

# **HIOKI**

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**INSTRUCTION MANUAL**

## **8855**

# **MEMORY HiCORDER**

**HIOKI E. E. CORPORATION**

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# Introduction

Thank you for purchasing the HIOKI "8855 MEMORY HiCORDER." To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference.

## About This Manual

This manual is the Advanced edition (Instruction Manual) for the "8855 MEMORY HiCORDER." It describes the advanced functions and procedures for the 8855. For information on general functions and procedures, refer to the Basics edition (Quick Start Manual) of this manual.

# 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
9231 RECORDING PAPER (when the 8994 PRINTER UNIT is installed) .....	1
Roll paper attachment (when the 8994 PRINTER UNIT is installed) .....	2
PC card protector .....	1
Connector cable label .....	1
Instruction Manual .....	1
Guide book .....	1
Application Disk (CD-R) .....	1

## Options

8950	ANALOG UNIT
8951	VOLTAGE/CURRENT UNIT
8952	DC/RMS UNIT
8953-10	HIGH RESOLUTION UNIT
8954	VOLTAGE/TEMP UNIT
8955	F/V UNIT
8994	PRINTER UNIT
9646	MO UNIT (with eject pin)
9663	HD UNIT
9645	MEMORY BOARD (96 M words) total 128 M words
9645-01	MEMORY BOARD (512 M words) total 512 M words
9557	RS-232C CARD
9558	GP-IB 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
9397-01	CARRYING CASE (for the 8855)
9231	RECORDING PAPER (6 rolls)
9197	CONNECTION CORD (for high voltage, maximum input voltage 500 V)
9198	CONNECTION CORD (for low voltage, maximum input voltage 300 V)
9199	CONVERSION ADAPTOR (between BNC and banana, female)
9217	CONNECTION CORD (isolated between BNC and BNC)
9327	LOGIC PROBE (maximum input voltage 50 V)
9321-01	LOGIC PROBE (maximum input voltage 250 V)
9665	10:1PROBE
9666	100:1PROBE
9322	DIFFERENTIAL PROBE
9328	POWER CORD (for the 9322)
9325	POWER CORD (for the 8951)

220H PAPER WINDER

\*9303 PT

9318 CONVERSION CABLE (for the 9270 to 9272, 9277 to 9279)

3273 CLAMP ON PROBE (DC to 50 MHz)

3273-50 CLAMP ON PROBE (DC to 50 MHz)

3274 CLAMP ON PROBE (DC to 10 MHz)

3275 CLAMP ON PROBE (DC to 2 MHz)

3276 CLAMP ON PROBE (DC to 100 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 50 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)

9667 FLEXIBLE CLAMP ON SENSOR

(500 to 5000 A/50 to 500 A, 10 to 20 kHz)

9333 LAN COMMUNICATOR

9335 WAVE PROCESSOR

9549 FUNCTION UP DISK (power monitor function)

\*: no CE marking

**NOTE**

To connect the 9270 to 9272 or 9277 to 9279 Clamp-On Sensor to the 8951 VOLTAGE/CURRENT UNIT, use the 9318 CONVERSION CABLE. To connect these sensors to other instruments, use in combination with the 9555 SENSOR UNIT.

## Safety Notes




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.

### DANGER

**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



- 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.

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

### DANGER

Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.

### WARNING

Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.

### CAUTION

Indicates that incorrect operation presents a possibility of injury to the user or damage to the instrument.

### NOTE

Indicates advisory items related to performance or correct operation of the instrument.



## Measurement categories (Overvoltage categories)

This instrument complies with CAT II safety requirements.

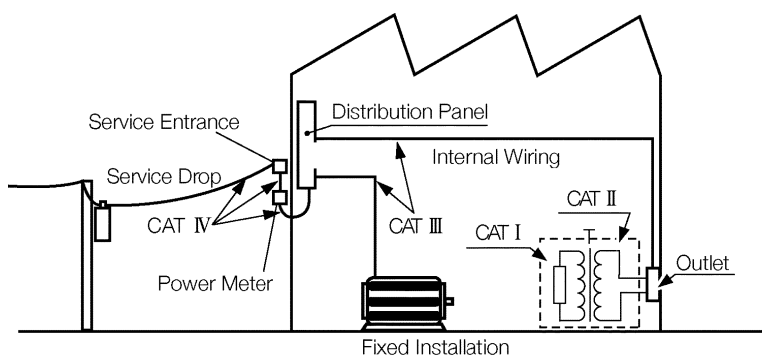
To ensure safe operation of measurement instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT I to CAT IV, and called measurement categories. These are defined as follows.

CAT I	Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.
CAT II	Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)
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).

Higher-numbered categories correspond to electrical environments with greater momentary energy. So a measurement device designed for CAT III environments can endure greater momentary energy than a device designed for CAT II.

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.

Never use a CAT I measuring instrument in CAT II, III, or IV environments. The measurement categories comply with the Overvoltage Categories of the IEC60664 Standards.



## Accuracy

We define measurement tolerances in terms of f.s. (full scale), rdg. (reading) and dgt. (digit) values, with the following meanings:

f.s.	(maximum display value or scale length) The maximum displayable value or the full length of the scale. This is usually the maximum value of the currently selected range.
rdg.	(reading or displayed value) The value currently being measured and indicated on the measuring instrument.
dgt.	(resolution) The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a "1".

## Notes on Use



**⚠ DANGER**

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

### Probe Connection, Measurement Voltage Input

- **Maximum input voltage ratings for the input module and the input terminals of the instrument are shown below. To avoid the risk of electric shock and damage to the instrument, take care not to exceed these ratings.**
- **The maximum rated voltage to earth of the input module (voltage between input terminals and main instrument frame ground, and between inputs of other analog input modules) is shown below. To avoid the risk of electric shock and damage to the instrument, 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 8950, 8952 or 8953-10, always connect the probe to the secondary side of the circuit breaker, so the breaker can prevent an accident if a short circuit occurs. Connection to the primary side involves the risk of electric shock and damage to the instrument.**
- **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 products in such conditions could cause an electric shock, so contact your dealer or Hioki representative for replacements. (Model 9197, 9198.)**

Input/output terminal	Maximum input voltage	Maximum rated voltage to earth
8950 (input)	400 V DC max.	370 V AC/DC
8951 (input)	30 V rms or 60 V DC	30 V rms or 60 V DC
8952 (input)	400 V DC max.	370 V AC/DC
8953-10 (input)	400 V DC max.	370 V AC/DC
8954 (input)	30 V rms or 60 V DC	370 V AC/DC
8955 (input)	30 V rms or 60 V DC	30 V rms or 60 V DC
9322	2000 V DC, 1000 V AC (CAT II) 600 V DC/AC (CAT III)	When using grabber clips 1500 V DC/AC (CAT II), 600 V DC/AC (CAT III) When using alligator clips 1000 V DC/AC (CAT II), 600 V DC/AC (CAT III)
EXT TRIG/ START • STOP/ EXT SMPL	-5 to +10 V DC	Not insulated
TRIG OUT/ GO/ NG/ EXT.OUT	-20 V to +30 V DC 500 mA max./ 200 mW max.	

**⚠ DANGER****External I/O terminal connections**

A common GND is used for the external I/O terminals (START, STOP, GO, NG, EXT\_OUT, EXT\_TRIG, EXT\_OUT, and EXT\_SMPL terminals) and the 8855 instrument. The terminals are not isolated. To prevent damage to the object connected to the external I/O terminals and the 8855 instrument, wire the terminals so that there is no difference in electrical potential between the GND for the external I/O terminals and the GND for the connected object.

**Logic Probe Connection**

- The logic input and 8855 instrument share a common ground. Therefore, if power is supplied to the measurement object of the logic probe and to the 8855 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 8855 could be damaged. We therefore recommend the following connection method to avoid this kind of result. Refer to Section 2.5, "Logic Probe Connection" 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 8855 using the supplied power cord.
  - (2) Before connecting the logic probe to the measurement object, connect the ground of the measurement object to the 8855 ground terminal. Also in this case, power should be supplied from the same source. Refer to Section 2.2, "Power Supply and Ground Connections" for grounding terminal details.

**Differential Probe Connection**

- When using grabber clips, the 9322's maximum rated voltage to earth is 1500 V AC or DC (CAT II) / 600 V AC or DC (CAT III); when using alligator clips, it is 1000 V AC or DC (CAT II) / 600 V AC or DC (CAT III). To avoid electrical shock and possible damage to the instrument, never apply voltage greater than these limits between the input channel terminals and chassis, or across the input of two 9322s.
- Maximum input voltage is 1000 V AC/2000 V DC (CAT II) / 600 V AC or DC (CAT III). Attempting to measure voltage in excess of the maximum rating could destroy the instrument and result in personal injury or death.

**⚠ DANGER****10:1 and 100:1 probe connections**

- The maximum rated to-voltage does not change when using a 9665 10:1PROBE or a 9666 100:1PROBE. To avoid electrical shock or damaging the 8855 instrument, make probe connections in such a manner that the method for the probe, and make sure the to-ground voltage does not exceed the rated maximum.
- The maximum input voltage is 1,000 V DC for the 9665 10:1PROBE, and 5,000 V DC for the 9666 100:1PROBE. (The measurement category (overvoltage category) is the same as that of the input modules of MEMORY HiCORDERs that use the 9665 and the 9666. ) Do not measure voltages that exceed the maximum input voltage, as the 8855 instrument could be damaged and an accidents resulting in injury or death could result.

**⚠ WARNING****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.

**Replacing the Input Modules**

- To avoid electric shock accident, before removing or replacing an input module, confirm that the instrument is turned off and that the connection cords 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.

**Grounding the Instrument**

To avoid electrical accidents and to maintain the safety specifications of this instrument, connect the power cord only to a 3-contact (two-conductor + ground) outlet. Refer to Section 2.2, "Power Supply and Ground Connections."

**Before Powering on**

Check that the power supply is correct for the rating of the instrument. Be careful to avoid connecting voltage improperly, as the internal circuitry may be destroyed. (The AC fuse is integrated in the instrument.)

**Usage Precautions for the Internal MO Drive (option)**

To prevent damage to the instrument, 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).

**⚠ CAUTION**

---

**Installation Environment**

This instrument should be installed and operated indoors only, between 5 and 40°C and 30 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.

**Storing (when the 8994 PRINTER UNIT is installed)**

When the product 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 product. If the paper is left in the product, paper support parts may be damaged due to vibrations. (when the 8994 PRINTER UNIT is installed)
- To avoid damage to the instrument, be sure to remove the input modules, floppy disk, MO disk, PC card, and SCSI cable before shipping.
- Use the original packing materials when reshipping the instrument, if possible.

**Handling the CD-R**

- Always hold the disc by the edges, so as not to make fingerprints on the disc or scratch the printing.
- 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.

**Others**

- In the event of problems with operation, first refer to Quick Start Section 14.4, "Troubleshooting".
  - Carefully read and observe all precautions in this manual.
-

**NOTE****Using a printer**

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

**Using the connection cords**

Use only the specified connection cord (9197, 9198). Using a non-specified cord may result in incorrect measurements due to poor connection or other reasons.

**Recording paper (when the 8994 PRINTER UNIT is installed)**

- Use only recording paper specified by Hioki. Non-specified recording paper may result in poor-quality or blank printouts.
- Printing is not possible if the recording paper is loaded wrong-side up. See Section 2.9.

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## Chapter Summary

<b>Chapter 1</b>	<b>Product Overview</b> Contains an overview of the instrument and its features.
<b>Chapter 2</b>	<b>Installation and Preparation</b> Explains how to set the instrument up for measurement.
<b>Chapter 3</b>	<b>Recorder and Memory Function</b> Explains how to use the recorder and memory functions of the instrument.
<b>Chapter 4</b>	<b>FFT Function</b> Explains how to use the FFT functions of the instrument.
<b>Chapter 5</b>	<b>Input Channel Settings</b> Explains how to use the input channel of the instrument. This manual describes the advanced functions of the 8855.
<b>Chapter 6</b>	<b>Memory Segmentation Function</b> Explains how to use the Memory Segmentation Function.
<b>Chapter 7</b>	<b>Operation Function</b> Explains how to use the Calculating, Waveform Parameter value and Waveform GO/NG Evaluation.
<b>Chapter 8</b>	<b>Search Function</b> Explains how to search for data.
<b>Chapter 9</b>	<b>Waveform Evaluation Function</b> Explains how to use the Calculating, Waveform Evaluating value and Waveform GO/NG Evaluation.
<b>Chapter 10</b>	<b>Printout of Measurement Data</b> Explains how to print out measurement data and how to read printed charts.
<b>Chapter 11</b>	<b>Communication Settings</b> Explains how to make settings for the LAN interface and PC card interface.
<b>Appendix</b>	Contains information that is necessary for using this instrument, including a description of error messages, a glossary, and an explanation how to increase memory.





# Chapter 1

## Product Overview

## 1.1 Major Features

### (1) Waveform collection performance

Using the 8950 ANALOG UNIT, the 8951 VOLTAGE/CURRENT UNIT, and the 8952 DC/RMS UNIT with the 8855, it is possible to record waveforms at 20 MS/s with a resolution of 12 bits.

Furthermore, using the 8953-10 HIGH RESOLUTION UNIT, it is possible to record waveforms at 1 MS/s with a resolution of 16 bits.

Using the 8954 VOLTAGE/TEMP UNIT in combination with the 8855, it is possible to record temperature.

Using the 8955 F/V UNIT in combination with the 8855, it is possible to measure items such as frequency.

Regardless of the input module, it is possible to record waveforms on up to 8 channels, simultaneously.

### (2) High-resolution display

The 8855 is equipped with a 10.4-inch (800 x 600 pixels) TFT color LCD, and can display waveforms with great precision.

Because both the values and gauge can be displayed simultaneously, it is easy to confirm waveform measurements directly on-screen.

### (3) Measurement functions

Memory with a maximum sampling speed of 50 ns (simultaneous recording on all channels).

If using the optional printer module, it is possible to output real-time recordings on recording paper.

### (4) Storage capacity

The 8855 has a standard storage capacity of 32 M words, expandable to 128 M or 512 M words with memory upgrades.

### (5) Trigger function

- Digital trigger circuit
- Trigger types: level trigger, window-in trigger, window-out trigger, period trigger, glitch trigger, event trigger, logic trigger (pattern trigger)

### (6) Diverse observation functions

The 8855 can calculate such values as the average, maximum, and absolute values, as well as perform arithmetic calculations.

The time and value of the cursor can be calculated for all channels.

### (7) Search function

You can set criteria and search through captured waveforms.

### (8) GUI display

The GUI-inspired (Graphical User Interface) design, which uses both graphical and textual representation on the function key display, makes the instrument easier to configure and operate.

**(9) On-line help**

On-line help guides the user through operation steps and various functions. Furthermore, you can easily display help using the setting item in the lower part of the screen.

**(10) 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.

**(11) Additional recording function**

When enabled, the memory is regarded as printer paper.

**(12) Input modules (Option)**

The analog inputs are floating, and so each input can be connected to its own independent potentials.

Select input modules suitable for measurements.

**(13) Built-in thermal printer (Option)**

Thermosensitive recording method using a thermal line head

The built-in printer delivers waveform printouts on the spot.

The printer can also be used to print screen shots, reduction screen shots and parameter information. Report print can be printed.

**(14) External storage means (MO/HD drive option)**

Measurements, settings, and images can be recorded on a MO disk or hard disk.

**(15) PC card**

Measurements, settings, and images can be recorded on a flash ATA card.

PPP connection is possible using a modem card.

**(16) SCSI 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.

When the 8855 is connected to your PC through an SCSI, you can access the data of the internal 8855 MO disk or hard disk from the PC.

**(17) Internal LAN interface (10BASE-T)**

You can connect the 8855 to a local area network (LAN) using the 9333 LAN COMMUNICATOR.

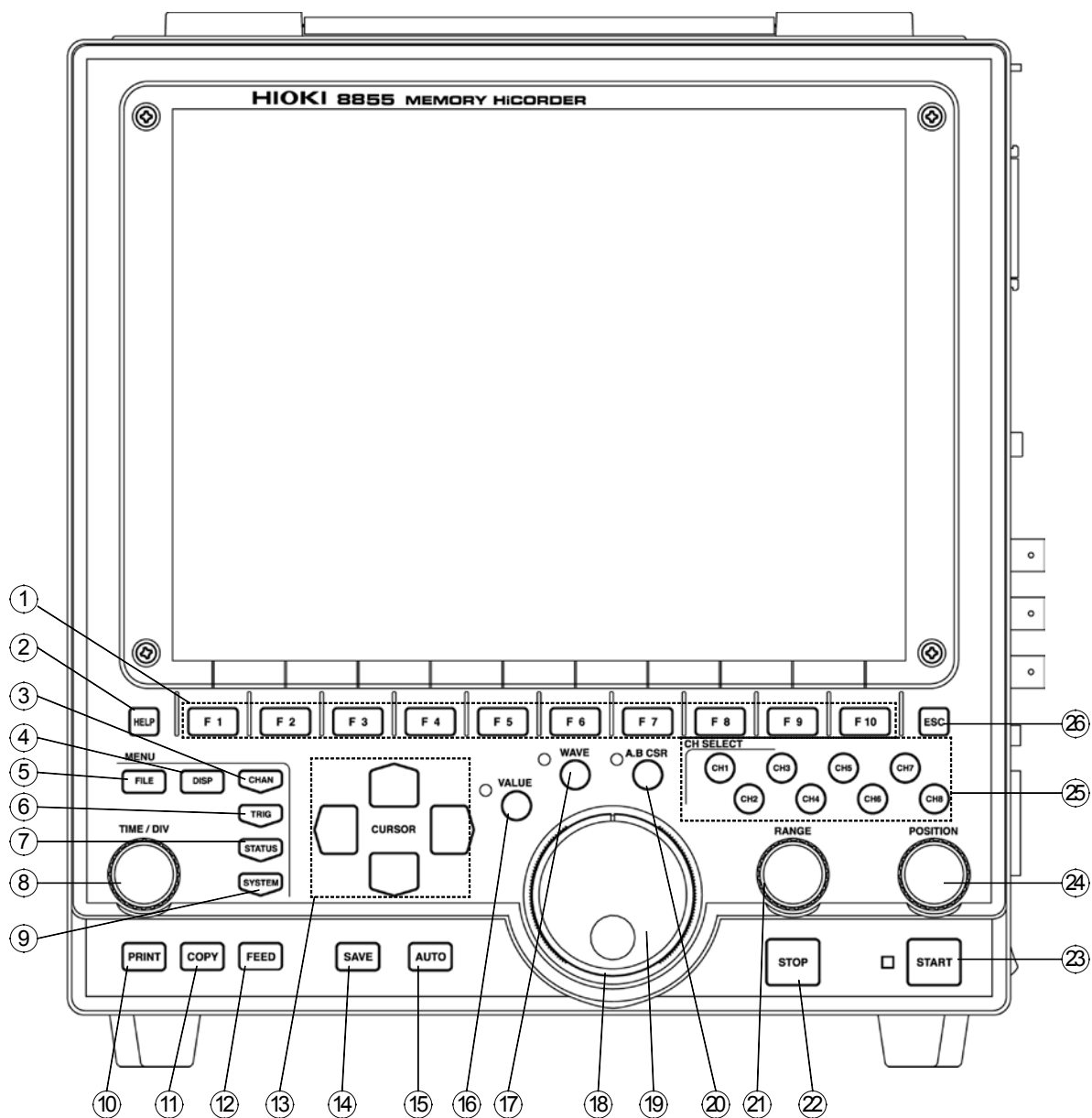
When performing rapid data exchanges, such as those between the 8855 and a PC, remote operations are possible from the PC.

The 8855 supports FTP.

**(18) Dual-language capability**

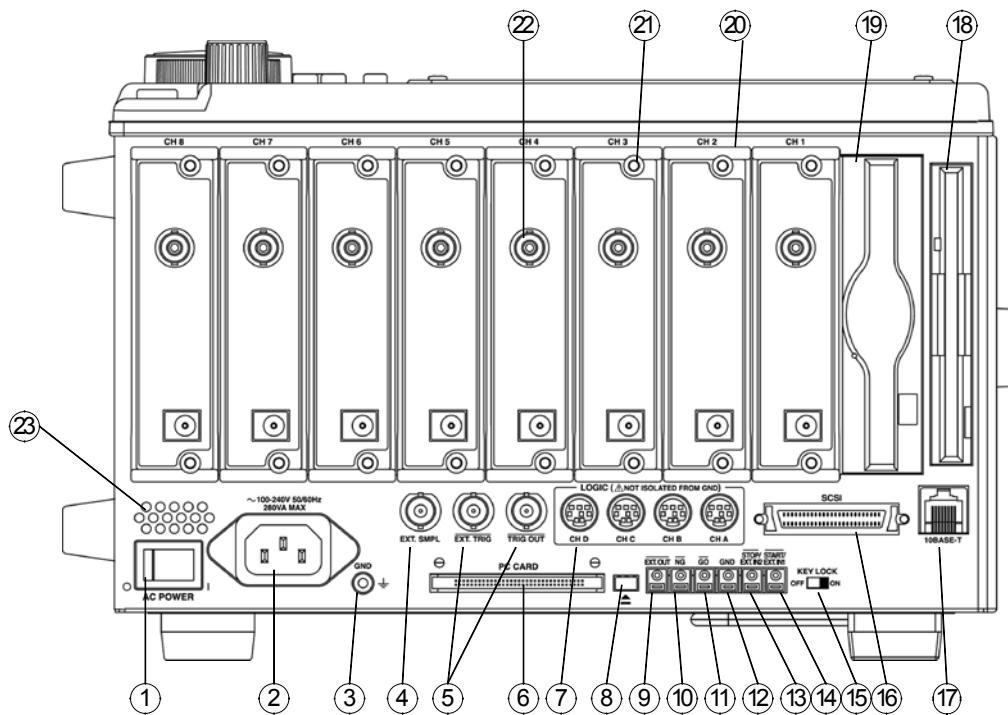
Display language is switchable between Japanese and English.

## 1.2 Identification of Controls and Indicators



Front Panel

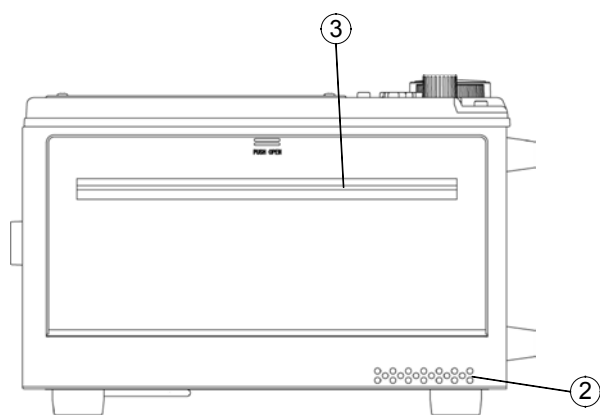
- |                        |  |
|------------------------|--|
| ① <b>F1 to F10</b> key | Serve to select setting items.   |
| ② <b>HELP</b> key      | Provides on-line help.   |
| ③ <b>CHAN</b> key      | Causes the display to show the Channel screen which serves for making input channel settings.  |
| ④ <b>DISP</b> key      | Causes the display to show measurement and analysis results.   |
| ⑤ <b>FILE</b> key      | Causes the display to show the File screen which serves for reading, storing, etc. the waveform data etc.  |
| ⑥ <b>TRIG</b> key      | Causes the display to show the Trigger screen. Setting the trigger functions.  |
| ⑦ <b>STATUS</b> key    | Causes the display to show the Status screen which serves for setting most measurement parameters.   |
| ⑧ <b>TIME/DIV</b> key  | Serves to set the speed for inputting and storing the input signal.  |
| ⑨ <b>SYSTEM</b> key    | Causes the display to show the System screen. Makes all the settings of common functions, such as the initial settings and various other settings.           |
| ⑩ <b>PRINT</b> key     | Serves to print out stored waveforms.  |
| ⑪ <b>COPY</b> key      | Serves to print out a hard copy of the current screen display.   |
| ⑫ <b>FEED</b> key      | Causes the printer paper to advance for as long as the key is pressed.   |
| ⑬ <b>CURSOR</b> key    | These keys serve to move the flashing cursor in the four directions.   |
| ⑭ <b>SAVE</b> key      | Saves the data on the specified media.   |
| ⑮ <b>AUTO</b> key      | Pressing this key activates automatic setting of time axis range and voltage range values of input waveform.   |
| ⑯ <b>VALUE</b> key     | Uses to select the numerical values setting.   |
| ⑰ <b>WAVE</b> key      | Uses to select the the waveform scrolling.   |
| ⑱ <b>SHUTTLE</b>       | Rotary control knob that serves to change values, move the A/B cursors, and scroll the waveform.   |
| ⑲ <b>JOG</b>           | Concentric ring that serves to change values, move the A/B cursors, and to scroll the waveform. The speed of movement is proportional to the rotation angle. |
| ⑳ <b>A.B CSR</b> key   | Uses to select the the A/B cursor moving.  |
| ㉑ <b>RANGE</b> knob    | Sets the measurement range for the channel.  |
| ㉒ <b>STOP</b> key      | Stops measurement and analysis.<br>Pressing this key twice stops measurement.  |
| ㉓ <b>START</b> key     | Initiates the measurement and analysis. During measurement, the LED above the key is lit.  |
| ㉔ <b>POSITION</b> knob | Sets the zero position for the channel.  |
| ㉕ Channel select keys  | Selects channel.   |
| ㉖ <b>ESC</b> key       | Exits the Input or Set up screen.  |



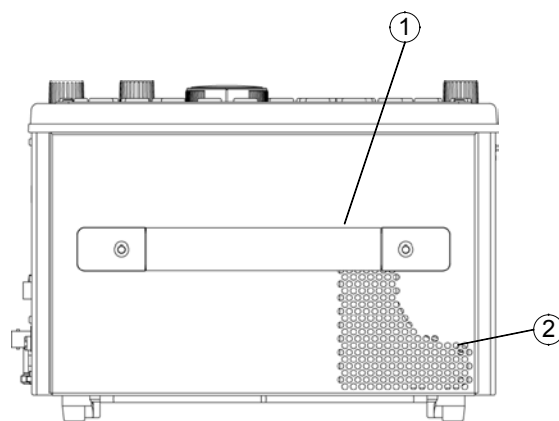
**Right Side Panel**

- |                                  |   |
|----------------------------------|---|
| ① AC power switch                | Switches on or off the AC power supply.   |
| ② AC connector                   | The supplied power cord must be plugged in here.  |
| ③ Function ground terminal (GND) | Connects to the earth.  |
| ④ External sampling terminal     | Allows input of an external sampling signal. (in the Memory function)   |
| ⑤ Trigger terminals              | Can be used to synchronize multiple instruments, using the EXT TRIG input and TRIG OUT output.                            |
| ⑥ PC card slot                   | Inserts the PC card.  |
| ⑦ Logic probe connectors         | Input connector for the logic input section, designed for the dedicate logic probes (CH A to D).                          |
| ⑧ Eject button                   | Removes the PC card.  |
| ⑨ External output terminal       | Various output signals can be selected, such as the BUSY or error signals.  |
| ⑩ NG evaluation output terminal  | When NG results from the numerical calculation evaluation and waveform evaluation, a signal is output from this terminal. |
| ⑪ GO evaluation output terminal  | When GO results from the numerical calculation evaluation and waveform evaluation, a signal is output from this terminal. |
| ⑫ Ground terminal (GND)          | Uses with ⑨ to ⑭ (except ⑫) terminals.  |
| ⑬ External stop terminals        | Stop operation can be controlled.   |
| ⑭ External start terminals       | Start operation can be controlled.  |
| ⑮ Key lock                       | Locks the operation of keys.  |
| ⑯ SCSI connector                 | An MO drive can be connected.   |
| ⑰ LAN connector                  | Can be connected to a network through a LAN.  |

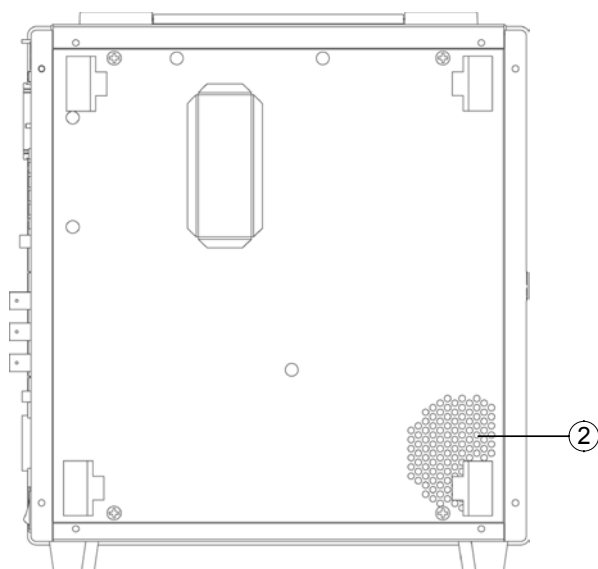
- ⑮ FD slot                      Floppy disk is inserted.
- ⑯ MO slot                    MO disk is inserted.
- ⑰ Input module slots        These slots accept input modules.
- ⑱ Fastening screw           Secures the plug-in instrument.
- ⑳ Analog input connector   Unbalanced analog input. (on ANALOG UNIT)
- ㉑ Blowing slot



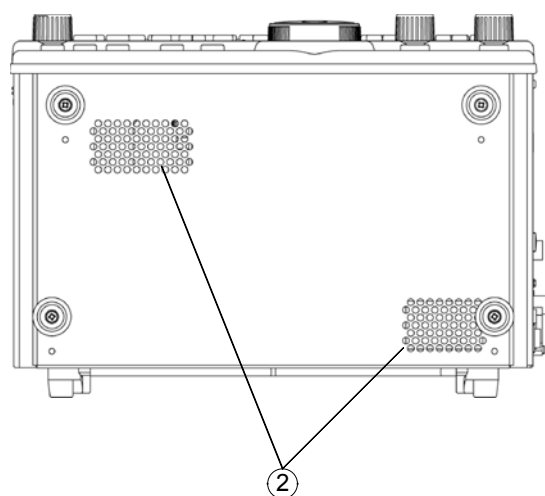
**Left Side Panel**



**Upper Panel**



**Rear Panel**



**Bottom Panel**

- ① Handle                      Serves for transporting the 8855.
- ② Ventilation slots
- ③ Printer                      (when the 8994 PRINTER UNIT is installed)





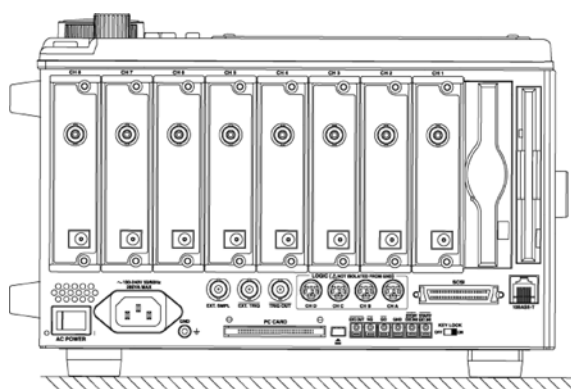
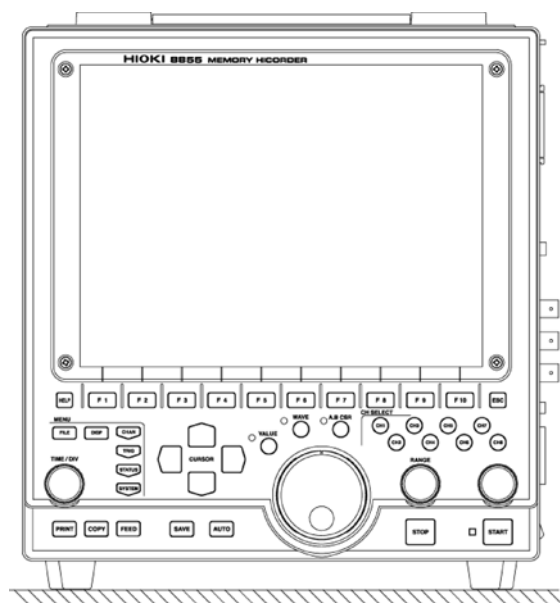
## Chapter 2

# Installation and Preparation

## 2.1 Installation of the Product

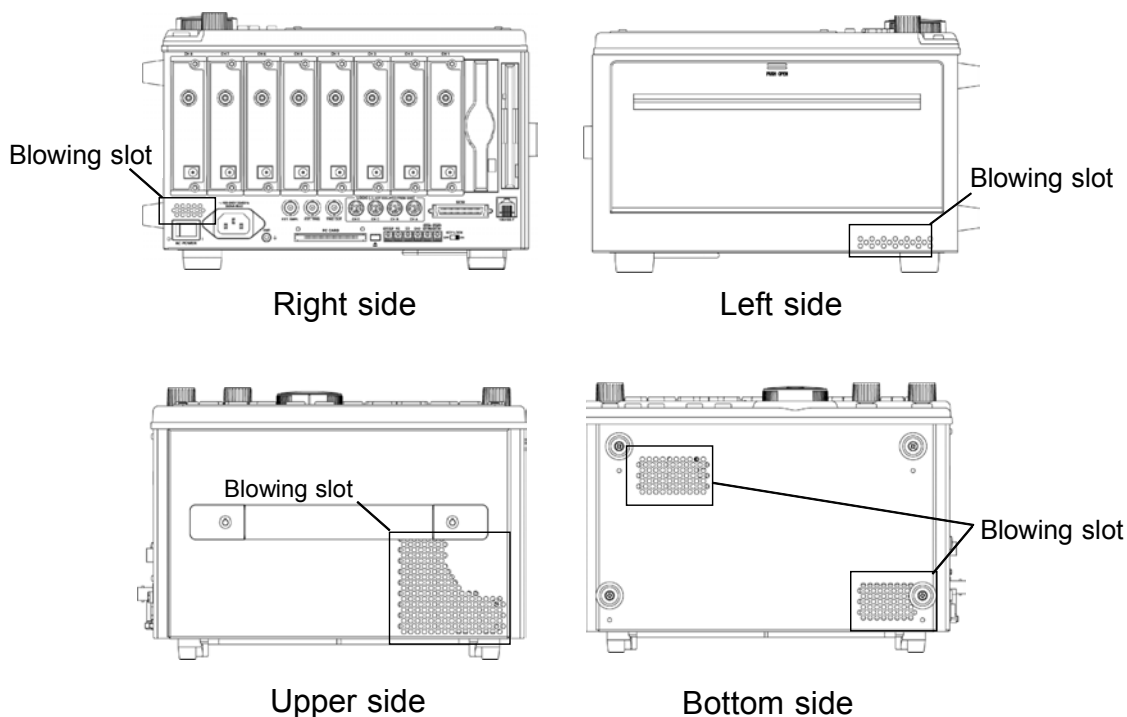
### Installation orientation

Install the instrument on a flat, level surface.



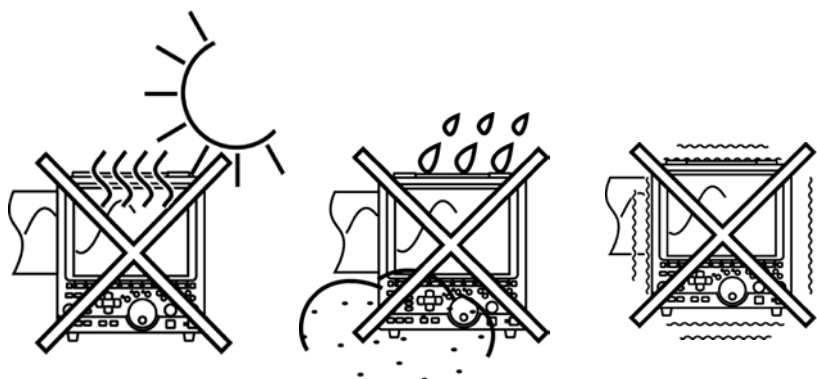
## Ambient conditions

Temperature	5 to 40°C, $23 \pm 5^\circ\text{C}$ recommended for high-precision measurements.
Humidity	30 to 80% RH (no condensation); $50 \pm 10\%$ RH (no condensation) recommended for high-precision measurements.
Ventilation	Take care not to block the ventilation openings and assure proper ventilation. When using the instrument in an upright position, take care not to block the openings on both side.



## 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.,  $\text{H}_2\text{S}$ ,  $\text{SO}_2$ ,  $\text{NI}_2$ , and  $\text{Cl}_2$ ) 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.



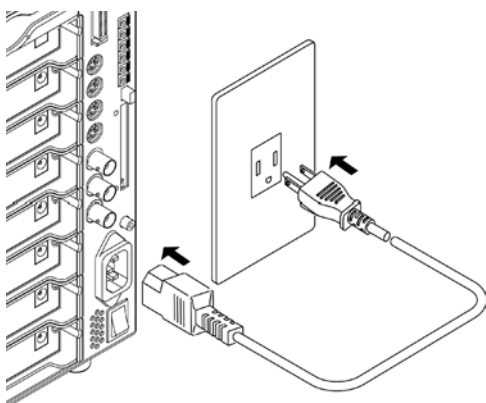
## 2.2 Power Supply and Ground Connections

### 2

### 2.2.1 Connecting the AC Power Supply

#### ⚠ WARNING

- Check the following points before connecting the instrument 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 instrument.
  - (1) Power supply matches Rated supply voltage (100 to 240 V AC: Voltage fluctuations of  $\pm 10\%$  from the rated supply voltage are taken into account.) and rated supply frequency (50/60 Hz).
  - (2) The AC power switch of the 8855 is set to OFF.
  - (3) Use only the supplied AC power cord.
- When supplying power with an inverter or an uninterruptible power supply (UPS), use a device that complies with the following conditions. To avoid the risk of electric shock and damage to the instrument, do not use devices that have a voltage frequency outside the specified range, or that output square waves.
  - (1) Voltage: 100 V to 240 V AC
  - (2) Power frequency: 50/60 Hz
  - (3) Sine wave output (Do not use devices that have an unstable output, even if the output is sinusoidal.)
- The 8855 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.



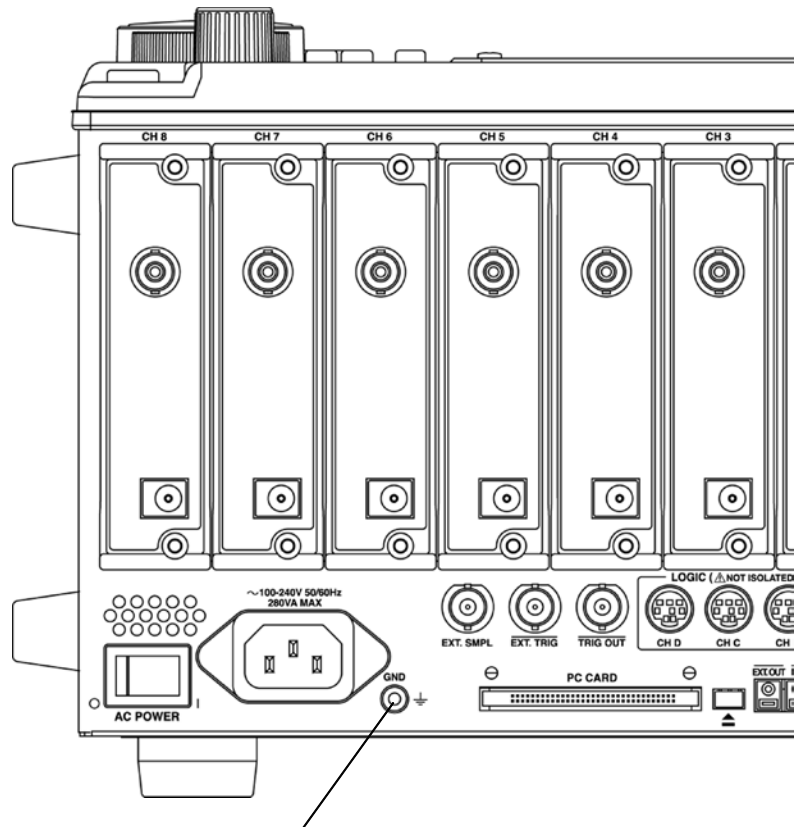
#### NOTE

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

1. Verify that the AC power switch of the 8855 is set to OFF.
2. Plug the grounded three-core power cord supplied into the AC power connector on the right side of the 8855.
3. Plug the power cord into an AC outlet corresponding to the rating of the 8855.

## 2.2.2 Functional Grounding of the 8855

When the 8855 is used in noise-prone environments, connect the functional grounding terminal to improve noise characteristics.



Functional grounding terminal

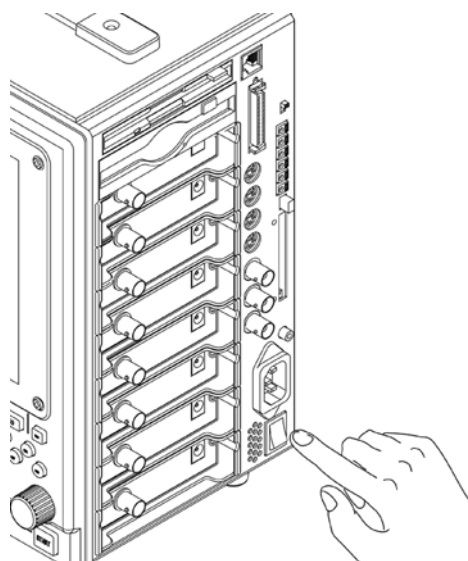
## 2.3 Power On/Off

2

**⚠ WARNING**

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

- Power supply matches Rated supply voltage (100 to 240 V AC: Voltage fluctuations of  $\pm 10\%$  from the rated supply voltage are taken into account.) and rated supply frequency (50/60 Hz).
- The instrument is correctly installed (Section 2.1).
- Power cord is correctly connected (Section 2.2).
- The instrument is properly grounded.

**NOTE**

- After the power switch is turned on, wait approximately 30 min to stabilize the inside temperature of the connected input module in order to obtain accurate waveforms. Then, make a zero adjustment prior to measurement. For details, see the specifications of each module, Quick Start Section 13.2 "Analog Inputs."  
Adjustment → See Quick Start Section 6.4 "Zero Adjustment."
- When the instrument is turned off, it memorizes the currently used settings and reestablishes the same settings the next time the instrument is turned on again.

## 2.4 Connection of the Input Product

### 2.4.1 8950, 8952, 8953-10, 8955 INPUT UNITS

#### ⚠ WARNING

- Never connect the probe to the 8855 while the probe is already connected to the measurement object. Otherwise there is a risk of electric shock.
- Use only the specified input cord with this probe.  
An insulating BNC connector is provided to prevent electric shock. When using a metal BNC, there is risk of electric shock, due to the input L terminal having the same potential as the metal portion of the BNC connector.

#### ⚠ CAUTION

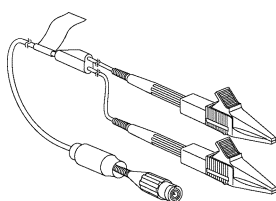
- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cord, can damage the connector.
- Use the power terminal with the 9322 DIFFERENTIAL PROBE only. To connect the probe, you need the 9328 POWER CORD. To avoid injuries or damage to this instrument, do not connect any device other than the 9322 to the terminal.

#### NOTE

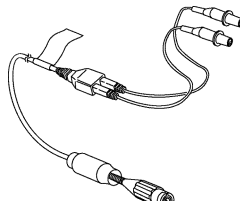
Use of an unspecified input cord may result in inaccurate measurements due to poor connection or BNC connector damage.

For safety reasons, only use the optional 9197, 9198, or 9217 CONNECTION CORD for connection to the analog input modules.

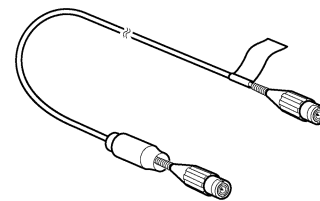
#### Connection Cord



9197  
(500 V)



9198  
(300 V)



9217  
(300 V)

(Maximum input voltage:)

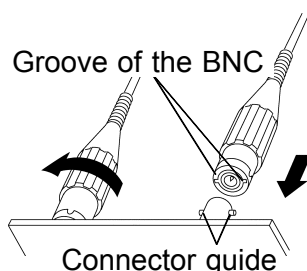
Measurement objects

Items that can be hooked to with large alligator clips

Items that can be hooked to with small alligator clips

BNC output

#### Connecting to the main instrument



1. Align the BNC connector with the guide groove of the module input connector, and turn clockwise while pressing in to lock the connector. (Only use the 9198 CONNECTION CORD for connection to the 8955 F/V UNIT.)
2. To remove from the module, turn the BNC connector counterclockwise to release the lock, then pull it.

## 2.4.2 8951 VOLTAGE/CURRENT UNIT

### DANGER

#### Precautions when using the 3273, 3273-50, and the 3276 CLAMP ON PROBE

- When 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), (2) Double (reinforced) Insulation Requirements for Working Voltages 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.
- Be careful to avoid damaging the insulation surface while taking measurements.
- Refer to the following standards regarding the meanings of underlined terms.  
IEC 61010-1 (JIS C 1010-1)  
IEC 61010-2-031 (JIS C 1010-2-31)  
IEC 61010-2-032 (JIS C 1010-2-32)

#### Precautions when using the 3274 and the 3275 CLAMP ON PROBE

- When conductors being measured carry in excess of the safe voltage level (SELV-E)\* and not more than 600 V (CAT II) or 300 V (CAT III), to prevent short circuits and electric shock while the core section is open, make sure that the conductor insulation satisfies the (1) Basic insulation requirements for the applicable (2) Measurement Category (Overvoltage Category), (3) Working Voltage, and (4) Pollution Degree. For safeties sake, never use this sensor on bare conductors.
- Be careful to avoid damaging the insulation surface while taking measurements.
- Refer to the following standards regarding the meanings of underlined terms.  
IEC 61010-1 (JIS C 1010-1)  
IEC 61010-2-031 (JIS C 1010-2-31)  
IEC 61010-2-032 (JIS C 1010-2-32)

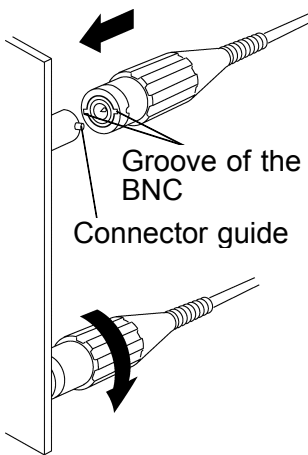
\*: The voltage levels are 30 V rms and 42.4 V peak or 60 V DC.

### WARNING

- When you are using the clamp to the 8855, the 8951 GND, clamp GND, and power supply terminals of modules on other channels are not insulated. Exercise care in handling these to avoid damaging this instrument or suffering from injury.
- To avoid shock and short circuits, turn off all power before connecting probes.

**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 cord, can damage the connector.



**Connecting the Connection cord (for voltage measurement)**

1. Align the BNC connector with the guide groove of the 8855 input connector, and turn clockwise while pressing in to lock the connector. (For using the 8951, use the 9198 CONNECTION CORD.)
2. To remove from the module, turn the BNC connector counterclockwise to release the lock, then pull it.

**Connecting the Clamp (for current measurement)**

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

Conversion cable	Clamp-on sensor/probe
9318	9270, 9271, 9272, 9277, 9278, 9279

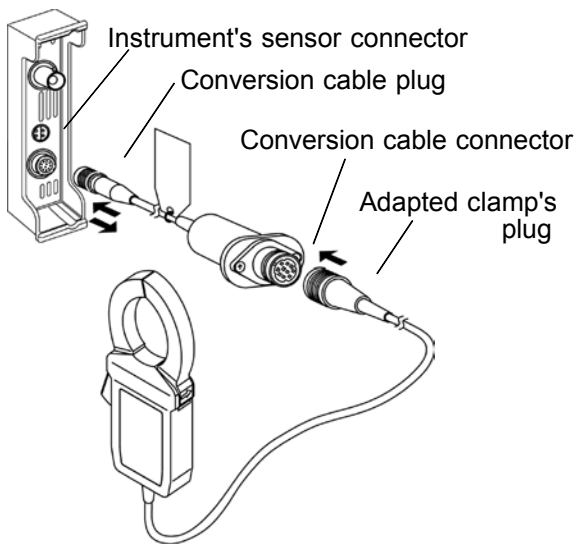
**Number of usable clamps**

The number of clamps that can be used with the 8855 is limited according to clamp type. The clamps that can be used for the relevant clamp type is shown to the list shown below.

In the case that the relevant clamp type is used the clamp total use number is confirmed and please do not exceed the number of the list shown below.

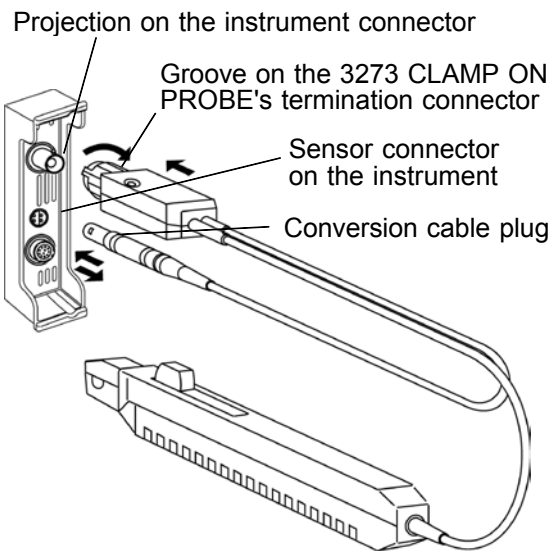
Clamp	Number
3274 CLAMP ON PROBE	
Continuous 150 A	8
Non-continuous 300 A	4
3273-50, 3275, 3276 CLAMP ON PROBE	4
9278 UNIVERSAL CLAMP ON CT	7
9279 UNIVERSAL CLAMP ON CT	7





### Connecting the 9318 CONVERSION CABLE

1. Align the groove on the conversion cable plug with the sensor connector on the 8951 and push inward until the connector locks into place.
2. Align the groove on the conversion cable connector with the adapted clamp on sensor plug and push inward until the connector locks into place.
3. To unplug the cables, slide the lock ring on each plug outward to unlock it, then pull out the plug.



### Connecting the 3273, 3273-50, 3274, 3275, 3276 CLAMP ON PROBE

1. Align the groove on the 3273, 3273-50, 3274, 3275, 3276 CLAMP ON PROBE's termination connector with the pin on the BNC connector on the 8951, then slide the termination connector over the BNC connector and turn to lock it in place.
2. Align the groove on the 3273, 3273-50, 3274, 3275, 3276 cable plug with the power connector on the 8951.

---

### 2.4.3 8954 VOLTAGE/TEMP UNIT

**⚠ WARNING**

- Do not connect the connection cord to the 8855 while the instrument is connected to the object being measured. This may cause electric shock.
- A common GND is used for the voltage and temperature input on each channel. When using the voltage and temperature inputs simultaneously, do not connect them both at the same time as this may damage the object you are measuring.
- When using a non-insulated thermocouple to measure the temperature of points, be careful not to touch the terminals. The terminals may be electrically charged.

**⚠ 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 cord, can damage the connector.
- Make sure that the thermocouple is installed in a location within the safe super-low voltage (30 V rms or 60 V DC ). For information on selecting a thermocouple when measuring high voltage components, contact the thermocouple manufacturer.

**NOTE**

The voltage and temperature inputs and this instrument are isolated.

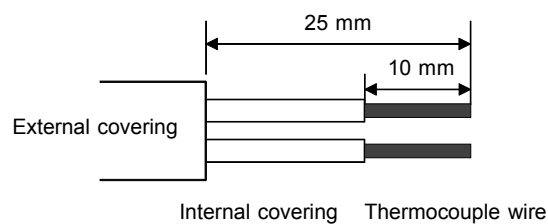
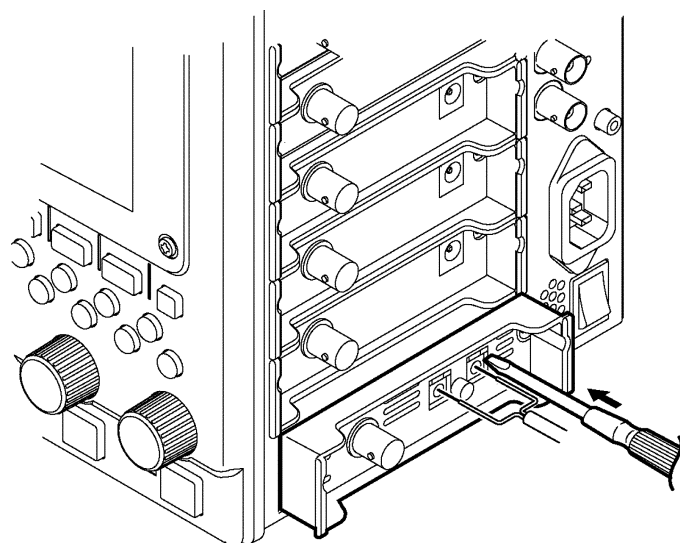
**Connecting the connection cord (when measuring voltage)**

1. Align the groove on the BNC connector with the connector guide on the module and insert the BNC connector, then turn it to the right to lock it in place. (Use the 9198 CONNECTION CORD when measuring voltage with the 8954.)
2. To remove the BNC connector, turn it to the left to release the lock, then pull it out.

**Connecting the thermocouple (when measuring temperature)**

1. First, remove the covering from the thermocouple.
2. Press the button with a tool, such as a screwdriver.
3. With the button pressed down, insert the thermocouple into the connection slot.
4. When you release the button, the thermocouple is fixed in place.
5. To remove the thermocouple, hold down the button and pull out the thermocouple.

## How to remove the covering from the thermocouple



Recommended diameter  
 $\phi$  0.4 mm to 1.2 mm  
 (AWG26 to 16)

### NOTE

- To install and remove the thermocouple, use a tool such as a screwdriver.
- The push-button terminal block on the 8954 VOLTAGE/TEMP UNIT is for use with a thermocouple. Only connect the thermocouples specified (types K, J, E, T, N, R, S, B, and W).
- If you reverse the + and - connections on the thermocouple, the correct value will not be displayed.

## 2.5 Logic Probe Connection



### **⚠ DANGER**

The logic input and 8855 instrument share a common ground. Therefore, if power is supplied to the measurement object of the logic probe and to the 8855 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 8855 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 8855 using the supplied power cord.
- (2) Before connecting the logic probe to the measurement object, connect the ground of the measurement object to the 8855 ground terminal. Also in this case, power should be supplied from the same source. Refer to Section 2.2, "Power Supply and Ground Connections" for grounding terminal details.

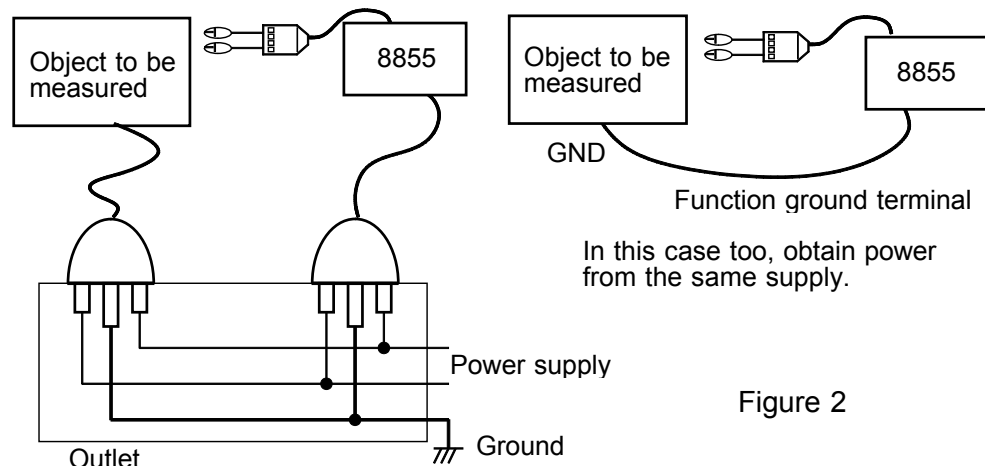
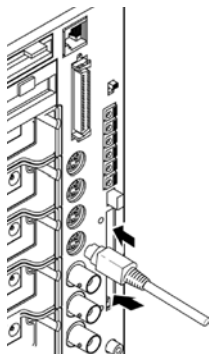


Figure 2



- The logic input is located on the rear of the instrument. Up to four probes can be connected.
- Since one logic probe can record 4 channels, the combined maximum recording capability for logic waveforms is 16 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.
- Do not connect logic probes other than supplied by HIOKI to the logic inputs.

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

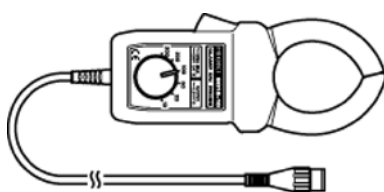


### **⚠ DANGER**

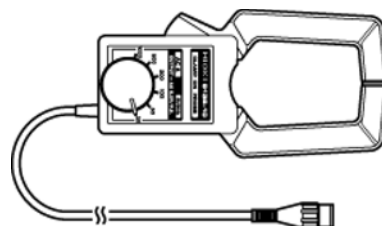
- Clamp-on probe should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.
- Before using the 9018-10, 9132-10 CLAMP ON PROBE, be certain that you understand the instructions and precautions in the manual

This instrument measures input voltage, so although current can not be measured directly, current can be measured by the voltage output from the HIOKI 9810-10, 9132-10 CLAMP ON PROBES.

Connect the BNC connector of the CLAMP ON PROBE to the analog input terminal. For details, refer to "Connecting the Connection cord (for voltage measurement)" of 2.4.2.



9018-10



9132-10

### **NOTE**

- The 8855 will indicate measurement results as voltage.
- Using the scaling function, units can be converted to "A" for display. See Section 5.3.2.
- When the clamp-on probe is used for measurement, the measurement precision will be affected both by the 8855 precision and clamp-on probe precision ratings. The same is true for cases where other clamps are used.
- When using the 9199 CONVERSION ADAPTOR, the 9018, 9132 CLAMP ON PROBES can be used.

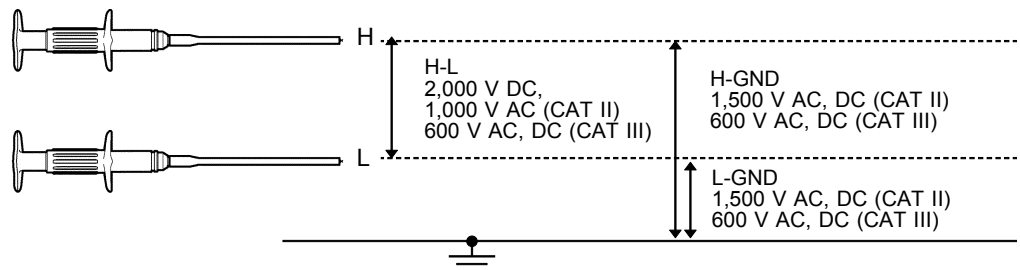
## 2.7 9322 DIFFERENTIAL PROBE Connection



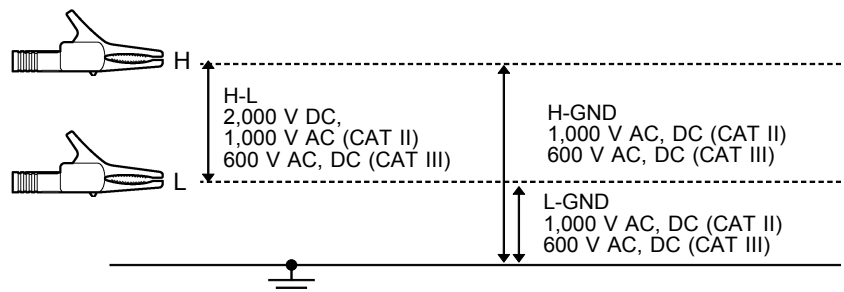
### ⚠ DANGER

- When using grabber clips, the 9322's maximum rated voltage to earth is 1500 V AC or DC (CAT II) / 600 V AC or DC (CAT III); when using alligator clips, it is 1000 V AC or DC (CAT II) / 600 V AC or DC (CAT III). To avoid electrical shock and possible damage to the instrument, never apply voltage greater than these limits between the input channel terminals and chassis, or across the input of two 9322s.
- Maximum input voltage is 1000 V AC/2000 V DC (CAT II) / 600 V AC or DC (CAT III). Attempting to measure voltage in excess of the maximum rating could destroy the instrument and result in personal injury or death.

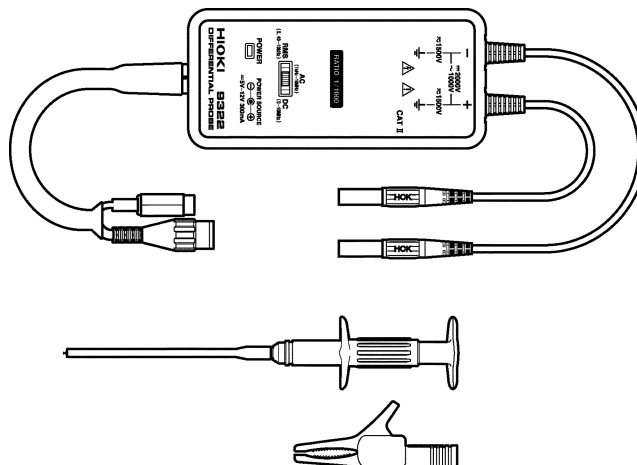
#### Grabber clips



#### Alligator clips



9322 is a differential probe that connects to input of 8855 MEMORY HiCORDER input module. For more details, refer to its instruction manual.



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## 2.8 9665 10:1 PROBE / 9666 100:1 PROBE

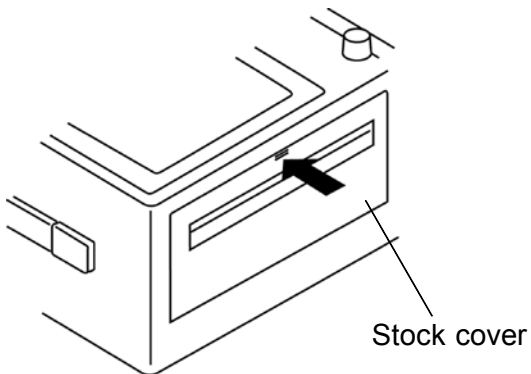
**⚠ DANGER****10:1 and 100:1 probe connections**

- The maximum rated to-voltage does not change when using a 9665 10:1PROBE or a 9666 100:1PROBE. To avoid electrical shock or damaging the 8855 instrument, make probe connections in such a manner that the method for the probe, and make sure the to-ground voltage does not exceed the rated maximum.
- The maximum input voltage is 1,000 Vrms (1MHz max) for the 9665 10:1PROBE, and 5,000 Vpeak (1MHz max) for the 9666 100:1PROBE. (The measurement category (overvoltage category) is the same as that of the input modules of MEMORY HiCORDERS that use the 9665 and the 9666. ) Do not measure voltages that exceed the maximum input voltage, as the 8855 instrument could be damaged and an accidents resulting in injury or death could result.

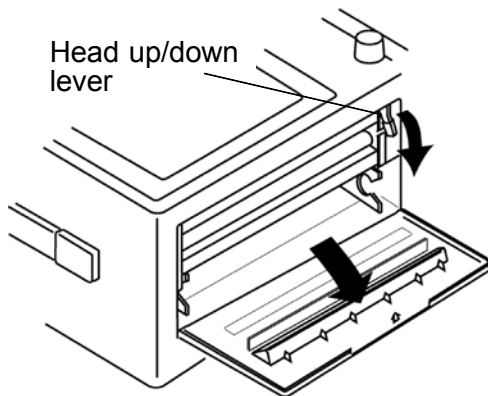
**NOTE**

- The 9665 10:1PROBE and the 9666 100:1PROBE cannot be used with the 8951 VOLTAGE/CURRENT UNIT, the 8954 VOLTAGE/TEMP UNIT, or the 8955 F/V UNIT.
- For details on the 9665 10:1PROBE and the 9666 100:1PROBE, refer to the instruction manuals supplied with the respective probes.

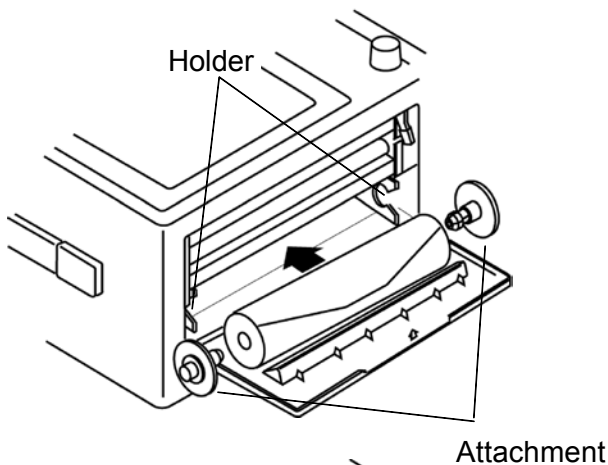
## 2.9 Loading Recording Paper (when the 8994 PRINTER UNIT is installed)



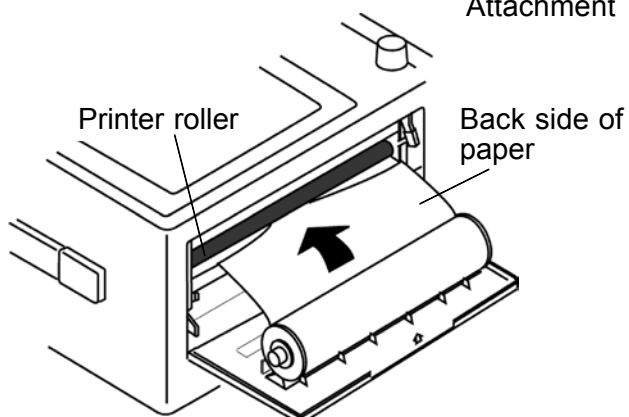
1. Press the stock cover and open it.



2. Put down the head up/down lever.

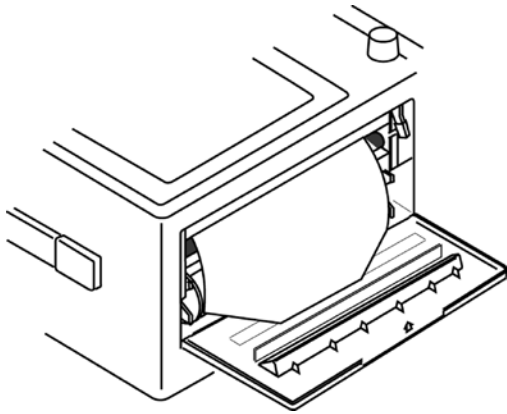


3. Insert the attachments into the ends of the roll of recording paper and set the paper into its holder.

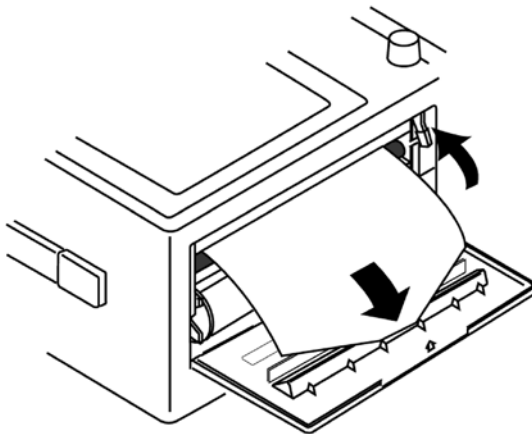


4. Insert the leading edge of the recording paper from above into the gap behind the printer roller, and pull it out to the other side.

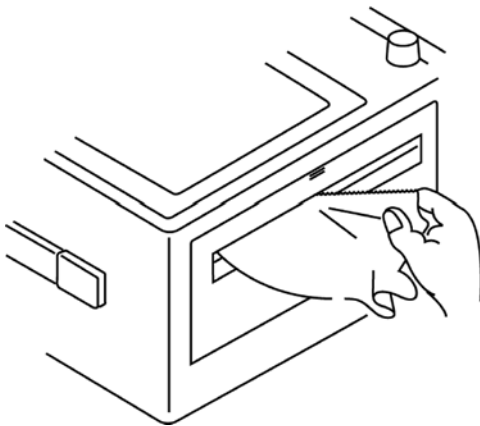




5. Align the edges of the recording paper you pulled out of the printer with the edges of the recording paper set into the holder. If the edges of the recording paper are not aligned exactly, the paper will come out crooked when printing.



6. Raise 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.

#### CAUTION

- 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.

#### NOTE

- Make sure that the paper may jam if it is not aligned with the roller.
- Printing is not possible if the recording paper is loaded wrong-side up.

## 2.10 Care of Recording Paper

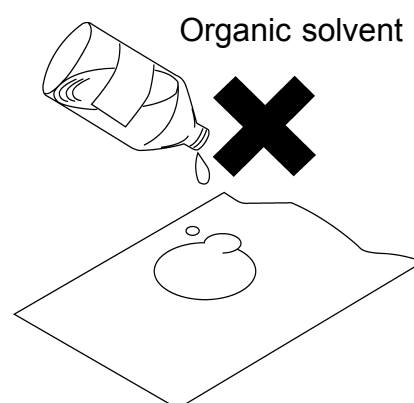
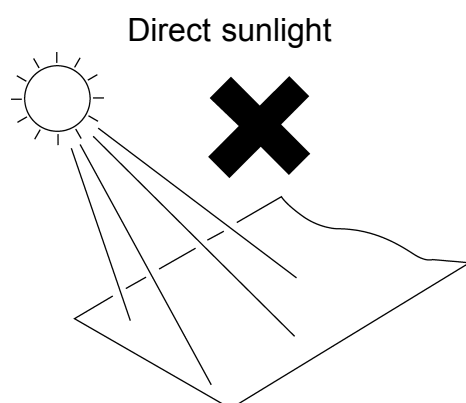
### Care of recording paper

- 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°C. Low temperatures cause no problem.
- After opening, protect the paper from strong light, to prevent discoloration.

### Storing data recordings

As the recording paper is thermally sensitive, be aware of the following points:

- To avoid paper discoloration, do not expose it to direct sunlight.
- Store at no more than 40°C and 90% RH.
- For permanent storage of important recorded data, photocopy the recording paper.
- 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.
- The thermal recording paper is ruined by contact with wet Daizo copy paper.



## 2.11 Notes on Measurement



### **⚠ DANGER**

- Maximum input voltage ratings for the input module and the input terminals of the instrument are shown below. To avoid the risk of electric shock and damage to the instrument, take care not to exceed these ratings.
- The maximum rated voltage to earth of the input module (voltage between input terminals and main instrument frame ground, and between inputs of other analog input modules) is shown below. To avoid the risk of electric shock and damage to the instrument, 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 8950, 8952 or 8953-10, 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 instrument.
- 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 products in such conditions could cause an electric shock, so contact your dealer or Hioki representative for replacements. (Model 9197 or 9198 CONNECTION CORD.)

Input/output terminal	Maximum input voltage	Maximum rated voltage to earth
8950 (input)	400 V DC max.	370 V AC/DC
8951 (input)	30 V rms or 60 V DC	30 V rms or 60 V DC
8952 (input)	400 V DC max.	370 V AC/DC
8953-10 (input)	400 V DC max.	370 V AC/DC
8954 (input)	30 V rms or 60 V DC	370 V AC/DC
8955 (input)	30 V rms or 60 V DC	30 V rms or 60 V DC
9322	2000 V DC, 1000 V AC (CAT II) 600 V DC/AC (CAT III)	When using grabber clips 1500 V DC/AC (CAT II), 600 V DC/AC (CAT III) When using alligator clips 1000 V DC/AC (CAT II), 600 V DC/AC (CAT III)
EXT TRIG/ START • STOP/ EXT SMPL	-5 to +10 V DC	Not insulated
TRIG OUT/ GO/ NG/ EXT.OUT	-20 V to +30 V DC 500 mA max./ 200 mW max.	

**⚠ WARNING**

- In order to avoid accidents from electric shock, before removing or replacing an input module, check that the connection cords and thermocouple are disconnected, turn off the power, and remove the power cord.
- 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.

**⚠ CAUTION**

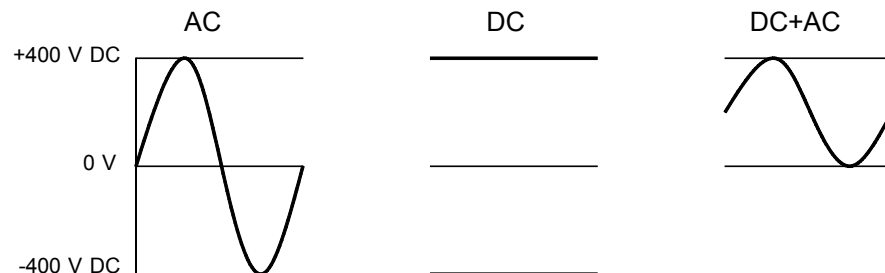
- When making measurements on an AC power line for example, using a voltage transformer, be sure to connect the voltage transformer ground terminal to ground.

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

370 V AC, DC: RMS value is displayed.

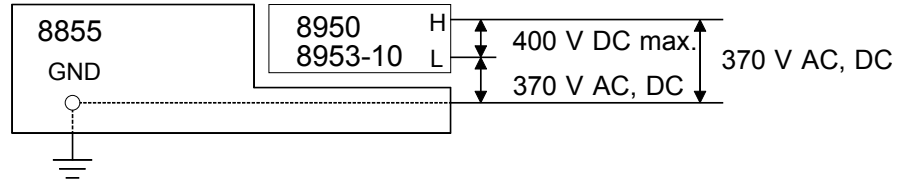
400 V DC max.: Instantaneous value is displayed.

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.

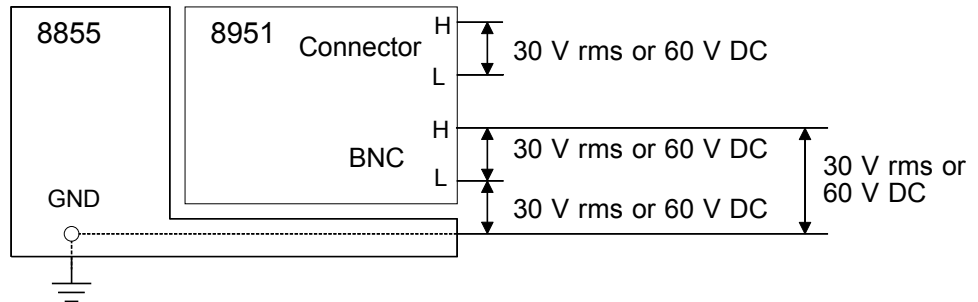


## 2.11.1 Maximum Input Voltage

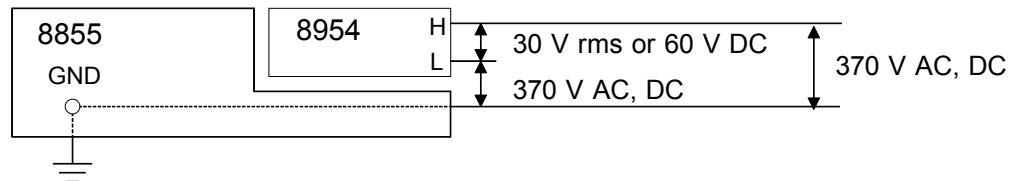
### 8950 ANALOG UNIT/ 8952 DC/RMS UNIT 8953-10 HIGH RESOLUTION UNIT



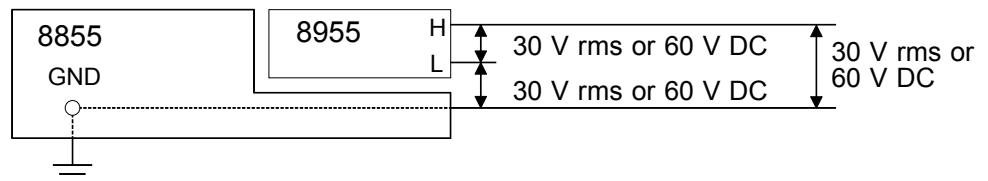
### 8951 VOLTAGE/CURRENT UNIT



### 8954 VOLTAGE/TEMP UNIT



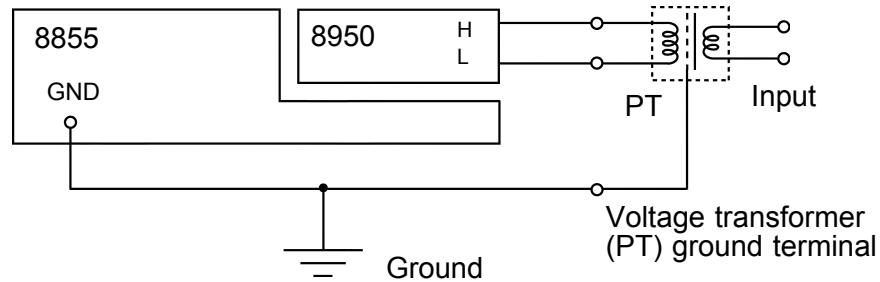
### 8955 F/V UNIT



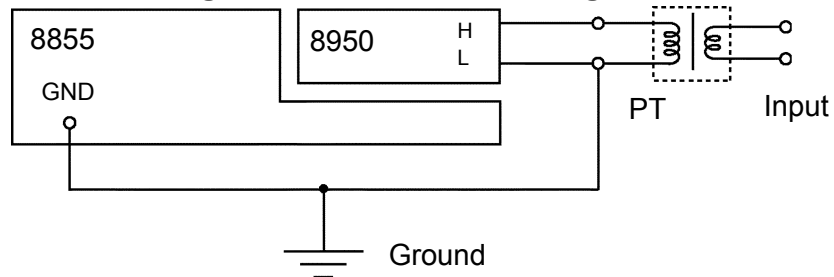
## 2.11.2 Using a Voltage Transformer

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

## Recorder & Memory Function 3

### 3.1 Overview of the Recorder & Memory Function

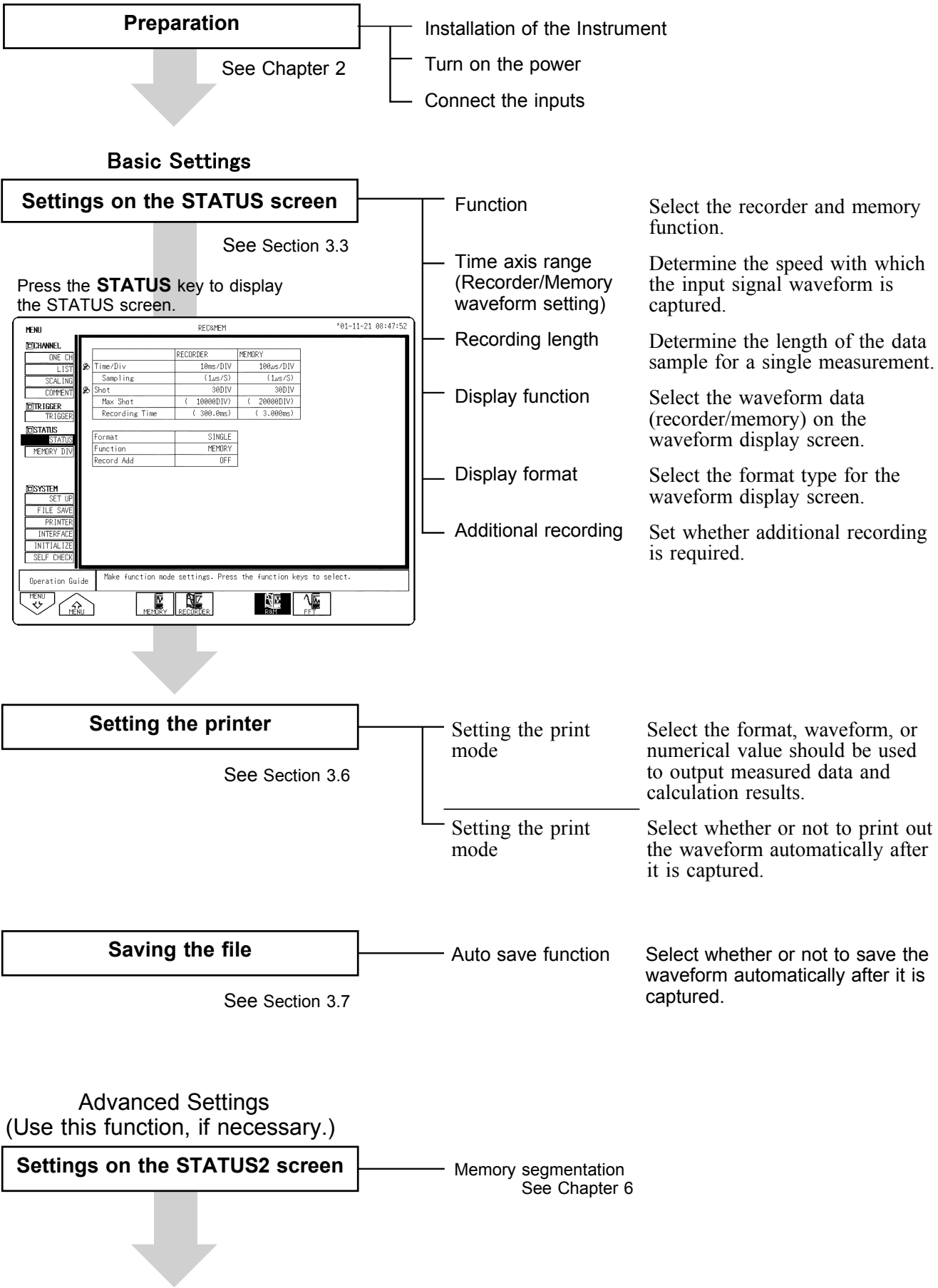
The recorder and memory function has the following features.

- (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) Simultaneous Display of Recorder and Memory Waveforms
- (4) Time axis setting  
10 ms/DIV to 1 h/DIV (recorder, 17 steps)  
10  $\mu$ s/DIV to 5 min/DIV (memory, 20 steps)
- (5) Time axis resolution 100 points/DIV
- (6) Storage capacity
 

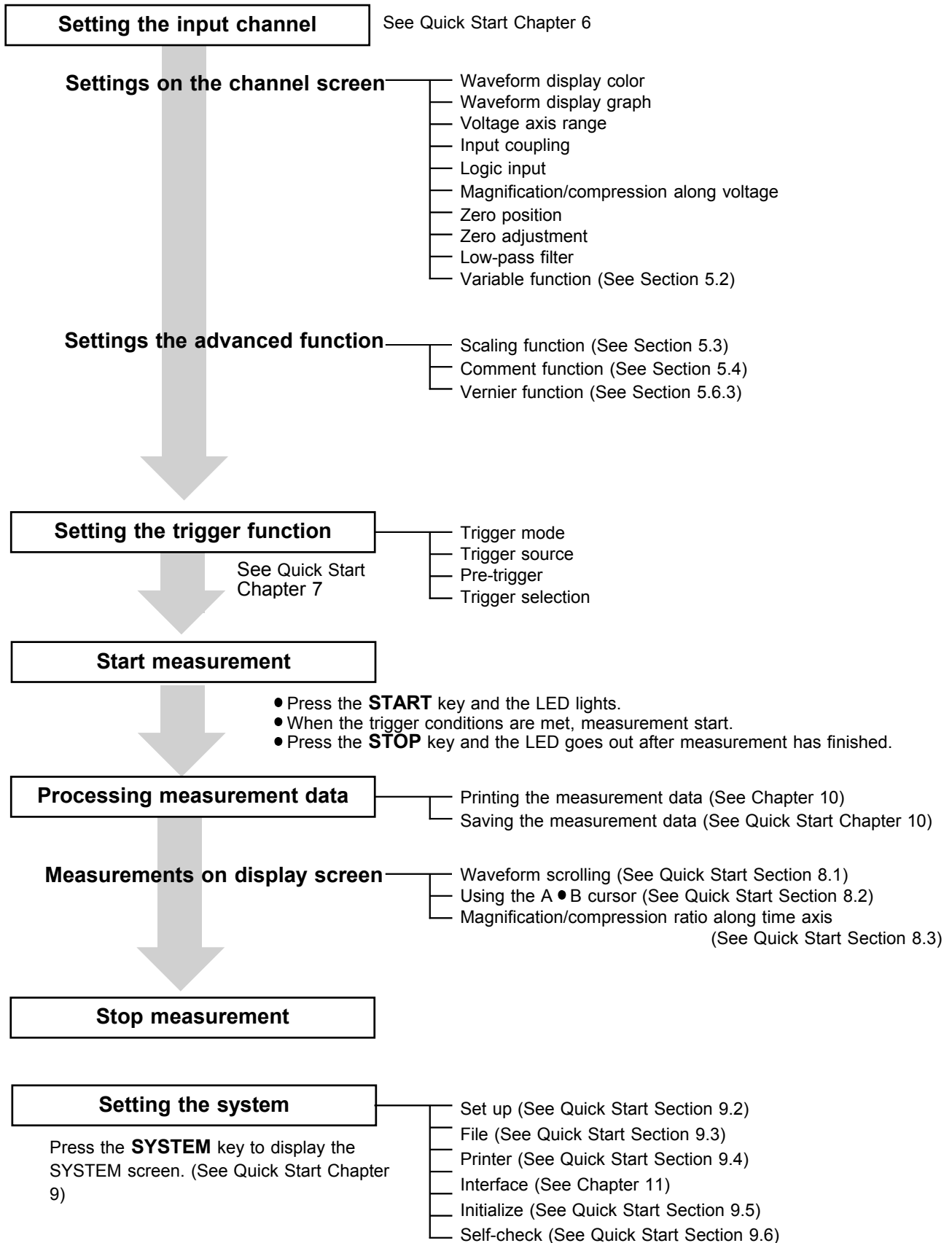
32 M words (DIV)	10000 (Recorder)	20000 (Memory)
128 M words (DIV)	40000 (Recorder)	80000 (Memory)
512 M words (DIV)	160000 (Recorder)	320000 (Memory)

 Desired setting: in addition to the above recording lengths, 1-division steps up to the highest division are possible
- (7) Display format  
Single, dual, quad, oct screen display
- (8) Printing  
Real-time print (recorder only), manual print, partial print, report print, screen hard copy can be printed.
- (9) High-quality print  
Smooth print function approximates analog waveform.
- (10) 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.
- (11) Logging function  
Numeric printout of waveform data

## 3.2 Operation Sequence (REC&MEM)





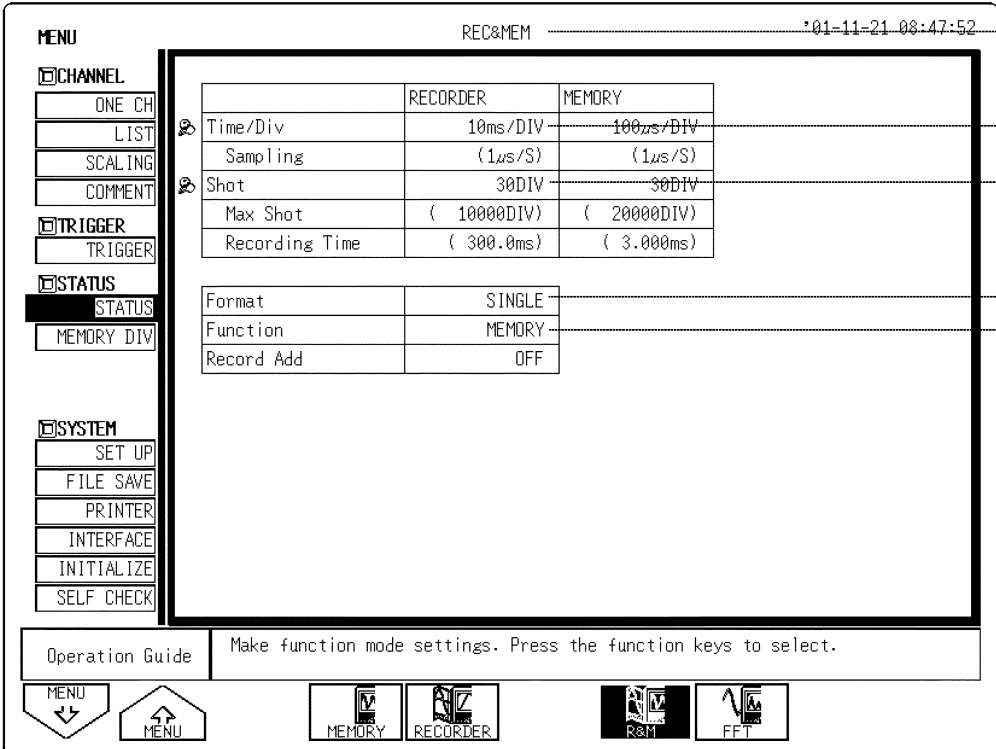


### 3.3 STATUS Settings (REC&MEM: STATUS Screen)

Press the **STATUS** key to access the STATUS screen. This section explains how to set the STATUS screen of the recorder and memory function. See the corresponding sections for items that can be set in the Waveform display or CHANNEL screens.

Waveform display screen: See Section 3.5

CHANNEL screen: See Quick Start Section 6.3



See Sections

3.3.1

3.3.2

3.3.3

3.3.5

3.3.4

**NOTE**

The settings of memory segmentation function, see Chapter 6.





### 3.3.1 Setting the Function Mode

The 8855 has four function modes. Select the Recorder and Memory functions.

#### Procedure

Screen: STATUS, CHANNEL, Waveform display, TRIGGER, SYSTEM

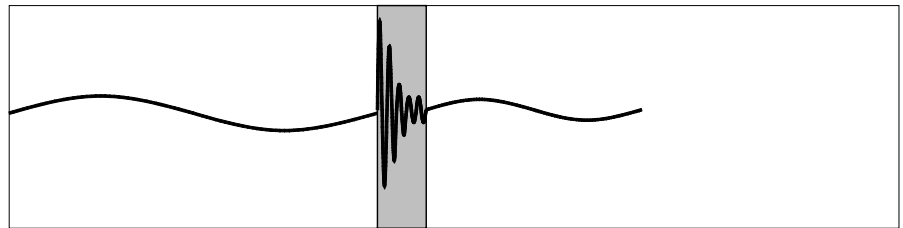
1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the top position.
3. Select the **REC&MEM** function key display.

Function display	Meaning
	: Memory recorder function
	: Recorder function
	: Recorder & Memory function
	: FFT function

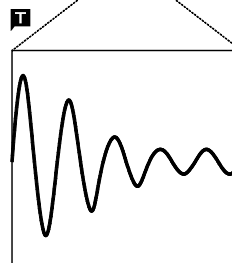
#### Recorder & Memory Function Operation

During real-time signal recording with the recorder function, if an abnormal phenomena latches the trigger, that period is recorded simultaneously by the high-speed sampling memory recorder. Normal recorder operation is not suspended during memory recording, so the real-time recording continues through the abnormal phenomena.

Low-speed Recorder recording



High-speed Memory recording



### 3.3.2 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)  
The sampling period for the sampling recorder is set by the memory.

Screen: STATUS

- Procedure 1**
1. Use the Menu keys to display the desired screen.
  2. Move the flashing cursor to the **Time/Div** item.
  3. Move the flashing cursor to the time axis range for recorder or memory to make the selection by using the Jog/Shuttle control, the function keys.  
For the time axis range setting for the recorder, the **TIME/DIV** knob can be also used.

Screen: Waveform display

- Procedure 2**
1. Press the **DISP** key to display the Waveform display screen.
  2. Move the flashing cursor to **Function change** and select **REC&mem** (recorder waveform) or **rec&MEM** (memory waveform) by using the **F4** function key.
  3. Move the flashing cursor to the **time axis range** item.
  4. Use the Jog/Shuttle control, the function keys, or **TIME/DIV** knob to make the setting. The **TIME/DIV** knob can be used regardless of where the flashing cursor is located.

**NOTE**

- The sampling period of the recorder is the same as that set for memory, so depending on the memory sampling period, the time axis may not be settable for the recorder.
- When the time axis range for recorder is set to the fast range (greater than 200 ms/division), the real-time print setting is automatically off.

**Combination of the recorder and memory time axis range.**

Vertical axis: time axis range of memory waveform (/DIV), horizontal axis: time axis range of recorder waveform (/DIV)

	10 ms	20 ms	50 ms	100 ms	200 ms	500 ms	1 s	2 s	5 s	10 s	30 s	1 min	2 min	5 min	10 min	30 min	1 hour
10 $\mu$ s	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
20 $\mu$ s	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
50 $\mu$ s	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
100 $\mu$ s	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
200 $\mu$ s	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
500 $\mu$ s	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
1 ms	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
2 ms	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
5 ms	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
10 ms	-	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
20 ms	-	-	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•
50 ms	-	-	-	-	•	•	•	•	•	•	•	•	•	•	•	•	•
100 ms	-	-	-	-	-	•	•	•	•	•	•	•	•	•	•	•	•
200 ms	-	-	-	-	-	-	•	•	•	•	•	•	•	•	•	•	•
500 ms	-	-	-	-	-	-	-	•	•	•	•	•	•	•	•	•	•
1 s	-	-	-	-	-	-	-	-	•	•	•	•	•	•	•	•	•
2 s	-	-	-	-	-	-	-	-	-	•	•	•	•	•	•	•	•
5 s	-	-	-	-	-	-	-	-	-	-	•	•	•	•	•	•	•
10 s	-	-	-	-	-	-	-	-	-	-	-	•	•	•	•	•	•
30 s	-	-	-	-	-	-	-	-	-	-	-	-	•	•	•	•	•
1 min	-	-	-	-	-	-	-	-	-	-	-	-	-	•	•	•	•
2 min	-	-	-	-	-	-	-	-	-	-	-	-	-	-	•	•	•
5 min	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	•	•

### 3.3.3 Setting the Recording Length

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

The recording lengths for the recorder and memory are set separately. Two setting methods are available.

**SELECT** Select the recording length.

**ARBITRARY** Variable recording length can be selected by the user.

Screen: STATUS, Waveform display

#### Procedure 1 Constant recording length mode

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Shot** item.
3. To set the recording length, move the flashing cursor to either Recorder or Memory, according to which is to be set, and select **SELECT**.
4. Use the Jog control or the function keys to make a setting.

Function  
display    Meaning



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.



: Setting the recording length to continuous format.

#### Procedure 2 Variable recording length mode

1. Use the Menu keys to display the desired screen. Move the flashing cursor to the **Shot** item.
2. To set the recording length, move the flashing cursor to either Recorder or Memory, according to which is to be set, and select **ARBITRARY**.
3. Use the Jog/Shuttle control or the function keys to make a setting.

Function  
display    Meaning



: Increases in number. (+50)



: Increases in number. (+1)



: Decreases in number. (-1)



: Decreases in number. (-50)

#### NOTE

- If the recording length is changed during measurement, measurement is restarted using the newly set recording length.
- The memory capacity of 32 M words can accommodate up to 10000 divisions (recorder) or 20000 divisions (memory) of waveform data. With 128 M words, waveform data of up to 40000 divisions (recorder) or 80000 divisions (memory) can be saved. With 512 M words, waveform data of up to 160000 divisions (recorder) or 320000 divisions (memory) can be saved.




### 3.3.4 Display Function

The type of display waveform can be selected.

#### Procedure

Screen: STATUS

1. Press the **STATUS** key to display the STATUS screen.
2. Move the flashing cursor to the **Function** item.
3. Use the function keys to make a setting.

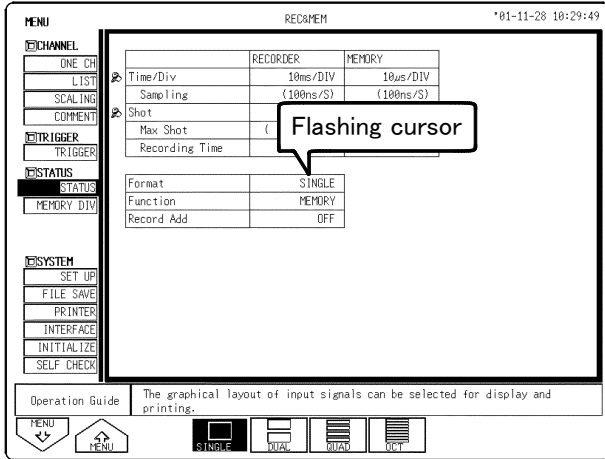
Function display	Meaning
	: Memory waveform is displayed
	: Recorder waveform is displayed
	: Displays both the memory (MEM) waveform and recorder (REC) waveform

#### NOTE

- The type of display waveform can be set by pressing the **REC&MEM** function key on the Waveform display screen.
- The memory waveform in Recorder and Memory function can be also displayed in memory recorder function.
- The display function setting cannot be changed during measurement.
- Starting up the 8855 with memory waveform display ON automatically selects REC&MEM display.

### 3.3.5 Setting the Display 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, and oct are available.



#### Procedure Screen: STATUS

1. Press the **STATUS** key to display 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.

Function display      Meaning



: Display and record the waveform in one graph.



: Display and record the waveform in two graphs.

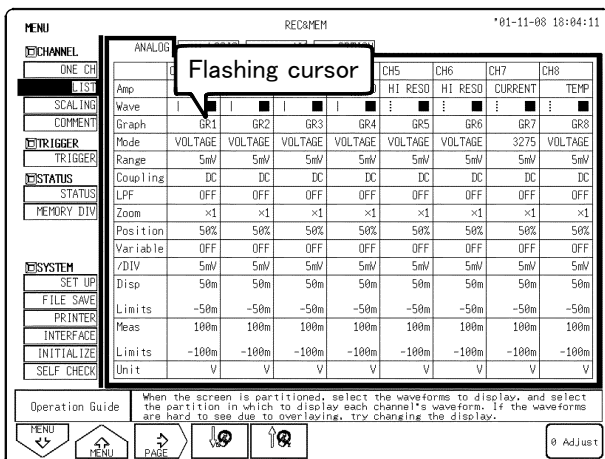


: Display and record the waveform in four graphs.



: Display and record the waveform in oct graphs.

On the channel screen, set the graph position of the display screen or waveform to be printed. This setting is valid when [Display format setting] on the status screen is set to a format other than single screen.



#### Procedure Screen: ONE CH, LIST (CHANNEL)

1. Press the **CHAN** key to display the Channel screen.
2. Move the flashing cursor to the position of the **Graph** to be set.
3. Use the function keys or **JOG** control to make the selection.

Function display      Meaning



: Increases in number



: Decreases in number

#### NOTE

Setting the display function to memory waveform and recorder waveform invalidates the display format setting.

## 3.4 Setting the Additional Recording Function

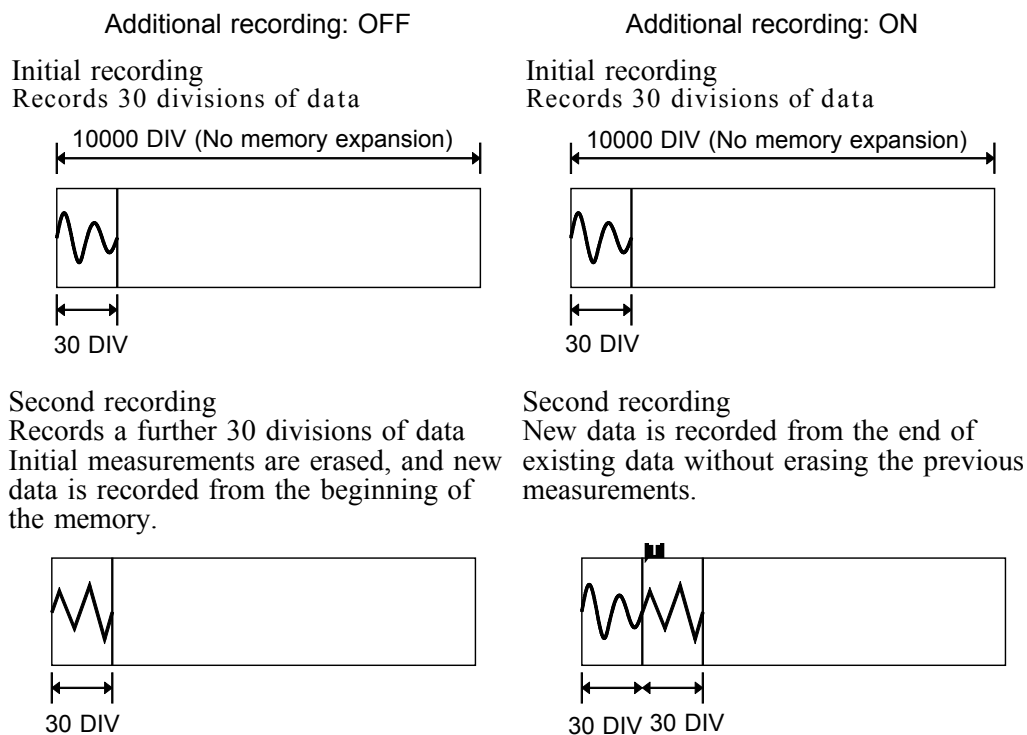
This records, regarding the memory as though it were recording paper. As waveforms captured by the recorder are stored in the instrument's memory, this machine can be operated as a paper recorder.

The memory capacity of 32 M words can accommodate up to 10000 divisions of waveform data. With 128 M words (after optional memory expansion), waveform data of up to 40000 divisions can be saved. With 512 M words (after optional memory expansion), waveform data of up to 160000 divisions can be saved.

The waveform can be scrolled and printed out.

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

(When the recording length is set to 30 divisions)





The first and second sets of waveforms can be observed by scrolling or printing the waveform.

### Procedure

Screen: STATUS

1. Press the **STATUS** key to display the STATUS screen.
2. Move the flashing cursor to the **Record Add** item.
3. Use the function keys to make a setting.

Function display	Meaning
 OFF	: Additional recording is disabled.
 ON	: 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 10000 (128 M words: 40000, 512 M words: 160000) DIV has been reached, old data will be overwritten.
- 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.
- A one-line data appears between the two measurements to delimit them. (The line of data is vertical.)
- When using the 8953-10 HIGH RESOLUTION UNIT, 8954 VOLTAGE/TEMP UNIT, or 8955 F/V UNIT, and its additional recording function is active, if logic input is activated during measurement, a logic waveform is displayed, but the data is invalid. When measurement is made with additional recording ON, the screen shows the logic waveform obtained before additional recording was turned on, but the data is invalid. If logic input is active, the analog data corresponding to that logic channel becomes 12-bit data. For details, see Quick Start Section 6.3.10.

### 3.5 Settings on the Waveform Display Screen (REC&MEM)

Explains the setting items on the Waveform display screen.

For details on setting, refer to Section 3.3.

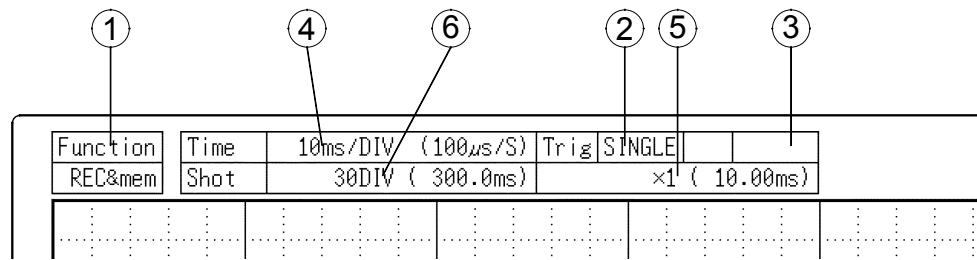
When want to use the Jog/Shuttle control, press the **VALUE** select key. (The selection window is not displayed.)

Pressing the F4 function key "REC&MEM" on the Waveform display screen toggles screen between memory waveform and recorder waveform.

**REC&mem** Recorder waveform display in Recorder and Memory function

**rec&MEM** Memory waveform display in Recorder and Memory function

**REC&MEM** Displays both the recorder waveform and memory waveform



Setting items	Selection	Explanation
1. Function	MEM, REC, FFT, REC&MEM	Select function.
2. Trigger mode (recorder waveform)	SINGLE, REPEAT, TIMER	Select trigger mode.
3. Pre-trigger (memory waveform)	0 to 100%, -95%	Set the Pre-trigger.
4. Time Axis Range	10 ms/DIV to 1 h/DIV (REC) 10 μs/DIV to 5 min/DIV (MEM)	Set the speed for inputting and storing the waveform of the input signal. Time axis range setting expresses the time for 1 DIV.
5. Magnification /compression along the time axis	x 1 to x 1/500 (REC) x 10 to x 1/10000 (MEM)	By magnifying the waveform, detailed observations can be made. By compressing the waveform, an entire change can be promptly apprehended.
6. Recording Length	SELECT: 30 DIV to continuous (REC) 30 DIV to 20000 DIV (MEM) ARBITRARY: 1 DIV to 10000 DIV (REC) 1 DIV to 20000 DIV (MEM)	Using channels: 8 ch Capacity: 32 M words The length of recording for one measurement operation (the number of DIV) can be set.
Input channel settings	<ul style="list-style-type: none"> <li>• Analog input</li> <li>• Logic input</li> </ul>	Press the <b>F9 (CH.SET)</b> key on the Waveform display screen to make settings for the input channel on the display. For details, see section 5.6.
Trigger settings	Analog trigger	Press the <b>F9 (CH.SET)</b> key on the Memory waveform display screen to make trigger settings on the display. For details, refer to Quick Start chapter 7.
Level monitor function	Press the <b>F8 (LEVEL MONITOR)</b> key on the Waveform display screen.	Refer to Quick Start Section 8.5.
VIEW function	Press the <b>F7 (VIEW)</b> key on the Waveform display screen.	Refer to Section 8.1.

## 3.6 Setting The Printer (Only When The 8994 PRINTER UNIT Is Installed)

### 3.6.1 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.

Logging             The data spacing interval also must be set.

#### Procedure

Screen: PRINTER

#### (1) Setting the printer format

1. Press the **SYSTEM** key to display the PRINTER screen.
2. Move the flashing cursor to the **Print Mode** item.
3. Use the function keys to make a setting.

Function  
display

Meaning



: 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 and print interval

1. When the waveform format is selected, determine whether to use the smooth printing or not. When the numerical value is selected, set the print interval. (unit: divisions)
2. Move the flashing cursor to the **smooth print** item or **interval**.
3. Use the function keys to make a setting.

Since 1 division represents 100 samples, the print interval "0.01" refers to a printout of every sample (no print interval). If the set print interval exceeds recording length, only the first point is printed.

#### NOTE

Smooth printing is available for memory waveform.



## 3.6.2 Setting the Real-time Printing Function

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

### Procedure

Screen: PRINTER

1. Press the **SYSTEM** key to display the PRINTER screen.
2. Move the flashing cursor to the **Realtime Print** item.
3. Use the function keys to make a setting.

Function display	Meaning
	: Printing is disabled.
	: Printing is enabled.

### NOTE







- When the recorder's time axis is set to 200 ms/DIV or faster, the real-time printing settings are automatically disabled. Further, when the time axis range is set to a speed faster than 200 ms/DIV, Real-Time Printing is automatically disabled.
- 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.  
50 ms/DIV x 1/2, 20 ms/DIV x 1/5, 10 ms/DIV x 1/10
- Setting a time axis range faster than 1 s/DIV may result in light printing.

## 3.7 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 and the recording is completed. The Auto Save function stores a file in the directory currently selected on the file screen.

### Procedure Screen: STATUS

1. Press the **SYSTEM** key to display the STATUS screen.
2. Move the flashing cursor to the **Auto Save** item.
3. Use the function keys, select the media for auto saving.

Function display	Meaning
	: 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.
	: Automatically stored on LAN.



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

Function display	Meaning
	: Data are stored as binary data.
	: Data are stored as text data.

Data stored in the text format is not readable by the 8855.

5. When the data format to be saved is set to text data, the intermittent setting item is displayed. Use the function keys or Jog/Shuttle control to make a setting.
6. Set the file name. For the input method, refer to Section 5.4.3.  
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.
7. Set whether a new directory is created when measurement data is saved.
8. Select the channels to be saved. Move the flashing cursor to the **Channel to Save** item.




9. When Media is selected, the Storage method item appears.

Function display	Meaning
	When [Make directory] is set to [NONE], auto-save is cancelled when the storage media is full, or when the directory's file count exceeds 5000. When [Make directory] is set to [EXIST], a new directory is created each time the current directory's file count exceeds 5000, until the storage media fills up, causing auto-save to cancel.
	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 file extension 'MEM' or 'REC' are deleted. If sequential save is selected, or if the saving data is 'R&M', this setting is invalid. When All Block Save is selected with the Binary Format, this operation is disabled. With the text format selected, files with the extension 'TXT' are deleted.

10. Set the data save area.

Select to save all of the waveform data or only the data between cursors A and B.

11. Select the item to be stored.

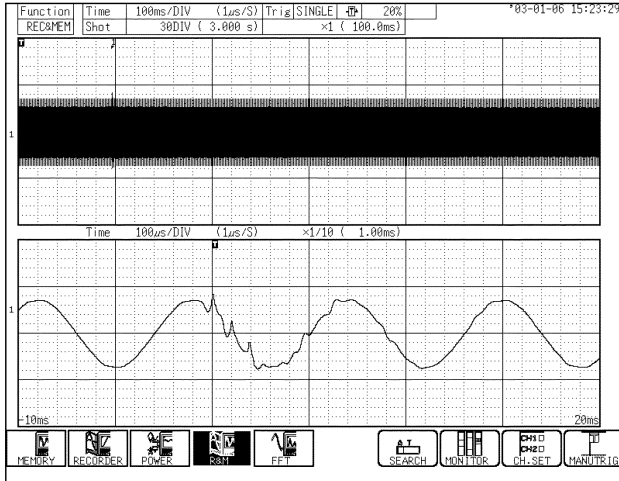
Function display	Meaning
	: 1 block save of recorder data
	: 1 block save of memory data
	: All block save both recorder and memory data

NOTE

- File names consist of 8 characters. With auto-save, since numbers are attached to the end of file names, long file names are truncated when this number is appended to the end of the file name.
- When automatic storage is selected for both recorder and memory data, automatic storage is activated (an index file is created). If only recorder or memory is set for storage, 1 block save is performed.
- 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, see to Quick Start Section 10.7.
- When the recording length of the recorder is set to "CONT.", the auto-saving cannot be made a setting.
- When cursor A and B are enabled, their setting will be preferred.
- 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 same media is used for both the recorder and memory. Separate media cannot be selected.
- The directory and the number of files that can be stored in the directory are limited. For details, see Quick Start Section 10.7.
- During automatic storage, if the STOP key is pressed to interrupt measurement, waveforms taken prior to the interruption are stored automatically.
- Do not use the symbols +, =, and [,] in a file name. A file containing any of these symbols in its file name cannot be processed under Windows 2000 or XP.

## 3.8 Simultaneous Display of Recorder and Memory Waveforms

A recorder waveform and memory waveform can be displayed simultaneously on the screen.

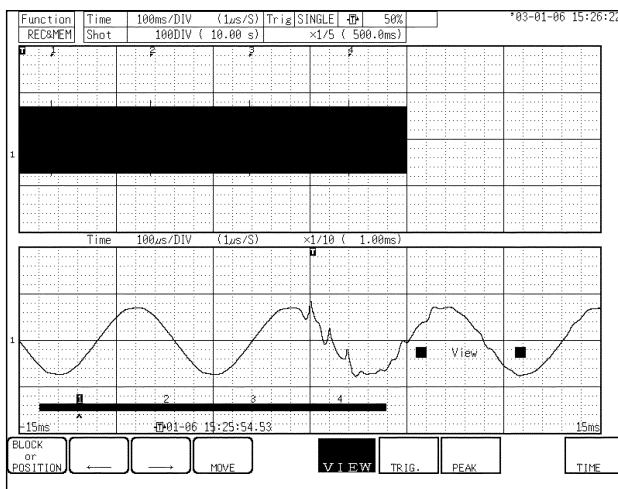


This allows trigger activation using memory to analyze in detail an incident that occurs during recording.

Top :Recorder waveform  
Bottom :Memory waveform

### Use with memory segmentation

By using memory segmentation, you can divide an incident during recording on the recorder into a set number of blocks.



The numbers shown on the recorder waveform display at the top represent the number of times data is loaded into memory blocks and the related trigger positions.

### Waveform scroll

When the blinking cursor is on the time axis or zoom for the memory waveform at the bottom of the screen, or when the VIEW function is ON, the MEM waveform can be scrolled. Otherwise, the REC waveform can be scrolled.

### Search

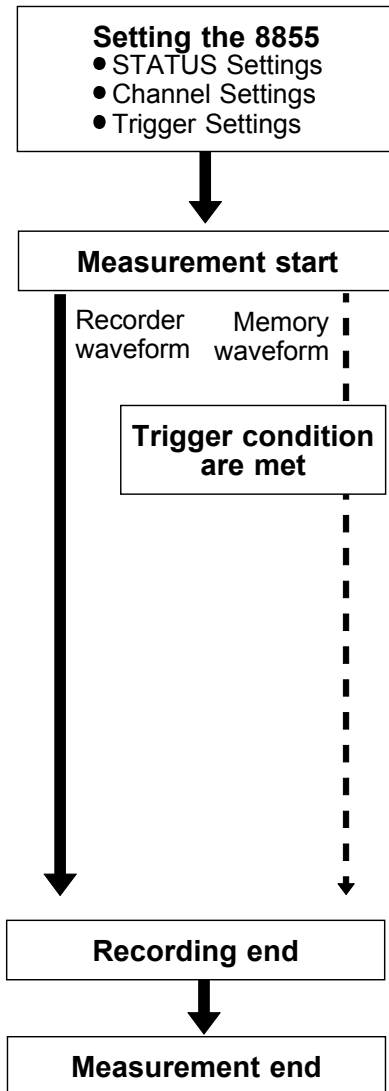
Search will be performed on the MEM waveform. To search the REC waveform, switch the screen for REC waveform display only.

**The waveform print after measurement, numeric data print, and A/B cursors are for MEM waveforms only.**

NOTE

- There is dead time between recorder startup and memory startup (trigger standby) due to internal processing.
- When memory segmentation has been performed, dead time occurs due to display and interblock processing.

## 3.9 Start and Stop Operation (REC&MEM)



See Section 3.3, "STATUS Settings", Chapter 5, "Input Channel Settings", Quick Start Chapter 7, "Trigger Functions."

Press the **START** key and LED light.

Setting the trigger to Timer causes a delay until the set time.

Displays "Storing" during storing the recorder waveform.

When the printer is enabled, the recording waveform is printed at the same time it is displayed.

Using the VIEW key to display the time (from measurement started time).

Data recording starts when trigger condition of memory waveform is met.

When Pre-Trigger is enabled during waveform storage, if the trigger conditions are met before the trigger point, data collection begins at that time.

When automatic storage is enabled and measurement is interrupted in progress, measurement data taken prior to the interruption point is stored automatically.

Auto save is executed.

Trigger mode	SINGLE
	REPEAT
	TIMER

End of measurement

Starts measurement again.  
Waveform data stored in memory blocks is cleared.  
Press the **STOP** key.

Measurement is repeated at the set time interval until the specified stop time.

During storing the waveform data, the following message is displayed:  
 "MEMORY WAVE WAIT TRIG": Waiting for trigger  
 "MEMORY WAVE STORING": Storing memory waveform  
 "MEMORY WAVE STORE END": End of storing memory waveform  
 When using the sequential save function:  
 "MEMORY WAVE XXX/000": Displays stored block  
 (XXX: the last stored block, 000: number of memory divisions)

**NOTE**

Numeric operation is possible using the memory function for a memory waveform loaded using the Recorder & Memory function. When memory segmentation is OFF, waveform processing is also possible. Note that when waveform processing is performed, the recorder waveform loaded by the Recorder & Memory function will be lost.



# Chapter 4

## FFT Function

### 4

## 4.1 Overview of the FFT Function

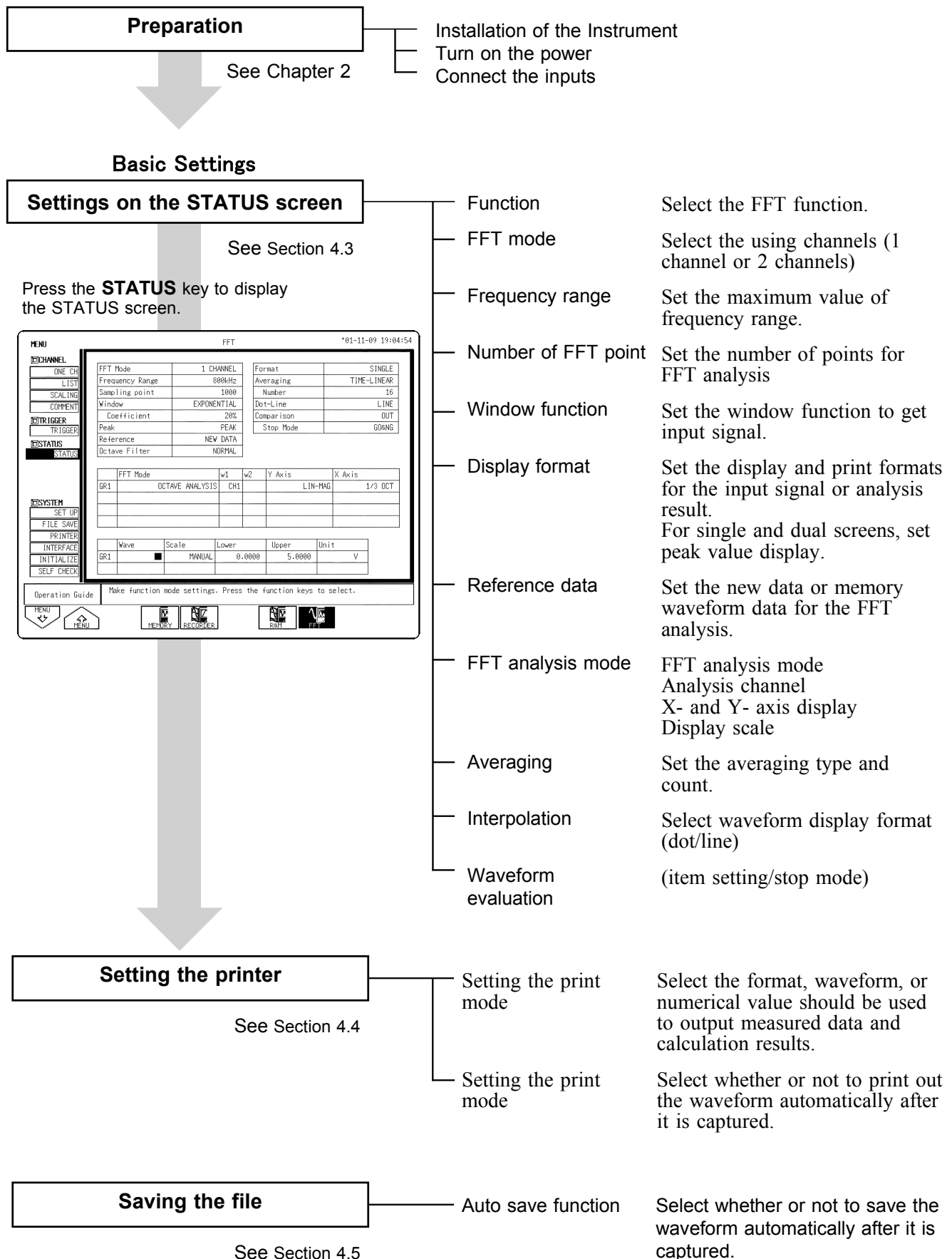
The FFT function has the following features.

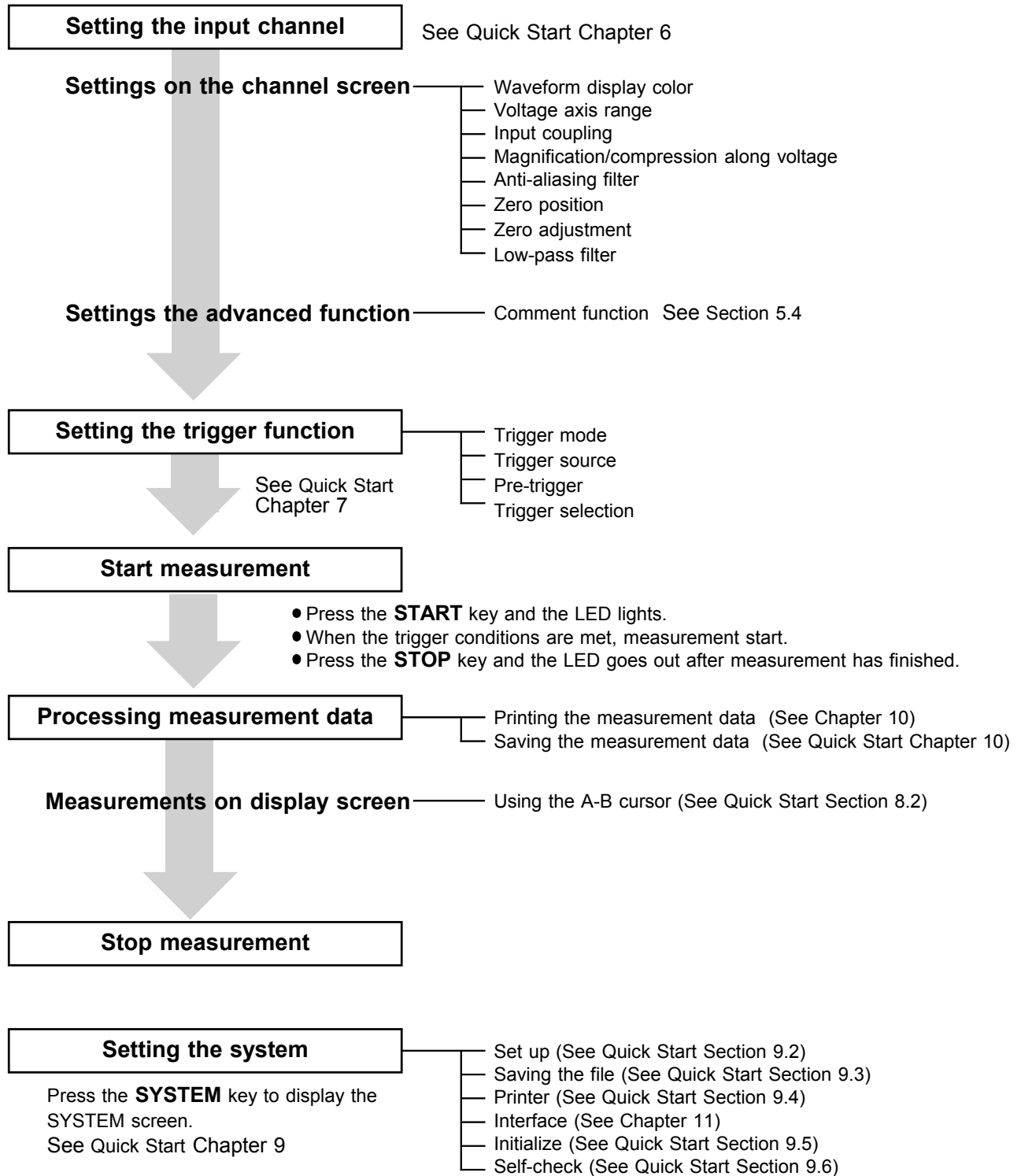
- (1) FFT (Fast Fourier Transform) processing can be performed on input signal data for frequency analysis.
- (2) Frequency range  
133 mHz to 8 MHz
- (3) Frequency resolution  
1/400, 1/800, 1/2000, 1/4000 of frequency range
- (4) 12 types of analysis functions  
Storage waveform, linear spectrum, RMS 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 anti-aliasing filter  
Automatic selection of cutoff frequency to match frequency range (8953-10 HIGH RESOLUTION UNIT)

**NOTE**

- We recommend using an input module equipped with an anti-aliasing filter that can be enabled to minimize sampling distortions during FFT analysis.
- Refer to Appendix 3.9, "FFT Function" for more information about aliasing distortion and anti-aliasing filters.

## 4.2 Operation Sequence (FFT)





## 4.3 STATUS Settings (FFT)

Press the **STATUS** key to access the STATUS screen. This section explains how to set the STATUS screen of the FFT function. See the corresponding sections for items that can be set in the Waveform display or CHANNEL screens.

Waveform display screen: See Section 4.6

CHANNEL screen: See Quick Start Section 6.3

See Sections

4.3.1 4.3.8 4.3.9 4.3.10 4.3.11

4.3.1 MENU FFT '01-11-09 19:04:54

4.3.2 ☒ CHANNEL

4.3.3 ONE CH

4.3.4 LIST

4.3.5 SCALING

4.3.6 COMMENT

4.3.7 ☒ TRIGGER

4.3.8 TRIGGER

4.3.9 ☒ STATUS

4.3.10 STATUS

4.3.11

FFT Mode	1 CHANNEL	Format	SINGLE
Frequency Range	800kHz	Averaging	TIME-LINEAR
Sampling point	1000	Number	16
Window	EXPONENTIAL	Dot-Line	LINE
Coefficient	20%	Comparison	OUT
Peak	PEAK	Stop Mode	GO&NG
Reference	NEW DATA		
Octave Filter	NORMAL		

4.3.12 ☒ SYSTEM

4.3.13 SET UP

4.3.14 FILE SAVE

4.3.15 PRINTER

4.3.16 INTERFACE

4.3.17

FFT Mode	w1	w2	Y Axis	X Axis
GR1	OCTAVE ANALYSIS	CH1	LIN-MAG	1/3 OCT

Wave	Scale	Lower	Upper	Unit
GR1	MANUAL	0.0000	5.0000	V

Operation Guide Make function mode settings. Press the function keys to select.

MENU

MEMORY RECORDER

R&M FFT





### 4.3.1 Setting the Function Mode

The 8855 has four function modes. Select the FFT function.

#### Procedure

Screen: STATUS, CHANNEL, Waveform display, TRIGGER

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the top position.
3. Select the **FFT** function key display.

Function display	Meaning
	: Memory recorder function
	: Recorder function
	: Recorder & Memory recorder function
	: FFT function



### 4.3.2 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.

#### Procedure

Screen: STATUS

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **FFT Mode** item.
3. Use the function key to make the selection.

Function display	Meaning
	: One channel
	: 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), unit impulse response (IMP), coherence function (COH)




### 4.3.3 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.

Screen: STATUS, Waveform display

- Procedure**
1. Use the Menu keys to display the desired screen.
  2. Move the flashing cursor to the **Frequency Range** item.
  3. Use the function key to make the selection.

You can also use the TIME/DIV knob to make the settings. In this case, you can change the settings irrelevant of the position of the flashing cursor.

Function display	Meaning
	: Move the cursor up in the selection window.
	: Move the cursor down in the selection window.
	: External sampling

**NOTE**

- The anti-aliasing filter 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 Quick Start Section 11.1.4.

Frequency Range, Frequency Resolution, Window Width, Corresponding Time Axis Range (when the number of FFT points is 1000)

Frequency range [ Hz ]	Frequency resolution*3[ Hz ]	Window width*4	Time axis [ /DIV ]
8 M*1	20 k	50 $\mu$ s	5 $\mu$ s
4 M*1	10 k	100 $\mu$ s	10 $\mu$ s
2 M*1	5 k	200 $\mu$ s	20 $\mu$ s
800 k*1	2 k	500 $\mu$ s	50 $\mu$ s
400 k*1	1 k	1 ms	100 $\mu$ s
200 k*1	500	2 ms	200 $\mu$ s
80 k*1	200	5 ms	500 $\mu$ s
40 k	100	10 ms	1 ms
20 k	50	20 ms	2 ms
8 k	20	50 ms	5 ms
4 k	10	100 ms	10 ms
2 k	5	200 ms	20 ms
800	2	500 ms	50 ms
400	1	1 s	100 ms
200	500 m	2 s	200 ms
80	200 m	5 s	500 ms
40	100 m	10 s	1 s
20	50 m	20 s	2 s
8 *2	20 m	50 s	5 s
4 *2	10 m	100 s	10 s
1.33 *2	3.33 m	5 min	30 s
667 m*2	1.67 m	10 min	1 min
333 m*2	0.83 m	20 min	2 min
133 m*2	0.33 m	50 min	5 min

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

\*1: Anti-aliasing filter is OFF.

\*2: Cutoff frequency is 20 Hz.

\*3: FFT Number of Points values of 2000, 5000 and 10,000 correspond to multiples of 1/2, 1/5 and 1/10, respectively.





\*4: FFT Number of Points values of 2000, 5000 and 10,000 correspond to multiples of 2, 5 and 10, respectively.

#### 4.3.4 FFT Number of Points Setup

This setting determines the sample count (Number of Points) used for FFT calculation. A higher setting increases the frequency analysis capability, but also increases the processing time required.

Screen: STATUS, Waveform display

- Procedure**
1. Use the Menu keys to display the desired screen.
  2. Move the flashing cursor to the **Sampling point** item.
  3. Use the function key to make the selection.




Function display	Meaning
	: 1000 points FFT calculation
	: 2000 points FFT calculation
	: 5000 points FFT calculation
	: 10000 points FFT calculation

### 4.3.5 Setting the Window Function



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

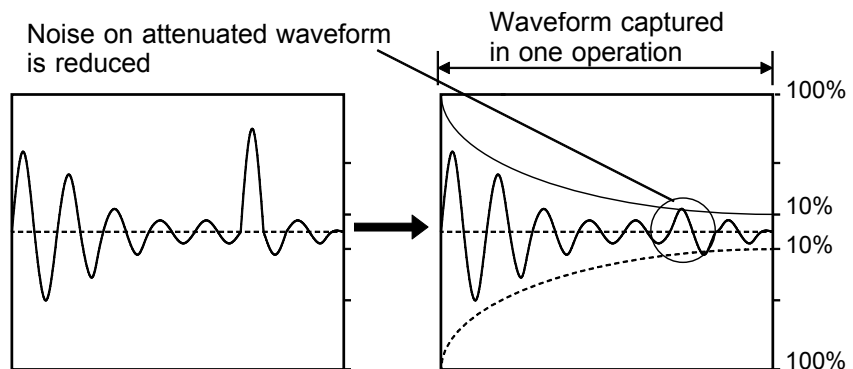
Screen: STATUS, Waveform display

- Procedure**
1. Use the Menu keys to display the desired screen.
  2. Move the flashing cursor to the **Window** item.
  3. Use the function key to make the selection.

Function display	Meaning
	: Rectangular (effective on discrete waveforms)
	: Hanning (effective on continuous waveforms)
	: Exponential (effective on decaying waveforms)

4. If **EXPO.** was selected, the coefficient item is displayed. Select the attenuation ratio in percent, using the function keys or the Jog/shuttle controls. If coefficient (attenuation ratio) is set to 0%, processing will be carried out as 0.1%.

Function display	Meaning
	: Increases in number, small step
	: Decreases in number, small step



When setting of exponential window function attenuation ratio 10%

**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.



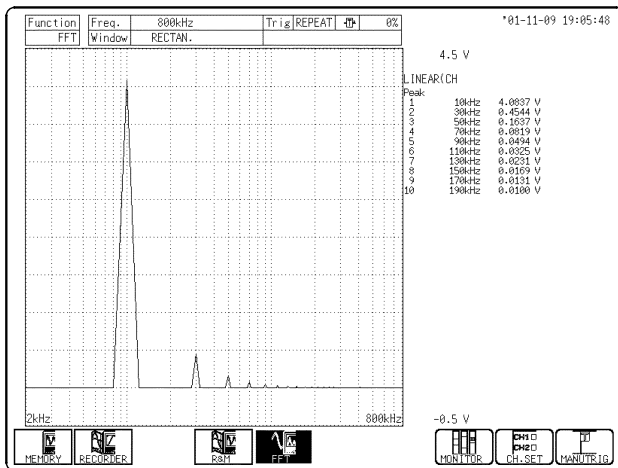
### 4.3.6 Setting the Peak Function

Display the peak or maximum value of the input signal and analyzed results. This is available only when the Format is set to Single or Dual display.

Screen: **STATUS**

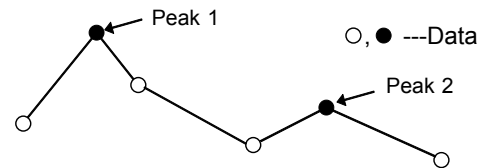
- Procedure**
1. Press the **STATUS** key to display the screen to be displayed.
  2. Move the flashing cursor to the **Peak** item.
  3. Use the function key to make the selection.

Function display	Meaning
<input type="radio"/> F F	: OFF
<input type="radio"/> PEAK	: Peak value
<input type="radio"/> MAXIMUM	: Maximum value



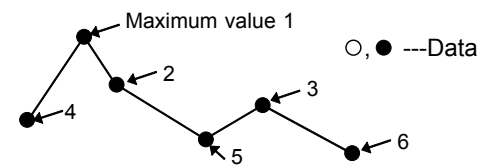
#### Peak value display

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 display

Points with the 10 highest values are shown.





### 4.3.7 Selecting Reference Data

Select data to be used for FFT processing.

Screen: STATUS

- Procedure**
1. Press the **STATUS** key to display the STATUS screen.
  2. Move the flashing cursor to the **Reference** item.
  3. Use the function keys to make a setting.

Function display	Meaning
	: Capture new waveform data for FFT processing
	: Use stored waveform data for FFT processing

#### NEW DATA

Pressing the **START** key initiates measurement, reads the number of samples specified as the FFT Number of Points, and FFT processing is performed.

#### FROM MEM

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 **Sampling point** 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 4.3.3.

#### NOTE




If a memory waveform is the reference data when the trigger mode is Continuous and Automatic, FFT processing is performed on the waveform data collected by the Memory Recorder function for the specified FFT Number of Points, and then shifted by that amount and processed again, until all data has been processed. (If the data is shorter than the FFT Number of Points, no processing occurs.)

### 4.3.8 Setting the Display Format

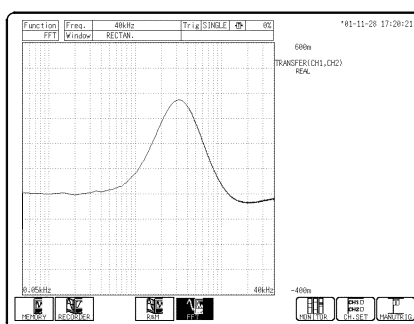
You can set the format for displaying input signal waveforms on the screen and recording them on the printer. The SINGLE, DUAL, and NYQUIST formats are available.

Screen: STATUS

- Procedure**
1. Press the **STATUS** key to display the screen to be displayed.
  2. Move the flashing cursor to the **Format** item.
  3. Use the function key to make the selection.

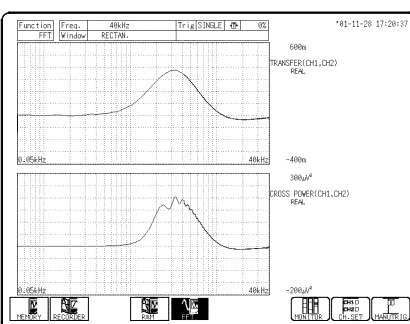
Function display	Meaning
	: Single screen
	: Dual screen
	: Nyquist screen

**Single graph**



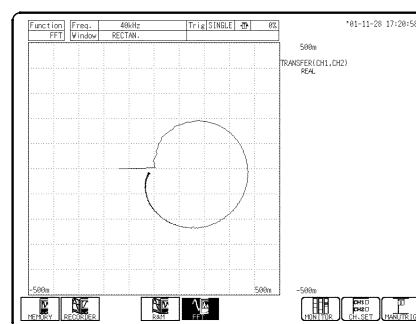
Displays the waveform on a single screen.

**Dual graph**



Divides the waveform display screen into upper and lower screens.

**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.

### 4.3.9 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.
- Averaging for the time axis waveform and frequency axis waveform can be selected.

**Procedure**      Screen: STATUS, Waveform display

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Averaging** item.
3. Use the function keys to make a setting.

Function display	Meaning
	: Disable averaging
	: Perform time axis waveform simple averaging
	: Perform time axis waveform exponential averaging
	: Perform frequency axis waveform simple averaging
	: Perform frequency axis waveform exponential averaging
	: Frequency axis waveform peak hold

4. Move the flashing cursor to the **Number** item, and set the time of averaging count by using the Jog/Shuttle controls or function keys.

Function display	Meaning
	: Move the cursor up in the selection window.
	: Move the cursor down in the selection window.

#### Time axis waveform averaging

- (1) Averages collected waveform data
- (2) FFT processing is then performed on the averaged values

When the trigger mode is 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.

#### Frequency axis waveform averaging

Unlike time axis averaging, the 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.

- (1) Captured data first undergo FFT processing.
- (2) Averaging is performed and the result is displayed.

## Frequency axis peak hold

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 Appendix 3.5.
- When averaging is used together with the waveform evaluation function, waveform evaluation is carried out after the specified averaging count is completed.
- After calculating the average, changing the analysis channel does not cause recalculation.

## FFT analysis mode and averaging

- : Setting is valid
- : Setting is invalid (has no effect)

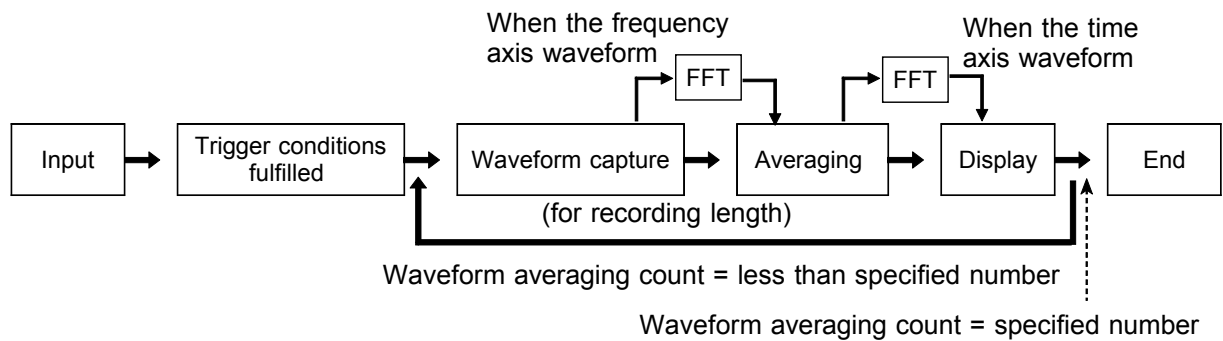
FFT analysis mode	Y-axis	Time axis averaging	Frequency axis averaging	Peak hold
Storage waveform	(Linear)	●	●	-
Linear spectrum	LIN-REAL	●	●	-
	LIN-IMAG	●	●	-
	LIN-MAG	●	●	●
	LOG-MAG	●	●	●
	PHASE	●	-	-
RMS spectrum	LIN-REAL	●	●	-
	LIN-IMAG	●	●	-
	LIN-MAG	●	●	●
	LOG-MAG	●	●	●
	PHASE	●	-	-
Power spectrum	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, transfer function, and cross-power spectrum with Nyquist display.

## Averaging and trigger mode

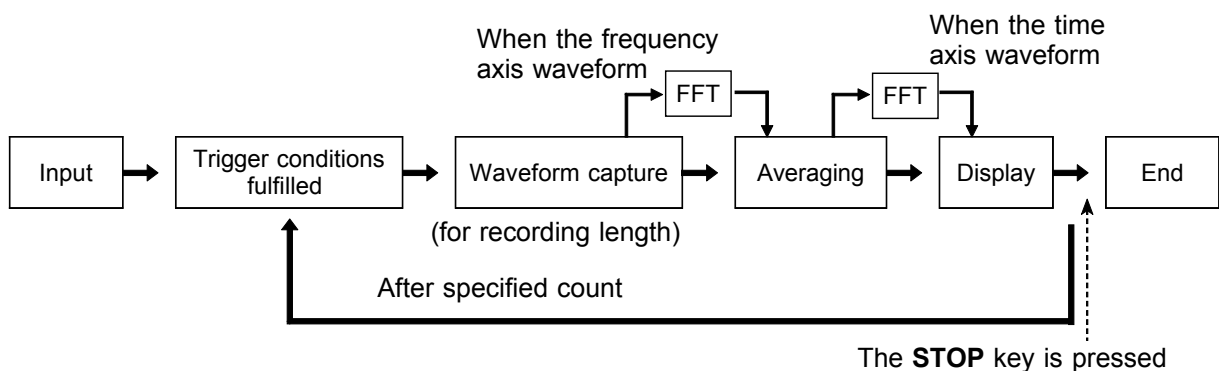
### (1) Trigger mode: SINGLE

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.



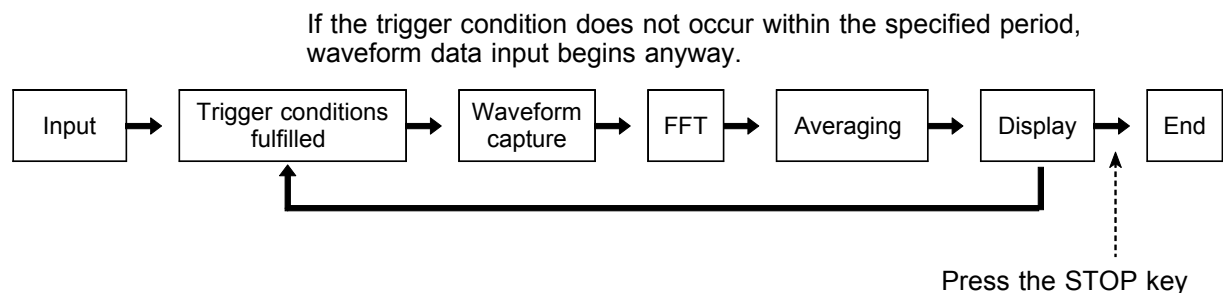
## (3) Trigger mode: AUTO

(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.



### 4.3.10 Setting the Interpolation (dot-line)

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.

#### Procedure Screen: STATUS

1. Press the **STATUS** key to display the STATUS screen.
2. Move the flashing cursor to the **Dot-Line** item.
3. Use the function keys to make a setting.

Function  
display

Meaning



: Linear interpolation is not performed.








: Linear interpolation is performed.

### 4.3.11 Setting the Waveform Evaluation




- Display format can be set on single screen or 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. All the channels being displayed are evaluated.

**Procedure**      Screen: STATUS

1. Press the **STATUS** key to display the STATUS screen.
2. Move the flashing cursor to the **Comparison** item.
3. Use the function keys to make a selection.

Function display	Meaning
	: 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.
	: Enable waveform evaluation area.

4. If Comparison is set to OUT or ALL-OUT, the **Stop Mode** item will be displayed. Move the flashing cursor to this item.
5. Use the function keys to make a setting.

Function display	Meaning
	: If GO is selected, recording and analysis will stop after an OK result.
	: If NG is selected, recording and analysis will stop after an NG result.
	: If GO & NG is selected, measurement will stop regardless of the evaluated results.

**NOTE**

When a waveform evaluation area is created by the FFT function, the waveform evaluation area created by the memory recorder function is cleared. For details on the waveform evaluation, refer to Section 9.1.



## 4.3.12 Setting the FFT Analysis Mode

Used to select the FFT calculation method.

### Procedure

Screen: STATUS, Waveform display

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **FFT Mode** item.
3. Use the function keys to make a setting.  
For details on analysis, please refer to 4.8 FFT Analysis Function.

MENU FFT \*01-11-09 19:06:39

**CHANNEL**

ONE CH  
LIST  
SCALING  
COMMENT

**TRIGGER**

TRIGGER

**STATUS**

STATUS

**SYSTEM**

SET UP  
FILE SAVE  
PRINTER  
INTERFACE  
INITIALIZE  
SELF CHECK

FFT Mode	2 CHANNELS	Format	SINGLE
Frequency Range	800kHz	Averaging	OFF
Sampling point	1000		
Window	RECTANGULAR	Dot-Line	LINE
Peak	PEAK	Comparison	OFF
Reference	NEW DATA		

FFT Mode	Y Axis	X Axis
GR1	TRANSFER FUNCTION	CH1 CH2 LIN-MAG LOG-Hz

Wave	Scale	Lower	Upper	Unit
GR1	AUTO			V

Operation Guide

MENU MENU Transfer TRF Cross Power CSP CrossCorrelation CCR Impulse IMP Coherence COH Octave OCT PAGE 1

Function display	Meaning	Function display	Meaning
Storage Waveform STR	: Stored waveform	Transfer TRF	: Transfer function
Linear Spectrum LIN	: Linear spectrum	Cross Power CSP	: Cross power spectrum
RMS Spectrum RMS	: RMS spectrum	CrossCorrelation CCR	: Cross correlation function
Power Spectrum PSP	: Power spectrum	Impulse IMP	: Impulse response
Auto Correlation ACR	: Auto correlation function	Coherence COH	: Coherence function
Histogram HIS	: Histogram	Octave OCT	: Octave analysis

### 4.3.13 Setting the Analysis Channel

Select the channel for FFT analysis.

#### Procedure

Screen: STATUS, Waveform display

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **w1** or **w2** item.
3. Use the function keys or Jog/shuttle control, select the channel.

Function display      Meaning



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

The screenshot shows the STATUS screen with the following settings:

MENU		FFT		*01-11-09 19:06:51	
CHANNEL					
ONE CH	FFT Mode	2 CHANNELS		Format	SINGLE
LIST	Frequency Range	800kHz		Averaging	OFF
SCALING	Sampling point	1000		Dot-Line	LINE
COMMENT	Window	RECTANGULAR		Comparison	OFF
TRIGGER					
TRIGGER	Peak	PEAK			
STATUS					
STATUS	Reference	NEW DATA			
SYSTEM					
SET UP	GR1	TRANSFER FUNCTION	CH1	CH2	LIN-MAG
FILE SAVE					LOG-Hz
PRINTER					
INTERFACE	Wave	Scale	Lower	Upper	Unit
INITIALIZE	GR1	■	AUTO		V
SELF CHECK					
Operation Guide					
<div> <div> <div>MENU</div> <div>↓</div> </div> <div> <div>↑</div> <div>MENU</div> </div> <div> <div>↓</div> <div>↑</div> </div> </div>					

A callout box labeled "Flashing cursor" points to the "w1" label in the "X Axis" column of the table.

#### NOTE

- The values for transmission interval and single impulse response are calculated from (W2)/(W1).
- To analyze data without aliasing distortion due to sampling, we recommend that you use a channel input module that is capable of FFT analysis, such as the 8953-10 HIGH RESOLUTION UNIT.

### 4.3.14 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.

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



**Procedure**      Screen: STATUS, Waveform display

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Y Axis** item.
3. Use the function keys or Jog control, select the channel. Set the x-axis in the same way.



#### Y Axis

Function display	Meaning
	: Real number part (linear display)
	: Imaginary number part (linear display)
	: Amplitude (linear display)
	: Amplitude (decibel display)
	: Phase (degree display)

#### X Axis

Function display	Meaning
	: Frequency (linear display)
	: Frequency (logarithm display)

(When octave analysis)

Function display	Meaning
	: 1/3 octave
	: 1/1 octave

	FFT Mode	w1	w2	Y Axis	X Axis
GR1	TRANSFER FUNCTION	CH1	CH2	LIN-MAG	LOG-Hz

Flashing cursor

## X and Y Axis Settings Available with each FFT Analysis Mode

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

The item shown by brackets ( ), it is fixed.

---

## 4.3.15 Setting the Wave Colors

Set the waveform display ON/OFF and the waveform color.

### Procedure

Screen: STATUS, Waveform display

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Wave** item.
3. Use the function keys or Jog control, select the channel. Set the x-axis in the same way.

Function  
display

Meaning



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.



: Waveform will be displayed in selected color.





: Waveform will not be displayed.

### 4.3.16 Setting the Display Scale

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

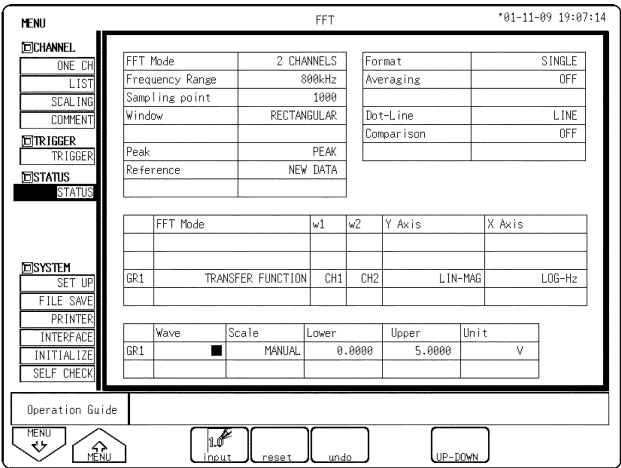
**Procedure**      Screen: STATUS





1. Press the **STATUS** key to display the STATUS screen.
2. Move the flashing cursor to the **Scale** item.
3. Use the function keys to make a setting.

Function display	Meaning
	: 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.

4. When **MANUAL** is selected, set the upper and lower limits to display and record the processing result.

Setting range is -9.9999E+29 to 9.9999E+29. (exponent is E-29 to E+29).



Function display	Meaning
	: A number pad will be displayed. Use the cursor and function keys to specify the value. Press [fix.] F4 to confirm.
	: Reset to the default values.
	: Return to the previous setting.
	: An input screen will be displayed. Use the cursor keys to move the flashing cursor to each digit, and the function keys to edit each value.

**NOTE**

- The unit (eu) setting is affected by the scaling setting. When scaling is turned off, a unit of measurement range is displayed.
- The selected unit is displayed for those channels for which the scaling function has been set.
- The X-axis setting for the histogram can be changed on the Waveform display screen or the CHANNEL screen. (If the upper or lower limit value is changed, the x-axis is changed.)

### 4.3.17 Octave Filter Setting



When octave analysis has been selected, two different filter types can be chosen.

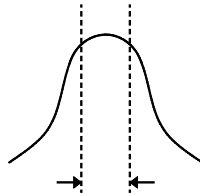
The characteristics of both filter types are within ANSI CLASS 3 tolerance limits (1/3 octave only).

#### Procedure

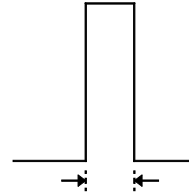
Screen: STATUS

1. Select "OCTAVE ANALYSIS" in FFT analysis mode, and the **Octave Filter** item is shown.
2. Move the flashing cursor to the **Octave Filter** item.
3. Use the function keys to make a selection.

Function display	Meaning
	: 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 instrument 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.

## 4.4 Printout of FFT Processing Results (When 8994 PRINTER UNIT is installed.)

### 4.4.1 Setting the Print Mode

Select the format, waveform, or numerical value should be used to output FFT processing results.

**Procedure**      Screen: PRINTER

(1) Setting the printer format

1. Press the **SYSTEM** key to display the PRINTER screen.
2. Move the flashing cursor to the **Print Mode** item.
3. Use the function keys to make a setting.

Function  
display

Meaning



: The result of calculation are printed as a waveform.



: The result of calculation are printed as numeric data.

(2) Setting the print interval

1. When the numerical value is selected, set the print interval. (unit: points)
2. Move the flashing cursor to the **Interval** item.
3. Use the function keys to make a setting.

Function  
display

Meaning



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

### 4.4.2 Setting the Auto Print Function

Printout is automatically carried out after FFT analysis.

**Procedure**      Screen: PRINTER

1. Press the **SYSTEM** key to display the PRINTER screen.
2. Move the flashing cursor to the **Auto Print** item.
3. Use the function keys to make a setting.

Function  
display

Meaning



: Auto print is disabled.



: Automatically print the FFT processing results to the internal printer.



: Automatically transfer the FFT processing results to the LAN connected device.  
Optional 9333 LAN COMMUNICATOR is required.









## 4.5 Setting the Auto Save Function

The FFT analysis is carried out and measurement data are automatically stored on a floppy disk, PC card, MO connected SCSI, or built-in MO/HD device after they are captured. The Auto Save function stores a file in the directory currently selected on the file screen. See Quick Start Section 10.13.2.



### Procedure

Screen: STATUS

1. Press the **STATUS** key to display the STATUS screen.
2. Move the flashing cursor to the **Auto Save** item.
3. Use the function keys, select the media for auto saving.

Function display	Meaning
	: Auto save is disabled.
	: Automatically stored on floppy disk
	: Automatically stored on PC card.
	: Automatically stored on MO/HD.
	: Automatically stored on external MO connected SCSI device.
	: Automatically stored on LAN-connected device. (Optional 9333 LAN Communicator is required.)

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



Function display	Meaning
	: Data are stored as binary data.
	: Data are stored as text data. (Nyquist cannot be saved in the text format)

Data stored in the text format is not readable by the 8855.

5. Set the file name. For the input method, refer to Section 5.4.3.  
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.

6. Set whether or not to create a new directory when saving.

7. Move the flashing cursor to **method**, and select the format.

Function display	Meaning
	: 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.

**NOTE**

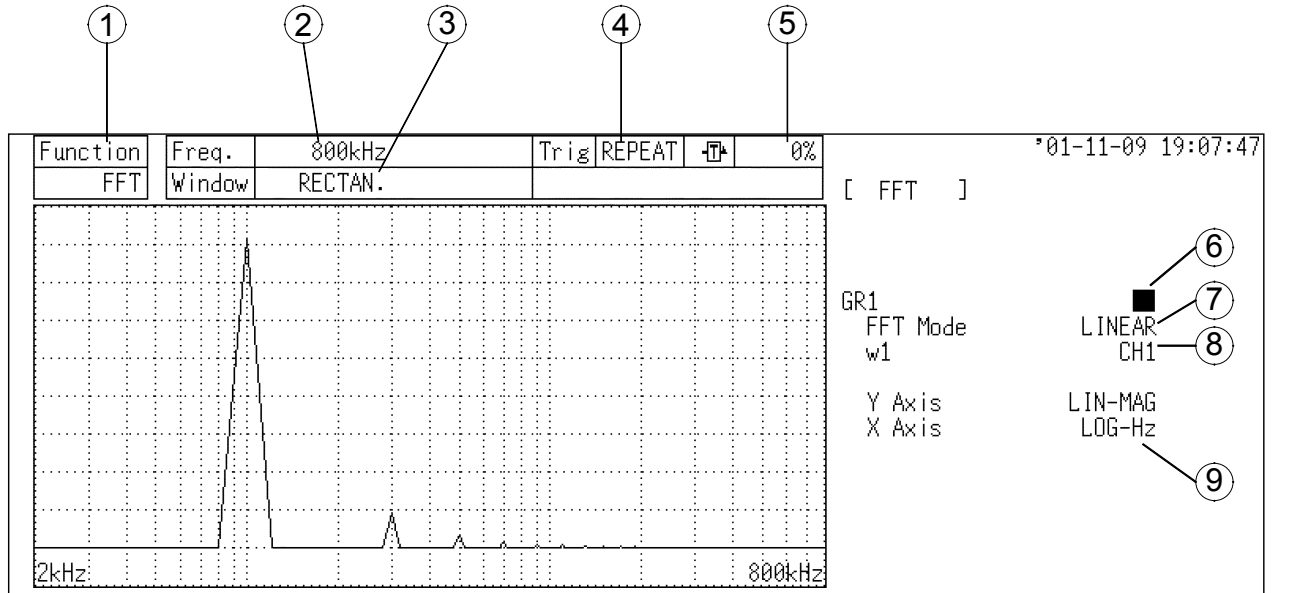
- File names consist of 8 characters. With auto-save, since numbers are attached to the end of file names, long file names are truncated when this number is appended to the end of the file name.
- When auto-save is enabled, the storage channel cannot be selected. Data for the channel for which the waveform is displayed is saved.
- For details on auto saving file name, refer to Quick Start Section 10.7.
- When both auto-print and auto-save are enabled, auto-save takes precedence.
- For details on connected SCSI device, refer to Quick Start Section 10.4.
- The directory and the number of files that can be stored in the directory are limited. For details, see Quick Start Section 10.7.
- Thinning is not applied with FFT data text format storage.
- 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.  
Full-size lowercase letters: a to z  
Full-size characters:  $\pi$ ,  $\mu$ ,  $\epsilon$   
Half-size symbols: +, =, [,]

## 4.6 Settings on the Waveform Display Screen (FFT)

Explains the setting items on the Waveform display screen.

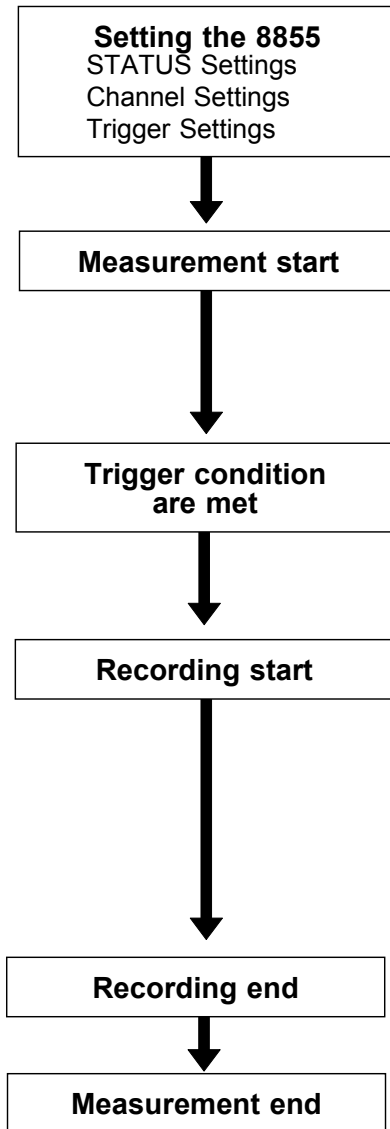
For details, refer to Sections 4.3.

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



Setting items	Selection	Explanation
1. Function	MEM, REC, FFT, REC&MEM	Select function.
2. Frequency range	133 mHz to 8 MHz (24 steps), EXT	Set the maximum value of the frequency axis.
3. Window function	Rectangular, hanning, exponential	Set a window function that uses multiples when reading an input signal.
4. Trigger mode	SINGLE, REPEAT, AUTO	Select trigger mode.
5. Pre-trigger	0 to 100%, -95%	Set the Pre-trigger.
6. Wave color	ON/OFF, desired color	Set the waveform display to ON/OFF and the waveform color.
7. Analysis mode	Select from 12 items.	Selects the FFT analysis method. See Section 4.8.
8. Analysis channel	Select from channel 1 to using channels	Selects the channel for FFT analysis.
9. X-, Y-axis	X axis Frequency (linear/logarithm display) When octave analysis: 1/3, 1/1 octave Y axis Real number part (linear), imaginary number part (linear), amplitude (linear/dB), phase (deg)	Sets the X-and Y- axis for display of FFT calculation results. With some FFT analysis mode, one of the axis cannot be set.

## 4.7 Start and Stop Operation (FFT)



See Section 4.3, "STATUS Settings (FFT)", Quick Start Chapter 6, "Input Channel Settings", Quick Start Chapter 7, "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, instrument waits for about 1 second for trigger conditions to be met. After this interval, data recording starts, regardless of trigger state.

Displays "Storing".

When the printer is enabled, the recording waveform is printed at the same time it is displayed.

When the **STOP** key is pressed twice during measurement, the 8855 is forcibly stopped.

The FFT calculation result display, auto-print, and automatic storage is not performed.

After capturing measured data, the FFT analysis is carried out and then the result is displayed.

Auto printout and auto save are executed.

Trigger mode	SINGLE
	REPEAT
	AUTO

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 8855 acquires measurement data in an amount corresponding to the set recording length, and the FFT analysis is carried, and then the measurement is stopped. (FFT analysis result, auto printout, auto save are executed.)

When the **STOP** key is pressed twice, the measurement is stopped forcibly. (FFT analysis result, auto printout, auto save are not executed.)

# 4.8 FFT Analysis Function

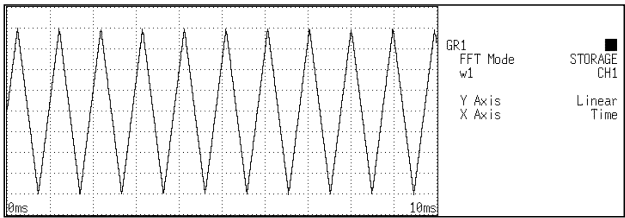
## 4.8.1 Storage Waveform [STR]

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 "Frequency Range, Frequency Resolution, Window Width, Corresponding Time Axis Range" in Section 4.3.3.)
Vertical cursor	Linear	Indicates the value of the measurement range of the input module in voltage units.

### Example

### Stored waveform



## 4.8.2 Linear Spectrum [LIN]

Displays the frequency domain waveform of the input signal, including magnitude and phase information.

Major applications include:

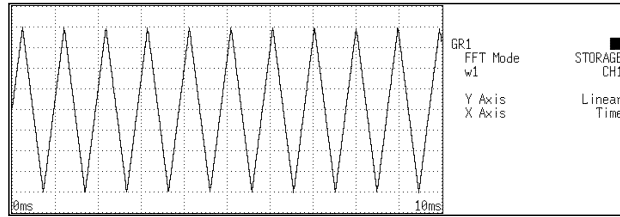
- Determining the peaks of waveform frequency components
- Determining the levels of high and low harmonics

Function	$F_a = \mathfrak{F}(f_a)$ $=  F_a  \exp(j\theta_a)$ $=  F_a (\cos \angle \theta_a + j \sin \angle \theta_a)$	
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 between 1/400 and 1/4000 of value to the 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=2V 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)

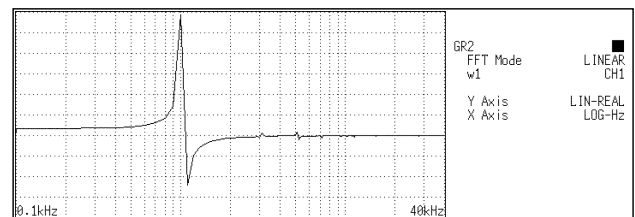
## Examples

## Linear spectra waveforms

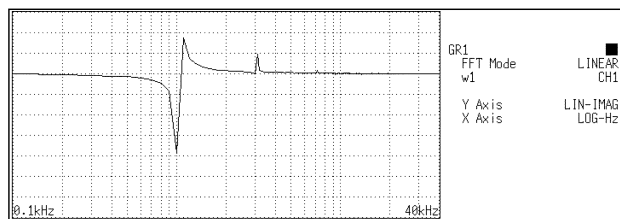
Stored waveform



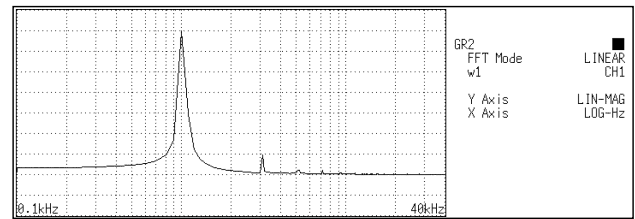
Y-axis: LIN-REAL (X-axis: LOG-Hz)



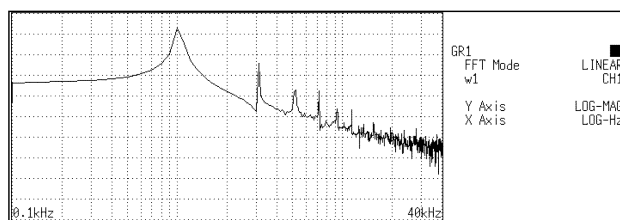
Y-axis: LIN-IMAG (X-axis: LOG-Hz)



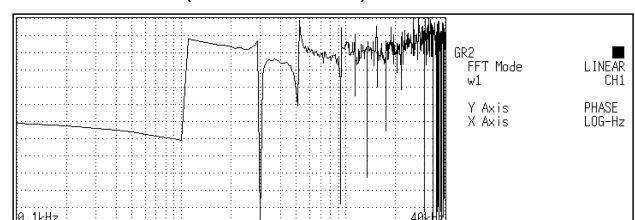
Y-axis: LIN-MAG (X-axis: LOG-Hz)



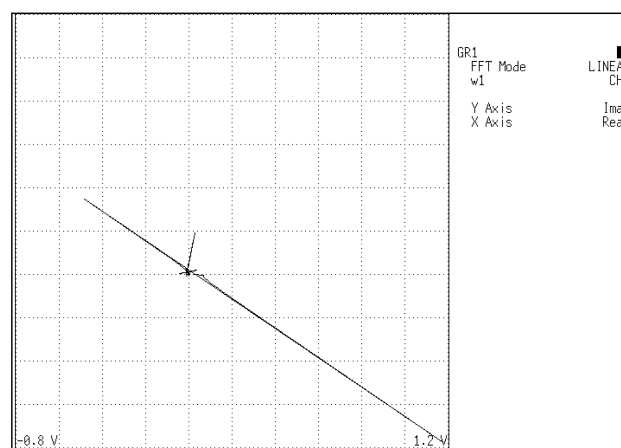
Y-axis: LOG-MAG (X-axis: LOG-Hz)



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



Nyquist



### 4.8.3 RMS Spectrum [RMS]

Displays the frequency domain waveform of the input signal, including magnitude (effective value) and phase information.

The LOG-MAG displays of RMS spectrum and Power spectrum express the same processing result.

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:  $R_a = F_a$

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

$$= |R_a| (\cos \angle \theta_a + j \sin \angle \theta_a)$$

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 between 1/400 and 1/4000 of value to the 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 V rms)

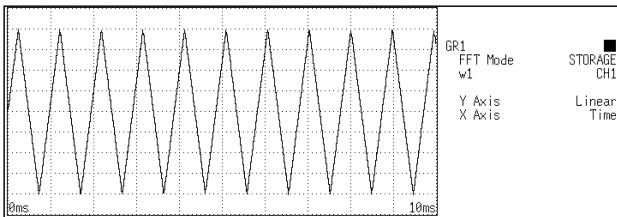
PHASE

Degrees (deg) display of phase component of data

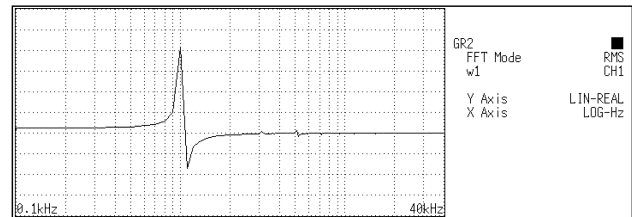
#### Examples

#### RMS spectra waveform

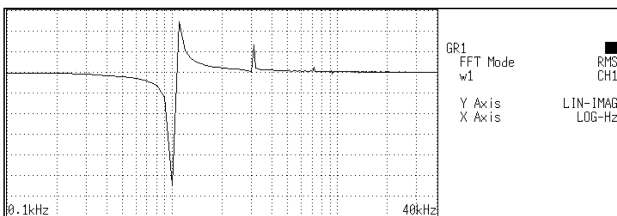
Stored waveform



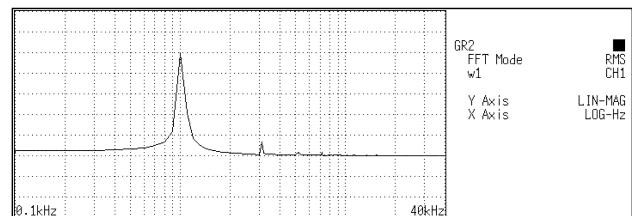
Y-axis: LIN-REAL (X-axis: LOG-Hz)



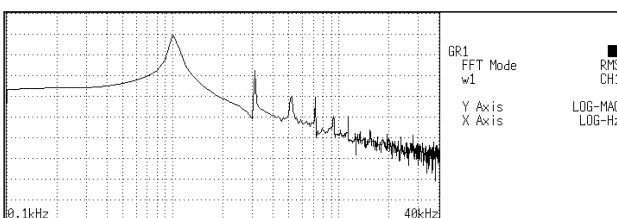
Y-axis: LIN-IMAG (X-axis: LOG-Hz)



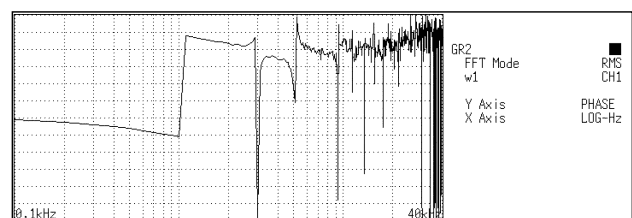
Y-axis: LIN-MAG (X-axis: LOG-Hz)



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



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





## 4.8.4 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

$$\begin{aligned} G_{aa} &= \frac{1}{2} F_a^* \cdot F_a \\ &= \frac{1}{2} \{ \text{Re}^2(F_a) + \text{Im}^2(F_a) \} \\ &= \frac{1}{2} |F_a| \end{aligned}$$

$F_a^*$ : complex conjugate of  $F_a$

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

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

DC component:

$$\begin{aligned} G_{aa} &= F_a^* \cdot F_a \\ &= \{ \text{Re}^2(F_a) + \text{Im}^2(F_a) \} \\ &= |F_a|^2 \end{aligned}$$

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 between 1/400 and 1/4000 of value to the frequency range value.

Vertical  
cursor

LIN-MAG

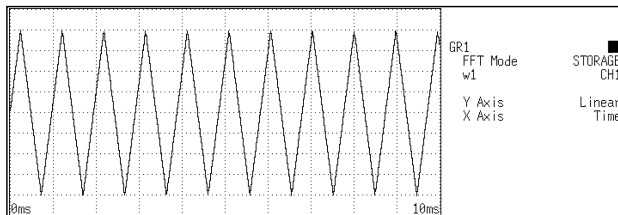
Linear display of analysis data as binary exponential voltage. This expresses the energy component.

LOG-MAG

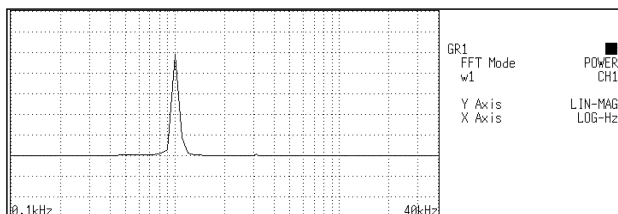
Logarithmic display of analysis data as dB (0dB reference value: 1 V<sup>2</sup> rms)

### Example Power spectra waveforms

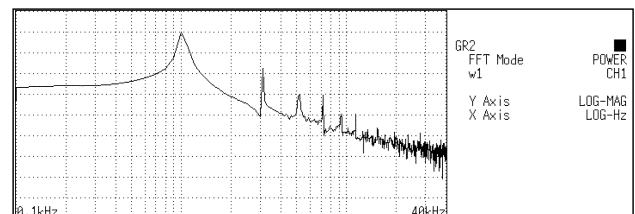
Stored waveform



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



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



### Overall value

The overall value is the total effective value obtained from the frequency spectrum contained in the input signal. It is obtained by taking the square root of the total of power spectra for all frequencies.

$$(\text{Overall value}) = \sqrt{\text{PSP}_0 + \sum_{i=1}^n \text{PSP}_i} \quad (\text{V}_{\text{rms}})$$

$\text{PSP}_0$  DC component

$\text{PSP}_i$   $i$ th AC component

Compensation is applied to data for specified 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:  $\gamma$

Square wave:  $\gamma = 1$

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

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

( $\alpha$  is a percentage with a range of  $0 \leq \alpha < 100$ .)

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

# 4.8.5 Auto Correlation [ACR]

Displays the degree of similarity between two points in the input signal separated by time difference ( $\tau$ ).

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

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

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

Horizontal cursor

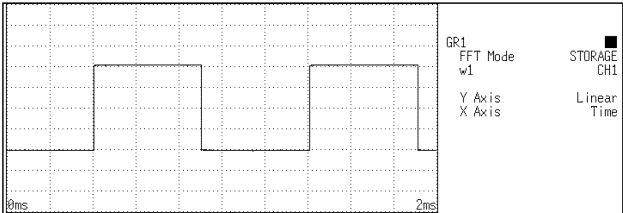
Time Time display. The center indicates the reference ( $\tau=0$ ), the right side indicates time lag ( $+\tau$ ), and the left side indicates time lead ( $-\tau$ ).

Vertical cursor

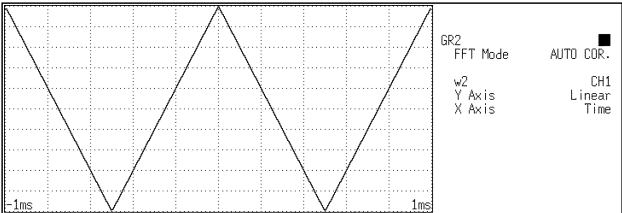
Linear Readings are between +1 and -1 (without units).  
+1: the highest similarity for time differential  $\tau$   
0: the lowest similarity, -1: the polarity is completely opposite.  
Due to the characteristics of the function,  $\tau=0$  always results in +1.

## Example Auto correlation function waveforms

Stored waveform



Auto correlation function



### 4.8.6 Histogram [HIS]

Displays the frequencies of the magnitudes of sampled points.  
Major applications include:

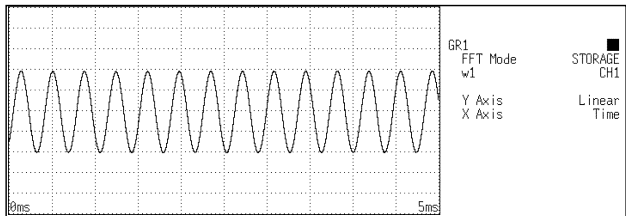
- Determining waveform imbalance
- Determining whether a waveform is artificial or natural from the waveform distribution (most natural waveforms are regular sine waves).

Function	Pa		
Horizontal cursor	Volt	Linear display of the measurement range of the input module.	
Vertical cursor	Linear	Number of sample points for the time axis data (total: specified points).	

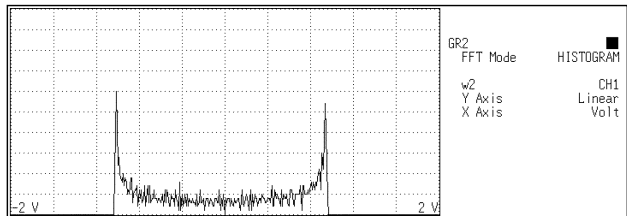
Example

Histogram function waveforms

Stored waveform



Histogram function



## 4.8.7 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.

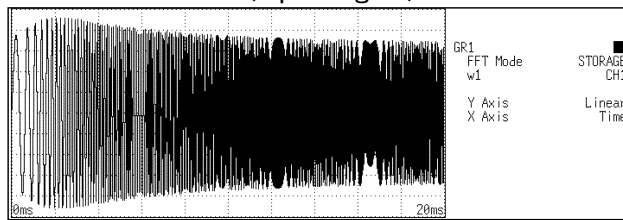
Major applications include:

- 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.

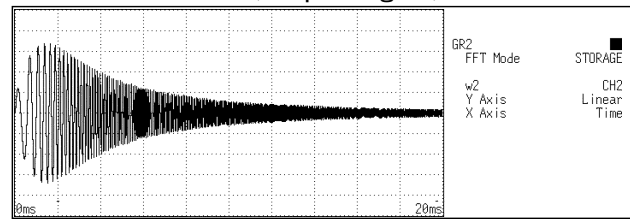
Function	$H_{ab} = \frac{F_b}{F_a} = \frac{F_b \cdot F_a^*}{F_a \cdot F_a^*} = \frac{G_{ab}}{G_{aa}}$ $= \frac{ G_{ab} }{ G_{aa} } \{ \cos(\angle \theta_b - \angle \theta_a) + j \sin(\angle \theta_b - \angle \theta_a) \}$	
Horizontal cursor	LIN-Hz	Frequency spectrum display as linear units. The range is from DC to the maximum frequency range value.
	LOG-Hz	Frequency spectrum display as logarithmic units. The range is from between 1/400 and 1/4000 of value to the 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).

## Example Transfer function spectra waveform

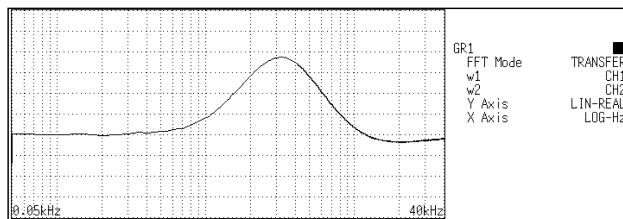
Stored waveform (input signal)



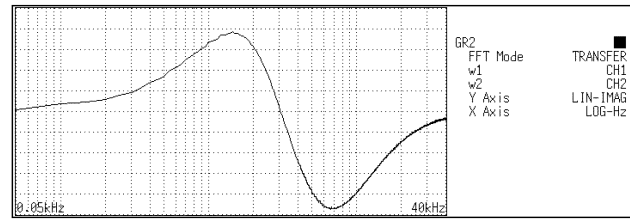
Stored waveform (output signal)



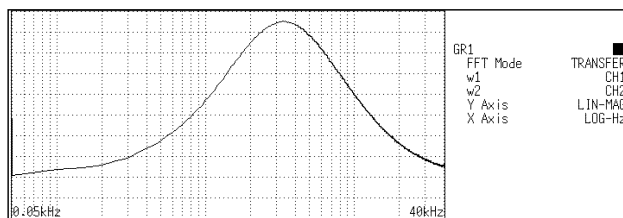
Y-axis: LIN-REAL (X-axis: LOG-Hz)



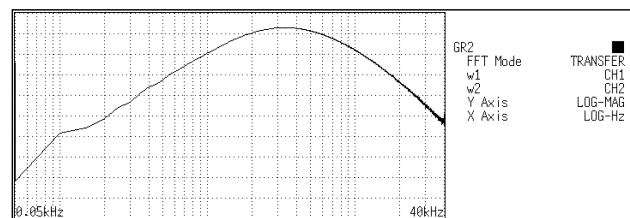
Y-axis: LIN-IMAG (X-axis: LOG-Hz)



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



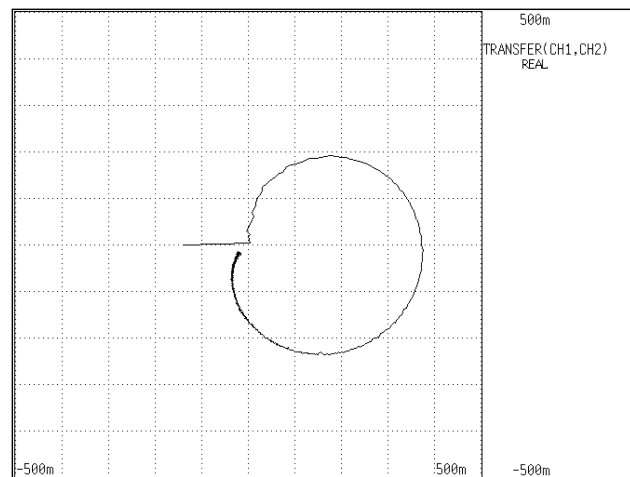
Y-axis: LOG-MAG (X-axis: LOG-Hz)



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



Nyquist



### 4.8.8 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.

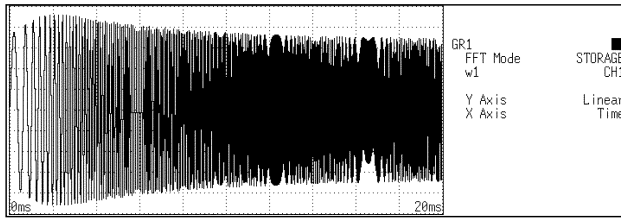
Major applications:

Obtaining frequency components common to two signals.

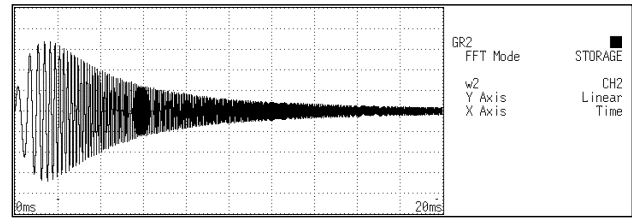
Function	$G_{ab} = \frac{1}{2} F_a^* \cdot F_b$ $= \frac{1}{2}  F_a  \cdot  F_b  \{ \cos(\angle \theta_b - \angle \theta_a) + j \sin(\angle \theta_b - \angle \theta_a) \}$	
Horizontal cursor	LIN-Hz	Frequency spectrum display as linear units. The range is from DC to the maximum frequency range value.
	LOG Hz	Frequency spectrum display as logarithmic units. The range is from between 1/400 and 1/4000 of value to the 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)

## Example Cross power spectra waveforms

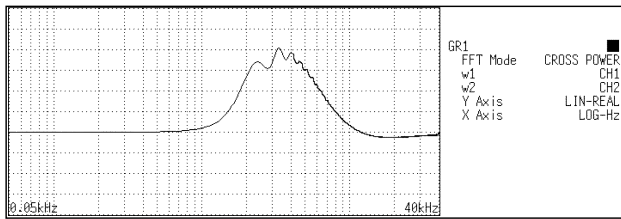
Stored waveform 1



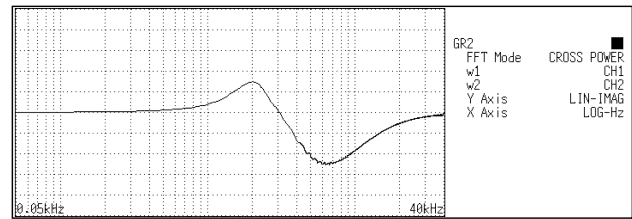
Stored waveform 2



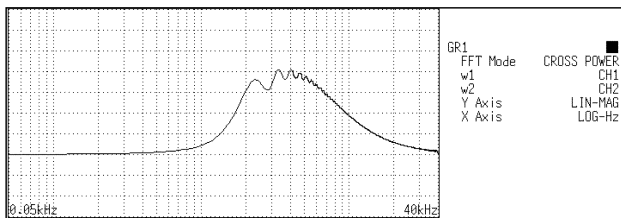
Y-axis: LIN-REAL (X-axis: LOG-Hz)



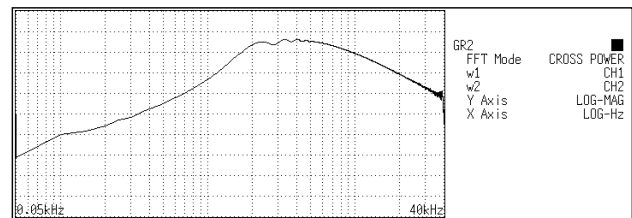
Y-axis: LIN-IMAG (X-axis: LOG-Hz)



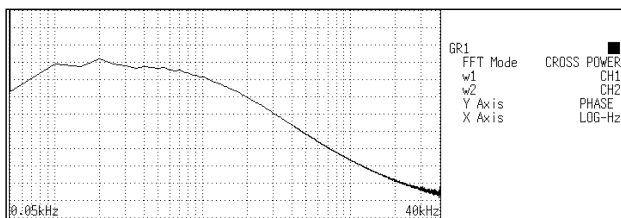
Y-axis: LIN-MAG (X-axis: LOG-Hz)



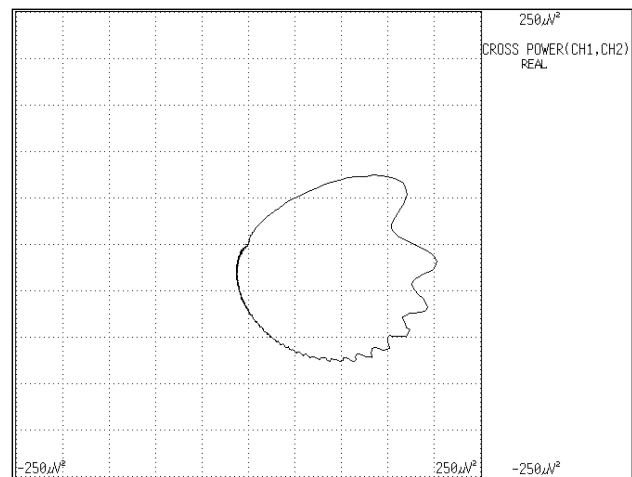
Y-axis: LOG-MAG (X-axis: LOG-Hz)



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



Nyquist





## 4.8.9 Cross Correlation [CCR]

Displays the degree of similarity between two points separated by a time difference ( $\tau$ ) on two signals.

The degree of similarity is expressed as a function of the time difference ( $\tau$ ).

Major applications:

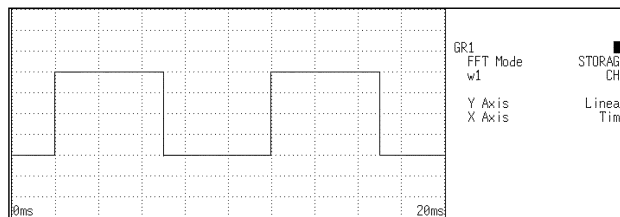
- Obtaining the phase difference between two signals in time units.
- Obtaining a speed or distance by measuring the time delay.

Function	$R_{ab}(\tau) = \mathcal{F}^{-1}(G_{ab})$ $= \frac{1}{2\pi} \int_{-\infty}^{+\infty} G_{ab} \cdot (\omega) \exp(j\omega\tau) d\omega$	
Horizontal cursor	Time	Time display. The center indicates the reference ( $\tau=0$ ), the right side indicates time lag ( $+\tau$ ), and the left side indicates time lead ( $-\tau$ ).
Vertical cursor	Linear	Readings are from +1 to -1 (no units). +1: the highest similarity between the input and output signals for time differential $\tau$ , 0: the lowest similarity, -1: the polarity is completely opposite

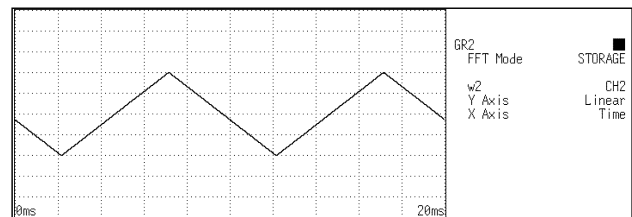
### Example

### Cross correlation function waveforms

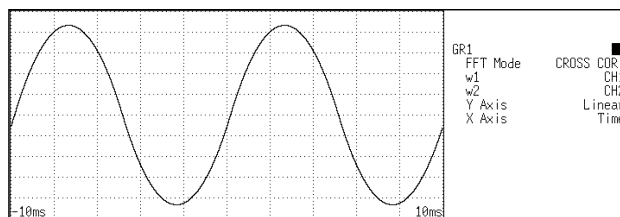
Stored waveform (input waveform)



Stored waveform (output waveform)



Cross correlation function



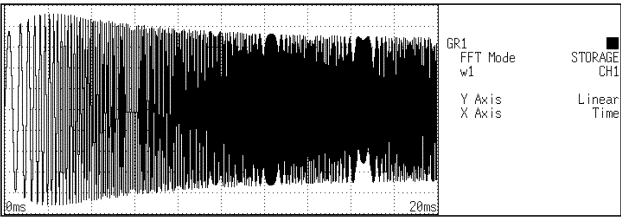
### 4.8.10 Unit Impulse Response [IMP]

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.

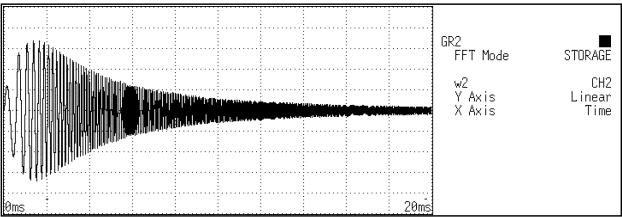
Function	$IMP = \mathcal{S}^{-1} (Hab)$	
Horizontal cursor	Time	Time display. The center indicates the reference ( $\tau=0$ ), the right side indicates time lag ( $+\tau$ ), and the left side indicates time lead ( $-\tau$ ).
Vertical cursor	Linear	Inverse Fourier conversion value of the transfer function ( $Hab$ ) (no units).

#### Example Unit impulse response waveforms

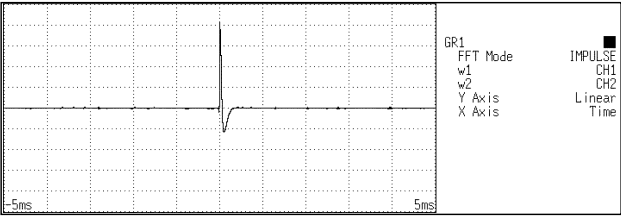
Stored waveform (input signal)



Stored waveform (output signal)



Unit impulse response



### 4.8.11 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 between 1/400 and 1/4000 of value to the 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).

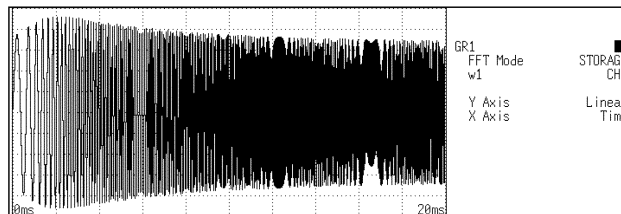
**NOTE**

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

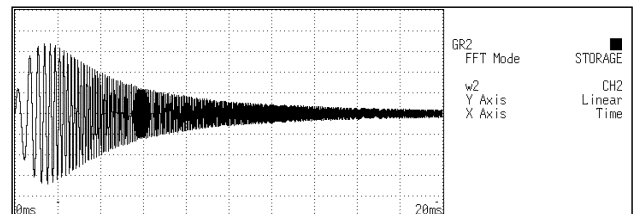
#### Example

#### Coherence function waveforms

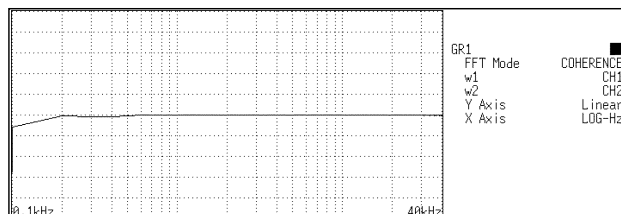
Stored waveform (input signal)



Stored waveform (output signal)



Coherence



## 4.8.12 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

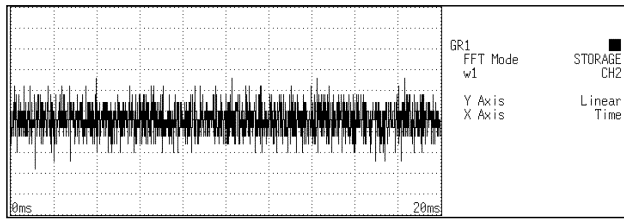
Function	OCT	
Horizontal cursor	1/1 OCT	1/1-octave band filtering
	1/3 OCT	1/3-octave band filtering
Vertical cursor	LIN-MAG	Linear display of octave analysis value as voltage
	LOG-MAG	Logarithmic display of octave analysis value as dB

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

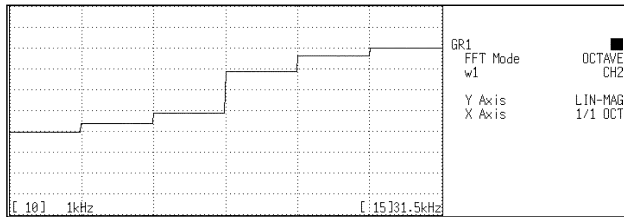
- For frequency analysis of a noise signal or similar, the signal is passed through fixed-ratio band filters with 1/1-octave or 1/3-octave bandwidth.
- As opposed to the power spectrum function, where the signal is divided into bands of identical width and the power in each band is displayed, octave 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 8855, 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 8855 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

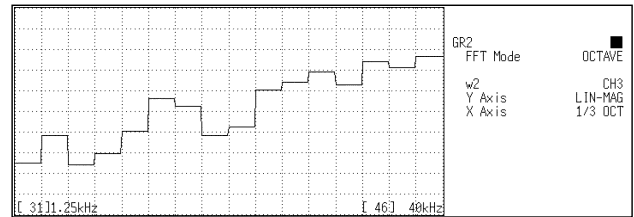
Stored waveform



1/1 octave analysis



1/3 octave analysis



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

0: 1/1 OCT, 1: 1/3 OCT

Band No.		Center frequency (Hz)	133	333	667	1.3	4	8	20	40	80	200	400	800	2k	4k	8k	20k	40k	80k	200	400	800	2 M	4 M	8 M
1/1	1/3		m	m	m	3															k	k	k			
-8	-24 -23	4 m 5 m	0 1																							
-7	-22 -21 -20	6.3 m 8 m 10 m	1 0 1	1 0 1																						
-6	-19 -18 -17	12.5 m 16 m 20 m	1 0 1	1 0 1	1 0 1																					
-5	-16 -15 -14	25 m 31.5 m 40 m	1 0 1	1 0 1	1 0 1	1 0 1																				
-4	-13 -12 -11	50 m 63 m 80 m	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1																			
-3	-10 -9 -8	100 m 125 m 160 m	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1																		
-2	-7 -6 -5	200 m 250 m 315 m		1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1																	
-1	-4 -3 -2	400 m 500 m 630 m			1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1																
0	-1 0 1	800 m 1 1.25				1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1															
1	2 3 4	1.6 2 2.5					1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1														
2	5 6 7	3.15 4 5					1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1													
3	8 9 10	6.3 8 10						1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1												
4	11 12 13	12.5 16 20							1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1											
5	14 15 16	25 31.5 40								1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1										
6	17 18 19	50 63 80									1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1									
7	20 21 22	100 125 160										1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1								
8	23 24 25	200 250 315											1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1							
9	26 27 28	400 500 630												1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1						
10	29 30 31	800 1 k 1.25 k													1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1					
11	32 33 34	1.6 k 2 k 2.5 k														1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1				
12	35 36 37	3.15 k 4 k 5 k															1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1			

Band No.		Center frequency (Hz)	133 m	333 m	667 m	1.3 3	4	8	20	40	80	200	400	800	2k	4k	8k	20k	40k	80k	200 k	400 k	800 k	2 M	4 M	8 M
1/1	1/3																									
13	38 39 40	6.3 k 8 k 10 k															1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1				
14	41 42 43	12.5 k 16 k 20 k																1 0 1	1 0 1	1 0 1	1 0 1	1 0 1				
15	44 45 46	25 k 31.5 k 40 k																	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1			
16	47 48 49	50 k 63 k 80 k																	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1	0 1		
17	50 51 52	100 k 125 k 160 k																			1 0 1	1 0 1	1 0 1	1 0 1	0 1	1
18	53 54 55	200 k 250 k 315 k																			1 0	1 0 1	1 0 1	1 0 1	1 0 1	1 0 1
19	56 57 58	400 k 500 k 630 k																				1 0	1 0 1	1 0 1	1 0 1	1 0 1
20	59 60 61	800 k 1 M 1.25 M																					1 0	1 0 1	1 0 1	1 0 1
21	62 63 64	1.6 M 2 M 2.5 M																					1 0	1 0 1	1 0 1	1 0 1
22	65 66 67	3.15 M 4 M 5 M																						1 0	1 0 1	1 0 1
23	68 69 70	6.3 M 8 M 10 M																							1 0	1
24	71	12.5 M																								





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## Chapter 5

# Input Channel Settings

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## 5.1 Overview

This section describes the various input channel settings.

This manual describes the advanced functions of the 8855.

For information on commonly used functions, refer to the Basics edition (Quick Start Manual) of this manual.

Item	Screen	Channel	Display	
Waveform Display Color	●	●	●	See Section Quick Start 6.3.1
Print Density	●	●	●	See Section Quick Start 6.3.2
Waveform display screen	●	-	-	See Section Quick Start 6.3.3 When the display format setup on Status screen.
Measurement Mode	●	-	-	See Section Quick Start 6.3.4
Measurement Range	●	●	●	See Section Quick Start 6.3.5
Input Coupling	●	●	●	See Section Quick Start 6.3.6
Magnification/Compression Ratio Along the Voltage Axis	●	●	●	See Section Quick Start 6.3.7
Zero Position	●	●	●	See Section Quick Start 6.3.8
Low-Pass Filter	●	●	●	See Section Quick Start 6.3.9
Logic Display Color	●	●	●	See Section Quick Start 6.3.10
Logic Display Position	●	●	●	See Section Quick Start 6.3.10
Zero Adjustment	●	●	●	See Section Quick Start 6.4
Variable Function	●	-	-	See Section 5.2
Scaling Function	●	-	-	See Section 5.3
Comment function	●	-	-	See Section 5.4
Vernier	-	●	●	See Section 5.6.3
Probe	●	-	-	See Section 5.7
Response	●	-	-	See Section 5.9 (8952 only)
AAF	●	-	-	See Section 5.10 (8953-10 only)
RJC	●	-	-	See Section 5.11 (8954 only)
Burn Out	●	-	-	See Section 5.11 (8954 only)
Threshold value	●	-	-	See Section 5.12 (8955 only)
Pull-up	●	-	-	See Section 5.12 (8955 only)
Hold Function	●	-	-	See Section 5.12 (8955 only)
Slope	●	-	-	See Section 5.12 (8955 only)
Functions	●	●	●	

## 5.2 Setting the Variable Function

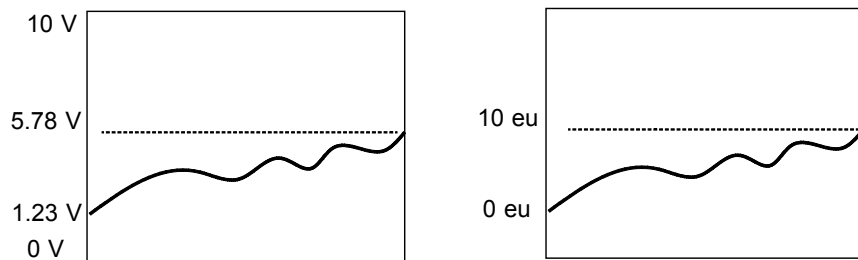
- The variable function allows the user to modify the waveform position and size.
- The variable screen serves for setting the lower and upper limit of the waveform display range.
- The variable function can be set to ON or OFF for each channel individually.

### 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:

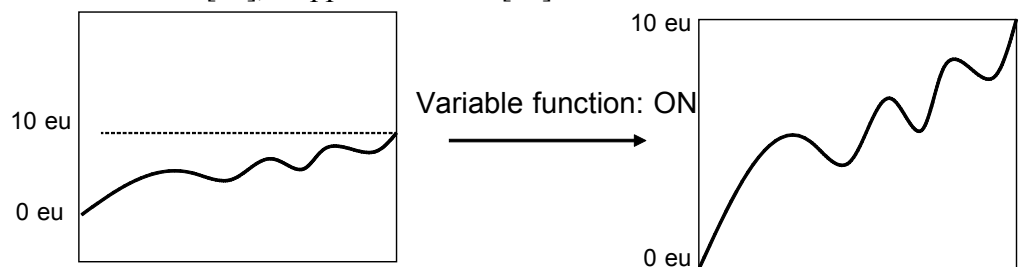
Output from sensor	→ Scaling	→ After conversion
1.23 V min,		0 [eu] min,
5.78 V max.		10 [eu] max.



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:

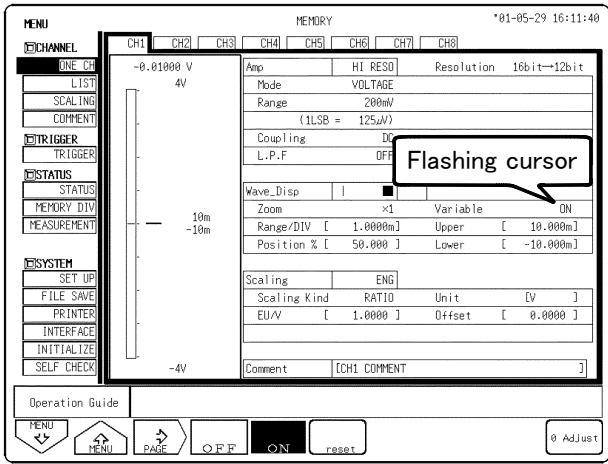
Lower limit: 0 [eu], Upper limit: 10 [eu]



#### NOTE

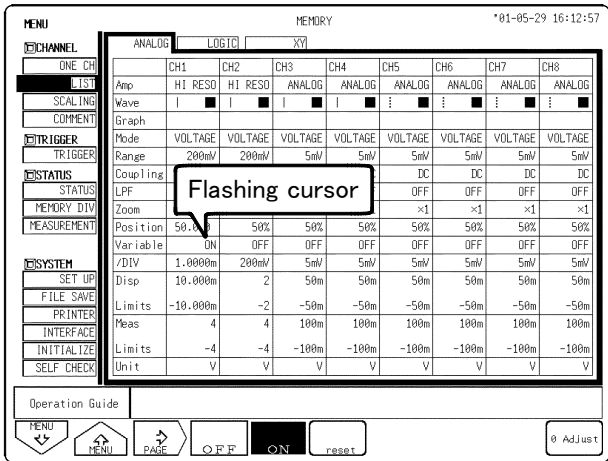
When variable automatic correction is ON, the variable upper and lower limits will be corrected according to the scaling and voltage axis range. The upper and lower limits will not be corrected when variable automatic correction is OFF.

For instructions on how to set variable automatic correction, see Quick Start Section 9.2.4, "Automatic Variable Scale" of quick start manual.



**Procedure** Screen: ONE CH, LIST (CHANNEL)

1. Press the **CHAN** key to display the Channel (ONE CH, LIST) screen.
2. Using the cursor key, move the flashing cursor to the variable position of the channel to be set.



3. Use the function keys to make a setting.

Function display

Meaning



: Variable function is disabled.

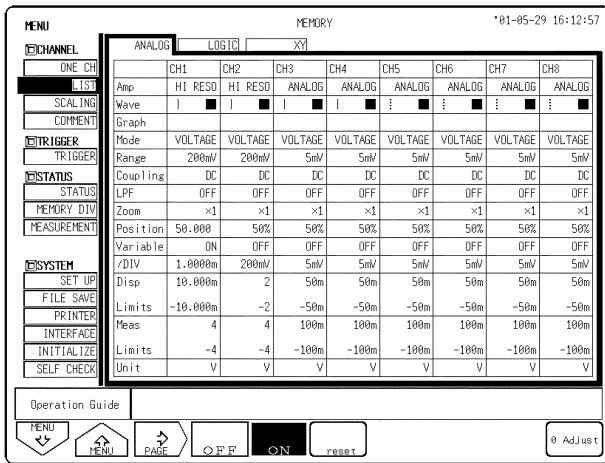


: Variable function is enabled.

## Setting the value

### Screen: CHANNEL (ONE CH, LIST)

1. Using the cursor key, move the flashing cursor to **/DIV** or **Disp Limits**.
2. Select the **F4 (numerical value input)** key to display the numerical value input screen.
3. Use the cursor keys and function keys to input numerical values. The instrument settings are reflected in the scale settings. To exit from the numerical value input screen, press the **ESC** key.



#### Function display

#### Meaning



: Displays the numerical value input screen.



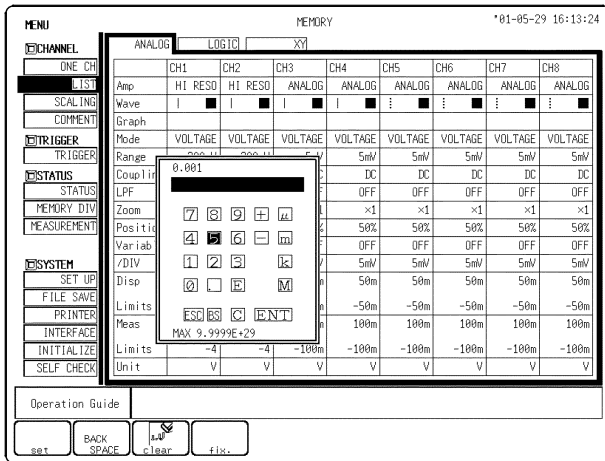
: Resets the system. The voltage axis range, zero position, and the magnification rate determine what values are reset.



: Returns the system to its original state. In this situation, the system reverts to the numerical values that were previously set.



: Use the cursor key to directly input a value.  
You can increase or decrease the values in 1-digit steps.



#### Function display

#### Meaning



: Sets the numerical values that were input.



: Performs backspaces.



: Clears all numerical values that were set.



: Determines the numerical values that were set and exits the numerical value input screen.

#### NOTE

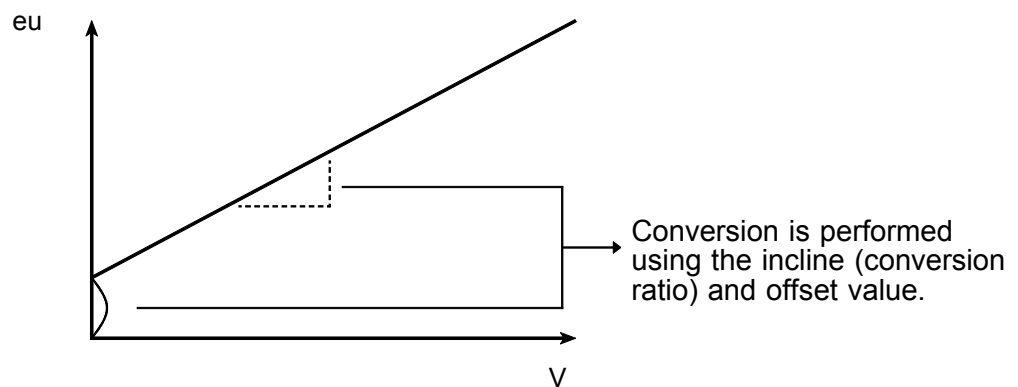
- Variable function and scaling function processing can be carried out simultaneously.
- To exit the numerical value input screen, press the **ESC** key.

## 5.3 Scaling Function (SYSTEM)

- 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 vertical 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.

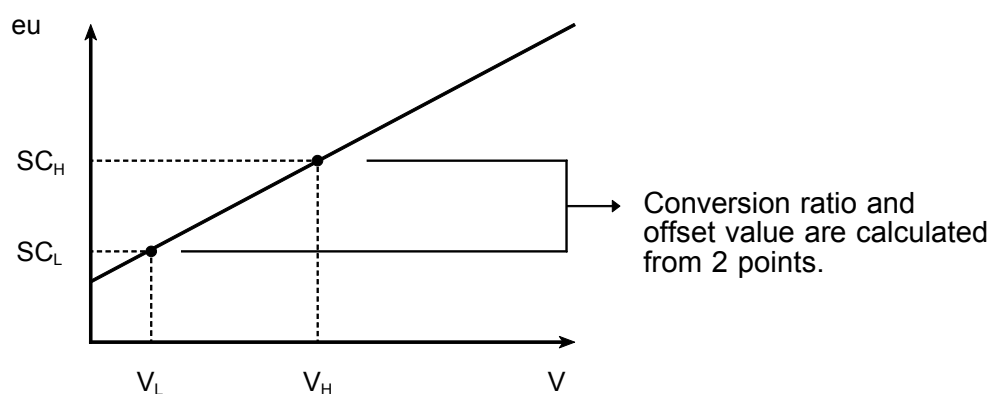
### Conversion ratio method

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-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

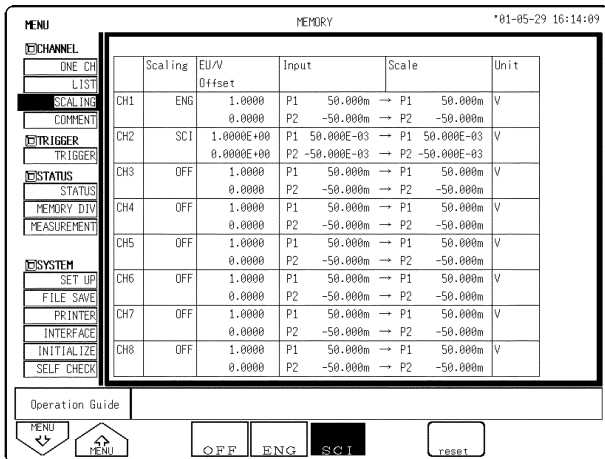
$V_L$ : Voltage low point

$SC_H$ : Scaling high point

$SC_L$ : Scaling low point

See Appendix 3.6, "2-point method" Scaling Equation."

## 5.3.1 Setting the Scaling Function



### (1) Setting the scaling function

#### Method 1 Screen: CHANNEL (SCALING)

1. Press the **CHAN** key and move to the **SCALING** items of the menu screen to display the scaling settings screen.
2. Using the cursor key, move the flashing cursor to the channel to be set.
3. Use the function keys to make the selection.

Function display      Meaning



: Scaling not used



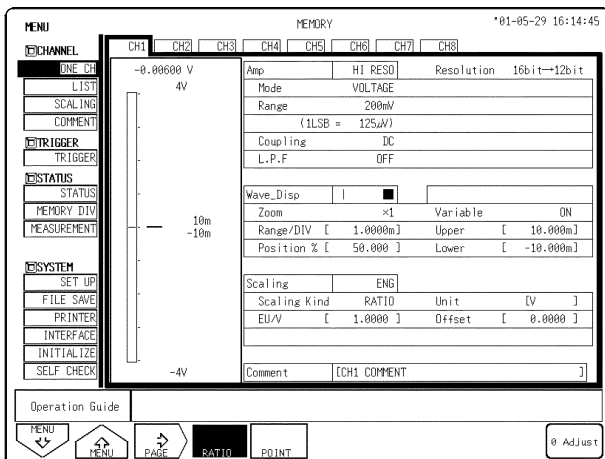
: Scaling used  
(Displays decimal points)



: Scaling used  
(specify exponent as multiple of 3)



: Initializes the conversion ratio



#### Method 2 Screen: CHANNEL (ONE CH)

1. Press the **CHAN** key and move to the **ONE CH** items of the menu screen to display the various channels screen.
2. Move the flashing cursor to the **Scaling** item to be set.
3. Use the function keys to make the selection.  
The method used to set the selection screen is the same as in step 1.
4. Move the flashing cursor to the **Scaling kind** item to be set.

Function display      Meaning

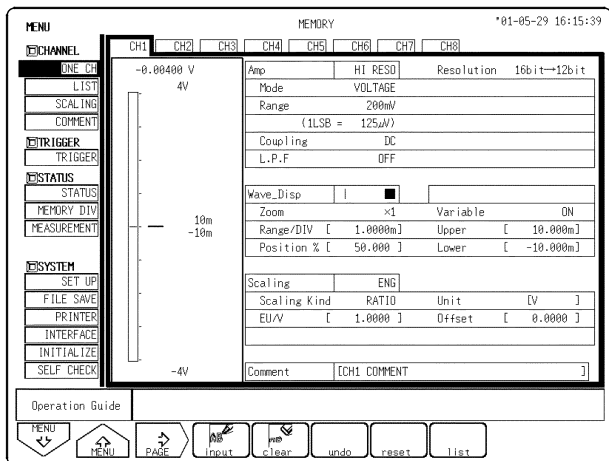
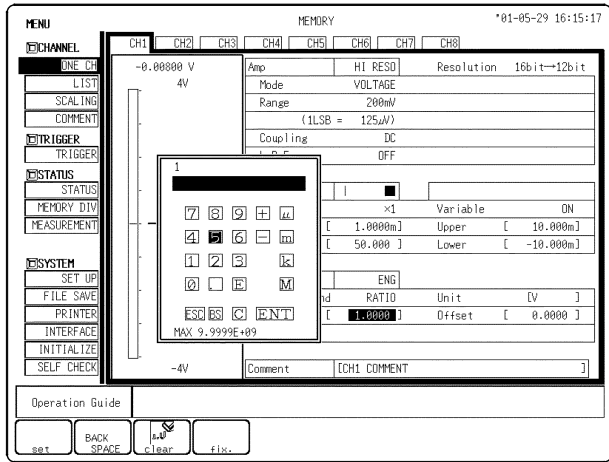
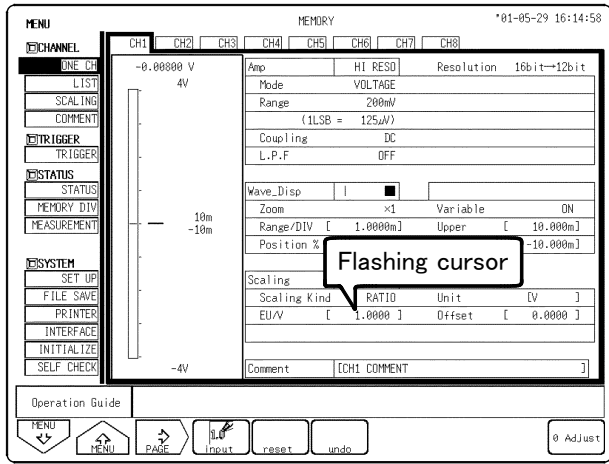


: Use conversion ratio method



: Use 2-point method

When "Specify with 2 Points" is selected for the scaling setting:  
Instantaneous monitor values can be entered as scaling values.  
This is effective only when scaling is turned off.



## (2) Entering the numerical value

1. Move the flashing cursor to the item to be set.
2. Use the function keys to make the selection.

Function display

Meaning



: Displays the numerical value input screen.



: Initializes the system.



: Returns to the numerical values set one step before.

3. Use the function key to enter the numerical value.

Function display

Meaning



: Sets the selected numerical values.



: Backspace



: Deletes all the set numerical values.



: Determines the numerical values that were set and exits the numerical value input screen.

Conversion ratio method (conversion ratio: eu/v, offset)

The setting range: -9.9999E+9 to +9.9999E+9.

2-point method (voltage value: volts, values after conversion: scale)

The setting range: -9.9999E+29 to +9.9999E+29.

## (3) Enter the unit

The unit name can be up to 7 characters long.

1. Move the flashing cursor to **Unit**.
2. Select the **INPUT** function key.

Function display

Meaning



: Displays the text input screen.



: Deletes all the set characters.



: Returns to the values set one step before.



: Initializes the system.



: You can select from the list.

3. Enter the unit name. Refer to the Section 5.4.

### NOTE

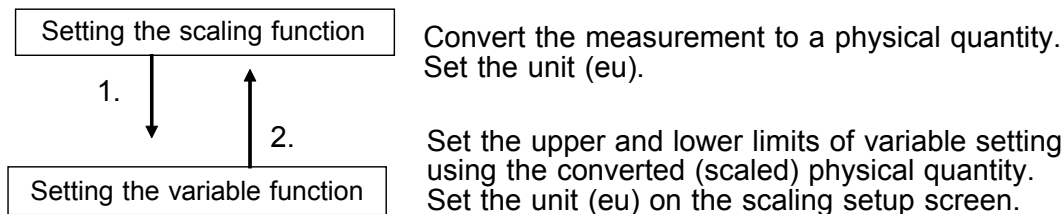
To exit from the character input screen or numerical input screen, press the **ESC** key.



## Combination of the scaling and variable functions

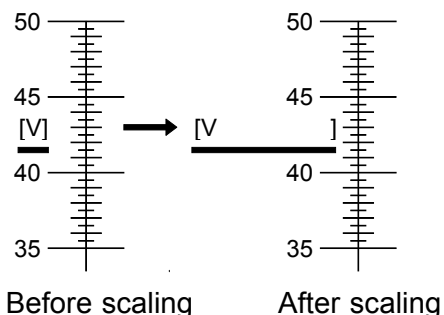
It is possible to combine the scaling and variable functions.

When using the scaling and variable functions together, it is necessary to set the upper and lower limits of the physical amounts after first conversion (after scaling). Perform this setting first for variables, then for scaling.

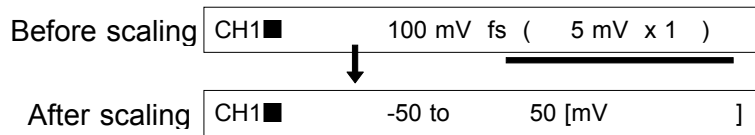


## How to identify scaled data output

The gauge unit indication [ ] is widened (when the gauge is set to ON.)

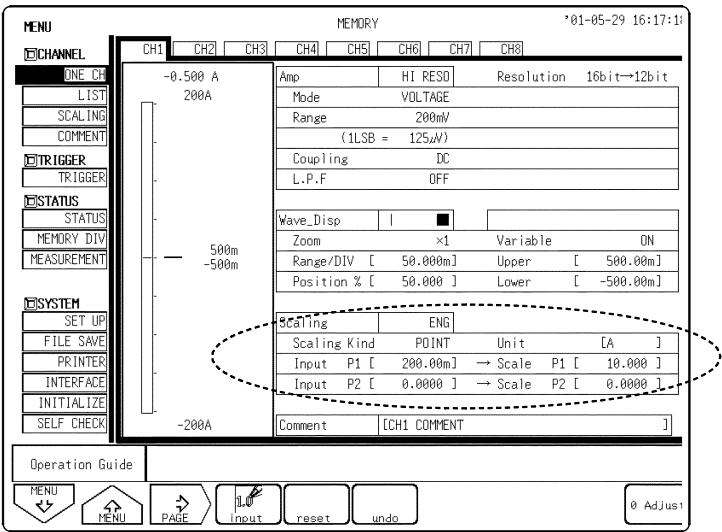


The input channel is represented in full-span mode instead of full-scale mode, and the unit is displayed in [ ]

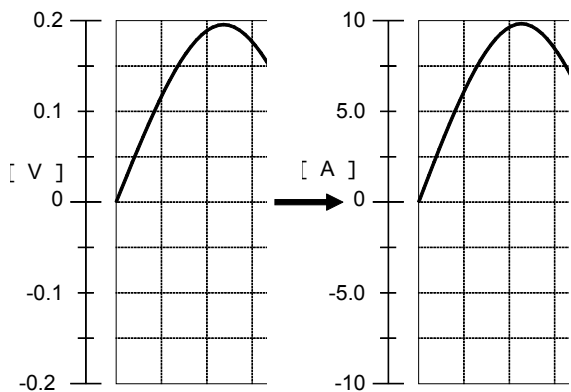
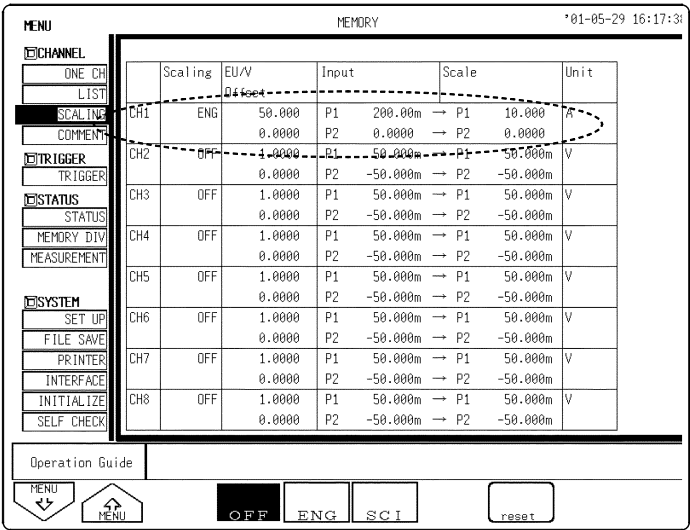


### 5.3.2 Scaling Setting Example

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



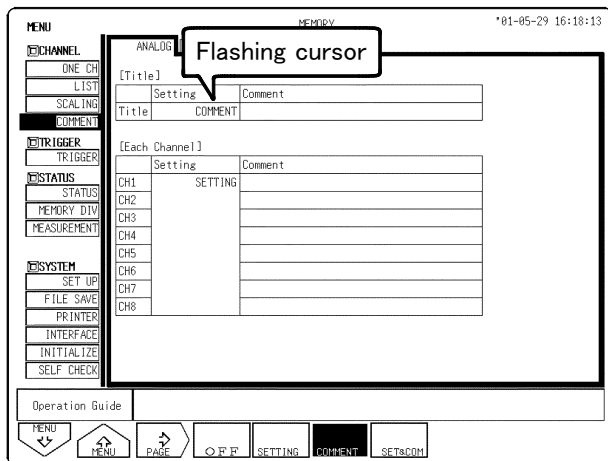
Through the use of the scaling function, the signal from the sensor can be obtained in the form of a current value. Cursor values A and B, respectively, show the current values. If the gauge is turned on before the printout is made, the gauge is output in a current value.

## 5.4 Comment Function (CHANNEL)

### 5.4.1 Title Comment Entry

Title comments of up to 40 characters can be included on the recording paper.

Enabling title comment input prints the title on recording paper for all functions. "SET & COM" prints setup conditions (function, time axis range, magnification of time axis, and trigger time) along with the title.



#### Procedure Screen: COMMENT (CHANNEL)

1. Press the **CHAN** key to display the System screen.
2. Move the flashing cursor to **Title**.
3. Use the function keys to make the selection.

Function display    Meaning



: Standard printout is performed.



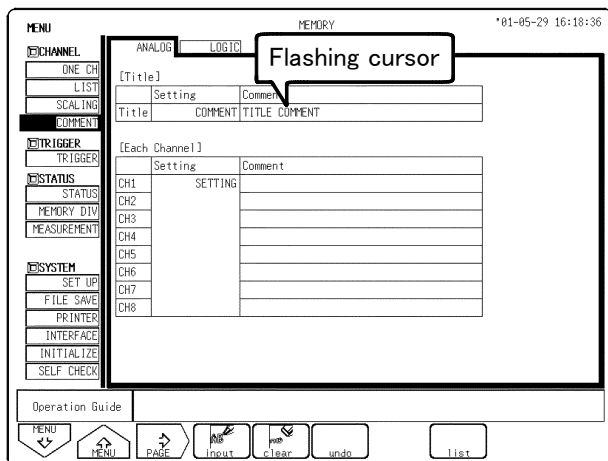
: Setting item is printed.



: Comment is printed.



: Both item and comment are printed.



4. Enter the comment when **COMMENT** or **SET&COM** is selected.
5. Move the flashing cursor to the position shown in the figure on the left.
6. Select the function key.

Function display    Meaning



: Input comment.



: Clear comment.



: Returns to the previous title.

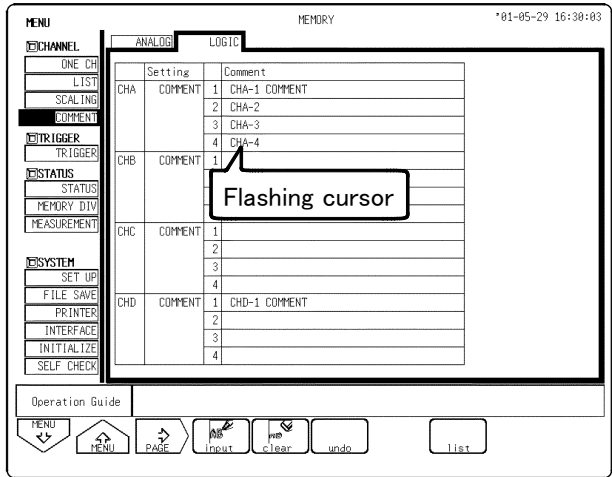
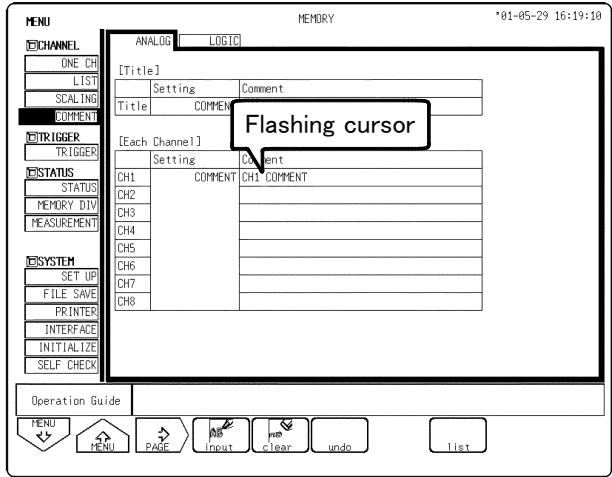
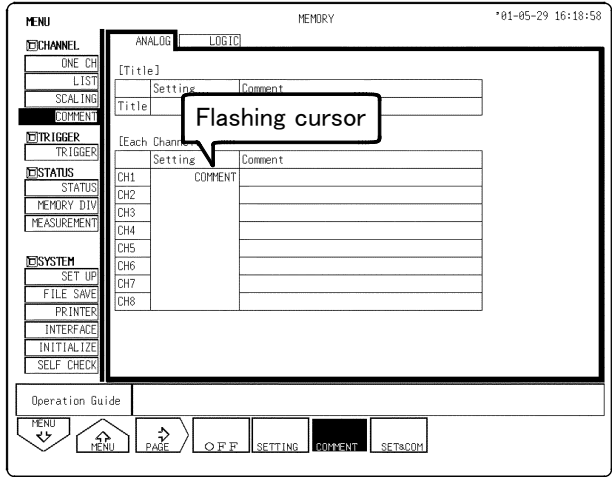


: You can select from the list.

For details on comment input, see Section 5.4.3.  
For the print examples, see Section 10.5.

### 5.4.2 Analog/Logic Channel Comment Entry

Comments of up to 40 characters can be printed or displayed with waveforms for each channel. If "COMMENT" or "SET & COM" is selected, this comment will be included on the recording paper in all functions. "SET & COM" prints the settings for each channel (voltage axis range, magnification of voltage axis, zero position, low-pass filter, and full span voltage range), along with comments. For details on display, see Qick Start Manual Section 9.2.2.



**Procedure** Screen: COMMENT (CHANNEL)

1. Press the **CHAN** key to display the comment setting screen.
2. Move the flashing cursor to the position shown in the figure on the left, and use the function keys to select the desired channel screen.

3. Move the flashing cursor to the position shown in the figure on the left. Use the function keys to make the selection.

Function display	Meaning
	: Standard printout is performed.
	: Setting item is printed.
	: Comment is printed.
	: Both item and comment are printed.

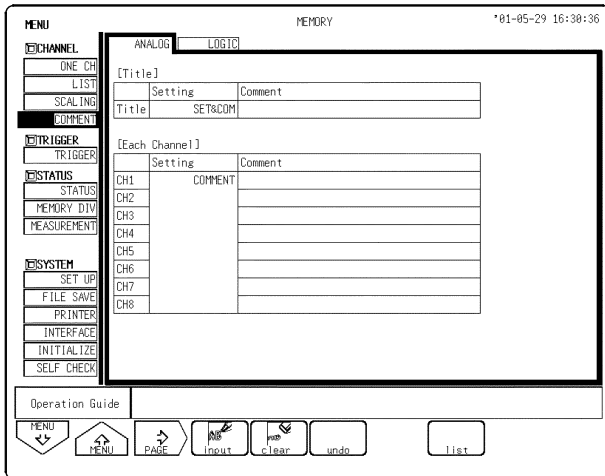
4. Move the flashing cursor to the channel to be input and use the function keys to make the selection.

Function display	Meaning
	: Input comment.
	: Clear comment.
	: Cancels the settings.
	: You can select from the list.

For details on comment input, see Section 5.4.3, and for the example of printing, see Section 10.5.

### 5.4.3 Character Entry Procedure

The procedure for entering the characters for the comments, units, etc. is described.



#### Procedure

Screen: COMMENT (CHANNEL), SCALING (UNIT),  
FILE (SAVE NAME)

1. Use the cursor key to move the flashing cursor to the position where you want to input the comment (characters).
2. Use the function keys to make the selection.

Function display    Meaning



: The character input screen appears.



: Clears all characters



: Returns the characters to their previous settings



: You can select from the list.

3. Use the cursor keys to move the cursor in the character input screen to the characters that you want to input and press **input** on the function key display to input the characters.

4. When you are done, press **end** on the function key display.

Function display    Meaning



: Inputs the characters at the cursor position (Switches between OVWR and INS. (When the cursor is on OVWR.INS.))



: Backspace



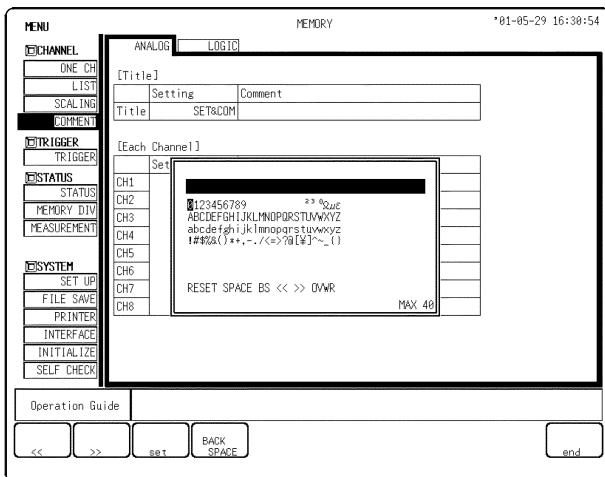
: Moves cursor to the left



: Moves cursor to the right



: Determines the characters Exits from the character input screen

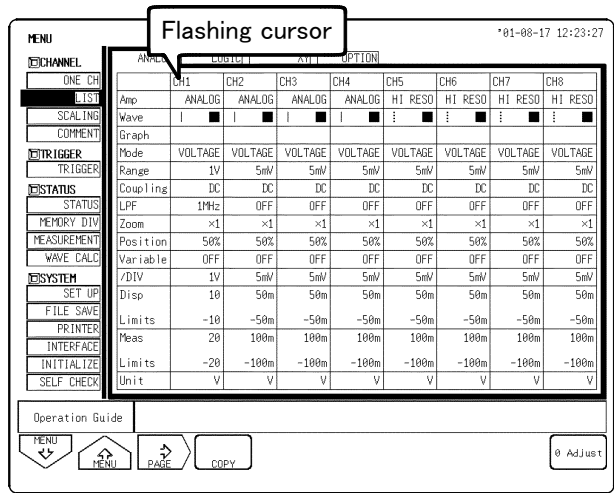


#### NOTE

To exit from the character input screen, press the **ESC** key. Doing so cancels the input operation. Do not insert spaces in directory names.

# 5.5 Copying Channel Settings

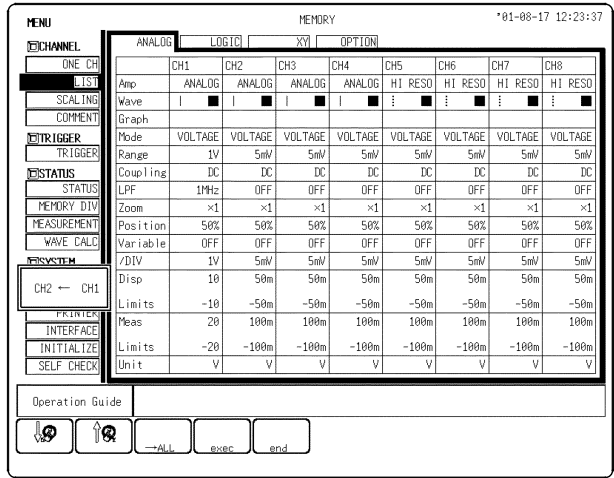
- Copies any of input channel settings (voltage axis range, input coupling, low-pass filter, and variable function), scaling function settings, or comment function settings to another channel.
- Copying channel settings cannot be carried out between different modules.



## Procedure

Screen: LIST, SCALING, COMMENT (CHANNEL)

1. Press the **CHAN** key to display the copy settings on the Channel screen (List screen, Scaling screen, or Comments screen).
2. Move the flashing cursor to the number of the channel to be used as copy source.
3. Press the **F4 (copy)** key. The copy source and copy destination are displayed in the small window that appears.



4. Using the function keys or **JOG** control, select the copy source channel.

Function display	Meaning
	: Increase channel number
	: Decrease channel number
	: Selects all channels.
	: Copies.
	: Closes the Copy screen.

5. When **set** is pressed, the settings of the copy source channel are copied to the copy target channel.

### NOTE

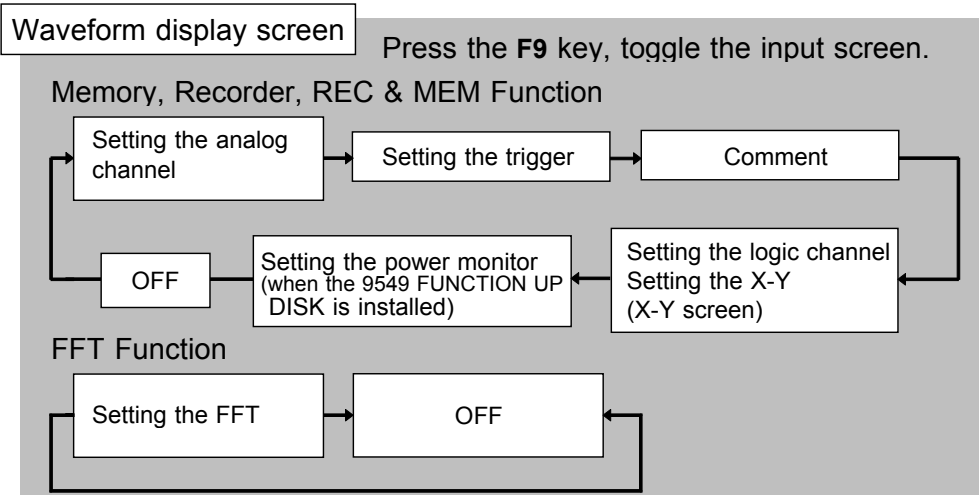
- Magnification and the zero position are not copied.
- Batch copying cannot be used with input channel settings, scaling, or comments.

## 5.6 Setting the Waveform Display Screen

### 5.6.1 Entering by F9 (CH.SET) Key

Pressing the **F9 (CH.SET)** key, enables the measurement conditions for each channel on the Waveform display screen to be set or changed.

It is possible to make the settings, while monitoring the waveforms in real time on the Waveform display screen. For details on settings, refer to Section Quick Start 6.3.



#### Setting the analog channels

- Waveform display color (other than in the X-Y screen)
- Waveform display graph
- Measurement range setting
- Input coupling setting
- Zero position
- Magnification/compression ratio of voltage axis.
- Vernier function
- Low-pass filter

#### Setting the comment

- Waveform display color
- It is not possible to input comments.

#### Setting the X-Y screen

- Waveform display color
- X axis
- Y axis

#### Setting the trigger

- Trigger type
- Trigger level
- Slope

#### Setting the logic channels

- Waveform display color
- Waveform display graph position

#### Setting the FFT screen

- Waveform display color
- FFT analysis mode
- Analysis channel

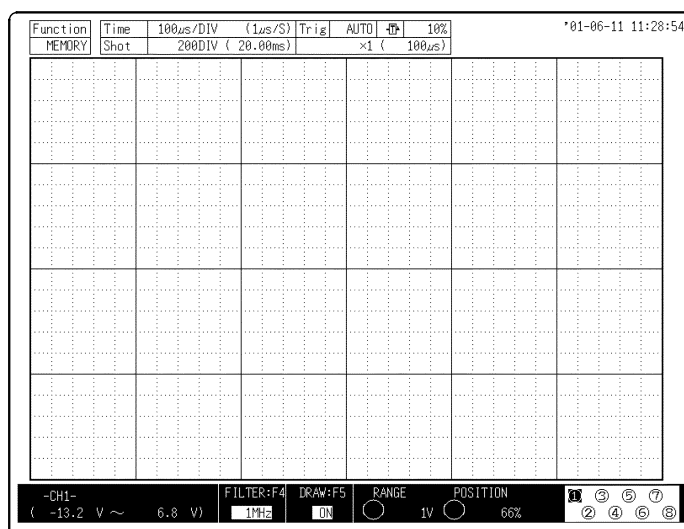
### Setting the power monitor (when the 9549 FUNCTION UP DISK is installed)

- Waveform display color
- Waveform display graph
- Zero position
- Magnification/compression ratio of voltage axis.

## 5.6.2 Entering by CH.SET Key

### Procedure

1. Press the **DISP** key to display the Waveform display screen.
2. Use the channel keys (**CH1** to **CH8**) to select channels. You can only select the input modules that are installed.
3. You can set the zero position and the voltage axis range of the channels that have been selected with the **POSITION** and **RANGE** knobs.
4. You can set the low-pass filter with the **F4** key.
5. You can turn the waveform display ON and OFF with the **F5** key.
6. When setting other channels, select the **CH.SET** key to set them.
7. Pressing any key other than the **F1** to **F10** and the **CH.SET** key returns you to the Waveform display screen.



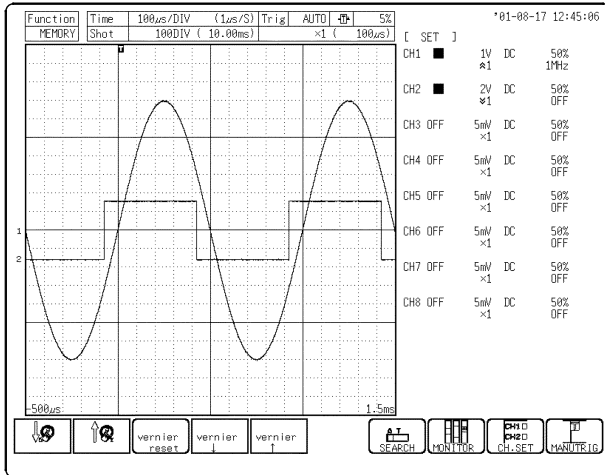
#### NOTE

- Possible settings with the **CH.SET** key:
  1. Voltage axis range settings
  2. Zero position settings
  3. Turning the waveform display ON and OFF
  4. Low-pass filter settings
 Settings other than those described above are not possible.
- Settings made with the **CH.SET** key are also enabled when starting.
- The **CH.SET** key is also available to make settings for each channel.



### 5.6.3 Setting the Vernier Function

With the vernier function, input voltage can be minutely adjusted to the desired value. When recording various physical quantities using noise, temperature, and acceleration sensors, this vernier function allows you to adjust amplitudes to assist with calibration. For example, use the vernier function when you want to convert an input voltage of 1.2 V to 1.0 V and display the converted value.



#### Procedure

1. Press the **DISP** key to display the Waveform display screen.
2. Press the **F9 (CH.SET)** key and move the flashing cursor to the channel to be set shown in the figure on the left.
3. Use the function key to select the vernier function.  
 ↑ is observed in its expanded state while ↓ is observed compressed. The adjustable range is 50 to 200% of the original waveform.

#### Function

display Meaning

vernier reset	: Cancel the vernier function (restores the waveform to its original size)
vernier ↓	: Compresses the waveform.
vernier ↑	: Magnifies 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 **F9 (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.

## 5.7 Setting the Probe Voltage Division Ratio

### **⚠ DANGER**

#### **10:1 and 100:1 probe connections**

- The maximum rated to-voltage does not change when using a 9665 10:1PROBE or a 9666 100:1PROBE. To avoid electrical shock or damaging the 8855 instrument, make probe connections in such a manner that the method for the probe, and make sure the to-ground voltage does not exceed the rated maximum.
- The maximum input voltage is 1,000 V DC for the 9665 10:1PROBE, and 5,000 V DC for the 9666 100:1PROBE. (The measurement category (overvoltage category) is the same as that of the input modules of MEMORY HiCORDERS that use the 9665 and the 9666. ) Do not measure voltages that exceed the maximum input voltage, as the 8855 instrument could be damaged and an accidents resulting in injury or death could result.

#### **Differential Probe Connection**

- When using grabber clips, the 9322's maximum rated voltage to earth is 1500 V AC or DC (CAT II) / 600 V AC or DC (CAT III); when using alligator clips, it is 1000 V AC or DC (CAT II) / 600 V AC or DC (CAT III). To avoid electrical shock and possible damage to the instrument, never apply voltage greater than these limits between the input channel terminals and chassis, or across the input of two 9322s.
- Maximum input voltage is 1000 V AC/2000 V DC (CAT II) / 600 V AC or DC (CAT III). Attempting to measure voltage in excess of the maximum rating could destroy the instrument and result in personal injury or death.

### **NOTE**

The 9665 10:1PROBE and the 9666 100:1PROBE cannot be used with the 8951 VOLTAGE/CURRENT UNIT, the 8954 VOLTAGE/TEMP UNIT, or the 8955 F/V UNIT.

The voltage axis range changes automatically when the voltage division ratio for the probe connected to the input terminal on the analog input module and probe settings match, allowing you to read values directly. Set each channel so that it matches the input probe voltage division ratio.

Operation Guide: This screen allows changing each channel setting from a list. Use the F1 and F2 keys to switch setting screens, and use the F3 key to change between the analog, logic and XY setting screens.

### Procedure Screen: LIST (CHANNEL)

1. Press the **CHAN** key to display the List (Channel) screen.
2. To display the optional settings screen, use the **F3 (PAGE)** key.
3. Move the flashing cursor to the **Probe** item to be set.
4. Use the function keys to make the selection.

#### Function display

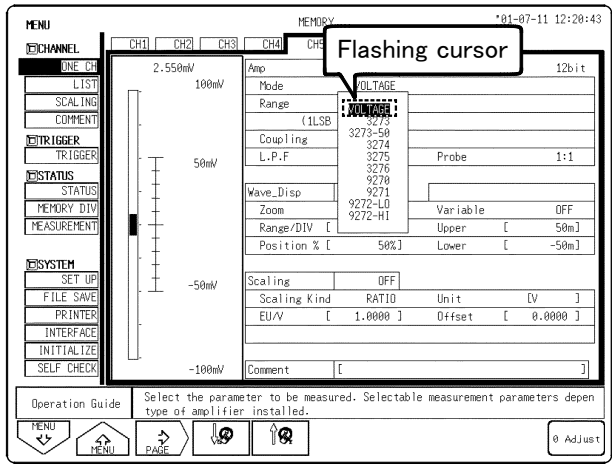
- | Function display | Meaning   |
|------------------|---|
|                  | 1:1 setting. Select this when using the 9197 or 9198 CONNECTION CORD on the modules input terminal. |
|                  | 10:1 setting. Select this when using the 9665 10:1PROBE on the modules input terminal.              |
|                  | 100:1 setting. Select this when using the 9666 100:1PROBE on the modules input terminal.            |
|                  | 1000:1 setting. Select this when using the 9322 DIFFERENTIAL PROBE.                                 |

#### NOTE

1:1 is set as the factory default and when the system is reset.  
For details on how to set the probe offset, see Quick Start Section 9.2.11.

# 5.8 Setting the 8951 VOLTAGE/CURRENT UNIT

## 5.8.1 Setting Voltage Measurement



### Procedure Screen: LIST, ONE CH (CHANNEL)

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Use the function keys to select **VOLTAGE**.

Function display	Meaning
	: Move the cursor up in the selection window.
	: Move the cursor down in the selection window.

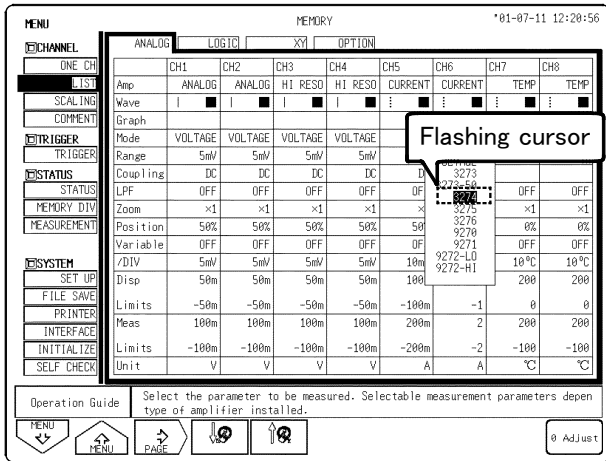
For details on other common settings, see Quick Start Section 6.3.

## 5.8.2 Setting Current Measurement

The 8951 VOLTAGE/CURRENT UNIT can be connected to a clamp-on sensor or clamp-on probe and used to measure current. Clamp-on sensors and clamp-on probes that can be directly connected or connected using a conversion cable are as follows. For details on connection methods, see section 2.4.2.

For details on other common settings, see Quick Start Chapter 6.3.

Conversion cable	Clamp-on sensor/probe
-	3273, 3273-50, 3274, 3275, 3276
9318	9270, 9271, 9272, 9277, 9278, 9279



### Procedure Screen: LIST, ONE CH (CHANNEL)

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Select the model name of the clamp-on sensor or clamp-on probe to be used with the function keys. Scaling is performed automatically.

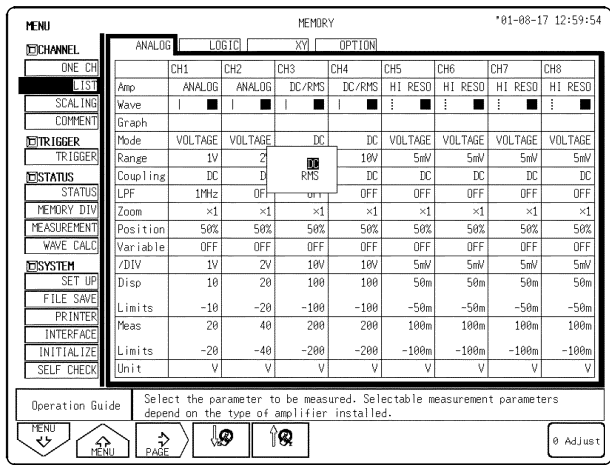
For details on other common settings, see Quick Start Section 6.3.

#### NOTE

When using a clamp-on sensor or clamp-on probe that is not listed in the measurement mode list, measure using voltage mode and use scaling. For details on how to set the scaling, see section 5.3.

# 5.9 Setting the 8952 DC/RMS UNIT


## 5.9.1 Setting Voltage Measurement




### Procedure Screen: LIST, ONE CH (CHANNEL)

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Use the function keys to select **DC**.

Function display      Meaning

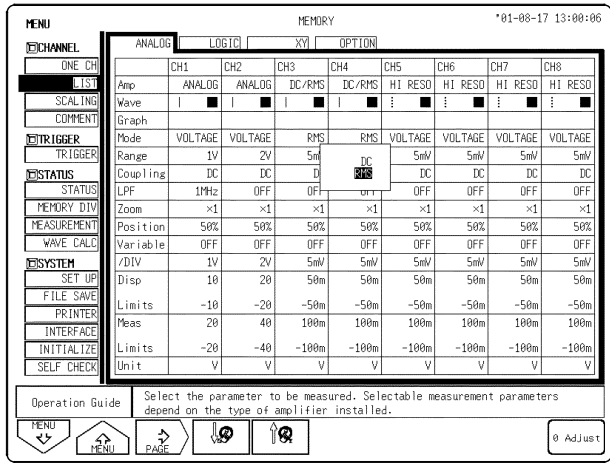
 : Move the cursor up in the selection window.

 : Move the cursor down in the selection window.

For details on other common settings, see Quick Start Section 6.3.

## 5.9.2 Setting RMS Measurement

The input signal is converted to a true RMS value, then displayed.



### Procedure Screen: LIST, ONE CH (CHANNEL)

#### (1) Setting the measurement mode

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Use the function keys to select **RMS**.

## (2) Setting the response

The response time can be selected from three levels, High Speed, Standard, or Low Speed. Normally, this selection is set to High Speed, but if the frequency is low or fluctuations are frequent, more stable display can be obtained by setting the response time to Standard or Low Speed.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Response** item to be set.
3. Use the function keys to make a setting.

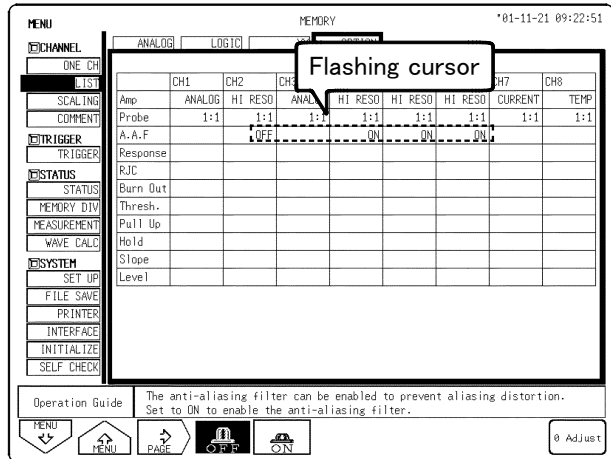
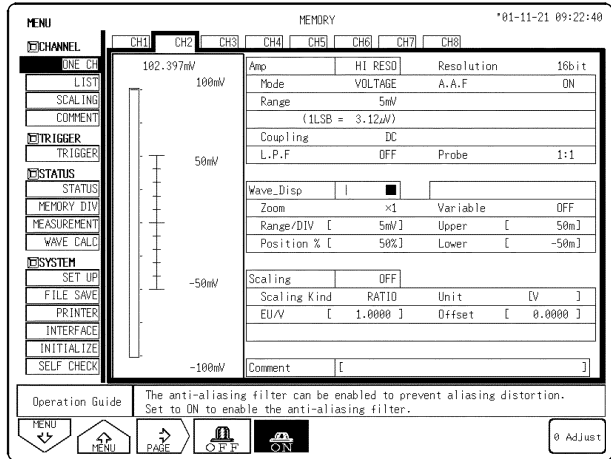
## Meaning

- |        |  |
|--------|--|
| FAST   | : The response time is set to High Speed (approximately 100 ms). |
| NORMAL | : The response time is set to High Speed (approximately 800 ms). |
| SLOW   | : The response time is set to High Speed (approximately 5 s).    |

# 5.10 8953-10 HIGH RESOLUTION UNIT

The 8953-10 HIGH RESOLUTION UNIT contains an internal anti-aliasing filter required for FFT analysis. Enable the anti-aliasing filter when doing FFT analysis.

For details on other common settings, see Quick Start Section 6.3.



## Procedure Screen: LIST, ONE CH (CHANNEL)

1. Use the Menu keys to display the desired screen. If the List screen is displayed, press the **F3** (→ **PAGE**) key to display the **OPTION** screen.
2. Move the flashing cursor to the **A.A.F** item to be set.
3. Use the function keys to make a setting.

Function display Meaning



: Anti-aliasing filter is disabled.



: Anti-aliasing filter is enabled.

### NOTE

- We recommend using an input module equipped with an anti-aliasing filter that can be enabled to minimize sampling distortions during FFT analysis.
- Refer to Appendix 3.9, "FFT Function" for more information about aliasing distortion and anti-aliasing filters.
- Refer to Section 4.3.3, "Setting the Frequency Range" for details about the relationship between the anti-aliasing filter cutoff frequency and the frequency range and time axis range.
- When using the recorder function, the anti-aliasing filter cannot be used even if it is enabled.
- When using the 8953, the anti-aliasing filter cannot be used even if it is enabled.

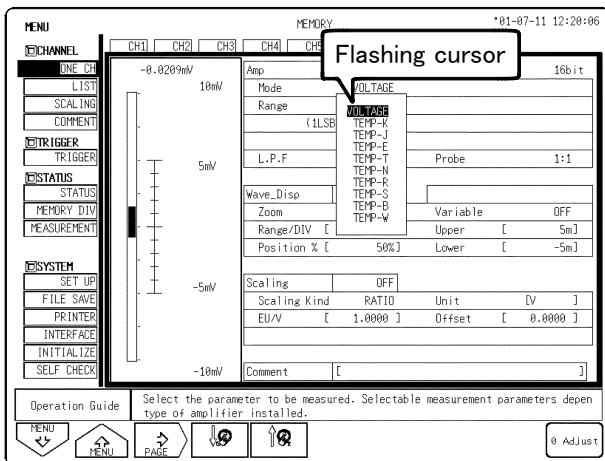


## 5.11 Setting the 8954 VOLTAGE/TEMP UNIT

### ⚠ WARNING

A common GND is used for voltage and temperature input on each channel. When using the voltage and temperature inputs simultaneously, do not connect them both at the same time, as this may damage the object you are measuring. (You cannot measure the voltage and temperature simultaneously on the same channel.)

### 5.11.1 Setting Voltage Measurement



#### Procedure Screen: LIST, ONE CH (CHANNEL)

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Use the function keys to select **VOLTAGE**.

#### Function display

Meaning



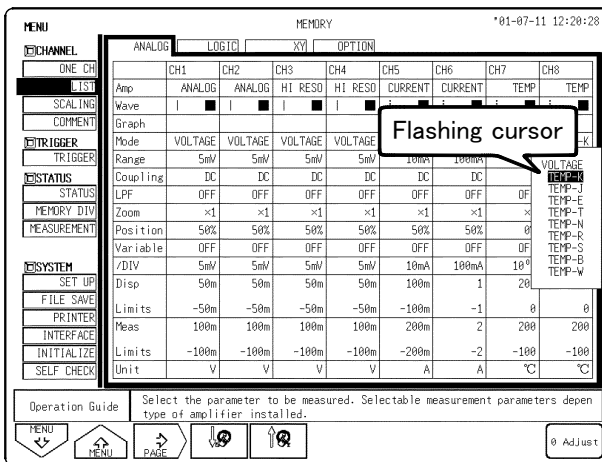
: Move the cursor up in the selection window.



: Move the cursor down in the selection window.

For details on other common settings, see Quick Start Section 6.3.

### 5.11.2 Setting Temperature Measurement

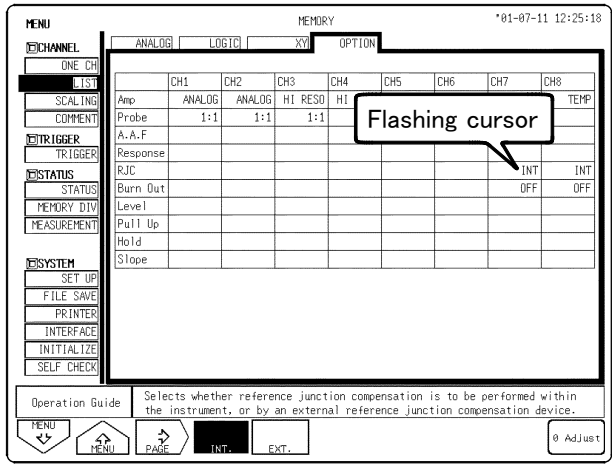


#### Procedure Screen: LIST, ONE CH (CHANNEL)

##### (1) Setting the measurement mode

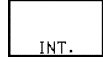
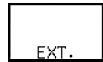
1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Select the temperature range and thermocouple to be used with the function keys.

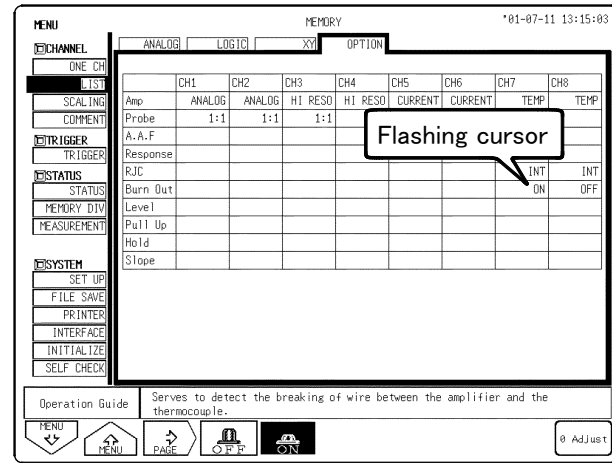
Thermocouple	Measurement input range	Thermocouple	Measurement input range
K	-200 to 1350°C	N	-200 to 1300°C
E	-200 to 800°C	R	0 to 1700°C
J	-200 to 1100°C	S	0 to 1700°C
T	-200 to 400°C	B	300 to 1800°C
		W	0 to 2000°C



(2) Setting reference junction compensation

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **RJC** item to be set.
3. Use the function keys to make the selection.

Function display	Meaning
	: The 8954 performs reference junction compensation internally. (Measurement accuracy is calculated from temperature measurement accuracy and reference junction compensation accuracy.)
	: The 8954 does not perform reference junction compensation. Select this when using an external reference junction compensator. (Measurement accuracy is temperature measurement accuracy only.)





(3) Setting the burn-out

When measuring temperature, check for discontinuity in cord connecting the thermocouple to the amp.

Normally, measurement values fluctuate when measurements are taken with the cord disconnected, but when this function is turned the value displayed is the maximum of the values obtained for measurement with discontinuities. This waveform is attached to the uppermost part of the display screen.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Burn Out** item to be set.
3. Use the function keys to make a setting.

Function display	Meaning
	: Discontinuity detection is not performed.
	: Discontinuity detection is performed.

## Measurement range and measurement input upper and lower limits

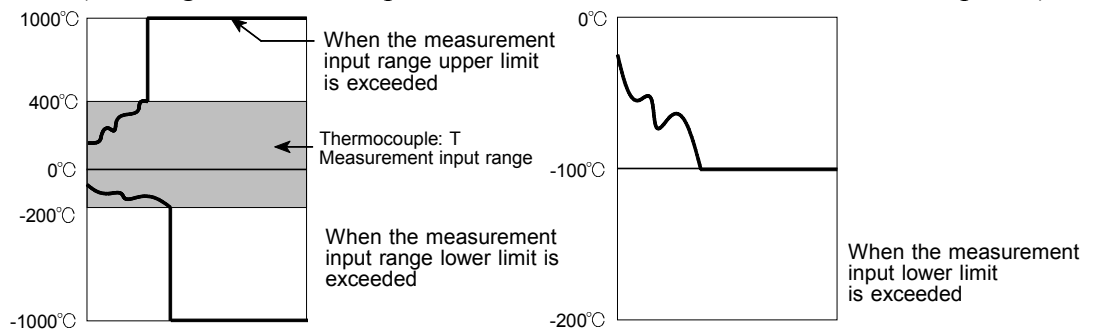
Note that the measurement input upper and lower limits change according to the measurement range.

When the following upper and lower temperature limits are exceeded, the waveform is saturated.

Measurement range	10°C/DIV	100°C/DIV
Measurement input upper limit	200°C	2000°C
Measurement input lower limit	-100°C	-200°C

## Differences in the waveform display depending on the measurement range

(For magnification/compression rate x 1, normal screen, thermocouple: T)



When the position is 50%, the measurement range is 100°C/DIV, and the thermocouple measurement input range (-200 to 400°C) is exceeded

When the position is 100%, the measurement range is 10°C/DIV and the waveform is within the thermocouple measurement input range, but the 10°C/DIV measurement input range lower limit (-100°C) is exceeded

### NOTE

- If the input terminals on the 8954 VOLTAGE/TEMP UNIT come into direct contact with strong winds, the thermal balance of the input module may be upset, causing an error to occur. When measuring in this type of location, change the location of the module so that it is not in direct contact with the wind.
- When the peripheral temperature changes suddenly, the thermal balance may be upset, causing an error to occur. In this case, leave the instrument for approximately an hour and start measuring once the temperature has stabilized.

# 5.12 Setting the 8955 F/V UNIT

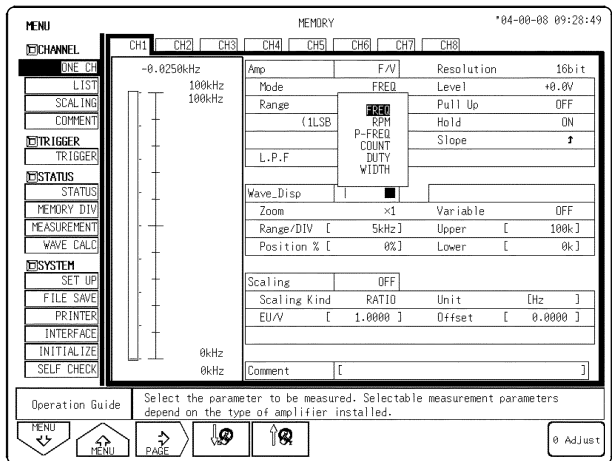
The 8955 F/V UNIT can measure the frequency, rotation speed, commercial power frequency, integral value, pulse duty ratio, and pulse width for each channel. (Only one setting type can be measured for each channel.) For details on common settings, see Quick Start section 6.3.

<b>FREQ</b>	Frequency is calculated using the input pulse that corresponds to the measurement waveform.
<b>RPM</b>	Rotation speed is calculated using the input pulse that corresponds to the measurement waveform.
<b>P-FREQ</b>	Commercial power frequency is calculated using the input pulse that corresponds to the measurement waveform.
<b>COUNT</b>	Integrates the number of integrated input pulses.
<b>DUTY</b>	Calculates the duty ratio of measured waveforms.
<b>WIDTH</b>	Calculates the pulse width for measurement waveforms.

## 5.12.1 Frequency, Rotation, and Commercial Power Frequency Measurement Settings

Sets the Frequency, Rotation, and Commercial power frequency measurement.

Object to be measured	Measurement range
Frequency	0.1 Hz to 5k Hz
Rotation	10 r/min to 500 r/min
Commercial Power Frequency Measurement	50 Hz / 60 Hz

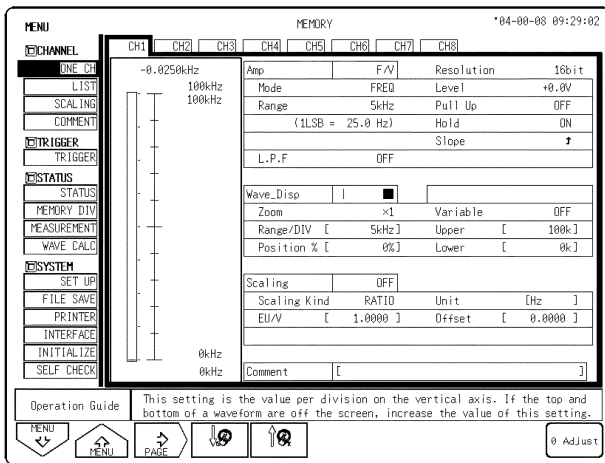


### Procedure Screen: LIST, ONE CH (CHANNEL)

#### (1) Setting the measurement mode

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Use the function keys to select **FREQ**, **RPM** or **F-FREQ**.

Function display	Meaning
	: Move the cursor up in the selection window.
	: Move the cursor down in the selection window.



## (2) Setting the measurement range

Set the value per division.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Range** item to be set.
3. Use the **JOG** control, the function keys or the **RANGE** knob to make the selection.

## (3) Setting the threshold value

The waveform is measured for the interval that it crosses the threshold value.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Level** (threshold value) item to be set.
3. Use the function keys to make the selection.

## (4) Setting the pull-up resistance

Pull-up resistance is used when the 8855 is connected to an open-collector output signal.

When ON is selected, the input terminal is pulled up by +5V. With most measurements, this option is set to OFF.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Pull Up** item to be set.
3. Use the function keys to make the selection.

## (5) Setting the hold function

Displayed measurement results are retained until frequency and rotation values are verified.

When this is set to OFF and the measured frequency is not verified within the specified time, the previously displayed value is halved.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Hold** item to be set.
3. Use the function keys to make the selection.

## (6) Setting the slope

Set the slope to use as a reference for measurement.

Measurement is made based on the point where the rising or falling slope of the input signal crosses the threshold.

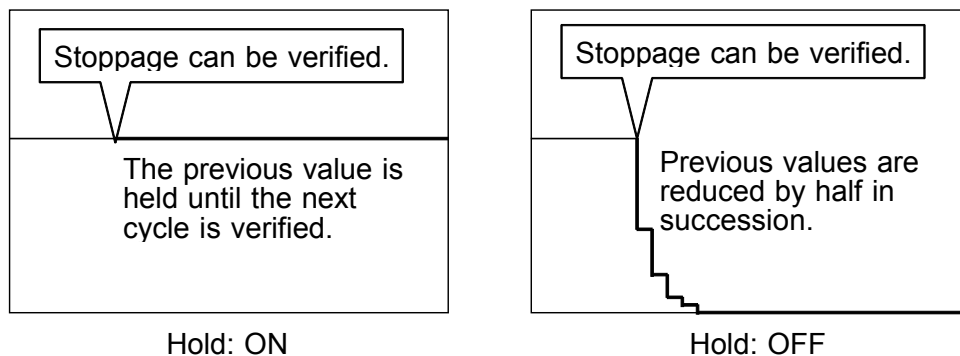
1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Slope** item to be set.
3. Use the function keys to make the selection.

## Hold ON/OFF Setting during measurement of stop action

Hold ON/OFF setting when measurement is stopped

Frequency and rotation speed measurement results are displayed after a single cycle is verified. When measuring the phenomena called rotation stoppage with hold set to ON, the 8855 waits endlessly for measurement period verification, so the stoppage cannot be detected. When hold is set to OFF and the period is not verified within the specified interval (2 times the previous measurement sampling period), the 8855 displays the previous signal at half its former value. This allows you to predict when measurement will stop as the measurement value gets closer to zero.

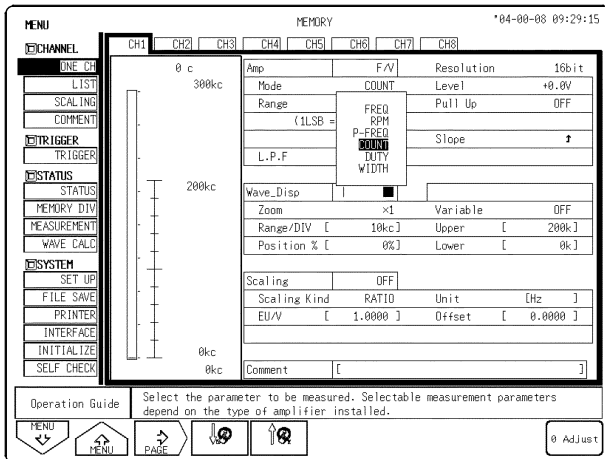
Rotation stoppage



## 5.12.2 Integration Measurement Settings

With integration, the number of input pulses is counted. Input pulses are displayed as "c" counts.

Object to be measured	Measurement range
Integration	2 kc to 1 Mc



### Procedure Screen: LIST, ONE CH (CHANNEL)

#### (1) Setting the measurement mode

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Use the function keys to select **COUNT**.

#### Function display

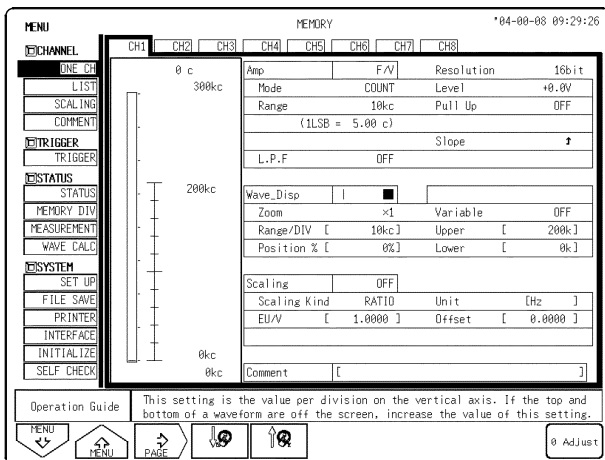
#### Meaning



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.



#### (2) Setting the measurement range

Set the value per division.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Range** item to be set.
3. Use the **JOG** control, the function keys or the **RANGE** knob to make the selection.

#### (3) Setting the threshold value

The waveform is measured for the interval that it crosses the threshold value.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Level** (threshold value) item to be set.
3. Use the function keys to make the selection.

#### (4) Setting the pull-up resistance

Pull-up resistance is used when the 8855 is connected to an open-collector output signal.

When ON is selected, the input terminal is pulled up by +5V. With most measurements, this option is set to OFF.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Pull Up** item to be set.
3. Use the function keys to make the selection.

(5) Setting the slope

Set the slope to use as a reference for measurement.

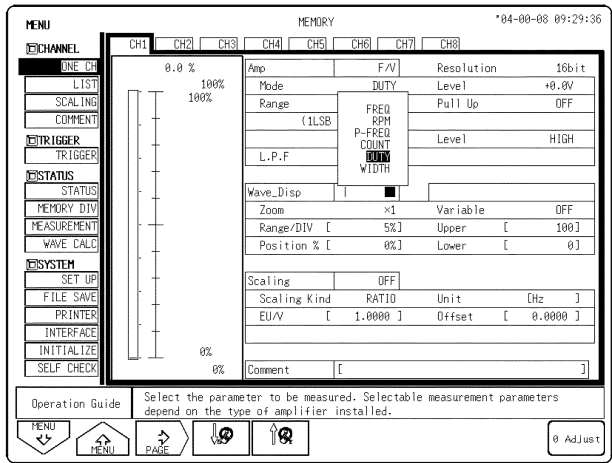
Measurement is made based on the point where the rising or falling slope of the input signal crosses the threshold.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Slope** item to be set.
3. Use the function keys to make the selection.

5.12.3 Pulse Duty Ratio Measurement Settings

The pulse duty ratio measurement is the ratio between the measured HI level and LO pulse levels.

Object to be measured	Measurement range
DUTY	5% (fixed)





**Procedure** Screen: LIST, ONE CH (CHANNEL)

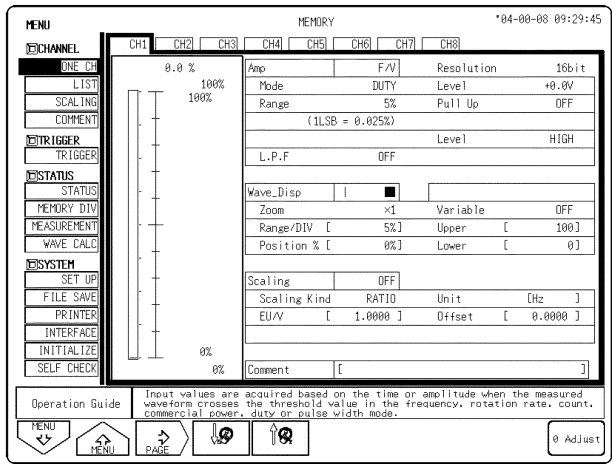
(1) Setting the measurement mode

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Use the function keys to select **DUTY**.

Function display      Meaning

 : Move the cursor up in the selection window.

 : Move the cursor down in the selection window.



(2) Setting the threshold value

The waveform is measured for the interval that it crosses the pulse duty ratio.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Level** (threshold value) item to be set.
3. Use the function keys to make the selection.

(3) Setting the pull-up resistance

Pull-up resistance is used when the 8855 is connected to an open-collector output signal. When ON is selected, the input terminal is pulled up by +5V. With most measurements, this option is set to OFF.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Pull Up** item to



be set.

3. Use the function keys to make the selection

#### (4) Setting the level

Select whether you want to measure duty ratio based on the HI level or the LO level.

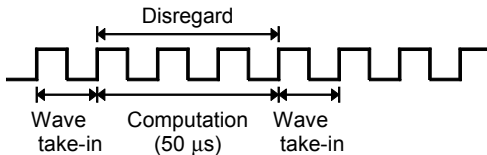
1. Use the Menu keys to display the desired screen.

2. Move the flashing cursor to the **Level** item to be set.

3. Use the function keys to make the selection.

### Precautions for measuring pulse duty ratio

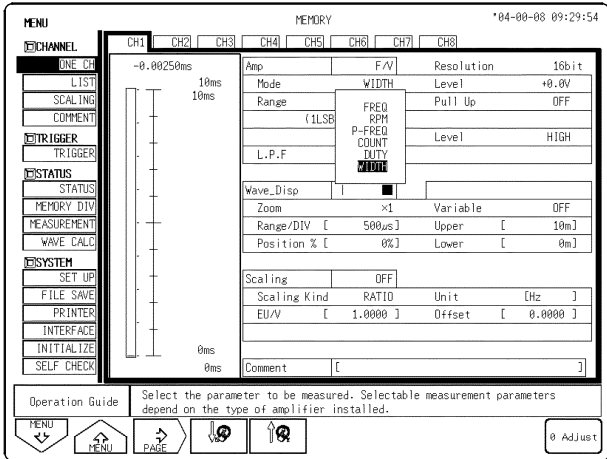
Upon measurement of pulses (20 kHz or more) that rise during dead time (computation), the duty ratio of dead time pulses is not measured. The duty ratio is determined from pulses that follow the dead time.



## 5.12.4 Pulse Width Measurement Settings

This option measures fluctuations in pulse width.

Object to be measured	Measurement range
Pulse width	500 $\mu$ s to 100 ms



#### Procedure Screen: LIST, ONE CH (CHANNEL)

##### (1) Setting the measurement mode

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Mode** item to be set.
3. Use the function keys to select **WIDTH**.

Function display

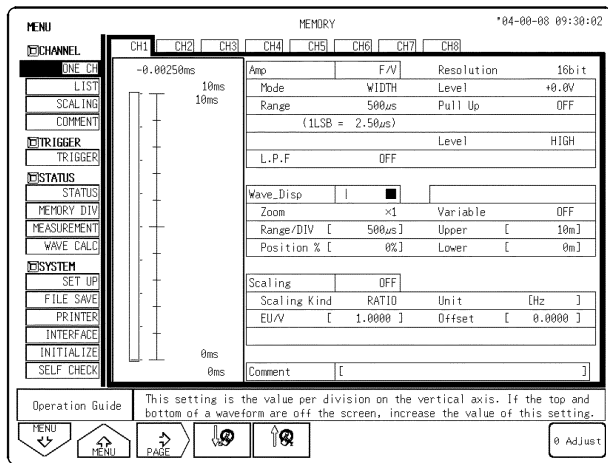
Meaning



: Move the cursor up in the selection window.



: Move the cursor down in the selection window.



## (2) Setting the measurement range

Set the value per division.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Range** item to be set.
3. Use the **JOG** control, the function keys or the **RANGE** knob to make the selection.

## (3) Setting the threshold value

The waveform is measured for the interval that it crosses the pulse duty ratio.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Level** (threshold value) item to be set.
3. Use the function keys to make the selection.

## (4) Setting the pull-up resistance

Pull-up resistance is used when the 8855 is connected to an open-collector output signal.

When ON is selected, the input terminal is pulled up by +5V. With most measurements, this option is set to OFF.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Pull Up** item to be set.
3. Use the function keys to make the selection.

## (5) Setting the level

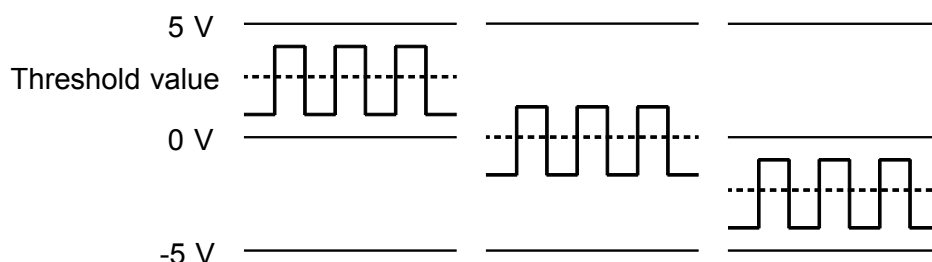
Select whether you want to measure duty ratio based on the HI level or the LO level.

1. Use the Menu keys to display the desired screen.
2. Move the flashing cursor to the **Level** item to be set.
3. Use the function keys to make the selection.

### NOTE

- Hold, pull-up ON/OFF, slope rise and drop, HI and LO level, and threshold settings cannot be determined from the display screen. Determine the settings for each channel or list according to its options. When printing a list, hold, pull-up ON/OFF, slope rise and drop, HI and LO level, and threshold settings are printed. For details, see section 10.5.
- Measurement results may differ depending on the Threshold Value Setting. To obtain correct measurement results, set the proper threshold value to match the input waveform.

Example



- When performing quantitative measurement, the previous data may be appended to the beginning of measured data.

# Chapter 6

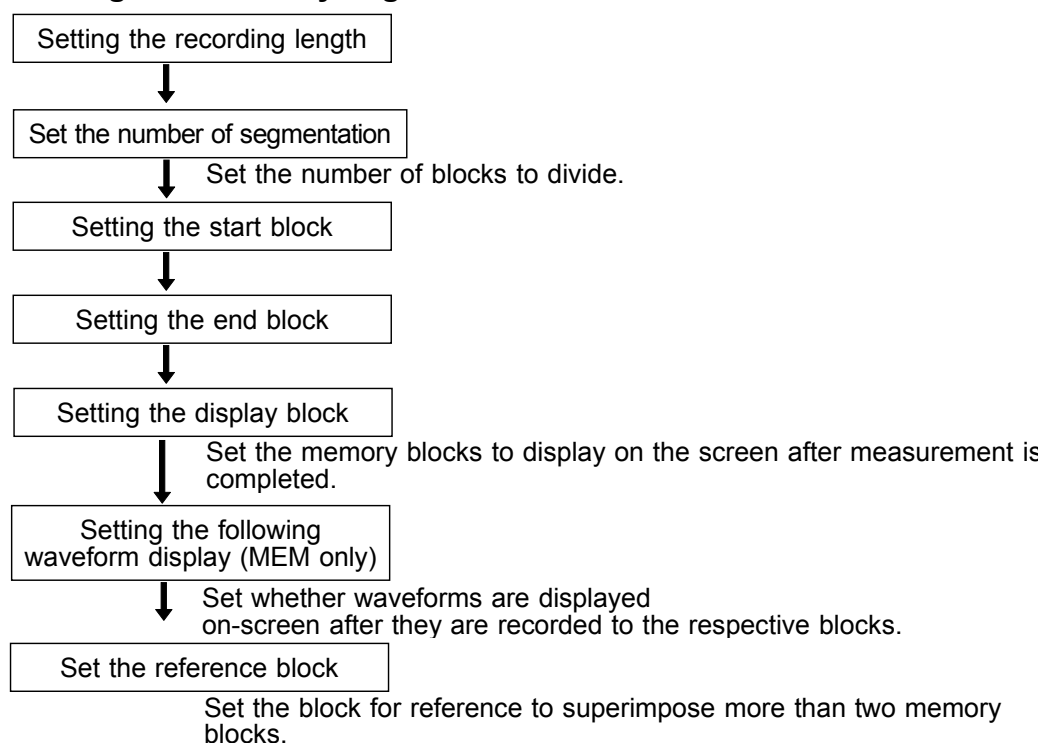
## Memory Segmentation Function

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

- The recording length (DIV) has priority over the number of memory blocks. (A maximum of 1024 segments, or a maximum of 512 segments when using the recorder & memory function.)
- Input signal capture is carried out continuously using the trigger, storing waveform data successively in each block.
- During recording, printout is not carried out.
- This reduces dead time (non-sensitivity periods due to display and printing delays).
- Waveform data can be stored in a selected block. (Selects the beginning and end blocks)
- Data from different blocks can be overlaid on screen for easy comparison. (it can be printed out)

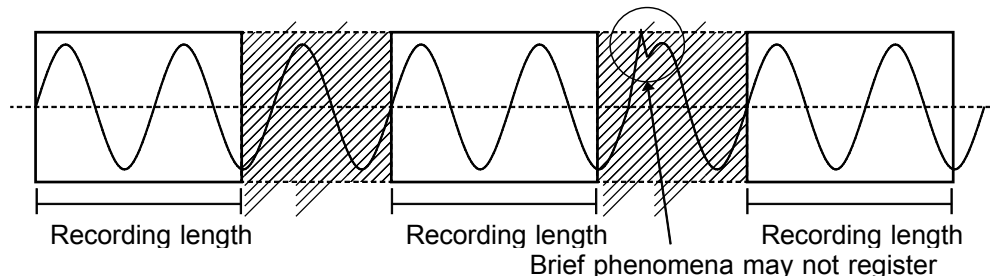
6

### Settings the Memory segmentation function

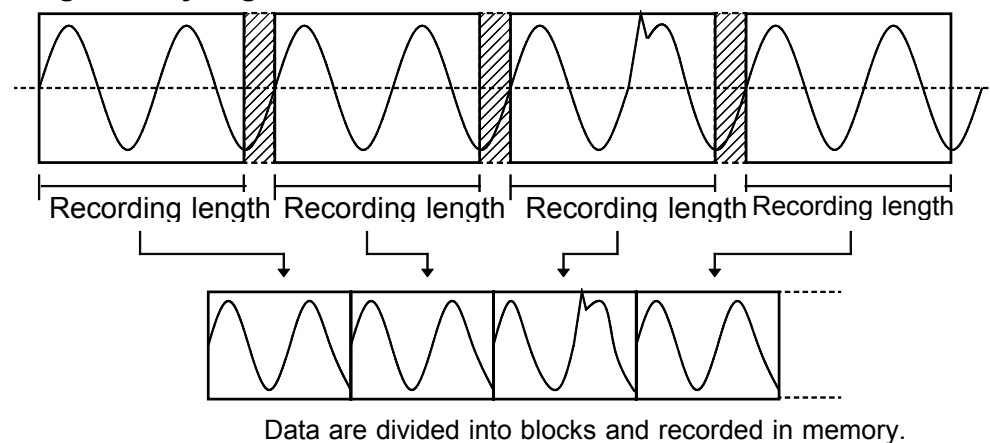


Input signal capture is carried out continuously using the trigger, storing waveform data successively in each block. Any block in which an input signal is recorded can be called up on the display. During measurement, displaying, printing, and saving cannot be carried out until the recording data in all block is completed.

### When continuous print (auto print) is being performed in REPEAT trigger mode



### Using Memory segmentation function



---Dead time: approx. 5 ms min.  
(interval in which no sampling occurs due to display and print processing)

#### NOTE

- In order to permit display and recording after the acquired data is recorded to one block, sampling is not performed during the following times (dead time).

#### Memory Function

View function ON, Trigger Priority ON: about 8 ms

View function ON, Trigger Priority OFF: about 10 ms

View function OFF, Trigger Priority ON: about 1 ms

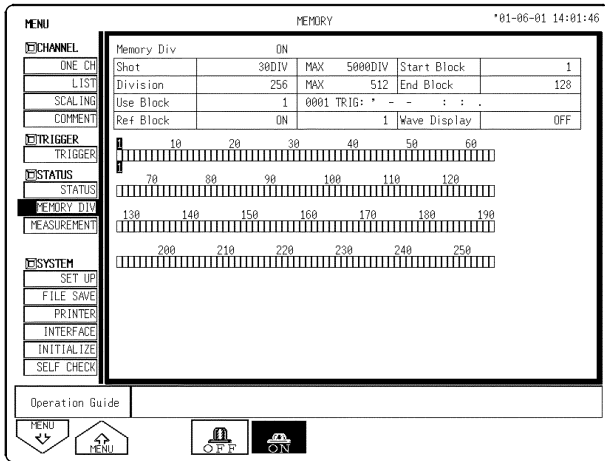
View function OFF, Trigger Priority OFF: about 3 ms

#### REC & MEM Function

Trigger Priority ON: about 0.8 ms

Trigger Priority OFF: about 2 ms

- For details on trigger priority function, see Quick Start Section 7.5.2.
- For details on view function, see Section 8.1.
- When using the memory segmentation function, you cannot use the averaging function.
- While the roll mode is being used in memory function, the memory segmentation function in the status is disabled.



## Procedure Screen: MEMORY DIV (STATUS)

### (1) Select the Memory Segmentation

1. Press the **STATUS** key to display the Memory segmentation (MEMORY DIV) screen.
2. Move the flashing cursor to the position shown in the figure.
3. Use the function keys, and select **ON**.

Function display      Meaning



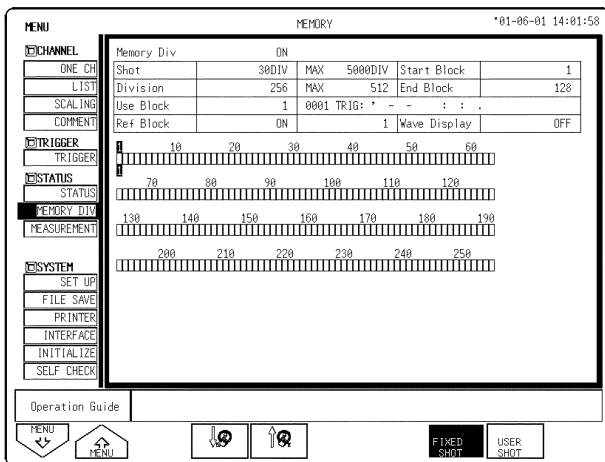
: Disable memory segmentation



: Enable memory segmentation

### (2) Set the Recording Length.

1. Move the flashing cursor to the **Shot** item.
2. Use the **JOG** control or the function keys to make the selection.



Function display      Meaning



: Increases the recording length



: Decreases the recording length



: Select from fixed recording lengths



: Freely set any recording length

When setting a recording length that the memory cannot split on other screens, the memory segmentation setting is automatically deactivated. (See tables below.)

### Maximum number of divisions

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. Refer to Quick Start 4.3.10.

A maximum of 512 segments when using the recorder & memory function.

32 M words

Recording length (DIV)	Number of channels		
	8	4	2
0 to 40	1024	1024	1024
41 to 80	512	1024	1024
81 to 163	256	512	1024
164 to 327	128	256	512
328 to 655	64	128	256
656 to 1310	32	64	128
1311 to 2621	16	32	64
2622 to 5242	8	16	32
5243 to 10485	4	8	16
10486 to 20971	-	4	8
20872 to 40000	-	-	4

(Fixed recording length)

128 M words

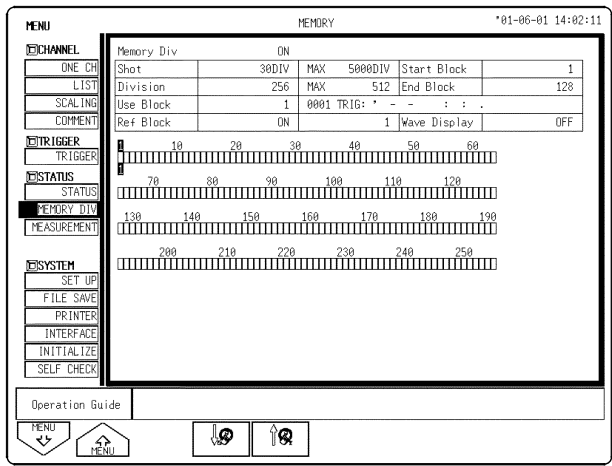
Recording length (DIV)	Number of channel		
	8	4	2
0 to 63	1024	1024	1024
64 to 327	512	1024	1024
328 to 655	256	512	1024
656 to 1310	128	256	512
1311 to 2621	64	128	256
2622 to 5242	32	64	128
5243 to 10485	16	32	64
10486 to 20971	8	16	32
20972 to 41943	4	8	16
41944 to 83886	-	4	8
83887 to 167772	-	-	4

(Fixed recording length)

512 M words

Recording length (DIV)	Number of channel		
	8	4	2
0 to 655	1024	1024	1024
656 to 1310	512	1024	1024
1311 to 2621	256	512	1024
2622 to 5242	128	256	512
5243 to 10485	64	128	256
10486 to 20971	32	64	128
20972 to 41943	16	32	64
41944 to 83886	8	16	32
83887 to 167772	4	8	16
167773 to 335544	-	4	8
335545 to 671088	-	-	4

(Fixed recording length)



(3) Set the number of segmentation.

1. Move the flashing cursor to the **Division** item.
2. Use the function keys or **JOG** to set the number of splits. See item (2) of this section for details about the number of splits that can be set.

Function display

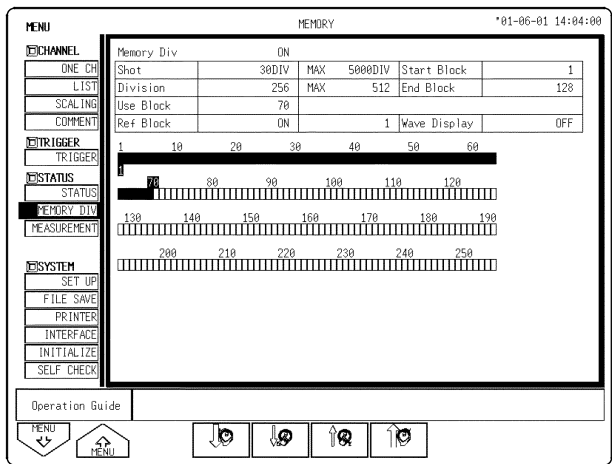
Meaning



: Increases the number splits



: Decreases the number splits



(4) Start/end block setting

Set the beginning and end blocks when you use blocks from a memory that is split sequentially. It only uses the block when the beginning and ending blocks are set in the same block.

1. Move the flashing cursor to the **Start Block** or **End Block** item.
2. Use the **JOG/SHUTTLE** control or the function keys to make the selection.

Function display

Meaning



: Increases in number (+10)



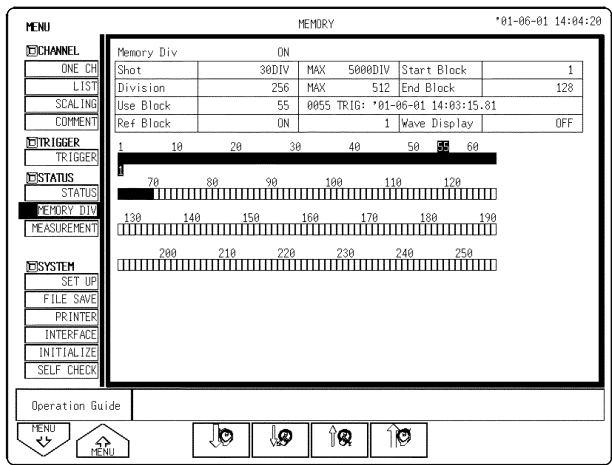
: Increases in number (+1)



: Decreases in number (-1)



: Decreases in number (-10)



(5) Display block setting

Set the block to be displayed.

1. Move the flashing cursor to the **Use Block** item, as shown in the figure on the left.
2. Use the **JOG** control or the function keys to make the selection.

Function display

Meaning



: Increases in number (+10)



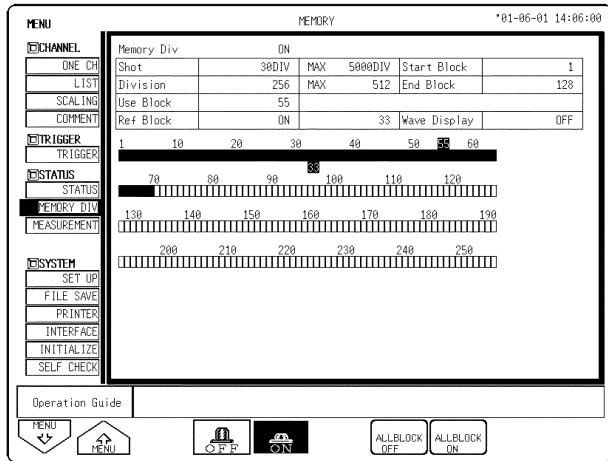
: Increases in number (+1)



: Decreases in number (-1)



: Decreases in number (-10)

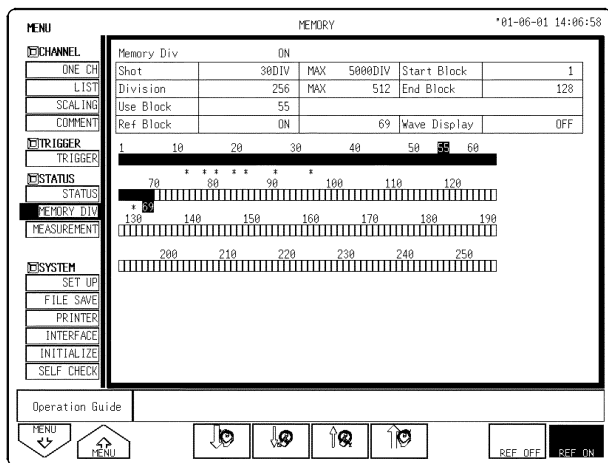


## (6) Setting ref blocks

Waveform data recorded in multiple blocks can be displayed in a composite display.

1. Move the flashing cursor to the **Ref Block** item.
2. Use the function keys to make the selection.

Function display	Meaning
	: Disable ref block
	: Enable ref block
	: Turns off reference for all blocks.
	: Turns on reference for all blocks.

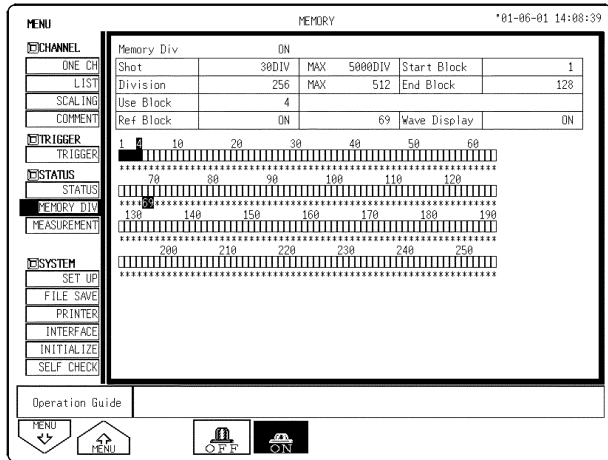


3. Move the flashing cursor to the numerical value item (ref block). Ref block settings can be made one block at a time. Blocks set as ref blocks are marked with an asterisks.

Function display	Meaning
	: Increases in number (+10)
	: Increases in number (+1)
	: Decreases in number (-1)
	: Decreases in number (-10)
	: Does not refer to the selected block
	: Refers to the selected block

### NOTE

- The reference block is not displayed during REC&MEM measurement; it is displayed when measurement is completed.



## (7) Setting the following waveform display

This displays waveforms taken by sequential trigger in each block when you use blocks from a memory that is split sequentially. (For that reason the lag increases.)

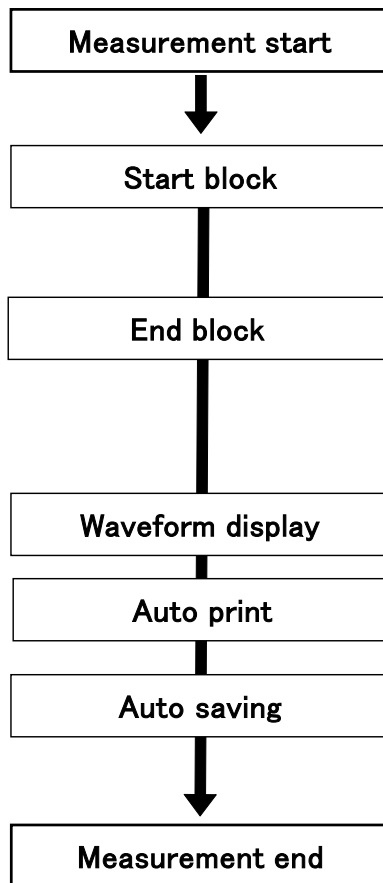
1. Move the flashing cursor to the **Wave Display** item.
2. Use the function keys to make the selection.

Function display	Meaning
	: After all blocks are recorded, the waveform of the last block only is displayed.
	: Each block is recorded and displayed.

### 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 Waveform display screen. (See Section 8.1.)

## Relation between trigger mode and sequential save function



Press the **START** key and LED light.

Data recording starts when trigger condition are met.

Start block is stored by trigger setting.

The following waveform display ON:  
waveform is displayed.

The following waveform display OFF:  
waveform is not displayed.

End block is stored by trigger setting.

The following waveform display ON:  
waveform is displayed.

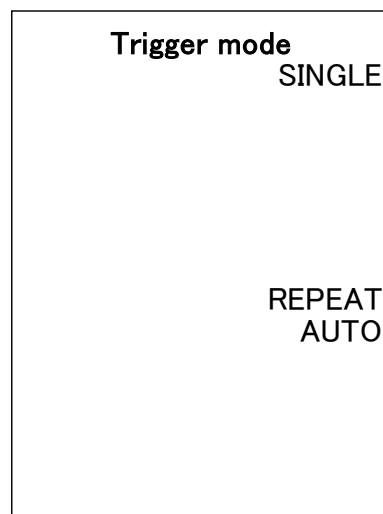
The following waveform display OFF:  
waveform is not displayed.

Displays end block waveform.

When auto printing is enabled, all blocks are printed from the start block while individual blocks are displayed.

When auto saving is enabled, waveforms in all blocks are saved in a batch.

REPEAT or AUTO trigger mode returns you to the start block, and recording starts.



End of measurement

When the **STOP** key is pressed twice during measurement, the 8855 is forcibly stopped. (Auto printout is not executed.)

When auto save is enabled and the 8855 is forcibly stopped during measurement, the measurement data up to the point where the 8855 was forcibly stopped is saved automatically.

End of measurement

If the **STOP** key is pressed during recording, recording continues until the end of the current block.

(Waveform display, auto printout and auto save are executed.)

When the **STOP** key is pressed twice during measurement, the 8855 is forcibly stopped.

When auto save is enabled, waveforms are saved after recording the end of the current block, and then recording starts from the start block.

When auto save is enabled and the 8855 is forcibly stopped during measurement, the measurement data up to the point where the 8855 was forcibly stopped is saved automatically. (Auto printout is not executed.)

NOTE

When the following waveform display (memory function) is on and the view function is on, the dead time becomes very large.



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# Chapter 7

## Calculation Function

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### 7.1 Numerical Calculation (MEM)

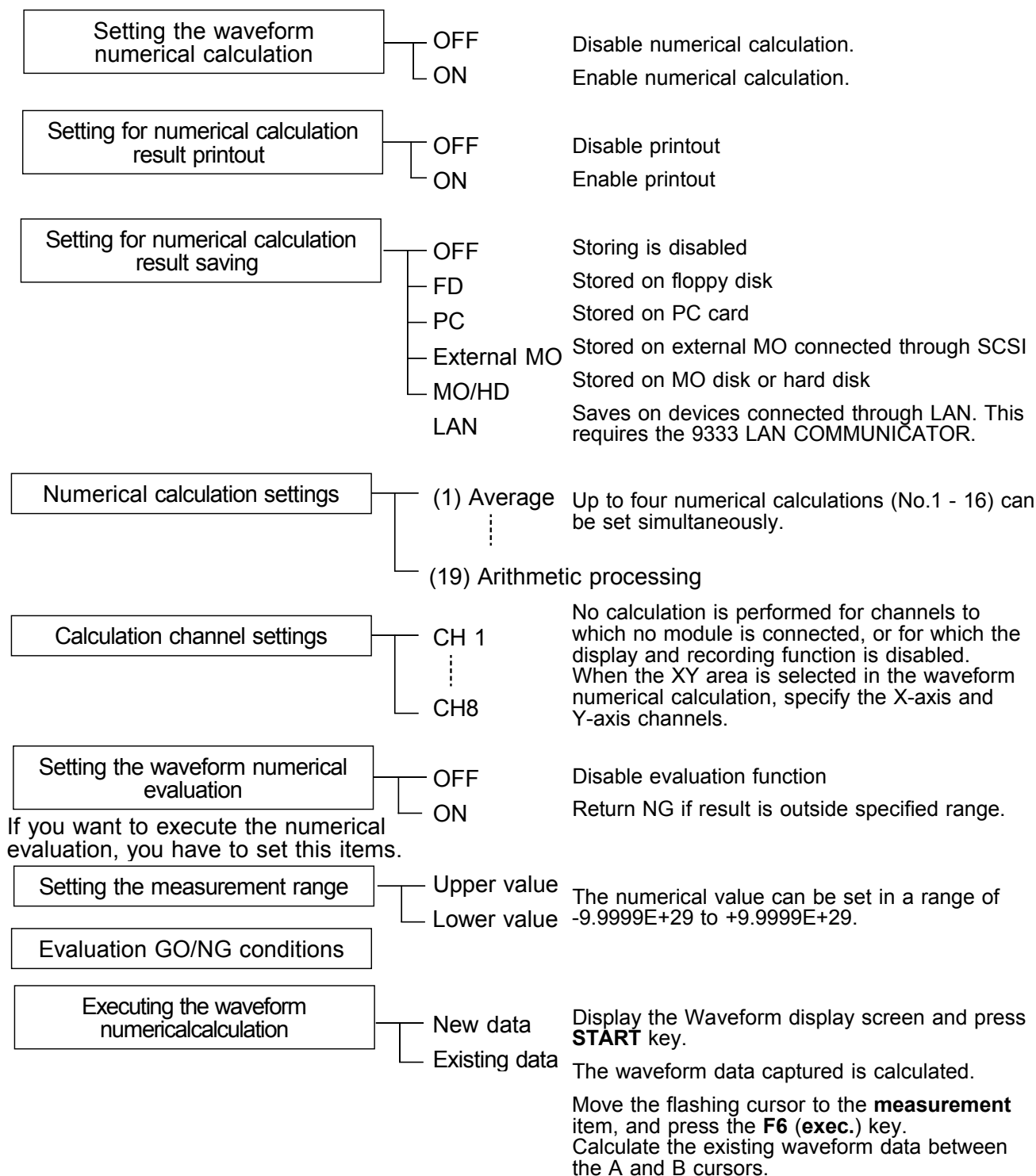
This performs calculation only on those waveforms in the memory. Once it performs calculation, it displays numerical results.

When using A-B cursor, it performs waveform calculation only for the data between the cursors. (When the calculation range is specified.)

The following 19 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) XY area value,
- (15) Specified level time, (16) Pulse width, (17) Duty ratio, (18) Pulse count,
- (19) Arithmetic processing

## Numerical calculation Operating Sequence

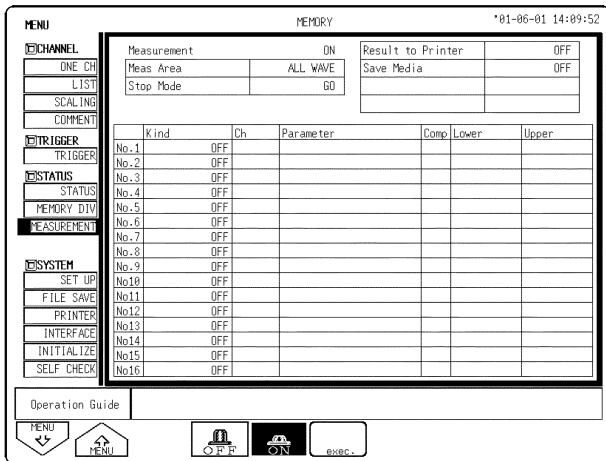


## 7.1.1 Making Settings for Numerical Calculation

Numerical calculations results can be printed on the internal printer.

Numerical calculations results can be saved in text format to the current directory selected in the File screen.

For the file name to be saved, see Quick Start Section 10.7, "Saving the Data."



### Procedure Screen: STATUS

(1) Set the numerical calculation.

1. Press the **STATUS** key to display the numerical calculation screen.
2. Move the flashing cursor to **Measurement**.
3. Use the function keys to make the selection.

Function display

Meaning



: Disable numerical calculation

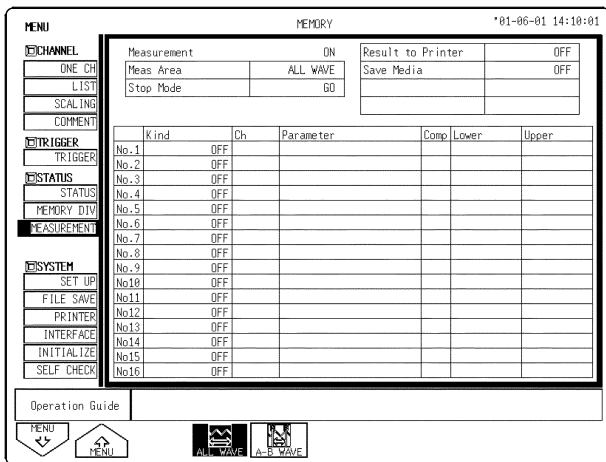


: Enable numerical calculation. The various setting items are displayed.



: Execute numerical Calculation.

7



(2) Setting the Meas Area

Allows you to specify the numerical calculation range.

1. Move the flashing cursor to **Meas Area**.
2. Use the function key to specify the calculation range.

Function display

Meaning



: Performs numerical calculation on all waveforms



: Performs numerical calculation only on the waveform between cursors A and B

(3) Setting Waveform Numerical Calculation Results to be Printed or Saved

1. Move the flashing cursor to **Result to Printer**.
2. Make selections from the function key display.

Function display

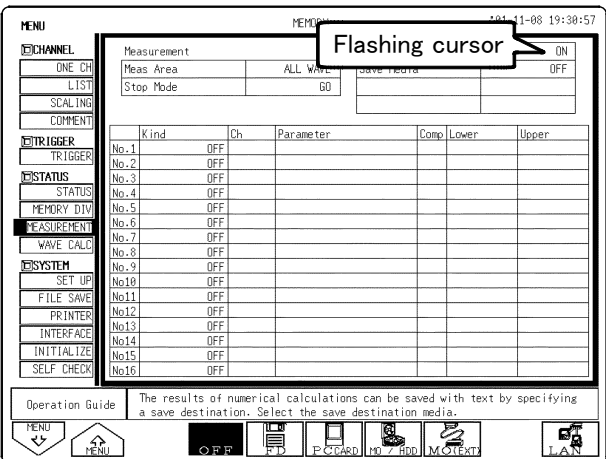
Meaning



: Does not print the calculation results









: Prints the calculation results





3. Move the flashing cursor to **Save Media**.

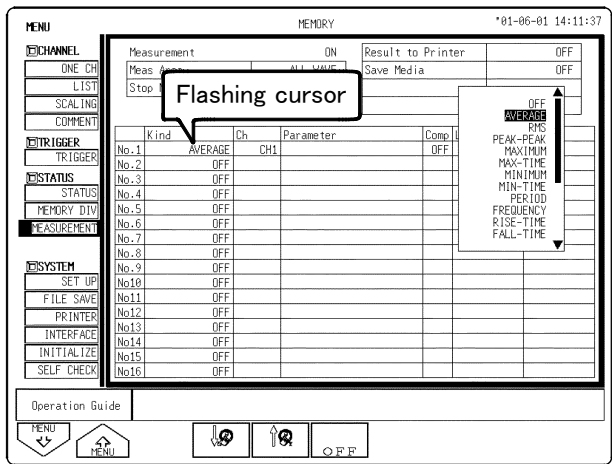
4. Make a selection from the function key display.

Function display	Meaning
	: Does not save calculation results
	: Saves the calculation results on a floppy disk
	: Saves the calculation results on a PC card
	: Saves the calculation results on the built-in MO disk or hard disk
	: Saves the calculation results on a external MO disk connected through a SCSI
	: Saves the calculation results on a device connected through a LAN

5. Move the flashing cursor to the item you want to save to file. Allows you to choose between saving each calculation result to a new file, or adding data to an existing file.

Function display	Meaning
	: Add and save data to an existing file.
	: Create a new file and save data.

6. Move the flashing cursor to the save name item. Enter the file name you want to save the calculation results under. For details on how to enter file names, see section 5.4.3.



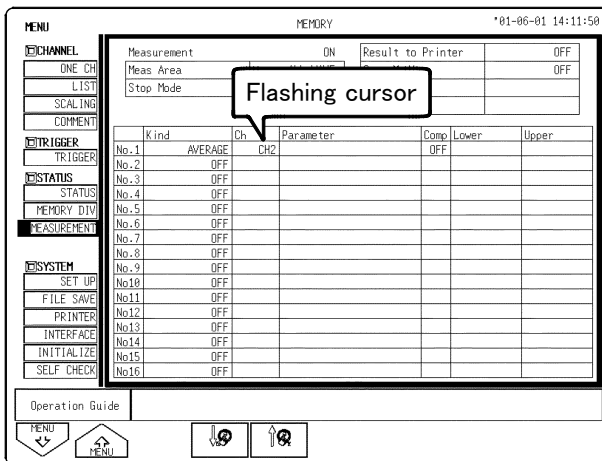
(4) Select numerical calculation

1. Move the flashing cursor to the position shown in the figure on the left.
2. Use the function keys or **JOG** in the selection window to make settings. You can set up to a maximum of 16 numerical calculation operations simultaneously, from No. 1 to No. 16.

## Numerical calculation operations

Average value	The average value in the waveform data
RMS value	The RMS value of the waveform data
Peak	The peak-to-peak value of the waveform data
Maximum value	The maximum value in the waveform data
Time to maximum value	The time from the trigger to the maximum value
Minimum value	The minimum value in the waveform data
Time to minimum value	The time from the trigger to the minimum value
Period	The cycle of the waveform signal
Frequency	The frequency of the waveform signal
Rise time	The rise time of the waveform data
Fall time	The fall time of the waveform data
Standard deviation	The standard deviation of the waveform data
Area value	The area enclosed by the zero position and the waveform signal
X-Y area value	The composite X-Y area
Specified level time	The time from the trigger to the specified level
Pulse width	The pulse width of the waveform data
Duty ratio	The duty ratio of the waveform signal
Pulse count	The pulse count of the waveform data
Four arithmetic operations	The four basic arithmetic operations of the numerical calculation results

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### (5) Set the calculation 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 make the selection.

Function  
display

Meaning



: Increase channel number.



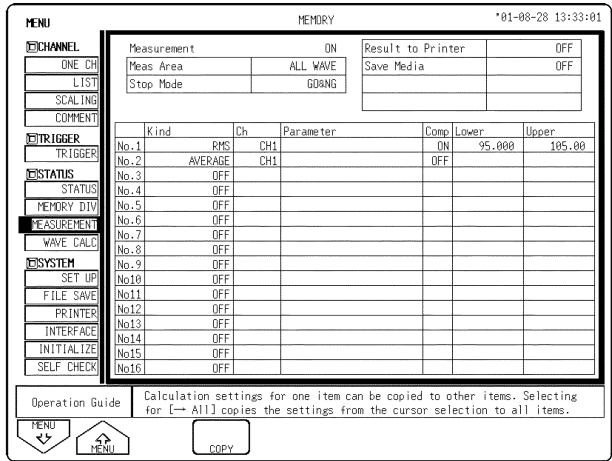
: Decrease channel number.

#### NOTE

- The channels where no modules 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 XY area value is selected in numerical 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 XY area value can be selected.

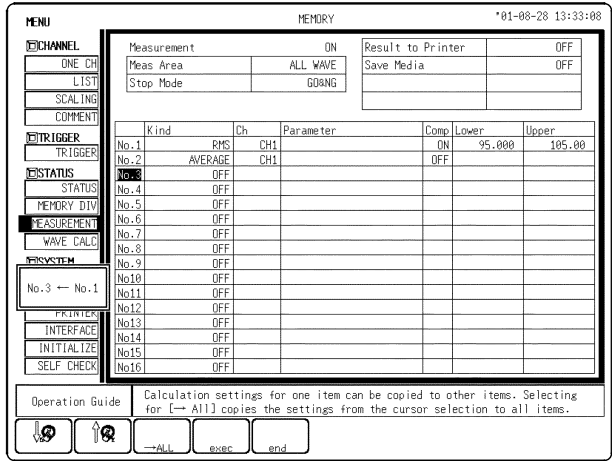
# 7.1.2 Copying Calculations Settings

Numerical calculation settings can be copied from one channel to another.



## Procedure Screen: MEASUREMENT (STATUS)

1. Press the **STATUS** key to display the numerical calculation screen.
2. Move the flashing cursor to the number of the calculation to be used as copy source.
3. Press the **F4 (copy)** key. The copy source and copy destination are displayed in the small window that appears.



4. Using the function keys or **JOG** control, select the copy source channel.

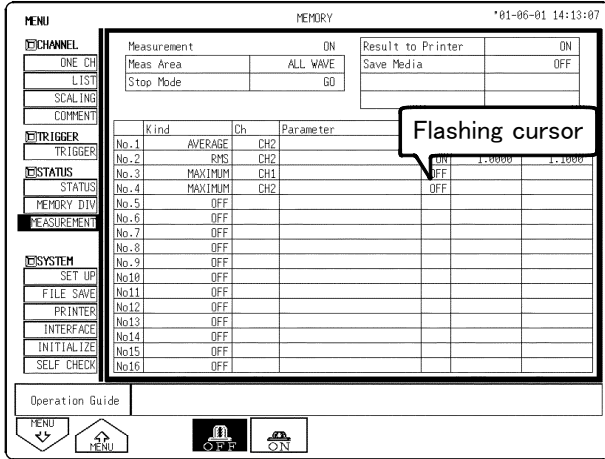
Function display	Meaning
	: Increase channel number
	: Decrease channel number
	: Selects all channels.
	: Copies.
	: Closes the Copy screen.

Select ALL to copy the settings for the channel selected with the blinking cursor to all other channels.

5. To copy the file, press the **F4 (exec.)** key.

### 7.1.3 Making Settings for Numerical Evaluation

- Depending on the results of the numerical 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. 16.



#### Procedure Screen: MEASUREMENT (STATUS)

1. Set each numerical calculation operation.
2. Move the flashing cursor to **COMP**, and use the function key to select.

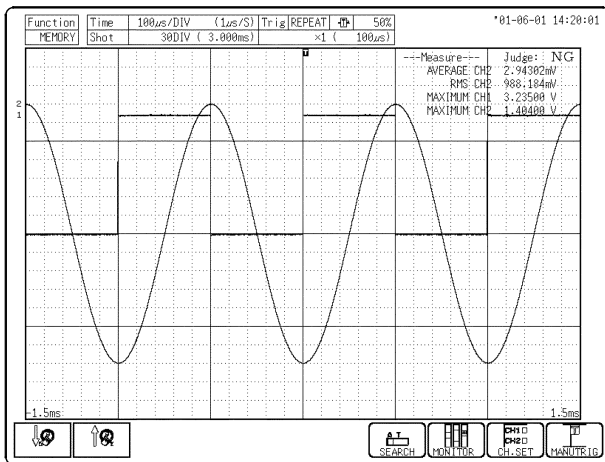
Function display      Meaning



: Disable evaluation function.



: Return NG if result is outside specified range.



3. Make settings in the numerical value input screen. (See 5.4 for details about the input method.)  
The range is  $-9.9999\text{E}+29$  to  $+9.9999\text{E}+29$ .  
It is not possible to set the upper limit under the lower limit, or the lower limit over the upper limit.

4. Set the evaluation interruption conditions.  
Move the flashing cursor to Evaluation Interruption Conditions and select using the function keys.

Function display      Meaning



: Stops at GO



: Stops at NG



: Stops regardless of the evaluation result

**Evaluation result**

Interpret the numerical calculation evaluation results by the color of the numerical values. NG numerical values are red. Also, if a beeping sound has been set, you hear the sound whenever a NG occurs.

When a NG occurs, the numerical values of the channel that experience the error are displayed red on the screen. NG channels are represented by an "x" on the printout.

The overall evaluation result is NG even if there is only one NG channel.

**NOTE**

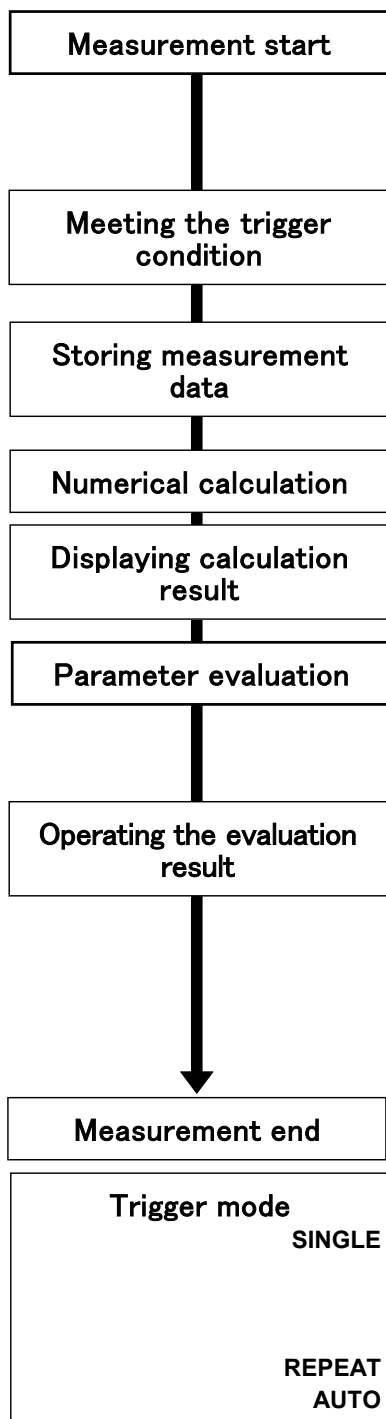
- While all evaluation results appear on the Waveform display screen, the evaluation results are printed out for each parameters in the print mode.
- When the evaluation result is NG, an NG output signal can be obtained between the NG terminal and the GND terminal. For details, please refer to the Quick Start Section 11.1.6.
- The numerical calculation is set to ON, the settings by using the **F9** (CH.SET) key are automatically set to OFF.



## 7.1.4 Executing Numerical Calculation

- Calculation is carried out in the order No.1 through No.16.
- Also for channels where no input module is installed, numerical calculation is carried out if data loaded from media are stored in the channel.
- The scaling setting has effect. (RMS value and area value are calculated after scaling.)

### Numerical calculation while capturing the waveform



- 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, instrument waits for about 1 second for trigger conditions to be met. After this interval, data recording starts, regardless of trigger state.
- Displays "Storing". Waveform displays after data corresponding to recording length have been stored in memory.
- When the **STOP** key is pressed twice during measurement, the 8855 is forcibly stopped. (numerical calculation are not executed.)

Displays "Calculating".

Displays numerical calculation result on the screen.

Depending on the results of the numerical calculation, a GO (pass) or NG (fail) result is returned.

When the evaluation result is GO:

- Outputs GO signal.
- Continue measurements, until NG result appeared.

When the evaluation result is NG:

- Outputs NG signal.
- When a NG occurs, the numerical values of the channel that experiences the error are displayed red on the screen. NG channels are represented by an "x" on the printout.

Result to printer ON → Prints the evaluation results.

Result save ON → Saves the evaluation results.

Auto print ON → Prints the measurement data.

Auto save ON → Saves the measurement data.

End of measurement.

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

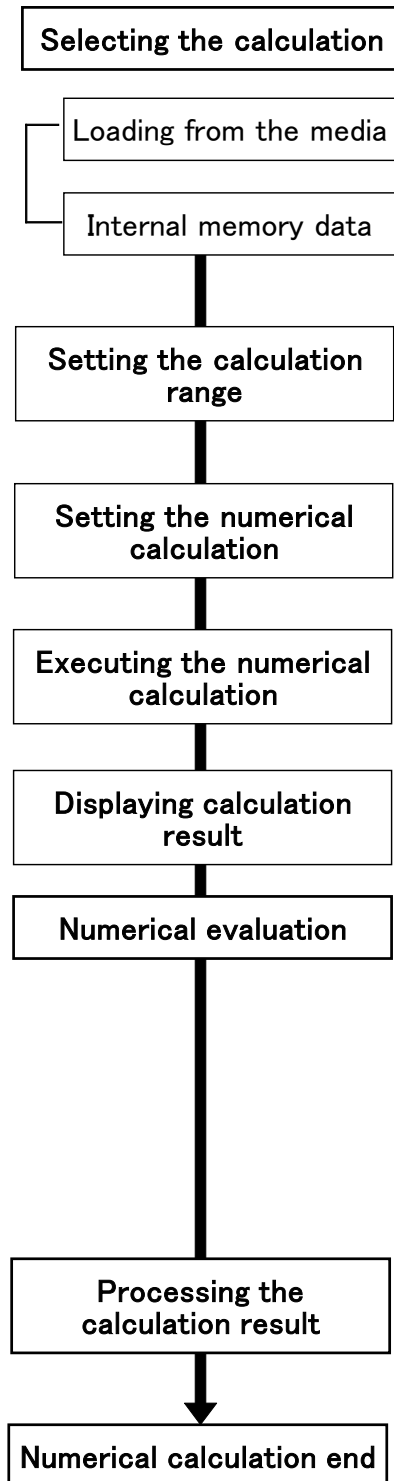
End of measurement in REPEAT and AUTO trigger modes

When the **STOP** key is pressed once during measurement, the 8855 acquires measurement data in an amount corresponding to the set recording length, and the measurement is stopped. (Waveform display, numerical calculation are executed.)

#### NOTE

When numerical evaluation and waveform evaluation are carried out simultaneously, the waveform evaluation stop mode is given priority.

## Calculation of data stored in memory



Press the **FILE** key to display the File screen.

Read the measurement data. See Quick Start Section 10.8.

The measurement data stored in memory of the instrument is calculated.

The calculation range can be specified by the A and B cursors. If the range is not specified, all measurement data is calculated. For the A and B cursors, see Quick Start Section 8.2, "Using the A/B Cursors."

Press the **STATUS** key to display the Numerical calculation screen. Set the items. For details, see Section 7.1.1, "Making Settings for Numerical Calculation."

Move the flashing cursor to **measurement** and **F6 (exec.)** key. "measurement" is displayed.

The calculation result is displayed on the Waveform display screen.

Depending on the results of the numerical calculation, a GO (pass) or NG (fail) result is returned.

When the evaluation result is GO:

- Outputs GO signal.

When the evaluation result is NG:

- Outputs NG signal.
- When a NG occurs, the numerical values of the channel that experiences the error are displayed red on the screen. NG channels are represented by an "x" on the printout.

Result to printer : ON → Prints the evaluation results.

Result save : ON → Saves the evaluation results.

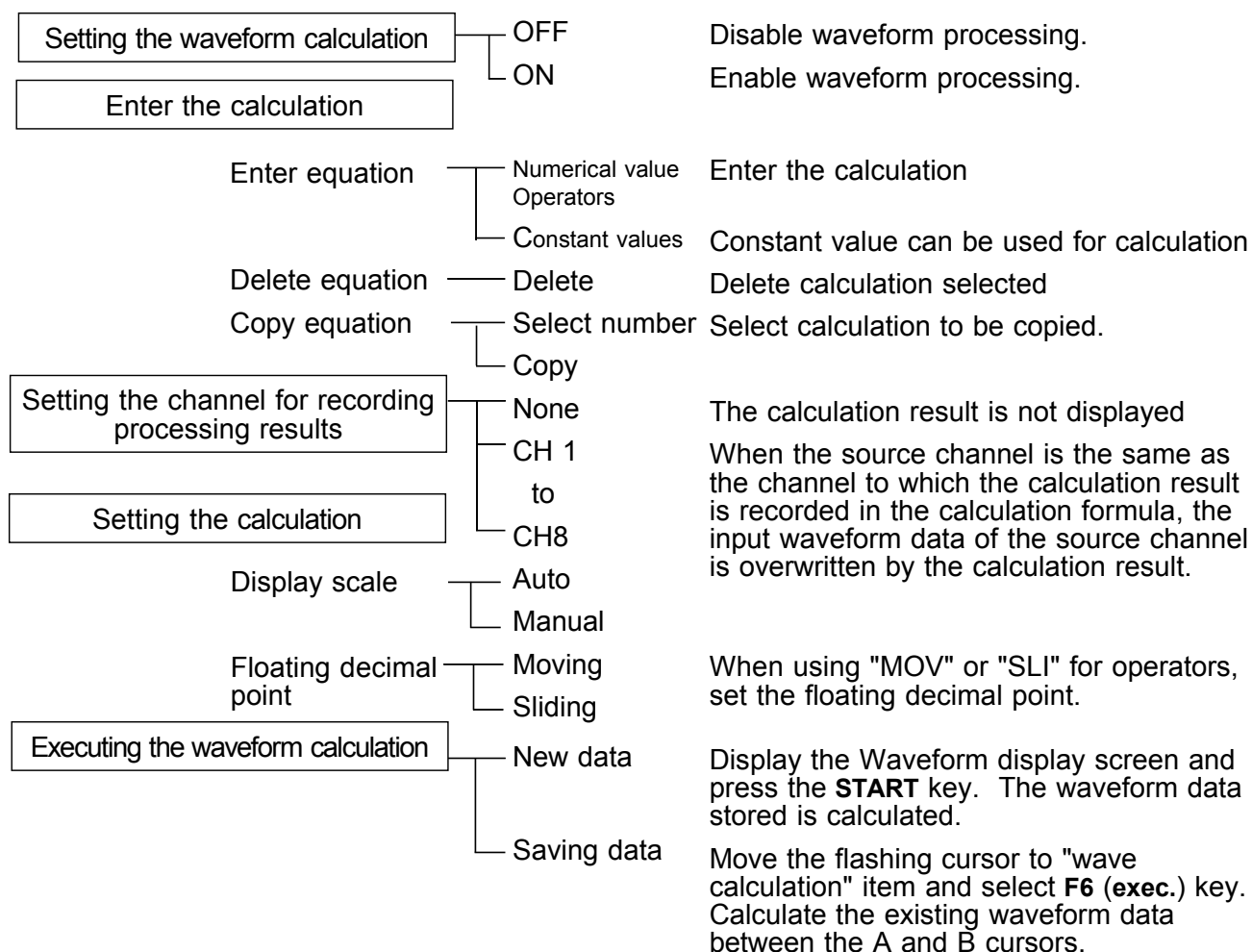
### NOTE

- 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.

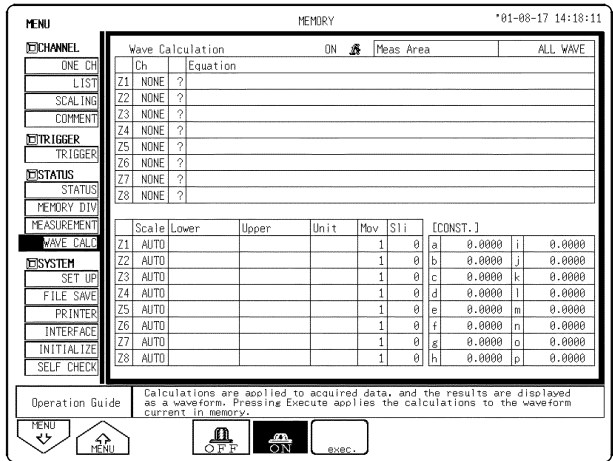
## 7.2 Waveform Calculation (MEM)

- Waveform processing is possible only for the memory function.
- Processing result are displayed as a waveform.
- The maximum recording length allowing waveform processing calculation is 5000 divisions (20,000 divisions for 128 M words, 80,000 divisions for 512 M).
- Use the A/B cursors to specify the processing range for the waveform data within the maximum recording length .
- 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



## 7.2.1 Preparing for Waveform Processing



### Procedure Screen: WAVE CALC (STATUS)

(1) Set the waveform calculation.

1. Press the **STATUS** key to display the waveform calculation screen.
2. Move the flashing cursor to **Wave CALC**.
3. Use the function keys to make the selection.

Function display

Meaning



: Disable waveform processing.



: Enable waveform processing.  
The various setting items are displayed.

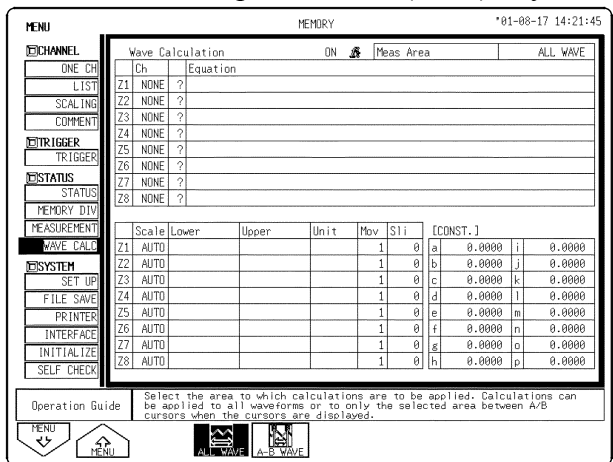


: Execute Waveform Processing

#### NOTE

- The maximum recording length at which waveform processing calculation is possible is 5000 divisions (20,000 divisions for 128 M words, 80,000 divisions for 512 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.
- When the memory split setting is turned off, you can browse the last 16 waveforms, but when calculations are applied to the waveform, all waveforms except the block you are currently browsing will be lost. (All waveforms except the block that calculations are applied to will be lost.)
- The averaged waveform becomes available for waveform processing when the averaging setting is turned OFF following 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. (See Section 5.3.)
- When the waveform processing calculation executes simultaneously with data acquisition, a forced termination displays the results being calculated.

In such cases, press the **F6 (exec.)** key to reexecute the calculation.



### (2) Setting the Meas Area

Allows you to specify the waveform calculation range.

1. Move the flashing cursor to **Meas Area**.
2. Use the function key to specify the calculation range.

Function display

Meaning



: Performs numerical calculation on all waveforms



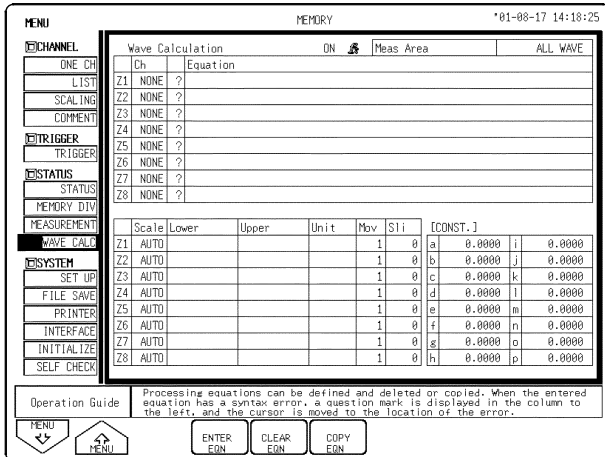
: Performs numerical calculation only on the waveform between cursors A and B

**NOTE**

- If the cursors are overlaid so that they form a single cursor, that point only is calculated.
- You cannot use horizontal line cursors to specify an area for calculation.
- If cursor A only is used, calculations are applied to the area from cursor A to the end of the measurement data.

## 7.2.2 Defining the Processing Equation

Sixteen processing equations (Z1 - Z8) can be defined.



### Procedure Screen: WAVE CALC (STATUS)

#### (1) Making the processing equation

1. Press the **STATUS** key to display the waveform calculation screen.
2. Move the flashing cursor to **Equation**.

Function display

Meaning

ENTER EQN

: Enter equation

CLEAR EQN

: Delete equation

COPY EQN

: Copy equation

3. Move the cursor to the desired item with the **JOG/SHUTTLE** control or the cursor key. Use the function key to move the cursor.

Function display

Meaning

set

: Enter the item into selected equation.

>>

: Move the equation cursor right.

<<

: Move the equation cursor left.

BACK SPACE

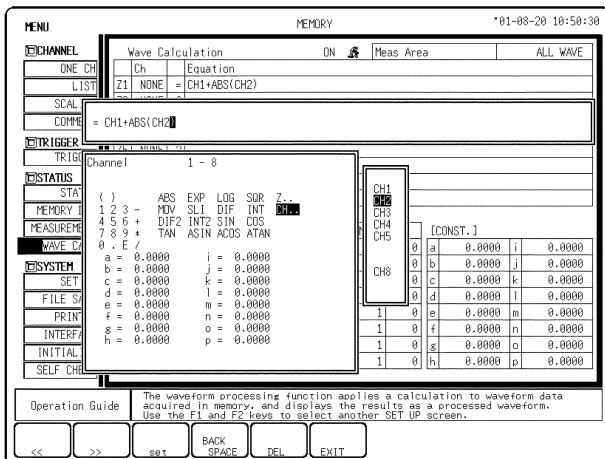
: Back space

DEL

: Delete character under cursor in equation.

end

: Terminate equation input.



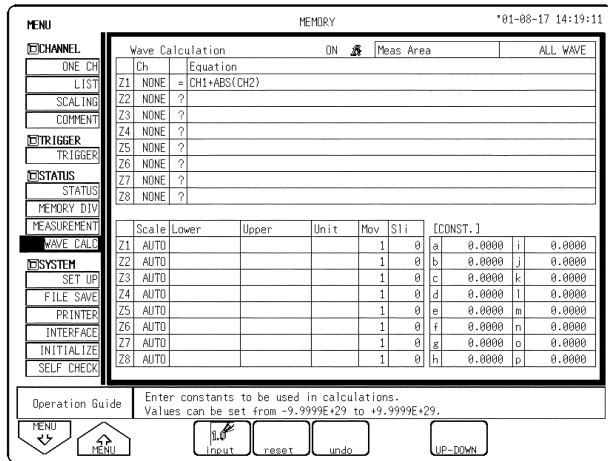
4. When the equations have been input, select **EXIT** function key. If there are any syntax errors in the equations (incomplete bracketing, missing "\*", more than four MOV, SLI, DIF, DIF2, INT, INT2 operators, etc.), a "?" is displayed, and the cursor rests on the error, so that the problem can be corrected. When there are no syntax errors, a "=" is displayed.
5. Make settings for Z2 to Z8 as for Z1.

## Operators (For details, see Appendix.3.8.)

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 four can be used in the same equation (for example four MOV operators or two MOV and two 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 Z8.
- 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, Z5 cannot be used on Z4).
- 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.



### (2) Entering the constant values

1. Move the flashing cursor to **CONST.**
2. Use the function keys to select **input**.  
The setting range is -9.9999E+29 to +9.9999E+29 (exponent: -29 to +29).

Function  
display

Meaning



: Accesses the numerical input screen.



: Initializes the system.



: Returns to the numerical values set one step previously.



: Allows you to enter values directly using the cursor keys.

3. Use the cursor keys or **SHUTTLE** key to move the cursor. Enter the constant value with the function key, the **JOG** control or the numerical input key.

MENU MEMORY \*01-08-20 10:56:25

Wave Calculation ON Meas Area ALL WAVE

Ch	Equation
Z1	NONE
Z2	NONE
Z3	NONE
Z4	NONE
Z5	NONE
Z6	NONE
Z7	NONE
Z8	NONE

Scale Lower Upper Unit Mov Sli [CONST.]

	Scale	Lower	Upper	Unit	Mov	Sli	[CONST.]
Z1	AUTO				1	0	a 2.5000 i 0.0000
Z2	AUTO				1	0	b 0.0000 j 0.0000
Z3	AUTO				1	0	c 0.0000 k 0.0000
Z4	AUTO				1	0	d 0.0000 l 0.0000
Z5	AUTO				1	0	e 0.0000 m 0.0000
Z6	AUTO				1	0	f 0.0000 n 0.0000
Z7	AUTO				1	0	g 0.0000 o 0.0000
Z8	AUTO				1	0	h 0.0000 p 0.0000

Operation Guide Processing equations can be defined and deleted or copied. When the entered equation has a syntax error, a question mark is displayed in the column to the left, and the cursor is moved to the location of the error.

YES NO

### (3) Deleting an Equation

1. Move the flashing cursor to one of the Z1 - Z8 items.
2. Select **YES**.
3. Make the setting with the function keys.

Function display

Meaning

YES

: Clear equation

NO

: Do not clear equation

## 7.2.3 Copying an Equation

An equation to which an equation number has been assigned (copy source) can be copied to another equation number (copy target).

MENU MEMORY \*01-08-20 10:57:50

Wave Calculation ON Meas Area ALL WAVE

Ch	Equation
Z1	NONE
Z2	NONE
Z3	NONE
Z4	NONE
Z5	NONE
Z6	NONE
Z7	NONE
Z8	NONE

Scale Lower Upper Unit Mov Sli [CONST.]

	Scale	Lower	Upper	Unit	Mov	Sli	[CONST.]
Z1	AUTO				1	0	a 2.5000 i 0.0000
Z2	AUTO				1	0	b 0.0000 j 0.0000
Z3	AUTO				1	0	c 0.0000 k 0.0000
Z4	AUTO				1	0	d 0.0000 l 0.0000
Z5	AUTO				1	0	e 0.0000 m 0.0000
Z6	AUTO				1	0	f 0.0000 n 0.0000
Z7	AUTO				1	0	g 0.0000 o 0.0000
Z8	AUTO				1	0	h 0.0000 p 0.0000

Operation Guide Processing equations can be defined and deleted or copied. When the entered equation has a syntax error, a question mark is displayed in the column to the left, and the cursor is moved to the location of the error.

EXEC EXIT

### Procedure Screen: WAVE CALC (STATUS)

1. Move the flashing cursor to one of the Z1 - Z8 items.
2. Select the **F3 (exec.)** function key.
3. Use the function keys or the Jog/Shuttle control to specify the number of the equation to be copied.

Function display

Meaning

↑

: Increase equation number.

↓

: Decrease equation number.

EXEC.

: Execute copy.

end

: Quit copy mode.

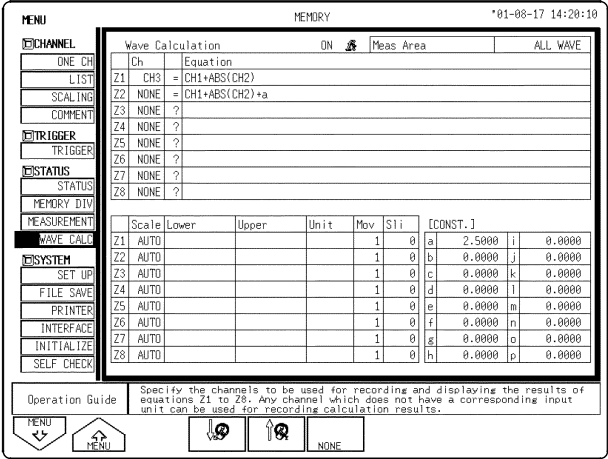
3. Move the cursor to the desired item with the **JOOG/SHUTTLE** control or the cursor key.  
Use the function key to move the cursor.

#### NOTE

The calculation result output destination and calculation formula settings (display scale and number of moved points) are not copied.

# 7.2.4 Setting the Channel for Recording Processing Results

- The calculation result of equations Z1 - Z8 can be recorded and displayed in a specified channel.
- Processing results can be recorded also in channels where no input module is installed (but the range of the "number of channels in use" setting cannot be exceeded).



## Procedure Screen: WAVE CALC (STATUS)

### (1) Making the processing equation

1. Press the **STATUS** key to display the waveform calculation screen.
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 make a setting.

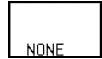
Function display Meaning



: Increase channel number.



: Decrease channel number.



: Calculation result is not recorded

Equations not to be used should be set to **NONE** (calculation result is not recorded).

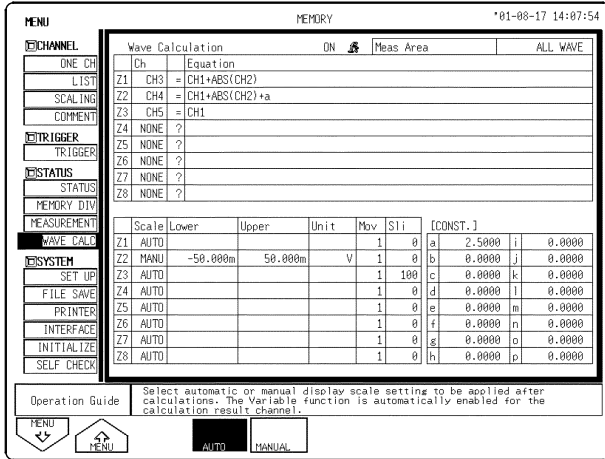
### NOTE

- 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 module 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 Channel screen or Waveform display screen to make the setting.
- The channel selected for recording is automatically set to variable display.



## 7.2.5 Setting the Display Scale

- Display scale can be set automatically or manually.
- The channel selected for recording is automatically set to variable display. (See Section 5.2)
- If MOV or SLI was used, the number of moved points must be specified.



### Procedure Screen: WAVE CALC (STATUS)

#### (1) Setting the Display Scale

1. Press the **STATUS** key to display the waveform calculation screen.
2. Move the flashing cursor to **Scale**.
3. Make the setting with the function keys.

Function display      Meaning

: Set display scale automatically.

: Set display scale manually.

#### • 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 VARIABLE screen to set the upper and lower limit and units. (See Section 5.2.)

#### • 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.

#### • Calculation Result Units

There is no specified unit for calculation results, but you can assign one by turning on the scaling setting for the channel being recorded. For details on the scaling function, see section 5.3.

MENU

ONE CH

LIST

SCALING

COMMENT

TRIGGER

TRIGGER

STATUS

STATUS

MEMORY DIV

MEASUREMENT

WAVE CALD

SYSTEM

SET UP

FILE SAVE

PRINTER

INTERFACE

INITIALIZE

SELF CHECK

MEMORY

\*01-08-17 14:07:44

Wave Calculation

ON

Meas Area

ALL WAVE

Ch	Equation
Z1 CH3	= CH1+ABS(CH2)
Z2 CH4	= CH1+ABS(CH2)+a
Z3 CH5	= CH1
Z4 NONE	?
Z5 NONE	?
Z6 NONE	?
Z7 NONE	?
Z8 NONE	?

Scale	Lower	Upper	Unit	Mov	SLi	[CONST.]
Z1 AUTO				1	0	a 2.5000 i 0.0000
Z2 MANU	-50.000m	50.000m	V	1	0	b 0.0000 j 0.0000
Z3 AUTO				1	100	c 0.0000 k 0.0000
Z4 AUTO				1	0	d 0.0000 l 0.0000
Z5 AUTO				1	0	e 0.0000 m 0.0000
Z6 AUTO				1	0	f 0.0000 n 0.0000
Z7 AUTO				1	0	g 0.0000 o 0.0000
Z8 AUTO				1	0	h 0.0000 p 0.0000

Operation Guide

Specify the number of moving points to move for the SLI function in an equation. The settable range is from -4000 to 4000.

MENU

MENU


(1) Setting the number of moved point

1. Move the cursor to the position of the number of moved point setting (MOV or SLI).
2. Make the setting with the function keys or the **JOG/SHUTTLE** control.


For MOV (moving average): 1 to 4000

For SLI (parallel displacement): -4000 to +4000

Function  
display      Meaning

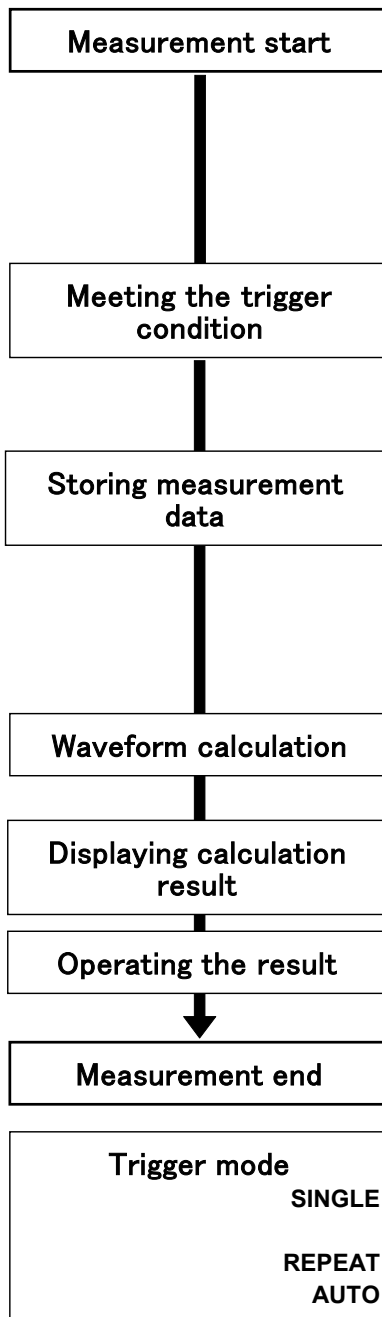
 : Increase value.

 : Decrease value.

 : End

## 7.2.6 Perform Waveform Processing

Waveform processing while capturing the waveform



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, instrument waits for about 1 second for trigger conditions to be met. After this interval, data recording starts, regardless of trigger state.

Displays "Storing".

Waveform displays after data corresponding to recording length have been stored in memory.

When the **STOP** key is pressed twice during measurement, the 8855 is forcibly stopped. (Waveform calculation are not executed.)

Displays **Waveform calculating**.

When the waveform processing calculation is forcibly terminated, a forced termination displays the results being calculated.

Select **F6 (exec.)** key to calculate again.

Displays waveform calculation result on the screen.

Auto print: ON → Prints the measurement data.

Auto save: ON → Saves the measurement data.

Trigger mode

SINGLE

REPEAT  
AUTO

End of measurement.

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

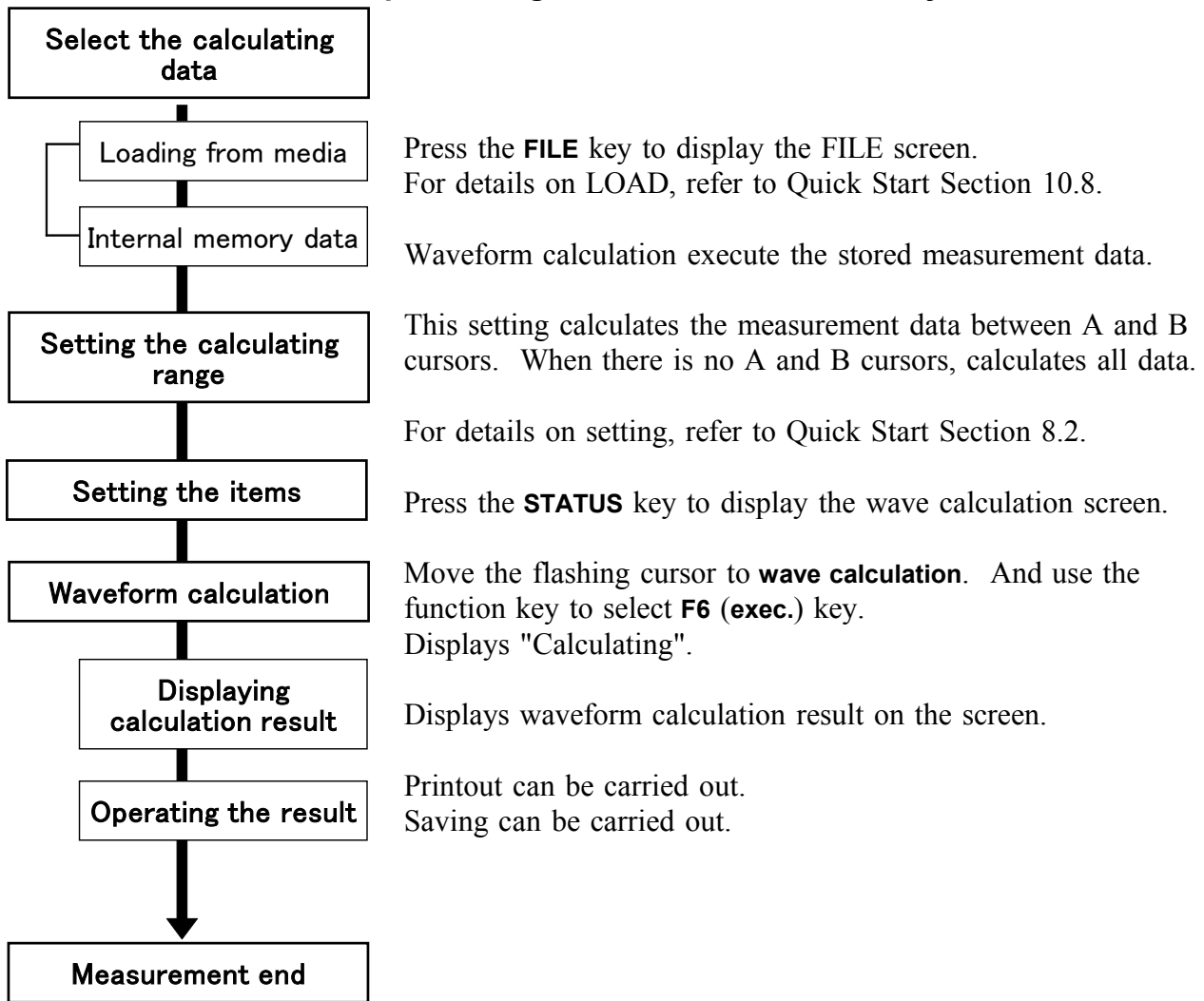
End of measurement in REPEAT and AUTO trigger modes

When the **STOP** key is pressed once during measurement, the 8855 acquires measurement data in an amount corresponding to the set recording length, and the measurement is stopped. (Waveform display, Waveform calculation are executed.)

### NOTE

The maximum recording length allowing waveform processing calculation is 5000 divisions (20000 divisions for 128 M words, 80000 divisions for 512 M words).

## Waveform processing of data in internal memory or media



### NOTE

- The maximum recording length allowing waveform processing calculation is 5,000 divisions (20,000 divisions for 128 M words, 80,000 divisions for 512 M words).
- When using the trace cursor, the trace point value is displayed as processed value.
- The result can be recalculated by altering the calculation process.

---

# Chapter 8

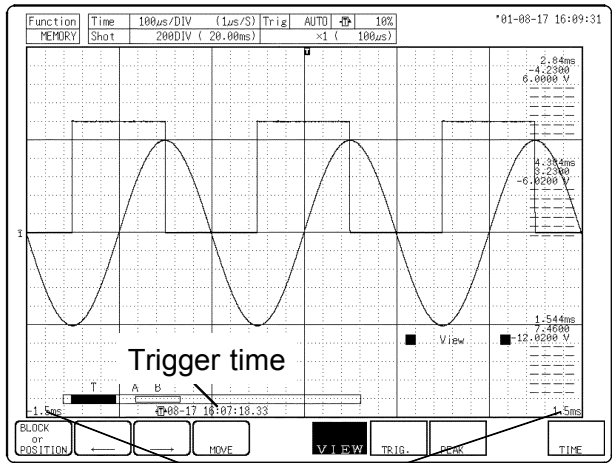
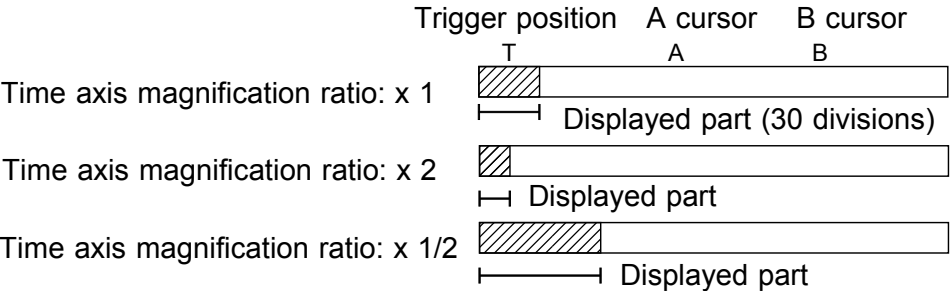
## Search Function

---

# 8.1 View Function (VIEW key)

## 8.1.1 Position Display

Indicates the position of the currently displayed waveform within the entire recording length. The trigger time, trigger position and A/B cursor position are displayed when using the vertical or trace cursors.  
When the recording length is 200 divisions:



Time from trigger point (MEM)  
Time from starting record (Recorder)

### Procedure Screen: Waveform display

1. Press the **F7 (SEARCH)** key on the Waveform display screen. The position is displayed at lower of the screen.
2. Press the **F6 (VIEW)** key.
3. Use the function keys to move the ( ☐ ) mark to the desired point with function key. Slide the bar graph cursor to select from 0, 25, 50, 75, and 100% of full recording length, trigger point, and A and B cursors.

Function display	Meaning
<input type="checkbox"/>	: Shifts the destination to the left.
<input type="checkbox"/>	: Shifts the destination to the right.
MOVE	: Executes the dislocation.
BLOCK or POSITION	: Toggles block display.

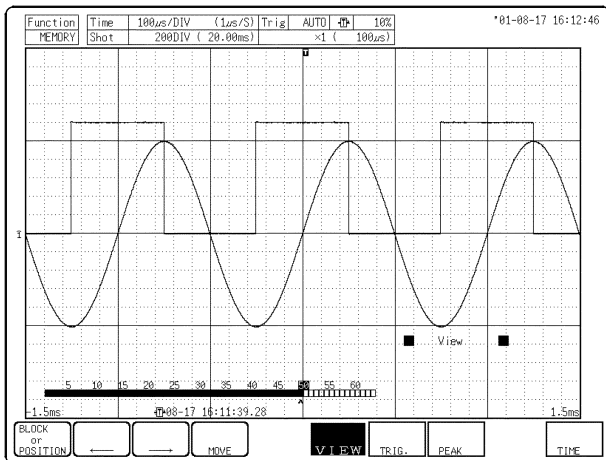
4. Press the **F4 (MOVE)** function key. The high-speed shift is carried out and the display position changes.

### 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 **F7 (SEARCH)** key.
- When the recording length is set to "CONT." on the recorder and at least 20000 divisions (50000 divisions for 128 M words, 200000 divisions for 512 M words) are recorded, the time displayed does not represent the value counted from the trigger point.
- To exit from the view function, press the **ESC** key.

## 8.1.2 Block Display

When memory segmentation is being used, the memory block status is shown. Any block in which an input signal is recorded can be called up on the display.



### Procedure Screen: Waveform display

1. Press the **F7 (SEARCH)** key on the Waveform display screen.
2. The position is displayed.
3. Using the function key to select **Block Display**.

Function display

Meaning



: Shifts the destination to the left.



: Shifts the destination to the right.



: Executes the dislocation.



: Toggles block display.

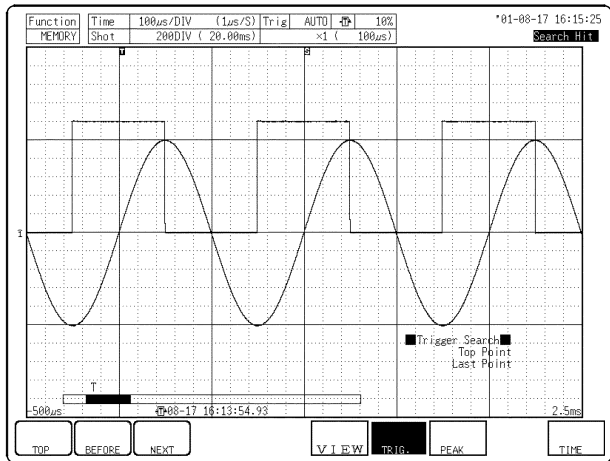
4. When the number of divisions is 31 or over, change the bar graph using the up and down cursor keys.
5. Use the function keys to move the "▲" mark and specify the memory block you wish to display.
6. Press the **F4 (MOVE)** function key.

#### NOTE

- While the view function is active, the flashing cursor is not displayed and the settings cannot be changed.
- The memory segmentation function can be used in memory function.
- When the memory is not split, you can refer to up to 16 blocks of past waveforms by their recording lengths.
- To exit from the view function, press the **ESC** key.

# 8.2 Trigger Search

Allows you to set the triggering conditions and find the location that matches those conditions in the captured waveforms.  
This is set in the trigger screen.  
See Quick Start Chapter 7 for details about trigger settings.

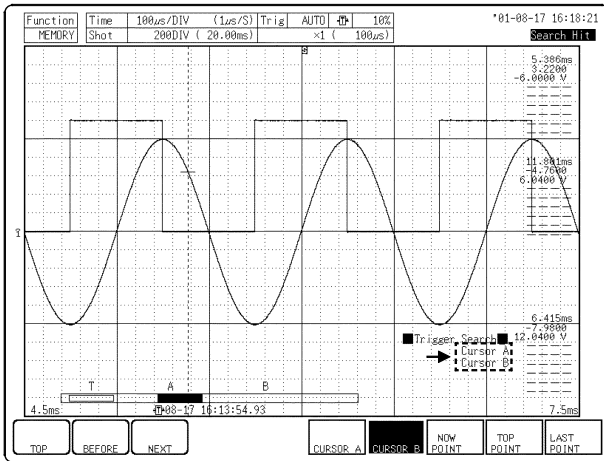


## Procedure Screen: Waveform display, TRIGGER

1. Sets triggering conditions. See Quick Start Chapter 7 for details about trigger settings.
2. In the function key display, press the **F7 (SEARCH)** key .
3. In the function key display, press the **F7 (TRIG.)** key .
4. Search for the waveforms that matches the set triggering conditions.  
Press the **F1 (TOP)** key to move to the top of the conditions.  
Press the **F2 (BEFORE)** key to search for the previous conditions from the current position.  
Press the **F3 (NEXT)** key to search for the next conditions from the current position.

Function display	Meaning
<div>TOP</div>	: Moves to the top
<div>BEFORE</div>	: Searches for the previous condition from the current position
<div>NEXT</div>	: Searches for the next condition from the current position
<div>VIEW</div>	: Accesses the view screen
<div>TRIG.</div>	: Searches waveforms by trigger settings
<div>PEAK</div>	: Searches for peaks
<div>TIME</div>	: Executes a time search.





5. You can specify the range of waveforms to search for. Move the flashing cursor on the → position on the screen.

Function display

Meaning

NOW POINT

: Specifies the current position

TOP POINT

: Specifies the data start

LAST POINT

: Specifies the data end

CURSOR A

: Specifies cursor A

CURSOR B

: Specifies cursor B

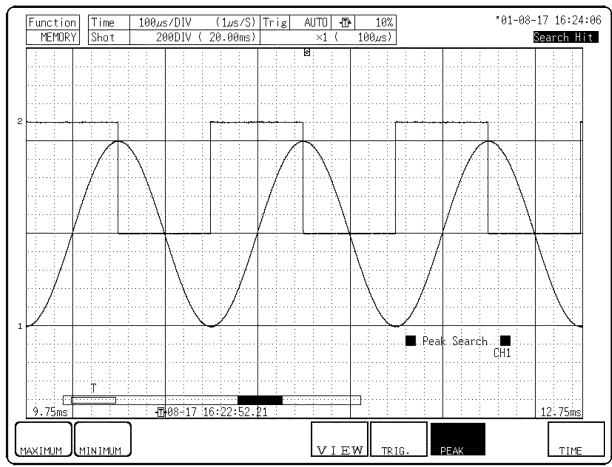
6. Use the function keys to specify the search range (start and end points).

#### NOTE

- To exit the trigger search screen, press the **ESC** key.
- The Previous condition search of captured waveforms from the current position runs backward in time. Therefore, because a search from the current position using Next is the opposite (runs forward in time), the positions found are different. Pay attention to trigger settings.
- It is possible to get back erroneous search results because of noise in the captured waveform. In these case, use the trigger filter.
- When the trigger slope is set to rising & falling (↑ ↓) and the waveform crosses the search level at successive points, every second crossing point is used as the search point.

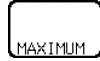


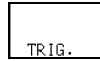
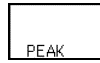
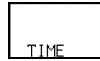
# 8.3 Peak Search Function

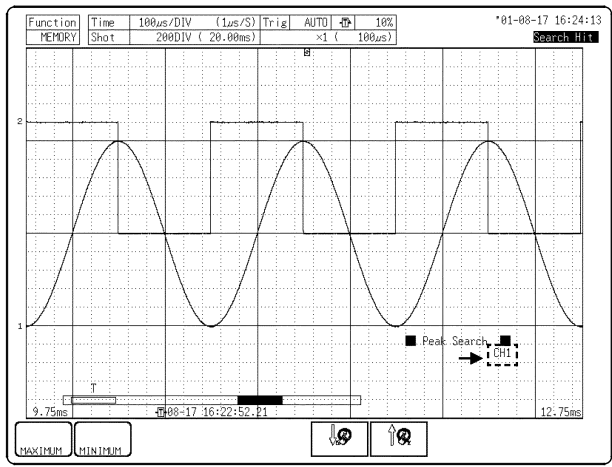
Allows you to search for the captured waveform maximum and minimum values.



## Procedure Screen: Waveform display, TRIGGER

1. Press the **F7 (SEARCH)** key on the Waveform display screen.
2. Press the **F8 (PEAK)** key on the function key display.

Function display	Meaning
	: Searches for maximum values
	: Searches for minimum values
	: Accesses the view screen
	: Searches waveforms by settings
	: Searches for peaks
	: Executes a time search.



**NOTE**

To exit the Peak search screen, press the **ESC** key.

## 8.4 Event Search

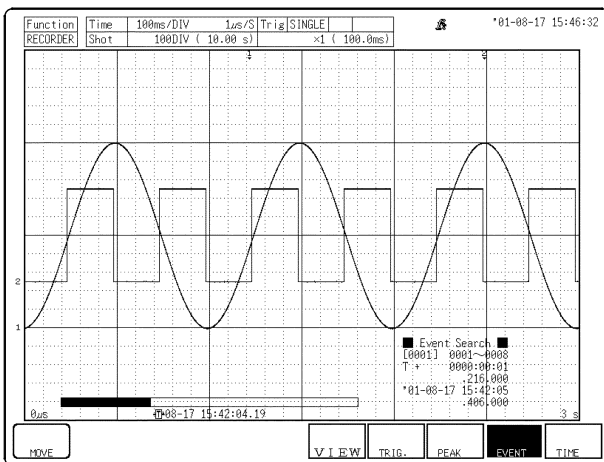
This selection applies only to the Recorder mode or REC & MEM Function. An event mark is entered each time the **START** key is pressed during measurement in the Recording mode. (Event marks can also be entered using the external start terminal.)

When the screen is set to REC&MEM, an event mark is automatically entered at the point where a MEM trigger has been activated.

Event marks entered are numbered in sequence with numbers from 1 to 1000. It is not possible to enter more than 1000 event marks.

After measurement is completed, event marks are displayed at the top of the Waveform screen.

Further, event marks are printed in charts when Real-Time Printing is enabled.



### Procedure Screen: RECORDER (Waveform display)

1. Press the **F7 (SEARCH)** key on the Waveform display screen.
2. Press the **F9 (EVENT)** key on the function key display.

Function  
display

Meaning

VIEW

: Accesses the view screen

TRIG.

: Searches waveforms by settings

PEAK

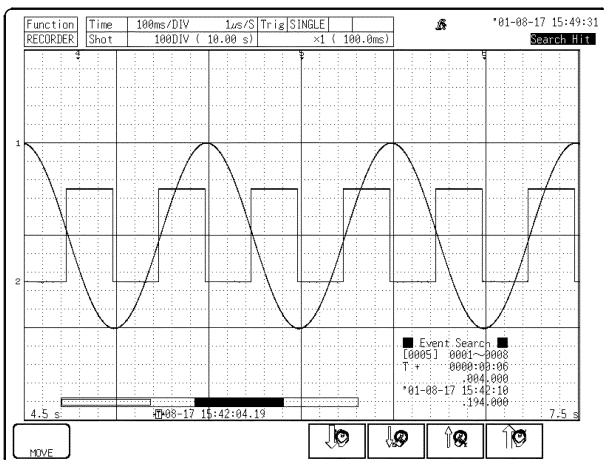
: Searches for peaks

EVENT

: Searches for event marks.

TIME

: Executes a time search.



3. Enter the event number you want to search for. Move the cursor below the event search on the screen display. Use the function keys, **JOG/SHUTTLE** control to enter the event number. The time elapsed from the trigger point and the date are displayed as you enter the event number
4. Press the **F1 (MOVE)** key to search for the specified event number.

Function  
display

Meaning

MOVE

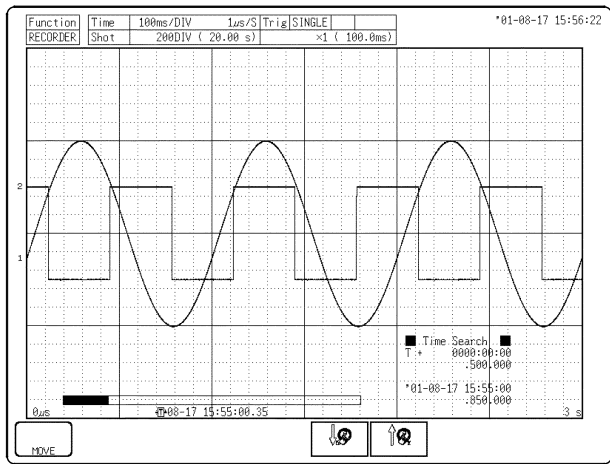
: Searches for the specified event number.

#### NOTE

- To exit the event search screen, press the **ESC** key.
- When the additional recording function is active, the event number takes the next number in sequence after the number of the waveform that was previously loaded.

# 8.5 Time Search

This function searches acquired waveforms.  
You can search using the elapsed time since triggering or the date.

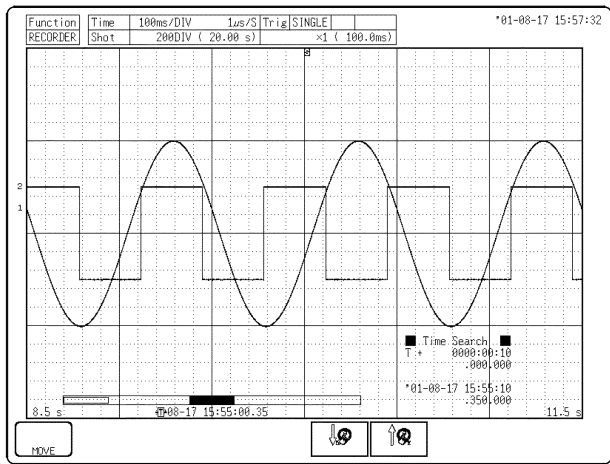


## Procedure Screen: Waveform display

1. Press the **F7 (SEARCH)** key on the Waveform display screen.
2. Press the **F10 (EVENT)** key on the function key display.

Function display    Meaning

<div>VIEW</div>	: Accesses the view screen
<div>TRIG.</div>	: Searches waveforms by settings
<div>PEAK</div>	: Searches for peaks
<div>EVENT</div>	: Searches for event marks.
<div>TIME</div>	: Executes a time search.



3. Enter the event number you want to search for.  
Use the function keys, **JOG/SHUTTLE** control to set the time.  
The search time can be set using the time elapsed since the trigger point or the date.
4. Press the **F1 (MOVE)** key to search for the specified event number.

Function display    Meaning

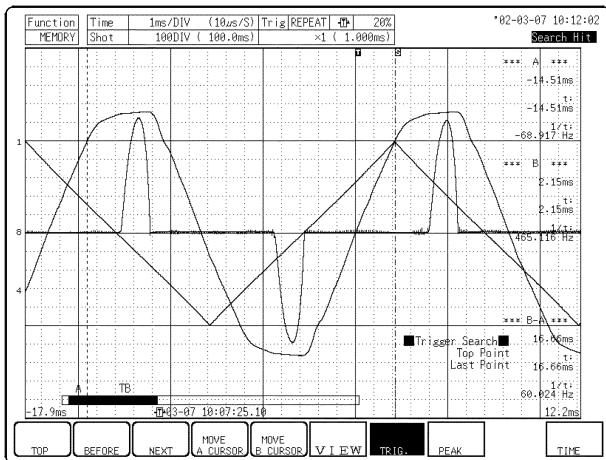
<div>MOVE</div>	: Moves to the waveform for the set time, and displays the waveform.
-----------------	--

### NOTE

To exit the time search screen, press the **ESC** key.

## 8.6 Moving Cursors to the Search Points

The A and B cursors can be moved to the search points.



### Procedure Screen: Waveform display

1. Display the A and B cursors other than horizontal cursors on the display screen.
2. Press the **F7 (SEARCH)** key on the function key display.
3. The data is searched (for triggers, peaks, time, and events).
4. Use the function key display to select Move Cursor.

The cursor moves to the search point.

Function display      Meaning

**MOVE A CURSOR** : The A cursor moves to the search point.

**MOVE B CURSOR** : The B cursor moves to the search point.

#### NOTE

Horizontal cursors (voltage axis cursors) cannot be moved to search points. To exit from the search screen, press the **ESC** key.



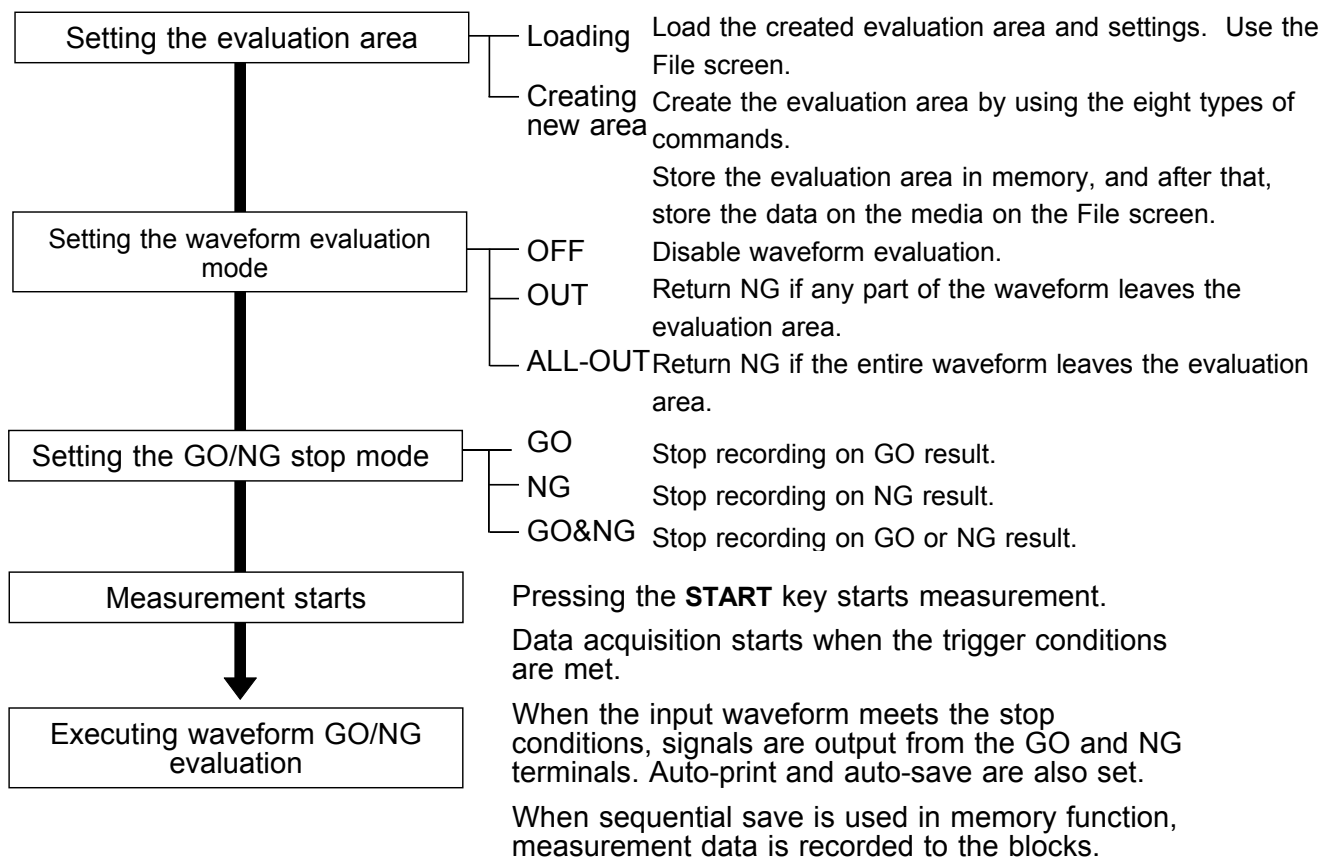
# Chapter 9

## Waveform Evaluation Function

### 9.1 Waveform GO/NG Evaluation (MEM, FFT Function, Power Monitor Function)

- The waveform evaluation function can be used from the Memory function (single screen, X-Y single screen), FFT function, or the Power monitor function (when the 9549 FUNCTION UP DISK is installed).
- 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.

9

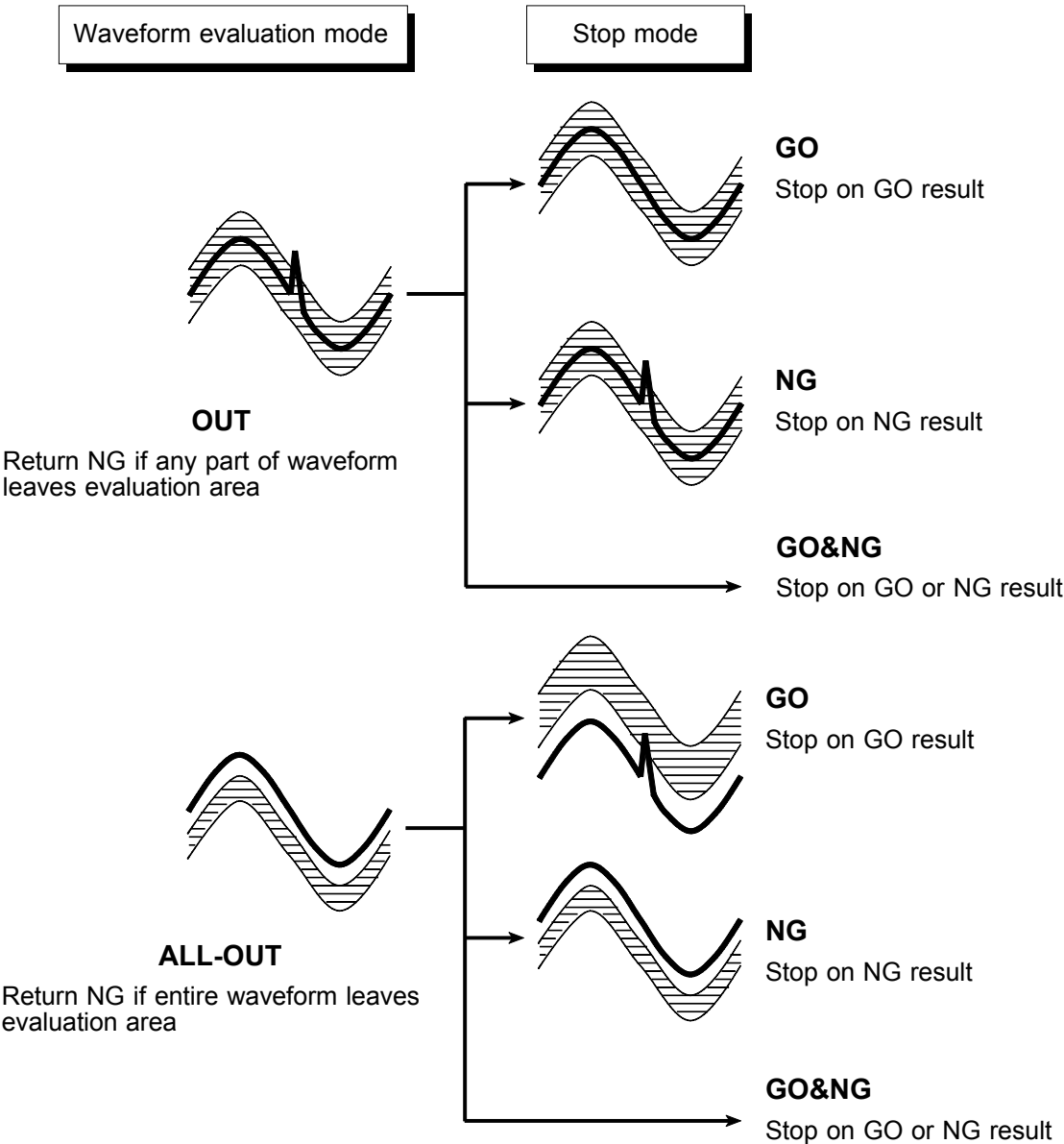


**NOTE**

- 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. The time required for evaluation is on the order of 750 ms.
- If a high setting is chosen for recording length or if compression is used, the evaluation cycle becomes slower.
- 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 (30 divisions) is printed out. When waveform data having a recording length of more than 30 divisions is to be printed out, the time axis should be compressed. See Quick Start Section 8.3.

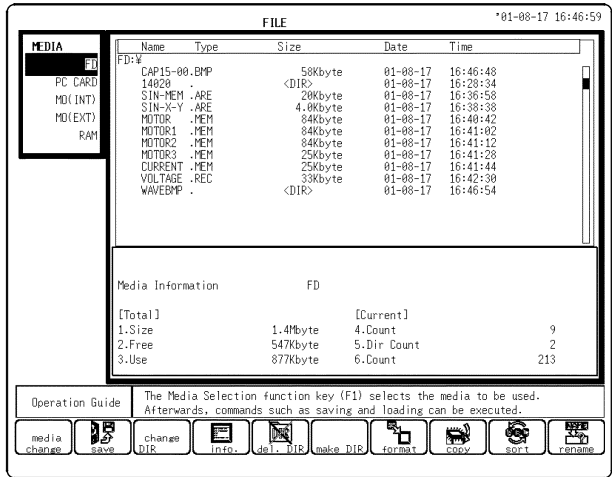


# Waveform evaluation mode and stop mode



## 9.2 Setting the Waveform Area

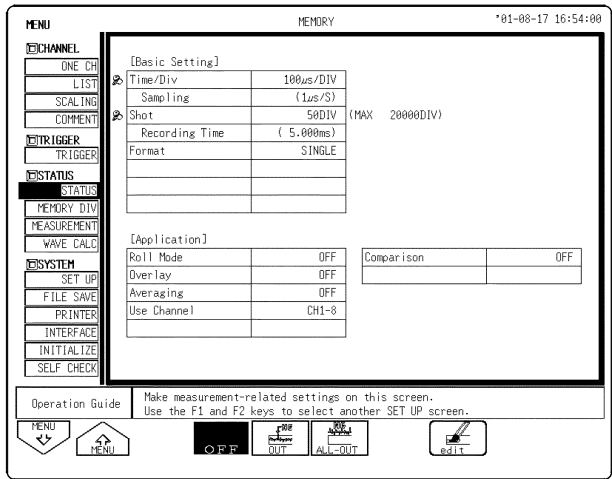
To evaluate the waveforms, a evaluation area is required. Two methods are available: one is to load the already created evaluation area and settings, and the other is to create a new evaluation area.



### (1) Loading the already created evaluation area

#### Procedure 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. Press the **F3 (load)** key.
5. Press the **F9 (exec.)** key.
6. When no more changes need be made to the loaded settings, press the **DISP** key to make the Waveform 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 Waveform display screen appear, and then press the **START** key to initiate measurement.  
For details on load, see Quick Start Section 10.8.



### (2) Creating a new evaluation area

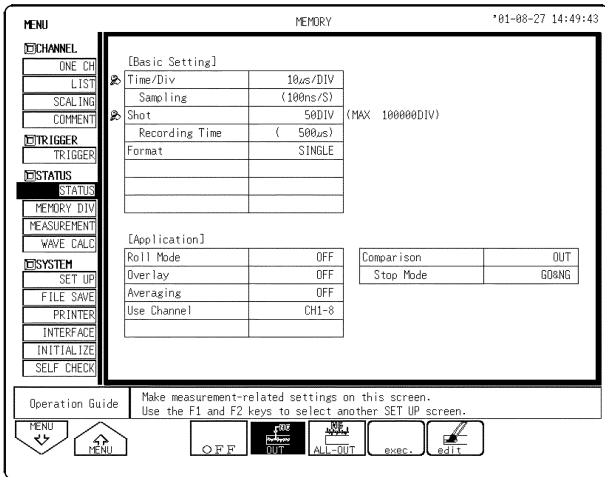
#### Procedure Screen: STATUS

1. Press the **STATUS** key to call the Status screen.
2. Move the flashing cursor to **Comparison**.
3. Press the **F8 (edit)** key.
4. Make the new evaluation area.  
See Section 9.5.
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 Waveform 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 Quick Start Section 10.7.

#### NOTE

Only one waveform evaluation area is stored in internal memory. For example, when operation is changed from the Memory function screen to the X-Y screen and the X-Y screen waveform evaluation area is stored, the waveform evaluation area created for the Memory function is lost.

## 9.3 Setting the Waveform Evaluation Mode



### Procedure Screen: STATUS

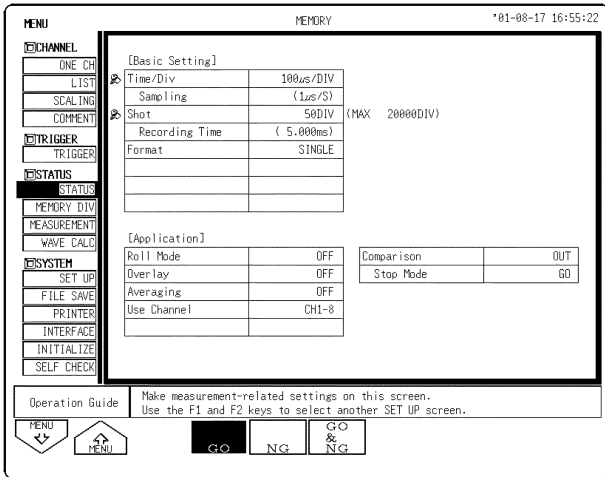
1. Move the flashing cursor to **Comparison**.
2. Make the setting with the function keys.

Function display	Meaning
	: 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.
	: Enable waveform evaluation.
	: Activate editor for setting up evaluation area.

## 9.4 Setting the GO/NG Stop Mode

When waveform evaluation is enabled (OUT or ALL OUT is selected), the "Stop mode" menu appears. Specify which evaluation option, GO or NG, should be used to stop the recording.  
The Auto Save and Auto Print functions are only executed when interruption conditions are satisfied.

9

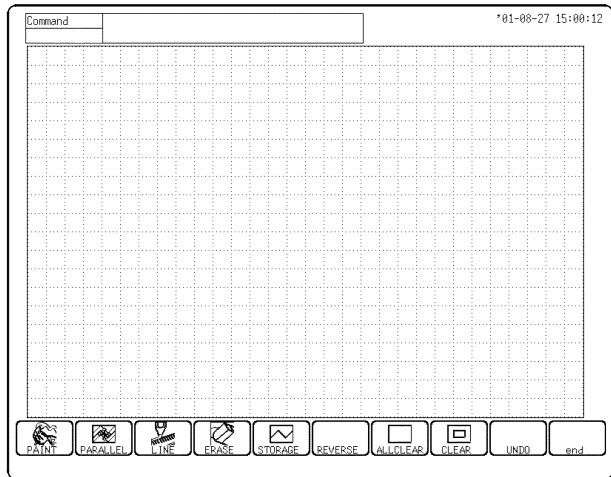


### Procedure Screen: STATUS

1. Move the flashing cursor to the position **Stop Mode**.
2. Make the setting with the function keys.

Function display	Meaning
	: Stop recording on GO result.
	: Stop recording on NG result.
	: Stop recording on GO or NG result.

# 9.5 Creating the Evaluation Area



## Procedure Screen: Waveform display


1. Move the flashing cursor to the **Comparison** item. Press the **F8 (edit)** key.
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. Select the **F10 (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 Quick Start Section 10.7.

# 9.6 Editor Command Details

## paint



### Fills in an enclosed area.

1. Press this key.
2. Use the cursor keys to move the paintbrush mark  to the area to be filled in. Pressing speed up accelerates the movement of the mark.  
If the area is not completely enclosed, adjacent areas will also be filled in.
3. Press the **F5 (exec.)** key. The area completely enclosed by lines is filled in.
4. Press the **F6 (exit)** key to terminate the paint mode.

## parallel



### Shifts the line pattern in parallel direction, to create an area.

1. Press this key.
2. Set the amount of shift.
  - Use the function keys or the Jog/Shuttle control to set the value.
  - Use the next 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 **F5 (exec.)** key. The parallel shift is carried, thereby creating the evaluation area.
4. Press the **F6 (exit)** key to terminate the parallel shift mode.

Function  
display

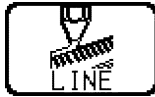
Meaning




: Increase shift amount




: Decrease shift amount

**line****Serves to draw a straight or polygonal line.**

1. Press this key.
2. Use the cursor keys to move the pencil mark  to the start point of the line. Pressing speed up accelerates the movement of the mark.  
If the area is not completely enclosed, adjacent areas will also be filled in.
3. Press the **F4 (SET)** key.
4. Move the pencil mark. A line is drawn between the set point and the pencil mark.
5. Press the **F4 (SET)** key again. The color of the line changes, and it is fixed.  
Press the **F5 (CANCEL)** key. Cancel the immediately preceding set point.
6. Repeat steps 4. and 5. when wishing to draw a polygonal line.
7. Press the **F6 (exit)** key to terminate the line mode.

**erase****Serves to erase unwanted sections.**

1. Press this key.
2. Use the cursor keys to move the eraser mark  to the start point of the section to be erased.  
Pressing speed up accelerates the movement of the mark.
3. Press the **F4 (SET)** key.  
Press the **F5 (CANCEL)** key. Cancel the immediately preceding set point.
4. Move the eraser mark to erase the unwanted section.
5. Press the **F6 (exit)** key to terminate the erase mode.

**storage****Loads a waveform already stored in memory into the editor.**

Press this key and 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.

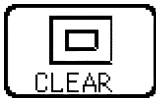
**reverse****Reverses the colors of a filled-in area and the surrounding area.**

Press this key.  
Displays filled in area in reverse.

**all clr****Clears the entire editor screen.**

Press this key.

**clear**



**Clears a specified rectangular area of the editor screen.**

1. Press this key.
2. Use the cursor keys to move the pencil mark to the start corner of the area to be erased. Pressing speed up accelerates the movement of the mark.
3. Press the **F4 (SET)** key.
4. Move the pencil mark to the end corner of the area to be erased.
5. Press the **F4 (SET)** key again. The rectangular area is cleared.  
Press the **F5 (CANCEL)** key. Cancel the immediately preceding set point.
6. Press the **F6 (exit)** key to terminate the clear area mode.

**undo**



**Serves to undo the immediately preceding command. Undo is applicable to all commands except save and end.**

Press this key and clears the editor screen

**end**



**Terminates the editor.**

Press this key and select storing evaluation area in memory and quit editor or quitting editor without storing evaluation area in memory.

Function display	Meaning
A rectangular button with a black border and the word "SAVE" written in black capital letters inside.	: Store evaluation area in memory and quit editor (See Quick Start Section 10.7)
A rectangular button with a black border and the words "KILL AREA" written in black capital letters inside.	: Quit editor without storing evaluation area in memory. The created area is discarded.

If the end key is pressed without having done any editing or immediately after using the store command, the editor is terminated without confirmation.

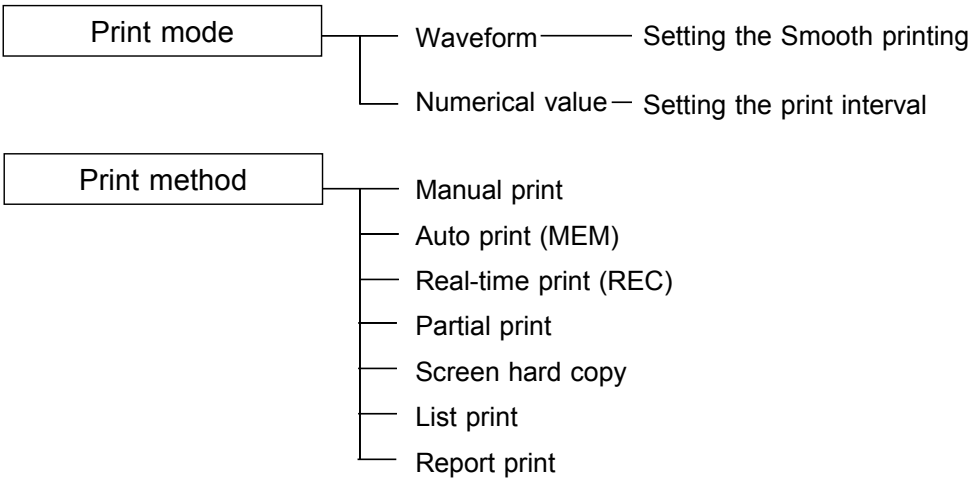
**NOTE**

Press the **ESC** key to cancel. (The editor remains open.)

# Chapter 10

## Printout of Measurement Data

Printing is possible when the 8994 PRINTER UNIT is installed.  
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 10.5.

# 10.1 Printout of Measurement Data Operating Procedure

Settings on the STATUS screen

Press the **STATUS** key to make the settings on the STATUS screen.

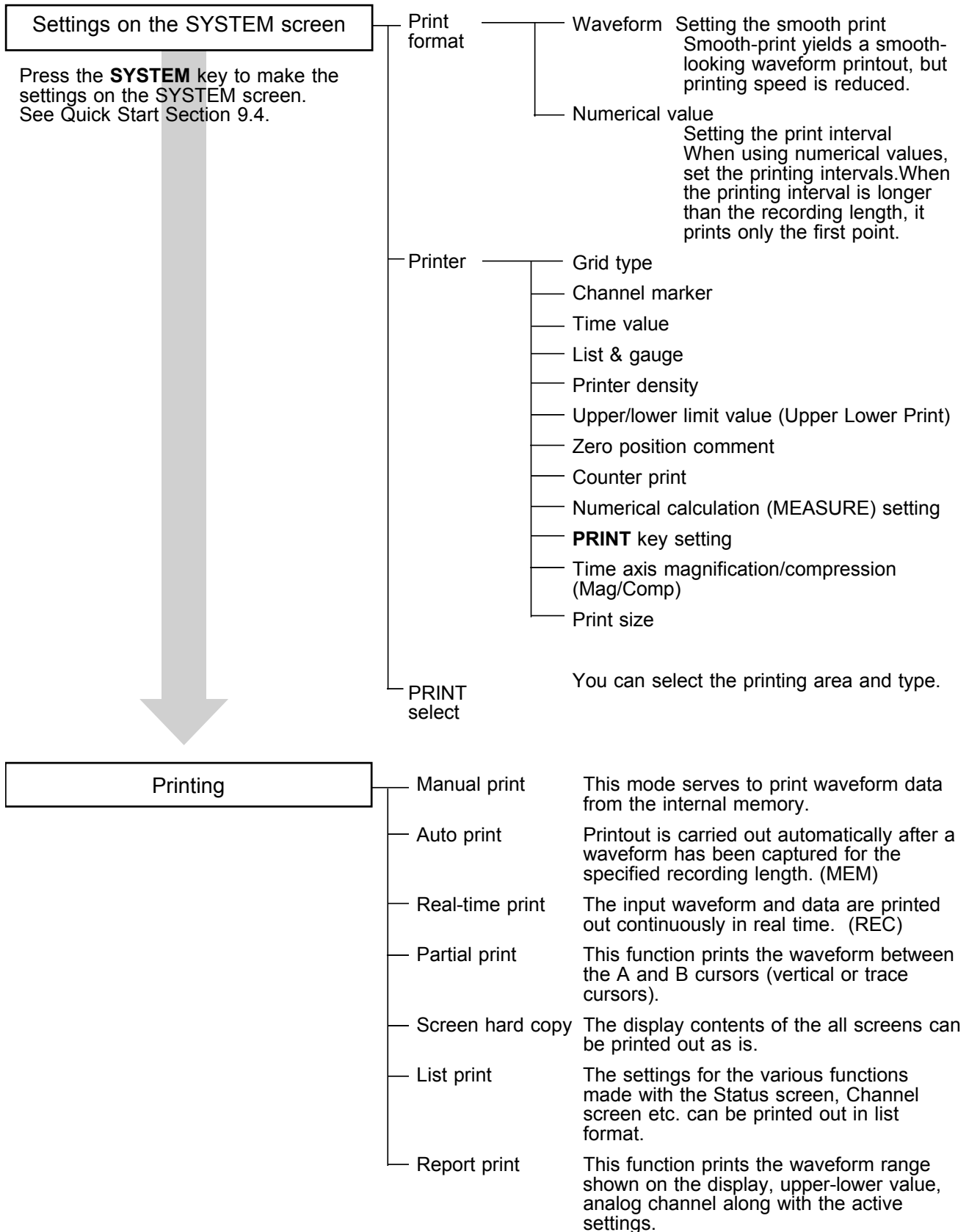
- Display format
- Single      Display and record as one graph. (8 analog + 16 logic signals max.)
  - Dual        Display and record as two graphs. (8 analog + 16 logic signals max.)
  - Quad        Display and record as four graphs. (8 analog + 8 logic signals max.)
  - Oct          Display and record as eight graphs. (8 analog + 4 logic signals max.)
  - X-Y single   X-Y waveforms of graphs 1 to 4 are displayed and recorded in one screen. (memory and recorder functions)
  - X-Y quad    X-Y waveforms of graphs 1 to 4 are displayed and recorded in four screen. (memory and recorder functions)

Settings on the CHANNEL screen

Press the **CHAN** key to make the settings on the CHANNEL screen.

- Print density      The density of waveform data printing can be set.
- Waveform display graph position      The position of waveform data print can be set when the display format has been set to screen display excluding Single screen.
- Scaling            The printout will use the scaled gauge. See Section 5.3.
- Comment          Two types of comments - title comments and channel-by-channel comments - may be superimposed on a graph. See Section 5.4.

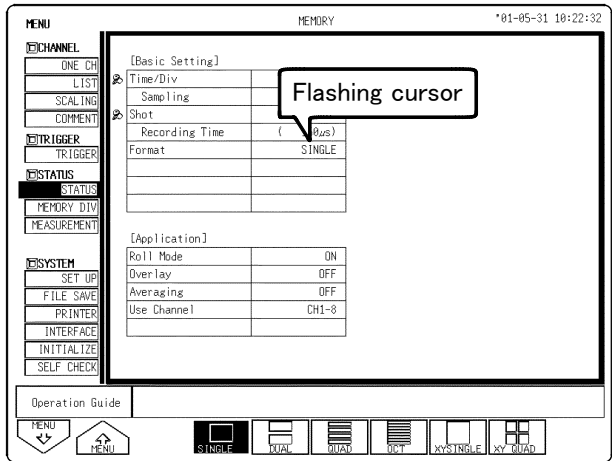




## 10.2 Setting the STATUS Screen (printout)







### 10.2.1 Setting the Display 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, oct, X-Y single, X-Y quad are available.



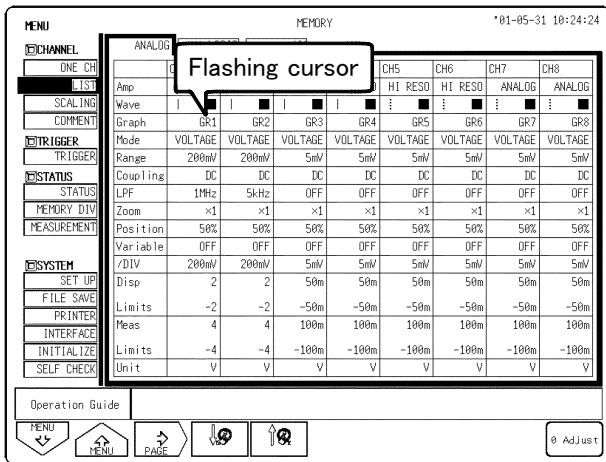
#### Procedure Screen: STATUS

1. Press the **STATUS** key to display 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.

Function display	Meaning
	: Display and record the waveform in one graph.
	: Display and record the waveform in two graphs.
	: Display and record the waveform in four graphs.
	: Display and record the waveform in oct graphs.
	: X-Y waveforms of graphs 1 to 4 are displayed in one screen.
	: X-Y waveforms of graphs 1 to 4 are displayed in four screen.

## 10.2.2 Setting the Waveform Display Graph Position

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



### Procedure Screen: ONE CH, LIST (CHANNEL)

1. Press the **CHAN** key to display the Channel screen.
2. Move the flashing cursor to the position of the **Graph** to be set.
3. Use the function keys or **JOG** control to make the selection.

Function  
display

Meaning



: Increases in number



: Decreases in number

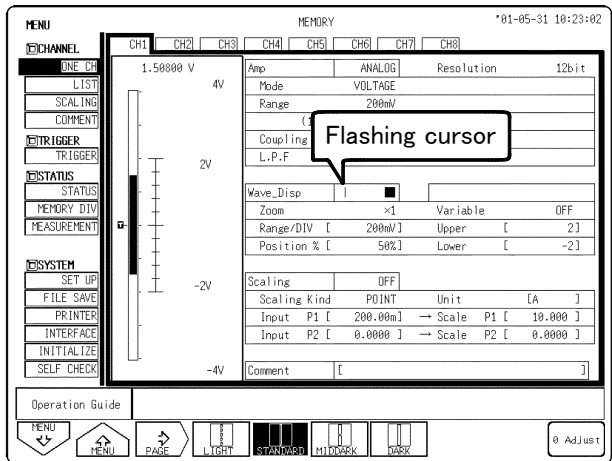
#### NOTE

For the X-Y screen (memory and recorder) display format, see the X-Y recorder setting for each function.

# 10.3 Setting the CHANNEL Screen (printout)

## 10.3.1 Setting the Print Density

If the data is to be output on the internal printer, any of four print densities may be set for twelve waveform display colors. The set print density determines waveform density on printouts or hard copies.



### Procedure Screen: ONE CH, LIST (CHANNEL)

1. Press the **CHAN** key to display the Various channels (ONE CH) or List screen.
2. Move the flashing cursor to the **Wave\_Disposition** position.
3. Use the function keys to select density.

Function display	Meaning
	: Selects light
	: Selects standard
	: Selects semi-dark
	: Selects dark

- If the system is reset, print density returns to its previous setting.
- If the analog channel comment is set to "SETTING" or "SET & COM," the analog channel print density (■) is output during printing.

## 10.3.2 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 vertical axis) and A/B cursor measurement values are displayed in the scaled units.
- Scaling can be performed for every channel.

**NOTE**

For details, see Section 5.3.

---

### 10.3.3 COMMENT Screen

Three types of comment are available.  
If "COMMENT" or "SET & COM" is selected, this comment will be included on the recording paper in all functions.

**NOTE**

For details, see Section 5.4.

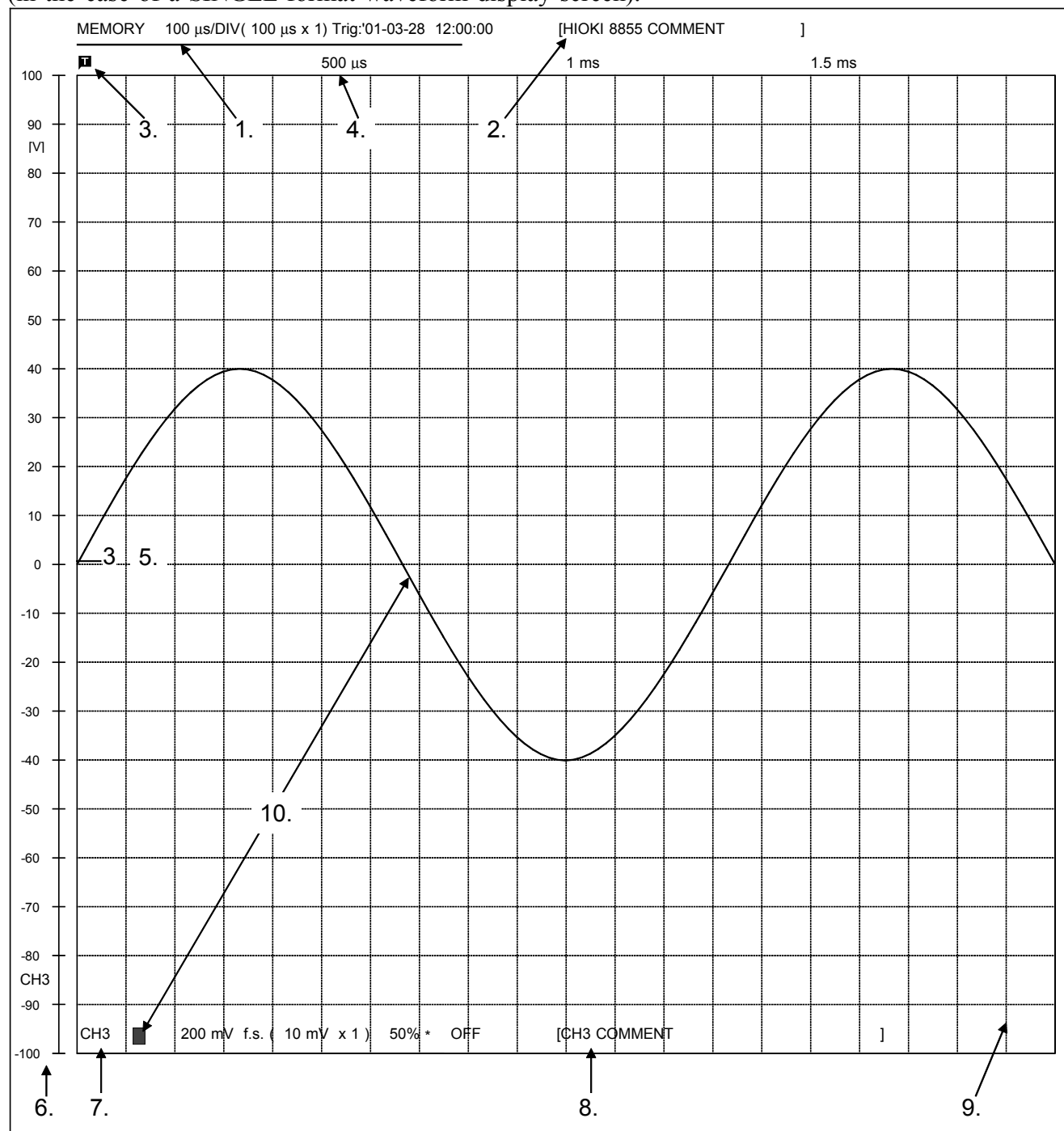
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## 10.4 Setting the **SYSTEM** Screen (printout)

The various printer settings can be made on the system's Printer screen. For details, see Quick Start section 9.4.

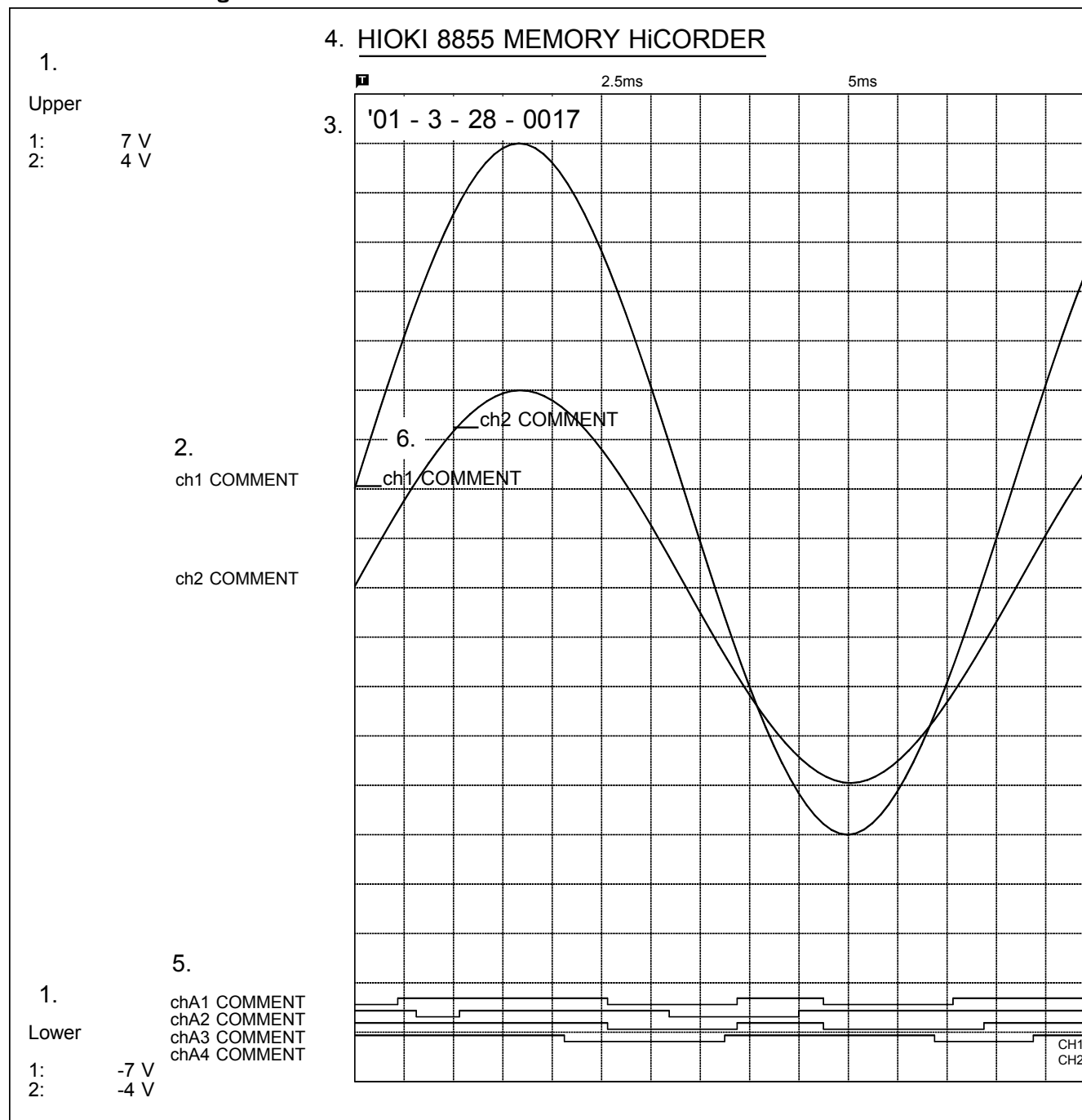
## 10.5 Example of Printer Output

This section explains the printer type and how to read the printout (in the case of a SINGLE format waveform display screen).



- |                            |                         |
|----------------------------|-------------------------|
| 1. Title (SETTING)         | 6. Gauge (List & gauge) |
| 2. Title (COMMENT)         | 7. Analog (SETTING)     |
| 3. Trigger mark            | 8. Analog (COMMENT)     |
| 4. Time value (TIME)       | 9. Grid type (STANDARD) |
| 5. Channel marker (CH.No.) | 10. Print density       |

## Advanced settings



1. Upper-lower print (ON)
2. Zero position comment (ON)
3. Counter print (DATE)
4. Title (COMMENT)
5. Logic (COMMENT)
6. Channel marker (COMMENT)

**NOTE**

- The gauge, upper and lower limits, and zero position comments are printed out in this order. Since the zero 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 zero position comments are printed on channels having the same zero position, the printed comments will overlap each other.



## Printing the List (MEM)

### HIOKI 8855 MEMORY HiCORDER

#### STATUS

Function	MEMORY	Roll Mode	OFF	Memory Div	OFF
Time/Div	5us/DIV	Overlay	OFF	Measurement	OFF
Sampling	(50ns/S)	Averaging	OFF		
Shot	30DIV	Use Channel	CH1-3		
Format	OCT				

#### SYSTEM

Start Backup	OFF	Auto Variable Scale	ON
Grid(Disp/Print)	STD./STD.	START/EXT. IN1	START
Comment	OFF	STOP /EXT. IN2	STOP
Time(Disp/Print)	TIME/TIME	EXT. TRIG	↑
Back Light Saver	OFF	EXT. SMPL	↑
Display Color	COLOR 1	GO	MEASURE
Beep Sound	BEEP1	NG	MEASURE
Language	ENGLISH	EXT. OUT	ERROR
START Key Acceptance	ONE PUSH	TRIG OUT	PULSE

#### CHANNEL

ch.	draw graph	range	zoom ( /DIV)	θpos.	filter ( [OPTION]	lower ~	upper )
1:①	G1	200mV	×1 (200mV)	50%	[A.A.F OFF, 1:1Probe]	-2 V ~	2 V )
2:②	G2	100mV	×1 (100mV)	50%	[A.A.F OFF, 1:1Probe]	-1 V ~	1 V )
3:③	G3	100mV	×1 (100mV)	50%	[A.A.F OFF, 1:1Probe]	-1 V ~	1 V )
4:④	G4	100mV	×1 (100mV)	50%	[A.A.F OFF, 1:1Probe]	-1 V ~	1 V )
5:⑤	G5	100mV	×1 (100mV)	50%	[A.A.F OFF, 1:1Probe]	-1 V ~	1 V )
6:⑥	G6	100mV	×1 (100mV)	50%	[A.A.F OFF, 1:1Probe]	-1 V ~	1 V )
7:⑦	G7	20mV	×1 (20mV)	50%	[A.A.F OFF, 1:1Probe]	-200mV ~	200mV )
8:⑧	G8	50mV	×1 (50mV)	50%	[A.A.F OFF, 1:1Probe]	-500mV ~	500mV )
CHA	A1 A2 A3 A4	CHB	B1 B2 B3 B4	CHC	C1 C2 C3 C4	CHD	D1 D2 D3 D4
POS: 1	① ① ① ①	POS: 2	② ② ② ②	POS: 3	③ ③ ③ ③	POS: 4	— — — —

#### TRIGGER

Trigger Mode	AUTO	Timer Trigger	OFF
Pre-Trigger	0%		
Trigger Source	OR		
External Trig	OFF		
1: LEVEL	Level: 0.0000 V	Slope: ↑	Filter: OFF
2: IN	Lower: -40.000mV	Upper: 40.000mV	Filter: OFF
3: OUT	Lower: -40.000mV	Upper: 40.000mV	Filter: OFF
4: PERIOD	Level: 0.0000 V	Slope: ↑ Lower: 500ns Upper: 1.5us	
5: GLITCH	Level: 0.0000 V	Slope: ↑ Width: 100ns	
6: EVENT	Level: 0.0000 V	Slope: ↑ Event: 1 Filter: OFF	
7: TRIG OFF			
8: TRIG OFF			
A: OFF	B: OFF	C: OFF	D: OFF

## Example

### FILE LIST

0001 INV	01-06-11 12:07:00	<DIR>	0002 REC_DATA.	01-06-11 13:47:06	<DIR>
0003 MEM_DATA.	01-06-11 14:33:34	<DIR>	0004 NOISE1	01-06-12 08:38:32	<DIR>
0005 AUTO1	.MEM 01-03-28 14:20:42	56K	0006 AUTO2	.MEM 01-03-28 14:20:42	56K
0007 AUTO3	.MEM 01-03-28 14:20:42	56K	0008 NONAME	.MEM 01-03-28 14:20:42	56K
0009 NONAME	.SET 01-03-28 14:20:36	14K	0010 NONAME	.TXT 01-03-28 14:20:56	60K
0011 TEST1	.MEM 01-03-28 16:16:36	56K	0012 TEST2	.MEM 01-03-28 16:15:00	56K
0013 NOISE	01-06-06 10:44:50	<DIR>	0014 MOTER.	01-06-06 10:44:10	<DIR>
0015 COMMENT	01-06-06 11:25:30	<DIR>	0016 VOLT_MES.SET	01-03-28 14:20:36	14K
0017 CURT_MES.TXT	01-03-28 14:20:56	60K	0018 POWER	.MEM 01-03-28 14:38:32	65K

18 files

## 10.6 Printing Procedure

### 10.6.1 Manual Print

This mode serves to print waveform data from the internal memory.

- **Memory function**  
Measurement data from one measurement (entire recording length) are printed.
- **Recorder function**  
Measurement data stored in memory before the end of measurement are printed (2000 divisions<sup>\*1</sup> max.).  
<sup>\*1</sup>: Expanded to 128 M words : 50000 DIV, 512 M words : 200000 DIV,

#### Procedure

Screen: Waveform display

After the measurement is completed, press the **PRINT** key.

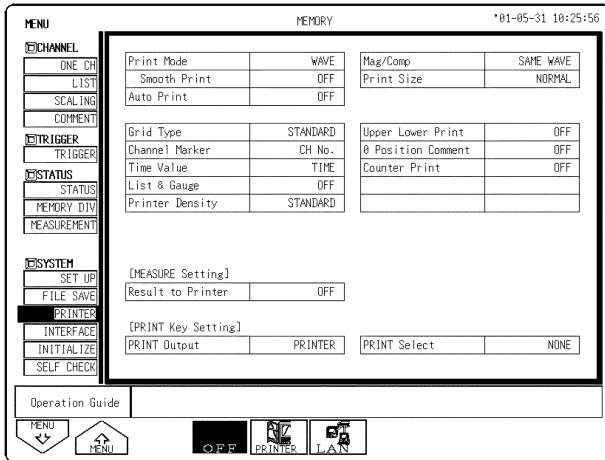
- Since data are stored, they can be printed as often as desired.
- When magnification/compression was used, the printout reflects this condition.
- If you want to stop the printing, press the **STOP** key.

#### NOTE

- When A-B cursor is ON, it prints that area. When executing from the Print screen (system), you can select the all screens Between A-B cursor if the Print Selection when Executing is Yes.
- On the recorder, when the recording length is set to Continuous and the time value display of the Print screen (system) is set to Time, the time value display is not the time from the triggering point (or the start of recording) when recording over 20000 DIV (128 Mwords is 50000 DIV, 512 Mwords is 200000 DIV). When set to Date, it prints the time when printing starts.

## 10.6.2 Auto Print

Printout is carried out automatically after a waveform has been captured for the specified recording length. (MEM)



### Procedure Screen: PRINTER (SYSTEM)

1. Press the **SYSTEM** key to display the Printer screen.
2. Move the flashing cursor to the **Auto Print** item.
3. Use the function keys to make a setting.
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.

Function display      Meaning



: Does not print automatically.



: Prints using the internal printer.



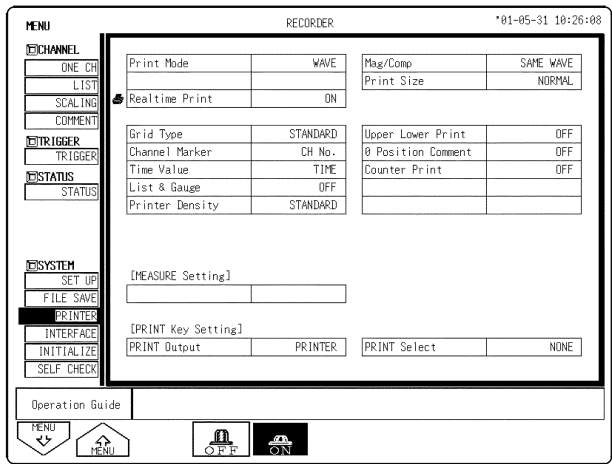
: Automatically transfers data to a device connected through a LAN. This setting requires that you have the 9333 LAN COMMUNICATOR.

#### NOTE

- When cursors A and B are enabled in memory function, partial printing is executed.
- When the roll mode is enabled in memory function and the time-axis range is lower than 10 ms/division, data is displayed and printed simultaneously.
- When both auto-print and auto-save are enabled in the memory function, auto-save usually takes precedence. However, if roll mode is enabled, auto-print will execute first.

### 10.6.3 Real Time Print

The input waveform and data are printed out continuously in real time. (in Recorder function)



#### Procedure

Screen: PRINTER (SYSTEM)

1. Press the **STATUS** key to display the Status screen.
2. Move the flashing cursor to the **Realtime Print** item.
3. Use the function keys, and select **ON**.
4. When measurement starts, waveform appears on screen and printout starts.

**NOTE**

- At a time axis range setting of 200 ms/DIV or faster, the waveform data will be printed out later. (See Quick Start Section 12.3.)
- 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 x 1/2, 20 ms/DIV x 1/5, 10 ms/DIV x 1/10
- Setting a time axis range faster than 1 s/DIV may result in light printing.

## 10.6.4 Partial Print

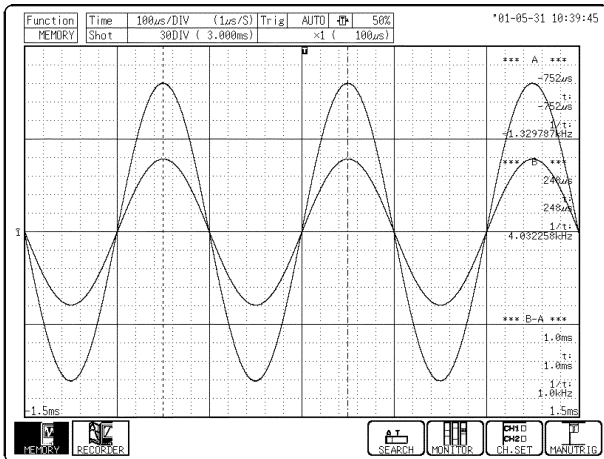
This function prints the waveform between the A and B cursors (vertical or trace cursors). The function is available also when the A/B cursors are currently outside the range displayed on screen. Printing is possible also when the print format is currently set to "numeric". For details regarding the use of the A/B cursors, refer Quick Start to Section 8.2.

- **Memory function**

Specified range (out of entire data recorded from a measurement) is printed.

- **Recorder function**

Specified range (out of last 20,000 (expended 128 M is 50,000, 512 M is 200,000) divisions (magnification: x 1) of data in memory) is printed.



### Procedure Screen: Waveform display

1. Press the **DISP** key to display the Waveform 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. Then press the **PRINT** key. The specified range is printed, also if cursor A (or B) is currently off screen. When only the cursor A is used, the waveform data from the position of cursor A to the end of the data is printed.

#### NOTE

- On the waveform evaluation screen, cursors A and B are available, but partial printing cannot be performed.
- On the XY screen, the partial printing cannot be performed.

## 10.6.5 Screen Hard Copy

The display contents of the all screens can be printed out as is.

### Procedure

Screen: All

1. Display 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.

---

## 10.6.6 List Print

The settings for the various functions made with the Status screen, Channel screen etc. can be printed out in list format.

### Procedure

Screen: Excluding Waveform display

Press the **PRINT** key on the screen excluding Waveform display.

#### 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.

---

## 10.6.7 Report Print

Prints the waveform (in the range displayed on the Waveform display screen), upper and lower values, and analog channel settings.

- If the A and B cursors are displayed on the screen, they are also printed.
- When "COMMENT" or "SET & COM" is set, the comments are also printed (see Section 5.4).

### Procedure

Screen: Waveform display

1. Display the Waveform display screen.
2. Press the **FEED** key and **COPY** key simultaneously.  
(Press and hold the **FEED** key and then press the **COPY** key.)

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# Chapter 11

## Communication Settings

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### 11.1 INTERFACE Screen (LAN Interface)

The LAN capabilities of the instrument are supported through the Ethernet 10Base-T interface. You can connect to networks with an Ethernet 10BASE-T-compatible cable (maximum length 100 m).

Connecting to a network enables you to communicate with the Hioki PC communication program, 9333 LAN COMMUNICATOR.

Further, because the 8855 can be controlled by Communication command, control programs can be created and the instrument controlled by connection to the communication command port using TCP.

Further, because the 8855 provides an FTP service, you can use an FTP client from your PC to access the files in this instrument.

For details on how to use the 9333 LAN COMMUNICATOR, see the 9333 User's Guide; and for details on communication commands, see the explanation in the supplied FDD.

This section explains LAN settings.

#### Settings and Connection Order

The settings and connections are performed in the following order.

1. Make all the LAN settings.
2. Move the cursor to Reset and press Execute on the GUI.(If you do not reset, your settings are not reflected in the LAN that is currently operating.)
3. Plug the LAN cable and connect to the network.

Because it is possible to duplicate the IP address of another device on the LAN when modifying settings while connected (causing illegal address information to be distributed), make sure that you adjust the settings before connecting to the network.

#### Preparations

Make the following settings when connecting to the network. Ask your network administrator to provide you with the following.

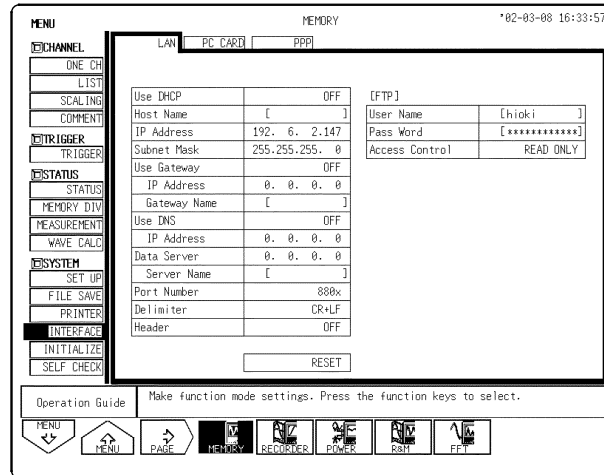
DHCP	: Yes/No
Host Name and Address setting	
Host Name (Up to 12 characters)	: _____
IP Address	: ____·____·____·____
Subnet Mask	: ____·____·____·____
(When using DHCP, you do not need to enter the IP address or subnet mask.)	
DNS setting	
DNS	: Yes/No
IP Address (If Yes)	: ____·____·____·____
(When settings can be acquired from DHCP, the DHCP setting takes priority.)	
Gateway setting	
Gateway	: Yes/No
IP Address (If Yes)	: ____·____·____·____
Gateway name (If Yes)	: _____
(When using DNS, only specification of the name is necessary; when not using DNS, the IP address must be specified.)	
TPC/IP Port Number	: __x (Default: 880x)
Specify the first 3 digits of the number. The last digit ranges from 0 to 9, reserving the ports for use by the unit.	
Specifications in case 880x is unavailable	

You may ask your network administrator for help when building a new network composed of a PC and a recorder only; however, in some cases there may be no network administrator, or the network administrator may leave settings up to you. When building a local network that is isolated, we recommended using the following addresses.

IP Address of the PC	: 192.168.0.1
IP address of the first recorder	: 192.168.0.2
IP address of the second recorder	: 192.168.0.3
IP address of the third recorder	: 192.168.0.4
↓	↓
Host Name	: Anything (However, each should be unique)
Subnet Mask	: 255.255.255.0
Gateway	: OFF
DNS	: OFF
DHCP	: OFF
TCP/IP Port Number	: 880x



## Settings



Make each setting prepared previously. After making each setting, move the cursor to Reset and press Execute on the GUI.

### DHCP

DHCP is a method whereby devices automatically acquire and set their own IP address, etc.

Enabling DHCP makes automatic acquisition and setting of an IP address and subnet mask possible when a DHCP server is operating on the same network as the device.

### Host Name

This name represents the device on the network. Do not duplicate the host name of other devices.

If acquisition of DNS or Gateway information is applicable, it is acquired at the same time.

### IP Address

Address used to identify each device on the network. Do not duplicate the IP address of other devices.

(This takes priority over entered settings.)

### Subnet Mask

This setting separates the IP address into a portion representing the network and another representing the device.

Therefore, make it the same as the subnet mask of other devices on the same network.

(This takes priority over entered settings.)

## **DNS**

It is difficult to remember an IP address since it is simply a string of numbers. However, it is easier to remember if it can be specified as a name. When the network includes a server that can search for IP addresses from names on the network, you can specify devices by name instead of using the IP address.

This service is provided by both DNS and WINS servers; however, the 8855 only supports DNS.

Further, the 8855 does not dynamically register names and IP addresses with the DNS.

Enabling DNS allows a connected remote device to be specified by name.

When DHCP is enabled and DNS information can be acquired from the DHCP server, the setting obtained from DHCP is given priority.

## **Gateway ON/OFF, IP Address**

When the communicating device (PC) is on the network connected to this device as well as on different network, turn the Gateway setting ON, and specify the IP address of the device that is the gateway. Generally, if a PC is on the same network, you can make this setting the same as the default gateway address of the PC.

No default gateway is needed when the device and the PC are connected 1-to-1 (peer-to-peer), or when connected to the same hub, therefore turn this setting OFF.

When DNS is effective and the set IP address is other than 0.0.0.0, the set IP address is used.

If the IP address is set to 0.0.0.0, DNS is used to search for the IP address.

For example, names are set in the following format: gateway.hioki.co.jp In the case of this example, if ".hioki.co.jp" is omitted, DNS may not be able to identify the IP address.

When DHCP is effective and Gateway information can be acquired from the DHCP server, the setting obtained from DHCP is given priority.

## **TCP/IP Port Number**

This device uses TCP/IP protocols for communications. TCP/IP enables multiple connections of each type to communicate and classifies them by port number. This device normally uses numbers from 8800 to 8809.

8800 (This device is the server): Used in remote operation applications on the 9333

8801 (This device is a client): Used in data collection applications on the 9333

8802 (This device is the server): For the control by the communication command

8803 to 8809 are reserved.

Normally, these do not need to be changed. However, if there is a port that cannot be used because for security reasons or because it is being used on the PC communicating with this device, change this port. Set the first 3 digits. The last digit, ranging between 0 and 9, is either used or reserved for use by the device.

### **Data Collection Server**

When communicating with this device, specify the IP address of the PC running the 9333 LAN COMMUNICATOR. This is necessary when collecting data using the 9333 LAN COMMUNICATOR.

If necessary, set "LAN" as storage media in the Save screen and as the output destination for the PRINT key in the Printers screen.

When DNS is effective and the set IP address is other than 0.0.0.0, the set IP address is used.

If the IP address is set to 0.0.0.0, DNS is used to search for the IP address.

For example, names are set in the following format: collect.hioki.co.jp. In the case of this example, if ".hioki.co.jp" is omitted, DNS may not be able to identify the IP address.

### **Delimiter Header ON/OFF Setting**

Use this option when controlling the 8855 using communication commands. Set whether headers are to be included in command responses, and whether LF or CR/LF is to be used to start a new line. Either LF or CR/LF can be used to send commands.

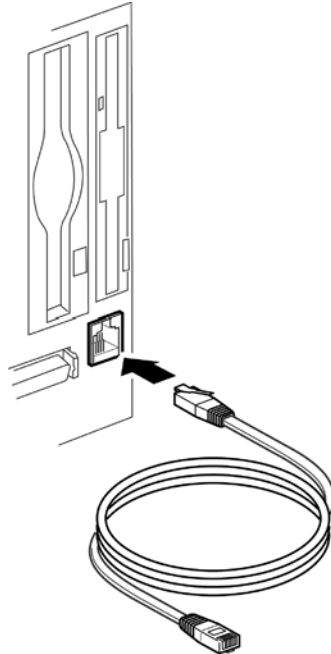
To send command, connect to the 8855's 8802 (factory default) port using TCP protocol, and send command character strings. For commands, see the supplied FDD.

## Connection

Connect only when you have completed making the settings.

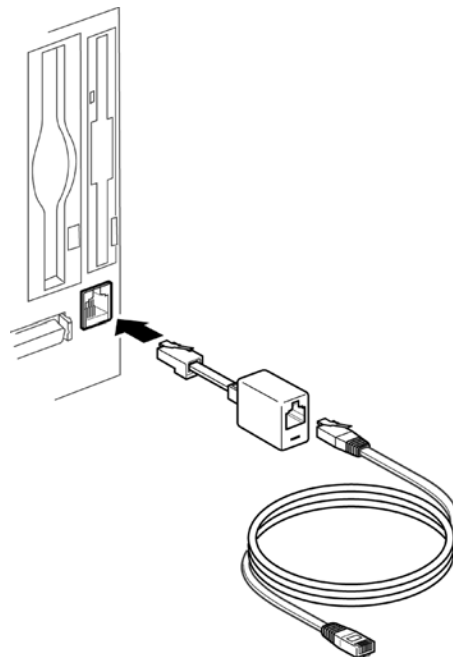
Connecting this device to an existing network.

Connect this device's LAN connector and the hub with a straight 10BASE-T cable. Use a commonly sold straight 10BASE-T-compatible cable or a 9642 LAN CABLE, and connect it as illustrated below.



A cross cable is necessary when connecting this device and the PC one-to-one (peer-to-peer). A standard 10BASE-T-compatible cross cable or a straight cable + cross converter is required.

A straight cable cross-converter (9642 LAN CABLE accessory) can be used with this instrument. Connect it as illustrated below.



**NOTE**

Power for the 8855, and PC should be obtained from the same outlet. Otherwise, potential difference between grounds may cause malfunctions.

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## 11.2 FTP Service

This instrument provides FTP service by means of an FTP (File-Transfer-Protocol, RFC959 compatible) server. By using FTP client software from your PC, you can access the files stored on the media in this instrument. For information on how to use FTP on your PC, refer to the explanation provided with the FTP software.

### Settings

The following three settings are available: User Name, Password, and Access Control.

Move the cursor to make the appropriate settings.

Passwords are displayed as "\*\*\*\*\*".

### User Name, Password

Use these as authentication when logging onto this instrument's FTP server. If these items are set, you cannot log on unless they are entered correctly. If you leave these settings blank, authentication is not required and anyone can log onto this instrument's FTP server. Further, leave both entry boxes blank when logging on anonymously from the FTP client.

### Access Control

This setting controls external access to this instrument. Select a setting from the following items.

[Load only]: From external sources, files can only be loaded.

[Read and write enabled]: From external sources, files can be read or written to, or deleted.

### Relationship Between the Various Media and Directories

Each media can be viewed as a directory on the FTP server.

/FD a Floppy disk

/PC a PC card

/MO a Internal MO drive

/HDD a Hard disk drive

/SCSI a External MO drive

/RAM a Internal RAM drive

/STORAGE/BIN a Binary files stored in the memory

/STORAGE/TEXT a Text files stored in the memory

In the above list, "/STORAGE" is not actually a media, but by accessing the storage memory, you can access measured data stored in the memory just as you can access binary and text files.

If the A and B cursors are displayed with this data, Partial Save and Channel to Save are the only Display Channel settings available. When the memory is split, you can store as many files as there are blocks. For example, DATA001.MEM, DATA002.MEM, and so on. However, the number attached to the data file is not the same as the block number, and numbers are attached sequentially to blocks that contain data. Thinning is not available when saving data in text format.

Further, files in "/STORAGE" (files stored in the memory) can only be loaded, and files cannot be written to "/STORAGE".

**Restrictions**

The following restrictions apply when using the FTP service.

Files cannot be accessed during measurement.

The service must be partially terminated to access files during measurement.

If necessary, perform one of the following:

- Wait until measurement is finished.
- Stop measurement using the 9333 remote control.
- Use the pre-software for starting and stopping measurement on this instrument planned to be provided on the HIOKI Web site.
- Use the following FTP SITE commands.
  - SITE START: Starts measurement
  - SITE STOP: Stops measurement
  - SITE ABORT: Aborts the current action
  - SITE STAT: Returns the status(During measurement, returns "211 START", and when stopped, returns "211 STOP".)

Further, you require an FTP client that can send recognized commands directly to the server when using SITE commands.

For example, when using the command line FTP client from the Windows command prompt, use the "literal" command to send a "SITE" command, such as "FTP>literal SITE START".

- Generally, only one connection is allowed at any one time.

Therefore, please avoid using high-speed download tools that use multiple connections.
- Because FTP does not define the format in which file information is to be exchanged, depending on the FTP client you are using, you may not be able to display file information properly.
- Only commonly used FTP commands are supported.

Therefore, if you are using an FTP client that uses commands that are not supported, you may not be able to use them.

## 11.3 PPP connection

The instrument can be connected to a telephone circuit via a LAN connection that runs through a PC by using a modem card and PPP (Point-to-Point Protocol). If a modem card is inserted into the instrument, PPP takes priority, and the instrument's internal LAN stops.

Since a LAN connection is made, the 9333 and FTP can be used via the telephone circuit.

When the PC is dialed from this instrument, the RAS server must be running in order for the PC to receive the signal. For details on the RAS server, refer to the Windows help file, since the server is supplied with Windows. This instrument's PPP uses PAP, which does not use encoding for authentication.

When the instrument is connected in this manner, its IP address while the instrument is receiving data is 192.168.55.2, and the IP address of the sender is 192.168.55.1. When data is being sent, the IP address for the instrument differs depending on receiver settings, but normally when using Windows 98, "192.168.55.2" is assigned as the IP address for the instrument, and "192.168.55.1" as that for the receiver. The actual IP address allocated to the recorder is displayed in Current IP on the PPP screen in Communications located in System Settings.

For details on PC cards that can be used with the instrument, refer to HIOKI's Web site. (URL <http://www.hioki.co.jp>)

### Settings

Settings can be broadly divided into the following two categories:

Recorder --> PC outbound settings

PC --> recorder inbound settings

Other common settings fall outside of these two categories.

All common settings can be made from the PPP screen in Communications located in System Settings.

### **Outbound settings**

If LAN is set as the save location for the Auto Save and Save buttons, when files are saved, the PC is dialed from the recorder and the data saved in the specified location.

Two locations (A and B) can be registered as the dial destination, and dialing is performed according to the settings made in Pattern on the PPP settings screen.

However, when data is being sent from the PC to the recorder, dial operations are not necessary because the inbound connection is used instead.

- "Outbound" user name and password  
Sets a user name and password used for authentication when connecting to a PC. Passwords are displayed as "\*\*\*\*\*".  
User names and passwords are common to both the A and B dial destinations.
- Dial A/B telephone numbers  
Sets the telephone number for the connection point. Two locations (A and B) can be specified. When only specifying one location, set A.
- DNS specification and IP addresses for Dial A/B  
When using the DNS connection point, select this setting and set the IP address for DNS. If you want the IP address to be automatically acquired upon connection, set Automatic Acquisition as the Priority Setting.
- Dial A/B data collection server  
Specifies the PC on which the 9333 data collection server is operating.  
Connection point: Specifies the device for connection.  
IP Address: Specifies the server using IP.  
Host Name: Specifies the server using a host name (DNS is required).  
When IP Address is selected, an IP address is set in the next column below. When Host Name is selected, a host name is set in the next column below.
- Save backup  
When files are set to be saved automatically (when LAN is selected as the Save Media), a backup media is set for the instrument according to the following connection patterns.
- Save pattern  
Specifies a pattern for connection when files are saved automatically.  
When an inbound connection is made, the pattern applies to the inbound connection only.  
A --> B --> backup: Changes the save destination in order until successful.  
(A --> B) + backup: Tries A --> B in order, and makes a backup of files regardless of whether the save was successful.  
(A + B) --> backup: Saves to both A and B save locations, and makes a backup of files if both attempts to save to A and B fail.  
A + B + backup: Saves to all three locations.



## Inbound settings

Set when the recorder is dialed from the PC.

- "Inbound" receipt permission  
Sets whether the recorder is able to receive data from an external source.
- "Inbound" user name and password  
Sets a user name and password used for authentication when receiving data.  
Passwords are displayed as "\*\*\*\*\*".
- "Inbound" DNS specification and IP addresses  
When using the DNS connection point, select this setting and set the IP address for DNS. If you want the IP address to be automatically acquired upon connection, set Automatic Acquisition as the Priority Setting.
- "Inbound" data collection server  
Specifies the PC on which the 9333 data collection server is operating.  
Connection point: Specifies the device for connection.  
IP Address: Specifies the server using IP.  
Host Name: Specifies the server using a host name (DNS is required).  
When IP Address is selected, an IP address is set in the next column below. When Host Name is selected, a host name is set in the next column below.

## Other settings

Settings common to both inbound and outbound settings can be made.

- FTP, User Name, Password, Access Control  
Sets FTP. For details, see section 11.2.
- Port Number, Delimiter, Header  
Sets the delimiter/header that is used when a port number or communications command is used by the device. For details, see section 11.1.
- AT Commands  
AT commands can be specified as an option on the modem.  
For example, when using a cellular phone, a command that specifies data communications may be required. (For command details, refer to the instructions for the modem you are using.)
- Disconnect Timeout  
If no communications are performed, the connection is cut once the specified time has elapsed.
- Using PPP  
Connect the external modem to the RS-232C card, and select ON to use PPP.

## 11.4 PC Card Interface

Make settings for the RS-232C interface and GP-IB interface.

Press the Next (F3) key on the Communications screen to display the screen for making PC card interface settings.

When the PC card is inserted, it is automatically recognized, and you can make the necessary settings.

### RS-232C

PC Card	RS-232C
Speed	9600
Data	8bit
Parity	NONE
Stop	1bit
Delimiter	CR+LF
Header	OFF
Flow	NONE

Transfer rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Data length	8 or 7 bits
Parity	None, even, or odd
Stop bit	1 or 2 bits
Delimiter	LF, CR+LF
Header	On or off
Flow control	None, Xon/Xoff, or hardware

### GP-IB

PC Card	GP-IB
Mode	ADDRESSABLE
Address	5
Header	OFF

Mode	Addressable or disable
Address	(0 to 30)
Header	Off or on

#### NOTE

For detail, see application disk (CD-R) supplied with the instrument.

# Appendix

## Appendix 1 Error Messages

The instrument 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 001: Print paper run out.	Set recording paper.
ERROR 002: Set printer lever.	Lower the printer lever.

### 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 003: Print paper run out.	Set recording paper.
WARNING 004: Set printer lever.	Lower the printer lever.
WARNING 005: Invalid. (Shot:CONT.)	Set the recording length of other than that of continuous recording.
WARNING 006: Cannot set. (Time/Div 10ms-200ms).	When the recording length is continuous, the printer cannot be used.
WARNING 007: Printer is not installed.	It can not be printed.
WARNING 010: Mount media.	Set the recording media.
WARNING 011: Illegal format.	The recording format is not MS-DOS. It is probably a double-density floppy disk.
WARNING 012: Write Protected.	The media is write-protected. Release the write-protect.

WARNING 013: Disk full.	The media is running low on storage space. Cannot save. Delete files or use a new media.
WARNING 014: File is read only.	This is a read-only file. Save or delete is not possible.
WARNING 015: General failure.	File cannot be accessed because of unsuccessful formatting or save.
WARNING 016: File already exists.	Change the file name.
WARNING 017: Directory already exists.	Change the directory name.
WARNING 018: Directory full.	There are restrictions to the files and directories created in the root directory.
WARNING 020: Path name error.	Set to a maximum of 127 characters.
WARNING 021: Internal error.	Internal error occurred. Check the media.
WARNING 022: Can't save without waveform.	Capture waveform data.
WARNING 023: Conditions for OVERWRITE are not satisfied.	Align the file functions and time axis range with the instruments measurement data.
WARNING 030: AUTORANGE_FAULT	Check the input signal.
WARNING 031: AB cursor positions invalid.	Cursors A and B overlap. Check the cursor positions.
WARNING 032: Zero Adjustment is necessary.	Perform zero adjust.
WARNING 034: Invalid. (OVER LAY)	Not possible because superimpose is not active.
WARNING 036: No comparison AREA.	Set the trigger.
WARNING 037: Up to 1000 event markers are available.	Up to 1000 event markers are available.
WARNING 048: The recorder time axis range has been changed.	There are restrictions for pairing the memory and recorder time axes when using REC&MEM.
WARNING 049: The memory time axis range has been changed.	There are restrictions for pairing the memory and recorder time axes when using REC&MEM.
WARNING 050: Cannot use. (Roll Mode)	Cannot use roll mode when superimpose is active.
WARNING 051: Cannot use. (Roll Mode, Pre Trigger)	Cannot use roll mode or pre-trigger functions when using external sampling.
WARNING 052: Cannot use.(Roll Mode, Memory Division)	Cannot use roll mode or memory segmentation functions when using averaging.
WARNING 054: Cannot use. (Averaging, Overlay)	Cannot use averaging or superimpose function when roll mode is active.
WARNING 056: Cannot use. (Realtime Print)	Recording length cannot be continuous when the recorder time axis is set between 10 ms and 200 ms.
WARNING 057: Cannot set. (External sampling)	Cannot use roll mode when using external sampling.
WARNING 058: Cannot use. (Averaging)	Cannot use the averaging function when using the memory segmentation.
WARNING 060: No waveform data.	Capture waveform data.
WARNING 061: Cannot use roll mode, averaging, or memory split functions.	When waveform calculation is enabled, roll mode, averaging, and memory split functions cannot be used.
WARNING 062: The memory recording length is too short.	More data than FFT points is required when using the FFT function.Capture a waveform that has more data than the number of FFT points.
WARNING 063: Trigger priority is not available.	When averaging is enabled, trigger priority cannot be set.

WARNING 064: The number of clamps that can be used is limited.	Check the number of clamps that can be used, and make sure you do not use more than this number.
WARNING 065: The overlay and waveform evaluation functions cannot be used.	Turn off the Roll mode.
WARNING 066: Failed to detect the zero cross.	Set the zero cross filter so that the zero cross can be detected.
WARNING 080: In key lock.	Keylock is engaged.
WARNING 085: Failed to log onto PPP.	Check password, user name, and PC settings.
WARNING 086: Modem error	Check the AT commands option.
WARNING 087: PPP: Connection failed.	Check connection and settings.
WARNING 088: PPP: Bad Telephone number.	Check the phone number.
WARNING 089: PPP: Connection was aborted.	Connection aborted.
WARNING 090: LAN: Bad MAC address.	Set or check the MAC address.
WARNING 091: LAN: Bad IP address.	Check the IP address.
WARNING 092: LAN: Bad server IP address.	Check the server's IP settings.
WARNING 093: LAN: Can not connect to server.	Check the settings and connection.
WARNING 094: LAN: Can not connect to 9333.	Check the settings and connection of the 9333.
WARNING 095: LAN: Connection timed out.	Check the connected device.
WARNING 096: LAN: Transfer was aborted.	Check the connected device.
WARNING 097: LAN: Network error.	Check the instrument and connected device.
WARNING 098: LAN: Server not found or DNS failed.	Check IP or server settings.
WARNING 099: LAN: DHCP failed.	Check the DHCP server.

## Appendix 2 Glossary

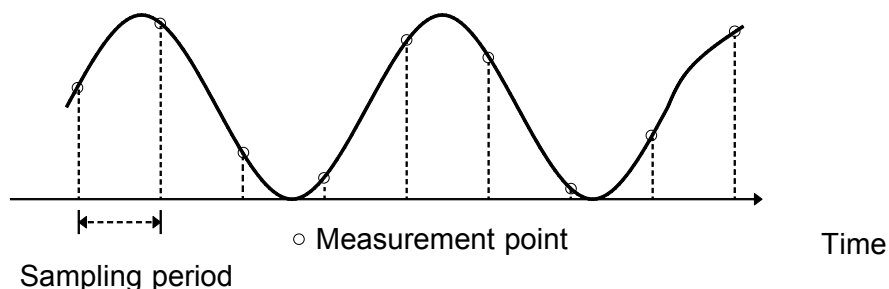
A/D	Conversion of an analog quantity into a digital quantity
Aliasing	Phantom signal components; a phenomenon that occurs if sampling frequency is low in relation to the frequency of the sampled signal (see Appendix 3.2).
Analog	Continuous physical quantity such as voltage or current
Attenuator	Device 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
Chassis	Metal frame of the instrument
Comment	Notations such as the recording paper and printable measurement conditions that can be entered by the user.
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)	Unit to indicate the measurement
Dynamic range	Ratio of maximum vs. minimum amplitude that can be displayed
FFT	Fast Fourier Transform
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 formatting	Formatting that writes basic file structure information to the physically-formatted disks, making them compatible for use with the 8855 system.
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
Physical formatting	Preparatory formatting necessary before use of floppy 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
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.

## Appendix 3 Reference

### Appendix 3.1 Sampling

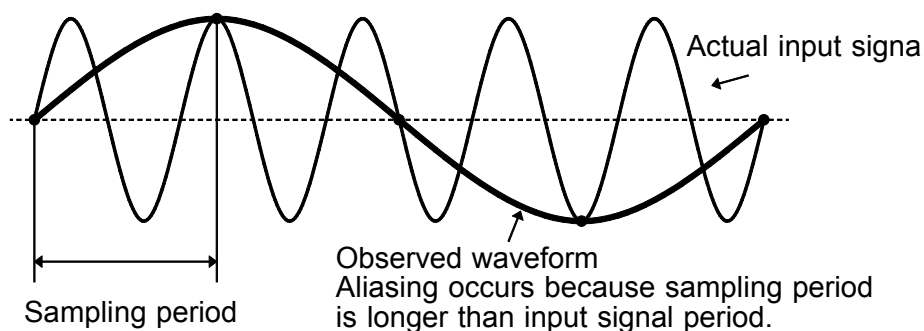
- The 8855 converts the input signal to a digital value, then carries out all internal processing digitally. This process of converting an analog signal to digital values is termed sampling.
- Sampling measures the magnitude of the signal at fixed time intervals (sampling periods).



- 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 ( $1/T$ ).

### Appendix 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.

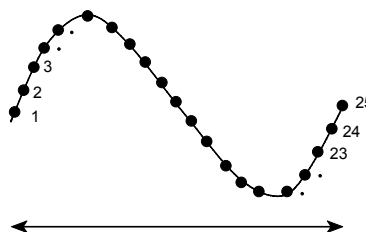


- When using the memory function, because the sampling period for the time axis range may vary widely, care should be taken in setting the range not to produce aliasing.
- The measurement frequency limit is determined by the setting of the time axis range. In any event, it is always best to use the highest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



## Appendix 3.3 Measurement Limit Frequency

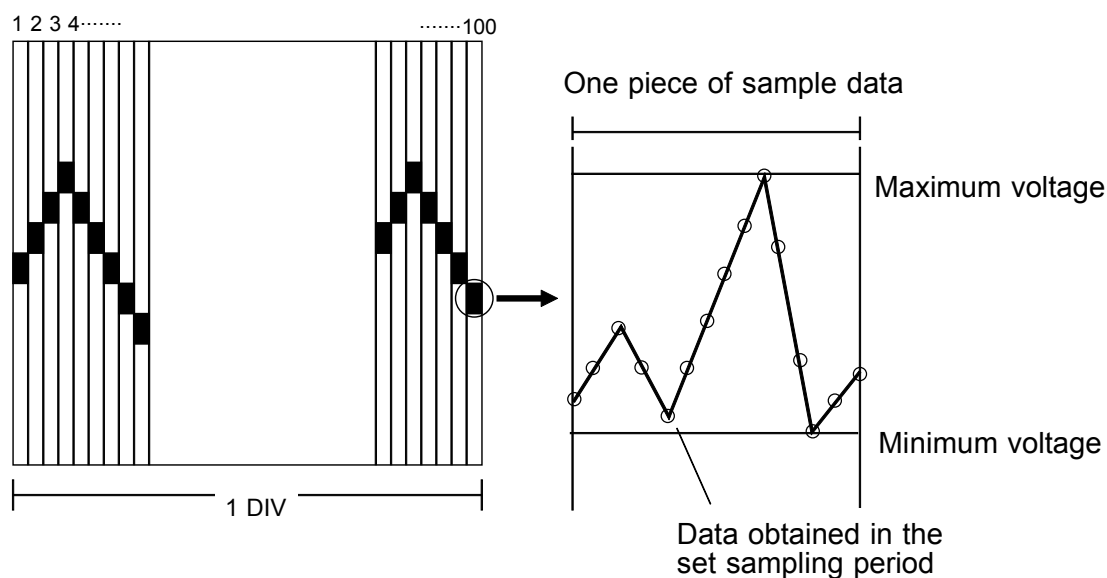
- As a general rule, to ensure that sampling catches the peaks of a typical sine wave input on the display, more than 25 samples are required for each input cycle.
- The measurement limit frequency changes depending on the time axis range.



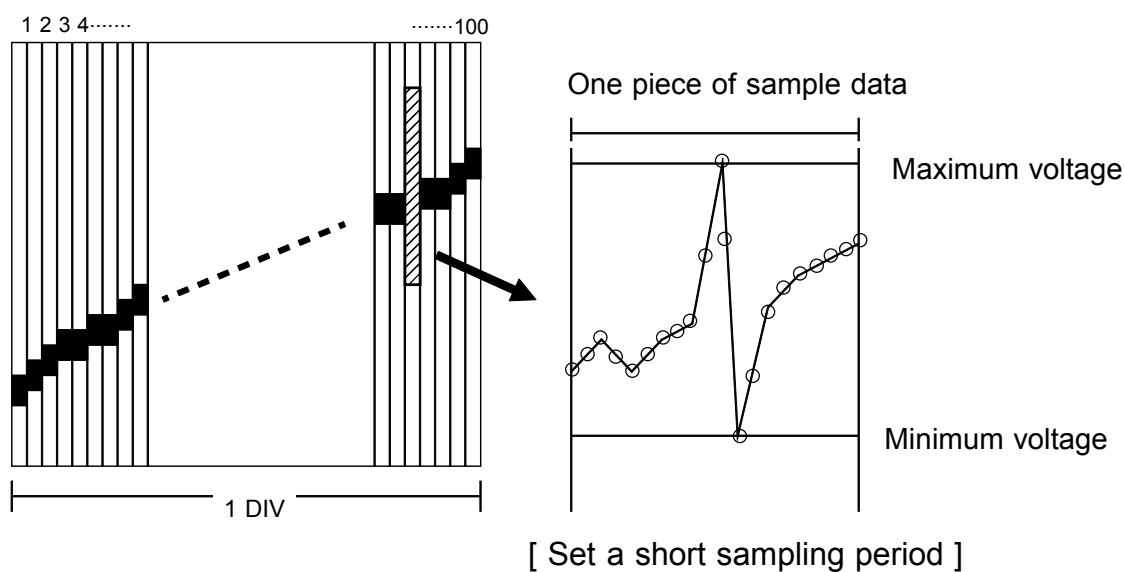
TIME/DIV (s/DIV)	Sampling period (s)	Measurement limit frequency (Hz)
5 $\mu$ s/DIV	50 ns	800 kHz
10 $\mu$ s/DIV	100 ns	400 kHz
20 $\mu$ s/DIV	200 ns	200 kHz
50 $\mu$ s/DIV	500 ns	80 kHz
100 $\mu$ s/DIV	1 $\mu$ s	40 kHz
200 $\mu$ s/DIV	2 $\mu$ s	20 kHz
500 $\mu$ s/DIV	5 $\mu$ s	8 kHz
1 ms/DIV	10 $\mu$ s	4 kHz
2 ms/DIV	20 $\mu$ s	2 kHz
5 ms/DIV	50 $\mu$ s	800 Hz
10 ms/DIV	100 $\mu$ s	400 Hz
20 ms/DIV	200 $\mu$ s	200 Hz
50 ms/DIV	500 $\mu$ s	80 Hz
100 ms/DIV	1 ms	40 Hz
200 ms/DIV	2 ms	20 Hz
500 ms/DIV	5 ms	8 Hz
1 s/DIV	10 ms	4 Hz
2 s/DIV	20 ms	2 Hz
5 s/DIV	50 ms	0.8 Hz
10 s/DIV	100 ms	0.4 Hz
30 s/DIV	300 ms	0.13 Hz
1 min/DIV	600 ms	0.067 Hz
2 min/DIV	1.2 s	0.033 Hz
5 min/DIV	3 s	0.013 Hz

## Appendix 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.



## Appendix 3.5 Averaging Equations

For time axis averaging in memory functions, summing averaging is synchronized by the trigger.

If trigger synchronization is not performed, the results will be meaningless.

### Summing averaging

Captured data are added sequentially and the sum is divided by the number of samples.

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

$n$             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.

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

$N$             Specified averaging count  
 $n$             Averaging count  
 $A_n$         Result of  $n$  times averaging  
 $Z_n$          $n$ -th measurement data

## Appendix 3.6 "2-point method" Scaling Equation

$$Y = \{(SCH - SCL)/(VH - VL)\} x + \{(VH \times SCL - VL \times SCH)/(VH - VL)\}$$

VH: Voltage high point            SCH: Scaling high point

VL: Voltage low point            SCL: Scaling low point

The ranges for the parts enclosed in dotted lines are as follows.

$$-9.9999E+9 \leq \{ \quad \} \text{value of enclosed part} \leq -1.0000E-9$$

$$-9.9999E+9 \leq \{ \quad \} \text{value of enclosed part} = 0$$

$$+1.0000E-9 \leq \{ \quad \} \text{value of enclosed part} \leq +9.9999E+9$$

- 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.

## Appendix 3.7 Waveform Parameter Calculation Details

### (1) Average value

Calculates the average value (V) of the waveform data.

$$AVE = \frac{1}{n} \sum_{i=1}^n di$$

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.

$$RMS = \sqrt{\frac{1}{n} \sum_{i=1}^n di^2}$$

AVE      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

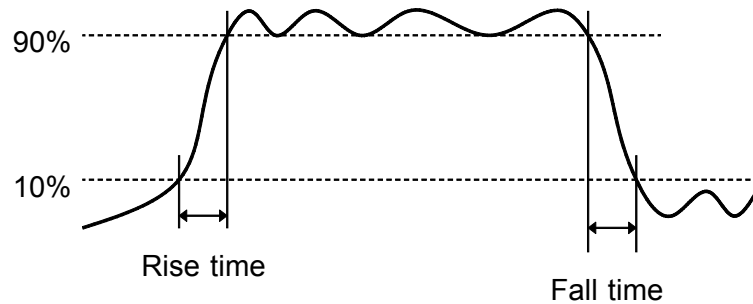
### (9) Frequency

- 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.



It is possible to set values of the rise time (10% to 90%) and of the fall time to (90% to 10%).

## (12) Standard deviation

Calculates the standard deviation (V) of the waveform data.

$$\sigma = \sqrt{\left\{ \sum_{i=1}^n (d_i - AVE)^2 / n \right\}}$$

$\sigma$  standard deviation

AVE effective value

$n$  number of data samples

$d_i$   $i$ -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.

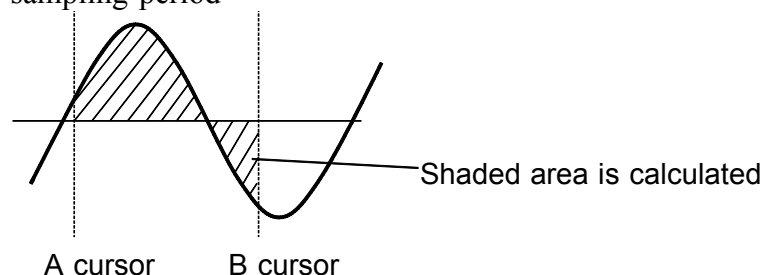
$$S = \sum_{i=1}^n |d_i| \cdot h$$

$S$  Area value

$n$  number of data samples

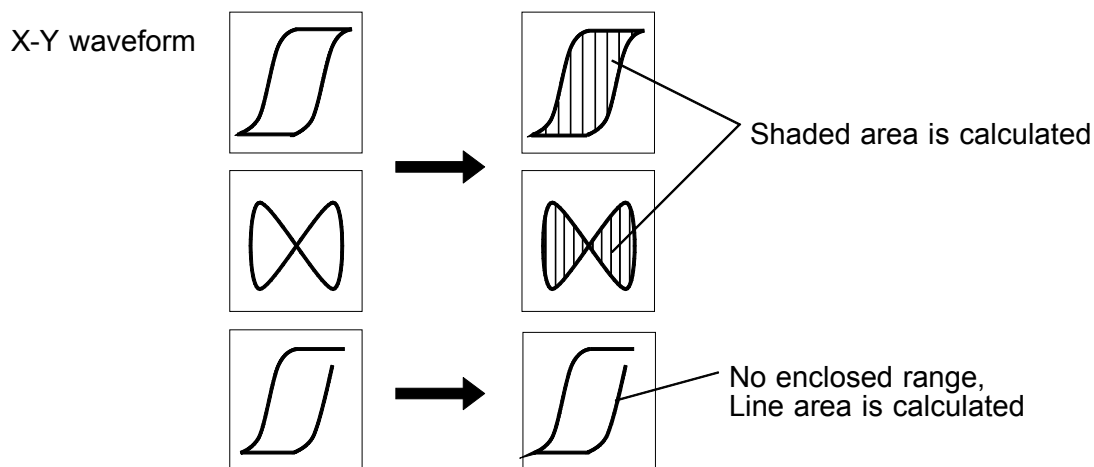
$d_i$   $i$ -th data of the source channel

$h = \Delta t$  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 Quick Start Section 8.2.) for X-Y plotting and area calculation.
- On the X-Y screen of the memory function, it is not possible to specify the range with the A/B cursors.

**(15) Specified level time**

Searches from the top of the arithmetic range to the point intersecting the specified level to find the time from that point to the trigger.

**(16) Pulse width**

Calculates the time difference between the point where the rising or falling waveform intersects the set level and the intersection of the next opposite slope.

**(17) Duty Ratio**

The ratio is calculated according to the time difference between the point where the rising waveform intersects the set level and the intersection of the next opposite slope. It can also be calculated according to the time difference between the point where the falling waveform intersects the set level and the intersection of the next opposite slope.

$$\text{Duty Ratio} = \frac{\text{Tu-d}}{\text{Tu-d} + \text{Td-u}} \times 100 (\%)$$

Tu-d: Time from rise to fall (s)

Td-u: Time from fall to rise (s)

**(18) Pulse Count**

Counts the pulse's number of intersections of the set level by the rising or falling waveform.

**(19) Arithmetic Operations**

Selects any result between (1) and (18) to be processed through the arithmetic operations.

**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 5.3).

## Appendix 3.8 Details on Operators

This section describes the operators used in waveform operation. The parameter "bi" shows the operational result, and "di" 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)

$$b_i = |d_i| \quad (i = 1, 2, \dots, n)$$

### (3) Exponential (EXP)

$$b_i = \exp(d_i) \quad (i = 1, 2, \dots, n)$$

### (4) Common logarithm (LOG)

$$\text{When } d_i > 0, b_i = \log_{10} d_i$$

$$\text{When } d_i = 0, b_i = -\infty \text{ (overflow value is output)}$$

$$\text{When } d_i < 0, b_i = \log_{10} |d_i| \quad (i = 1, 2, \dots, n)$$

Use the following equation to convert to natural logarithm:

$$\ln X = \log_e X = \log_{10} X / \log_{10} e$$

$$1 / \log_{10} e \approx 2.33E + 0$$

### (5) Square root (SQR)

$$\text{When } d_i \geq 0, b_i = \sqrt{d_i}$$

$$\text{When } d_i < 0, b_i = -\sqrt{|d_i|} \quad (i = 1, 2, \dots, n)$$

### (6) Moving average (MOV)

$$b_i = 1/k \sum_{t=i-k/2}^{i+k/2} d_t \quad (i = 1, 2, \dots, n)$$

dt: t-th data of source channel

k: number of points for averaging (1 to 4000)

1 DIV = 100 points

### (7) Parallel displacement on time axis (SLI)

Shifts the value on the time axis by a certain number of points.

$$b_i = d_{i-k} \quad (i = 1, 2, \dots, n)$$

k : number of points for averaging (-4000 to 4000)

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.

When the input voltage becomes small, processing results will show little variation. In such a case, apply the MOV operator.

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

$h = \Delta t$ : sampling period

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.

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

$h = \Delta t$ : sampling period

2st integral

Point  $t_1$   $\Pi_1 = 0$

Point  $t_2$   $\Pi_2 = (I_1 + I_2)h/2$

Point  $t_3$   $\Pi_3 = (I_1 + I_2)h/2 + (I_2 + I_3)h/2 = \Pi_2 + (I_2 + I_3)h/2$

Point  $t_n$   $\Pi_n = \Pi_{n-1} + (I_{n-1} + I_n)h/2$

$\Pi_1$  to  $\Pi_n$ : processing result data

**(12) Sine (SIN)**

$b_i = \sin(d_i)$  ( $i = 1, 2, \dots, n$ )

**(13) Cosine (COS)**

$b_i = \cos(d_i)$  ( $i = 1, 2, \dots, n$ )

**(14) Tangent (TAN)**

$b_i = \tan(d_i)$  ( $i = 1, 2, \dots, n$ )

$-10 \leq b_i \leq 10$

**(15) Arc-sine (ASIN)**

$b_i = \pi/2$   $d_i > 1$

$b_i = \text{asin}(d_i)$   $-1 \leq d_i \leq 1$

$b_i = -\pi/2$   $d_i < -1$

**(16) Arc-cosine (ACOS)**

$b_i = 0$   $d_i > 1$

$b_i = \text{acos}(d_i)$   $-1 \leq d_i \leq 1$

$b_i = \pi$   $d_i < -1$  ( $i = 1, 2, \dots, n$ )

**(17) Arc-tangent (ATAN)**

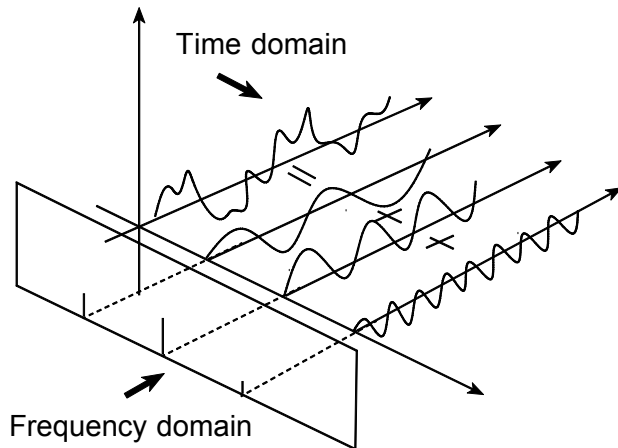
$b_i = \text{atan}(d_i)$  ( $i = 1, 2, \dots, n$ )

The unit for the Trigonometric and inverse trigonometric functions (12) - (17) is rad (radian).

## Appendix 3.9 FFT Function

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.

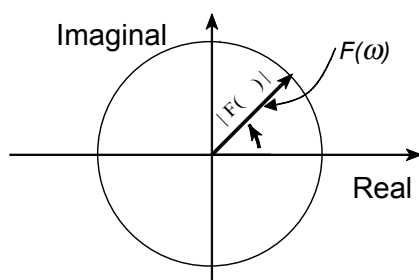
Waveform in the figure on the left is an example of such a signal.

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.

$$F(\omega) = \mathfrak{F} \{f(t)\} = \int_{-\infty}^{+\infty} f(t) \cdot \exp(-j\omega t) dt \quad 2$$

$$f(t) = \mathfrak{F}^{-1} \{F(\omega)\} = \frac{1}{2\pi} \int_{-\infty}^{+\infty} F(\omega) \cdot \exp(j\omega t) d\omega \quad 3$$

The function  $F(\omega)$  generally results in a complex number, and can be expressed as follows.

$$F(\omega) = |F(\omega)| \cdot \exp(j\phi(\omega)) = |F(\omega)| \angle \phi(\omega) \quad 4$$

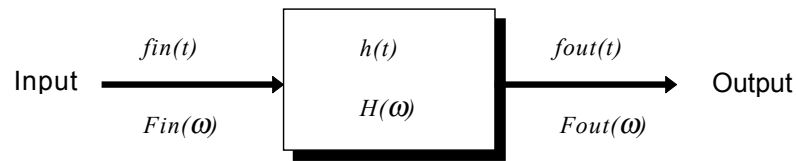
$|F(\omega)|$ : Absolute value spectrum of  $f(t)$

$\phi(\omega)$ : 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

$t, \tau$ : time

$$f_{out}(t) = \int_{-\infty}^{+\infty} f_{in}(\tau) \cdot h(t-\tau) d\tau \quad 5$$

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  $\omega$  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  $h(t)$

$\omega$ : Angular frequency

$$F_{out}(\omega) = F_{in}(\omega) \cdot H(\omega) \quad 6$$

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.

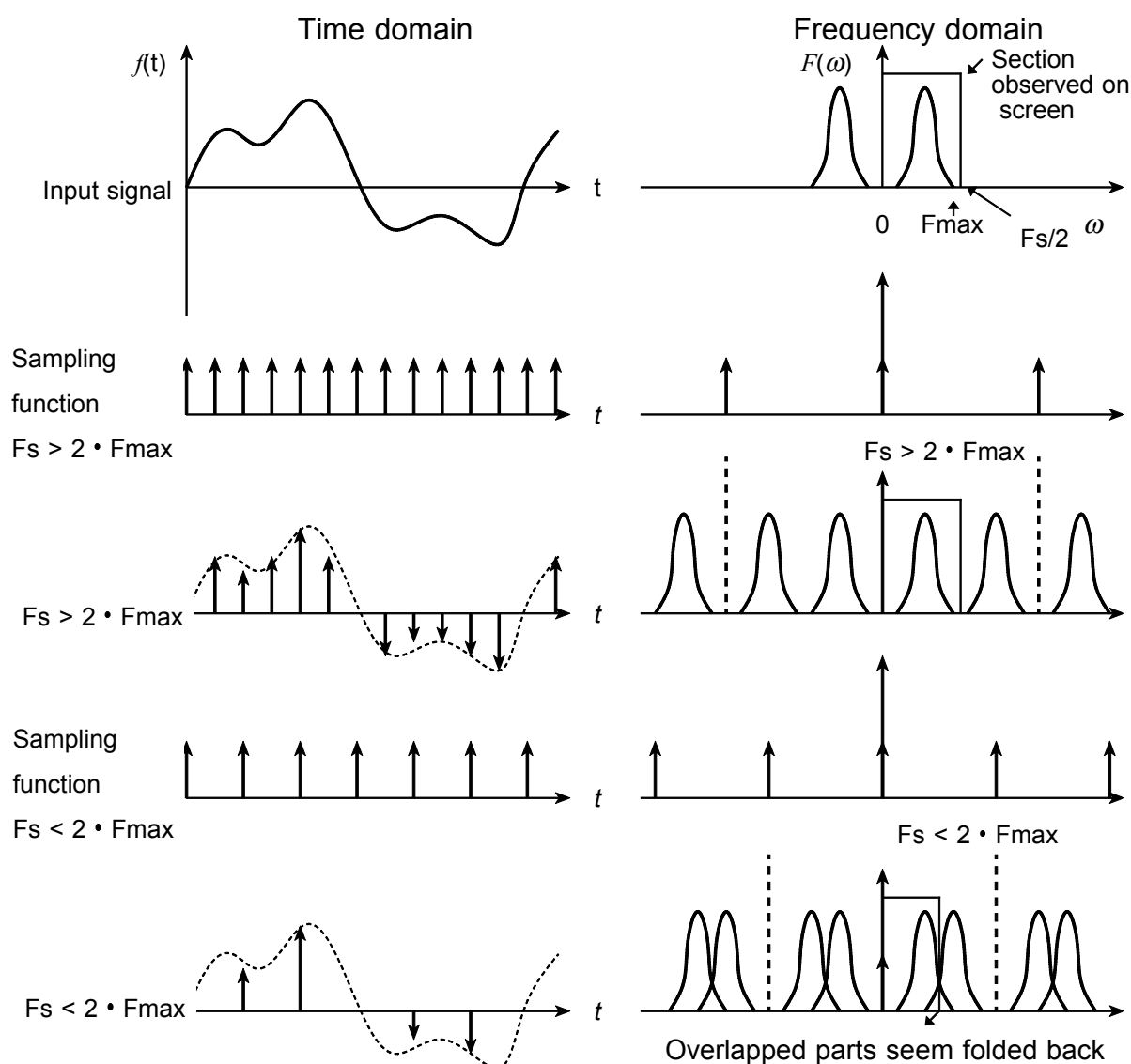
Sampling theorem

$$F_s = 2 \cdot F_{max} \quad 1$$

$F_{max}$ : Highest frequency component to be measured

$F_s$ : Sampling frequency (Nyquist frequency)

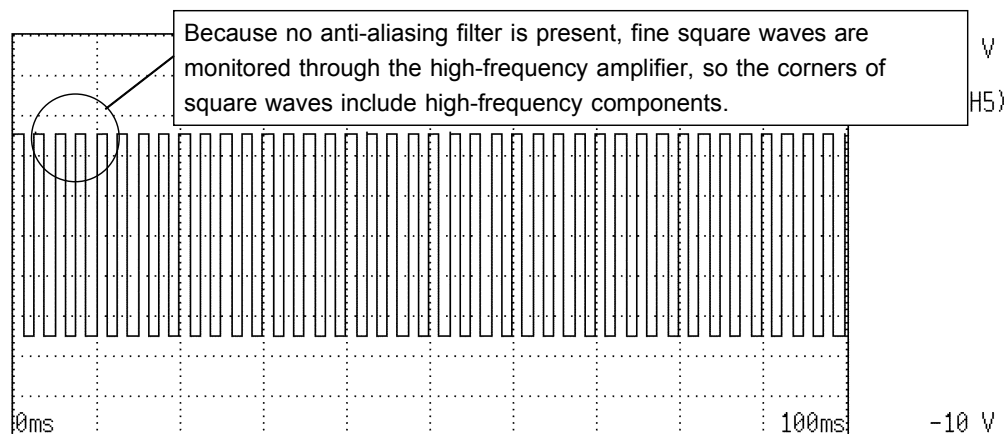
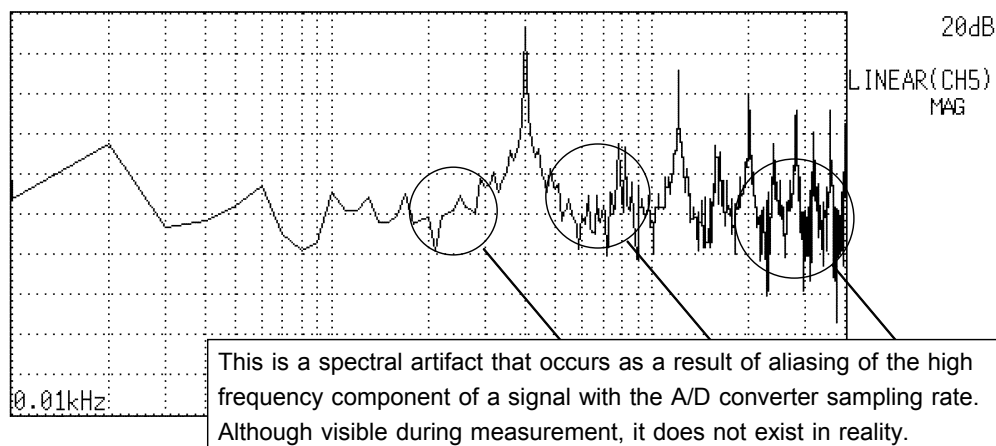
- In order to be able to restore the original waveform from the sampling data, the sampling frequency must be at least twice as high as the signal frequency.
- If sampling is carried out at a frequency lower than the Nyquist frequency, frequency components above 1/2 of the sampling frequency will be aliased to lower frequencies, and the measured signal will appear to contain frequency components that actually do not exist.



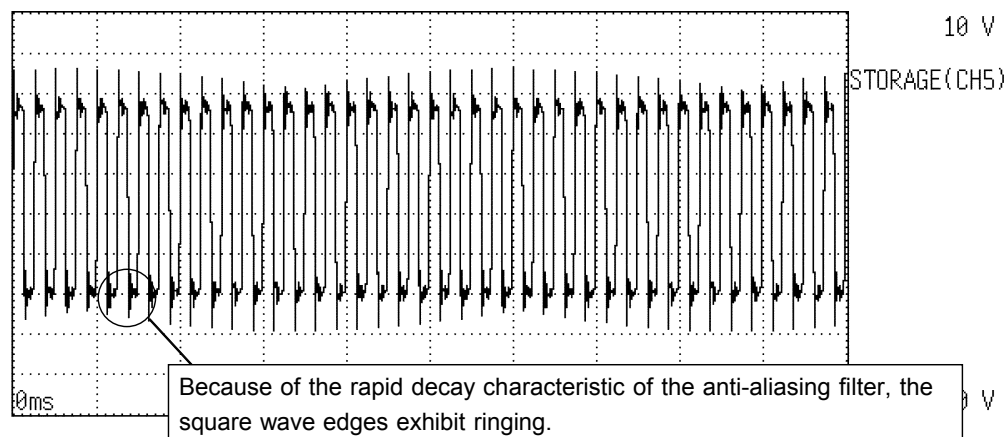
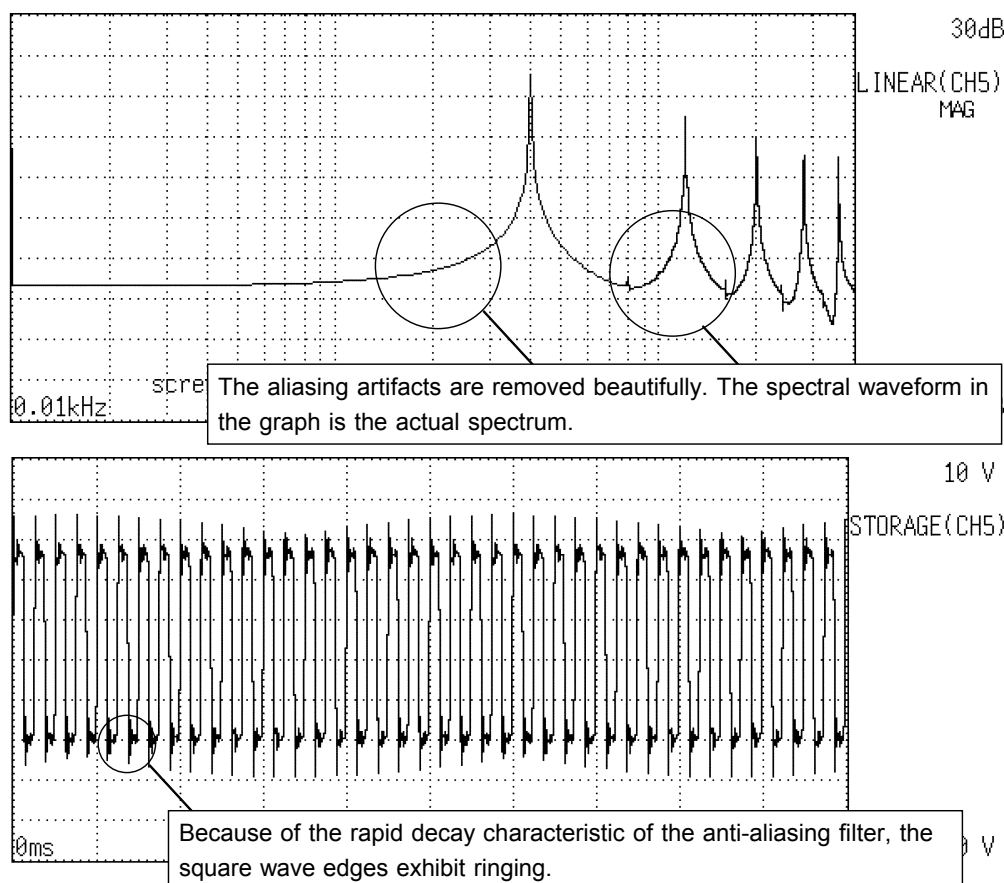
### □ Anti-aliasing filter

- 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 input module incorporates an anti-aliasing filter and therefore allows the 8855 to perform FFT analysis without being subject to aliasing.

When an anti-aliasing filter is not used.



When an anti-aliasing filter is used.

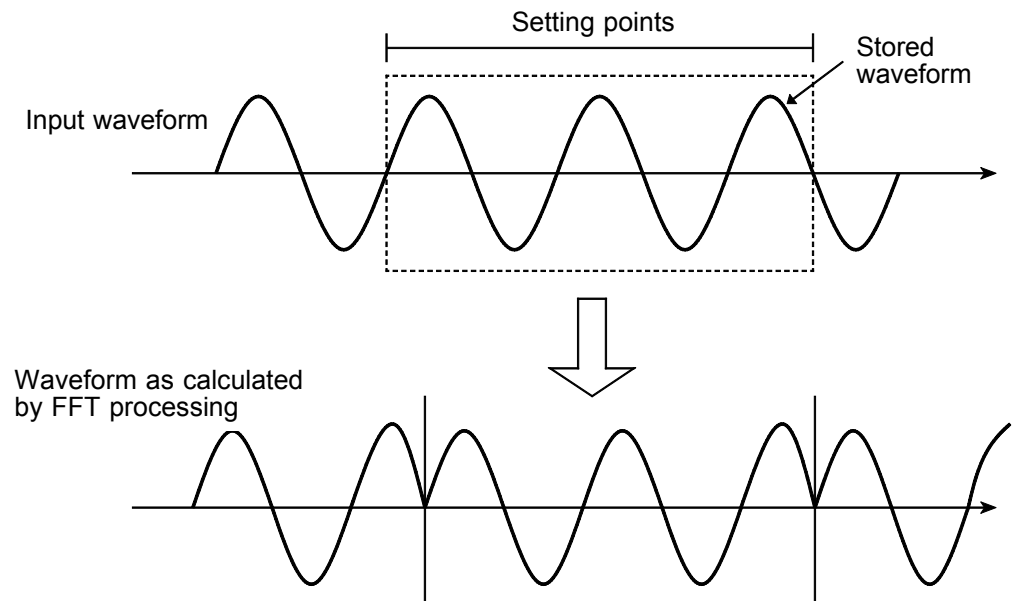


## □ Window processing

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.



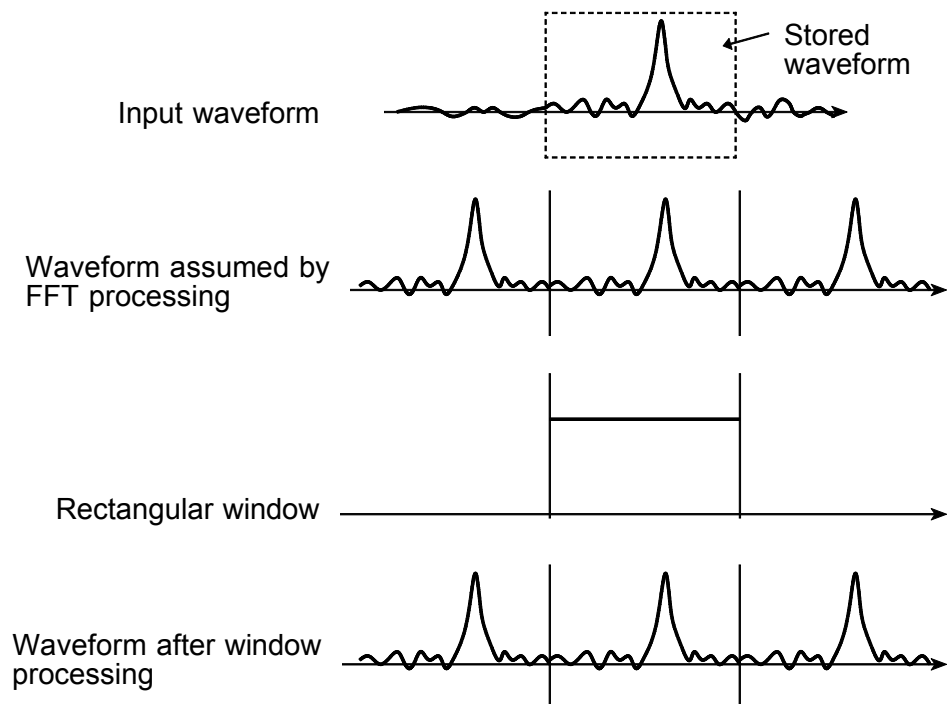
## □ Leakage error

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 8855, 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.

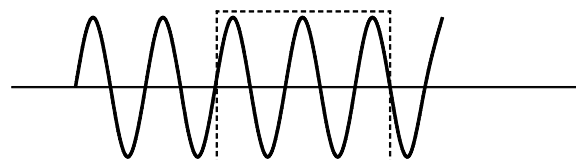
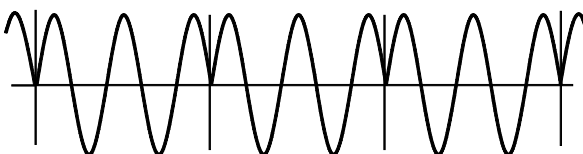
### Rectangular window



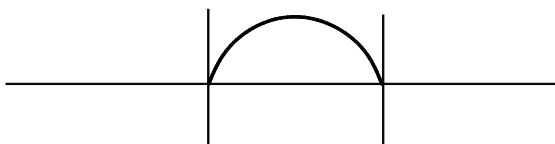
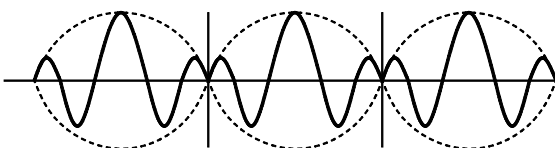


**Hanning window**

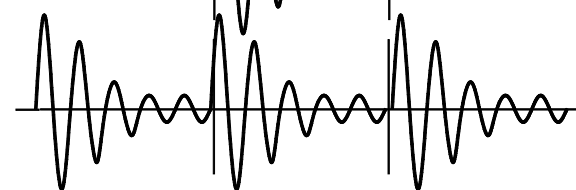
Input waveform

Waveform assumed by  
FFT processing

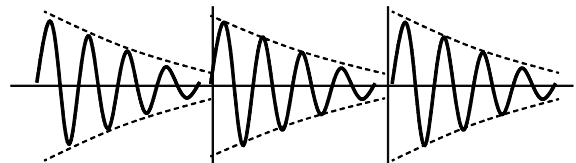
Hanning window

Waveform after window  
processing**Exponential window**

Input waveform

Waveform assumed by  
FFT processing

Exponential window

Waveform after window  
processing

## Appendix 4 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 the viewer by following the procedure below.

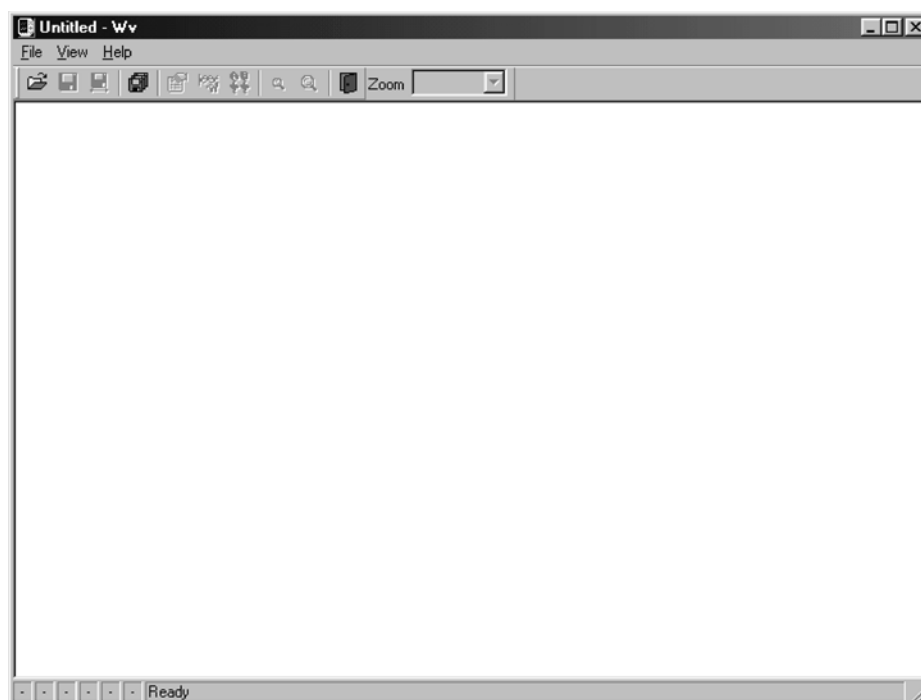
1. Close all active applications.
2. Insert FD into the floppy disk drive.
3. Click the windows Start menu, and select [Run].
4. Enter the following (assuming that your floppy disk drive is A):  
A: \SETUP.EXE
5. Click <OK>.

---

## Appendix 4.1 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 judgement result.

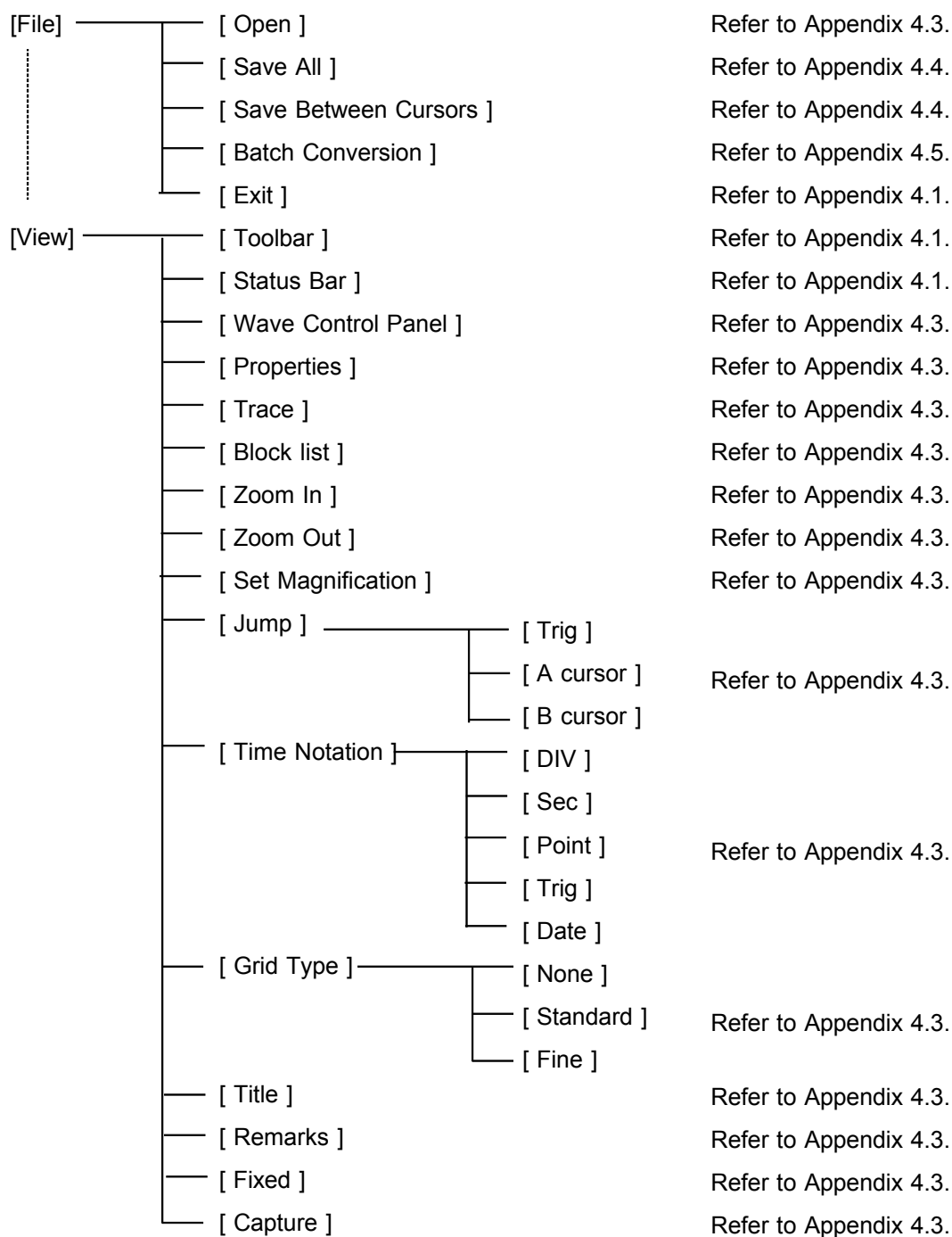
### Version information

When making inquiries, the version number will be required.

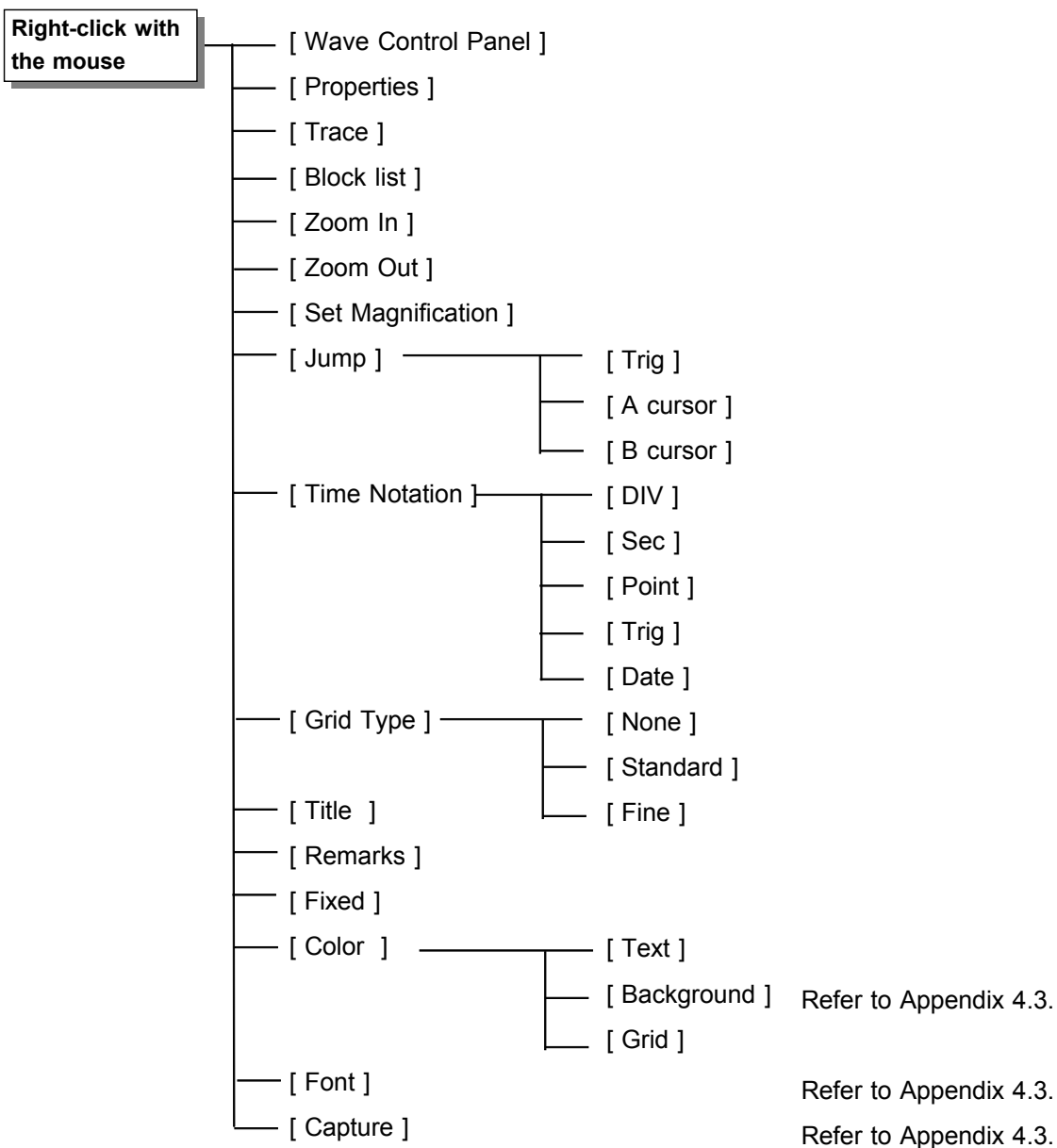
To check the software version number, in the [Help] menu select [About Wv].

## Appendix 4.2 Waveform Viewer Menus

The following is the complete menu tree of the waveform viewer application.



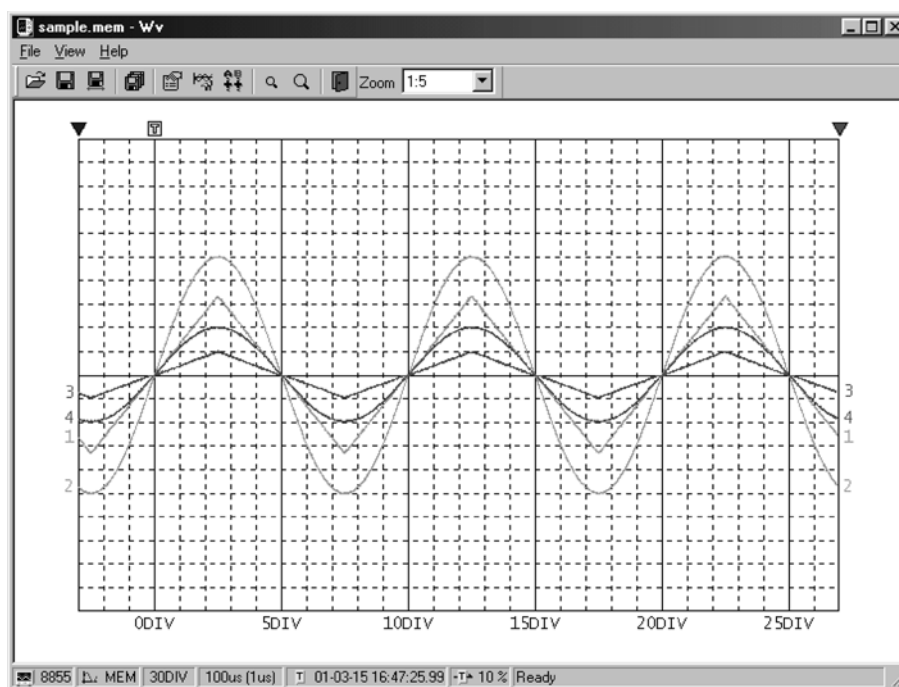
Right-click with the mouse in the waveform display screen for the following functions.



## Appendix 4.3 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.



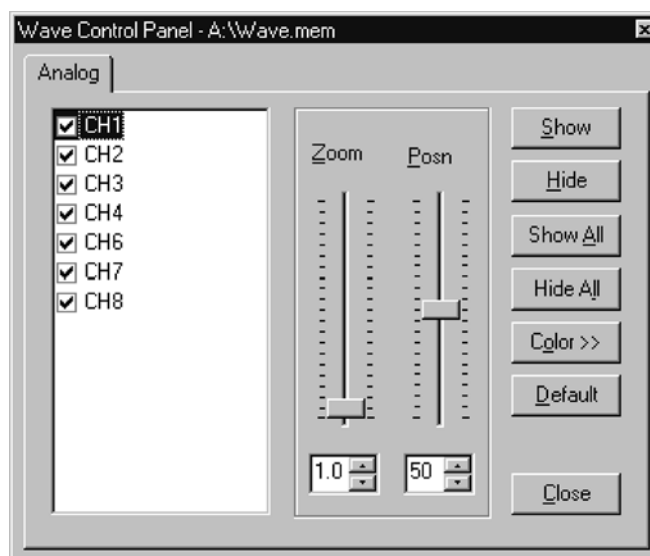
### Changing the time axis scale (zoom function)

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) back 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.

### Finding 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 module 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)**

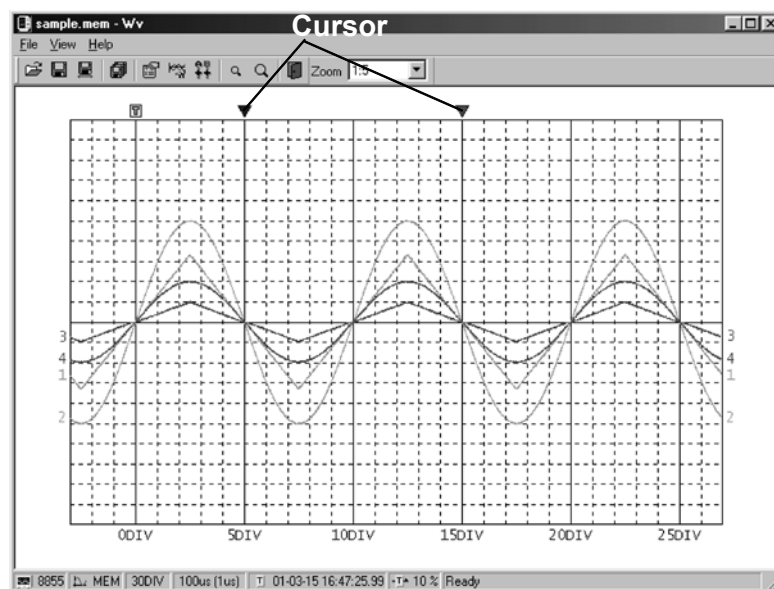
Select [View], then [Capture] on the menu to capture waveform display and copy to clipboard as a bit image. You can paste it into other applications.



## Appendix 4.4 Conversion to CSV Format

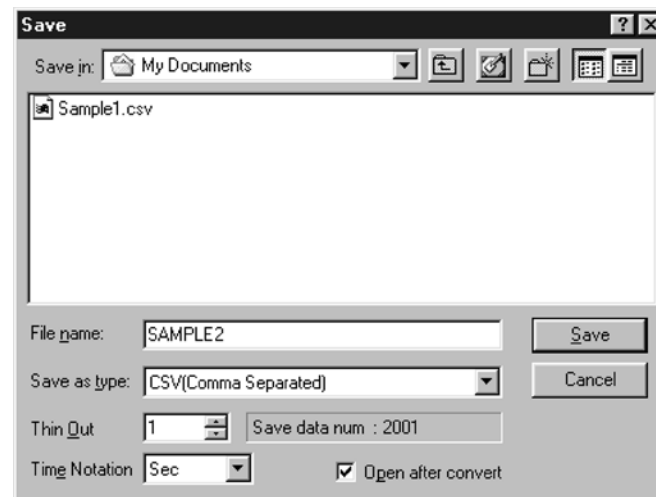
You can convert displayed waveform data to a CSV format file. Once in CSV format, the file can be loaded into spreadsheet or other software for further processing. You can either convert the whole data file or a range selected with the cursors.

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.

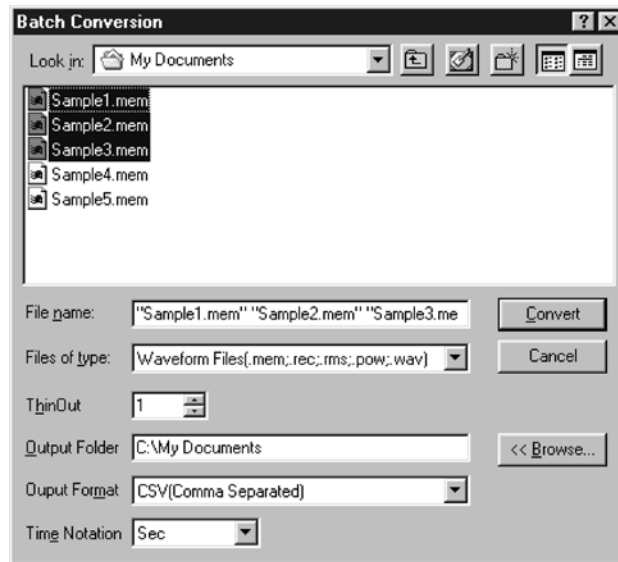
Select [Time Notation] from among [Sec], [Date], [Trig], and [Point].

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.

## Appendix 4.5 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.

## Appendix 5 Size of a Waveform File

### □ In the memory function (Binary data)

Size of a file = header + data

Size of a header = number of W header + number of B header + number of C header + number of L header + number of S header + number of P header

Number of W header = 1

Number of B header = To save in either analog or logic is 1; to save in both analog and logic is 2

Number of C header = number of analog channels to be saved

Number of L header = number of logic probes to be saved

Number of S header = 1

Number of P header = number of PF header + number of PV header

Number of PF header = 2, number of PV header = 4

Size of a header = 8 + number of B header + number of C header + number of L header

Size of a data = size of an analog data\*number of analog data to be saved + size of a logic data (when logic is saved)

Size of an analog data =  $\text{CEILING}(2 * (\text{recording length}(\text{DIV}) * 100 + 1), 512)$

Size of a logic data =  $\text{CEILING}(2 * (\text{recording length}(\text{DIV}) * 100 + 1), 512)$

Multiple of the minimum of b when  $\text{CEILING}(a, b)$  is larger than a

Example:  $\text{CEILING}(3.14, 1) = 4$ ,  $\text{CEILING}(56, 10) = 60$

□ : 32 Mwords (standard) ■ : 128 Mwords (expansion) ■ : 512 Mwords (expansion)

#### Logic not saved

Recording length	Number of analog channels				
	0	1	2	4	8
30		11,264	17,920	31,232	57,856
50		15,360	26,112	47,616	90,624
100		25,600	46,592	88,576	172,544
200		45,568	86,528	168,448	332,288
500		105,472	206,336	408,064	811,520
1000		205,312	406,016	807,424	1,610,240
2000		405,504	806,400	1,608,192	3,211,776
5000		1,005,568	2,006,528	4,008,448	8,012,288
10000		2,005,504	4,006,400	8,008,192	16,011,776
20000		4,005,376	8,006,144	16,007,680	32,010,752
50000		10,005,504	20,006,400	40,008,192	80,011,776
100000		20,005,376	40,006,144	80,007,680	160,010,752
200000		40,005,632	80,006,656	160,008,704	320,012,800
500000		100,005,376	200,006,144	400,007,680	800,010,752
1000000		200,005,632	400,006,656	800,008,704	
2000000		400,005,632	800,006,656		

#### All logic saved

Note  
Logic is channel 4 of  
a module

Recording length	Number of analog channels				
	0	1	2	4	8
30	12,800	19,968	26,624	39,936	65,560
50	16,896	28,160	38,912	60,416	103,424
100	27,136	48,640	69,632	111,616	195,584
200	47,104	88,576	129,536	211,456	375,296
500	107,008	208,384	309,248	510,976	914,432
1000	206,848	408,064	608,768	1,010,176	1,812,992
2000	407,040	808,448	1,209,344	2,011,136	3,614,720
5000	1,007,104	2,008,576	3,009,536	5,011,456	9,015,296
10000	2,007,040	4,008,448	6,009,344	10,011,136	18,014,720
20000	4,006,912	8,008,192	12,008,960	20,010,496	36,013,568
50000	10,007,040	20,008,448	30,009,344	50,011,136	90,014,720
100000	20,006,912	40,008,192	60,008,960	100,010,496	180,013,568
200000	40,007,168	80,008,704	120,009,728	200,011,776	360,015,872
500000	100,006,912	200,008,192	300,008,960	500,010,496	900,013,568
1000000	200,007,168	400,008,704	600,009,728	1,000,011,776	
2000000	400,007,168	800,008,704	1,200,009,728		

## ❑ In the recorder function (Binary data)

Size of a file = header + data

Size of a header = number of W header + number of B header + number of C header + number of L header + number of S header + number of P header

Number of W header = 1

Number of B header = To save in either analog or logic is 1; to save in both analog and logic is 2

Number of C header = number of analog channels to be saved

Number of L header = number of logic probes to be saved

Number of S header = 1

Number of P header = number of PF header + number of PV header

Number of PF header = 2, number of PV header = 4, number of PE header = 9

Size of a header = 8 + number of B header + number of C header + number of L header

Size of a data = size of an analog data\* number of analog data to be saved + size of a logic data (when logic is saved)

Size of an analog data = CEILING(4\*(recording length(DIV)\*100+1),512)

Size of a logic data = CEILING(4\*(recording length(DIV)\*100+1),512)

Multiple of the minimum of b when CEILING (a, b) is larger than a

Example: CEILING(3.14,1)=4, CEILING(56,10)=60

 : 32 Mwords (standard)  : 128 Mwords (expansion)  : 512 Mwords (expansion)

### Logic not saved

Recording length	Number of analog channels				
	0	1	2	4	8
30		22,016	34,816	60,416	111,616
50		30,208	51,200	93,184	177,152
100		50,176	91,136	173,056	336,896
200		90,112	171,008	332,800	656,384
500		209,920	410,624	812,032	1,614,848
1000		410,112	811,008	1,612,800	3,216,384
2000		809,984	1,610,752	3,212,288	6,415,360
5000		2,010,112	4,011,008	8,012,800	16,016,384
10000		4,009,984	8,010,752	16,012,288	32,015,360
20000		8,010,240	16,011,264	32,013,312	64,017,408
50000		20,009,984	40,010,752	80,012,288	160,015,360
100000		40,010,240	80,011,264	160,013,312	320,017,408
200000		80,010,240	160,011,264	320,013,312	640,017,408

### All logic saved

Note  
Logic is channel 4 of a module

Recording length	Number of analog channels				
	0	1	2	4	8
30	23,552	36,864	49,664	75,264	126,464
50	31,744	53,248	74,240	116,224	200,192
100	51,712	93,184	134,144	216,064	379,904
200	91,648	173,056	253,952	415,744	739,328
500	211,456	412,672	613,376	1,014,784	1,817,600
1000	411,648	813,056	1,213,952	2,015,744	3,619,328
2000	811,520	1,612,800	2,413,568	4,015,104	7,218,176
5000	2,011,648	4,013,056	6,013,952	10,015,744	18,019,328
10000	4,011,520	8,012,800	12,013,568	20,015,104	36,018,176
20000	8,011,776	16,013,312	24,014,336	40,016,384	72,020,480
50000	20,011,520	40,012,800	60,013,568	100,015,104	180,018,176
100000	40,011,776	80,013,312	120,014,336	200,016,384	360,020,480
200000	80,011,776	160,013,312	240,014,336	400,016,384	720,020,480

### ❑ In the memory function (text data)

Size of a file = header + data

Size of a header = 170+27\*number of analog channels+64\*number of logic probes

Size of a data = (17+15 x number of analog channels+9 x number of logic probes) x (recording length[DIV] x 100+1)

Number of analog channels = 4

 : 32 Mwords (standard)  : 128 Mwords (expansion)  : 512 Mwords (expansion)

#### Logic not saved

Recording length	Number of analog channels				
	0	1	2	4	8
30		102,231	147,273	237,357	417,525
50		170,231	245,273	395,357	695,525
100		340,231	490,273	790,357	1,390,525
200		680,231	980,273	1,580,357	2,780,525
500		1,700,231	2,450,273	3,950,357	6,950,525
1000		3,400,231	4,900,273	7,900,357	13,900,525
2000		6,800,231	9,800,273	15,800,357	27,800,525
5000		17,000,231	27,500,273	39,500,357	69,500,525
10000		34,000,231	49,000,273	79,000,357	139,000,525
20000		68,000,231	98,000,273	158,000,357	278,000,525
50000		170,000,231	245,000,273	395,000,357	695,000,525
100000		340,000,231	490,000,273	790,000,357	1,390,000,525
200000		680,000,231	980,000,273	1,580,000,357	*2,780,000,525
500000		1,700,000,231	*2,450,000,273	*3,950,000,357	*6,950,000,525
1000000		*3,400,000,231	*4,900,000,273	*7,900,000,357	
2000000		*6,800,000,231	*9,800,000,273		

#### All logic saved

Note  
Logic is channel  
4 of a module

Recording length	Number of analog channels				
	0	1	2	4	8
30	165,481	210,523	255,565	345,649	525,817
50	275,481	350,523	425,565	575,649	875,817
100	550,481	700,523	850,565	1,150,649	1,750,817
200	1,100,481	1,400,523	1,700,565	2,300,649	3,500,817
500	2,750,481	3,500,523	4,250,565	5,750,649	8,750,817
1000	5,500,481	7,000,523	8,500,565	11,500,649	17,500,817
2000	11,000,481	14,000,523	17,000,565	23,000,649	35,000,817
5000	27,500,481	35,000,523	42,500,565	57,500,649	87,500,817
10000	55,000,481	70,000,523	85,000,565	115,000,649	175,000,817
20000	110,000,481	140,000,523	170,000,565	230,000,649	350,000,817
50000	275,000,481	350,000,523	425,000,565	575,000,649	875,000,817
100000	550,000,481	700,000,523	850,000,565	1,150,000,649	1,750,000,817
200000	1,100,000,481	1,400,000,523	1,700,000,565	*2,300,000,649	*3,500,000,817
500000	*2,750,000,481	*3,500,000,523	*4,250,000,565	*5,750,000,649	*8,750,000,817
1000000	*5,500,000,481	*7,000,000,523	*8,500,000,565	*11,500,000,649	
2000000	*11,000,000,481	*14,000,000,523	*17,000,000,565		

## ❑ In the Recorder function (text data) (bytes)

Size of a file = header + data

Size of a header = 170 + 27 x number of analog channels + 64 x number of logic probes

Size of a data = (17+30 x number of analog channels+18 x number of logic probes) x (recording length[DIV] x 100+1)

Number of analog channels = 4

 : 32 Mwords (standard)  : 128 Mwords (expansion)  : 512 Mwords (expansion)

### Logic not saved

Recording length	Number of analog channels				
	0	1	2	4	8
30		147,246	237,303	417,417	777,645
50		245,246	395,303	695,417	1,295,645
100		490,246	790,303	1,390,417	2,590,645
200		980,246	1,580,303	2,780,417	5,180,645
500		2,450,246	3,950,303	6,950,417	12,950,645
1000		4,900,246	7,900,303	13,900,417	25,900,645
2000		9,800,246	15,800,303	27,800,417	51,800,645
5000		24,500,246	39,500,303	69,500,417	129,500,645
10000		49,000,246	79,000,303	139,000,417	259,000,645
20000		98,000,246	158,000,303	278,000,417	518,000,645
50000		245,000,246	395,000,303	695,000,417	1,295,000,645
100000		490,000,246	790,000,303	1,390,000,417	*2,590,000,645
200000		980,000,246	1,580,000,303	*2,780,000,417	*5,180,000,645

### All logic saved

#### Note

Logic is channel 4 of a module

Recording length	Number of analog channels				
	0	1	2	4	8
30	273,517	363,574	453,631	633,745	993,973
50	455,517	605,574	755,631	1,055,745	1,655,973
100	910,517	1,210,574	1,510,631	2,110,745	3,310,973
200	1,820,517	2,420,574	3,020,631	4,220,745	6,620,973
500	4,550,517	6,050,574	7,550,631	10,550,745	16,550,973
1000	9,100,517	12,100,574	15,100,631	21,100,745	33,100,973
2000	18,200,517	24,200,574	30,200,631	42,200,745	66,200,973
5000	45,500,517	60,500,574	75,500,631	105,500,745	165,500,973
10000	91,000,517	121,000,574	151,000,631	211,000,745	331,000,973
20000	182,000,517	242,000,574	302,000,631	422,000,745	662,000,973
50000	455,000,517	605,000,574	755,000,631	1,055,000,745	1,655,000,973
100000	910,000,517	1,210,000,574	1,510,000,631	*2,110,000,745	*3,310,000,973
200000	1,820,000,517	*2,420,000,574	*3,020,000,631	*4,220,000,745	*6,620,000,973

\* The file size exceeds the maximum 2 GB. Cannot be saved.

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