing cursor to the (Sort) item, shown in the figure on the left.
- ④ Use the function keys to make the selection.

Selection

A000
80000
file name

: Sorted in file name order

12-31-17:00
6-10-12:00
1-2-8:00
date

: Sorted in data order

10 B
200 B
3000 B
file size

: Sorted in file size order

---MEM
---REC
---SET
type

: Sorted in file type order

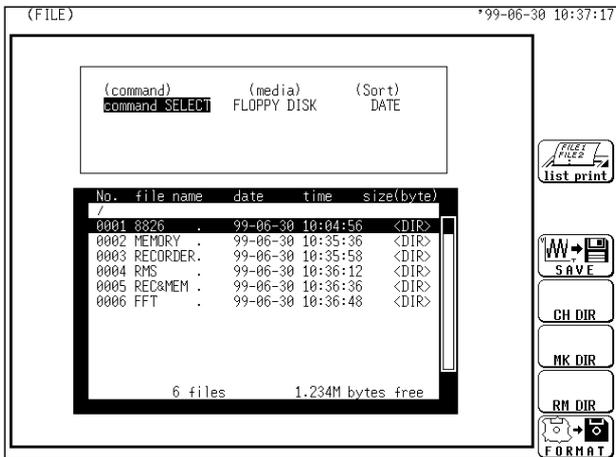
NOTE

- When directories and files are mixed, directories are always displayed before files.
- Press the highlighted (reverse-colored) function key to invert the display sort order.

14.12 Operating the Directory

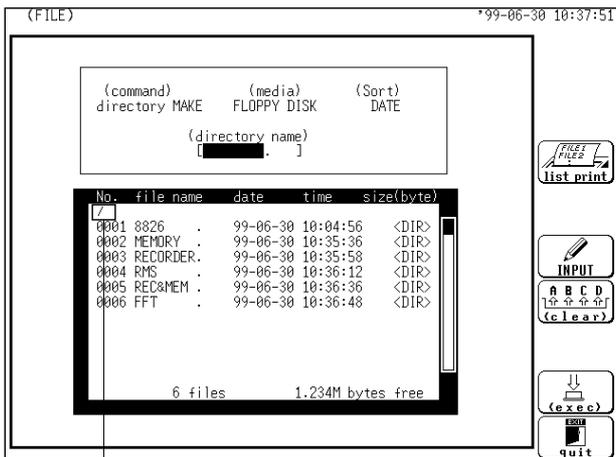
14.12.1 MK DIR (Making a Subdirectory)

A subdirectory is created.



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Select the media.
- ③ Move the flashing cursor to the (command) item, shown in the figure on the left.
- ④ Use the function keys to select the **MK DIR**.



- ⑤ Use the function keys to select the **INPUT**. Enter the directory name. For character entry procedure, see Section 9.8.4.

Selection

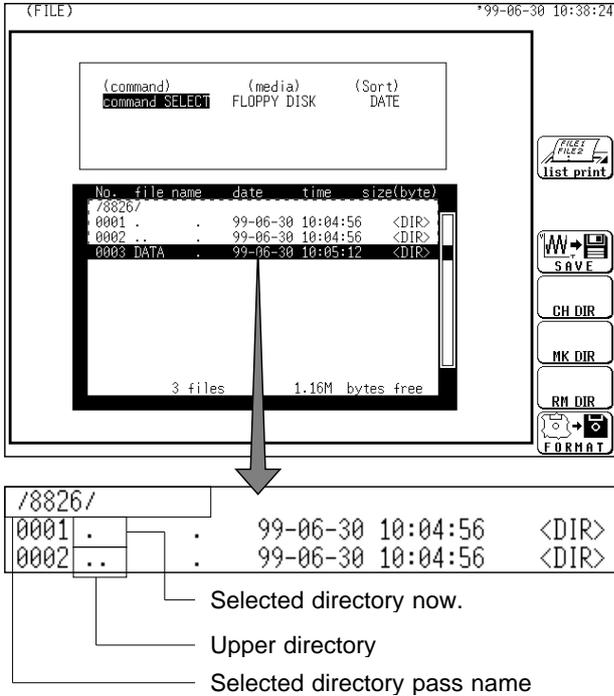
-  : Enter a directory name.
-  : Delete a directory name.
-  : Make a directory.
-  : End

Displays root directory.

14.12.2 CH DIR (Changing a Directory)

A directory is changed.

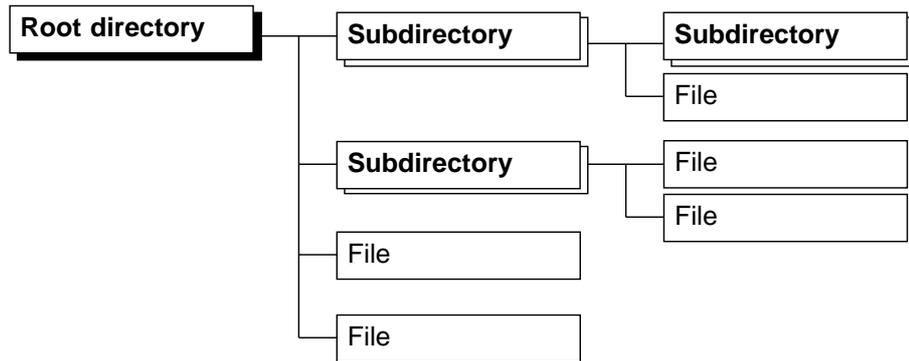
The 8826 provides direct movement only one layer up or down in the directory hierarchy.



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Select the media.
- ③ Move a directory.
 - To move to the lower directory:
Using the JOG/SHUTTLE control, or the CURSOR key, select the target directory on the bar cursor from the file list.
 - To move to the upper directory:
Using the JOG/SHUTTLE control, or the CURSOR key, select the target file name with "." on the bar cursor from the file list.
- ④ Move the flashing cursor to the (command) item, shown in the figure on the left.
- ⑤ Use the function keys to select the **CH DIR**.

Directory organization

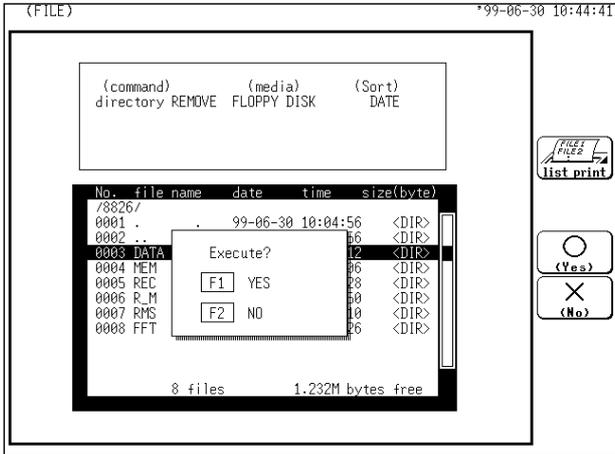


NOTE

- The directory and the number of files that can be stored in the directory are limited. For details, see Section 14.7.
- Stores a file in the directory currently selected on the file screen.

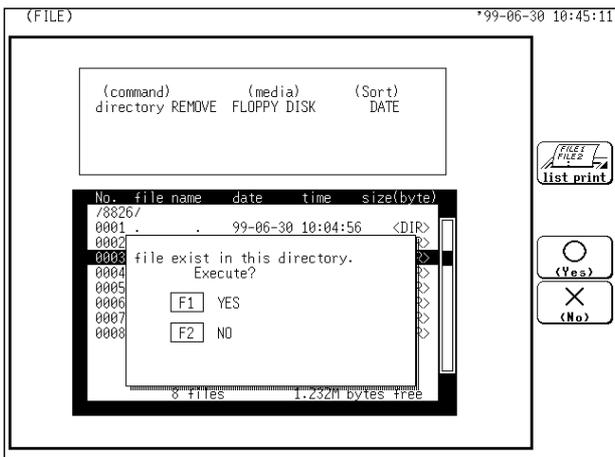
14.12.3 RM DIR (Deleting a Directory)

A directory is deleted. Even if there are files and directories in a directory, the directory can be deleted.



Method Screen: FILE

- ① Press the **FILE** key to call up the FILE screen.
- ② Select the media.
- ③ Using the JOG control, or the **CURSOR** key, select the target directory on the bar cursor from the file list.
- ④ Move the flashing cursor to the (command) item, shown in the figure on the left.
- ⑤ Use the function keys to select the **RM DIR**.



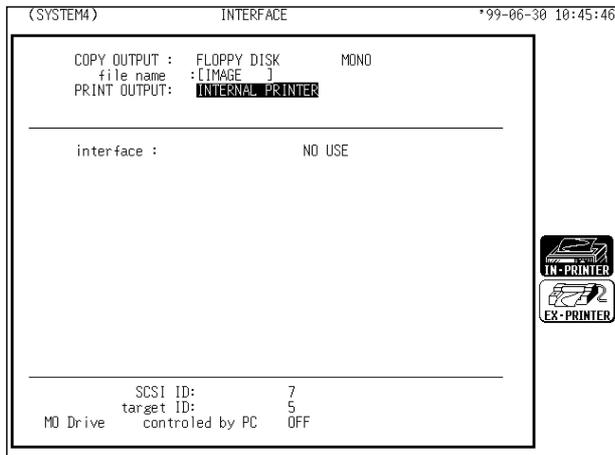
- ⑥ Select the "YES" function key.
A confirmation message appears if a file is present in the directory to be deleted. Select the function key again to continue.

Selection

- (Yes) : Delete a directory.
- (No) : Cancel the deletion procedure.

14.13 Printing the File List

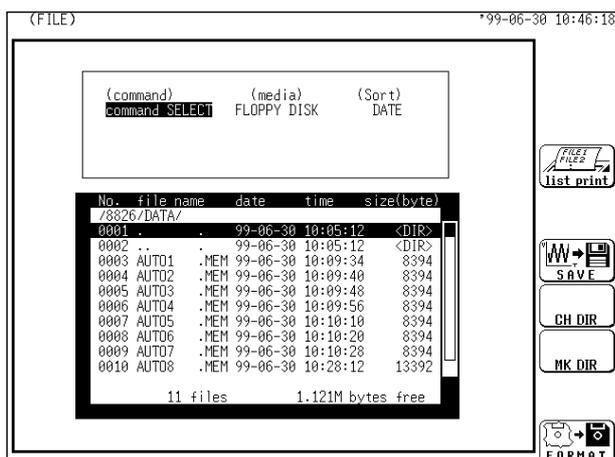
Prints a list of files (including directories) displayed on the file screen. The printing destination is selected by the "PRINT OUTPUT" setting.



Method Screen: SYSTEM4 - FILE

(1) Setting the output destination.

- ① Press the **SYSTEM** key to call up the SYSTEM4 screen. Move the flashing cursor to the **PRINT OUTPUT** item, as shown in the figure on the left.
- ② Use the function keys to select the "IN-PRINTER" or "EX-PRINTER". (See 12.5.2)



(2) Printing the File List

- ① Press the **FILE** key to call up the FILE screen.
- ② Select the media.
- ③ Display the list to be printed. If you want to print sub-directory contents, move to the directory to be printed (refer to Section 14.12.2, CH DIR).
- ④ Press the **VIEW** key to print.

NOTE

The data to be printed is that displayed on the file screen. Only directory names are printed; not their contents.

Chapter 15

Memory Segmentation Function

- This function divides the memory into separate blocks, each of which can be used for waveform recording.
- The memory segmentation function has two modes: sequential save and multi-block.

Sequential save function

- The recording length (DIV) has priority over the number of memory blocks.
- Input signal capture is carried out continuously using the trigger, storing waveform data successively in each block.
- During recording, no display or printout is carried out.
- This reduces dead time (non-sensitivity periods due to display and printing delays).
- Data from different blocks can be overlaid on screen for easy comparison. (it can be printed out)

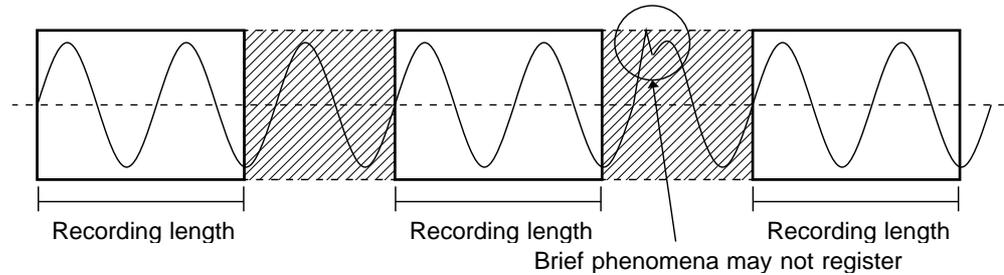
Multi-block function

- The number of memory blocks has priority over the recording length (DIV).
- Waveform data can be stored in a selected block.
- Data from different blocks can be overlaid on screen for easy comparison. (it can be printed out)

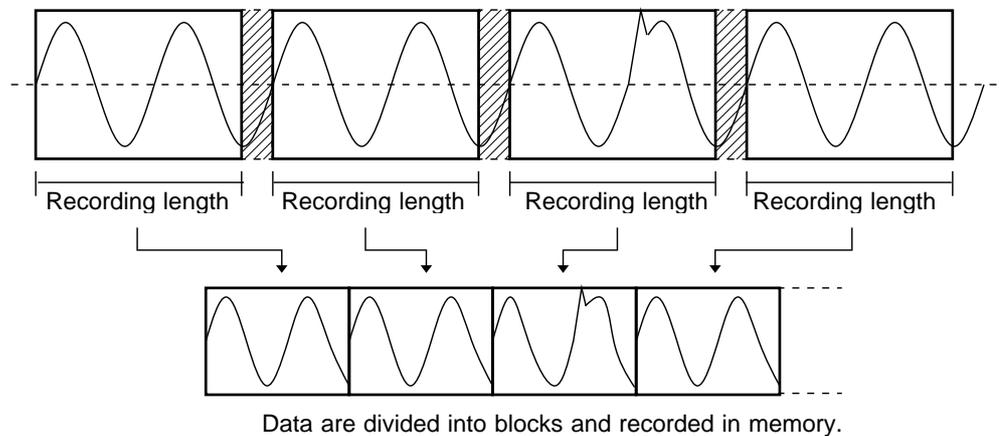
15.1 Using the Sequential Save Function (MEM)

- Input signal capture is carried out continuously using the trigger, storing waveform data successively in each block.
- Any block in which an input signal is recorded can be called up on the display.

When continuous print (auto print) is being performed in REPEAT trigger mode



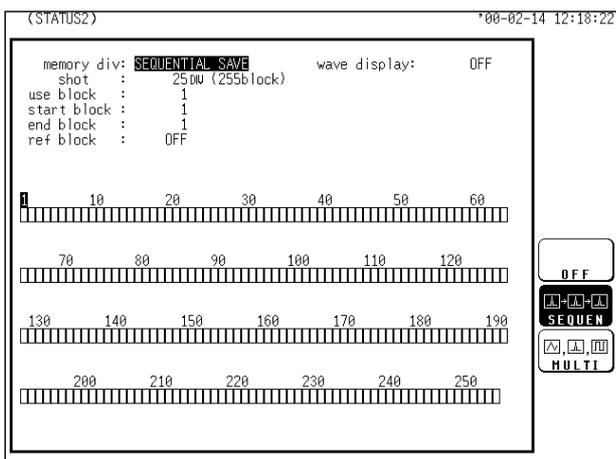
Using sequential save



▨ ... Dead time: approx. 5 ms min.
(interval in which no sampling occurs due to display and print processing)

NOTE

- The time during which sampling is not performed for display and recording after data is recorded in one block (i.e., dead time) is approximately 15 ms when the view function of the memory recorder function is turned on, and approximately 4 ms when the view function is turned off. The Recorder & Memory function is active within the range of [15 ms + the recorder sampling cycle (1/100 of the time axis range)] to [15 ms + the recorder sampling cycle × 2].
- While the sequential save function is being used, the waveform processing calculation and averaging functions are disabled (MEM).
- While the roll mode is being used, the sequential save function in the status is disabled (MEM).



Method **Screen: STATUS2**

(1) Select the Memory Segmentation

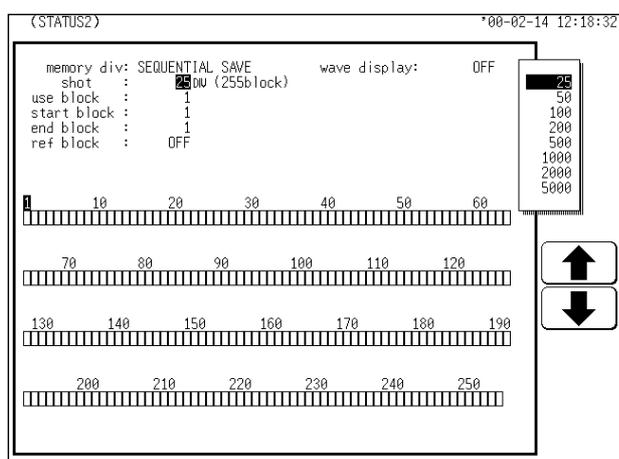
- ① Press the **STATUS** key to call up the STATUS2 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Press the **F2** [SEQUEN].

Selection

OFF : Disable memory segmentation.

SEQUEN : Enable sequential save function.

MULTI : Enable multi-block function.



(2) Setting the Recording Length

- ① Move the flashing cursor to the **shot** item, as shown in the figure on the left.
- ② Use the JOG control or the function keys to make the selection.

Selection

↑ : Move the cursor up in the selection window.

↓ : Move the cursor down in the selection window.

When the recording length is set to the arbitrary recording-length mode, recording-length setting cannot be performed on the memory segmentation screen.
 When the recording length is changed to one for which memory segmentation is not permitted on the STATUS1 or the DISPLAY screen, sequential saving is automatically set to OFF.

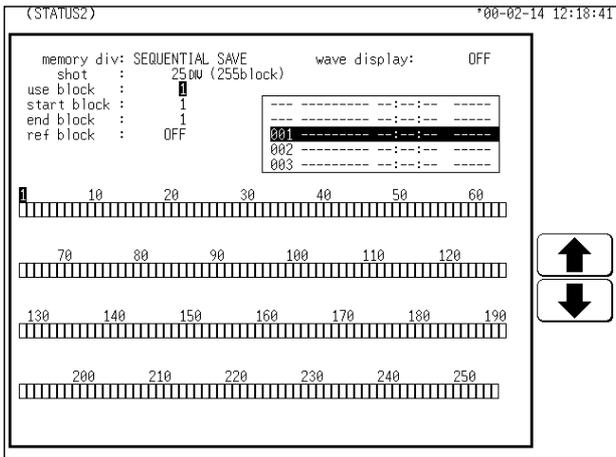
The recording length and maximum number of divisions are automatically determined according to the set memory capacity and number of available channels, as shown in the tables below. See Section 12.2.1 about setting of the use channel.

Maximum number of divisions (16 MW)

Recording length (DIV)	Number of channel				REC&MEM (MEM)
	32 ch	16 ch	8 ch	4 ch	
25	127	255	255	255	63
50	63	127	255	255	31
100	31	63	127	255	15
200	15	31	63	127	7
500	7	15	31	63	3
1000	3	7	15	31	-
2000	-	3	7	15	-
5000	-	-	3	7	-
10000	-	-	-	3	-

Maximum number of divisions (64 MW)

Recording length (DIV)	Number of channel				REC&MEM (MEM)
	32 ch	16 ch	8 ch	4 ch	
25	255	255	255	255	255
50	255	255	255	255	127
100	127	255	255	255	63
200	63	127	255	255	31
500	31	63	127	255	15
1000	15	31	63	127	7
2000	7	15	31	63	3
5000	3	7	15	31	-
10000	-	3	7	15	-
20000	-	-	3	7	-
40000	-	-	-	3	-



(3) Display block setting

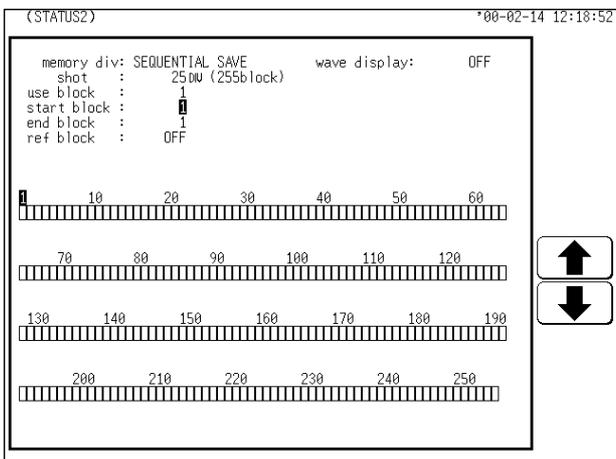
- ① Move the flashing cursor to the **use block** item, as shown in the figure on the left.
- ② Use the JOG/SHUTTLE control or the function keys to make the selection.

Selection

↑ : Value up.

↓ : Value down.

After measurement starts, the displayed block is updated by the recorded block. When measurement is completed, the most recently recorded block is displayed.



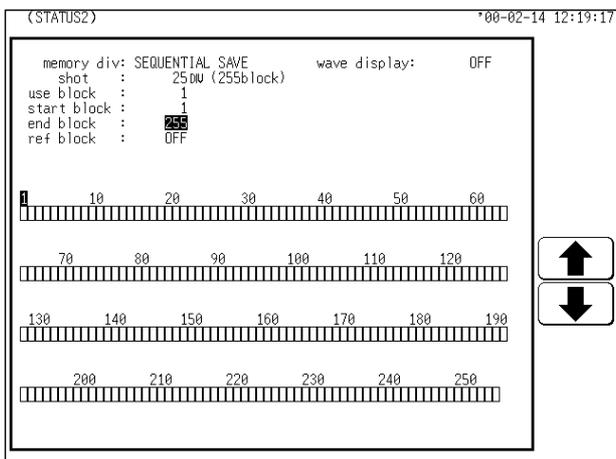
(4) Start block setting

- ① Move the flashing cursor to the **start block** item, as shown in the figure on the left.
- ② Use the JOG/SHUTTLE control or the function keys to make the selection.

Selection

↑ : Value up.

↓ : Value down.



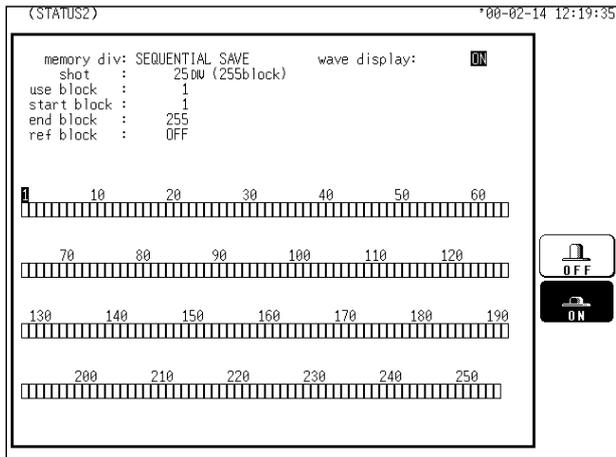
(5) End block setting

- ① Move the flashing cursor to the **end block** item, as shown in the figure on the left.
- ② Use the JOG/SHUTTLE control or the function keys to make the selection.

Selection

↑ : Value up.

↓ : Value down.



(6) Setting the follow-up waveform display

Waveforms acquired for each block by triggering during the sequential saving process are displayed one by one. (As a result, the dead time is increased.)

- ① Move the flashing cursor to the **wave display** item, as shown in the figure on the left.
- ② Use the the function keys to make the selection.

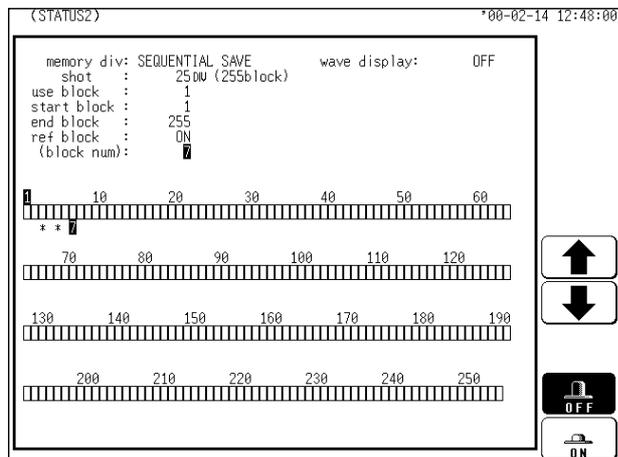
Selection (MEM only)



: After all blocks are recorded, the waveform of the last block only is displayed.



: Each block is recorded and displayed.



(7) Set the ref block.

Select a memory block whose waveform data are to be overlaid on screen with the memory block selected for display. The recording start time and time axis range are displayed on the window.

- ① Move the flashing cursor to the **ref block** item.
- ② Use the function keys to make the selection.



: Disable ref block



: Enable ref block



: Turns off all ref block settings.



: Sets all blocks as ref blocks.

- ③ Move the flashing cursor to the numerical value item (ref block).
Ref block settings can be made one block at a time. Blocks set as ref blocks are marked with an asterisks.



: Increases in number.



: Decreases in number.



: Enable ref block

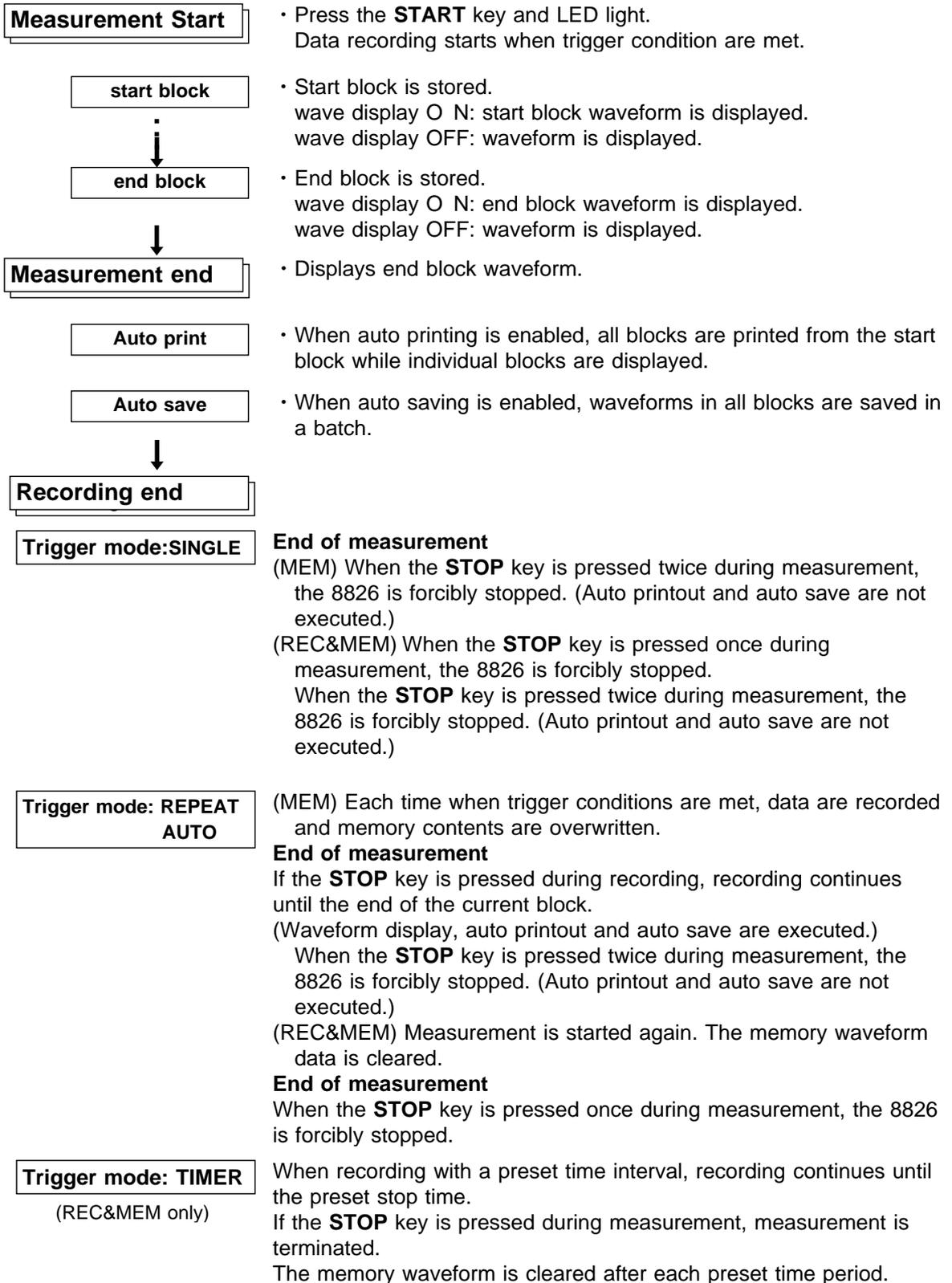


: Disable ref block

NOTE

- The colored blocks indicate that measured data has been saved to the blocks.
- The displayed block settings and block status are shown on the display screen. (See Section 11.6.)

Relation between trigger mode and sequential save function



NOTE

When the following waveform display (memory recorder) is on and the view function is on, the dead time becomes very large

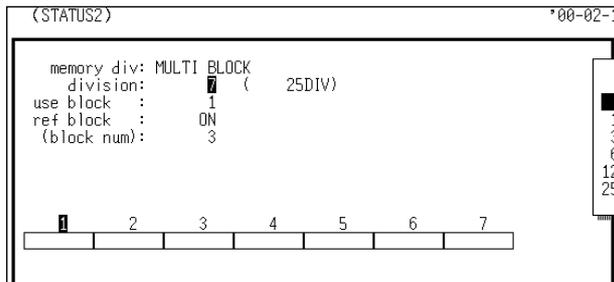
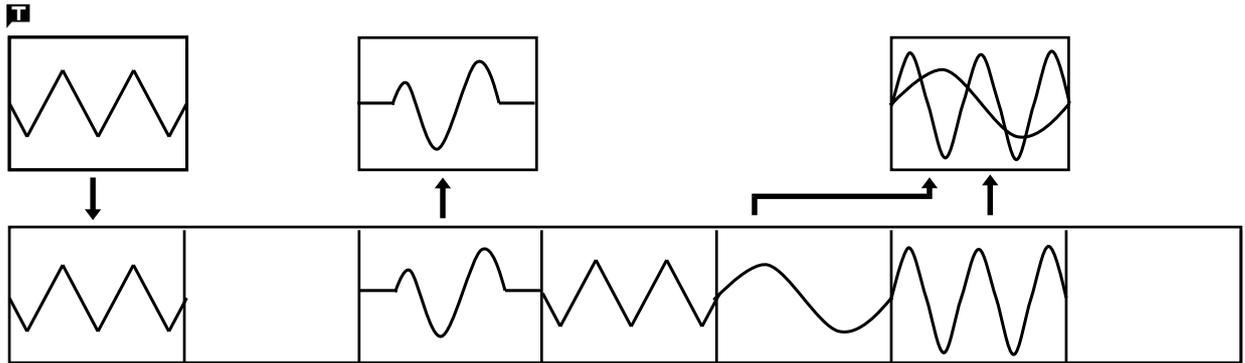
15.2 Using the Multi-Block Function

- Memory is divided into blocks which can be freely selected by the user for storing measurement data.
- Data stored in any block can be called up on the display.
- Data from different blocks can be overlaid on screen for easy comparison. (it can be printed out)

(1) Store in memory

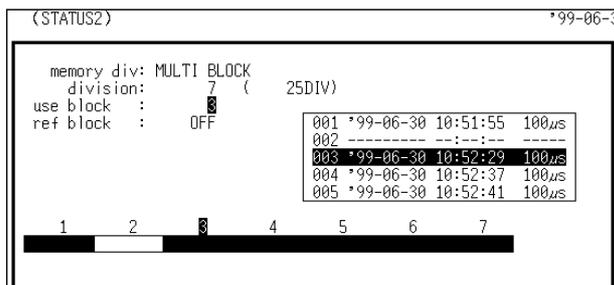
(2) Any block can be called up on display

(3) Overlaid display of data from 2 blocks



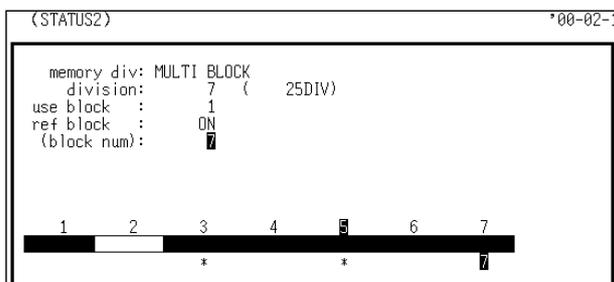
(1) Recording the waveform data in an arbitrary block

- ① Set the number of memory divisions.
- ② Select the block to be used for saving the waveform data, from among the divided blocks on the "use block" menu.
- ③ Press the **START** key to conduct measurement and save waveform data to the specified block.



(2) Displaying an arbitrary block

Select the block to be used to display the waveform data, from among the recorded blocks on the "use block" menu.

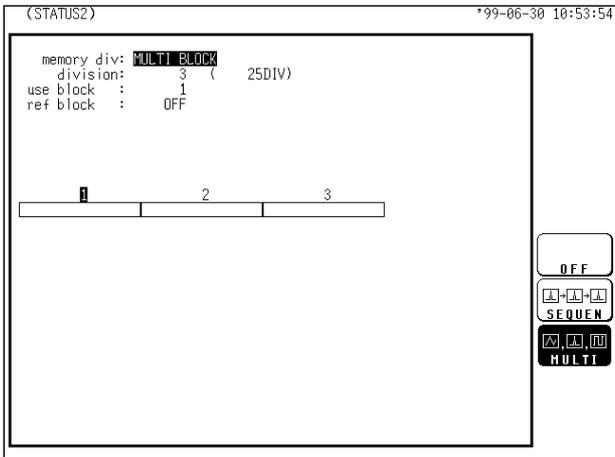


(3) Displaying arbitrary blocks in duplicate

- ① Save at least two waveform data items.
- ② Select the block to be used to display waveform data, from among the recorded blocks on the "use block" menu.
- ③ Select the block to be displayed in duplicate on the "ref block" menu.
- ④ Display the block selected from the "use block" menu and the block selected from the "ref block" menu, in duplicate. Note that waveform data cannot be saved while blocks are overlapping.

NOTE

- While the multi-block function is being used, the waveform processing calculation and averaging functions are disabled.
- If the blocks have different recording lengths, the overlap block display is disabled.
- The **VIEW** key can be used to change the displayed memory block or to call up information about the usage status of memory blocks. See Section 11.6.



Method Screen: STATUS2

(1) Select the Memory Segmentation

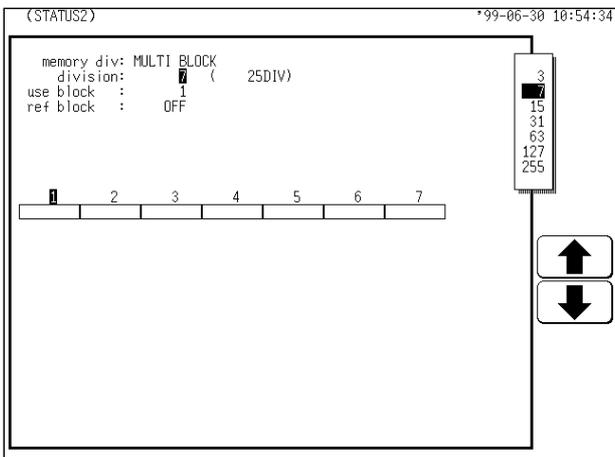
- ① Press the **STATUS** key to call up the STATUS2 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Press the **F3** [MULTI].

Selection

OFF : Disable memory segmentation.

SEQUEN : Enable sequential save function.

MULTI : Enable multi-block function.



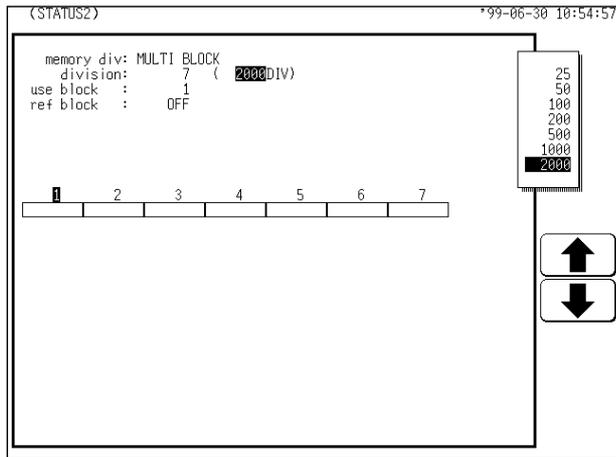
(2) Set the number of memory block

- ① Move the flashing cursor to the **division** item, as shown in the figure on the left.
- ② Use the JOG control or the function keys to make the selection.

Selection

↑ : Move the cursor up in the selection window.

↓ : Move the cursor down in the selection window.



(3) Setting the Recording Length

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the JOG control or the function keys to make the selection.

Selection



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

When the recording length is set to the arbitrary recording-length mode, recording-length setting cannot be performed on the memory segmentation screen.

When the recording length is changed to one for which memory segmentation is not permitted on the STATUS1 or the DISPLAY screen, multi-block saving is automatically set to OFF.

The maximum number of divisions and the maximum recording length are automatically determined according to the set memory capacity and number of available channels, as shown in the tables below. See Section 12.2.1 about setting of the use channel.

Maximum recording length (16 MW)

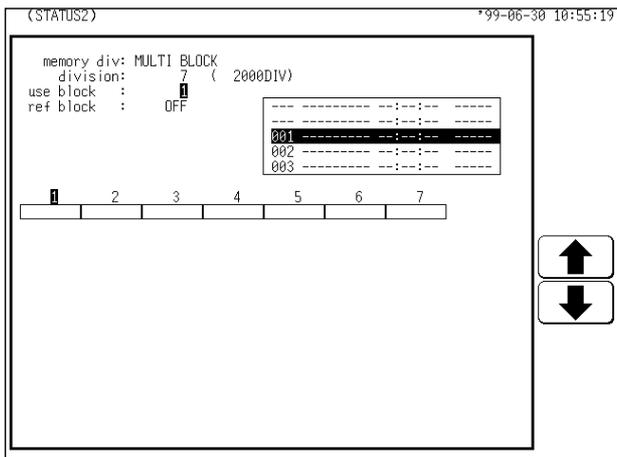
DIV	Number of channel			
	32 ch	16 ch	8 ch	4 ch
3	1000	2000	5000	10000
7	500	1000	2000	5000
15	200	500	1000	2000
31	100	200	500	1000
63	50	100	200	500
127	25	50	100	200
255	-	25	50	100

Maximum recording length (64 MW)

DIV	Number of channel			
	32 ch	16 ch	8 ch	4 ch
3	5000	10000	20000	40000
7	2000	5000	10000	20000
15	1000	2000	5000	10000
31	500	1000	2000	5000
63	200	500	1000	2000
127	100	200	500	1000
255	50	100	200	500

NOTE

When using the multi-block function, the number of memory blocks has priority over the recording length (DIV). When the number of memory blocks is changed, the recording length may automatically be adjusted.



(4) Setting the using block

- Select the number of the memory block for display and recording of the input signal waveform.
- ① Move the flashing cursor to the **use block** item, as shown in the figure on the left.
 - ② Use the JOG/SHUTTLE control or the function keys to make the selection.

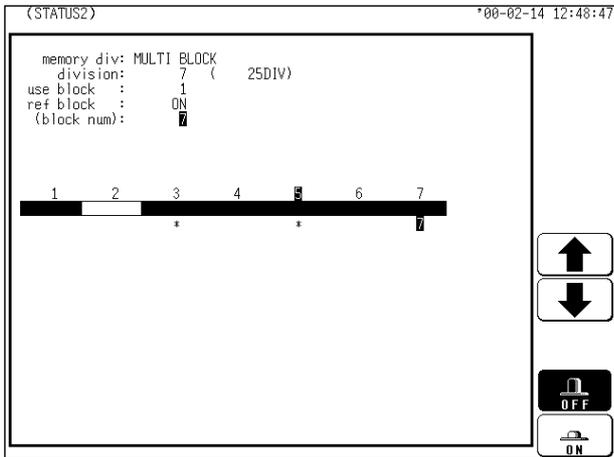
Selection



: Value up.



: Value down.



(5) Set the ref block.

Select a memory block whose waveform data are to be overlaid on screen with the memory block selected for display. The recording start time and time axis range are displayed on the window.

- ① Move the flashing cursor to the **ref block** item.
- ② Use the function keys to make the selection.



: Disable ref block



: Enable ref block



: Turns off all ref block settings.



: Sets all blocks as ref blocks.

- ③ Move the flashing cursor to the numerical value item (ref block).
Ref block settings can be made one block at a time. Blocks set as ref blocks are marked with an asterisks.



: Increases in number.



: Decreases in number.



: Enable ref block



: Disable ref block

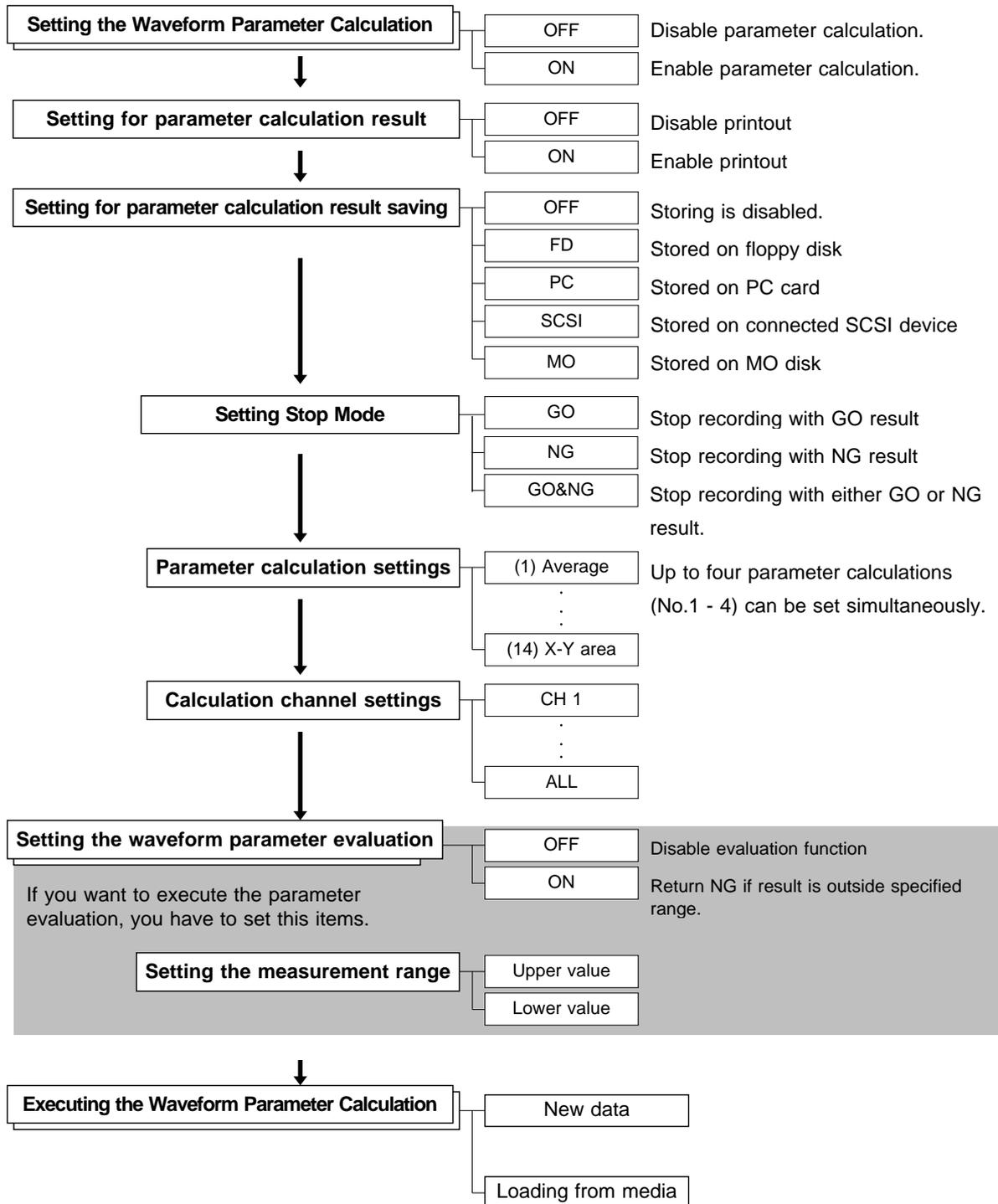
Chapter 16

Waveform Operation Function

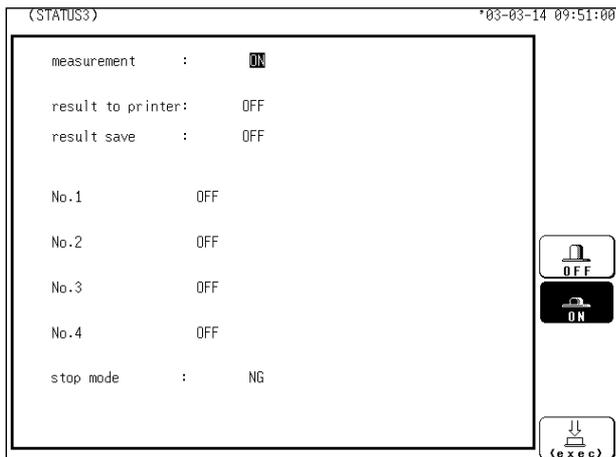
16.1 Waveform Parameter Calculation

- Available for memory recorder function and REC&MEM function.
The Memory waveform for the Record & Memory function is performed with the Memory recorder function.
- Parameters that were used for captured waveform data and for data after waveform processing can be determined. The result is shown in numeric form.
- The A/B cursors (vertical, trace) can be used to determine the parameters of a certain range.
- The following 14 types of calculations are possible:
 - (1) Average value, (2) RMS value, (3) peak-to-peak value
 - (4) Maximum value, (5) time to maximum value, (6) minimum value,
 - (7) time to minimum value, (8) period, (9) frequency, (10) rise time,
 - (11) fall time, (12) standard deviation, (13) area value, (14) X-Y area value
- The result of waveform parameter calculation is compared to a reference range, for GO/NG evaluation.

Waveform parameter calculation Operating Sequence



16.1.1 Making Settings for Waveform Parameter Calculation



Method Screen: STATUS3 (MEM)

- ① Press the **STATUS** key to call up the STATUS3 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Use the function keys to make the selection.

Selection



: Disable parameter calculation.



: Enable parameter calculation.
The various setting items are displayed.

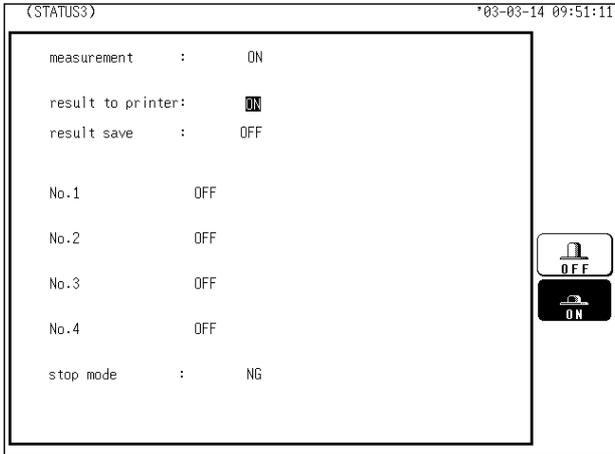


: Execute Waveform Parameter Calculation.

Choose the setting for parameter calculation result printout and saving

- The internal printer can be printed parameter calculation result.
- The parameter calculation results stores a file in the directory currently selected on the file screen as text data.

For details on saving, refer to Section 14.7.



Method Screen: STATUS3 (MEM)

- ① Press the **STATUS** key to call up the STATUS3 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Use the function keys to make the selection.

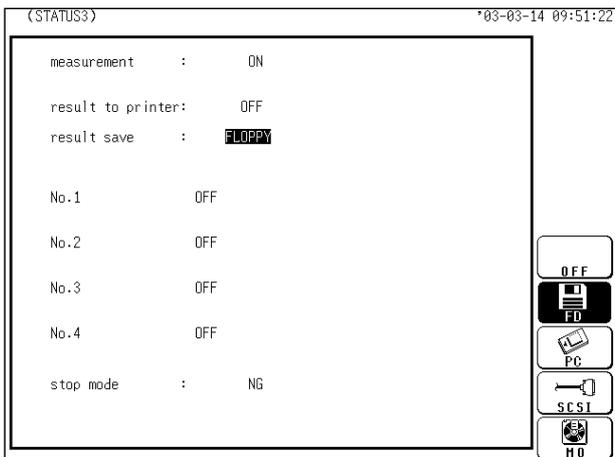
Selection



: Disable printout of parameter calculation results



: Enable printout of parameter calculation results



- ④ Move the flashing cursor to the position shown in the figure on the left.
- ⑤ Use the function keys to make the selection.

Selection



: Storing is disabled.



: Stored on floppy disk



: Stored on PC card



: Stored on connected SCSI device

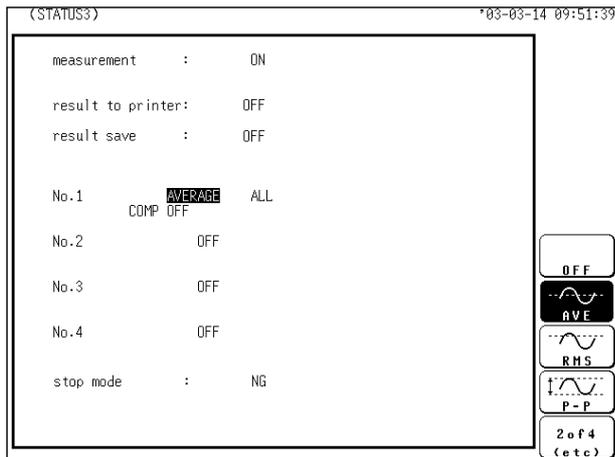


: Stored on MO disk



: Data can only be transferred to the 9333 LAN COMMUNICATOR when using a LAN card.

Parameter calculation settings



Method

Screen: STATUS3 (MEM)

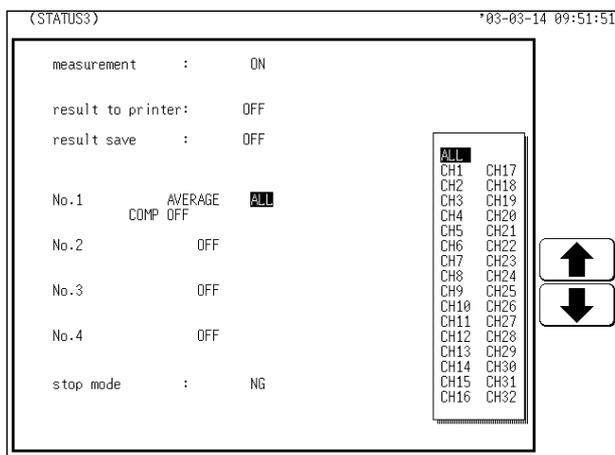
- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to make the selection.

Up to four parameter calculations (No. 1 - 4) can be set simultaneously.

	Disable calculation		Time to maximum value		Rise time
	Average value		Minimum value		Fall time
	RMS value		Time to minimum value		Standard deviation
	Peak-to-peak value		Period		Area value
	Maximum value		Frequency		X-Y area value

For details on the various calculation functions, refer to Section 21.3.8

Calculation channel settings



Method

Screen: STATUS3 (MEM)

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys or the JOG control to make the selection.

Selection



: Channel number up.



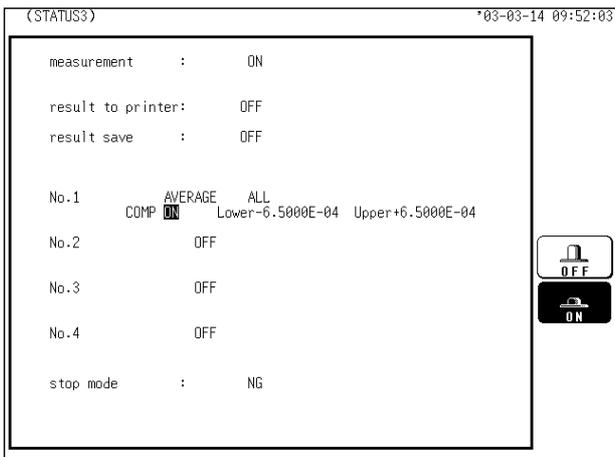
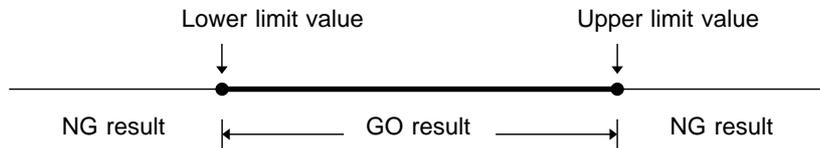
: Channel number down.

NOTE

- Also when "ALL" is selected, channels where no units are installed, a channel that deviates from the set active channel range and channels for which display/record is set to "OFF" will not be calculated.
- When the X-Y area value is selected in parameter calculation, channels on the X and Y axes should be specified. "ALL" cannot be selected.
- Even if the display format is not the X-Y screen, the X-Y area value can be selected.

16.1.2 Making Settings for Waveform Parameter Evaluation

- Depending on the results of the waveform parameter calculation, a GO (pass) or NG (fail) result is returned.
- Evaluation criteria can be set independently for each of the calculation sets No. 1 - No. 4.



Method

Screen: STATUS3 (MEM)

- ① Make the settings for waveform parameter calculation.
- ② Move the flashing cursor to the COMP item. And use the function key to select.

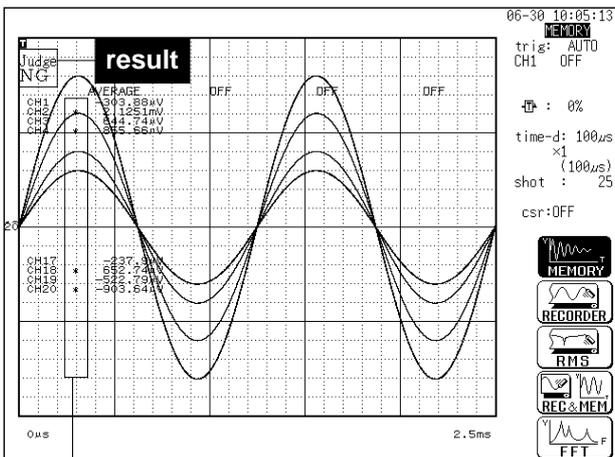
Selection



: Disable evaluation function.



: Return NG if result is outside specified range.



NG channel marked with an "*"

- ③ Set the upper and lower limits.

The setting range is $-9.9999E+29$ to $+9.9999E+29$ (exponent: -29 to +29).

Move the flashing cursor to the various digits and make the setting with the function keys, the JOG control or the CH&NUM key.

The upper limits must not be smaller than the lower limits, or the lower limits must not be larger than the upper limits.

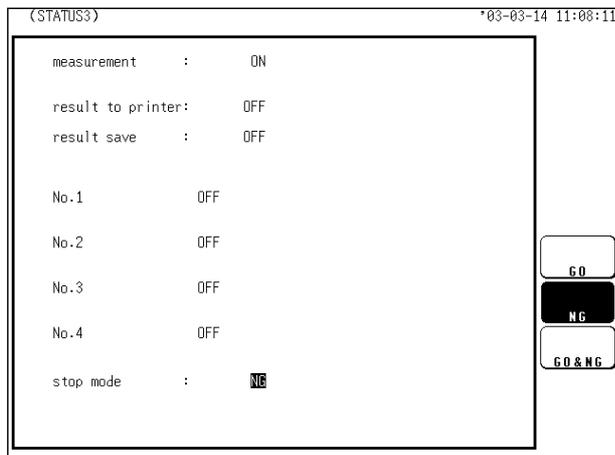
Use the function key to select the TEN-KEY, the CH&NUM key can be entered numerical value. For details, refer to Section 9.6.1.

NOTE

- When waveform parameter measurement and waveform evaluation are carried out simultaneously, the screen displayed waveform evaluation results. Check the results of parameter evaluation using "*" (NG decision) accompanying the figure. Alternatively, a beeping sound can be used for the evaluation instead of the "*" mark; the machine beeps if the result of either parameter or waveform evaluation is NG.
- When the evaluation result is NG, the calculation value for that channel is marked with an "*" (on the display and the printout).
The result of the evaluation is NG if any of the values is NG.
- While all evaluation results appear on the display screen, the evaluation results are printed out for each parameters in the print mode.
- When the evaluation result is NG, an NG output signal can be obtained between the NG terminal and the GND terminal. For details, please refer to the Section 17.6.
- When waveform parameter evaluation is ON, **CH.SET** key settings are automatically OFF.
- When ALL is selected using the A and B cursors, the calculation No.4 result will not be displayed on the screen.

16.1.3 Setting Waveform Parameter Evaluation GO/NG Stop Mode

Set which evaluation result (GO or NG) shall be used to stop recording.



Method Screen: STATUS3

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys or the JOG control to make the selection.

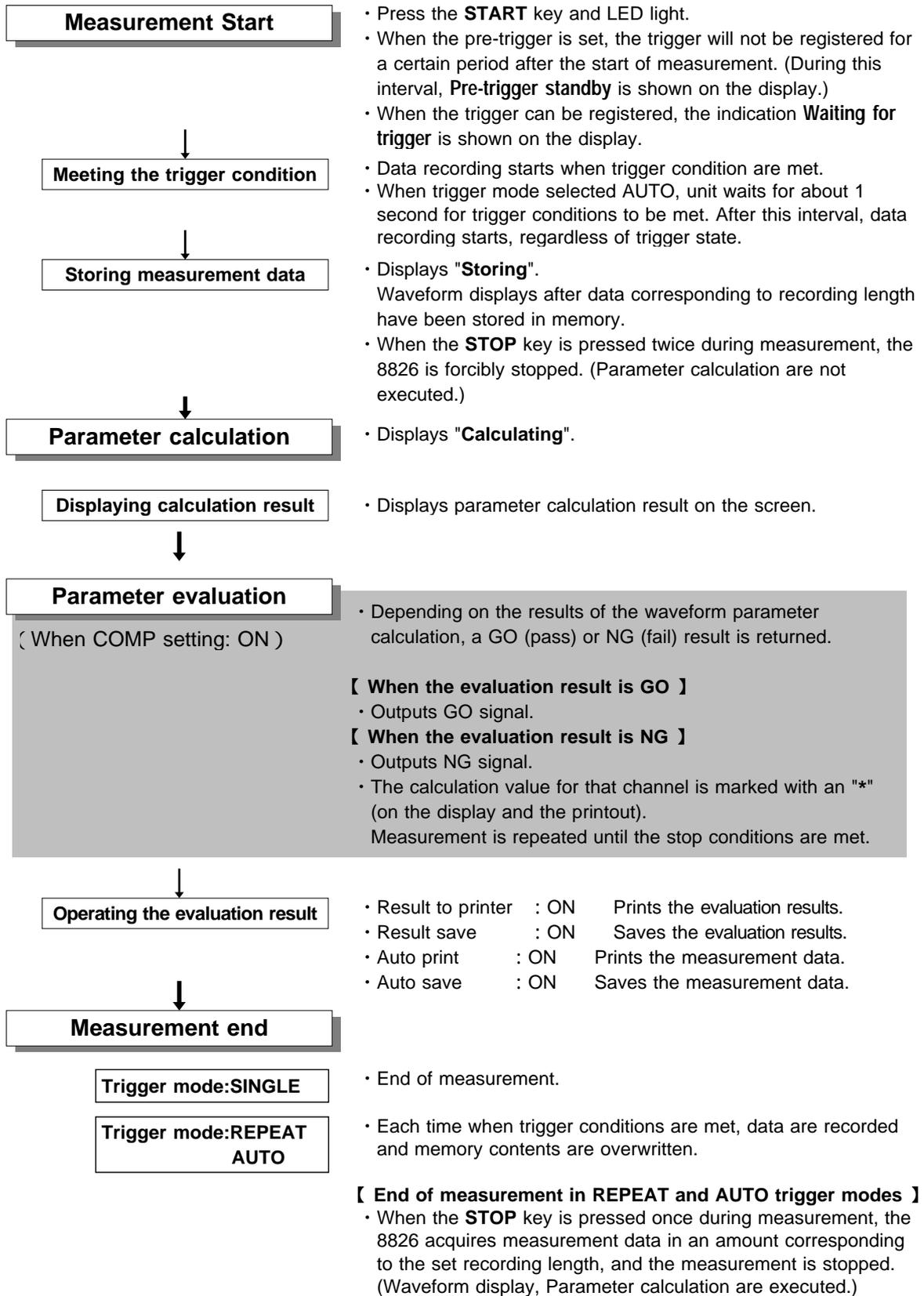
Selection

- | | |
|--|---|
| <input type="button" value="GO"/> | : Stop recording with GO result. |
| <input type="button" value="NG"/> | : Stop recording with NG result. |
| <input type="button" value="GO & NG"/> | : Stop recording with either GO or NG result. |

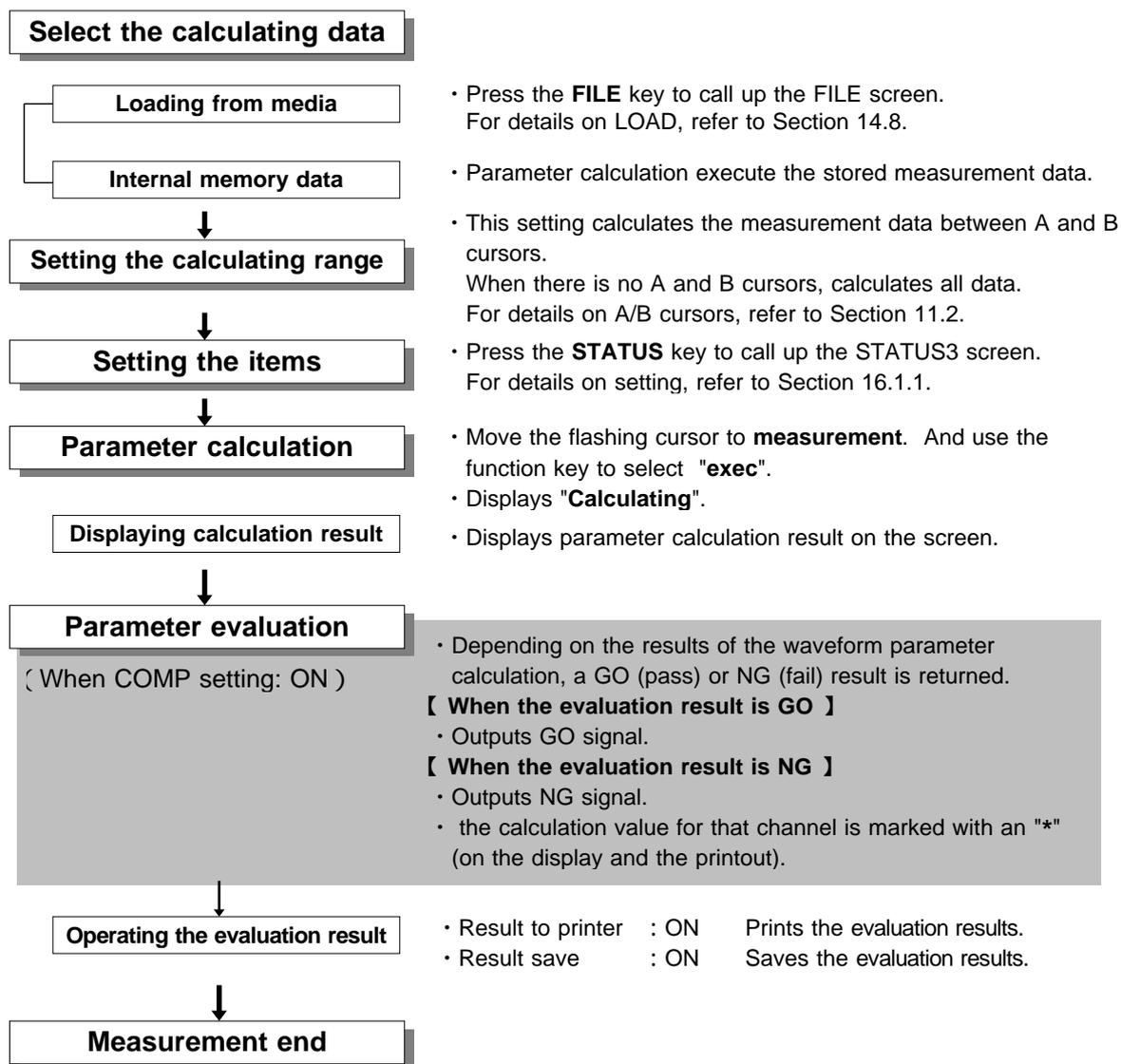
16.1.4 Executing Waveform Parameter Calculation

- Calculation is carried out in the order No.1 through No.4.
- Also for channels where no input unit is installed, parameter calculation is carried out if waveform processing results or data loaded from media are stored in the channel.
- The scaling setting has effect. (RMS value and area value are calculated after scaling.)
- When measurement is set to ON, waveform data after waveform processing are used for parameter calculation.

Parameter calculation while capturing the waveform



Parameter calculation of measurement data loaded from media



NOTE

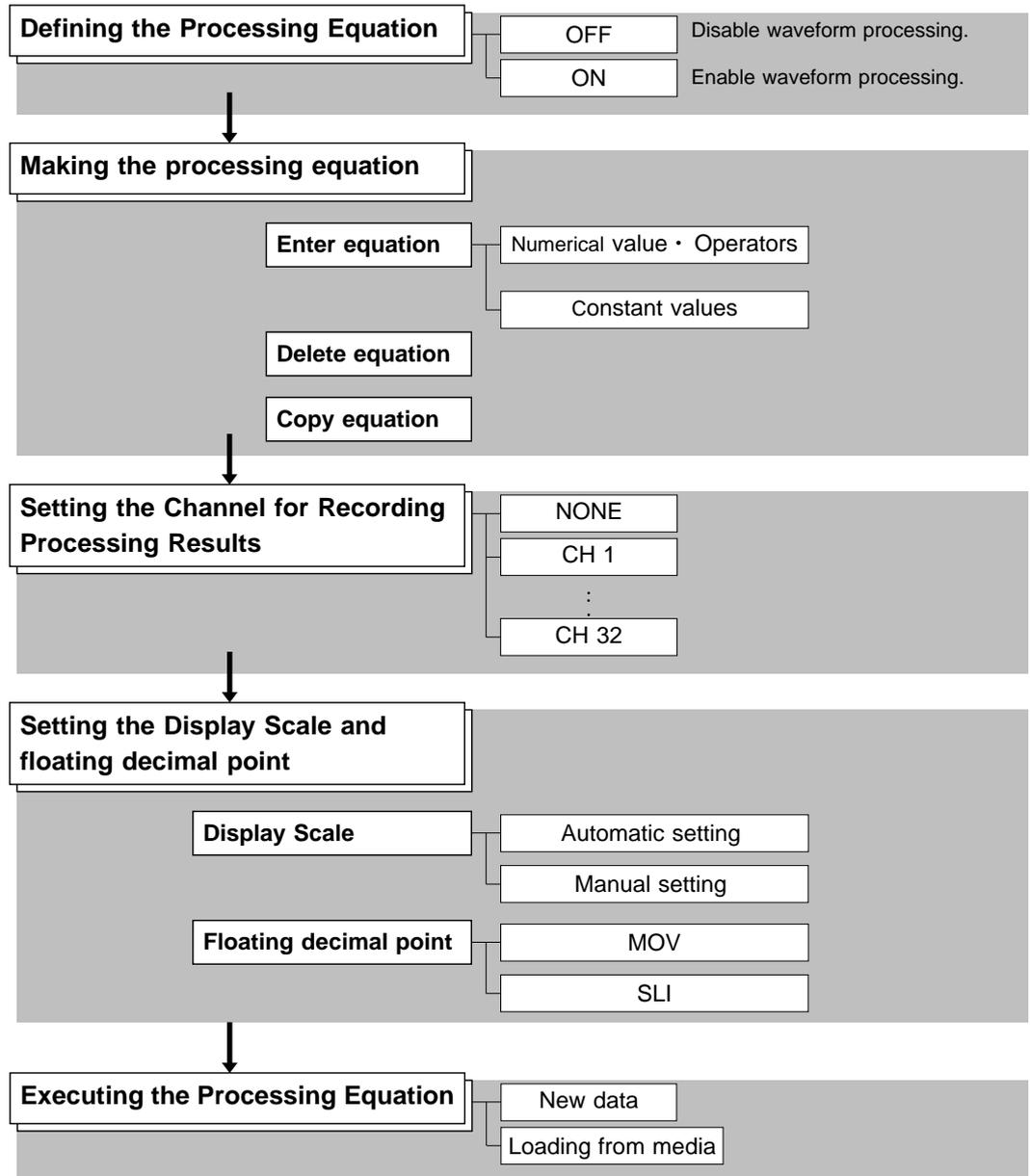
- Line cursor (horizontal) can not be set calculating ranges.
- When only the cursor A is used, the waveform data from the position of cursor A to the end of the data is calculated.
- The result can be recalculated by altering the calculation process.

16.2 Calculating Waveform Data

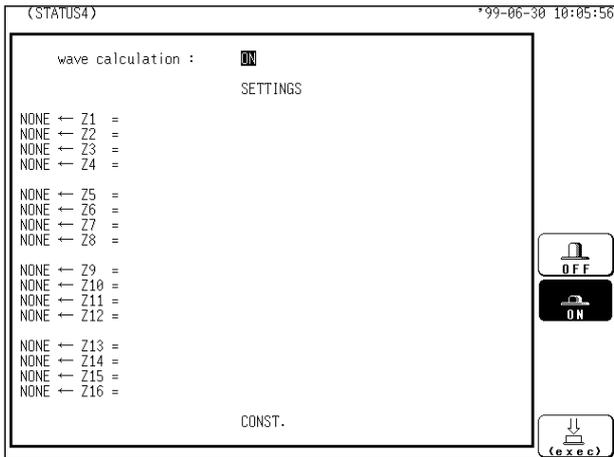
- Waveform processing is possible only for the memory recorder function and REC&MEM function.
The Memory waveform for the Record & Memory function is performed with the Memory Recorder function.
- Processing result are displayed as a waveform.
- Use the A/B cursors (vertical or trace cursor) to specify the processing range for the waveform data.
- The following operators can be used to define processing equations.

- (1) Arithmetic operators (+, -, *, /)
- (2) Absolute value (ABS)
- (3) Exponent (EXP)
- (4) Logarithm (LOG)
- (5) Square root (SQR)
- (6) Displacement average (MOV)
- (7) Parallel displacement on time axis (SLI)
- (8) 1st and 2nd differential (DIF, DIF2)
- (9) 1st and 2nd integral (INT, INT2)
- (10) Trigonometric functions (SIN, COS, TAN)
- (11) Reverse trigonometric functions (ASIN, ACOS, ATAN)

Waveform Processing procedure



16.2.1 Preparing for Waveform Processing



Method Screen: STATUS4 (MEM)

- ① Press the **STATUS** key to call up the STATUS4 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Make the setting with the function keys.

Selection



: Disable waveform processing.



: Enable waveform processing.
The various setting items are displayed.



: Execute Waveform Processing.

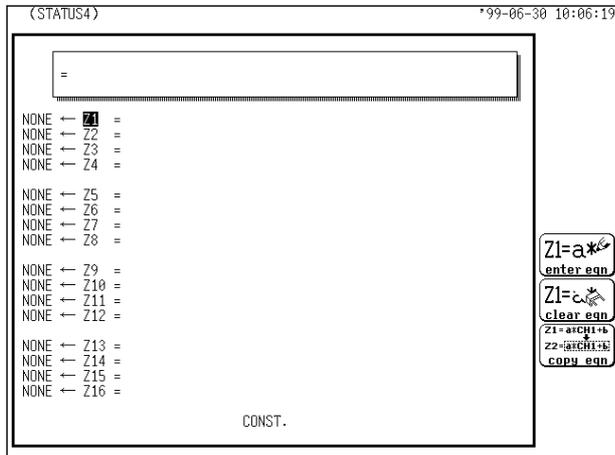
NOTE

- The maximum recording length at which waveform processing calculation is possible is 1000 divisions (5000 divisions for 64 M words). If the recording length exceeds this limit, the waveform processing calculation is disable.
- When the memory segmentation function or roll mode is used, waveform processing is not possible.
- The averaged waveforms can be processed following the measurement.
- When scaling is set for the channel in which the processing result is to be stored, scaling is not carried out and only the unit is valid. For details on scaling, refer to Section 9.7.
- When the waveform processing calculation executes simultaneously with data acquisition, a forced termination displays the results being calculated. In such cases, press the function key (exec) to reexecute the calculation.

16.2.2 Defining the Processing Equation

Sixteen processing equations (Z1 - Z16) can be defined.

Making the processing equation



Method Screen: STATUS4 (MEM)

- ① Press the **STATUS** key to call up the STATUS4 screen.
- ② Move the flashing cursor to " Z1 to Z16".
- ③ Use the function keys to select the "enter eqn".

Selection



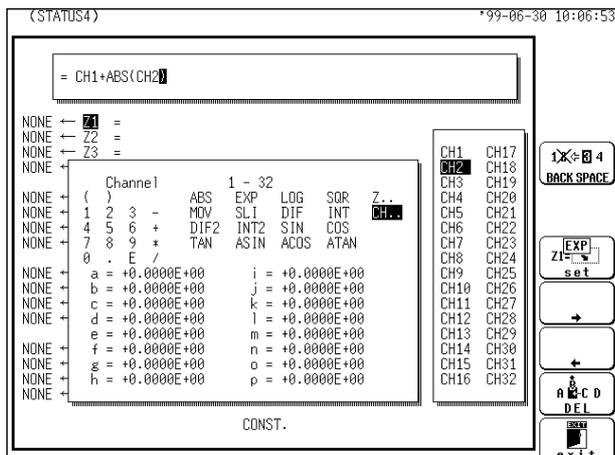
: Enter equation.



: Delete equation.



: Copy equation.



- ④ Move the flashing cursor to the desired item with the JOG control or the CURSOR key, use the function keys to select the **set**. The **CH&NUM** key can be used. Use the function key to move the flashing cursor within the equation.

Selection



: Enter the item into selected equation.



: Move the equation cursor right.



: Move the equation cursor left.



: Delete character under cursor in equation.



: Terminate equation input.

- ⑤ When the equations have been input, press the **F5** [exit] key. If there are any syntax errors in the equations (incomplete bracketing, missing "*", more than eight MOV, SLI, DIF, DIF2, INT, INT2 operators, etc.), a "?" is displayed, and the cursor rests on the error, so that the problem can be corrected. When there are no syntax errors, a "=" is displayed.
- ⑥ Make settings for Z2 to Z16 as for Z1.

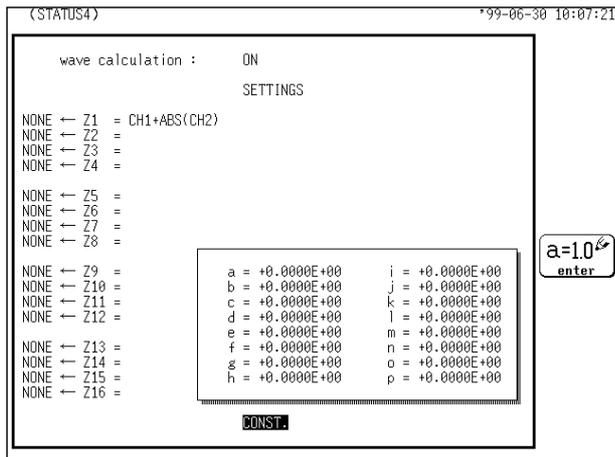
Operators (For details, see Section 21.3.9.)

ABS	Absolute value	DIF2	2nd differential
EXP	Exponential	INT2	2nd integral
LOG	Logarithm	SIN	Sine
SQR	Square root	COS	Cosine
MOV	Displacement average	TAN	Tangent
SLI	Parallel displacement on time axis	ASIN	Arc-sine
DIF	1st differential	ACOS	Arc-cosine
INT	1st integral	ATAN	Arc-tangent

NOTE

- For multiplication, always use the "*" sign.
- Out of the MOV, SLI, DIF, DIF2, INT, and INT2 operators, up to eight can be used in the same equation (for example eight MOV operators or five MOV and three SLI operator, etc.).
- The maximum number of digits for a constant is 30.
- If division by 0 is specified (1/0), an overflow value is output.
- Equations are calculated in ascending order, from Z1 to Z16.
- The data that can be used in an operational equation (channel data and results of operation) must be smaller than in the preset operation numbers (for example, Z10 cannot be used on Z8).
- Up to eighty characters can be entered in an operational equation. However, only the first line of the expression is displayed on the waveform operation screen.

Entering the constant values



Method

Screen: STATUS4 (MEM)

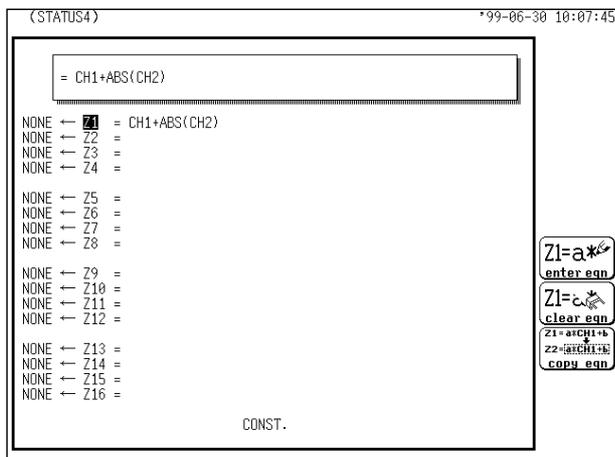
- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Use the function keys to select the **enter**.
The setting range is $-9.9999E+29$ to $+9.9999E+29$ (exponent: -29 to $+29$).

Selection

a=1.0 enter : Enter the constant values.

- ③ Move the flashing cursor to the desired item with the **CURSOR** key, enter the constant value with the function key, the **JOG** control or the **CH&NUM** key. Use the function key to select the **TEN-KEY**, the **CH&NUM** key can be entered numerical value.
For details, refer to Section 9.6.1.

Deleting an Equation



Method

Screen: STATUS4 (MEM)

- ① Move the flashing cursor to one of the **Z1 - Z16** items.
- ② Press the **F2** [clear eqn].
- ③ Make the setting with the function keys.

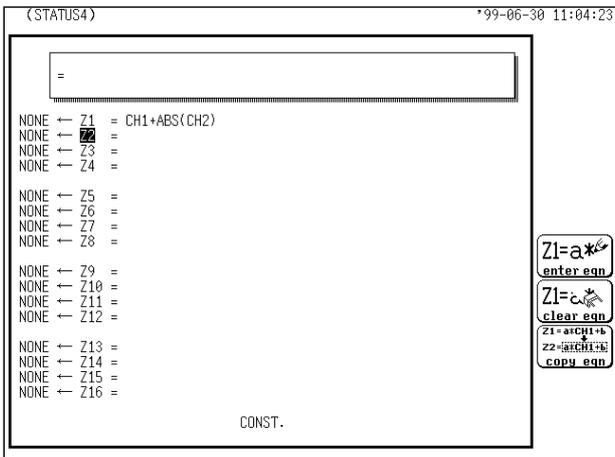
Selection

O (Yes) : Clear equation

X (No) : Do not clear equation

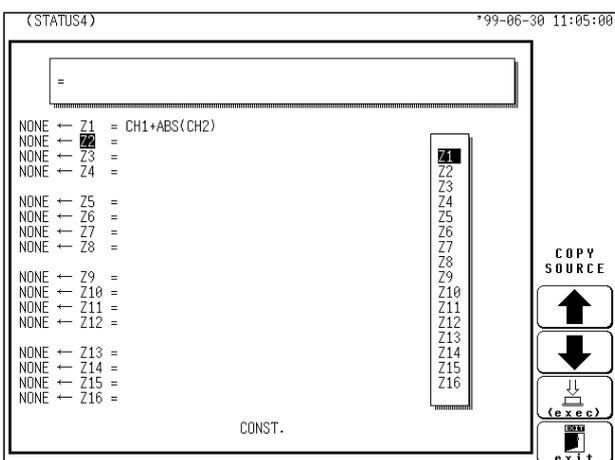
16.2.3 Copying an Equation

An equation to which an equation number has been assigned (copy source) can be copied to another equation number (copy target).



Method **Screen:** STATUS4 (MEM)

- ① Move the flashing cursor to one of the Z1 - Z16 items.
- ② Press the **F3** [copy eqn].



- ③ Use the function keys or the JOG control to specify the number of the equation to be copied.

Selection

-  : Increase equation number.
-  : Decrease equation number.
-  : Execute copy.
-  : Quit copy mode.

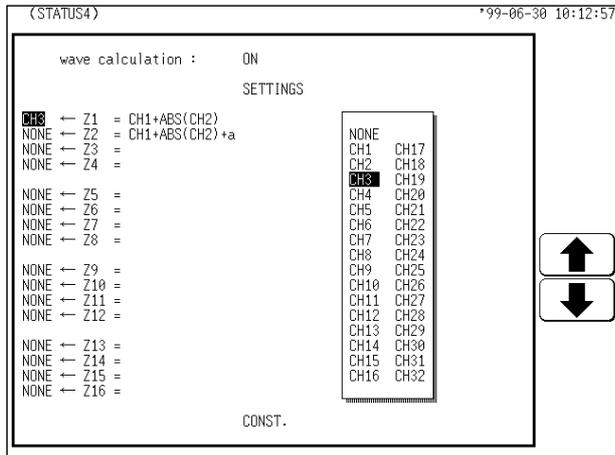
- ④ Press the **F4** [exec] key. The copy source equation is copied to the copy target.

NOTE

The calculation result output destination and calculation formula settings (display scale and number of moved points) are not copied.

16.2.4 Setting the Channel for Recording Processing Results

- The calculation result of equations Z1 - Z16 can be recorded and displayed in a specified channel.
- Processing results can be recorded also in channels where no input unit is installed (but the range of the "number of channels in use" setting cannot be exceeded).



Method Screen: STATUS4 (MEM)

- ① Move the flashing cursor to one of the Z1 - Z16 items.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Use the function keys or the JOG control to specify the number of the equation to be copied.

Selection



: Increase channel number.



: Decrease channel number.

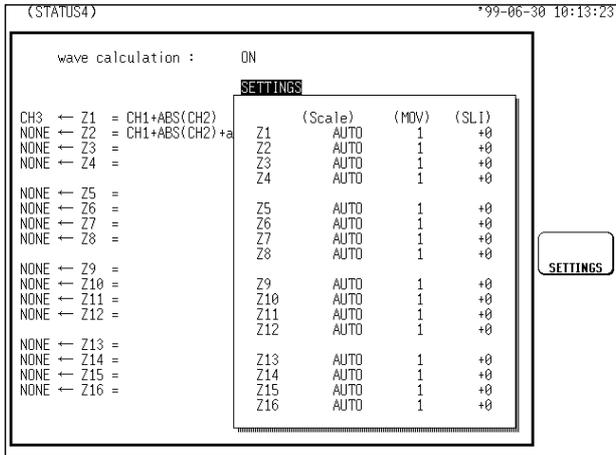
Equations not to be used should be set to NONE (calculation result is not recorded).

NOTE

- If the same channel is selected as source in the equation and as target for recording, the waveform data in the source channel are overwritten by the equation calculation result.
- In the following cases, the calculation result is displayed with in the same color set as the channel number for the first processing run:
 - ① If results are recorded in a channel where no input unit is installed.
 - ② If the display color for the channel selected for recording is set to OFF. When wishing to change the display color set, perform calculation once and then use the CHANNEL1 screen or DISPLAY screen to make the setting.
- The channel selected for recording is automatically set to variable display.

16.2.5 Setting the Display Scale and Floating Decimal Point

- Display scale can be set automatically or manually.
- The channel selected for recording is automatically set to variable display. For details on variable function, refer to Section 9.6.1.

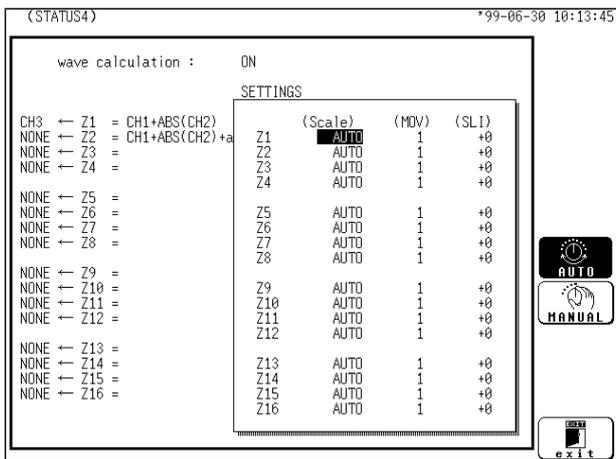


Method Screen: STATUS4 (MEM)

- ① Press the **STATUS** key to call up the STATUS4 screen.
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Press the **F1** [SETTINGS] key.

Selection

 : Set the scale and floating decimal point.



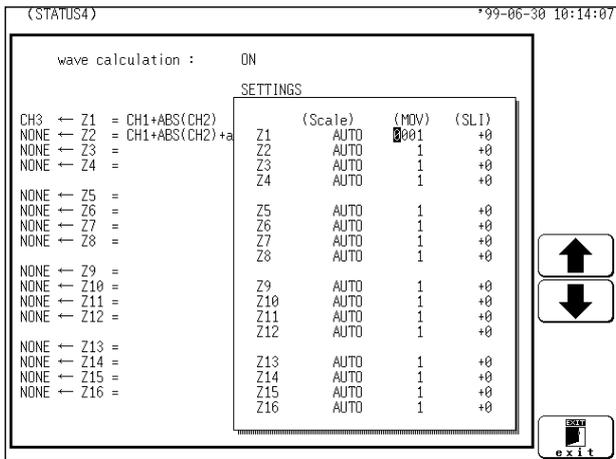
- ④ Move the flashing cursor to the position shown in the figure on the left.
- ⑤ Make the setting with the function keys.

Selection

 : Set display scale automatically.

 : Set display scale manually.

 : End.



- ⑥ If MOV or SLI was used, the floating decimal point must be specified. Move the cursor to the various digits and make the setting with the function keys, the JOG control or the **CH&NUM** key. For MOV (moving average): 1 to 4000 For SLI (parallel displacement): -4000 to +4000

Selection

 : Value up.

 : Value down.

 : End.

- **Automatic setting**

After calculation, the upper and lower limit is determined from the result, and the variable display settings are made accordingly.

Depending on the type of calculation, automatically display scale setting may not be satisfactory. In such a case, use the manual setting procedure.

- **Manual setting**

Use the variable display setting function on the CHANNEL2 screen to set the upper and lower limit. (See section 9.6.1.)

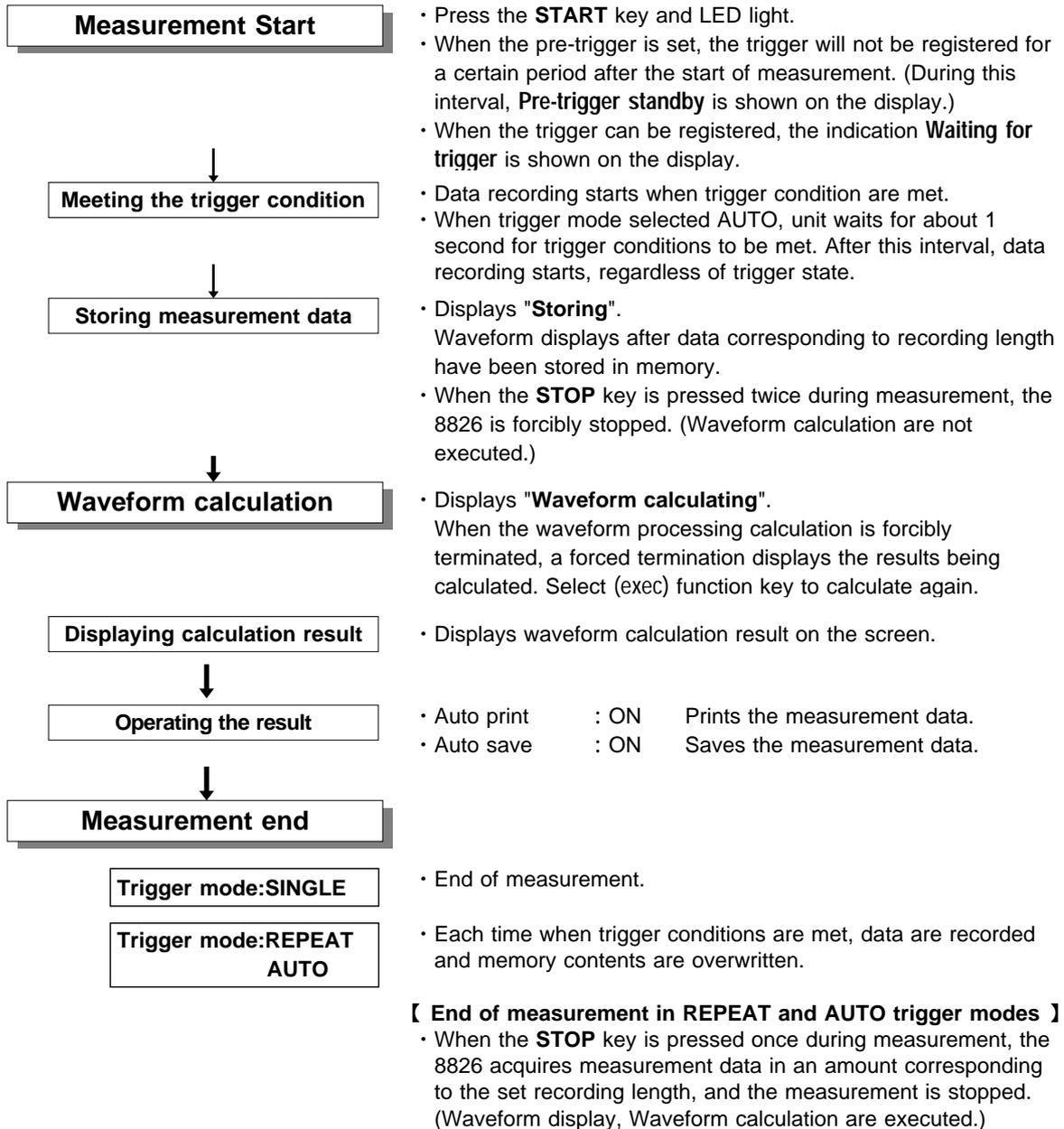
- **Calculation result with overflows**

The values shown using cursors A and B and the printed values obtained when the printer recording type is set to "numerical value" are not accurate.

If the display scale is set to "AUTO," the waveform is shown at the top or bottom of the screen. This indicates that the calculation result has overflowed.

16.2.6 Perform Waveform Processing

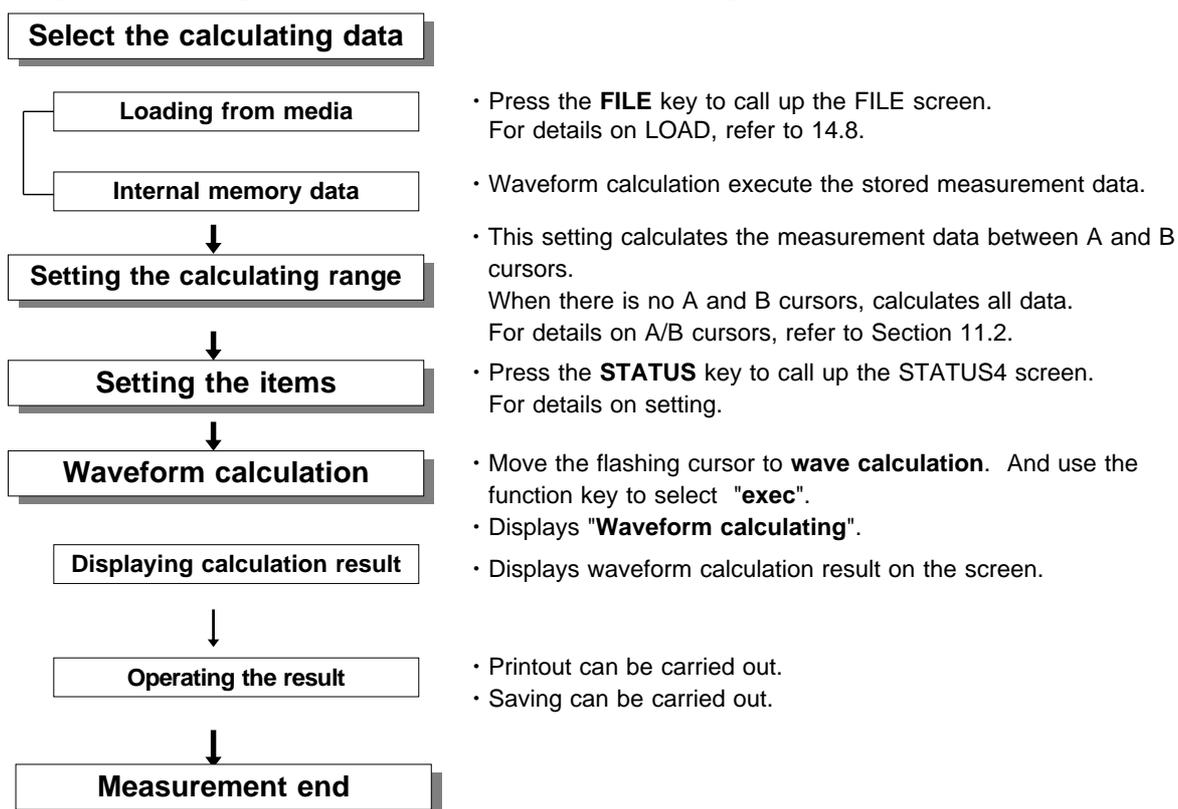
Waveform processing while capturing the waveform



NOTE

The maximum recording length allowing waveform processing calculation is 1000 divisions (5000 divisions for 64 M words).

Waveform processing of data in internal memory or media

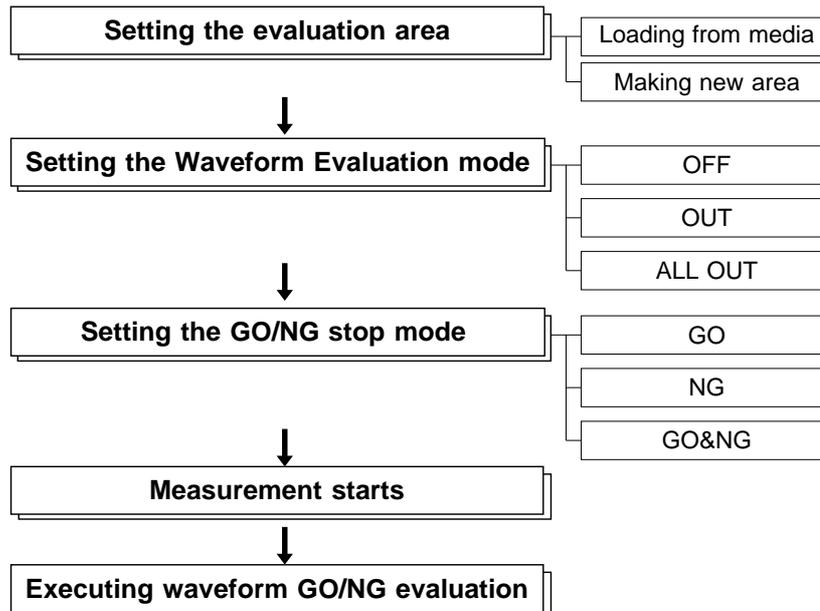


NOTE

- The maximum recording length allowing waveform processing calculation is 1000 divisions (5000 divisions for 64 M words).
- When using the trace cursor, the trace point value is displayed as processed value.
- When the cursors overlap, processing is carried out for that point.
- Line cursor can not be set calculating ranges.
- When only the cursor A is used, the waveform data from the position of cursor A to the end of the data is calculated.
- The result can be recalculated by altering the calculation process.
- A stored waveform read by the Recorder & Memory function can be subjected to waveform processing by the Memory function, but doing so erases the Recorder waveform.

16.3 Waveform GO/NG Evaluation

- The waveform evaluation function can be used from the Memory recorder function (single screen, X-Y single screen) and FFT function (single nyquist).
- GO (pass) or NG (fail) evaluation of the input signal waveform can be performed using an evaluation area specified by the user.
- This can serve to detect irregular waveforms.
- Depend on evaluation result, GO and NG terminal output the signal.
- Displaying all channels can be used for GO/NG evaluation.

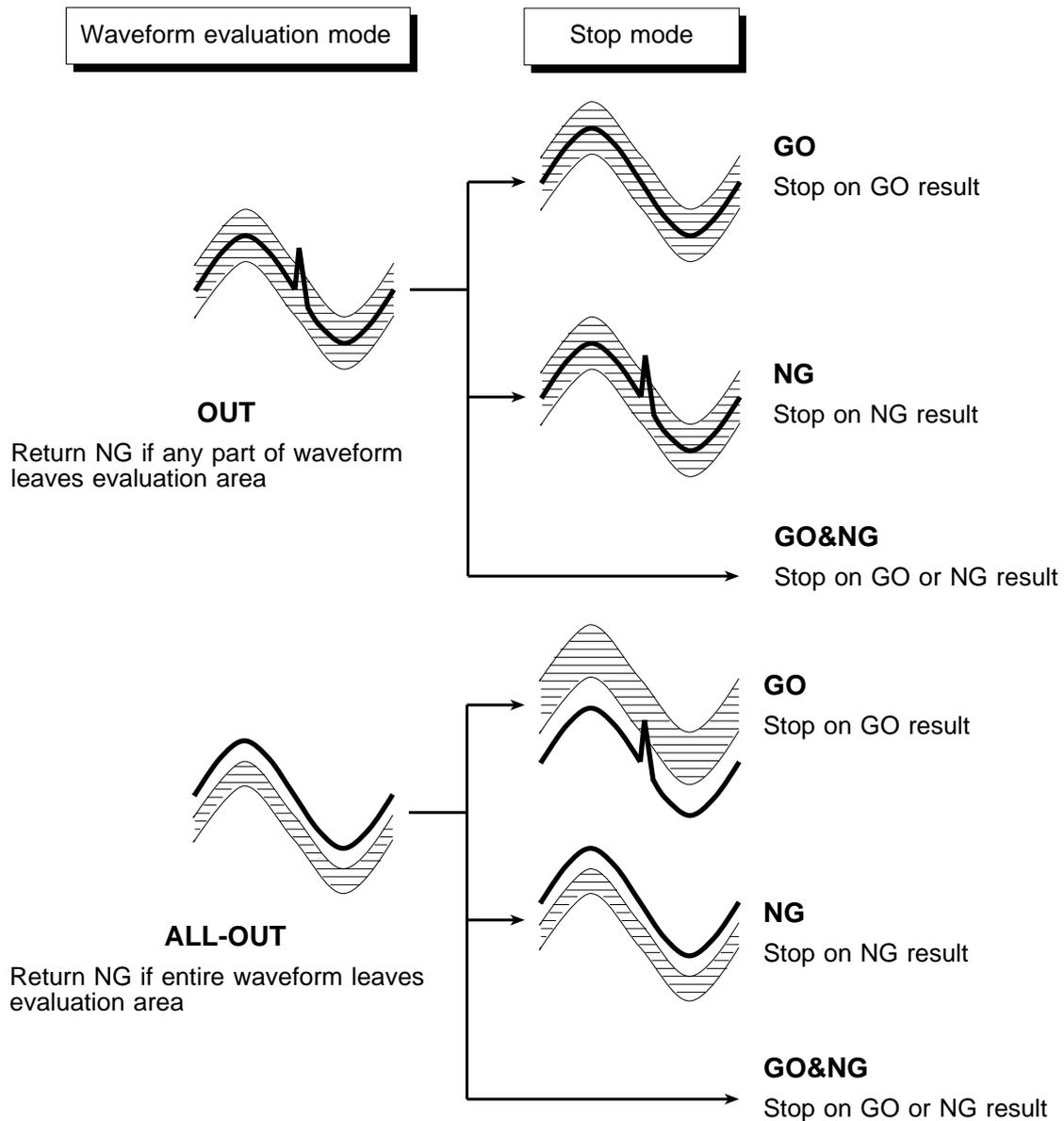


NOTE

- Trigger mode: SINGLE
Measurement continues until stop mode conditions are fulfilled and then stops.
- Trigger mode REPEAT, AUTO
Recording and waveform evaluation is carried out continuously. Press the **STOP** key to terminate the measurement.
- When auto print is set to ON, the waveform is printed out when operation stops.
- When auto save is set to ON, data are stored on media when operation stops.
- When memory segmentation (sequential save) is ON, data are stored in the memory block only when operation stops.
- Waveform evaluation consists of two actions, namely capturing data and performing the evaluation. These two actions are carried out in sequence, not simultaneously. Therefore data are not captured while the evaluation is in progress, which means that the input signal is not being continuously monitored (FFT also requires calculation time). The time required for evaluation is on the order of 20 ms.
(excluding the data sampling time, display time and FFT calculation time)
- If a high setting is chosen for recording length or if compression is used, the evaluation cycle becomes slower.
- Waveform area made by 8825 cannot be used 8826.

- On the waveform evaluation screen, A/B cursors can be used, but a partial printout cannot be made.
- When the waveform evaluation is specified, data equivalent to one screen (25 divisions) is printed out. When waveform data having a recording length of more than 25 divisions is to be printed out, the time axis should be compressed (MEM). See Section 11.3.

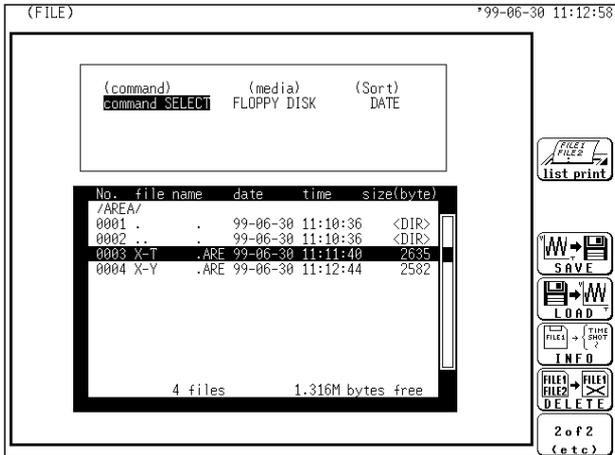
Waveform evaluation mode and stop mode



16.3.1 Setting the Evaluation Area

To evaluate the waveforms, an evaluation area is required. Two methods are available: one is to load the already created evaluation area and settings, and the other is to create a new evaluation area.

Loading the already created evaluation area



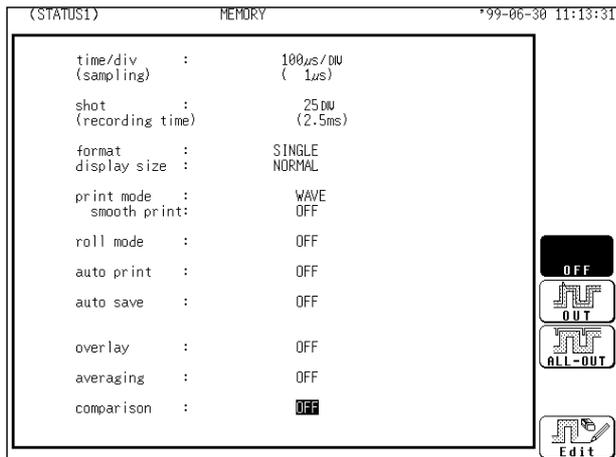
Method Screen: FILE

- ① Press the **FILE** key to call the FILE screen.
- ② Select the media for loading.
- ③ Use the bar cursor to select the desired file.
- ④ Use the function key to select the **LOAD**.
- ⑤ Use the function key to select the **exec**.
- ⑥ When no more changes need be made to the loaded settings, press the **DISP** key to make the display screen appear, and then press the **START** key to initiate measurement.

To change the settings, first change the contents, press the **DISP** key to make the display screen appear, and then press the **START** key to initiate measurement.

For details on load, see Section 14.8.

Creating a new evaluation area



Method

Screen: STATUS1 (MEM)
: STATUS2 (FFT)

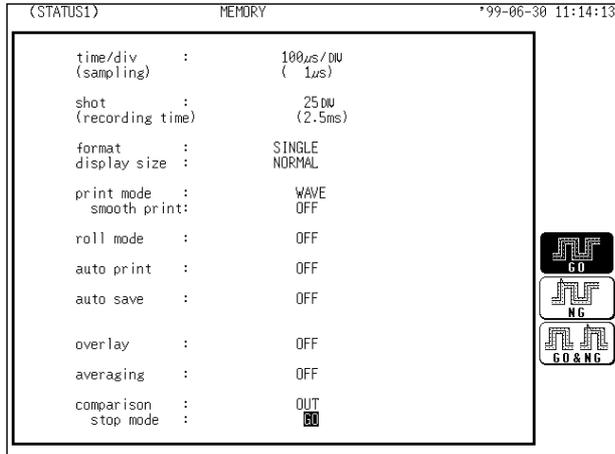
- ① Press the **STATUS** key to call the STATUS1 screen (MEM) or STATUS2 screen (FFT).
- ② Move the flashing cursor to the position shown in the figure on the left.
- ③ Use the function key to select the **Edit**.
- ④ Make the new evaluation area. See Section 16.3.4.
- ⑤ Store the new evaluation area in the internal memory.
- ⑥ After setting the parameters for "comparison" and "stop mode," press the **DISP** key to make the display screen appear, and then press the **START** key to initiate measurement.
- ⑦ Save the evaluation area on the FILE screen if it is necessary. See Section 14.7.

NOTE

Only one waveform evaluation area is saved in the internal memory. For example, when the memory recorder function is changed to the FFT function and the waveform evaluation area of the FFT is saved, the waveform evaluation area created using the memory recorder function is erased.

16.3.3 Setting the GO/NG Stop Mode

When waveform evaluation is enabled (OUT or ALL OUT is selected), the "Stop Conditions" menu appears. Specify which evaluation option, GO or NG, should be used to stop the recording.



Method

Screen: STATUS1 (MEM)
: STATUS2 (FFT)

- ① Move the flashing cursor to the position shown in the figure on the left.
- ② Make the setting with the function keys.

Selection



: Stop recording on GO result.



: Stop recording on NG result.



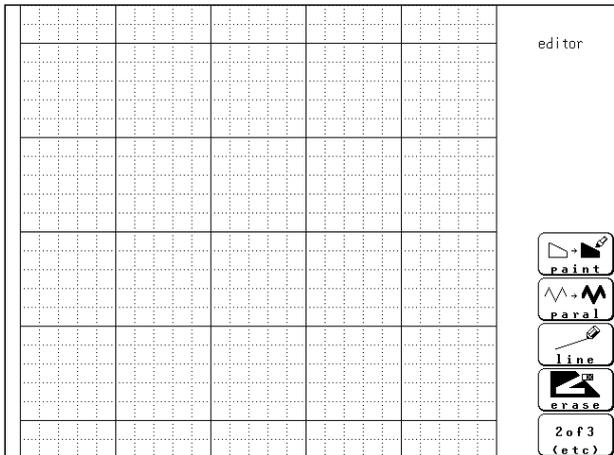
: Stop recording on GO or NG result.

NOTE

When waveform parameter measurement and waveform evaluation are carried out simultaneously, the screen displayed waveform evaluation results. Check the results of parameter evaluation using "*" (NG decision) accompanying the figure. Alternatively, a beeping sound can be used for the evaluation instead of the "*" mark; the machine beeps if the result of either parameter or waveform evaluation is NG (MEM).

16.3.4 Creating the Evaluation Area

- The graphics editor serves to create the waveform evaluation area.
- The area is created by drawing it on screen.



Method

Screen: STATUS1 (MEM)
: STATUS2 (FFT)

- ① Move the flashing cursor to the comparison item. Press the **F5** [Edit].
- ② Use these commands to create the evaluation area.
- ③ When the area has been stored in memory, it can be used for waveform evaluation.
- ④ Press the **F4** [end] function key to terminate the editor.
- ⑤ Serves to store the created area in memory.
- ⑥ Save the evaluation area through the file screen, if necessary. See Section 14.7.

Editor commands

When the editor is active, the following commands are assigned to the function keys.

	Fill in a closed area		Clear screen
	Parallel shift		Clear area
	Draw a straight line		Undo immediately preceding command
	Erase		Store area in memory
	Import waveform into editor		Quit editor
	Display filled-in area in reverse		

NOTE

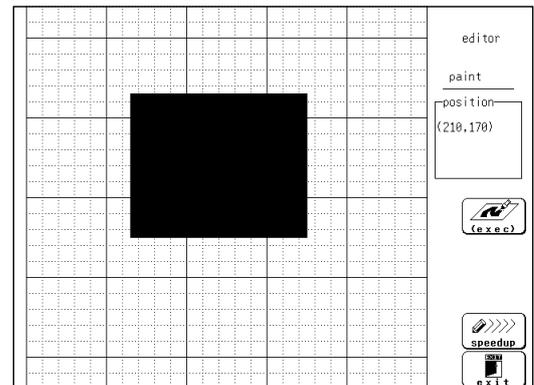
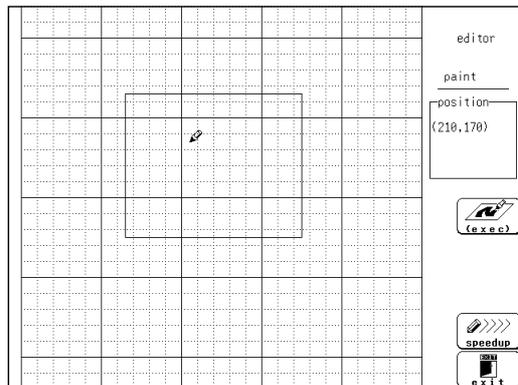
The evaluation area is created on the wide screen (single screen: 25 x 24 divisions, X-Y screen: 24 x 24 divisions). When the screen size is normal during evaluation of waveforms, the out-of-range area is not evaluated (MEM).

16.3.5 Editor Command Details



paint Function key display: 1/3
: Fills in an enclosed area.

- ① Press the **F1** [paint].
- ② Use the **CURSOR** keys to move the  mark to the area to be filled in. Pressing  accelerates the movement of the mark. If the area is not completely enclosed, adjacent areas will also be filled in.
- ③ Press the **F1** [exec] key. The area completely enclosed by lines is filled in.
- ④ Press the **F5** [exit] key to terminate the paint mode.





parallel Function key display: 1/3

: Shifts the line pattern in parallel direction, to create an area.

- ① Press the **F2** [parallel].
- ② Set the amount of shift.
 - Use the function keys or the JOG control to set the value.
 - Use the **F3** [move csr] key (or the CURSOR keys) to set the shift amount in the up/down/right/left directions.
 - Minimum shift increments is 0.05 movement.
- ③ Press the **F4** [exec] key. The parallel shift is carried, thereby creating the evaluation area.
- ④ Press the **F5** [exit] key to terminate the parallel shift mode.

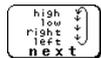
Selection



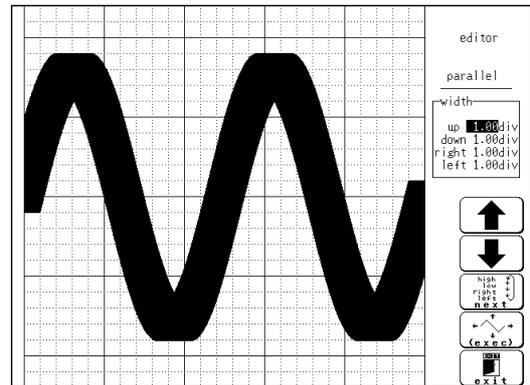
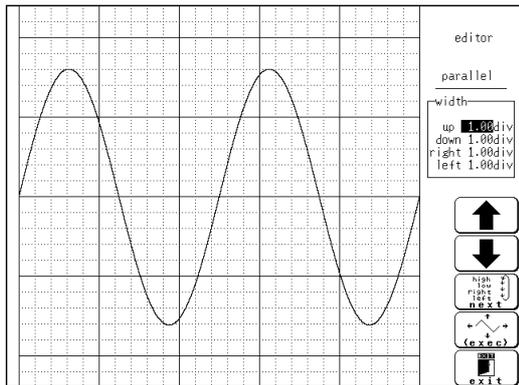
: Increase shift amount



: Decrease shift amount



: Cycle the cursor through up/down/right/left

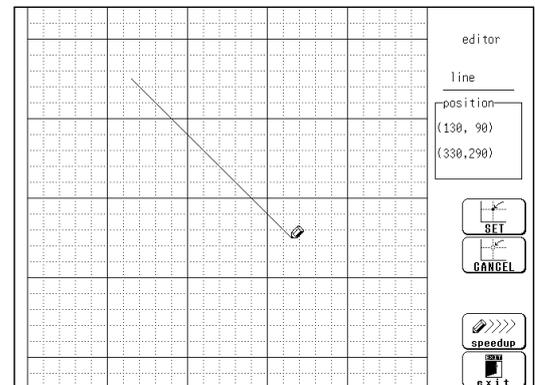
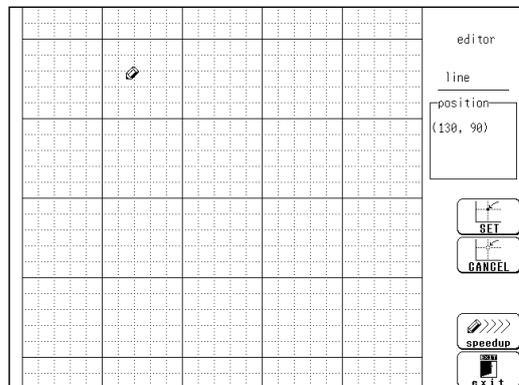




line Function key display: 1/3

: Serves to draw a straight or polygonal line.

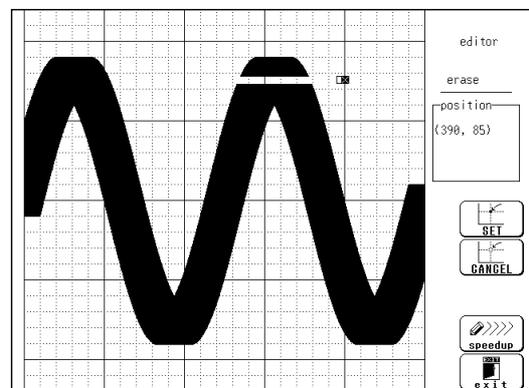
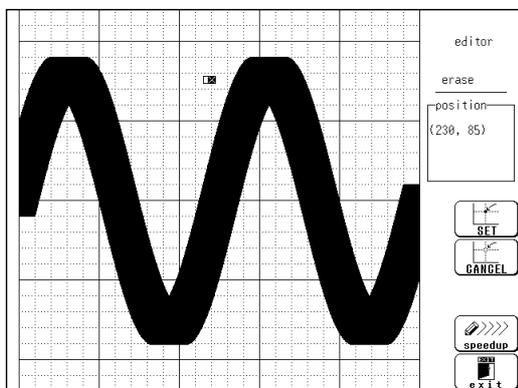
- ① Press the **F3** [line] key.
 - ② Use the **CURSOR** keys to move the  mark to the start point of the line.
Pressing  accelerates the movement of the mark.
If the area is not completely enclosed, adjacent areas will also be filled in.
 - ③ Press the **F1** [set] key.
 - ④ Move the  mark. A line is drawn between the set point and the  mark.
 - ⑤ Press the **F1** [set] key again. The color of the line changes, and it is fixed.
- Press the **F2** [cancel] key. Cancel the immediately preceding set point.
- ⑥ Repeat steps ④ and ⑤ when wishing to draw a polygonal line.
 - ⑦ Press the **F5** [exit] key to terminate the line mode.





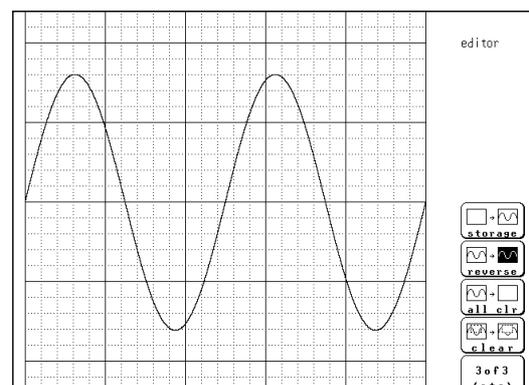
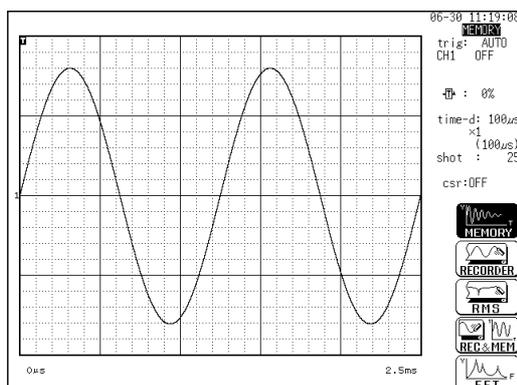
erase Function key display: 1/3
: Serves to erase unwanted sections.

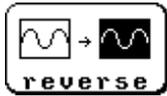
- ① Press the **F4** [erase].
- ② Use the CURSOR keys to move the  mark to the start point of the section to be erased.
Pressing  accelerates the movement of the mark.
- ③ Press the **F1** [set] key.
Press the **F2** [cancel] key. Cancel the immediately preceding set point.
- ④ Move the  mark to erase the unwanted section.
- ⑤ Press the **F5** [exit] key to terminate the erase mode.



storage Function key display: 2/3
: Loads a waveform already stored in memory into the editor.

- ① Press the **F1** [storage].
The waveform that was displayed on the screen is loaded into the editor.
The imported waveform is shown in a different color from the original setting.

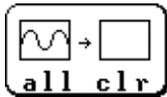
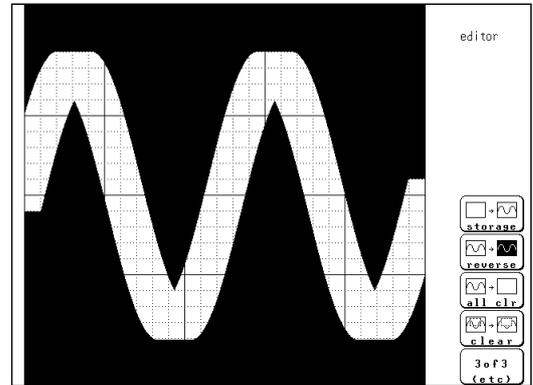
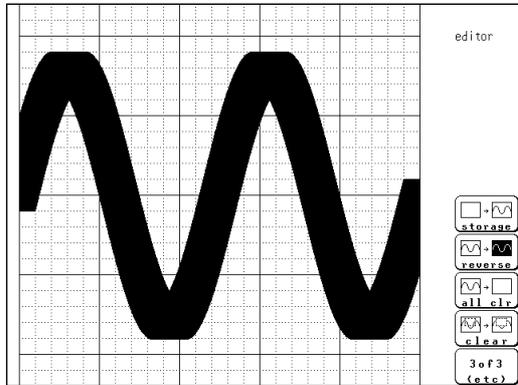




reverse Function key display: 2/3

: Reverses the colors of a filled-in area and the surrounding area.

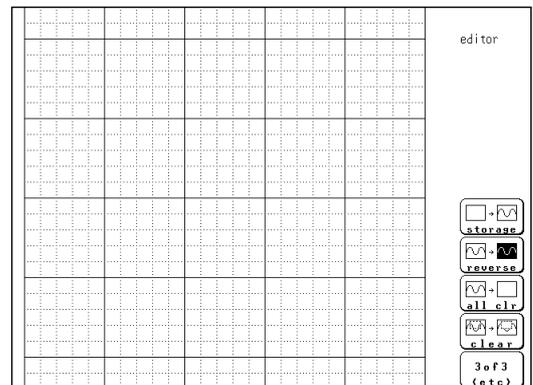
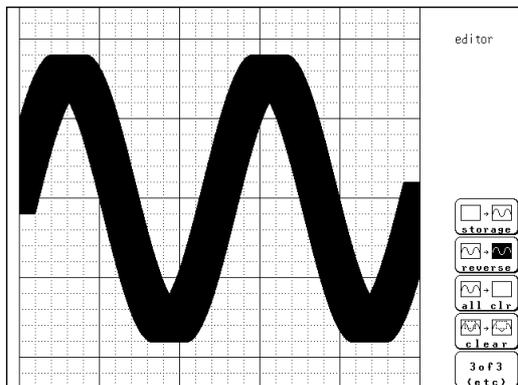
- ① Press the **F2** [reverse].
Displays filled in area in reverse.



all clr Function key display: 2/3

: Clears the entire editor screen.

- ① Press the **F3** [all clear].

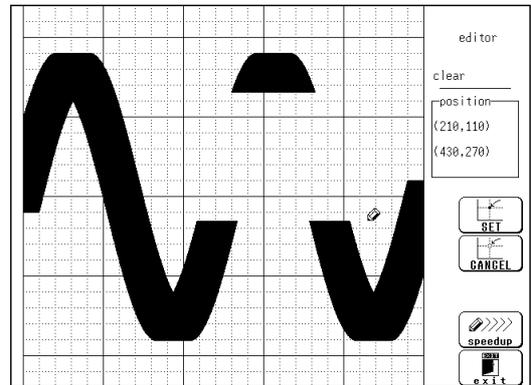
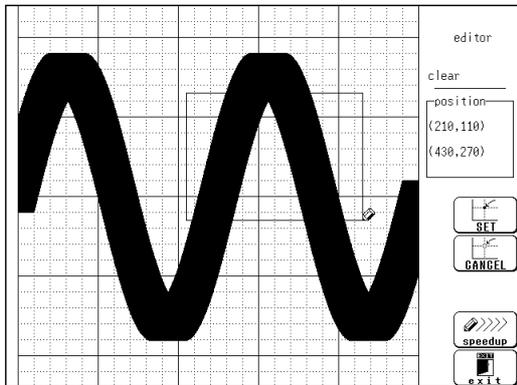




clear Function key display: 2/3

: Clears a specified rectangular area of the editor screen.

- ① Press the **F4** [clear].
- ② Use the CURSOR keys to move the  mark to the start corner of the area to be erased. Pressing  accelerates the movement of the mark.
- ③ Press the **F1** [set].
- ④ Move the  mark to the end corner of the area to be erased.
- ⑤ Press the **F1** [set] key again. The rectangular area is cleared.
Press the **F2** [cancel] key. Cancel the immediately preceding set point.
- ⑥ Press the **F5** [exit] key to terminate the clear area mode.

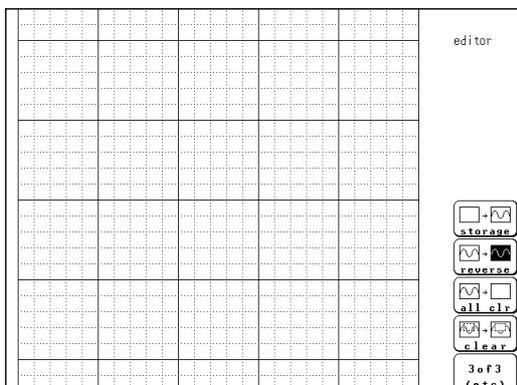


undo Function key display: 3/3

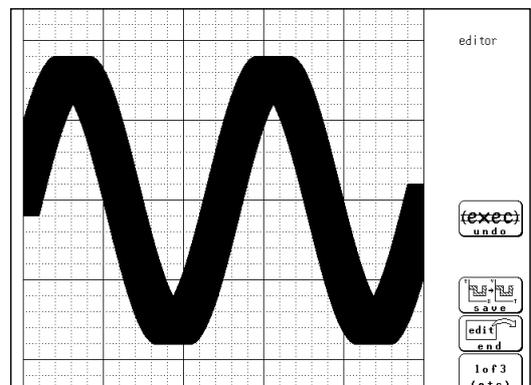
: Serves to undo the immediately preceding command.

Undo is applicable to all commands except **save** and **end**.

- ① Press the **F1** [undo].



Clears the editor screen



Screen before "clear screen" is restored.



save function key display: 3/3

: Serves to store the created area in memory.

After an area has been stored, it can be used for waveform evaluation.

- ① Press the **F3** [save] key.
Saving the media, refer to Section 14.7.



end function key display: 3/3

: Terminates the editor.

- (1) Store evaluation area in memory and quit editor
 - Press the **F4** [end] key and then the **F3** [save] key.
 - The stored area can be used for waveform evaluation.
- (2) Quit editor without storing evaluation area in memory
 - Press the **F4** [end] key and then the **F5** [kill area] function key.
 - The created area will be discarded.

NOTE

If the **F4** [end] key is pressed without having done any editing or immediately after using the store command, the editor is terminated without confirmation.

Chapter 17

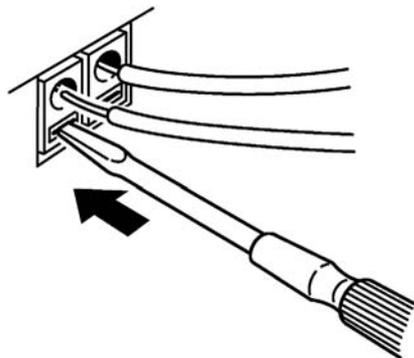
External Input/Output Terminals

17.1 Connecting the Terminals

⚠ WARNING

- Maximum input voltage ratings for the input/output terminals of the 8826 are shown below. To avoid the risk of electric shock and damage to the unit, take care not to exceed these ratings.
- The external I/O terminal and the unit have a common GND.

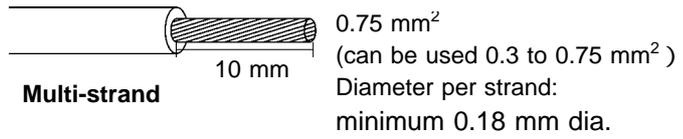
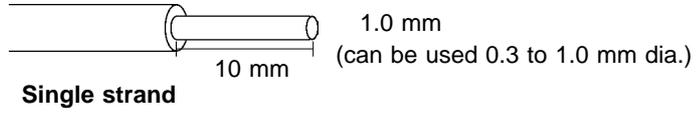
Input/output terminal	Maximum input voltage	Maximum rated voltage to earth
EXT TRIG	-5 to +10 V DC	Not insulated
START · STOP		
PRINT		
EXT SMPL		
TRIG OUT	-20 V to +30 V DC 500 mA max. 200 mW max.	
GO		
NG		



- (1) Push the tab with a flatblade screwdriver or similar.
- (2) While keeping the tab depressed, insert a stripped wire into the connector opening.
- (3) Release the tab to lock the wire.

Recommended wire **Single strand: 1.0 mm dia. (AWG #18)**
 Multi-strand: 0.75 mm²

Usable limits **Single strand: 0.3 to 1.0 mm dia. (AWG #26 to #18)**
 Multi-strand: 0.3 to 0.75 mm² (AWG #22 to #20)
 Strand diameter: minimum 0.18 mm
 Standard insulation stripping length: 10 mm



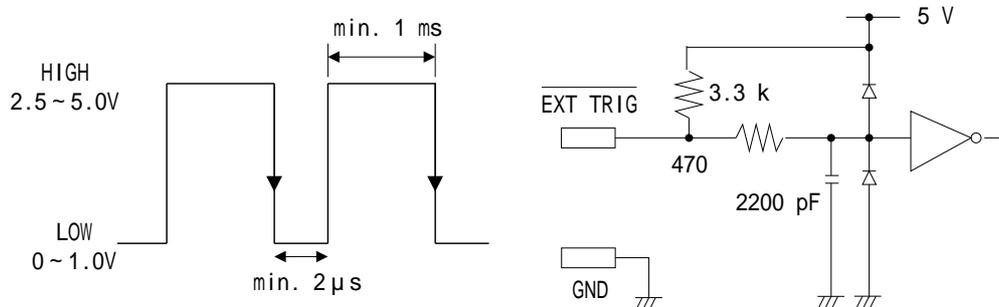
17.2 External Trigger Input Terminal [EXT TRIG]

- An external signal can be used as trigger source.
- Several 8826 units can be synchronized for parallel operation.

Signal input method

- Short the terminal to ground, or input a pulse signal (High level: 2.5 to 5.0 V, Low level: 0 to 1.0 V) or a square wave signal.
- Triggering is activated at the falling edge.

Voltage range	High level: 2.5 to 5.0 V, Low level: 0 to 1.0 V
Pulse width	High level: min. 1 ms, Low level: min. 2 μ s
Maximum input voltage	-5 to 10 V



NOTE

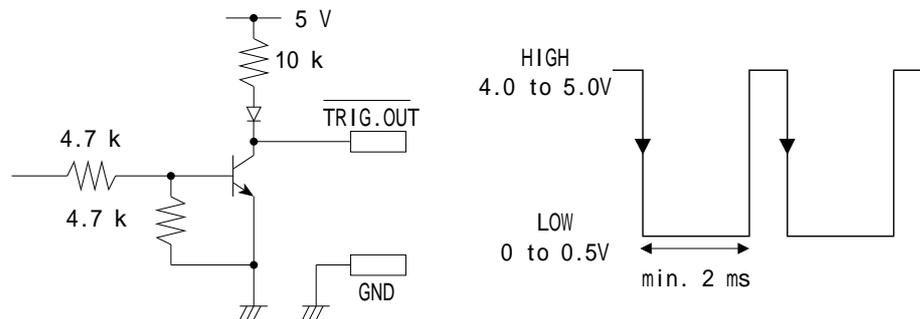
The external trigger input (EXT TRIG) cannot be used, unless the external trigger is enabled on the TRIGGER screen.

17.3 External Trigger Output Terminal [TRIG OUT]

- When triggering occurs, a signal is output from this terminal.
- Several 8826 units can be synchronized for parallel operation.

Trigger output signal

Signal type	Open-collector signal, active Low
Output voltage	High level: 4.0 to 5.0 V
range	Low level: 0 to 0.5 V
Pulse width	Low level:min. 2 ms.
Maximum input voltage	-20 to +30 V, max. 500 mA, max. 200 mW



NOTE

When the auto range function is activated by pressing the AUTO key, a trigger output signal is generated. This should be taken into consideration when using both the trigger output and the auto range function. (Memory recorder function only)

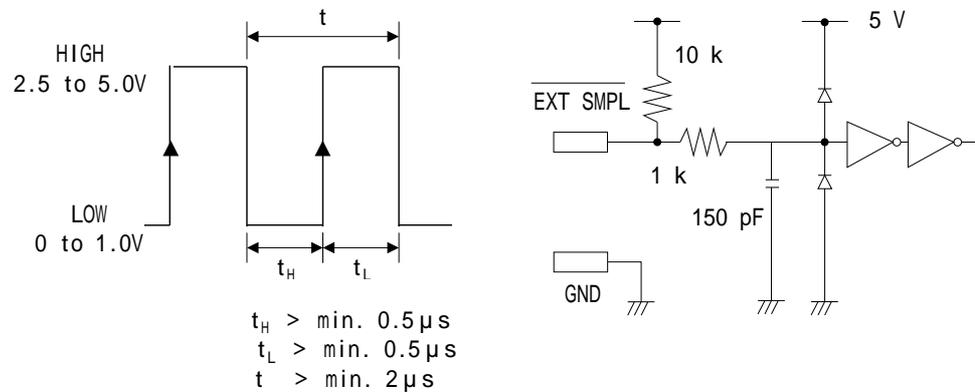
17.4 External Sampling Terminal [EXT SMPL]

An external signal can be used to set the sampling rate.

Signal input method

- Short the terminal to ground, or input a pulse signal (High level: 2.5 to 5.0 V, Low level: 0 to 1.0 V) or a square wave signal.
- Triggering is activated at the rising edge.

Voltage range	High level: 2.5 to 5.0 V, Low level: 0 to 1.0 V
Pulse width	High, Low level: min. 0.5 μ s
Frequency	500 kHz max (MEM)
Maximum input voltage	-5 to 10 V



NOTE

External sampling can be used on the memory recorder and FFT. To do so, set the time-axis range (memory recorder) or frequency range (FFT) to "EXT.".

17.5 External Print / Start / Stop Terminal

PRINT terminal Printing starts when a signal is input here.

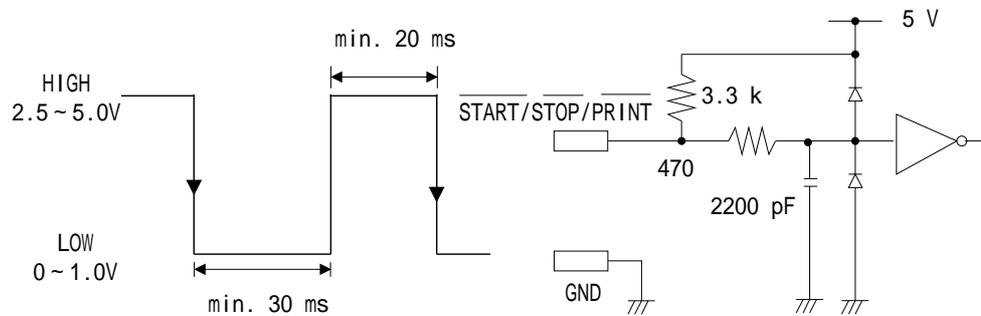
START terminal Measurement starts when a signal is input here.

STOP terminal Measurement and printing stop when a signal is input here.

Signal input method

- Short the terminal to ground, or input a pulse signal (High level: 2.5 to 5.0 V, Low level: 0 to 1.0 V) or a square wave signal.
- Control is activated at the falling level of the input waveform (active Low).

Voltage range High level: 2.5 to 5.0 V, Low level: 0 to 1.0 V
 Pulse width High level: min. 20 ms, Low level: min. 30 ms
 Maximum input voltage -5 to 10 V



17.6 GO/NG Evaluation Output Terminal

When waveform evaluation or waveform parameter evaluation is used, a signal is output from these connectors when the result is GO (pass) or NG (fail).

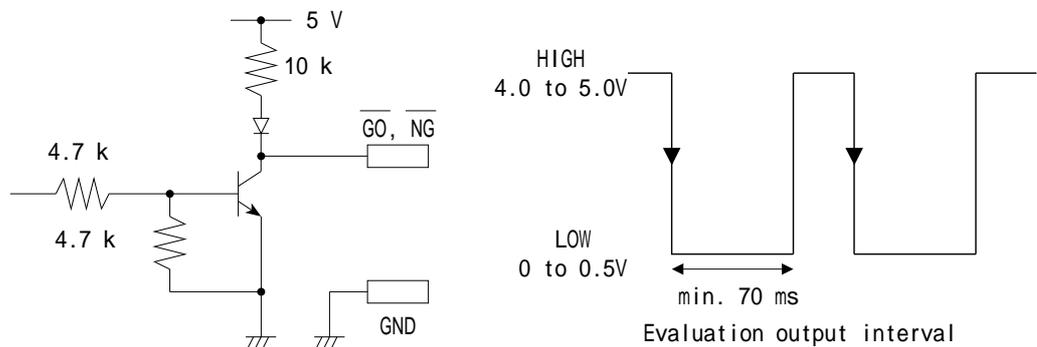
Output signal

Signal type Open-collector signal, active Low
 Output voltage range High level: 4.0 to 5.0 V, Low level: 0 to 0.5 V
 Maximum input voltage -20 to +30 V, max. 500 mA, max. 200 mW

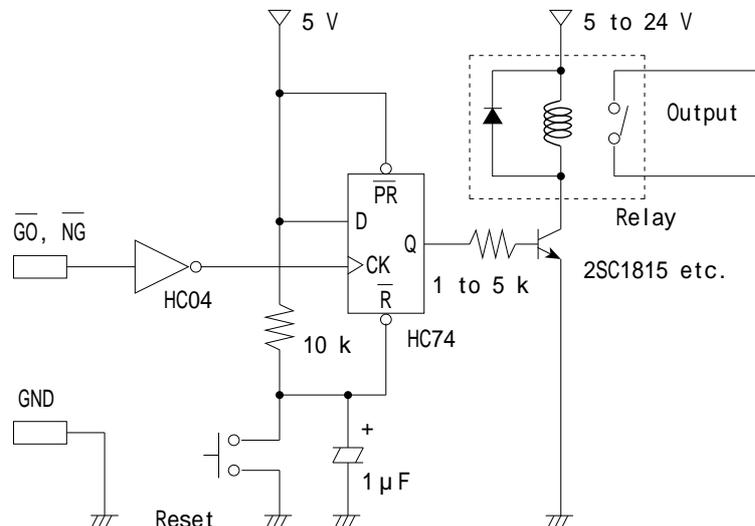
Evaluation output interval (min. 70 ms)

The evaluation outputs are shown in the following table. Between these states, there is an interval during which the next data are read and waveform data are created. The duration of this interval is inversely proportional to the time axis and proportional to the recording length.

Output Terminal	Evaluation result	
	GO	NG
GO	Low level	High level
NG	High level	Low level



The following diagram shows an example of a circuit that operates an alarm by means of a GO/NG terminal.



Chapter 18

Specifications 18

18.1 General Specifications

Basic specifications

Measurement functions	Memory recorder Recorder RMS recorder Recorder & Memory FFT	High-speed data saving Real time recording For commercial power supplies Real time recording & High-speed data saving Frequency analysis
Number of channels (maximum)	32 analog channels + 32 logic channels (The logic channels are standard equipment for the 8826, common ground with main unit)	
Memory capacity	Standard: 16 M words Expansion: 64 M words (added 48 M words)	
Maximum sampling period	1 μ s (all channels simultaneously) External sampling period (2 μ s)	
Time axis accuracy	$\pm 0.01\%$ (difference between grid and actual time)	
Input method	Plug-in 2-ch analog units	
External control terminals	External trigger input, trigger output, GO/NG output, external start/stop, print input, external sampling	
Time measurement functions	Auto calendar with automatic leap year, 24 hour clock	
Backup battery and lifetime	Used for clock and to preserve waveforms and settings, at least 10 years (reference value at 25 $^{\circ}$ C)	
Operating place	Max. 2000 m height, indoors	
Operational ranges for temperature and humidity	Temperature: 5 $^{\circ}$ C to 40 $^{\circ}$ C Relative humidity: 35% to 80%RH (with no condensation)	
Temperature and humidity ranges for assured accuracy	Temperature: 23 \pm 5 $^{\circ}$ C Relative humidity: 35% to 80%RH (with no condensation)	
Period of guaranteed accuracy	For 1 year	
Temperature and humidity ranges for storage	Temperature: 0 $^{\circ}$ C to 50 $^{\circ}$ C Relative humidity: 20% to 80%RH (with no condensation)	

Insulation resistance	Between the main unit and the power supply, between the input units and the main unit, and between the input units: At least 100 M /500 VDC
Dielectric strength	One minute at 1.35 kVAC between the main unit and the power supply One minute at 3.7 kVAC between the input units and the main unit, and between the input units (For input units, same as specifications of each input unit)
Power supply	Rated power voltage 100 to 240 VAC (Voltage fluctuations of 10% from the rated supply voltage are taken into account.) Rated power frequency 50/60 Hz
Maximum rated power	300 VA max (Printer off: 100 VA)
Dimensions	Approx. 401W × 235H × 382D mm (excluding projections)
Mass	Approx. 11 kg
Standard applying	EMC EN61326, ClassA EN 6100-3-2 EN 61000-3-3 Safety EN61010 Pollution Degree 2, measurement category II (anticipated transient overvoltage 4000V)

Recorder

Method of recording	Thermosensitive recording method using a thermal line head
Recording paper	Roll type thermosensitive paper, 264 mm × 30 m (long)
Width of recording	Total recording width: 256 mm ± 0.3 mm Waveform portion: NORMAL 200 mm (20 DIV) ± 0.3 mm WIDE 240 mm (24 DIV) ± 0.3 mm
Recording speed	Approx. 25 mm/s max.
Paper feed accuracy	± 1% (25 , 60%RH)

Display

Display language	Japanese/English (selectable)
Screen	10.4 inch TFT color LCD display (640 × 480 dots) (TFT color LCDs characteristically have a few defective pixels that do not always light, or that remain lit. We do not consider the presence of six or fewer such defects to indicate a damaged or faulty display. Please be aware of this in advance.)
Display resolution	MEM, REC, RMS, REC&MEM function <ul style="list-style-type: none"> • Waveform: NORMAL 25 DIV × 20 DIV, WIDE 25 DIV × 24 DIV • Text: 40 characters × 30 lines FFT function <ul style="list-style-type: none"> • Waveform: 10 DIV × 20 DIV • Text: 40 characters × 30 lines X-Y display <ul style="list-style-type: none"> • Waveform: NORMAL 20 DIV × 20 DIV, WIDE 24 DIV × 24 DIV • Text: 40 characters × 30 lines (1 DIV= 20 (horizontally) × 20 (vertically) dots)
Dots spacing	0.33 (H) × 0.33(V) mm
Backlight lifetime	Approx. 50,000 hours (reference value)

18.2 External Data Storage and Interface

Floppy Disk

Device	3.5-inch floppy disk drive
Capacity	<ul style="list-style-type: none"> • 1.44 MB (2HD) (IBM PC/AT compatible or NEC PC-9801 series with 3-mode drive) • 1.2 MB (2HD) (NEC PC-9801 series) • 720 KB (2DD) (IBM PC/AT compatible)
Data format	MS-DOS format (MS-DOS is the registered trademark of Microsoft Corporation.)
Data stored	Settings, waveform evaluation area, screen data, measurement data (binary or text), (Measurement data can be saved between cursors A and B.) spacing data (text)

MO Disk (Option)

Device	3.5-inch MO disk drive
Capacity	640 MB (128 MB, 230 MB, 540 MB)
Data format	Accordance with ISO standard, overwrite object supported
Data stored	Settings, waveform decision area, screen data, measurement data (binary or text), (Measurement data can be saved between cursors A and B.) spacing data (text)

PC Card

Expansion slot	<ul style="list-style-type: none"> • PC card standard (1 slot) • Accepts TYPE I, II, III PC cards
Card types	SRAM card, flash ATA card, hard disk drive card (HDD) (The performance is guaranteed for our optional PC cards only.)
Card capacity	32 MB max. (SRAM), 528 MB max. (flash, HDD)
Data format	MS-DOS format (MS-DOS is the registered trademark of Microsoft Corporation.)
Data stored	Settings, waveform decision area, screen data, measurement data (binary or text), (Measurement data can be saved between cursors A and B.) spacing data (text)

Interface

GP-IB	<ul style="list-style-type: none"> • Complies with IEEE 488.2-1987 • Remote control including input unit is possible. • The optional 9558 GP-IB CARD is used.
RS-232C	<ul style="list-style-type: none"> • Complies with EIA RS-232C • Remote control including input unit is possible. • The optional 9557 RS-232C CARD is used.
LAN	<ul style="list-style-type: none"> • Complies with IEEE 802.3i (Ethernet 10BASE-T) • Remote control including input unit is possible. • The optional 9578 10BASE-T LAN CARD (option) is used. • Commercially available LAN cards (specified) can be used. • Using the 9333 LAN COMMUNICATOR, remote control and data accumulation are possible.
Printer	<ul style="list-style-type: none"> • Complies with PC-AT centronics • Using the external printer, color print can be printed. • The optional 9559 PRINTER CARD is used.

SCSI Interface

SCSI	ANSI X3.131-1986 (SCSI level 2) JIS X6051 (SCSI level 2)
Driver/receiver	Single - ended
Bus-parity	Output data . . . none Input data . . . none
Data transfer method	Asynchronous
Terminator	Provided (not removable)
Terminator power	Provided
Initiator operation	Provided
Target	3.5-inch MO disk
Address	0 to 7
Connector	<ul style="list-style-type: none"> • Connect to MO disk drive with SCSI cable • Connector type : High density (pin-type)(D-Sub half-pitch 50 P)
MO disk drive	Connect to MO disk drive with SCSI cable
Data stored	Settings, waveform evaluation area, screen data, measurement data (binary or text), (Measurement data can be saved between cursors A and B.) spacing data (text)

18.3 Trigger Unit

Trigger Method	Digital comparison										
Trigger modes	<table border="1"> <thead> <tr> <th>Function</th> <th>Available trigger modes</th> </tr> </thead> <tbody> <tr> <td>Memory recorder</td> <td>Single, repeat, auto</td> </tr> <tr> <td>Recorder, RMS recorder</td> <td>Single, repeat</td> </tr> <tr> <td>Recorder & Memory</td> <td>Single, repeat, timer</td> </tr> <tr> <td>FFT</td> <td>Single, repeat, auto</td> </tr> </tbody> </table>	Function	Available trigger modes	Memory recorder	Single, repeat, auto	Recorder, RMS recorder	Single, repeat	Recorder & Memory	Single, repeat, timer	FFT	Single, repeat, auto
Function	Available trigger modes										
Memory recorder	Single, repeat, auto										
Recorder, RMS recorder	Single, repeat										
Recorder & Memory	Single, repeat, timer										
FFT	Single, repeat, auto										
Trigger source	<p>CH1 to CH32, logic CHA to CHH</p> <ul style="list-style-type: none"> • External trigger (With an external trigger, the triggering occurs on a falling edge of 2.5 V, or when the terminals are shorted together.) • Manual trigger • Timer trigger • Sources can be set on or off. When all sources are off, the unit is in the free-run state. <p>Trigger conditions can be set for each channel individually.</p>										
Trigger conditions	Logical AND or OR of any trigger sources										
Trigger types (analog)	<p>(1) Level trigger</p> <ul style="list-style-type: none"> • Digital setting of voltage values for full scale • Triggering occurs at rising edge (falling edge) of set value. <p>(2) Window-in, window-out trigger</p> <ul style="list-style-type: none"> • Upper and lower trigger levels can be set. • Triggering occurs when the waveform enters or leaves the defined area. <p>(3) Voltage drop trigger (for commercial power supplies)</p> <ul style="list-style-type: none"> • Triggering occurs when the peak of the voltage falls lower than the setting level. <p>(4) RMS level trigger (for commercial power supplies and DC)</p> <ul style="list-style-type: none"> • Set the RMS value by digital value. • Triggering occurs at rising edge (falling edge) of set value . <p>(5) Period trigger</p> <ul style="list-style-type: none"> • This function sets both the period reference voltage and the period range, and measures the rise (fall) period of the set voltage. • When the measured period deviates from the specified range, triggering occurs. 										
Trigger type (logic)	Pattern trigger specified by 1, 0, and × (× means that either 1 or 0 is fine.)										
Trigger filter	<ul style="list-style-type: none"> • MEM, REC&MEM, FFT: OFF, 0.1,0.2,0.5,1.0,1.5,2.0,2.5,5.0,10.0 DIV • REC: ON, OFF (10 ms fixed) 										
Trigger level resolution	0.25%f.s. (f.s. = 20 DIV)										
Pre-trigger	<ul style="list-style-type: none"> • MEM, REC&MEM, FFT: 0,2,5,10,20,30,40,50,60,70,80,90,95,100,-95 % • RMS: 0,5,10 DIV 										
Trigger timing	Start, Stop, Start and Stop (REC)										
Trigger output	<ul style="list-style-type: none"> • Open collector output (with 5 V output voltage, active low) • Pulse width 2 ms min. 										
Level meter function	<ul style="list-style-type: none"> • When waiting for trigger, the level of the analog input signal is displayed on the DISPLAY screen. 										

18.4 Memory Recorder Function

Time axis	100, 200, 500 μ s/DIV 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1, 2, 5 min/DIV , EXT.
Time axis resolution	100 points/DIV
Sampling period	1/100 of the time axis
Recording length	<ul style="list-style-type: none"> • Standard (16 M words) 25,50,100,200,500,1000,2000,5000,10000^{*1},20000^{*2},40000^{*3}DIV • Expansion (64 M words) 25,50,100,200,500,1000,2000,5000,10000,20000,40000^{*1},80000^{*2},160000^{*3} DIV • Arbitrarily (Set from 1 division to the maximum number of divisions at 1-division intervals.)
Screen · print format	The styles single, dual, quad, (DISPLAY screen), oct · hex (Print only, Display quad style) X-Y single · X-Y quad (dot) and (line) are available.
Interpolation	Line (excluding X-Y format), Dot· line (X-Y format)
Recording line display	12-color (LCD), Printout: 4-type
Overlay function	Provided
Waveform magnification/ compression	<ul style="list-style-type: none"> • Time axis $\times 10$, $\times 5$, $\times 2$, $\times 1$, $\times 1/2$, $\times 1/5$, $\times 1/10$, $\times 1/20$, $\times 1/50$, $\times 1/100$, $\times 1/200$, $1/500$, $\times 1/1000$, $\times 1/2000$, $\times 1/5000$, $\times 1/10000$ • Measurement range $\times 10$, $\times 5$, $\times 2$, $\times 1$, $\times 1/2$ (single, X-Y single) $\times 5$, $\times 2.5$, $\times 1$, $\times 1/2$, $\times 1/4$ (2, 4, 8, 16, X-Y quad)
Waveform scrolling	Available in the left/right directions
Auto-print	Automatically prints the memorized waveform
Manual print	Available
Partial print	Prints between the A and the B cursors
Print smoothing function	When set, a smoothed waveform is printed, with twice the density in the time axis direction.
Report print	B4 size print available
Logging function	Records measured data as digital values
Variable function	Provided
Zoom function	Provided

(^{*1}): When 16 channels are in use

(^{*2}): When 8 channels are in use

(^{*3}): When 4 channels are in use

18.5 Recorder Function

Time axis	20 ^{*1} , 50 ^{*1} , 100 ^{*1} , 200 ^{*1} , 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV
Time axis resolution	100 points/DIV (with the printer)
Sampling period	1, 10, 100 μ s, 1, 10, 100 ms (Can be selected, from 1/100 of the time axis setting)
Recording length	<ul style="list-style-type: none"> • Standard (16 M): 25,50,100,200,500,1000,2000 DIV,CONT^{*2} • Expansion (64 M): 25,50,100,200,500,1000,2000,5000,10000 DIV,CONT^{*2} • Arbitrarily (Set from 1 division to the maximum number of divisions at 1-division intervals.) • X-Y format can be set CONT only
Screen · print format	The styles single, dual, quad, (DISPLAY screen), oct · hex (Print only, Display quad style) X-Y single · X-Y quad (dot) and (line) are available.
Interpolation	Line (excluding X-Y format), Dot·line (X-Y format)
Recording line display	12-color (LCD), Printout: 4-type
X-Y Spatial resolution	20 dots/DIV (with the display) 100 dots/DIV (horizontally), 80 dots/DIV (vertically) (with the printer)
X-Y Sampling period	Dot display: 500 μ s (fixed), Line display: 500 μ s to 18 ms (unfixed)
Waveform magnification/ compression	<ul style="list-style-type: none"> • Time axis × 1, × 1/2, × 1/5, × 1/10, × 1/20, × 1/50, × 1/100, × 1/200, × 1/500 • Measurement range × 10, × 5, × 2, × 1, × 1/2 (single, X-Y single) × 5, × 2.5, × 1, × 1/2, × 1/4 (2, 4, 8, 16, X-Y quad)
Waveform storage	<ul style="list-style-type: none"> • Last 2000 divisions of data saved in memory^{*3} • Can be checked by reverse scrolling and reprinted
Print function	ON/OFF and reprinted
Report print	B4 size print available
Additional recording function	ON/OFF ^{*4}
Logging function	Records measured data as digital values
Variable function	Provided
Virtual record function	ON/OFF ^{*5}

(^{*1}): Display shows real-time recording data, but printer output is at 20 mm/s.

(^{*2}): With time axis 20 to 200 ms/DIV, "continuous" is not possible with printer ON.

(^{*3}): Expanded to 64 words: 10000 DIV

(^{*4}): Additional recording function (recording data without paper)

When enabled, the memory is regarded as printer paper. Recording starts at the end of previous data, without erasing them. When the 2000 DIV^{*3} has been reached, old data will be overwritten. When OFF, previous data will be erased. Set to ON if erasing is not desired.

(^{*5}): Virtual record function

Although real-time recording to the recording paper is not possible in the high-speed range (20 to 200 ms/DIV), the waveforms are stored to the memory and can therefore be monitored on the screen. The last 2000 divisions of each waveform^(^{*3}) are retained in memory before the measurement is complete. If the recording length is not set to "continuous," the printer can also be operated, enabling the waveforms to be printed out later.

18.6 RMS Recorder Function

Time axis	5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV
Time axis resolution	100 points/DIV (with the printer)
Number of channel	Analog 32 ch + logic 32 ch
Sampling period	20 rms data/s (200 μ s fixed) ^{*1}
RMS accuracy	$\pm 3\%$ f.s. (at 50/60 Hz ± 2 Hz, DC) (f.s.=20 DIV)
Measuring object	Commercial power supplies (50/60 Hz), DC
Recording length	<ul style="list-style-type: none"> • Standard (16 M): 25,50,100,200,500,1000,2000 DIV,CONT^{*2} • Expansion (64 M): 25,50,100,200,500,1000,2000,5000,10000 DIV,CONT^{*2} • Arbitrarily (Set from 1 division to the maximum number of divisions at 1-division intervals.)
Screen · print format	The styles single, dual, quad, (DISPLAY screen), oct · hex (Print only, Display quad style)
Interpolation	Line
Recording line display	12-color (LCD), Printout: 4-type
Waveform magnification/ compression	<ul style="list-style-type: none"> • Time axis <ul style="list-style-type: none"> $\times 1$, $\times 1/2$, $\times 1/5$, $\times 1/10$, $\times 1/20$, $\times 1/50$, $\times 1/100$, $\times 1/200$, $\times 1/500$ • Measurement range <ul style="list-style-type: none"> $\times 10$, $\times 5$, $\times 2$, $\times 1$, $\times 1/2$ (single) $\times 5$, $\times 2.5$, $\times 1$, $\times 1/2$, $\times 1/4$ (2, 4, 8, 16)
Waveform storage	<ul style="list-style-type: none"> • Last 2000 divisions of data saved in memory^{*2} • Can be checked by reverse scrolling and reprinted
Print function	ON/OFF and reprinted
Report print	B4 size print available
Additional recording function	ON/OFF ^{*3}
Variable function	Provided
Logging function	Records measured data as digital values

(^{*1}): Refer to 21.3.5.

(^{*2}): Expanded to 64 words: 10000 DIV

(^{*3}): Additional recording function (recording data without paper)

When enabled, the memory is regarded as printer paper. Recording starts at the end of previous data, without erasing them. When the 2000 DIV^{*2} has been reached, old data will be overwritten. When OFF, previous data will be erased. Set to ON if erasing is not desired.

18.7 Recorder & Memory Function

Time axis	<ul style="list-style-type: none"> • Recorder 20, 50, 100, 200 ms/DIV (display only) 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV • Memory Recorder 100, 200, 500 μs/DIV 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1, 2, 5 min/DIV
Time axis resolution	100 points/DIV
Sampling period	1/100 of the time axis.....Memory waveform
Recording length	<ul style="list-style-type: none"> • Standard (16 M): 25, 50, 100, 200, 500, 1000, CONT (Recorder waveform) 25, 50, 100, 200, 500, 1000, 2000, CONT (Memory waveform) • Expansion (64 M): 25, 50, 100, 500, 1000, 2000, 5000 DIV, CONT (Recorder waveform) 25, 50, 100, 500, 1000, 2000, 5000, 10000 DIV (Memory waveform)
Screen · print format	The styles single, dual, quad, (DISPLAY screen), oct · hex (Print only, Display quad style)
Recording line display	12-color (LCD), Printout: 4-type
Display	Switchable between recorder and memory waveforms
Printer output	During measurement operation, recorder waveform only. After data capture, printout of recorder waveform as on display or memory waveform.
Waveform storage (REC)	Last 1000 divisions of data saved in memory ^(*) Can be checked by reverse scrolling and reprinted
Additional recording function	ON/OFF ^(*)
Trigger source	CH1 to CH32, CHA to CHH and external trigger (Memory waveform)
Report print	B4 size print available
Variable function	Provided
Zoom function	Provided(in the memory recoder function)
Real time save function	Time axis range: 100 ms/DIV(less than 16 ch) 200 ms/DIV to 5 min/DIV (more than 17 ch) (1 DIV = 100 points) Save destination: PC card or 9598 MO Drive Unit (option) Save time: depends on available space on the PC card or MO disk

(^{*}1): Expanded to 64 words: 5000 DIV

(^{*}2): Additional recording function (recording data without paper)

When enabled, the memory is regarded as printer paper. Recording starts at the end of previous data, without erasing them. When the 2000 DIV^(*) has been reached, old data will be overwritten. When OFF, previous data will be erased. Set to ON if erasing is not desired.

18.8 FFT Function

FFT channel mode	1 ch FFT 2 ch FFT
FFT range setting	133 mHz ~ 400 kHz, EXT.
Dynamic range	72 dB (logical value)
Number of sampling points	1000, 2000, 5000, 10000 points
Frequency resolution	1/400, 1/800, 1/2000, 1/4000
Antialiasing filter	Automatic cutoff frequency selection linked to frequency range
Analysis channel setting	2 channels selectable from all analog channels
FFT analysis mode setting	Storage waveform, Linear spectrum, RMS spectrum, Power spectrum, Cross-power spectrum, Auto-correlation function, Histogram, Transfer function, Cross-correlation function, Unit-impulse response, Coherence function, Octave analysis
Display format setting	Single, dual screen display, Nyquist display
Windows	Rectangular, Hanning, Exponential
Display scale	Linear scale, Log scale, Phase
Print function	As per the memory recorder function, excluding partial print function
Averaging function	Simple average of time and frequency axis, exponential average, peak hold (frequency axis) (2, 4, 8 to 4096 samples)

18.9 Auxiliary Functions

Computation functions (MEM)	<p>① Waveform processing calculations*¹ Arithmetic operations, absolute value, exponents, common logarithms, square roots, moving average, 1st and 2nd derivatives, 1st and 2nd integrals, parallel displacement on time axis, trigonometric functions, reverse trigonometric functions 16 arbitrary operational equations: Calculations are possible up to a recording length that corresponds to one fourth of the memory capacity.</p> <p>② Waveform parameter calculations*¹ Average value, RMS value, peak-to-peak value, maximum value, time to maximum value, minimum value, time to minimum value, period, frequency, rise time, fall time, area value, XY area value, standard deviation (parameter calculation result can be saved on floppy disk, MO disk, and so on.)</p> <p>③ Averaging function Additive averaging, exponential averaging (2, 4, 8 to 256 samples)*¹ Simple average, exponential average, peakhold (2, 4, 8 to 4096 samples) *²</p>
Memory segmentation	<ul style="list-style-type: none"> • Memory can be segmented among channels. • Number of segments: Maximum 255 • Batch saving of all blocks can be selected.
Sequential saving* ^{1*3}	<ul style="list-style-type: none"> • Input signal capture is carried out continuously using the trigger, storing waveform data successively in each block. • Displaying waveform ON or OFF can be selected.
Multi-block* ¹	<ul style="list-style-type: none"> • Recording the waveform data in an arbitrary block. • Displaying arbitrary blocks in duplicate.
Waveform evaluation* ^{1*2}	<p>① Waveform area evaluation *^{1*2}</p> <ul style="list-style-type: none"> • Waveform evaluation based on evaluation area for Y-T waveform, X-Y waveform, or FFT results • Evaluation modes <ul style="list-style-type: none"> • Out: fail if any part of waveform is outside evaluation area • All out: fail if whole of waveform is outside evaluation area • Stop modes <ul style="list-style-type: none"> • GO (pass) stop, NG (fail) stop, GO & NG stop • Printer output or waveform save at stop • Decision time : Approx. 20 ms max • Evaluation cycle : Approx. 250 ms*¹ <ul style="list-style-type: none"> With input 2 Vp-p sin wave, frequency: 400 Hz Used channel ch1 to 4, 100 μs/DIV \times 1, 25DIV (depend on time-axis compression, recording length) Approx. 490 ms*² 1000 points, Linear spectrum, Window - Rectangular (depend on frequency range, analysis mode, FFT points) • Graphics editor (Provided, used for defining an arbitrary evaluation area for waveform evaluations) : Line, paint, storage, erase, parallel, reverse, clear, all clr, undo, save, end <p>② Waveform parameter evaluation*¹ Decision based on setting minimum and maximum values for waveform parameter calculation results.</p> <p>③ Decision output*^{1*2} GO and NG outputs on rear panel: open collector outputs (with 5 V output, active low, pulse width 10 ms min.)</p>

*¹: Memory recorder function, *²: FFT function, *³: Recorder and memory function

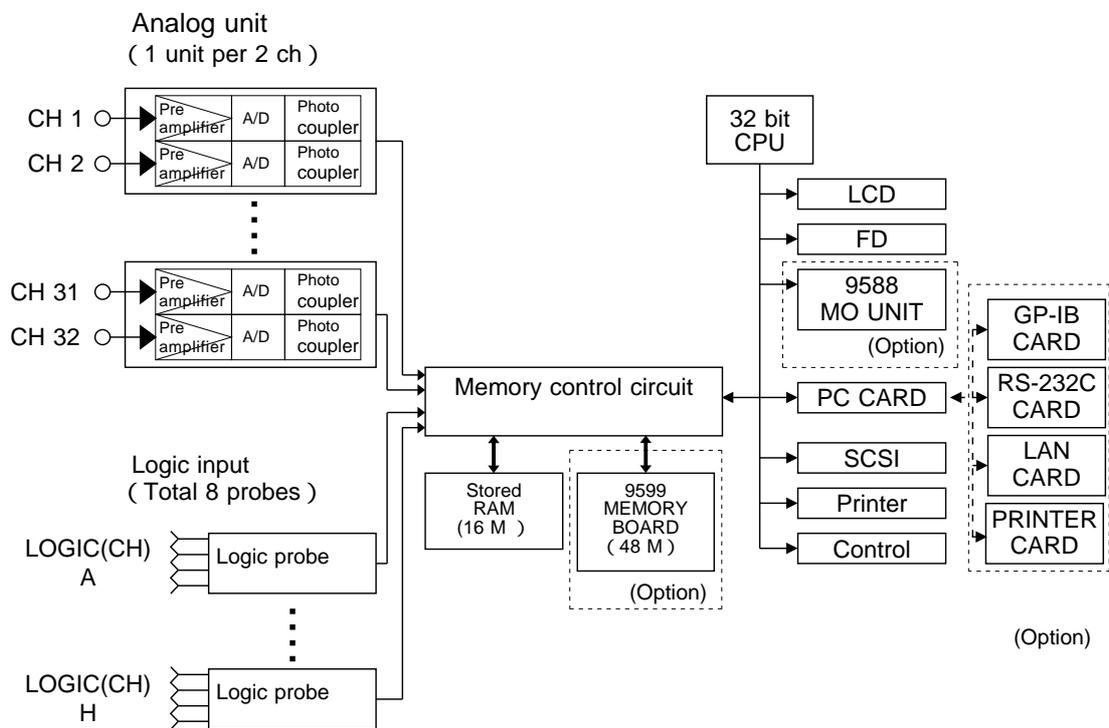
18.10 Others

Comment printing	Function, channel, Input range, Zero position, Trigger time, DIV and other information can be printed.
Comment input function	Provided
Cursor measurement function	Time difference, voltage difference or number of cycles between cursors A and B, voltage at each cursor, time from trigger
Scaling function	Specifiable for each channel
Display copy function	Provided
List • gauge functions	ON, OFF
Starting status backup function	Provided
Auto setup function	When the power is turned on, settings and a waveform evaluation area stored on a floppy disk can be automatically loaded.
Auto save function	Provided
Remote control	Start, stop and print control terminals (threshold value: 2.5 V approx. , active low, or terminal short)
Auto-range function	Provided, selects optimum time axis and measurement range for input waveform
VIEW function	<ul style="list-style-type: none"> • Shows relative positions of displayed data within recording length and to full-scale point. • When memory segmentation is used, usage condition of each block is shown.
On-line help	An explanation of the display screen or the item currently selected by the cursor appears.
Key lock function	Locks all keys except the KEY LOCK key
LCD back lighting	ON, OFF (with the auto OFF function)(auto OFF time can be selected 1 to 30 min)
List print function	<ul style="list-style-type: none"> • Settings output after waveform data print. • Output by pressing the PRINT key other than on display screen.
Vernier function	Provided
Direct channel setting	Special keys allow range and position selection for direct input units.
Level monitor function	Provided

18.11 System Operation

System operation is explained according to the block diagram.

- (1) All system operations are controlled by a 32-bit RISC CPU.
- (2) The input units incorporate high-speed 12-bit A/D converters which are connected to the main unit via a photocoupler integrated in each input unit. Each channel has its own power supply, to assure electrical isolation from the main unit.
- (3) Measurement data stored in memory are processed by the CPU, displayed on the LCD screen, and output to the printer. Output to floppy disk, MO disk, PC card or SCSI is also provided.



Block Diagram

18.12 Maximum Recording Length for Time Axis Settings

Memory Recorder Function: Standard (16 M)

Time axis range /DIV	Sampling period	Max. recording length			
		32 ch 5000 DIV	16 ch 10000 DIV	8 ch 20000 DIV	4 ch 40000 DIV
100 μ s	1.00 μ s	500ms	1s	2s	4s
200 μ s	2.00 μ s	1s	2s	4s	8s
500 μ s	5.00 μ s	2.5s	5s	10s	20s
1ms	10.0 μ s	5s	10s	20s	40s
2ms	20.0 μ s	10s	20s	40s	1min 20s
5ms	50.0 μ s	25s	50s	1min 40s	3min 20s
10ms	100 μ s	50s	1min 40s	3min 20s	6min 40s
20ms	200 μ s	1min 40s	3min 20s	6min 40s	13min 20s
50ms	500 μ s	4min 10s	8min 20s	16min 40s	33min 20s
100ms	1.00ms	8min 20s	16min 40s	33min 20s	1h 06min 40s
200ms	2.00ms	16min 40s	33min 20s	1h 06min 40s	2h 13min 20s
500ms	5.00ms	41min 40s	1h 23min 20s	2h 46min 40s	5h 33min 20s
1s	10.0ms	1h 23min 20s	2h 46min 40s	5h 33min 20s	11h 06min 40s
2s	20.0ms	2h 46min 40s	5h 33min 20s	11h 06min 40s	22h 13min 20s
5s	50.0ms	6h 56min 40s	13h 53min 20s	1D 03h 46min 40s	1D 07h 33min 20s
10s	100ms	13h 53min 20s	1D 03h 46min 40s	2D 07h 33min 20s	4D 15h 06min 40s
30s	300ms	1D 17h 40min 00s	3D 11h 20min 00s	6D 22h 40min 00s	13D 21h 20min 00s
1min	600ms	3D 11h 20min 00s	6D 22h 40min 00s	13D 21h 20min 00s	27D 18h 40min 00s
2min	1.20s	6D 22h 40min 00s	13D 21h 20min 00s	27D 18h 40min 00s	55D 13h 20min 00s
5min	3.00s	17D 08h 40min 00s	34D 17h 20min 00s	69D 10h 40min 00s	138D 21h 20min 00s

Memory Recorder Function: Expansion (64 M)

Time axis range /DIV	Sampling period	Max. recording length			
		32 ch 20000 DIV	16 ch 40000 DIV	8 ch 80000 DIV	4 ch 160000 DIV
100 μ s	1.00 μ s	2s	4s	8s	16s
200 μ s	2.00 μ s	4s	8s	16s	32s
500 μ s	5.00 μ s	10s	20s	40s	1min 20s
1ms	10.0 μ s	20s	40s	1min 20s	2min 20s
2ms	20.0 μ s	40s	1min 20s	2min 40s	5min 20s
5ms	50.0 μ s	1min 40s	3min 20s	6min 40s	13min 20s
10ms	100 μ s	3min 20s	6min 40s	13min 20s	26min 40s
20ms	200 μ s	6min 40s	13min 20s	26min 40s	53min 20s
50ms	500 μ s	16min 40s	33min 20s	1h 06min 40s	2h 13min 20s
100ms	1.00ms	33min 20s	1h 06min 40s	2h 13min 20s	4h 26min 40s
200ms	2.00ms	1h 06min 40s	2h 13min 20s	4h 26min 40s	8h 53min 20s
500ms	5.00ms	2h 46min 40s	5h 33min 20s	11h 06min 40s	22h 13min 20s
1s	10.0ms	5h 33min 20s	11h 06min 40s	22h 13min 20s	1D 20h 26min 40s
2s	20.0ms	11h 06min 40s	22h 13min 20s	1D 20h 26min 40s	3D 16h 53min 20s
5s	50.0ms	1D 03h 46min 40s	1D 07h 33min 20s	3D 15h 06min 40s	7D 06h 13min 20s
10s	100ms	2D 07h 33min 20s	4D 15h 06min 40s	9D 06h 13min 20s	18D 12h 26min 40s
30s	300ms	6D 22h 40min 00s	13D 21h 20min 00s	27D 18h 40min 00s	55D 13h 20min 00s
1min	600ms	13D 21h 20min 00s	27D 18h 40min 00s	55D 13h 20min 00s	111D 02h 40min 00s
2min	1.20s	27D 18h 40min 00s	55D 13h 20min 00s	111D 02h 40min 00s	222D 05h 20min 00s
5min	3.00s	69D 10h 40min 00s	138D 21h 20min 00s	277D 18h 40min 00s	555D 13h 20min 00s

Recorder Function

Time axis range	Chart speed	Approximate recording time on one roll (30 m) of recording paper	Time axis resolution
20ms/DIV	20mm/s(*1)	1min	100 points /DIV
50	20(*1)	25min	
100	20(*1)	5min	
200	20(*1)	10min	
500	20	25min	
1s/DIV	10	50min	
2	5	1hour 40min	
5	2	4hour 10min	
10	1	8hour 20min	
30	20mm/min	1DAY 1hour	
1min/DIV	10	2DAY 2hour	
2	5	4DAY 4hour	
5	2	10DAY 10hour	
10	1	20DAY 20hour	
30	20mm/h	62DAY 12hour	
1h/DIV	10	125DAY	

(*1) Virtual record

18.13 Memory Capacity and Recording Length

Memory capacity and recording length after memory expansion with 9599 MEMORY BOARD.

Memory Recorder Function

Card capacity	Number of divisions per channel			
	When 4 channel is in use	When 8 channel is in use	When 16 channel is in use	When 32 channel is in use
16 M	40000	20000	10000	5000
64 M	160000	80000	40000	20000

Recorder and RMS Recorder Function

Card capacity	Number of divisions
16 M	2000
64 M	10000

Recorder & Memory Function

Card capacity	Number of divisions	
	REC	MEM
16 M	1000	2000
64 M	5000	10000

Chapter 19

Logic and Analog Inputs

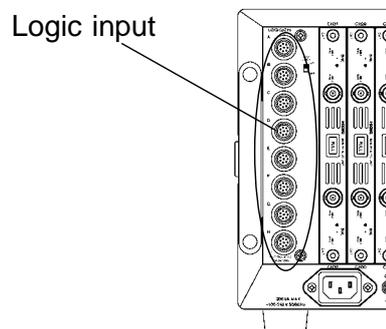
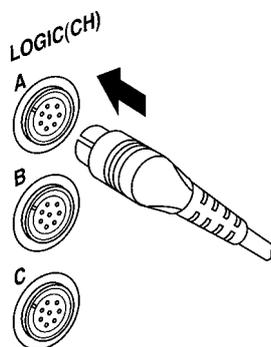
19.1 Logic Inputs

WARNING

- The 8826 has separate inputs for eight probes, but the ground lines of these inputs are not isolated from each other and from the frame ground of the unit (common ground). If voltage having a different ground level is input, a short circuit will occur, depending on the probe type.
- Do not connect logic probes other than supplied by HIOKI to the logic inputs.

Logic Probe Connection

- The logic input is located on the top side of the unit. Up to eight probes can be connected.
- Since one logic probe can record 4 channels, the combined maximum recording capability for logic waveforms is 32 channels.
- Connect the probe by aligning the groove on the plug with the ridge on the connector.



NOTE

- If no logic probe is connected, the corresponding logic waveform is displayed on the screen at high level.
- Carefully read the instruction manual supplied with the probe.

19.1.1 9320 LOGIC PROBE

The 9320 is a logic probe with indicator. It is connected to the logic input unit for the 8800 Series MEMORY HiCORDER. It is equipped with a selector for each channel, so that the input type can be switched between digital input and contact input for each channel. This makes it possible to use this unit for a variety of applications such as measurement of electronic circuits and operation timing of mechanical relays.

DIGITAL INPUT

Set the input selector to DIGITAL when measuring digital signals. In this case, use IC clip lead. Connect the alligator clip to the circuit ground. Use the threshold value selector to select the threshold value.

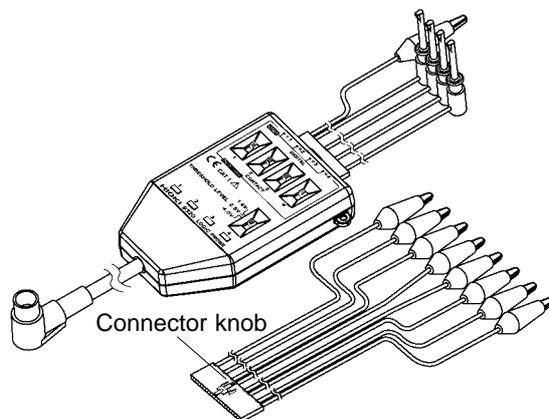
CONTACT INPUT

Set the input selector to CONTACT when measuring contact signals. In this case, use alligator clip lead. When these lines are shorted, H level is applied to the contact input.

Specifications

The number of channels	4 (common ground)	
Input type	Digital input	Contact input
Input resistance	1 M \pm 5% (0 to +5 V) 500 k (+5 to +50 V)	Contact inputs are supplied with a voltage of +5V via the input terminal at approximately 2 k .
Maximum input voltage	0 to 50 VDC	
Response time	less than 500 ns	

Detecting level		
	Digital input (Threshold value)	Contact input (Detecting resistance value)
1.4 V range	1.4 V \pm 0.3 V	more than 1.5 k : opened (Output L) less than 500 : shorted (Output H)
2.5 V range	2.5 V \pm 0.4 V	more than 3.5 k : opened (Output L) less than 1.5 k : shorted (Output H)
4.0 V range	4.0 V \pm 0.5 V	more than 25 k : opened (Output L) less than 8 k : shorted (Output H)



In performing lead replacement, pull out the lead while pressing the connector knob downward.

NOTE

Both the 9306 and 9307 (discontinued product) can also be used.
(Not complied with the CE marking)

19.1.2 MR9321 LOGIC PROBE

The MR9321 is a logic probe with indicator. It is connected to the logic input unit for the 8800 Series MEMORY HiCORDER. This unit detects presence of AC or DC voltage, making it possible to measure the operation timing of relay sequence circuits. Each channel is floated so that connection is easy.

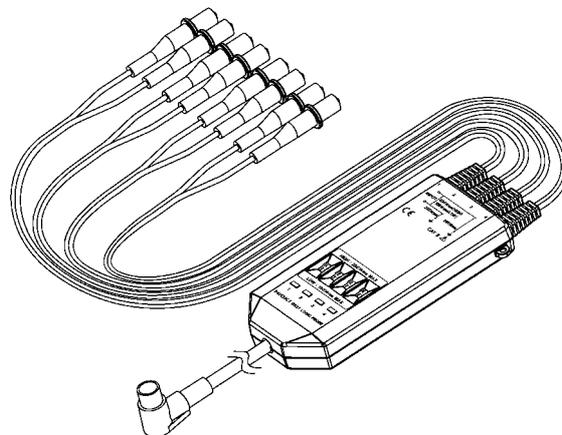
Operation

- Set the input selector in accordance with the measured voltage.
LOW range: Turning AC 100 V and DC 24 V, etc. ON/OFF
HIGH range: Turning AC 200 V, etc. ON/OFF
- Since the inputs are bipolar, polarity should be disregarded.
- Because the inputs are insulated, each channel is connectable to independent potential points.

Specifications

The number of channels	4 (insulated)	
Input voltage range	LOW	HIGH
Input resistance	more than 30 k	more than 100 k
Sensitivity (Output: H)	0 to 10 VAC ± (0 to 15) VDC	0 to 30 VAC ± (0 to 43) VDC
Sensitivity (Output: L)	60 to 150 VAC ± (20 to 150) VDC	170 to 250 VAC ± (70 to 250) VDC
Response time (↓) (↑)	less than 1 ms less than 3 ms with 100 VDC	less than 1 ms less than 3 ms with 200 VDC
Maximum input voltage	150 V rms	250 V rms
Maximum rated voltage to earth	250 V rms	
Dielectric strength	AC2.3 kV / 1 min (between unit and channels)	
Insulation resistance	more than 100 M / 500 VDC (between unit and channels)	

This unit detects absolute values so that negative DC voltages can be applied. The above values for AC voltages are those obtained with sine wave signals of 50/60 Hz.



NOTE

For details on Specifications, refer to the MR9321 LOGIC PROBE manual.

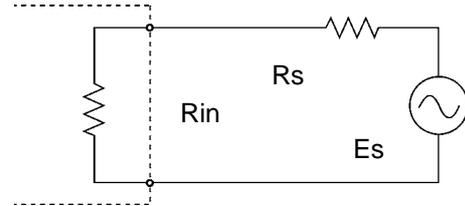
19.2 Analog Inputs

Measurement Errors Caused by Signal Source Internal Resistance

- If the signal source impedance is higher than the input impedance of the unit, a measurement error will occur.
- The input impedance of the 8936 ANALOG UNIT is 1 M Ω . If the signal source impedance is 1 k Ω , an error of about 0.1% will occur.

$$\text{Measurement error} = E_s \left[1 - \frac{R_{in}}{R_s + R_{in}} \right] \text{ [V]}$$

E_s : Signal voltage
 R_s : Signal source resistance
 R_{in} : Input resistance



19.2.1 8936 ANALOG UNIT

Accuracy at 23 ± 5 °C, 35% to 85%RH after zero adjustment after 30-minute warming-up time Accuracy guaranteed for 1 year.

Measurement ranges	5, 10, 20, 50, 100, 200, 500 mV/DIV, 1, 2, 5, 10, 20 V/DIV
DC amplitude accuracy	± 0.4%f.s.
Zero position accuracy	± 0.1%f.s.
Zero position setting range	-50 to 150% of the recording width (in full-size representation of the measurement range)
Temperature characteristic	Gain: ± 0.025%f.s./ °C, Zero position: ± 0.02%f.s./ °C
Frequency characteristic	DC to 400 kHz ± 3 dB (DC coupling) 7 Hz to 400 kHz ± 3 dB (AC coupling, low cut-off frequency: 7 Hz ± 20%)
Noise	450 μVp-p(typ), 750 μVp-p(max) (sensitivity range, with input shorted)
Common mode rejection ratio	80 dB min (at 50/60 Hz and with signal source resistance 100 Ω max)
Low-pass filter	OFF, 5, 500, 5 k, 100 k ± 50%(Hz) -3 dB
Input type	Unbalanced (input isolated from output)
Input resistance / Input capacitance	1 M Ω ± 1% 30pF ± 10pF (at 100kHz)
Input coupling	DC, GND, AC
A/D resolution	12 bits
Voltage axis resolution	80 points/DIV
Maximum sampling speed	1 MS/s (sampling period: 1 μs)
Input terminals	Insulated BNC terminal
Maximum input voltage	400 V DC max
Maximum rated voltage to earth	370 V AC/DC (between each input channel and main unit, and between input channels)
Operational ranges for temperature and humidity	Same as the MEMORY HiCORDER in which the 8936 is installed
Operating place	Same as the MEMORY HiCORDER in which the 8936 is installed
Temperature and humidity ranges for storage	Temperature: -10 °C to 50 °C (50° F to 122° F) Relative humidity: 80%RH max (with no condensation)
Effect of radiated radio-frequency electromagnetic field	± 2% f.s. at 3 V/m
Effect of conducted radio-frequency electromagnetic field	± 28% f.s. at 3 V
Dielectric strength	Between 8936 and main unit, between 8936 and input unit: 3.7 kV AC for a minute
Dimensions	Approx. 170 W × 20 H × 148.5 Dmm (6.69" W × 0.79" H × 5.832" D)
Mass	Approx. 290 g (10.2 oz)
Standard Applying	EMC EN61326, ClassA Safety EN61010 Pollution Degree 2, measurement category II (anticipated transient overvoltage 4000 V)

19.2.2 8937 VOLTAGE/TEMP UNIT

Accuracy at 23 ± 5 °C, 35% to 85%RH after zero adjustment after 60-minute warming-up time
Accuracy guaranteed for 1 year.

Voltage input

Measurement ranges	500 μV/DIV, 1, 2, 5, 10, 20, 50, 100, 200, 500 mV/DIV 1, 2 V/DIV
Zero position setting range	-50 to 150% of the recording width (in full-size representation of the vertical axis)
DC amplitude accuracy	± 0.4% f.s.
Zero position accuracy	± 0.15% f.s.
Temperature characteristic	Gain: ± 0.02%f.s./ Zero position: ± 0.03%f.s./
Frequency characteristic	DC to 400 kHz $\pm \frac{1}{3}$ dB (in 500 μV to 2 V/DIV range) DC to 3 kHz $\pm \frac{1}{3}$ dB (with digital filter ON in 500 μV to 2 mV/DIV range) (data update rate: 100 μs ± 20%)
Noise	75 μVp-p typical, 120 μVp-p max. (with digital filter OFF in 500 μV/DIV range) 20 μVp-p typical, 30 μVp-p max. (with digital filter ON in 500 μV/DIV range)
Input terminals	BNC terminal
Input resistance	1 MΩ ± 1%
Input capacitance	50 pF ± 20 pF (at 100 kHz)
Input coupling	DC, GND, AC
Low-pass filter	OFF, 5, 500, 5 k, 100 k ± 50% (Hz) -3 dB

Temperature input

Measurement ranges	10, 20, 50, 100 °C/DIV
Measurement input range	K: -200 to 1350 R: 0 to 1700 E: -200 to 800 S: 0 to 1700 J: -200 to 1100 B: 300 to 1800 T: -200 to 400 N: -200 to 1300
Zero position setting range	-100 to 100% f.s. (in full-size representation of the vertical axis)
Temperature measurement accuracy	K, E, J, T, N ± 0.1% f.s. ± 1.0 ± 0.1% f.s. ± 2.0 (-200 to 0 °C) R, S ± 0.1% f.s. ± 3 B (effective measurement range: 400 to 1800 °C) ± 0.1% f.s. ± 4
Reference junction compensation	Selectable internal or external

Reference contact compensation accuracy	$\pm 0.1\%$ f.s. ± 1.5 (with internal reference contact compensation and input terminal in state of temperature equilibrium)
Temperature characteristic	$\pm 0.05\%$ f.s./ (sensor: K, E, J, T, N, with drift compensation mode OFF) $\pm 0.25\%$ f.s./ (sensor: R, S, B, with drift compensation mode OFF) $\pm 0.04\%$ f.s./ (all sensors, with drift compensation mode ON)
Frequency characteristic	DC to 1 kHz $\pm 1/3$ dB (data update rate: 250 μ s $\pm 70\%$, with drift compensation mode OFF) (data update rate: 1 s $\pm 20\%$, with drift compensation mode ON)
Input terminals	2-terminal terminal block
Input resistance	5.1 M $\pm 5\%$
Low-pass filter	OFF, 5, 500 $\pm 50\%$ (Hz) -3 dB

Common specifications

Common mode rejection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 maximum)
Input type	Unbalanced (input isolated from output)
A/D resolution	12 bits
Maximum sampling speed	1 MS/s (However, update rate differs with temperature input.)
Maximum input voltage	30 V rms or 60 V DC
Maximum rated voltage to earth	30 V rms or 60 V DC
Operational ranges for temperature and humidity	Same as the MEMORY HiCORDER in which the 8937 is installed
Operating place	Same as the MEMORY HiCORDER in which the 8937 is installed
Temperature and humidity ranges for storage	Temperature: -10 to 50 (14° F to 122° F) Relative humidity: 80%RH maximum (with no condensation)
Effect of radiated radio-frequency electromagnetic field	$\pm 2\%$ f.s. at 3 V/m (at 5 mV/DIV range)
Dielectric strength	Between 8937 and main unit, between 8937 and input unit: 400 V AC for a minute
Dimensions	Approx. 170 W \times 20 H \times 148.5 D mm (6.69" W \times 0.79" H \times 5.832" D mm) (excluding projections)
Mass	Approx. 300 g (10.6 oz)
Standard Applying	EMC EN61326, ClassA Safety EN61010 Pollution Degree 2, measurement category I (anticipated transient overvoltage 330 V)

19.2.3 8938 FFT ANALOG UNIT

Accuracy at 23 ± 5 °C, 35% to 85%RH after zero adjustment after 60-minute warming-up time
Accuracy guaranteed for 1 year.

Number of channels	2 channels
Measurement ranges	5, 10, 20, 50, 100, 200, 500 mV/DIV, 1, 2, 5, 10, 20 V/DIV
DC amplitude accuracy	± 0.4%f.s.
Zero position accuracy	± 0.1%f.s.
Temperature characteristic	Gain: ± 0.025%f.s./°C, Zero position: ± 0.02%f.s./°C
Frequency characteristic	DC to 400 kHz ± 3 dB (DC coupling) 7 Hz to 400 kHz ± 3 dB (AC coupling, low cut-off frequency: 7 Hz ± 20%)
Noise	500 μVp-p(typ), 750 μVp-p(max) (sensitivity range, with input shorted)
Common mode rejection ratio	80 dB min (at 50/60 Hz and with signal source resistance 100 Ω max)
Low-pass filter	OFF, 5, 500, 5 k, 100 k ± 50%(Hz) -3 dB
Anti-aliasing filter	Cutoff frequency (fc) 20, 40, 80, 200, 800, 2 k, 4 k, 8 k, 20 k, 40 k(Hz) These frequencies are automatically set when the anti-aliasing filter is set to ON. Attenuation characteristic: -66 dB, min. (at 1.5 fc)
Input type	Unbalanced (input isolated from output)
Input resistance	1 MΩ ± 1%
Input capacitance	30pF ± 10pF (at 100kHz)
Input coupling	DC, GND, AC
A/D resolution	12 bits
Maximum sampling speed	1 MS/s (sampling period: 1 μs)
Input terminals	Insulated BNC terminal
Maximum input voltage	400 V DC max
Maximum rated voltage to earth	370 V AC/DC (between each input channel and main unit, and between input channels)
Operational ranges for temperature and humidity	Same as the MEMORY HiCORDER in which the 8938 is installed
Operating place	Same as the MEMORY HiCORDER in which the 8938 is installed
Temperature and humidity ranges for storage	Temperature: -10 °C to 50 °C (14°F to 122°F) Relative humidity: 80%RH max (with no condensation)
Effect of radiated radio-frequency electromagnetic field	± 2% f.s. at 3 V/m
Effect of conducted radio-frequency electromagnetic field	± 28% f.s. at 3 V
Dielectric strength	Between 8937 and main unit, between 8937 and input unit: 400 V AC for a minute
Dimensions / Mass	Approx. 170 W × 20 H × 148.5 D mm (6.69" W × 0.79" H × 5.832" D mm) (excluding projections)
Mass	Approx. 290 g (10.2 oz)
Standard Applying	EMC EN61326, ClassA Safety EN61010 Pollution Degree 2, measurement category II (anticipated transient overvoltage 4000 V)

19.2.4 8939 STRAIN UNIT

Accuracy at 23 ± 5 °C, 35% to 85%RH after auto-balancing,
after 60-minutes warming-up time. Accuracy guaranteed for 1 year

Number of channels	2 channels
Appropriate adapter	Strain gauge adapter, Bridge resistance: 120 Ω to 1 kΩ
Bridge voltage	2 ± 0.05 V
Balancing	Electronic auto-balancing
Balance adjustment range	± 10000 μV max
Measurement ranges	20, 50, 100, 200, 500, 1000 μV /DIV
DC amplitude accuracy	± (0.5%f.s. + 2 μV)
Zero position setting range	-50 to 150% of the recording width (in full-size representation of the measurement range)
Zero position accuracy	± 0.5%f.s.
Temperature characteristic	<ul style="list-style-type: none"> • Gain: ± 0.05%f.s./ • Zero position: ± 2 μV / (20,50 μV /DIV) <li style="padding-left: 2em;">± 0.1%f.s./ (other ranges)
Frequency characteristic	DC to 20 kHz $\pm 1_{-3}$ dB
Low-pass filter	OFF, 10, 30, 300, 3k ± 30% (Hz) -3 dB
A/D resolution	12 bits
Maximum sampling speed	1 MS/s (sampling period: 1 μs)
Maximum input voltage	10 V (DC + AC peak)
Maximum rated voltage to earth	30 V rms or 60 V DC
Operational ranges for temperature and humidity	Same as the MEMORY HiCORDER in which the 8939 is installed
Operating place	Same as the MEMORY HiCORDER in which the 8939 is installed
Temperature and humidity ranges for storage	Temperature: -10 °C to 50 °C (14° F to 122° F) Relative humidity: 80%RH max (with no condensation)
Dimensions	Approx. 170 W × 20 H × 148.5 D mm (6.69" W × 0.79" H × 5.832" D mm)
Mass	Approx. 250 g (8.8 oz)
Effect of radiated radio-frequency electromagnetic field	± 5% f.s. at 3 V/m
Dielectric strength	Between 8939 and main unit, between 8939 and input unit: 400 V AC for a minute
Accessories	Conversion cable × 2 (Compatible sensor connector: PRC03-12A10-7M10.5 by TAJIMI)
Standard Applying	EMC EN 61326, Class A Safety EN 61010 Pollution Degree 2, measurement category I (anticipated transient overvoltage 330 V)

19.2.5 8940 F/V UNIT

Accuracy at 23 ± 5 °C, 35% to 85%RH after zero adjustment after 60-minute warming-up time
Accuracy guaranteed for 1 year.

A/D resolution	12 bit
Vertical axis resolution	80 LSB/DIV
Measurement function	Frequency measurement, Count, Duty, Voltage measurement, Current measurement
Maximum sampling speed	1 μs
Low-pass filter	OFF, 5, 500, 5 k, 100 k ± 50% (Hz) -3 dB
Input type	DC, GND, AC (Fixed DC coupling except voltage and current measurement)
Pull up	ON/OFF (Constant OFF in current measurement) Pull up resistance: 10 k
BNC connector	Input resistance: 1 M Ω ± 1% (at pull-up OFF) Input capacitance: 60 pF ± 20 pF (at 100 kHz) Input type: Unbalanced (for Voltage, Frequency, Count, Duty) Note: With the 3273, 3273-50*1, the BNC connector and sensor connector are used together. GND is common with the MEMORY HiCORDER in which the unit is installed.
Sensor connector terminal (Current measurement)	Possible to connect 6 channel Note: With the 3273, 3273-50*1, the BNC connector and sensor connector are used together. GND is common with the MEMORY HiCORDER in which the unit is installed.
Maximum input voltage	30 V rms or 60 V DC
Maximum rated voltage to earth	30 V rms or 60 V DC (BNC)
Operational ranges for temperature and humidity	Same as the Memory HiCorder in which the 8940 is installed
Operating place	Same as the Memory HiCorder in which the 8940 is installed
Temperature and humidity ranges for storage	Temperature: -10 °C to 50 °C (14°F to 122°F) Relative humidity: 80%RH maximum (with no condensation)
Effect of radiated radio-frequency electromagnetic field	± 5% f.s. at 3 V/m
Dimensions	Approx. 170 W × 20 H × 148.5 D mm, 6.69" W × 0.79" H × 5.85" D (excluding projections)
Mass	Approx. 300 g , (10.6 oz)
Standard Applying	EMC EN 61326, Class A Safety EN 61010 Pollution Degree 2, measurement category I (anticipated transient overvoltage 330 V)
Options	9318 CONVERSION CABLE (9270,9271,9272,9277,9278,9279) 9319 CONVERSION CABLE (3273,3273-50*1)

*1:When using the Model 3273-50 with the 8940, bear in mind that the maximum input of the 3273-50 is 15 Arms.

Frequency · Count · Duty Measurement

Frequency ranges	0.05, 0.1, 0.5, 1.5, 10, 50, 100, 500 Hz/DIV 1, 5 kHz/DIV 5, 10, 50, 100, 500 r/min/DIV Power source frequency ranges: 50 Hz (40 to 60 Hz), 60 Hz (50 to 70 Hz)
Frequency accuracy	± 0.2%f.s. (except 100 kHzf.s. range) ± 0.7%f.s. (100 kHzf.s. range) ± 0.032Hz (Power source frequency ranges)
Frequency hold	ON/OFF (waiting time 10 ms, 1 s variable) When hold is OFF, the current measurement value is halved if the next measurement value is not fixed within the waiting time.
Count ranges	5, 10, 50, 100, 500 counts/DIV 1, 5, 10, 50, 100, 500 k counts/DIV
Duty range	100%f.s.
Duty accuracy	± 1% (10 Hz to 10 kHz)
Threshold value (common)	-10 to +10 V variable (0.2 V steps)
Frequency measurement ranges (common)	DC to 100 kHz (Frequency) DC to 90 kHz (Count) 10 Hz to 100 kHz (Duty)
Response time (common)	10 μs not greater (Frequency (more than 300 Hz), Count) 50 μs not greater (Frequency (300 Hz not greater), Duty) The sampling period of the MEMORY HiCORDER in which the unit is installed must be added to the above.

Voltage · Current Measurement

Voltage range	500 μV/DIV, 1, 2, 5, 10, 20, 50, 100, 200, 500 m/DIV 1, 2 V/DIV
Current range	Using the 9270, 9272 (20A), 9277, 3273, 3273-50 5, 10, 20, 50, 100, 200, 500 mA/DIV, 1 A/DIV Using the 9271, 9272 (200A), 9278 50, 100, 200, 500 mA/DIV, 1, 2, 5, 10 A/DIV Using the 9279 100 [*] , 200 [*] , 500 mA/DIV 1 [*] , 2 [*] , 5, 10 [*] , 20 [*] , 50, 100 [*] A/DIV [*] : Vertical resolution 64 LSB/DIV
Frequency characteristic (common)	DC to 400 kHz ± 3 dB (DC coupling) (When using a sensor, depends on the characteristics of the sensor.)
DC amplitude accuracy ^{*1} (common)	± 0.4%f.s. (Using the 9279 ± 0.5%f.s.)
Zero position accuracy ^{*1} (common)	± 0.15%f.s. (Using the 9279 ± 0.2%f.s.)
Temperature characteristic ^{*1} (common)	Gain: ± 0.025%f.s./ Zero position: ± 0.03%f.s./ (range: more than f.s.=100 mV range) ± 0.04%f.s./ (range: more than f.s.=50 mV range)
Common mode rejection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 maximum)
Noise ^{*1}	150 μVp-p max (at 0.5 mV/DIV range)

(^{*1}) : When measuring current, the accuracy and characteristics of the sensor or probe must be added to the above.

19.2.6 8947 CHARGE UNIT

Accuracy at 23 ± 5 °C, 35% to 85%RH after zero adjustment after 60-minute warming-up time
Accuracy guaranteed for 1 year.

Number of input channels	2 channels (switchable) Any of the following can be selected: Charge input, input from preamp, voltage input or individual channels
Input type	Unbalanced input (floating between inputs, floating between input and unit ground, common ground between voltage input and charge input)
Zero position setting range	-5 to 150%f.s. (when vertical axis (× 1) display)
Common mode rejection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 maximum)
Anti-aliasing filter	Cutoff frequency (fc) 20, 40, 80, 200, 400, 800, 2 k, 4 k, 8 k, 20 k, 40 k (Hz) (ON/OFF, auto setting corresponding to the time axis and frequency axis range) Attenuation: -66 dB min at 1.5 fc
Maximum sampling speed	1 MS/s
A/D resolution	12 bits
Operational ranges for temperature and humidity	Temperature: -5 °C to 40 °C (23° F to 104° F) Relative humidity: 80%RH maximum (Same as the MEMORY HiCORDER in which the 8947 is installed)
Temperature and humidity ranges for storage	Temperature: -10 °C to 50 °C (14° F to 122° F) Relative humidity: 80%RH maximum (with no condensation)
Location for use	Same as the MEMORY HiCORDER in which the 8947 is installed
Effect of radiated radio-frequency electromagnetic field	± 10% f.s. at 3 V/m (5 mV/DIV range)
Dimensions	Approx. 170 W × 20 H × 148.5 D mm, 6.69" W × 0.79" H × 5.85" D (excluding projections)
Mass	Approx. 310 g, (10.9 oz)
Standard Applying	EMC EN 61326, Class A Safety EN 61010 Pollution Degree 2, measurement category I (anticipated transient overvoltage 330 V)

Charge Input

Compatible converter	Charge-output type piezoelectric accelerator pickup sensor
Measurement sensitivity	0.1 to 10 pC/(m/s ²)
Measurement range	2,5,10,20,50,100,200,500,1k,2k,5k,10 km/s ² /DIV (Measurement sensitivity: 0.1 to 0.25 pC/(m/s ²)) 1,2,5,10,20,50,100,200,500,1k,2k,5 km/s ² /DIV (Measurement sensitivity: 0.251 to 0.5 pC/(m/s ²)) 500m,1,2,5,10,20,50,100,200,500,1k,2 km/s ² /DIV (Measurement sensitivity: 0.501 to 1.0 pC/(m/s ²)) 200m,500m,1,2,5,10,20,50,100,200,500,1 km/s ² /DIV (Measurement sensitivity: 1.01 to 2.5 pC/(m/s ²)) 100m,200m,500m,1,2,5,10,20,50,100,200,500 m/s ² /DIV (Measurement sensitivity: 2.51 to 5.0 pC/(m/s ²)) 50m,100m,200m,500m,1,2,5,10,20,50,100,200 m/s ² /DIV (Measurement sensitivity: 5.01 to 10.0 pC/(m/s ²))
Amplitude accuracy	± 2%f.s
Temperature characteristic	± 0.2%f.s./
Frequency characteristic	1 Hz to 50 kHz (+1/-3 dB)
Low-pass filter	500,5k Hz ± 50% (-3 dB)
Maximum input charge	± 500 pC (with six high-sensitivity ranges selected) ± 50,000 pC (with six low-sensitivity ranges selected)
Input terminal	Miniature connector (#10-32 UNF)

Input for Sensor Preamp

Compatible converter	Internal preamp type acceleration pickup sensor
Measurement sensitivity	0.1 to 10 mV/(m/s ²)
Measurement range	2,5,10,20,50,100,200,500,1k,2k,5k,10k m/s ² /DIV (Measurement sensitivity: 0.1 to 0.25 mV/(m/s ²)) 1,2,5,10,20,50,100,200,500,1k,2k,5k m/s ² /DIV (Measurement sensitivity: 0.251 to 0.5 mV/(m/s ²)) 500m,1,2,5,10,20,50,100,200,500,1k,2k m/s ² /DIV (Measurement sensitivity: 0.501 to 1.0 mV/(m/s ²)) 200m,500m,1,2,5,10,20,50,100,200,500,1k m/s ² /DIV (Measurement sensitivity: 1.01 to 2.5 mV/(m/s ²)) 100m,200m,500m,1,2,5,10,20,50,100,200,500 m/s ² /DIV (Measurement sensitivity: 2.51 to 5.0 mV/(m/s ²)) 50m,100m,200m,500m,1,2,5,10,20,50,100,200 m/s ² /DIV (Measurement sensitivity: 5.01 to 10 mV/(m/s ²))
Amplitude accuracy	± 2%f.s.
Temperature characteristic	± 0.2%f.s./
Frequency characteristic	1 Hz to 50 kHz(+1/-3 dB) (low-end cutoff frequency = 1 Hz ± 50%)
Low-pass filter	500,5 kHz ± 50%(-3 dB)
Drive power	2 mA ± 20%, +15 V ± 5%
Input terminal	BNC connector

Voltage input

Measurement range	500 μ , 1m, 2m, 5m, 10m, 20m, 50m, 100m, 200m, 500m, 1, 2 V/DIV
DC amplitude accuracy	$\pm 0.4\%$ f.s.
Zero position setting range	$\pm 0.15\%$ f.s.
Temperature characteristic	Gain: $\pm 0.02\%$ f.s./ , zero position: $\pm 0.03\%$ f.s./
Frequency characteristic	DC to 400 kHz +1/-3 dB (DC coupling) 1 Hz to 400 kHz +1/-3 dB (AC coupling, low-end cutoff frequency 1Hz \pm 50%)
Noise	75 μ Vp-p typ., 120 μ Vp-p max. (at 500 μ V/DIV range)
Low-pass filter	5 Hz, 500 Hz, 5 kHz, 100 kHz \pm 50% (-3 dB)
Input resistance	1 M \pm 1%
Input capacity	200 pF max (at 100 kHz)
Input coupling	DC / AC / GND
Maximum input voltage	30 V rms or 60 V DC
Maximum rated voltage to earth	30 V rms or 60 V DC
Input terminal	BNC terminal

Chapter 20

Maintenance and Service

20.1 Maintenance and Inspection

To ensure the safe operation of this unit, perform maintenance regularly.

- If the unit has been subject to moisture, or if oil and dust have accumulated in the unit interior, the danger of electrical shock or fires resulting from the deterioration of insulation increases greatly. If the unit is ever subject to excessive moisture, oil, or dust, cease use immediately, and return the unit to us for maintenance.
- Periodic calibration is necessary to verify and maintain accuracy. If calibration becomes necessary, return the unit to us for maintenance.
- This product uses a lithium battery to back up its memory. As the battery power is consumed, its ability to store measurement conditions diminishes. In the event that measurement conditions can no longer be stored, please contact the manufacturer for repair service.
- Spare and replacement parts for this product are guaranteed to be available only until 7 years after manufacture of this model is terminated.
- If the unit is not functioning properly, check the batteries, the probe and leads wiring, fuse blowing, and the "Troubleshooting" list. If a problem is found, contact your dealer.

Cleaning the Unit

- Gently wipe dirt from the surface of the unit with a soft cloth moistened with a small amount of water or mild detergent.
Do not try to clean the unit using cleaners containing organic solvents such as benzene, alcohol, acetone, ether, ketones, thinners, or gasoline. They may cause discoloration or damage.
- Wipe the LCD display gently with a dry, soft cloth.

Printer Head Cleaning

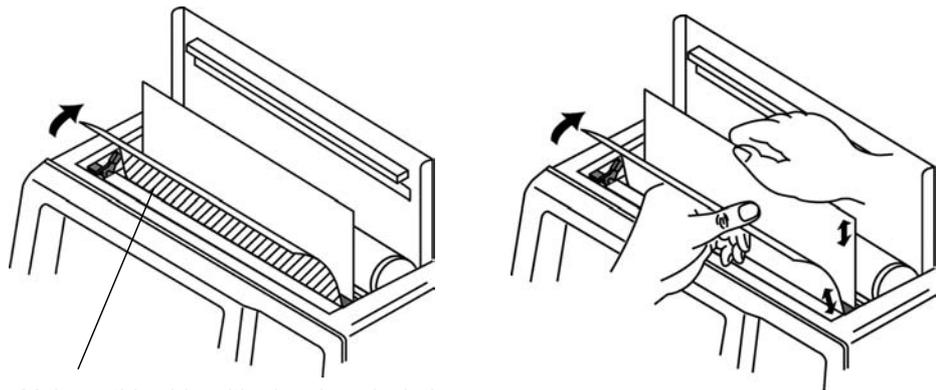
In normal use, the printer does not require periodic maintenance. However, depending on usage conditions, the thermal head may become contaminated by dust or paper scraps. If the print seems light or if there are dropped sections, clean the head as described below.

Method 1

- (1) Press the **SYSTEM** key to call up the SELF CHECK screen.
- (2) Move the flashing cursor to the **Printer check** item.
- (3) Press the **F5** [CLEANING] key for about 5 seconds. During this interval, the printer prints 100% black section.
- (4) If this method does not alleviate the problem, perform the steps of cleaning method 2 as described below.

Method 2

- (1) Moisten printer paper on the rear with alcohol and set the paper in the printer. (If the front side of the paper is moistened, discoloring will occur.)
- (2) Lower the head-up/down lever and move the printer paper back and forth to clean the head.



Moisten this side with cleaning alcohol

NOTE

- Do not use organic solvents such as thinners.
- After extended use, paper residue (visible as a white powder-like substance) may accumulate on the roller. While a small amount of residue has no adverse effect, the roller can be cleaned using an air-blow brush (such as sold as a camera accessory).
- Always use the paper cutter integrated in the printer cover to cut printer paper. If the paper is cut near the thermal head, a large amount of paper residue may accumulate on the roller.

20.2 Unit Replacement Procedure

⚠ DANGER

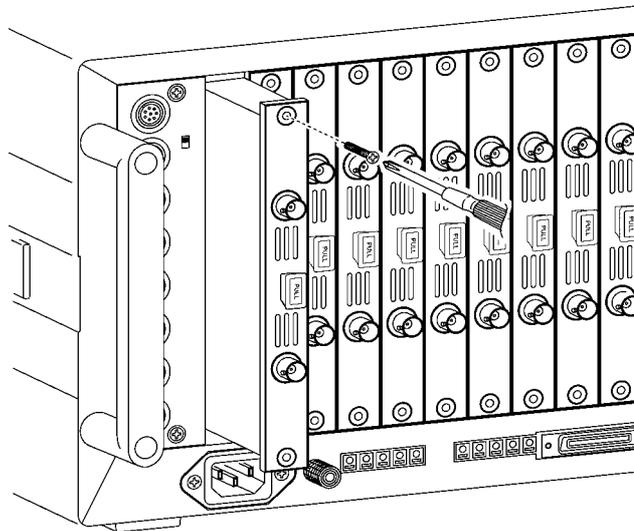
- To avoid the danger of electric shock, never operate the unit with an input unit removed. If you should wish to use the unit after removing an input unit, fit a blank panel over the opening of the removed unit.

⚠ WARNING

- To prevent electrical shock, before adding or replacing the input unit, check that the power for the unit is off and the power cord, connector cables and thermocouples are disconnected. The fixing screws must be firmly tightened or the input unit may not function up to specification, or may even fail.

- The following procedure describes how to remove the input unit.
- Install the units by reversing the procedure for removal.

- (1) Remove the connector cables from all input units.
- (2) Power off the 8826 main unit, and disconnect the power cord.
- (3) Remove the two fixing screws with a Phillips screwdriver, as shown in the figure below.
- (4) Grasp the handle or BNC connector and pull the unit out, as shown in the illustration.



NOTE

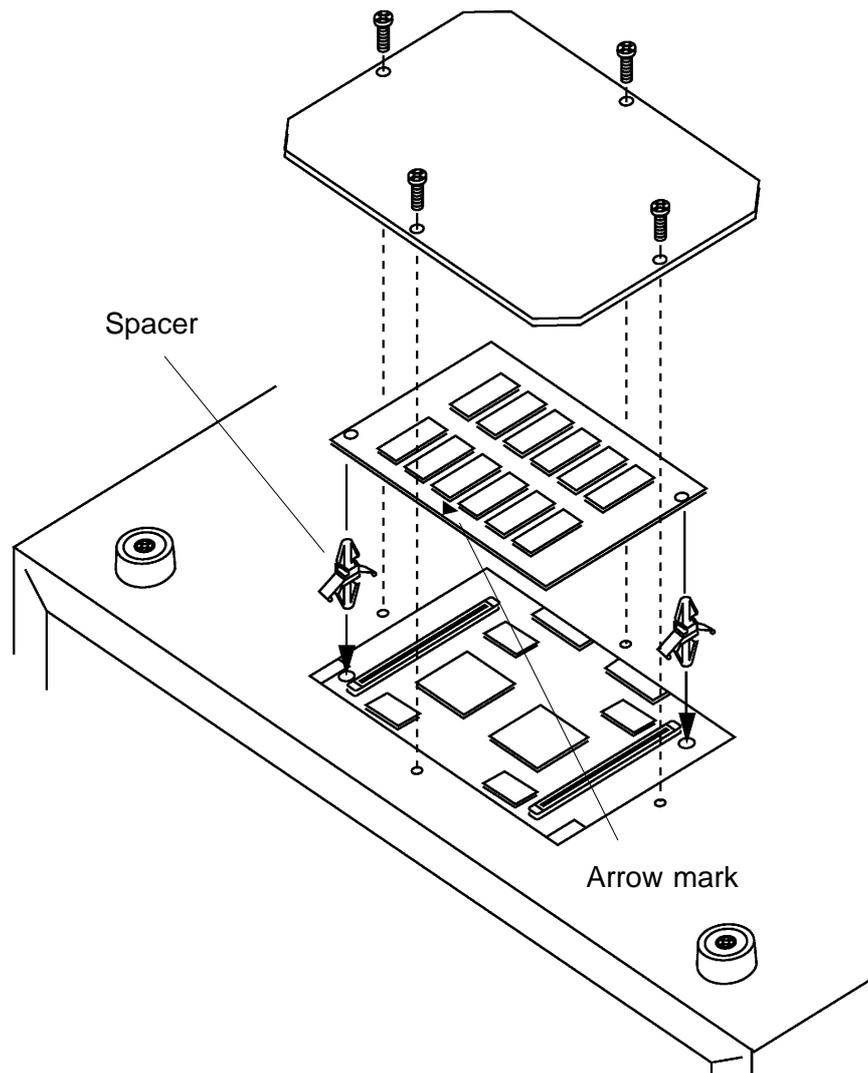
Do not measure with a blank panel removed. Otherwise, the unit internal temperature becomes unstable and consequently the specifications are not met.

20.3 Adding the 9599 MEMORY BOARD

WARNING

- To prevent electrical shock, before adding the 9599 MEMORY BOARD, check that the power for the unit is off and the power cord, connector cables and thermocouples are disconnected.
- The fixing screws must be firmly tightened or the input unit may not function up to specification, or may even fail.

- (1) Remove the connector cables and thermocouples from all input units.
- (2) Power off the 8826 main unit, and disconnect the power cord.
- (3) Using a Phillips-head screwdriver, remove the four bolts from the back plate on the unit bottom panel.
- (4) Position the spacers as illustrated below and secure them to the unit.
- (5) While monitoring the position of the arrow mark, insert the memory board into the connectors on the unit and lock it using the spacers.
- (6) Secure the back plate using the bolts.



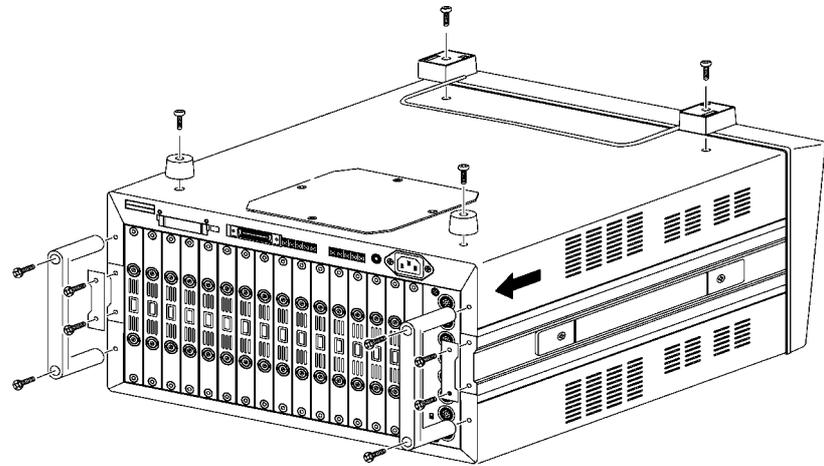
20.4 Removing the Battery Before Discarding the Unit

WARNING

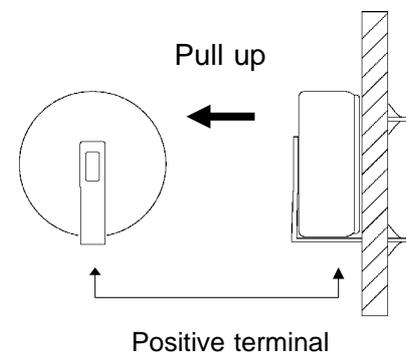
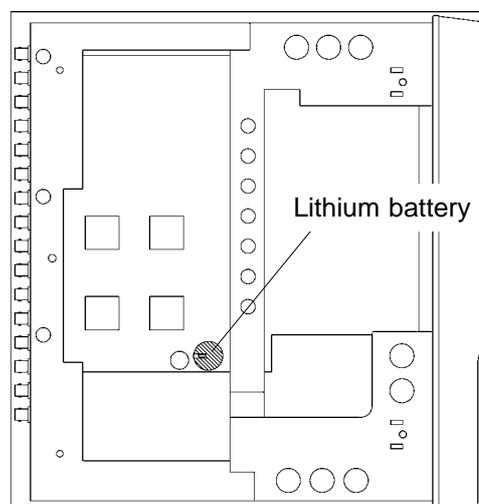
- To avoid electrocution, turn off the power switch and disconnect the power cord and measurement cables before removing the lithium battery.

- The 8826 incorporates a lithium battery for memory backup.
- Before final disposal of the 8826, remove the battery as described below.

- (1) Verify that the power is switched OFF.
- (2) Disconnect all connector cables, the power cord and thermocouples.
- (3) Remove 12 bolts and the stand, as illustrated below, and then slide and remove the cover in the direction of arrow.



- (4) Remove the rear panel. The battery is located in the position on the PCB shown in the figure.
- (5) Pull the battery up and cut the positive terminal with a wire cutter.
- (6) Pull the battery further up.
- (7) Cut the negative terminal (under the battery) with a wire cutter.



CALIFORNIA, USA ONLY

This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

20.5 Troubleshooting

If the unit does not seem to operate normally, check the following points before requesting service.

Problem	Check
LED does not light when the unit is turned on.	Is power cord connected properly?
There is absolutely no variation in the recorded waveform.	Is the " Pretrigger standby " message displayed? (When pretriggering is activated, triggering does not occur until the current waveform is fully captured.)
	Has the " Waiting for trigger " message appeared? Check the trigger settings.
There is absolutely no variation in the recorded waveform.	Is the measurement range setting appropriate?
	Has a low pass filter been set?
	Has a vernier setting been set?
	Has a offset cancel setting been set?
The printed recording is non-existent.	Is the recording paper back to front?
Even when the PRINT or the COPY key is pressed, no data is printed.	Make sure the destination of the printout created by pressing the PRINT key or the COPY key is set to "Internal Printer."
The printed recording is very faint.	Are you using the correct (thermal) recording paper?
During memory recorder operation, 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. For details, see Section 21.3.2.
Recording lines are dense or blurred.	Input signal contains ripple components. Make suitable filter settings at input unit.
Recording lines are duplicated.	When "Dotted line" is selected as the printed line type in the waveform display color settings, the top and bottom of the line become separated by a 1-dot gap. With waveforms that have little variation, this can cause waveform printing to appear variously as one line or as two lines. To correct this, select "Solid line" as the printed line type.
The keys are dead and do not respond.	Has the unit been put into the key lock condition (message " KEY LOCK " appeared)? Press the KEY LOCK key to clear the key lock condition.
	Is the unit being remotely controlled (" GP-IB REMOTE " is displayed, if the GP-IB interface is being used)?
Some channels cannot be used.	Is the number of channels to be used restricted?
The size of a waveform does not change, even if the input range is changed.	Has the variable function been enabled? Disable the variable function.

NOTE

If none of the above conditions apply, and the cause of the problem is not understood, try performing a **SYSTEM RESET**.
All the settings will revert to the factory settings.
For details, see Section 12.6.3.

Chapter 21

Appendix

21.1 Error Messages

21

The unit produces two levels of message to indicate problems. These are distinguished as follows.

Error messages

- The "ERROR" indication appears at the bottom of the screen, followed by the message. This remains until the cause of the error is removed, or the STOP key is pressed.
- If the "beep sound" item on the system screen is set to ON, then the beeper sounds intermittently while the message is displayed.

Error Message and explanation

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 11 : Printer is not ready.	• External printer is not ready to printout. Set the external printer.
ERROR 12 : Set printer power on	• Check the external printer connection and power on.
ERROR 13 : Paper End	• Printer paper has run out. Reload.
ERROR 14 : Printer Error.	• Check the built-in printer.

Warning Messages

- The "WARNING" indication is displayed on the bottom line of the screen, followed by the message, but disappears after a few seconds.
- Warning messages also disappear if any key is pressed.
- If the "beep sound" item on the system screen is set to ON, then the beeper sounds once only when the message is displayed.

Warning Message and explanation

WARNING 60 : Insert MO disk.	• No disk is present in the MO disk drive. Insert one.
WARNING 70 : Insert Floppy disk .	• No disk is present in the floppy disk drive. Insert one.
WARNING 71 : Cannot load (not 8826 data)	• Data cannot be loaded, because it is not a set of data created by the 8826.
WARNING 72 : Illegal format .	• The floppy disk is not a correctly formatted MS-DOS disk, or is a 2DD, 640 KB format disk.
WARNING 73 : Write Protected .	• The floppy disk is write-protected. Change the write-protect setting or use a different disk.
WARNING 74 : Disk full .	• There is insufficient space remaining on the floppy disk.
WARNING 75 : File is read only .	• File cannot be written or deleted, because it is read-only.
WARNING 76 : General failure .	• Access to disk is not possible because of some low-level error, such as in formatting or file saving.
WARNING 80 : Insert PC card.	• No card is present in the PC card slot. Insert one.
WARNING 90 : File already exists.	• Another file of the same name exists. Saving cannot be performed.
WARNING 91 : Directory full.	• Since only a limited number of files (including directory) can be created in the root directory.
WARNING 92 : Directory not empty.	• The directory is not empty.
WARNING 93 : Disk full.	• Little capacity is available.
WARNING 94 : Path name error.	• Up to 127 characters can be used for a path name.
WARNING 95 : Empty directory name.	• Name the directory.
WARNING 96 : Directory already exists.	• Another directory of the same name exists. Saving cannot be performed.
WARNING 97 : 2DD type FD.	• 2DD-type FD. Select the suitable format.
WARNING 98 : 2HD type FD.	• 2HD-type FD. Select the suitable format.
WARNING 99 : Conditions for OVERWRITE are not satisfied.	• Match the unit condition and file data condition (function and time-axis).
WARNING 201 : Set printer paper.	• Printer paper has run out. Reload.
WARNING 202 : Set printer lever	• The head up/down lever has been left in the up position.
WARNING 205 : Invalid (START)	• The key pressed is not valid, because measurement operation is in progress.
WARNING 207 : AUTO RANGE failure .	• The auto ranging function has failed. Check the input signal.
WARNING 208 : Cannot SAVE. (Write Protected)	• Remove the write-protect.
WARNING 209 : Cannot SAVE. (Disk Full)	• Little capacity is available.
WARNING 213 : Invalid (MEASUREMENT)	• Pressed key is invalid, because parameter processing is ON.
WARNING 214 : Invalid. (Pre Trigger)	• Additional recording set on, therefore pre-trigger can not be set.
WARNING 215 : Cannot set -95%.	• The pre-trigger cannot be set "-95%" at a recording length of 160000 DIV.

WARNING 216 : MO drive selected in auto-save.	• MO drive selected in auto-save, therefore SCSI cannot be selected.
WARNING 217 : SCSI selected in auto-save.	• Connected SCSI device selected in auto-save, therefore MO disk cannot be selected.
WARNING 300 : Cannot START. (SYSTEM)	• Cannot start measurement from SYSTEM screen.
WARNING 301 : Invalid (SYSTEM)	• The key pressed is not valid on the system screen.
WARNING 324 : Ignore in running . (AVERAGE)	• Because averaging is used, waveform processing is not carried out during the start operation.
WARNING 325 : Invalid . (Waveform processing)	• The vernier change is disabled for the processed waveforms.
WARNING 327 : Invalid . (COMPARISON)	• Pressed key is invalid, when waveform evaluation is being carried out.
WARNING 328 : Invalid . (OVER LAY)	• Operation is not possible, since the overlay function is enabled.
WARNING 329 : Wrong format for Comparison .	• Since the format is not SINGLE or XY single, a waveform decision is not possible.
WARNING 330 : Cannot set . (SHOT too long)	• The recording length is too long for the memory segmentation function or a waveform processing calculation to be carried out.
WARNING 334 : Cannot set.(AVERAGE)	• Averaging and waveform decision cannot be carried out.
WARNING 335 : Cannot set . (SEQUENTIAL)	• Waveform processing cannot be carried out, because memory segmentation function is active.
WARNING 336 : Cannot set . (MULTI BLOCK)	• Waveform processing cannot be carried out, because memory segmentation function is active.
WARNING 337 : Cannot set . (ROLL MODE)	• Overlay and waveform decision cannot be carried out, because roll mode is active.
WARNING 338 : Cannot set .(OVER LAY)	• Waveform processing cannot be carried out, because overlay function is active.
WARNING 339 : Invalid .(STATUS)	• On the status screen, the key pressed is invalid.
WARNING 340 : Invalid . (EXT sampling)	• External sampling cannot be carried out.
WARNING 345 : Cannot set. (AND logic trigger)	• AND cannot be set between trigger source RMS level trigger and the logic trigger.
WARNING 346 : Cannot set. (AND rms level)	• AND cannot be set between trigger source RMS level trigger and the logic trigger.
WARNING 347 : Invalid . (Pre Trigger)	• If no trigger has been set, pre-trigger (0%) is invalid.
WARNING 351 : Cannot set . (Free run)	• The pre-trigger setting cannot be made, since all trigger sources are switched off (free run).
WARNING 352 : Invalid .(CHAN)	• On the CHANNEL screen, the key pressed is invalid.
WARNING 353 : Cannot set. (time/div:100ms - 5min)	• The voltage drop trigger cannot be used when the time axis range is 100ms to 5 min/DIV.
WARNING 354 : Cannot set. (frequency:133mHz-400Hz)	• The voltage drop trigger is available is a frequency-axis range of 800 Hz to 400 kHz.
WARNING 355 : Change time axis. (RECORDER)	• Since the memory time axis range is delayed, the recorder time axis is delayed.
WARNING 356 : Change time axis. (MEMORY)	• If the speed of the recorder time axis range is increased beyond two steps below the memory time axis range, the memory time axis range speed is incremented.
WARNING 357 : AAF is invalid	• The anti-aliasing filter setting is invalid for the time axis range of 100 to 500 μ s and the frequency range of 400 to 80 kHz.

WARNING 358 : Change the time axis range (1 ms ~)	• The anti-aliasing filter setting is invalid for the time axis range of 100 to 500 μ s. Please change the time axis to between 1 ms and 5 min.
WARNING 359 : Change the frequency range (40 kHz ~)	• The anti-aliasing filter setting is invalid for the frequency range of 400 to 80 kHz. Please change the frequency range to between 40 kHz and 133 mHz.
WARNING 380 : No data in Ref . Block.	• 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. Start measurement operation to capture data.
WARNING 384 : Different Ref . shot .	• The recording lengths are different for the reference block and the block specified by the "using block" item. Capture data with the recording lengths set the same.
WARNING 386 : Invalid . (RECORDER)	• In the recorder function, the key pressed is invalid.
WARNING 387 : Invalid . (X-Ycont)	• In the X-Y recorder function, the key pressed is invalid.
WARNING 388 : No comparison AREA .	• No waveform evaluation area. Create waveform evaluation area.
WARNING 389 : Cannot use, Printer .	• The printer cannot be used when the time axis range is 20 to 200 ms/DIV and CONT.
WARNING 390 : Cannot set over up level .	• Setting cannot be higher than upper limit.
WARNING 391 : Cannot set under low level .	• Setting cannot be lower than lower limit.
WARNING 395 : Variable is ON.	• Since the variable is set to ON, the waveform will maintain its current size even if the voltage-axis range is changed.
WARNING 396 : Out of range . (variable)	• The settable range for the variable function (captured measurement range value $\times \pm 10000$) was exceeded. When this warning appears, the upper and lower value setting is automatically changed to be within range.
WARNING 397 : Out of range . (scaling)	• POINT was set for scaling and the settable range was exceeded. See Section 21.3.7.
WARNING 398 : A/B cursor positions invalid.	• Cursor A and B are not located correctly.
WARNING 421 : Equation contains a syntax error.	• Equation contains a syntax error. Correct equation.
WARNING 422 : Cannot copy the equation. (Zxx)	• Copy function cannot be carried out, because the copy source equation contains a Z number higher than the copy target.
WARNING 423 : Upper value has to be bigger than lower value.	• Upper value has to be bigger than lower value.
WARNING 425 : Length of data in memory is too short.	• The recording length is not sufficient for the number of FFT points.
WARNING 610 : No interface card.	• Insert the interface card (PC card).
WARNING 620 : Cannot connect. (LAN)	• Check the settings or connection environment.
WARNING 622 : LAN: Bad Ip address.	• The IP address is not set correctly.
WARNING 623 : LAN: Bad server Ip address.	• The IP of the server (that runs the 9333) is not specified correctly.
WARNING 624 : LAN: Can not connect to server.	• The 8826 cannot connect to the PC that runs the 9333. Check the connection environment.
WARNING 625 : LAN: Can not connect to 9333.	• The 8826 cannot connect to the 9333. Check on the PC to see whether the 9333 is in standby status

WARNING 626 : LAN: Connection timed out.	• Check the connection environment.
WARNING 627 : LAN: Transfer was aborted.	• Data transmission is interrupted by the <STOP> key or from the 9333.
WARNING 628 : LAN: Network error.	• Check the connection environment.
WARNING 629 : LAN: Server not found or DNS failed.	• Check whether the DNS server is running or set up correctly.
WARNING 630 : LAN: DHCP failed.	• Check whether the DHCP server is running correctly on the network.
WARNING 797 : Mem shot changed.	• Since the recording length is long, the recording length will also be short.
WARNING 798 : Invalid. (time/div:20ms-200ms)	• The printer cannot be enabled when the time axis range is set to 20 to 200 ms/DIV for the Recorder & Memory function.
WARNING 799 : Invalid.(shot:CONT.)	• Because the recording length set the CONT.

21.2 Glossary

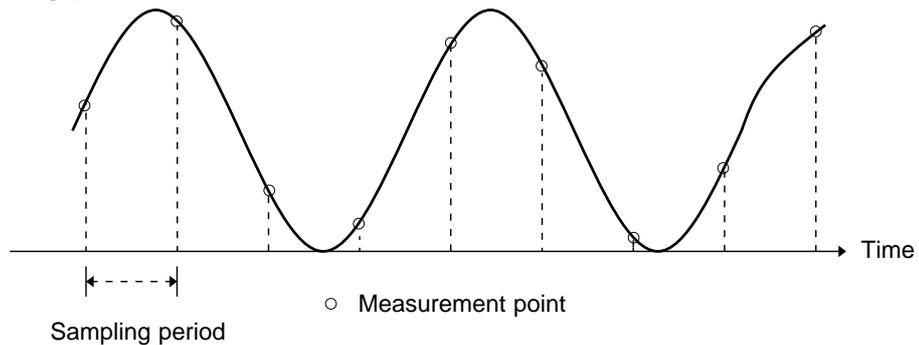
A/D	Conversion of an analog quantity into a digital quantity
Aliasing error	Phantom signal components; a phenomenon that occurs if sampling frequency is low in relation to the frequency of the sampled signal (see Section 21.3.2).
Active low	A signal that becomes active when its voltage changes from High level to Low level.
Analog	Continuous physical quantity such as voltage or current
Attenuator	Device for reducing the level of a signal
Bit	Smallest unit of binary information
Byte	Unit of information. 1 byte is made up of 8 bits.
Channel (CH)	Input signal route
Chart	Printout of recorded waveform
Chassis	Metal frame of the unit
Comment	Comments can be entered by the user, such as to describe measurement conditions, which can then be printed on the recording paper.
Common mode	Voltage between ground and measurement input line
Cutoff frequency	Point where the filter output amplitude is $1/\sqrt{2}$ of the input.
Digital	Discrete physical quantity
DIV (division)	One measurement grid unit on the display or printout.
Dynamic range	Ratio of maximum vs. minimum amplitude that can be displayed
FFT	Fast Fourier Transform. Refer to Section 21.3.10 for details.
File	A collection of data on a medium such as tape
LED	Abbreviation of "light-emitting diode"
Logic-level	Waveform expressed as High and Low level
Logical format	Formatting by which necessary information suitable for the 8826 is written to physically formatted disks.
Low-pass filter	Filter that passes through only signals below a certain frequency
Memory	A device for storing digital data
MS-DOS	Personal computer operating system. MS-DOS is a registered trademark of Microsoft Corporation.
Offset	Amount of shift in relation to 0 V when scaling is used
Open collector	A type of output requiring an external pull-up resistance.
Physical format	Formatting implemented prior to the use of disks.
Position	When referring to the position of the waveform along the measurement range on the display, this refers more precisely to the origin, that is the position corresponding to 0 V.
Pre-trigger	The condition of the signal before triggering occurred

Probe	Signal line for supplying the signal to the input
PT	Abbreviation of (voltage) "potential transformer"
Recording length	Total amount of sampling data expressed as number of increments
Reference junction compensation	When thermocouples are used, the temperature difference between the object and the measuring equipment terminal is measured. Reference junction compensation takes into account the terminal temperature so that the object temperature can be directly read.
Ripple component	AC component of noise
r/min	A unit of rotation, signifying the number of rotations per minute (rpm).
Sampling	Measuring an analog waveform at regular intervals
Sampling rate	Rate at which sampling carried out; sampling frequency
Scaling	Conversion of voltage value into a specified unit
Storage	Storing measurement data in the internal memory
Thermal head	Print head of thermal printer
Threshold value	When turning an analog signal into a logic signal, the level at which the measured value is divided between High and Low.
Trigger	An event that causes a certain action (such as starting or stopping a measurement) to happen.
Unbalanced input	Using a two-pole input in such a way that one pole carries the signal referenced to the other pole.
Word	A unit for expressing digital data. The digital data for one input signal point after conversion.

21.3 Reference

21.3.1 Sampling

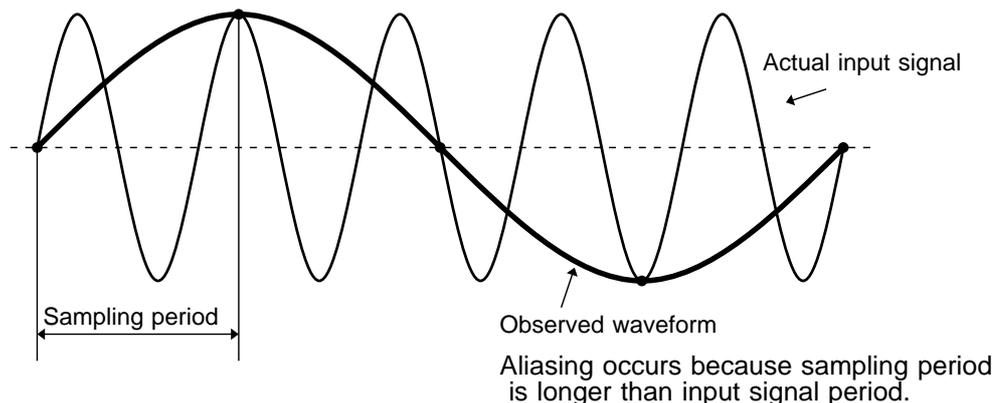
- The 8826 converts the input signal to a digital value, then carries out all internal processing digitally. This process of converting an analog signal to digital values is termed sampling.
- Sampling measures the magnitude of the signal at fixed time intervals (sampling periods).



- 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 ($1/T$).

21.3.2 Aliasing

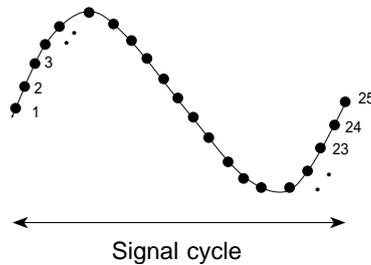
If the frequency of the signal being measured is significantly higher than the sampling rate, it is possible for sampling to produce an apparent signal which is actually nonexistent. This phenomenon is termed aliasing.



- 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 frequency limit 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.

21.3.3 Measurement Limit Frequency

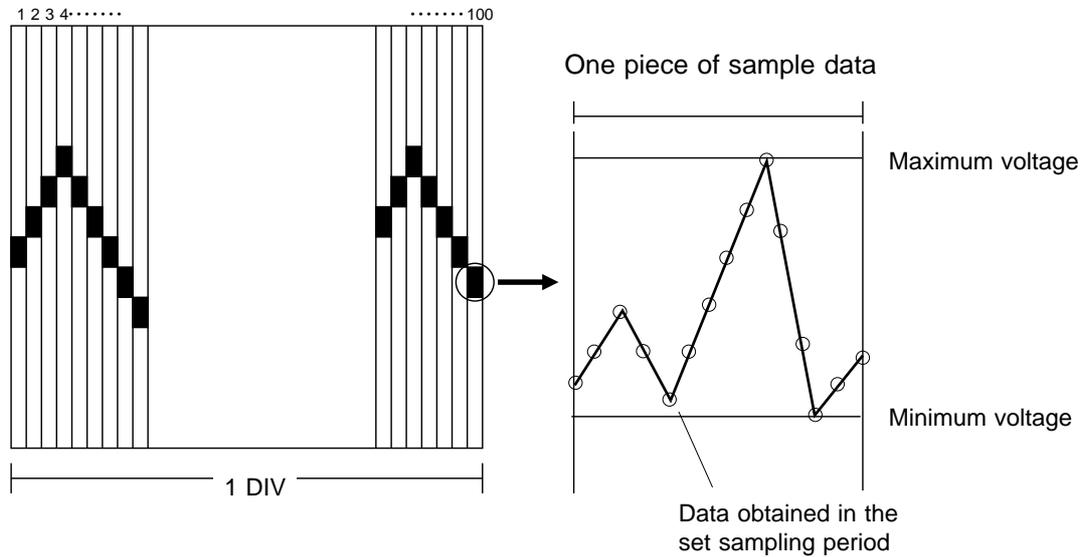
- As a general rule, to ensure that sampling catches the peaks of a typical sine wave input on the display, more than 25 samples are required for each input cycle.
- The measurement limit frequency changes depending on the time axis range.



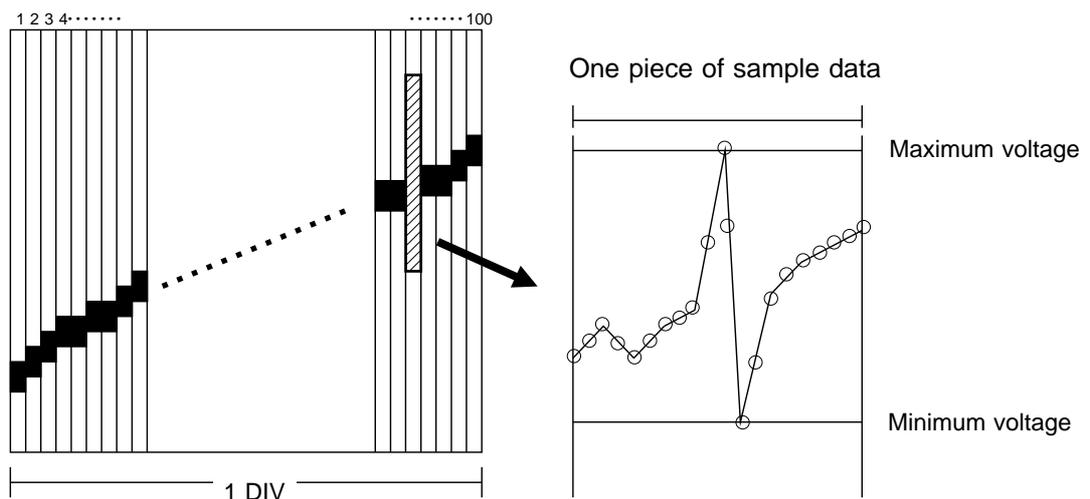
TIME/DIV	Sampling period	Measurement limit frequency	TIME/DIV	Sampling period	Measurement limit frequency
100 μ s/DIV	1 μ s	40 kHz	200 ms/DIV	2 ms	20 Hz
200 μ s/DIV	2 μ s	20 kHz	500 ms/DIV	5 ms	8 Hz
500 μ s/DIV	5 μ s	8 kHz	1 s/DIV	10 ms	4 Hz
1 ms/DIV	10 μ s	4 kHz	2 s/DIV	20 ms	2 Hz
2 ms/DIV	20 μ s	2 kHz	5 s/DIV	50 ms	0.8 Hz
5 ms/DIV	50 μ s	800 Hz	10 s/DIV	100 ms	0.4 Hz
10 ms/DIV	100 μ s	400 Hz	30 s/DIV	300 ms	0.13 Hz
20 ms/DIV	200 μ s	200 Hz	1 min/DIV	600 ms	0.067 Hz
50 ms/DIV	500 μ s	80 Hz	2 min/DIV	1.2 s	0.033 Hz
100 ms/DIV	1 ms	40 Hz	5 min/DIV	3 s	0.013 Hz

21.3.4 Recorder Function

- One division is equal to 100 samples.
- One piece of sample data collected using the recorder function contains the maximum and minimum voltage obtained in the set sampling period. Therefore, this data is of a certain width.



When a short sampling period is set and the input waveform changes slightly, a sudden disturbance such as noise will increase the difference between the maximum and minimum values. To eliminate this phenomenon, set a long sampling period.

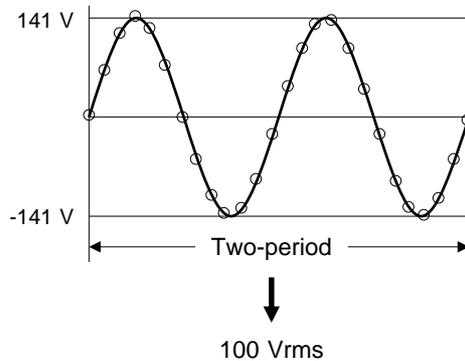


【 Set a short sampling period 】

21.3.5 RMS Recorder Function

- For the RMS recorder function, the sampling period is fixed to 20 RMS value data items per second.
- One division is equal to 100 samples.

Calculate one RMS value



Sample the 50 Hz or 60 Hz waveforms at 200 μ s and calculate one RMS value item using two-period data.

[Two-period]

50 Hz : 40 ms 200 sampling data

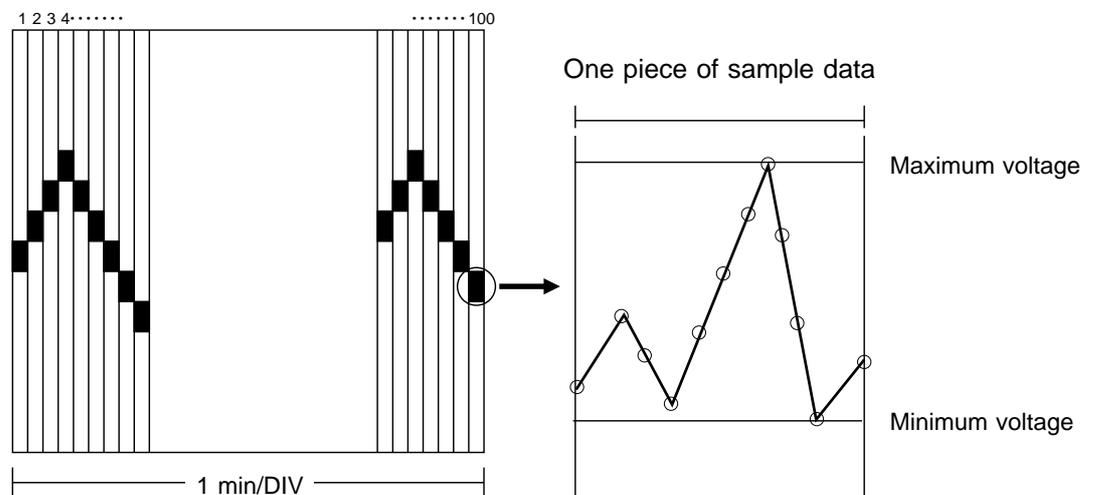
60 Hz : 33.4 ms 167 sampling data

(1) Time axis: 5 s/division

Since the sampling period is fixed to 20 RMS-value data items per second, 5 s/division provides 100 RMS-value data items per division. This value is in agreement with 100 samples per division and, therefore, the voltage axis does not have a width (upper and lower limits).

(2) Time axis: other than 5 s/division

The maximum and minimum values are specified based on the RMS-value data (by multiplying 20 RMS-value data items per second by the time-axis range [s/division]/100), and the data containing these maximum and minimum values are defined as one item of sample data. When the time-axis range is set to 1 mm/division, the maximum and minimum values are specified in the RMS-value data (20×60 [s/division]/100 = 12), and the data containing these maximum and minimum values are defined as one item of sample data.



○ : RMS-value data (20×60 [s/division]/100 = 12)

21.3.6 Averaging Equations

For time axis averaging, summing averaging is synchronized by the trigger. If trigger synchronization is not performed, the results will be meaningless. In the FFT function, unlike time axis averaging, results are valid also if no trigger synchronization is used. But if the characteristics of the input waveform allow triggering, using the trigger for synchronization is recommended.

Summing averaging (single averaging in FFT)

Captured data are added sequentially and the sum is divided by the number of samples.

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

n : Averaging count

A_n : Result of n times averaging

Z_n : n -th measurement data

Exponential averaging

Most recent data are given greatest weighting, and the weighting of older data is reduced with an exponential function.

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

N : Specified averaging count

n : Averaging count

A_n : Result of n times averaging

Z_n : n -th measurement data

Peak hold (frequency axis)

The specified number of samples are captured, and the peak value is held (stored) for each frequency.

21.3.7 2-point Method Scaling Equation

$$Y = \{ (SC_H - SC_L) / (V_H - V_L) \} X + \{ (V_H \times SC_L - V_L \times SC_H) / (V_H - V_L) \}$$

V_H : Voltage high point SC_H : Scaling high point

V_L : Voltage low point SC_L : Scaling low point

The ranges for the parts enclosed in dotted lines are as follows.

-9.9999E+9	{	}	value of enclosed part	-1.0000E-9
	{	}	value of enclosed part	= 0
+1.0000E-9	{	}	value of enclosed part	+9.9999E+9

- When a setting outside of the above range is attempted, a warning indication is given and the setting becomes "converted value" = "voltage value" (no scaling).
- For channels in which waveform processing result data are recorded, only the unit is valid (scaling is invalid).
- The scaling value is used for the gauge scale, upper and lower display limits, and for A/B cursor readings.

21.3.8 Parameter Calculation Details

(1) Average value

Calculates the average value (V) of the waveform data.

【 Equation 】

$$AVE = \frac{\sum_{i=1}^n di}{n}$$

AVE: average value

n: number of data samples

di: *i*-th data of the source channel

(2) RMS value

Calculates the RMS (effective) value (V) of the waveform data. When scaling is used, the value is calculated after scaling.

【 Equation 】

$$RMS = \sqrt{\frac{\sum_{i=1}^n di^2}{n}}$$

RMS: effective value

n: number of data samples

di: *i*-th data of the source channel

(3) Peak-to-peak value

Calculates the peak-to-peak (maximum-minimum) value of the waveform data.

(4) Maximum value

Calculates the maximum value of the waveform.

(5) Time to maximum value

- Calculates the time interval from the triggering point to the maximum value of the waveform (in seconds).
- If there are two maximum value points, the time to the first point is calculated.

(6) Minimum value

Calculates the minimum value of the waveform.

(7) Time to minimum value

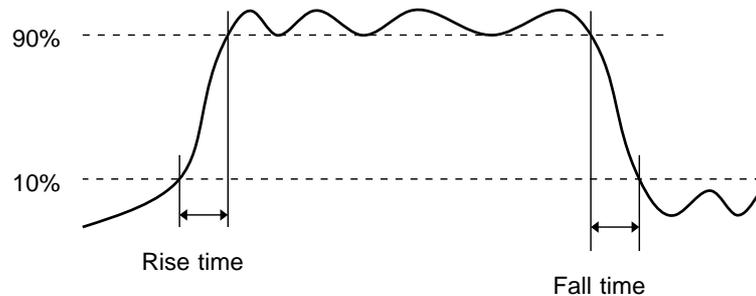
- Calculates the time interval from the triggering point to the minimum value of the waveform (in seconds).
- If there are two minimum value points, the time to the first point is calculated.

(8) Period**(9) Frequency**

- Displays the period (s) and frequency (Hz) of the signal waveform.
- The calculation is performed by determining the middle point of the signal amplitude and then measuring the interval from the point when that level is crossed (in rising or falling direction) to the point when it is next crossed.

(10) Rise time**(11) Fall time**

- From the captured waveform data, the 0% and 100% level is determined, and the rise time (s) is taken as the time required to go from 10% to 90% (fall time: from 90% to 10%).
- In the captured waveform data, the first rising slope (or falling slope) is used to make the calculation.
- If the A/B cursors (vertical, trace) are used, the first rising slope (or falling slope) within the range defined by the cursors is used.

**(12) Standard deviation**

Calculates the standard deviation (V) of the waveform data.

【 Equation 】

$$= \left(\sum_{i=1}^n (d_i - AVE)^2 / n \right)$$

: standard deviation

AVE: average value

n: number of data samples

di: i-th data of the source channel

(13) Area value

- Calculates the area bordered by the signal waveform and the zero position (potential 0 V).
- If the A/B cursors (vertical, trace) are used, the area between the cursors is calculated.

【 Equation 】

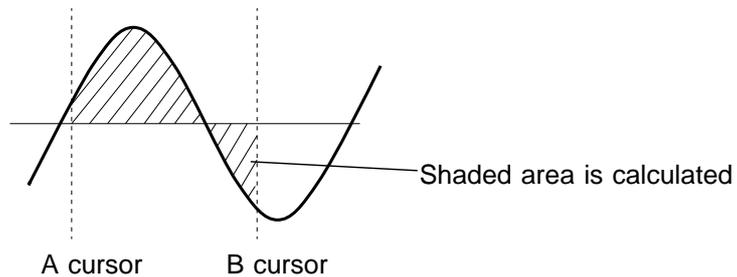
$$S = \sum_{i=1}^n |d_i| \cdot h$$

S: Area value

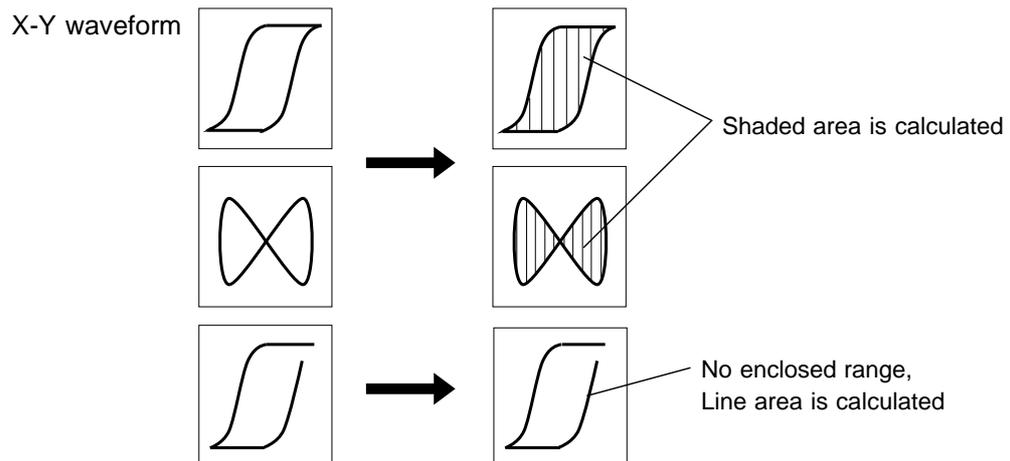
n: number of data samples

d_i: *i*-th data of the source channel

h = *t*: sampling period

**(14) X-Y area value**

- Calculates the area (V^2) after X-Y plotting.
- The waveform is plotted on the X-Y screen, and the area enclosed by the plot lines is calculated.
- In single, dual, or quad screen, the A/B cursors (vertical, trace) can be used to specify the range (see Section 11.2.) for X-Y plotting and area calculation.
- On the X-Y screen of the memory recorder function, it is not possible to specify the range with the A/B cursors.

**NOTE**

- Depending on the signal waveform, values for parameters (8), (9), (10), and (11) may not be displayed.
- When the scaling function is used, scaling is first applied to waveform data, and then the parameters are calculated. The parameter unit is determined by the scaling unit (see Section 9.7).

21.3.9 Details on Operators

This section describes the operators used in waveform operation. The parameter " b_i " shows the operational result, and " d_i " shows the source channel, respectively, in which " i " indicates the serial number of data.

(1) The four arithmetical operations (+, -, *, /)

According to the operators set, the four arithmetical operations are performed.

(2) Absolute value (ABS)

【 Equation 】

$$b_i = | d_i | \quad (i = 1, 2, \dots, n)$$

(3) Exponential (EXP)

【 Equation 】

$$b_i = \exp(d_i) \quad (i = 1, 2, \dots, n)$$

(4) Common logarithm (LOG)

【 Equation 】

$$\text{When } d_i > 0, \quad b_i = \log_{10} d_i$$

$$\text{When } d_i = 0, \quad b_i = - \quad (\text{overflow value is output})$$

$$\text{When } d_i < 0, \quad b_i = \log_{10} | d_i | \quad (i = 1, 2, \dots, n)$$

【 Reference 】 Use the following equation to convert to natural logarithm:

$$\ln X = \log_e X = \log_{10} X / \log_{10} e$$

$$1 / \log_{10} e \quad 2.33E + 0$$

(5) Square root (SQR)

【 Equation 】

$$\text{When } d_i \geq 0, \quad b_i = \sqrt{d_i}$$

$$\text{When } d_i < 0, \quad b_i = - \sqrt{|d_i|} \quad (i = 1, 2, \dots, n)$$

(6) Moving average (MOV)

【 Equation 】

$$b_i = \frac{1}{k} \int_{t=i-k/2}^{t=i+k/2} dt \quad (i = 1, 2, \dots, n)$$

dt : t -th data of source channel

k : number of points for averaging (1 to 4000)

【 Reference 】 1 DIV = 100 points

(7) Parallel displacement on time axis (SLI)

Shifts the value on the time axis by a certain number of points.

【 Equation 】

$$b_i = d_{i-k} \quad (i = 1, 2, \dots, n)$$

k : number of points for averaging (-4000 to 4000)

【 Reference 】 After shifting the waveform, the part right or left without source channel data becomes 0 V. 1 DIV = 100 points

(8) Differentiation once (DIF)**(9) Differentiation twice (DIF2)**

- 1st and 2nd differential are calculated using the 5th-order Lagrange interpolation equation, whereby data from a range of five surrounding points are used to determine the value of the current point.
- Data corresponding to sample time $t_1 - t_n$ are taken as $d_1 - d_n$ and used for calculating the differential.

【Reference】 When the input voltage becomes small, processing results will show little variation. In such a case, apply the MOV operator.

【Equation for 1st differential】

$$\text{Point } t_1 \ b_1 = (-25d_1 + 48d_2 - 36d_3 + 16d_4 - 3d_5)/12h$$

$$\text{Point } t_2 \ b_2 = (-3d_1 - 10d_2 + 18d_3 - 6d_4 + d_5)/12h$$

$$\text{Point } t_3 \ b_3 = (d_1 - 8d_2 + 8d_4 - d_5)/12h$$

$$\text{Point } t_i \ b_i = (d_{i-2} - 8d_{i-1} + 8d_{i+1} - d_{i+2})/12h$$

$$\text{Point } t_{n-2} \ b_{n-2} = (d_{n-4} - 8d_{n-3} + 8d_{n-1} - d_n)/12h$$

$$\text{Point } t_{n-1} \ b_{n-1} = (-d_{n-4} + 6d_{n-3} - 18d_{n-2} + 10d_{n-1} + 3d_n)/12h$$

$$\text{Point } t_n \ b_n = (3d_{n-4} - 16d_{n-3} + 36d_{n-2} - 48d_{n-1} + 25d_n)/12h$$

b_1 to b_n : data of calculation result

$h = t$: sampling period

【Equation for 2st differential】

$$\text{Point } t_1 \ b_1 = (35d_1 - 104d_2 + 114d_3 - 56d_4 + 11d_5)/12h^2$$

$$\text{Point } t_2 \ b_2 = (11d_1 - 20d_2 + 6d_3 + 4d_4 - d_5)/12h^2$$

$$\text{Point } t_3 \ b_3 = (-d_1 + 16d_2 - 30d_3 + 16d_4 - d_5)/12h^2$$

$$\text{Point } t_i \ b_i = (-d_{i-2} + 16d_{i-1} - 30d_i + 16d_{i+1} - d_{i+2})/12h^2$$

$$\text{Point } t_{n-2} \ b_{n-2} = (-d_{n-4} + 16d_{n-3} - 30d_{n-2} + 16d_{n-1} - d_n)/12h^2$$

$$\text{Point } t_{n-1} \ b_{n-1} = (-d_{n-4} + 4d_{n-3} + 6d_{n-2} - 20d_{n-1} + 11d_n)/12h^2$$

$$\text{Point } t_n \ b_n = (11d_{n-4} - 56d_{n-3} + 114d_{n-2} - 104d_{n-1} + 35d_n)/12h^2$$

(10) 1st integral (INT)**(11) 2nd integral (INT2)**

- The 1st and 2nd integral calculation uses the trapezoidal rule.
- Data corresponding to sample time $t_1 - t_n$ are taken as $d_1 - d_n$ and used for calculating the integral.

【Equation for 1st integral】

$$\text{Point } t_1 \ I_1 = 0$$

$$\text{Point } t_2 \ I_2 = (d_1 + d_2)h/2$$

$$\text{Point } t_3 \ I_3 = (d_1 + d_2)h/2 + (d_2 + d_3)h/2 = I_2 + (d_2 + d_3)h/2$$

$$\text{Point } t_n \ I_n = I_{n-1} + (d_{n-1} + d_n)h/2$$

I_1 to I_n : processing result data

$h = t$: sampling period

【 Equation for 2st integral】

Point t_1 $II_1 = 0$

Point t_2 $II_2 = (I_1 + I_2)h/2$

Point t_3 $II_3 = (I_1 + I_2)h/2 + (I_2 + I_3)h/2 = II_2 + (I_2 + I_3)h/2$

Point t_n $II_n = II_{n-1} + (I_{n-1} + I_n)h/2$

II_1 to II_n : processing result data

(12) Sine (SIN)

【 Equation 】

$b_i = \sin(d_i)$ ($i = 1, 2, \dots, n$)

(13) Cosine (COS)

【 Equation 】

$b_i = \cos(d_i)$ ($i = 1, 2, \dots, n$)

(14) Tangent (TAN)

【 Equation 】

$b_i = \tan(d_i)$ ($i = 1, 2, \dots, n$)

-10 b_i 10

(15) Arc-sine (ASIN)

【 Equation 】

$b_i = \sqrt{2} \quad d_i > 1$

$b_i = \text{asin}(d_i) \quad -1 \leq d_i \leq 1$

$b_i = -\sqrt{2} \quad d_i < -1$

(16) Arc-cosine (ACOS)

【 Equation 】

$b_i = 0 \quad d_i > 1$

$b_i = \text{acos}(d_i) \quad -1 \leq d_i \leq 1$

$b_i = \quad d_i < -1$ ($i = 1, 2, \dots, n$)

(17) Arc-tangent (ATAN)

【 Equation 】

$b_i = \text{atan}(d_i)$ ($i = 1, 2, \dots, n$)

【Reference】 The unit for the Trigonometric and inverse trigonometric functions (12) - (17) is rad (radian).

21.3.10 FFT Function

- **FFT**

FFT stands for Fast Fourier Transformation, which is a calculation method used to decompose a time-domain waveform into frequency components. By performing FFT calculation, various calculations can be performed.

- **Concept of time domain and frequency domain**

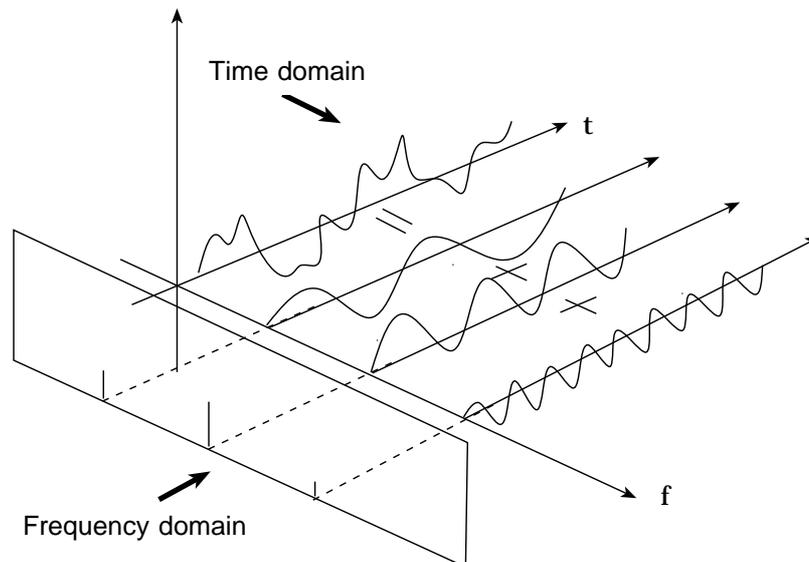
The signals measured by this memory recorder have values which correspond to time, that is the signals are functions of time.

Waveform in the figure below is an example of such a signal.

Signals which are expressed as a function of time are called time domain signals.

In reality, a signal consists of a number of sine-waves of different frequencies, called frequency components, which combine to create the final shape of the waveform. Expressing waveform the source signal, as a function of its frequency components yields a frequency domain representation.

Often, the characteristics of a signal which cannot be easily analyzed in the time domain, can be clearly revealed by the frequency domain representation.



• Fourier transformation and the Inverse Fourier transformation

The following equations define the Fourier transformation and the Inverse Fourier transformation.

$$F(\omega) = \mathcal{F}\{f(t)\} = \int_{-\infty}^{+\infty} f(t) \cdot \exp(-j\omega t) dt \dots\dots\dots (2)$$

$$f(t) = \mathcal{F}^{-1}\{F(\omega)\} = \frac{1}{2\pi} \int_{-\infty}^{+\infty} F(\omega) \cdot \exp(j\omega t) d\omega \dots\dots\dots (3)$$

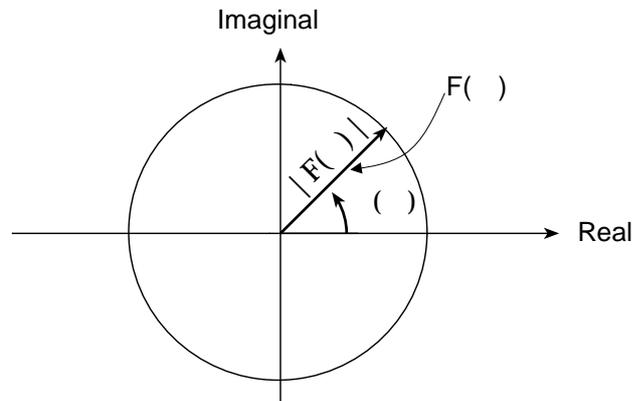
The function $F(\omega)$ generally results in a complex number, and can be expressed as follows.

$$F(\omega) = |F(\omega)| \cdot \exp(j\phi(\omega)) = |F(\omega)| \angle \phi(\omega) \dots\dots\dots (4)$$

$|F(\omega)|$: Absolute value spectrum of $f(t)$

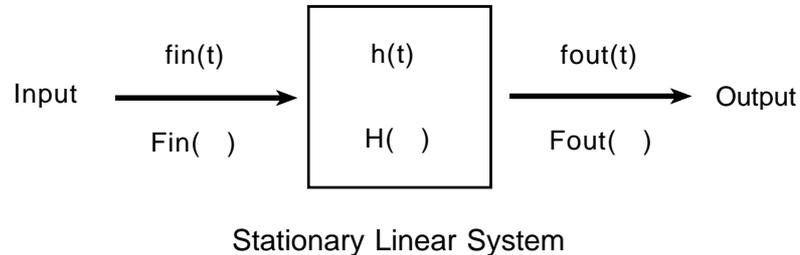
$\phi(\omega)$: Unit spectrum of the phase of $f(t)$

When conversion is made from the time domain to the frequency domain, the magnitude information and phase information are clearly expressed as indicated in equation (4). The figure below shows $F(\omega)$ in vector form.



- **Application of Fourier transform (transfer function, unit-impulse response)**

As an application of Fourier transform, this section describes a steady-state response in a static linear system.



$f_{in}(t)$: time function of input (source signal)

$f_{out}(t)$: time function of output (response function)

$h(t)$: unit impulse response of linear system

t , : time

$$f_{out}(t) = \int_{-\infty}^{+\infty} f_{in}(\tau) \cdot h(t-\tau) d\tau \quad \text{..... ⑤}$$

The relationship between the input and output is expressed as follows:

This indicates that the response of the linear system can be determined just by knowing the unit impulse response $h(t)$ of the system.

In the frequency domain, $F_{in}(\omega)$, $F_{out}(\omega)$, $H(\omega)$, and ω are defined as follows

$F_{in}(\omega)$: Fourier transformation of $f_{in}(t)$

$F_{out}(\omega)$: Fourier transformation of $f_{out}(t)$

$H(\omega)$: Fourier transformation of $h(t)$

ω : Angular frequency

$$F_{out}(\omega) = F_{in}(\omega) \cdot H(\omega) \quad \text{..... ⑥}$$

Therefore, when $f_{in}(t)$ and $f_{out}(t)$ are measured, the system transfer function $H(\omega)$ and the unit impulse response $h(t)$ can be obtained by performing an FFT operation and an inverse FFT operation.

• **Aliasing**

When the frequency of the signal to be measured approaches the sampling frequency, beyond a certain point the measured signal frequency will be lower than the actual signal frequency. In such a case, frequency components that do not exist will appear in the waveform along the frequency axis. This phenomenon is called aliasing, and it occurs if sampling is carried out at a frequency lower than the so-called Nyquist frequency determined by Nyquist's sampling theorem.

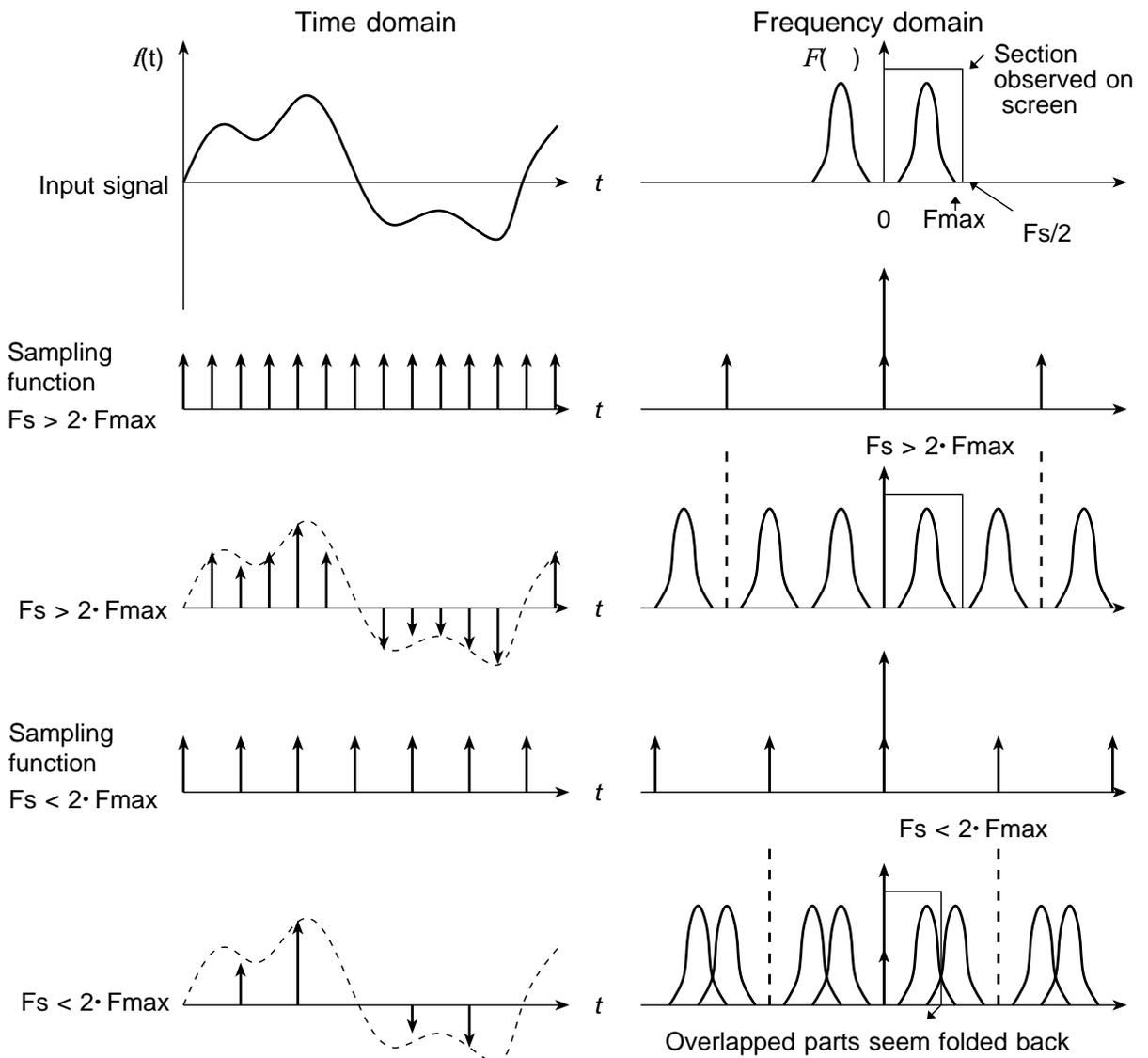
Sampling theorem

$$F_s = 2 \cdot F_{max} \dots\dots\dots \textcircled{1}$$

F_{max} : Highest frequency component to be measured

F_s : Sampling frequency (Nyquist frequency)

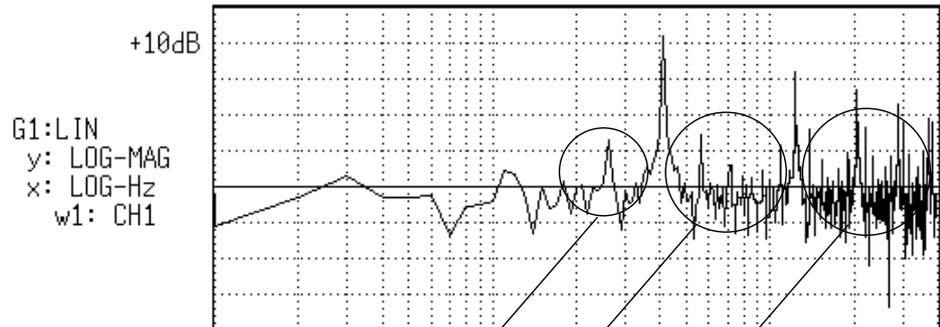
- In order to be able to restore the original waveform from the sampling data, the sampling frequency must be at least twice as high as the signal frequency.
- If sampling is carried out at a frequency lower than the Nyquist frequency, frequency components above 1/2 of the sampling frequency will be aliased to lower frequencies, and the measured signal will appear to contain frequency components that actually do not exist.



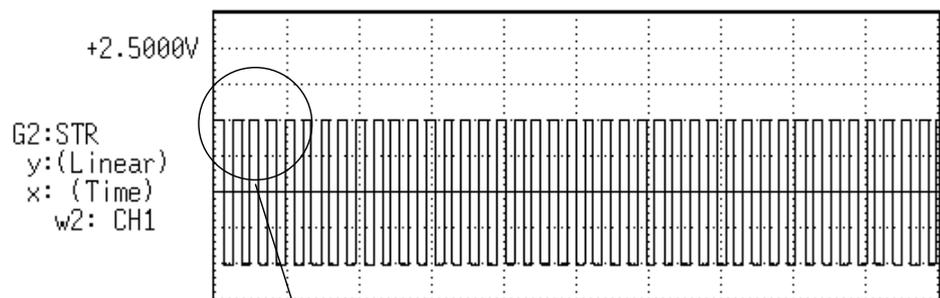
- **Anti-aliasing filter**

- In FFT processing, when the frequency bandwidth of the input signal is unlimited, frequency spectrum components that do not exist will appear, due to aliasing. To prevent this, a low-pass filter is required which cuts off the input waveform at 1/2 of the sampling frequency. Such a low-pass filter is called an anti-aliasing filter.
- The 8938 FFT ANALOG UNIT incorporates an anti-aliasing filter and therefore allows the 8826 to perform FFT analysis without being subject to aliasing.

(1) When an anti-aliasing filter is not used.

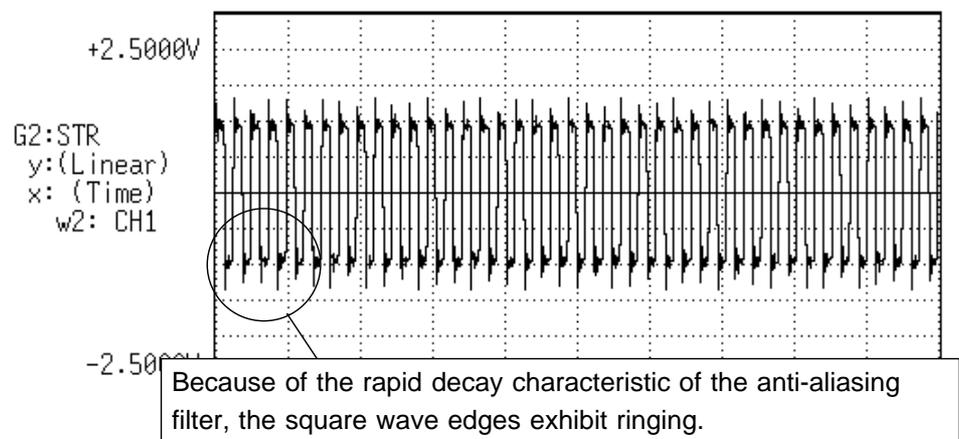
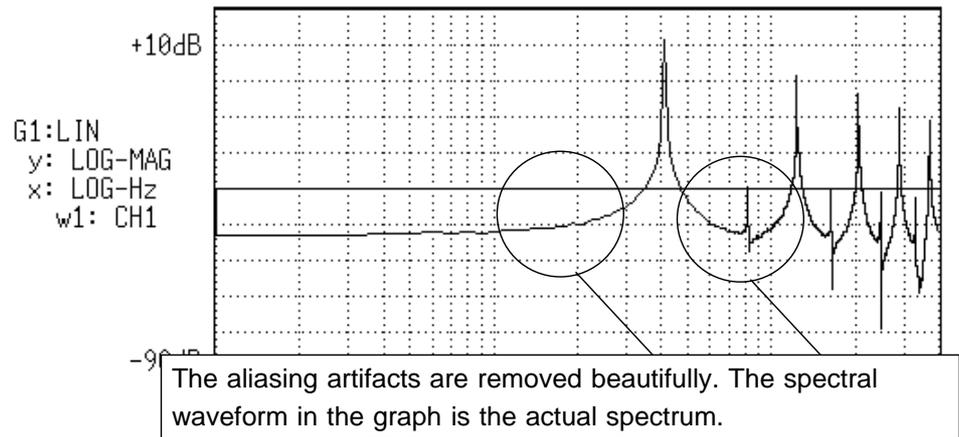


-9 This is a spectral artifact that occurs as a result of aliasing of the high frequency component of a signal with the A/D converter sampling rate. Although visible during measurement, it does not exist in reality.



-2.500 Because no anti-aliasing filter is present, fine square waves are monitored through the high-frequency amplifier, so the corners of square waves include high-frequency components.

(2) When an anti-aliasing filter is used.

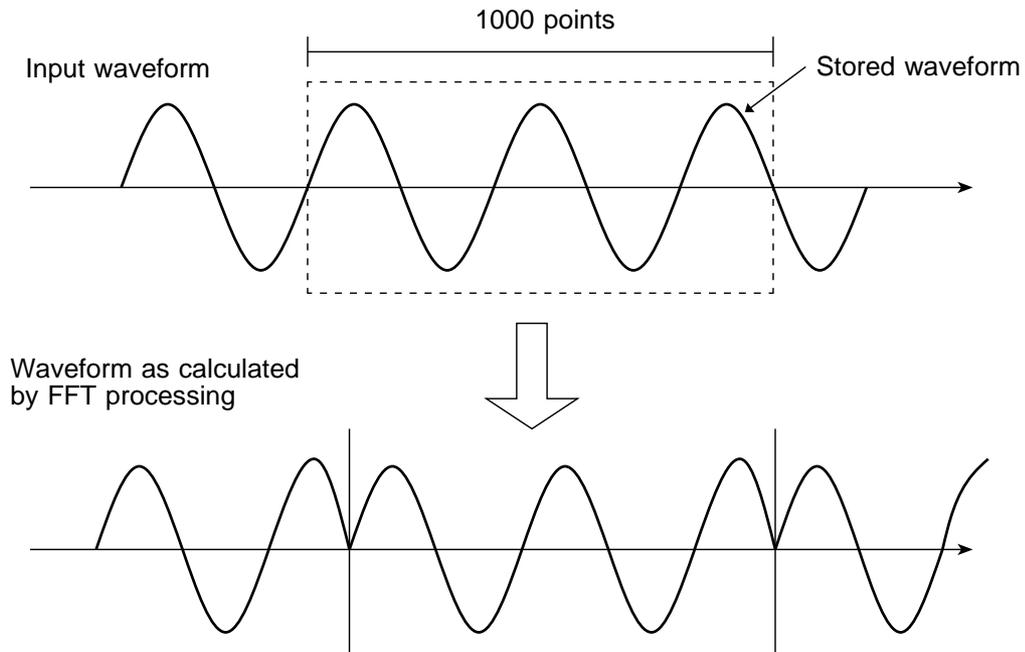


Window processing

Fourier transform is defined as the integration from negative infinity to positive infinity, but in actual measurement this calculation is not possible. Therefore only a limited segment of the continuous signal is taken for processing. This is called window processing.

The FFT algorithm assumes that the data of that limited segment are repeated and defines the input signal using a periodic function for determining the frequency spectrum.

Depending on the phase at the start and end of the stored waveform, there may be a difference between the waveform as calculated by FFT processing and the actual input waveform.



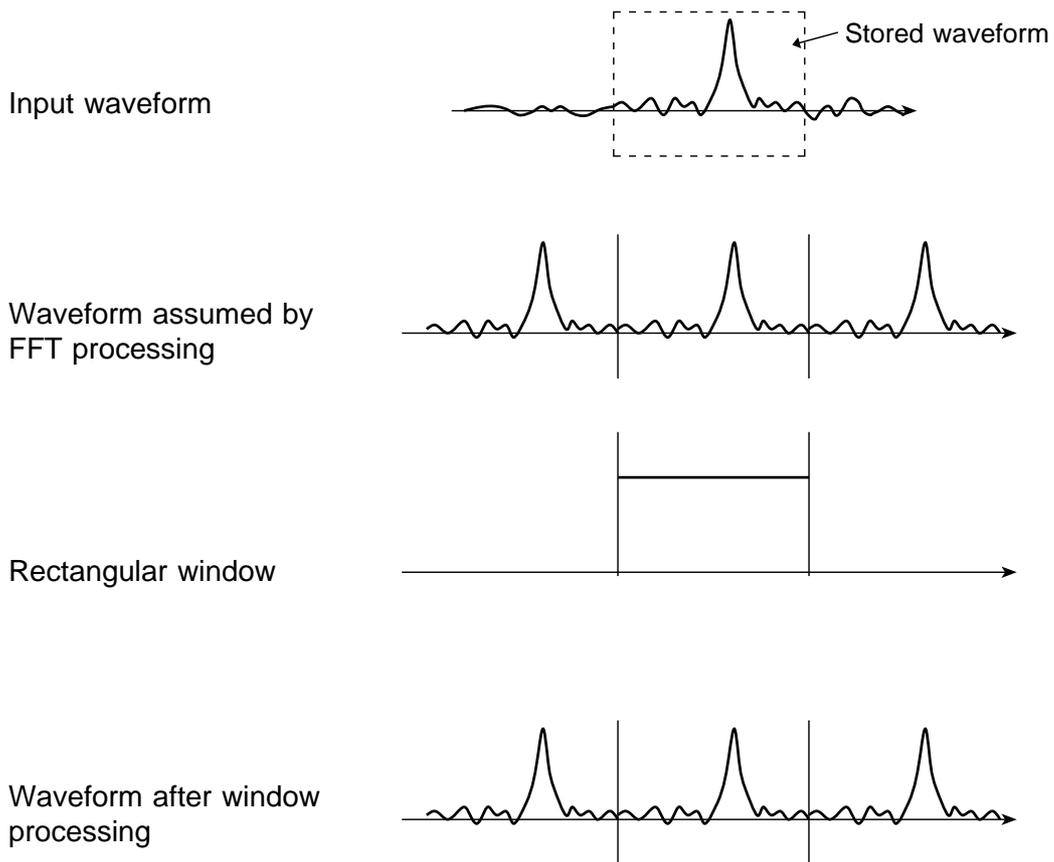
Leakage error

When the signal waveform as assumed by the FFT algorithm and the actual waveform are different, the processing result will contain an error. This error is called the leakage error.

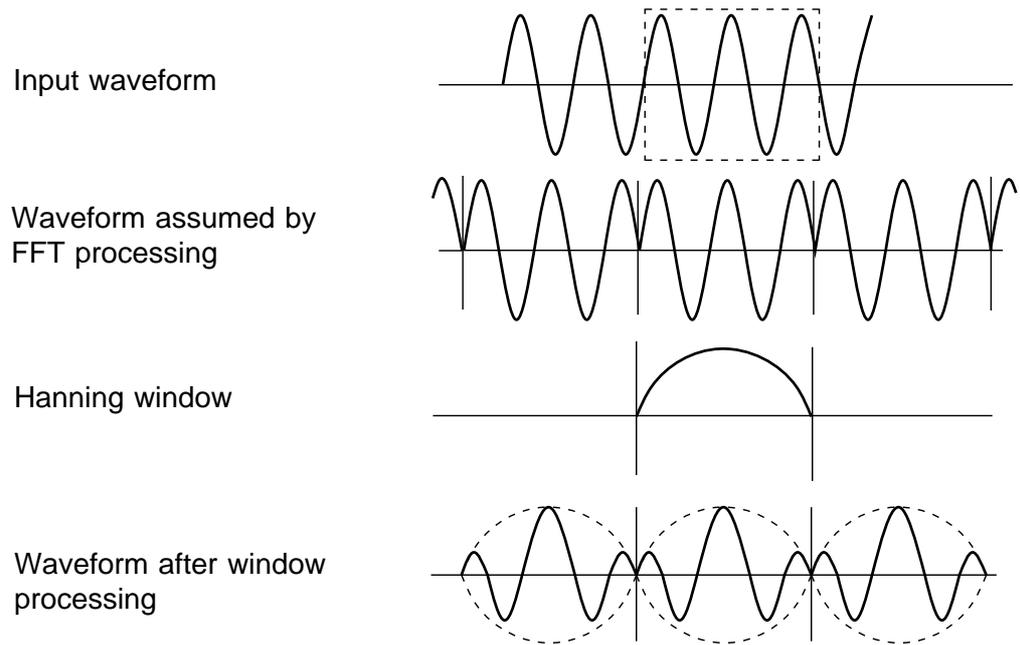
Window function

- When a limited segment of the input signal is captured, a function can be applied to reduce the leakage error.
- This function is called the window function.
- To minimize the leakage error, a suitable window should be chosen which matches the type of input signal.
- Possible window types include rectangular, Hanning, exponential, flat-top, minimum, force, etc. In the 8826, three window functions (rectangular, Hanning, exponential) are available.
- Generally, the rectangular window function is most useful for single waveforms, the Hanning window function for continuous waveforms, and the exponential window function for attenuated waveforms.

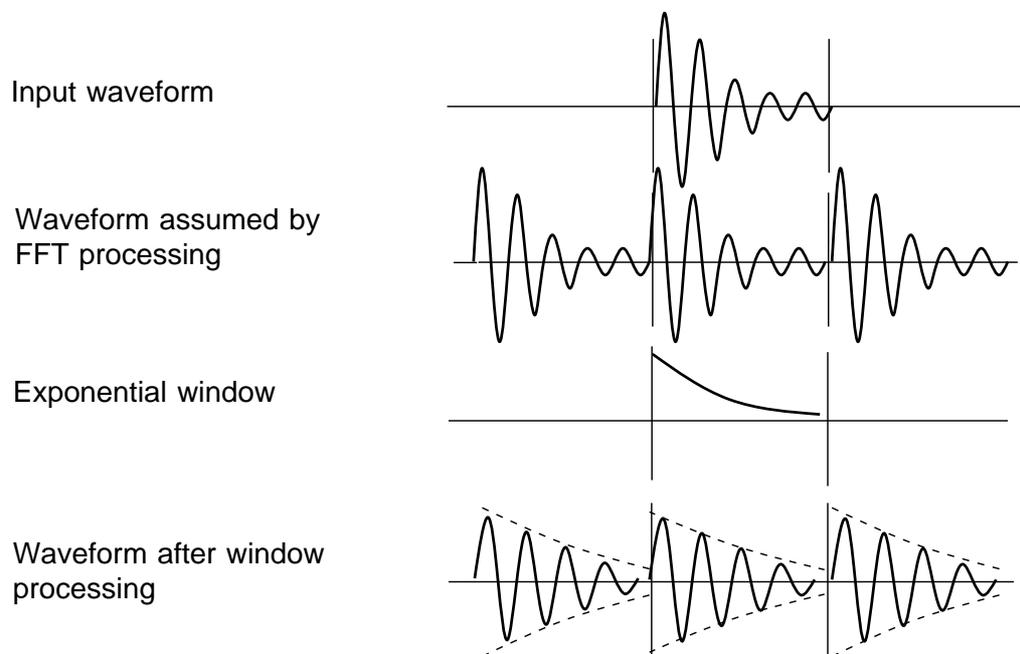
• Rectangular window



- **Hanning window**



- **Exponential window**



21.4 File Size

21.4.1 Size of a Waveform File (Binary data)

In the memory recorder function (Binary data)

Size of a file = header + data

Size of a header = $512 \times (15 + \text{number of analog channels} + \text{number of logic probes})$

Size of a data = $(2 \times \text{number of analog channels} + (\text{number of logic probes} + 1) / 2) \times (\text{recording length (DIV)} \times 100 + 1)$

(Truncates the decimal portion of the quotient of division.)

Recording length	Number of logic probes : 0				
	Number of analog channels				
	0 ch	4 ch	8 ch	16 ch	32 ch
25		27,736	51,792	95,904	182,128
50		49,736	91,792	175,904	344,128
100		89,763	171,792	335,904	664,128
200		169,763	331,792	655,904	1,304,128
500		409,763	811,792	1,615,904	3,224,128
1000		809,763	1,611,792	3,215,904	6,424,128
2000		1,609,763	3,211,792	6,415,904	12,824,128
5000		4,009,763	8,011,792	16,015,904	32,024,128
10000		8,009,763	16,011,792	32,015,904	64,024,128
20000		16,009,763	32,011,792	64,015,904	128,024,128
40000		32,009,763	64,011,792	128,015,904	
80000		64,009,763	128,011,792		
160000		128,009,763			

16 MW

64 MW

Recording length	Number of logic probes : 8 (32 ch)				
	Number of analog channels				
	0 ch	4 ch	8 ch	16 ch	32 ch
25	21,780	43,836	65,892	110,004	198,228
50	31,780	73,836	115,892	200,004	368,228
100	51,780	133,836	215,892	380,004	708,228
200	91,780	253,836	415,892	740,004	1,388,228
500	211,780	613,836	1,015,892	1,820,004	3,428,228
1000	411,780	1,213,836	2,015,892	3,620,004	6,828,228
2000	811,780	2,413,836	4,015,892	7,220,004	13,628,228
5000	2,011,780	6,013,836	10,015,892	18,020,004	34,028,228
10000	4,011,780	12,013,836	20,015,892	36,020,004	68,028,228
20000	8,011,780	24,013,836	40,015,892	72,020,004	136,028,228
40000	16,011,780	48,013,836	80,015,892	144,020,004	
80000	32,011,780	96,013,836	160,015,892		

16 MW

64 MW

In the Recorder and RMS recorder functions (Binary data)

Size of a file = header + data

Size of a header = $512 \times (15 + \text{number of analog channels} + \text{number of logic probes})$

Size of a data = $(4 \times \text{number of analog channels} + \text{number of logic probes})$
 $\times (\text{recording length (DIV)} \times 100 + 1)$

Recording length	Number of logic probes : 0				
	Number of analog channels				
	0 ch	4 ch	8 ch	16 ch	32 ch
25		49,744	91,808	175,936	344,192
50		89,744	171,808	335,936	664,192
100		169,744	331,808	655,936	1,304,192
200		329,744	651,808	1,295,936	2,584,192
500		809,744	1,611,808	3,215,936	6,424,192
1000		1,609,744	3,211,808	6,415,936	12,824,192
2000		3,209,744	6,411,808	12,815,936	25,624,192
5000		8,009,744	16,011,808	32,015,936	64,024,192
10000		16,009,744	32,011,808	64,015,936	128,024,192

16 MW
64 MW

Recording length	Number of logic probes : 8 (32 ch)				
	Number of analog channels				
	0 ch	4 ch	8 ch	16 ch	32 ch
25	31,784	73,848	115,912	200,040	368,296
50	51,784	133,848	215,912	380,040	708,296
100	91,784	253,848	415,912	740,040	1,388,296
200	171,784	493,848	815,912	1,460,040	2,748,296
500	411,784	1,213,848	2,015,912	3,620,040	6,828,296
1000	811,784	2,413,848	4,015,912	7,220,040	13,628,296
2000	1,611,784	4,813,848	8,015,912	14,420,040	27,228,296
5000	4,011,784	12,013,848	20,015,912	36,020,040	68,028,296
10000	8,011,784	24,013,848	40,015,912	72,020,040	136,028,296

16 MW
64 MW

21.4.2 Size of a Waveform File (Text data (Reference value))

In the memory recorder function (text data) (Reference value)

Size of a file = header + data

Size of a header = 170 + 64 × number of analog channels + 165 × number of logic probes

Size of a data = (14 + 26 × number of analog channels + 18 × number of logic probes)
× (recording length (DIV) × 100 + 1)

Recording length	Number of logic probes : 0				
	Number of analog channels				
	0 ch	4 ch	8 ch	16 ch	32 ch
25		165,344	259,504	555,824	1,076,464
50		330,344	590,504	1,110,824	2,151,464
100		660,344	1,180,504	2,220,824	4,301,464
200		1,320,344	2,360,504	4,440,824	8,601,464
500		3,300,344	5,900,504	11,100,824	21,501,464
1000		6,600,344	11,800,504	22,200,824	43,001,464
2000		13,200,344	23,600,504	44,400,824	86,001,464
5000		33,000,344	59,000,504	111,000,824	215,001,464
10000		66,000,344	118,000,504	222,000,824	430,001,464
20000		132,000,344	236,000,504	444,000,824	1,720,001,464
40000		264,000,344	472,000,504	888,000,824	
80000		528,000,344	944,000,504		
160000		1,056,000,344			

16 MW
64 MW

Recording length	Number of logic probes : 8 (32 ch)				
	Number of analog channels				
	0 ch	4 ch	8 ch	16 ch	32 ch
25	215,768	345,928	476,088	736,408	1,257,048
50	430,768	690,928	951,088	1,471,408	2,512,048
100	860,768	1,380,928	1,901,088	2,941,408	5,022,048
200	1,720,768	2,760,928	3,801,088	5,881,408	10,042,048
500	4,300,768	6,900,982	9,501,088	14,701,408	25,102,048
1000	8,600,768	13,800,982	19,001,088	29,401,408	50,202,048
2000	17,200,768	27,600,982	38,001,088	58,801,408	100,402,048
5000	43,000,768	69,000,982	95,001,088	147,001,408	215,001,976
10000	86,000,768	138,000,982	190,001,088	294,001,408	502,002,048
20000	172,000,768	276,000,982	380,001,088	588,011,408	1,004,002,048
40000	344,000,768	552,000,982	760,001,088	1,176,001,408	2,008,002,048
80000	688,000,768	1,104,000,982	1,520,001,088		

16 MW
64 MW

When data is saved in text format and data cropping is used, file size will be the same as when recording length is reduced. For example, the file size for a recording length of 500 DIV with 1/5 data cropping will be the same as for a recording length of 100 DIV without data cropping.

In the Recorder and RMS recorder functions (text data) (Reference value)

Size of a file = header + data

Size of a header = 170 + 64 × number of analog channels + 165 × number of logic probes

Size of a data = (14 + 26 × number of analog channels + 18 × number of logic probes)
× (recording length (DIV) × 100 + 1)

Recording length	Number of logic probes : 0				
	Number of analog channels				
	0 ch	4 ch	8 ch	16 ch	32 ch
25		295,544	555,904	1,076,624	2,118,064
50		590,544	1,110,904	2,151,624	4,233,064
100		1,180,544	2,220,904	4,301,624	8,463,064
200		2,360,544	4,440,904	8,601,624	16,923,064
500		5,900,544	11,100,904	21,501,624	42,303,064
1000		11,800,544	22,200,904	43,001,624	84,603,064
2000		23,600,544	44,400,904	86,001,624	169,203,064
5000		59,000,544	111,000,904	215,001,624	423,003,064
10000		118,000,544	222,000,904	430,001,624	846,003,064

16 MW

64 MW

Recording length	Number of logic probes : 8 (32 ch)				
	Number of analog channels				
	0 ch	4 ch	8 ch	16 ch	32 ch
25	396,648	657,008	917,368	1,438,088	2,479,528
50	791,648	1,312,008	1,832,368	2,873,088	4,954,528
100	1,581,648	2,622,008	3,662,368	5,743,088	9,904,528
200	3,161,648	5,242,008	7,322,368	11,483,088	19,804,528
500	7,901,648	13,102,008	18,302,368	28,703,088	49,504,528
1000	15,801,648	26,202,008	36,602,368	57,403,088	99,004,528
2000	31,601,648	52,402,008	73,202,368	114,803,088	198,004,528
5000	79,001,648	131,002,008	183,002,368	287,033,088	423,004,384
10000	158,001,648	262,002,008	366,002,368	574,003,088	990,004,528

16 MW

64 MW

21.4.3 Size of a FFT File (Reference value)

Binary data

Points	Averaging : OFF		Averaging : ON	
	1 ch FFT	2 ch FFT	1 ch FFT	2 ch FFT
1000	18,704	29,216	20,708	43,228
2000	28,704	49,216	32,708	77,228
5000	58,704	109,216	68,708	179,228
10000	1,087,704	209,216	128,708	349,228

Text data (reference value (Single display size))

points	FFT mode			
	STR, ACR, CCR, IMP	LIN,RMS,PSP,HIS, TRF,CSP,CHO	OCT(1/1)	OCT(1/3)
1000	27,190	11,017	320	580
2000	54,190	21,817		
5000	135,190	54,217		
10000	270,190	108,217		

21.4.4 Real-Time Save Files Size (Memory data)

Size of a file = header + data

Size of a header = $512 \times (15 + \text{number of analog channels} + \text{number of logic probes})$

Size of a data = $2 \times \text{number of analog channels} \times (\text{recording length (DIV)} \times 100 + 1)$

Saved channel number: When saving channels, each analog channel (up to 8) has a corresponding logic channel, and such pairs are regarded as single channels.

(Example: Saving analog channels 1 and 2 also saves logic channels A and B, constituting a saved channel number of 2.)

Relationship between saving analog and logic channels:

CH1, CHA	CH2, CHB	CH3, CHC	CH4, CHD
CH5, CHE	CH6, CHF	CH7, CHG	CH8, CHH
Analog channels 9 through 32 have no corresponding logic channels.			

Recording length	Number of analog channels (Number of logic channels: 0)				
	0	4	8	16	32
25		30 KB	51 KB	97 KB	180 KB
50		49 KB	90 KB	172 KB	337 KB
100		88 KB	168 KB	329 KB	649 KB
200		166 KB	325 KB	641 KB	1274 KB
1000		791 KB	1575 KB	4 MB	7 MB
2000		2 MB	4 MB	7 MB	13 MB
5000		4 MB	8 MB	16 MB	31 MB
10,000		8 MB	16 MB	31 MB	62 MB
20,000		16 MB	31 MB	62 MB	123 MB
40,000		31 MB	62 MB	123 MB	245 MB
80,000		62 MB	123 MB	245 MB	489 MB
160,000		123 MB	245 MB	489 MB	977 MB

Recording length	Number of analog channels (Number of logic channels: 8)				
	0	4	8	16	32
25	55 KB	77 KB	98 KB	141 KB	184 KB
50	94 KB	135 KB	176 KB	258 KB	341 KB
100	172 KB	252 KB	333 KB	493 KB	653 KB
200	329 KB	487 KB	645 KB	962 KB	1278 KB
1000	1579 KB	3 MB	4 MB	5 MB	7 MB
2000	4 MB	5 MB	7 MB	10 MB	13 MB
5000	8 MB	12 MB	16 MB	23 MB	31 MB
10,000	16 MB	23 MB	31 MB	46 MB	62 MB
20,000	31 MB	46 MB	62 MB	92 MB	123 MB
40,000	62 MB	92 MB	123 MB	184 MB	245 MB
80,000	123 MB	184 MB	245 MB	367 MB	489 MB
160,000	245 MB	367 MB	489 MB	733 MB	977 MB

Regarding saving of 4, 8 or 16 analog channels in the above table, file sizes are calculated for the case in which the analog channels have no corresponding logic channels.

Example: analog channels 9, 10, 11 and 12, and logic channels A through H are saved.

21.5 Waveform Viewer (Wv)

The waveform viewer provides a simplified view of data transferred to a PC by remote control or data acquisition. The viewer has a CSV conversion function. Converted files may be read by a spreadsheet program.

System requirements

For a PC running Windows 95, 98, Me, Windows NT4.0 SP3 or later, Windows 2000, or Windows XP

Installation

Install by the following procedure:

1. When you insert the Application Disk (CD-R) into the CD-ROM drive, the opening page should appear automatically. If it does not appear, open the "index.htm" file with your Web browser.
2. Select the language to display (click the English icon).
3. Click the [Wave viewer (Wv)] icon to view Wv specifications and revision history.
4. Click the [Install] icon at the top right of the page to open the [File Download] dialog.
5. Click [Open] to display the confirmation dialog to proceed with installation.
6. Click [Next] to open the installation destination selection window.
Click the [Browse] button to change the installation folder.
7. Click [Next] to start installation.

The program is now installed.

Handling the CD-R

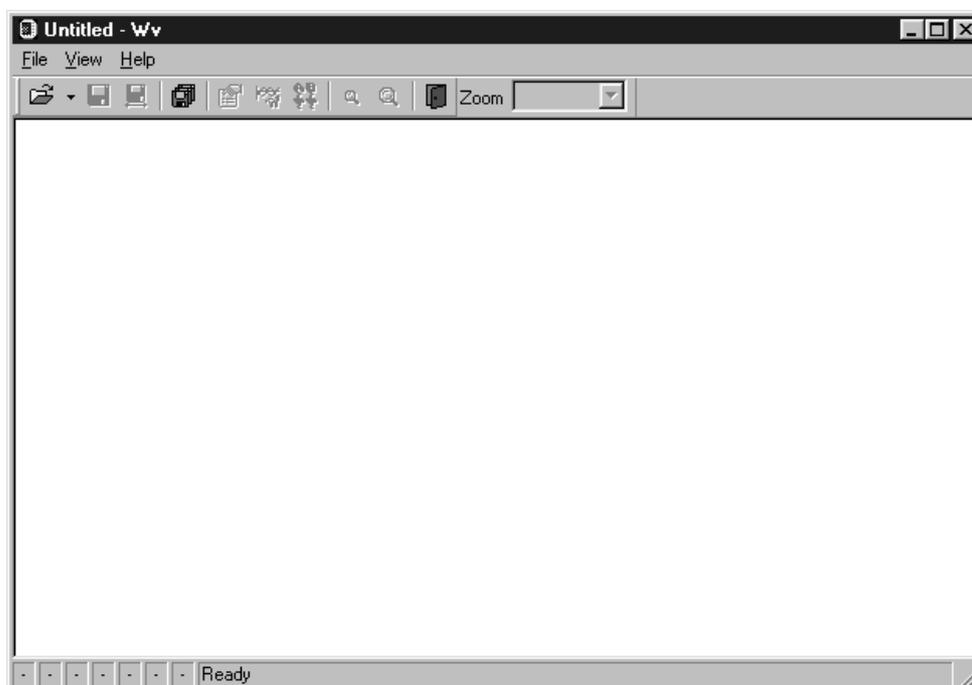


- Always hold the disc by the edges, so as not to make fingerprints on the disc or scratch the printing.
- Never touch the recorded side of the disc. Do not place the disc directly on anything hard.
- Do not wet the disc with volatile alcohol or water, as there is a possibility of the label printing disappearing.
- To write on the disc label surface, use a spirit-based felt pen. Do not use a ball-point pen or hard-tipped pen, because there is a danger of scratching the surface and corrupting the data. Do not use adhesive labels.
- Do not expose the disc directly to the sun's rays, or keep it in conditions of high temperature or humidity, as there is a danger of warping, with consequent loss of data.
- To remove dirt, dust, or fingerprints from the disc, wipe with a dry cloth, or use a CD cleaner. Always wipe radially from the inside to the outside, and do not wipe with circular movements. Never use abrasives or solvent cleaners.
- Hioki shall not be held liable for any problems with a computer system that arises from the use of this CD-R, or for any problem related to the purchase of a Hioki product.

21.5.1 Starting the Waveform Viewer

In the Windows Start menu, select [Programs] - [HIOKI] - [Wv]. This starts the waveform viewer application.

To close the waveform viewer application, in the [File] menu select [Exit]. You can also click the Close button at the top right corner of the window.



Toolbar

Click the icons in the toolbar for the respective functions.

From the left, these are: [Open], [Save All], [Save Between Cursors], [Batch Conversion], [Properties], [Wave Control Panel], [Trace], [Zoom Out], [Zoom In], and [Exit].

For details of these operations, see the descriptions of the corresponding menu items.

You can also select the magnification factor for the time axis by selecting on the toolbar.

Status bar

The status bar shows, from the left, the model name, function, recording length, time axis, trigger time, pre-trigger and judgment result.

Version information

When making inquiries, the version number will be required.

To check the software version number, in the [Help] menu select [About Wv].

21.5.2 Waveform Viewer Menus

The following is the complete menu tree of the waveform viewer application.

File ↓	Open	
	Save All	
	Save Between Cursors	
	Batch Conversion	
	Exit	
View	Toolbar	
	Status Bar	
	Wave Control Panel	
	Properties	
	Trace	
	Block List	
	Zoom In	
	Zoom Out	
	Set Magnification	
	Jump	Trig
		A Cursor
		B Cursor
	Time Notation	DIV
		Sec
		Point
		Trig
		Date
	Grid Type	None
		Standard
		Fine
	Title	
	Remarks	
	Fixed	
Capture		

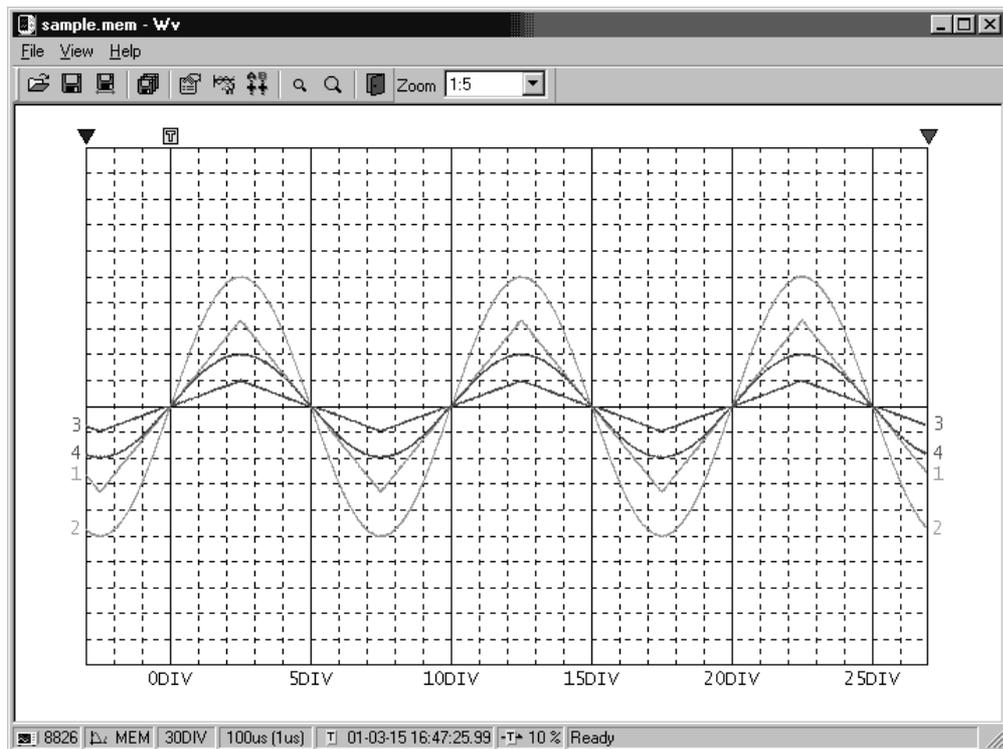
Right-click with the mouse in the waveform display screen for the following functions.

Right-click with the mouse	Wave Control Panel		
	Properties		
	Trace		
	Block List		
	Zoom In		
	Zoom Out		
	Set Magnification		
	Jump	Trig	
		A Cursor	
		B Cursor	
	Time Notation	DIV	
		Sec	
		Point	
		Trig	
		Date	
	Grid Type	None	
		Standard	
		Detail	
	Title		
	Remarks		
	Fixed		
	Color	Text	
		Background	
Grid			
Font			
Capture			

21.5.3 Using the Waveform Viewer

Waveform display

To display a waveform it is first necessary to select the file to be displayed. In the [File] menu, select [Open], to display the file selection dialog box. Select a waveform file, and click Open to read in the file, and display the waveform.

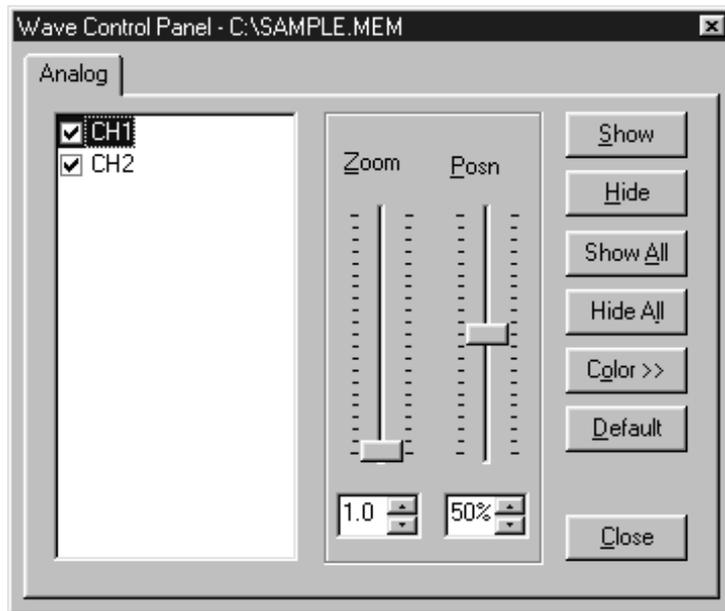


Changing the time axis scale (zoom function)

You can change the time axis scale in the display using the menus or toolbar. In the toolbar, click the [Set Magnification] box, to display the possible zoom factors: you can then select any desired value.

Changing waveform scale and position (Waveform Control Panel)

You can adjust the display for each channel separately. In the [View] menu, select [Wave Control Panel] to display a dialog box.



CH	This indicate the list of channel. When a check mark is present the corresponding channel is displayed.
Zoom	Set the magnification on the voltage axis for the specified channel.
Posn	Set the position of the specified channel.
Show	Display the specified channel(s).
Hide	Do not display the specified channel(s).
Show All	Display all channels.
Hide All	Do not display all channels.
Color	Change the color of the specified channel(s).
Default	Set all values of the specified channel(s) to their default values.
Close	Close the Waveform Control Panel.

Checking the waveform measurement conditions (Properties)

Select [View], then [Properties] from the menu to display the measurement settings on the MEMORY HiCORDER.

Checking voltage values (Trace)

Select [View], then [Trace] from the menu to check the time value and difference of the two cursors (A and B) and the voltage values and differences of all channels.

File list in index file

Select [View], then [Block List] to check the file list (block number, file name, time axis range, trigger time) in the index file.

Double-click a file in the list opens a new window in which you can check waveform in that file.

* This is effective only when reading Sequential, Multi-block, REC&MEM index files.

Waveform jump function

Select [View], then [Jump] to jump to the trigger position or the positions of the A or B cursors.

Time Notation

Select [View], then [Time Notation]. You can select the time notation on the waveform display screen.

Setting Grid Type

Select [View], then [Grid Type] on the menu to set the type of grid (None, Standard, or Fine).

Display of Title Comment

Select [View], then [Title] on the menu to display a title comment at the top of the waveform screen.

Waveform legend view

Select [View], then [Remarks] on the menu to view the unit type of each channel, measurement mode, measurement range, filters, comments, scaling, display position, and magnification on the portion below the waveform screen.

Fixing waveform view conditions

Select [View], then [Fixed] on the menu to always view waveforms with the same color, display position and magnification.

When this item is enabled, the file view settings are disabled.

The standard values for display conditions are automatically saved when the application is terminated or when the check mark is removed from [Fixed] menu.

Setting the display colors

Right-click on the waveform display screen, and select [Color], then [Text] [Background] [Grid] to display a dialog box for setting the respective colors.

Font settings (character size)

Right-click on the waveform display screen, and select [Font], to display the font setting dialog box. You can then select the font for text on the waveform display screen.

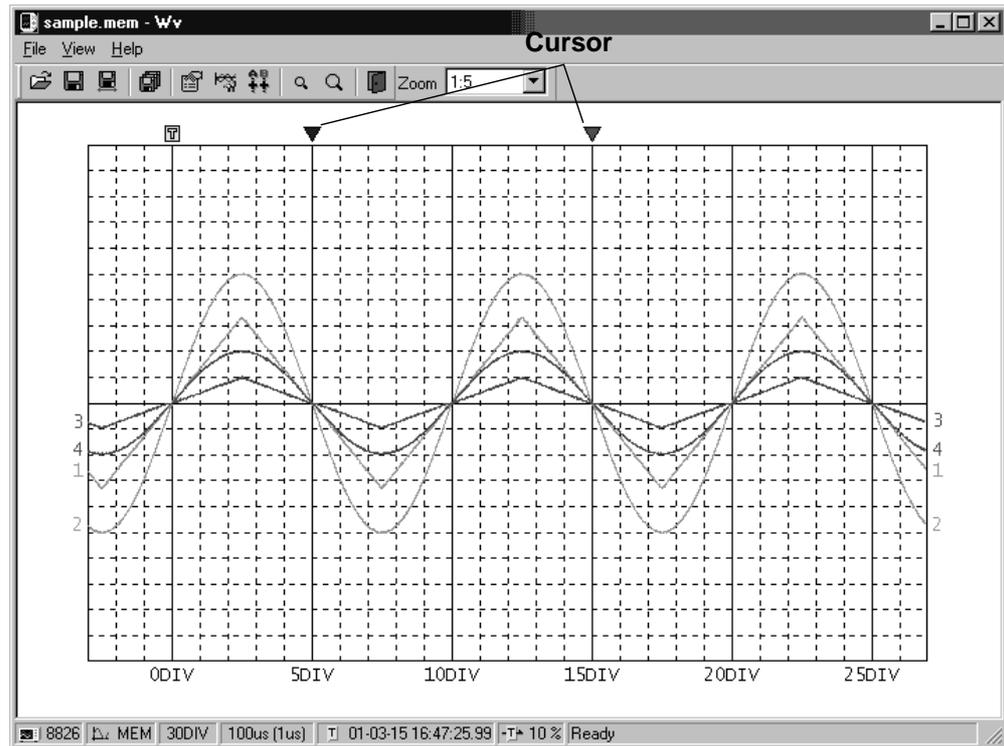
Waveform display snaps (capture)

Select [View], then [Capture] on the menu to capture waveform display and copy to clipboard as a bit image. You can paste it into other applications.

21.5.4 Conversion to CSV Format

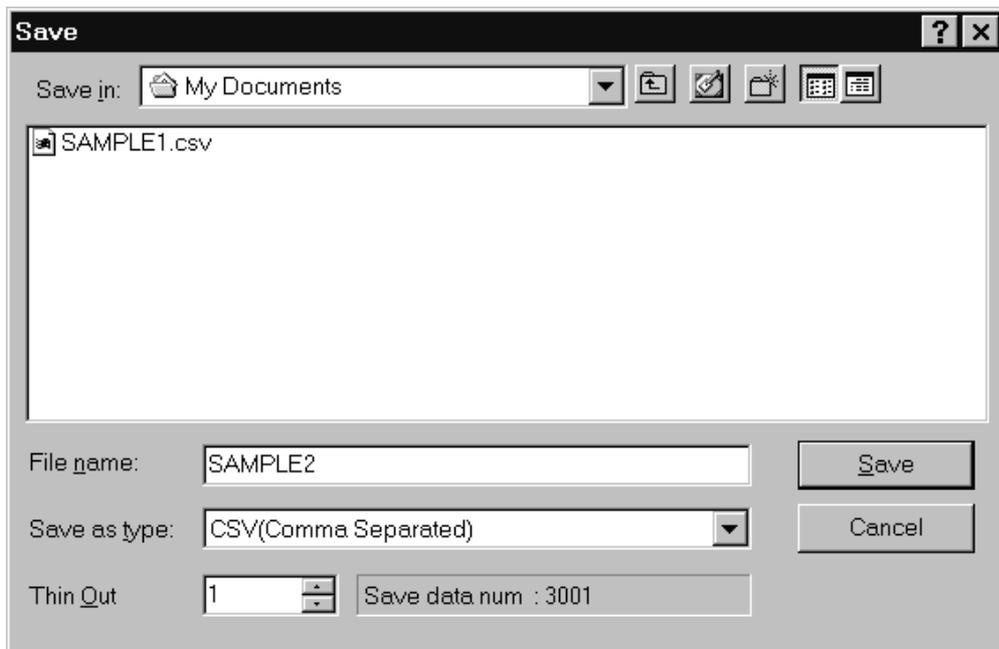
You can convert displayed waveform data to a CSV format file. Once in CSV format, the file can be loaded into spreadsheet or other software for further processing. You can either convert the whole data file or a range selected with the cursors.

If selecting a range, first set the cursors to the required positions. These are indicated at the top of the waveform screen by inverted blue and red "": drag these triangles with the mouse to set the range.



Then to save all of the data, in the [File] menu, select [Save All]; to save the range only, in the [File] menu, select [Save Between Cursors].

A dialog box appears for setting the file to be saved, and the thinning.



To save in text formats other than CSV (space delimited or tab delimited), select the desired format from the **[Save as type]** list.

In the **[Thin Out]** box, enter the number of original samples corresponding to one converted value.

Use this when data over a large range (long time interval) is required, but the whole set of sampled data is not required.

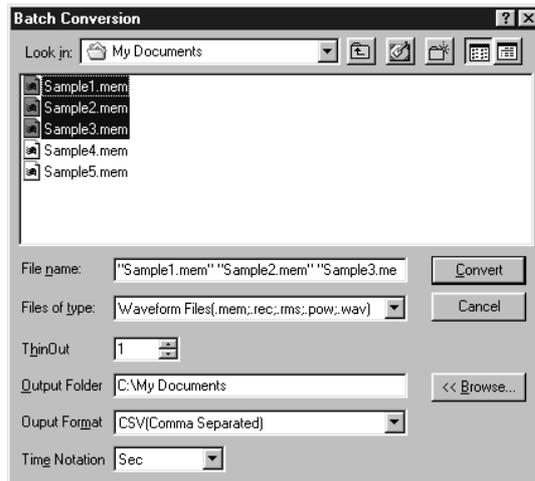
Select **[Time Notation]** from among **[Sec]**, **[Date]**, **[Trig]**, and **[Point]**.

Enter the name of the file to be saved, and click the **[Save]** button to convert the data to CSV format and save the file.

21.5.5 Batch Conversion

You can convert multiple waveform files CSV files.

1. Select **[File]** from the menu bar, then select **[Batch Conversion]** from the File menu.
2. Select the desired files from the file list. To select two or more files, left-click on the desired files while holding down the **Shift** or **Control** key.



3. If required, specify the sampling intervals in the **[ThinOut]** box at which data is to be converted. Remember that not all data needs to be converted. This setting is useful when you need data over a broad time span.
4. In the **[Output Folder]**, specify the folder in which to save the CSV files converted from waveform files. You can specify the desired folder without typing simply by clicking on the **<<Browse...** button and selecting the desired folder from the list.
5. To save in text formats other than CSV (space delimited or tab delimited), select the desired format from the **[Output Format]** list.
6. Select **[Time Notation]** from among **[Sec]**, **[Date]**, **[Trig]**, and **[Point]**.
7. Click the **[Convert]** button. All selected waveform files are converted to CSV files and saved in the specified folder.

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Warranty Certificate

Model	Serial No.	Warranty period One (1) year from date of purchase (___ / ___)
-------	------------	---

This product passed a rigorous inspection process at Hioki before being shipped.

In the unlikely event that you experience an issue during use, please contact the distributor from which you purchased the product, which will be repaired free of charge subject to the provisions of this Warranty Certificate. This warranty is valid for a period of one (1) year from the date of purchase. If the date of purchase is unknown, the warranty is considered valid for a period of one (1) year from the product's date of manufacture. Please present this Warranty Certificate when contacting the distributor.

Accuracy is guaranteed for the duration of the separately indicated guaranteed accuracy period.

1. Malfunctions occurring during the warranty period under conditions of normal use in conformity with the Instruction Manual, product labeling (including stamped markings), and other precautionary information will be repaired free of charge, up to the original purchase price. Hioki reserves the right to decline to offer repair, calibration, and other services for reasons that include, but are not limited to, passage of time since the product's manufacture, discontinuation of production of parts, or unforeseen circumstances.
2. Malfunctions that are determined by Hioki to have occurred under one or more of the following conditions are considered to be outside the scope of warranty coverage, even if the event in question occurs during the warranty period:
 - a. Damage to objects under measurement or other secondary or tertiary damage caused by use of the product or its measurement results
 - b. Malfunctions caused by improper handling or use of the product in a manner that does not conform with the provisions of the Instruction Manual
 - c. Malfunctions or damage caused by repair, adjustment, or modification of the product by a company, organization, or individual not approved by Hioki
 - d. Consumption of product parts, including as described in the Instruction Manual
 - e. Malfunctions or damage caused by transport, dropping, or other handling of the product after purchase
 - f. Changes in the product's appearance (scratches on its enclosure, etc.)
 - g. Malfunctions or damage caused by fire, wind or flood damage, earthquakes, lightning, power supply anomalies (including voltage, frequency, etc.), war or civil disturbances, radioactive contamination, or other acts of God
 - h. Damage caused by connecting the product to a network
 - i. Failure to present this Warranty Certificate
 - j. Failure to notify Hioki in advance if used in special embedded applications (space equipment, aviation equipment, nuclear power equipment, life-critical medical equipment or vehicle control equipment, etc.)
 - k. Other malfunctions for which Hioki is not deemed to be responsible

***Requests**

- Hioki is not able to reissue this Warranty Certificate, so please store it carefully.
- Please fill in the model, serial number, and date of purchase on this form.

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