HIOKI

Instruction Manual

8807-01
8808-01
8807-51
8808-51

MEMORY HiCORDER

HIOKI E. E. CORPORATION

January 2009 Revised edition 10 8807A981-10 09-01H

Contents

Introduction

Thank you for purchasing the HIOKI "8807-01, 8808-01, 8807-51, 8808-51 MEMORY HiCORDER." To obtain maximum performance from the product, please read this manual first, and keep it handy for future reference.

Inspection

When you receive the product, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the 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

Instruction Manual	1
Measurement Guide	1
Application Disk (CD)	1
LR6 alkaline batteries	6
Alkaline battery box	1
Strap	1

NOTE

The connector cable is not included with the product.
Use optional 9197, 9198, or 9217 CONNECTION CORD.
Maximum input voltage:
9197: 500 V AC/DC
9198: 300 V AC/DC
9217: 300 V AC/DC

Options

9418-15 AC ADAPTER
(SA145A-1240V-6, SINO AMERICAN)
(universal 100 to 240 V AC, 12 V DC output)
9197 CONNECTION CORD
(maximum input voltage: 500 V AC/DC)
9198 CONNECTION CORD
(maximum input voltage: 300 V AC/DC)
9199 CONVERSION ADAPTOR (BNC-Banana female)
9217 CONNECTION CORD (BNC-BNC)
(maximum input voltage: 300 V AC/DC)
9322 DIFFERENTIAL PROBE
(maximum input voltage: CAT Ⅱ: 1000 V AC, 2000 V DC, CAT Ⅲ: 600 V AC/DC)
9234 RECORDING PAPER (18 m/59.06feet, 112 mm/4.41" width)
9447 BATTERY PACK (7.2 V/2450 mAh)
9643 CHARGE STAND (for Model 9447 BATTERY PACK)
8992 PRINTER UNIT (printing width 100 mm/3.94")
9320-01 LOGIC PROBE
(4-channel digital, contact signal on/off detection)
9321-01 LOGIC PROBE
(4 insulated channels, AC/DC voltage on/off detection)
*9323 CONVERSION CABLE (for connecting 9320, 9321)
9331 WAVE PROCESSOR (Operation software for personal computer)
9335 WAVE PROCESSOR (Operation software for personal computer)
9391 CARRYING CASE
9612 RS-232C CABLE (mini DIN 9-pin Dsub 9-pin)
*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 A/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 together with 9270 to 9272, 9277 to 9279)
9018-10 CLAMP ON PROBE (10 A to 500 A, 40 Hz to 3 kHz)
9132-10 CLAMP ON PROBE (20 A to 1000 A, 40 Hz to 1 kHz)
*9303 PT
*220H PAPER WINDER

9626 PC CARD 32M
9627 PC CARD 64M
9726 PC CARD 128M
9727 PC CARD 256M
9728 PC CARD 512M
9729 PC CARD 1G
*: no CE marking

NOTE The 9270 to 9272 CLAMP ON SENSORs and 9277 to 9279 UNIVERSAL CLAMP ON CTs are designed for use only with the 9555 SENSOR UNIT, and cannot be used alone.

Safety Notes

This product is designed to conform to 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 product. 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 product defects.

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

Safety Symbols

- The ⚠ symbol printed on the product 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 product.

Indicates the ON side of the power switch.

Indicates the OFF side of the power switch.

Indicates both DC (Direct Current) and AC (Alternating Current).

Indicates DC (Direct Current).

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.
	Indicates that incorrect operation presents a possibility of injury to the user or damage to the product.
	Advisory items related to performance or correct operation of the product.

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.

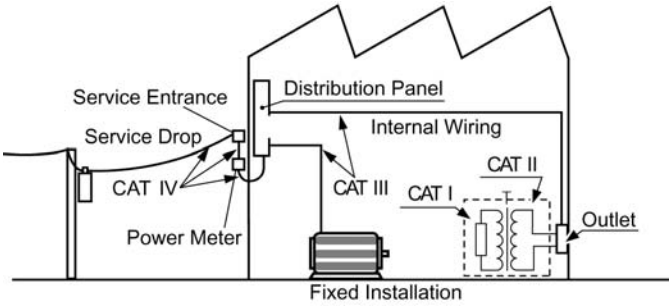
CAT I	Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.
CAT II	Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)
CAT III	Primary electrical circuits of heavy 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 product.
dgt. (resolution)
The smallest displayable unit on a digital measuring product, i.e., the input value that causes the digital display to show a "1".

Notes on Use

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

DANGER

To avoid the risk of electric shock and damage to the product

- **Do not apply more than 450 V AC or DC between the analog inputs and product, or between the analog inputs.**
- **Use only the specified Model 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN). AC adapter input voltage range is 100 to 240 V AC (with ±10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the product, do not apply voltage outside of this range.**
- **Terminal inputs should never exceed the limits indicated below.**

Input/output terminals	Maximum input voltage
Analog input	450 V AC/DC
EXT TRIG	-5 V to +10 V
TRIG OUT	-20 V to +30 V 500 mA max, 200 mW max

- **The maximum voltage applied to the probe and cables connecting to the analog input of the product must never exceed the limits in the following table. Notwithstanding these limits, the voltage at the analog input must not exceed 450V AC or DC.**

	Maximum input voltage
9197 CONNECTION CORD	500 V AC/DC
9217 CONNECTION CORD	300 V AC/DC
9322DIFFERENTIAL PROBE	1000 V AC, 2000 V DC (CAT II) 600 V AC/ DC (CAT III)

WARNING

- **When using the batteries, use LR6 alkaline batteries or 9447 BATTERY PACK. In this case, do not use new batteries with old ones. Also, do not mix batteries of different types. We take no responsibility for an accident using the batteries and battery packs which are not specified.**
- **The logic inputs are not floating. Although two sets of logic probes can be connected, they all have a common ground with the main product.**

⚠CAUTION

- Use only the specified input cord. Using a non-specified cable may result in incorrect measurements due to poor connection or other reasons.
- To avoid damage to the product, do not input a voltage/current exceeding the rated maximum to the external input terminals.
- This product should be installed and operated indoors only, between 5 and 40℃ and 35 to 80%RH.
- Do not store or use the product where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the product may be damaged and insulation may deteriorate so that it no longer meets specifications.
- Do not use the product where it may be exposed to corrosive or combustible gases. The product may be damaged.
- This product is not designed to be entirely water- or dust-proof. To avoid damage, do not use it in a wet or dusty environment.

Preliminary Checks

Before using the product the first time, verify that it operates normally to ensure that the no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.

(1) Before Powering On

- Check that the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN), 9447 BATTERY PACK, or LR6 alkaline batteries are correctly fitted.
- When using an AC adapter and if properly grounded three-pin outlet is available, then using the three-core power cord provides automatic grounding.

(2) Using the Printer

- Avoid using the printer in hot, humid environments, as this can greatly reduce printer life.
- Printing is not possible if the recording paper is loaded wrong-side up.

(3) Recording Paper

- This product uses a thermal printer. The recording paper supplied has characteristics finely tuned for use with the printer.
- Using recording paper of a different specification may not only result in impaired printing quality, but even prevent the printer from operating. Always use the 9234 RECORDING PAPER.

(4) Storage

Always place the product in the head-up condition when it is 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.

(5) Shipment

Use the original packing materials when reshipping the product, if possible.

Handling the CD

⚠CAUTION

- Always hold the disc by the edges, so as not to make fingerprints on the disc or scratch the printing.
- Never touch the recorded side of the disc. Do not place the disc directly on anything hard.
- Do not wet the disc with volatile alcohol or water, as there is a possibility of the label printing disappearing.
- To write on the disc label surface, use a spirit-based felt pen. Do not use a ball-point pen or hard-tipped pen, because there is a danger of scratching the surface and corrupting the data. Do not use adhesive labels.
- Do not expose the disc directly to the sun's rays, or keep it in conditions of high temperature or humidity, as there is a danger of warping, with consequent loss of data.
- To remove dirt, dust, or fingerprints from the disc, wipe with a dry cloth, or use a CD cleaner. Always wipe radially from the inside to the outside, and do no 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, or for any problem related to the purchase of a Hioki product.

Chapter Summary

This manual consists of the following chapters. "Introduction", "Safety Notes", "Notes on Use" describe precautions on use, overview, and features of this product. Be sure to read them all. Next, check Chapter 1 to 3 and the product to confirm your understanding of the function. For details on the harmonic wave analysis function of the 8807-51, 8808-51, refer to the supplement guide "Harmonic Wave Analysis Function."

Chapter 1 Product Overview
Contains an overview of the product and its features.

Chapter 2 Installation and Preparation
Explains how to set the product up for measurement.

Chapter 3 Basic Button Operation
Explains how to operate the buttons for carrying out basic measurement functions.

Chapter 4 Memory Recorder Function
Explains how to use the Memory Recorder functions of the product.

Chapter 5 Recorder Function
Explains how to use the Recorder functions of the product.

Chapter 6 RMS Recorder Function
Explains how to use the RMS Recorder functions of the product.

Chapter 7 Input Channel Settings
Explains how to make settings using the channel setting screen.

Chapter 8 Trigger Functions
Explains how to use the Trigger functions of the product.

Chapter 9 Waveform Screen Operation
Explains how to perform waveform scrolling, how to use the A/B cursors and so.

Chapter 10 System Settings
Explains how to make settings using the system setting screen.

Chapter 11 Printout of Measurement Data
Explains how to print out measurement data and how to read printed charts.

Chapter 12 Storing the Measurement Data
Describes how to save, load and delete measurement data and settings using a PC Card.

Chapter 13 RS-232C Interface
Describes RS-232C communications.

Chapter 14 Specifications
Contains general specifications and detailed function specifications.

Chapter 15 Logic and Analog Inputs
Contains specifications and precautions for logic input and analog inputs.

Chapter 16 Maintenance and Service
Describes maintenance procedures.

Appendix Contains important supplemental material such as error messages and other information pertaining to product operation.

Chapter 1
Product Overview

1.1 Major Features

(1) Easy-to-see color LCD

The 5.7-inch color LCD display has a resolution of 320 x 240 dots.

(2) Three functions support a variety of measurements

- Memory recorder with up to 2.5 µs (all channels simultaneously) sampling period (400 kS/s maximum sampling rate).
- Real-time recording capability to paper in Recorder function
- RMS recorder function for recording rms values of AC power supply lines and DC sources.

(3) Powerful trigger functions

Level trigger, window-in trigger, window-out trigger, voltage drop trigger, waveform detection trigger, pattern trigger (logic)

(4) Thermal printing with 8992 optional printer

(5) Scaling function

By setting the physical amount and the product to be used for 1 V input, the measurement result can be converted into any desired scale.

Two of the HIOKI CLAMP ON PROBEs, the 9018 and the 9132, feature a clamp mode that allows electric current values to be read directly.

(6) Four isolated analog input channels (8807-01: 2 channels)

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

(7) PC Card Slot provided

Measurement data and settings can be saved to a PC Card.

(8) Equipped with RS-232C standard interface

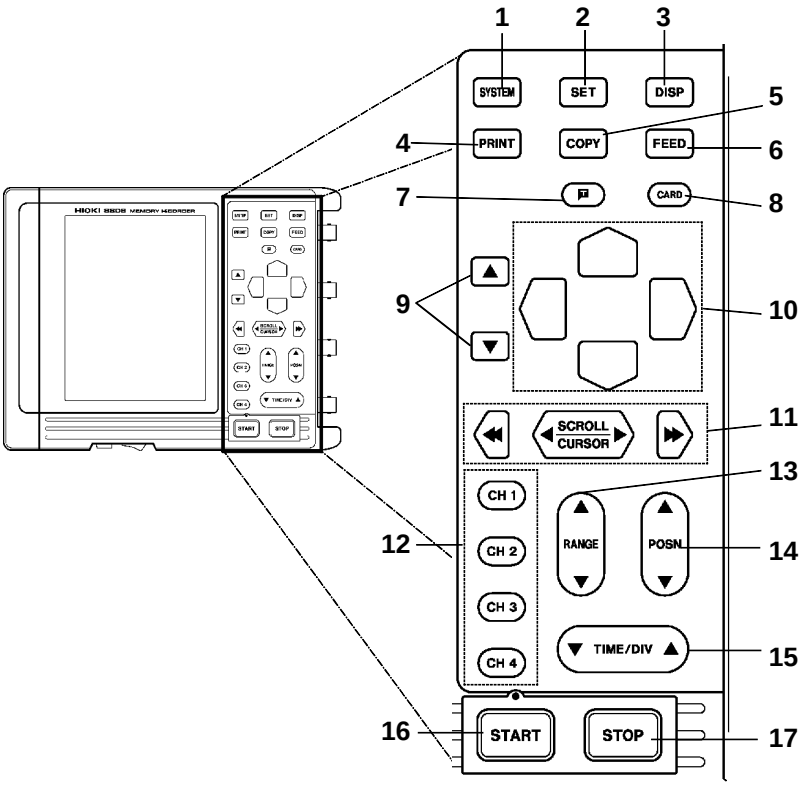
(9) Dual-language capability

Display language is switchable between Japanese and English.

(10) Harmonic wave analysis function (8807-51, 8808-51 only)

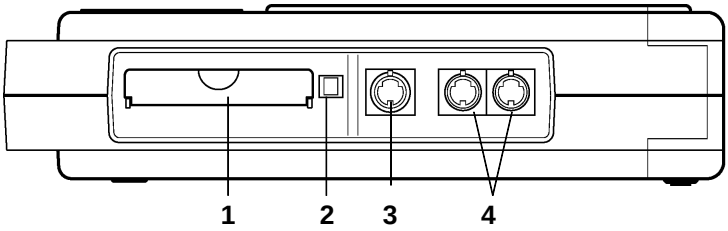
Harmonic wave analysis function that is a powerful tool for power supply analysis.

1.2 Identification of Controls and Indicators



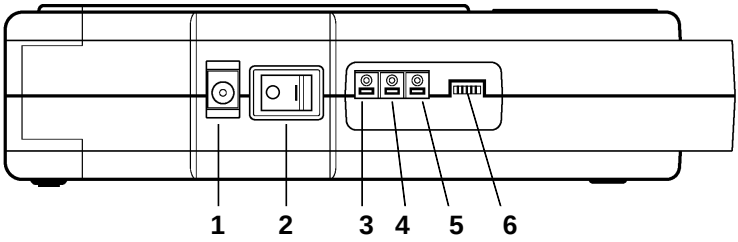
1. **SYSTEM** button	Selects the Environment, Comment, RS&COPY, setting, and Initialization Screens.
2. **SET** button	Selects the Status, Channel and Trigger Screens.
3. **DISP** button (Waveform display)	Selects the Waveform Screen. Pressing this button from the Waveform Screen switches to the DMM Screen.
4. **PRINT** button	Serves to print out stored waveforms.
5. **COPY** button	Serves to print out a copy of the current screen display.

6. **FEED** button	Causes the printer paper to advance for as long as the button is pressed.
7. T button (Manual trigger)	Press this button to activate a trigger event when manual triggering is enabled.
8. **CARD** button	Using PC card: Causes the display to show the File Screen. Using Fax/modem card: Causes the display to show the FAX&Modem Screen.
9. ▲▼ buttons	Select and accept settings here.
10.◁△▽▷ buttons	Moves the flashing cursor in the four directions.
11.◀ **scroll/cursor** ▶, ◀◀ ▶▶ buttons	Moves the A/B cursors and scrolls the waveforms.
12.**CH1** - **CH4** buttons	Input and trigger settings can be made by displaying the Settings window on the Waveform Screen.
13.**RANGE** button	Sets the voltage axis range for the channel.
14.**POSN** button	Sets the zero position for the channel.
15.**TIME/DIV** button	Sets the input signal capture speed. On the Waveform Screen, press both sides of the TIME/DIV button for at least 2 seconds to activate auto-ranging. (Memory recorder only)
16.**START** button	Initiates the measurement and analysis. During measurement, the LED above the button is lit.
17.**STOP** button	Stops measurement and analysis.



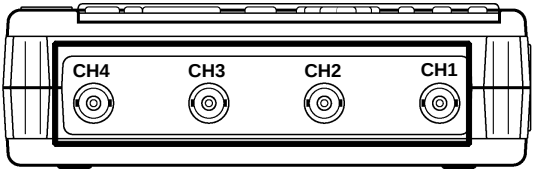
Upper Side View

1. PC card slot	Insert the PC card.
2. Eject button	Press this button to eject a PC card.
3. RS-232C connecting terminal	Connect the 9612 RS-232C CABLE.
4. Logic probe connectors	Input connector for the logic input section, designed for the optional 9320-01 and 9321-01 LOGIC PROBEs.



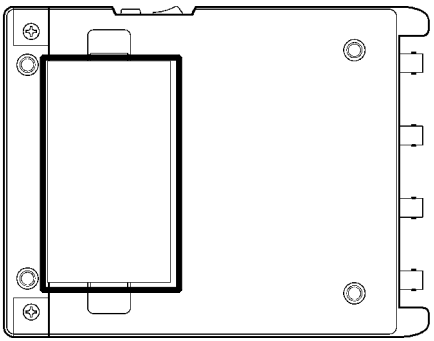
Lower Side View

1. AC adapter connecting terminal (for the AC adapter specified by Hioki)	
2. Power switch (POWER)	Switches on or off the power supply.
3. External trigger terminal (EXT TRIG)	External trigger source input.
4. Trigger output terminal (TRIG OUT)	Trigger signals are output.
5. Ground terminal (GND)	Used together with the trigger terminal.
6. Contrast adjustment knob	Adjusts screen contrast.



Right Side View

Analog input terminal	Input terminals for analog inputs, non-balanced input type (8808-01, 8808-51: 4-channel input, 8807-01, 8807-51: 2-channel input)



Bottom Side View

Battery compartment	Six LR6 alkaline batteries or the 9447 BATTERY PACK can be installed.

Chapter 2
Installation and Preparation

2.1 Installation of the Product

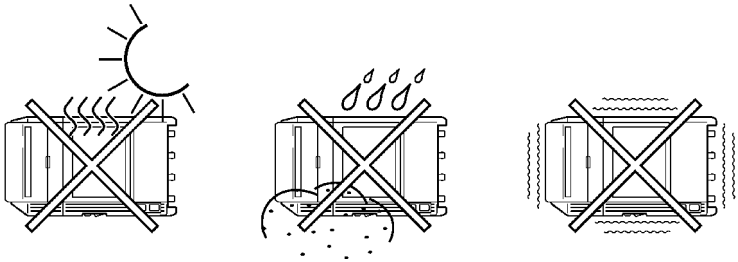
Ambient conditions

Temperature
5 to 40°C, 23±5°C (41 to 104°F, 73°F±9°F) recommended for high-precision measurements.

Humidity
35 to 80%RH (no condensation); 50±10%RH (no condensation) recommended for high-precision measurements.

Avoid the following locations:

- Subject to direct sunlight.
- Subject to high levels of dust, steam, or corrosive gases (Avoid using the equipment in an environment containing corrosive gases (e.g., H_2S, SO_2, NI_2, and CI_2) or substances that generate harmful gasses (e.g., organic silicones, cyanides, and formalins).
- Subject to vibrations.
- In the vicinity of equipment generating strong electromagnetic fields.

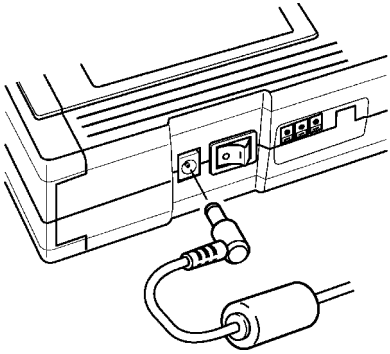


2.2 Power Supply and Ground Connection

2.2.1 Connecting the AC Adapter

DANGER

Use only the specified/supplied Model 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN). AC adapter input voltage range is 100 to 240 V AC (with ± 10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the product, do not apply voltage outside of this range.



NOTE • The AC adapter is prior to the battery when using together.

2.2.2 Installing the Batteries/Battery Pack

WARNING

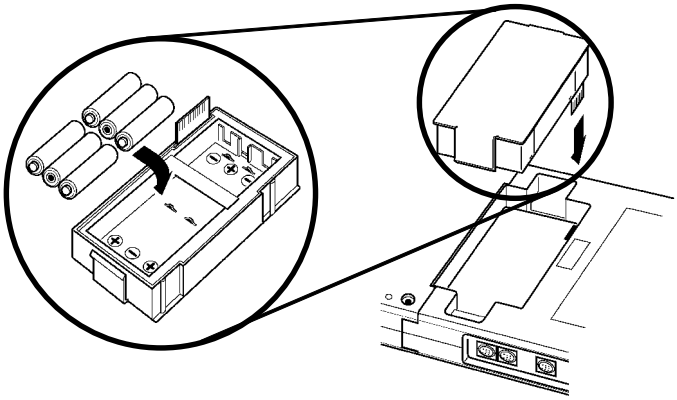
- **Use the specified 9447 BATTERY PACK or LR6 alkaline batteries. Do not use old and new batteries or batteries of different types together.**
  The manufacturer disclaims all responsibility for any accident or injury except that resulting due to defect in its specified batteries or Battery packs.
- **Do not use old and new batteries or batteries of different types together. If intend to, performance of the product may suffer.**

NOTE

- If not recharge, the 9447 can not be used.
- For the details on charging batteries, refer to Section 16.2, "9447 BATTERY PACK."
- If the battery voltage drops while the product is running off of battery power, the product will automatically switch off the power supply. If the product is left in this state for an extended period of time, the battery pack may be discharged too much. Be sure to turn OFF the power switch on the product.
- When the battery capacity is reduced, the power is automatically turned off. Before turning on the power again with AC adapter or new batteries, turn the power off and leave for about 30 seconds. If this time is shorter than 30 seconds, the power may be immediately turned off even if powering on.
- When not in use for a long time, to prevent possible corrosion caused by battery leakage, remove the batteries before storage.

Installing the Batteries or Battery Pack

1. Turn the power OFF.
2. Take off the cover of the battery compartment.
3. Remove the old batteries and replace them with six new LR6 alkaline batteries with the correct polarity.
4. Replace the battery cover.



Effective Battery-Powered Operating Time

(typical value at normal temperature)
Operating time is extended with the backlight brightness is set to Dark.
For details, refer to Section 10.1.7

Not operating (waiting for trigger, etc.) Alkaline battery: Approx. 60 min (dark)/ Approx. 40 min (bright) 9447 BATTERY PACK: Approx. 180 min (dark)/ Approx. 120 min (bright)
During operating (2 s/DIV 1 Hz sinewave (REC) Alkaline battery: Impossible 9447 BATTERY PACK: Approx. 120 min (dark)

NOTE

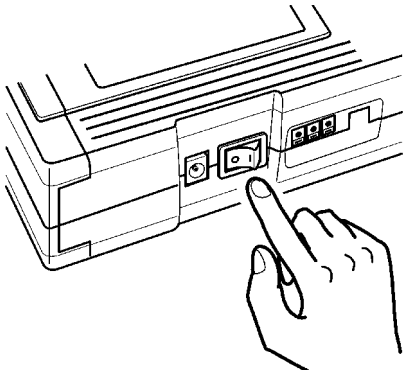
- Actual performance will change from values indicated in this table according to the types of batteries, temperature, and printing rate.
- The printer cannot be used with alkaline batteries: use either the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) or 9447 BATTERY PACK when using the printer.
- The backlight is automatically dimmed when the printer is in use.

2.3 Power On/Off

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 ±10% from the rated supply voltage are taken into account.) and rated supply frequency (50/60 Hz).**
- **The Product is correctly installed (See Section 2.1).**



Depending on the type and status of power supply of the product, one of the following messages appears on the Waveform Screen.

	Operating with the AC ADAPTER.
	Operating with batteries.
LOW	Battery capacity is low. Replace the batteries.

NOTE

When the product is turned off, it memorizes the currently used settings and reestablishes the same settings the next time the product is turned on again. (Backup function)

2.4 Connecting the Connection Cord

WARNING

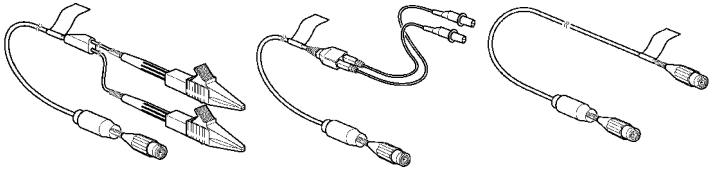
- **Never connect the cable to the product while the other end is connected to the measurement object, as you could receive an electric shock.**
- **Use only the specified connection cable. To prevent electric shock, an insulated BNC connector is used. There is the possibility of shock if a metal BNC is used because the input L terminal and the metal part of the BNC connector have the same electric potential.**

CAUTION

- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.
- Using a connection cable other than that specified may result in damage to the BNC connector, poor contact, or other symptoms preventing accurate measurement.

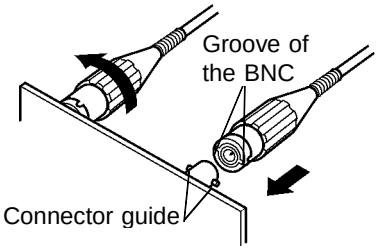
Use the optional 9197, 9198, or 9217 CONNECTION CORD to connect to the analog input terminals.

CONNECTION CORDs



	9197	**9198**	**9217**
Maximum input voltage:	500 V	300 V	300 V

Connecting to the main product



1. Align the grooves in the BNC connector with the guide pins on the product input connector, then turn clockwise while pressing in to lock the connector.
2. To remove from the product, turn the BNC connector counterclockwise to release the lock, then pull it.

2.5 Connecting the 9322 DIFFERENTIAL PROBE

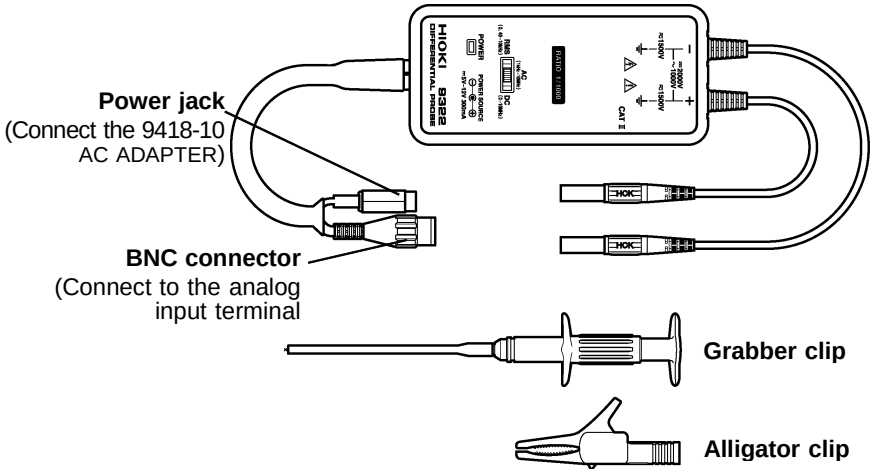
DANGER

- **For the 9322, the maximum rated voltage to earth is as follows.**
  When using grabber clips: 1500 V AC or DC (CAT II) / 600 V AC or DC (CAT III)
  When using alligator clips: 1000 V AC or DC (CAT II) / 600 V AC or DC (CAT III)
  To avoid electrical shock and possible damage to the product, never apply voltage exceeding these limits between the input terminals and the chassis, or between the inputs of two 9322s.
- **The maximum input voltage is 1000 V AC or 2000 V DC (CAT II) / 600 V AC or DC (CAT III).**
  Do not attempt to measure voltage exceeding these limits, as doing so may damage the equipment or cause an accident that might result in injury or death.

WARNING

- **High voltage can be present at the inputs to the 9322. To avoid electrical hazard, be sure to turn off the equipment to be measured before connecting the test leads. Turn the power on only after the leads have been securely connected.**
- **Before using the product, make sure that the sheathing on the probes is not damaged and that no bare wire is exposed. If there is damage, using the product could cause electric shock. Contact your dealer or HIOKI representative.**

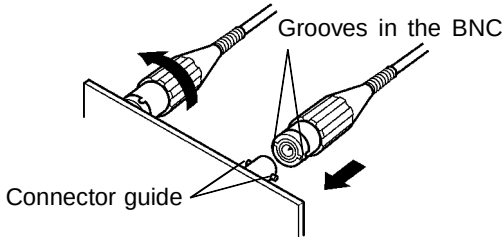
The Model 9322 is a differential probe that connects to input modules for the 8800 MEMORY HiCORDER series. High voltage applied between the H and L terminals is divided by 1/1000 and output as a voltage signal relative to GND.



Connection Method

1. Connect the alligator or grabber clips to the 9322.
   For the 9322, the maximum rated voltage to earth is as follows.
   When using grabber clips: 1500 V AC or DC (CAT ll) / 600 V AC or DC (CAT lll)
   When using alligator clips: 1000 V AC or DC (CAT lI) / 600 V AC or DC (CAT lll)
2. Connect the AC ADAPTER to power jack of the 9322.
   The indicator lights when power is applied.

3. Connect the BNC connector of the 9322 to the analog input terminal of the product.



4. Connect the alligator clip or grabber clip to equipment to be measured.
5. Select DC, AC or RMS output with the output selector switch.
   - DC The voltage between H and L signals is divided by 1/1000 and output as voltage relative to GND.
   - AC AC coupling for DC signals, and impulse voltage is sampled on the carrier voltage.
   - RMS RMS conversion is applied to DC output signals and output as a level variation.

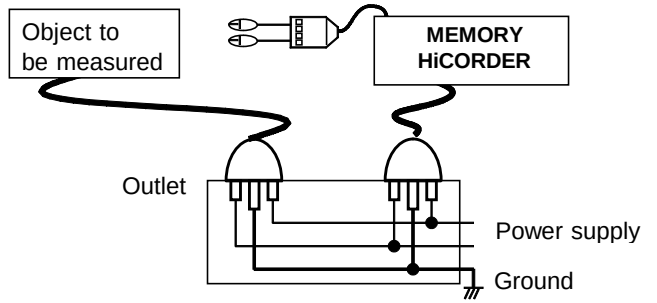
NOTE

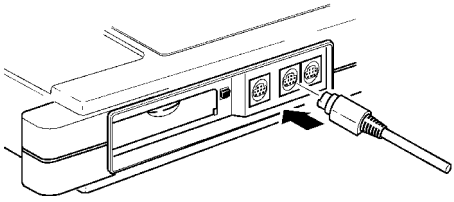
- One 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) is required for each 9322 to be used.
- Refer to the 9322 DIFFERENTIAL PROBE Instruction Manual for details.

2.6 Connecting the Logic Probe

WARNING

- **The ground sides of the logic inputs are connected in common to the frame ground of the product. Therefore, if the product is powered by the AC adapter and the object to be measured is powered from a different power source, the possibility exists for electric shock or damage to the equipment. Furthermore, even when power is supplied from the same source, a potential difference can exist due to different ground-side wiring, resulting in current flow through the logic probes that could result in electric shock or damage.**
  To avoid these hazards, before connecting a logic probe to the product and the object to be measured, confirm that power is supplied from the same grounded outlet using 3-wire grounded power cords.
- **Do not connect logic probes other than supplied by HIOKI to the logic inputs.**





The logic input is located on the top side of the product. Since one logic probe can record 4 channels, the combined maximum recording capability for logic waveforms is 8 channels.

NOTE

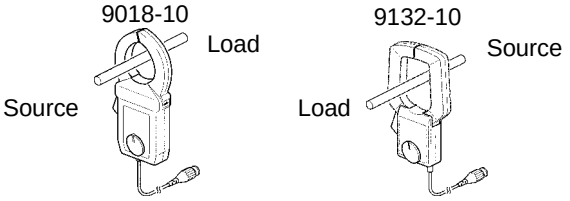
- If no logic probe is connected, the corresponding logic waveform is displayed on the screen at high level.
- Carefully read the instruction manual supplied with the 9320-01 or 9321-01 LOGIC PROBE.

2.7 Connecting the 9018-10, 9132-10 CLAMP ON PROBE

DANGER

- **Always connect the clamp-on probe to the secondary side of a breaker. On the secondary side of a breaker, even if the lines are shorted the breaker can trip and prevent an accident. On the primary side, however, the current capacity may be large, and in the event of a short-circuit there may be a serious accident.**
- **Before using the 9018-10, 9132-10 CLAMP ON PROBE, be sure to carefully read its instruction manual and familiarize yourself with the operation principles of this product.**

This product measures input voltage, so although current cannot be measured directly, current can be measured by the voltage output from the HIOKI 9018-10, 9132-10 CLAMP ON PROBEs.
Connect the BNC connector of the CLAMP ON PROBE to the analog input terminal. For details, refer to Section 2.4.

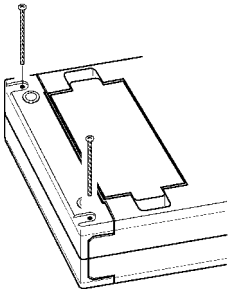


NOTE

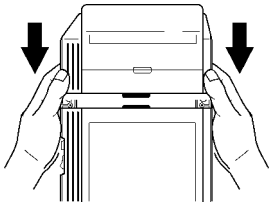
- To measure current, set the input coupling of the product to "CLAMP." For details, refer to Section 7.3.4.
- When the clamp-on probe is used for measurement, the measurement precision will be affected both by the product precision and clamp-on probe precision ratings.
- When using the 9199 CONVERSION ADAPTOR, the 9018, 9132 CLAMP ON PROBEs can be used.
- When measuring electric current, make sure that the direction of the CLAMP ON PROBE matches the direction of electric current.The direction of connection for the 9132-10 is opposite from the 9018-10. If the CLAMP ON PROBE is faced in the opposite direction, the phase will shift 180 degrees from the actual value.

2.8 Connecting the 8992 PRINTER UNIT

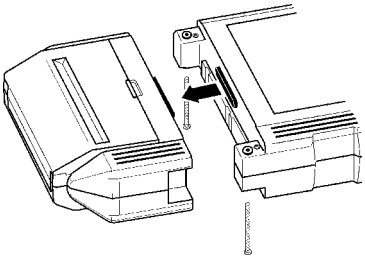
Before connecting or disconnecting the printer unit, make sure that the power switch is off. When the printer is not connected, be sure to install the cover.



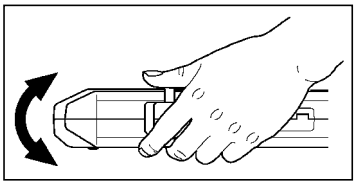
1. Using a plastic screwdriver, remove the two screws that secure the product's rear cover and lift off the cover.



2. Insert the 8992 PRINTER UNIT.



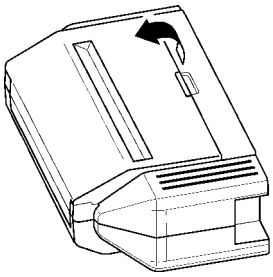
3. Secure with the two screws provided.



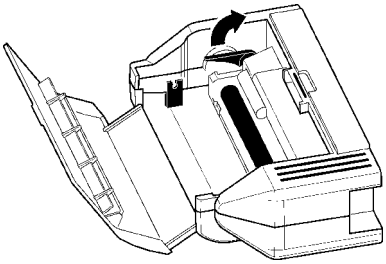
If the connector does not mate easily, rock the printer slightly as shown while pressing the products together.

NOTE The printer cannot be used with alkaline batteries: use either the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) or 9447 BATTERY PACK when using the printer.

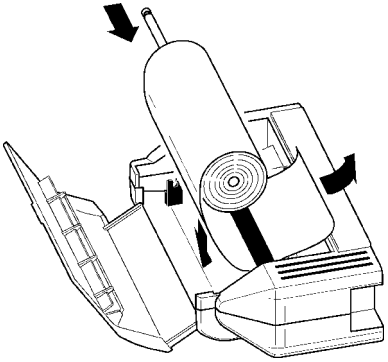
2.8.1 Loading Recoding Paper



1. Lift the stock cover in the direction of the arrows.

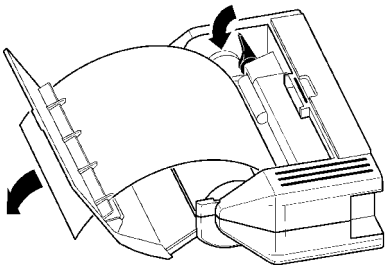


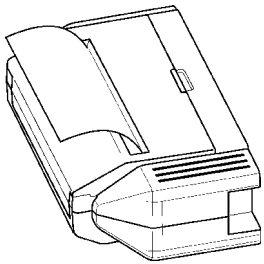
2. Raise the head up/down lever.



3. Insert the leading edge of the recording paper from bottom into the gap behind the printer roller, and pull it out to the other side. Pressing the **FEED** button feeds paper.

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





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

6. Put down the head up/down lever.

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

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

NOTE

- When the stock cover is fully open, attempting to force it open further may damage the cover.
- The paper may jam if it is not aligned with the roller.
- Always place the product in the head-up condition when it is to be transported or stored for an extended period of time. If the product is left idle for a long time with the head pressing on the roller, the roller may be deformed, resulting in uneven printing.
- Be careful to correctly orient the recording paper. Nothing will be printed if the recording paper is loaded with the wrong side facing the print head.
- We recommend using only the specified 9234 RECORDING PAPER.

2.8.2 Care of Recording Paper

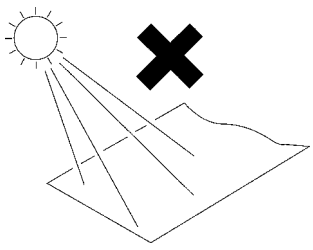
Care of recording paper

- 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℃ (104℉). Low temperatures cause no problem.
- After opening, protect the paper from strong light, to prevent discoloration.

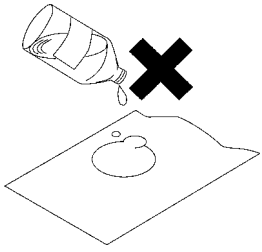
Storing data

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

- To avoid discoloration, do not leave recording paper in direct sunlight.
- Store at not more than 40℃ (104℉) and 90% RH.
- To keep definitive data, make photocopies of the recordings.
- Thermal paper will blacken when brought into contact with alcohol, ester, ketone, or other volatile organic substances.
- If the thermal paper absorbs an organic solvent such as alcohols or ketones it may no longer develop properly, and recorded information may fade. Soft PVC film and transparent contact adhesive tape contain such solvents, so avoid using them with recordings.
- Avoid interleaving the thermal recordings with damp diazo copies.



Direct sunlight

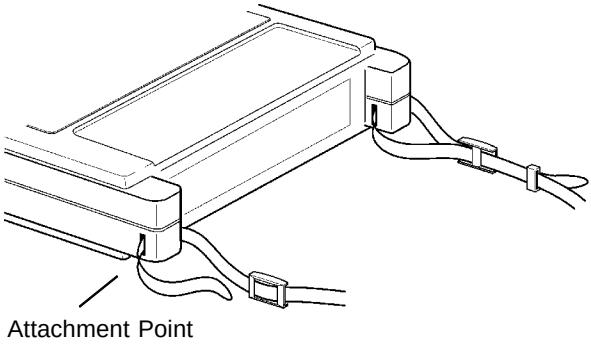


Organic solvent

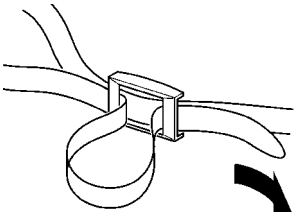
2.9 Attaching the Strap

⚠CAUTION Attach the ends of the strap securely at both attachment points. If the strap is not attached securely, the product could drop while being carried.

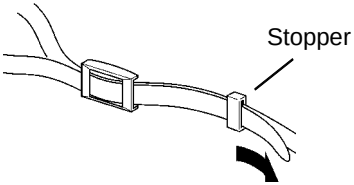
1. Insert each end of the strap through an attachment point on the product.



2. Thread the end of the strap through the buckle twice as shown below.



3. Finally, slide the stopper over the end of the strap. Tighten the strap to remove slackness or twisting.



2.10 Notes on Measurement

To avoid the risk of electric shock and damage to the product

- **Do not apply more than 450 V AC or DC between the analog inputs and product, or between the analog inputs.**
- **Terminal inputs should never exceed the limits indicated below.**

Input/output terminals	Maximum input voltage
Analog input	450 V AC rms, DC
EXT TRIG	-5 V to +10 V
TRIG OUT	-20 V to +30 V 500 mA max, 200 mW max

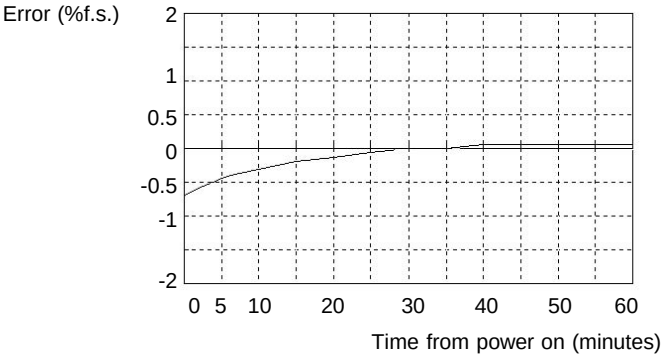
- **The maximum voltage applied to the probe and cables connecting to the analog input of the product must never exceed the limits in the following table. Notwithstanding these limits, the voltage at the analog input must not exceed 450V AC or DC.**

	Maximum input voltage
9197 CONNECTION CORD	500 V AC rms, DC
9217 CONNECTION CORD	300 V AC rms, DC
9322 DIFFERENTIAL PROBE	1000 V AC, 2000 V DC (CAT II) 600 V AC, DC (CAT III)

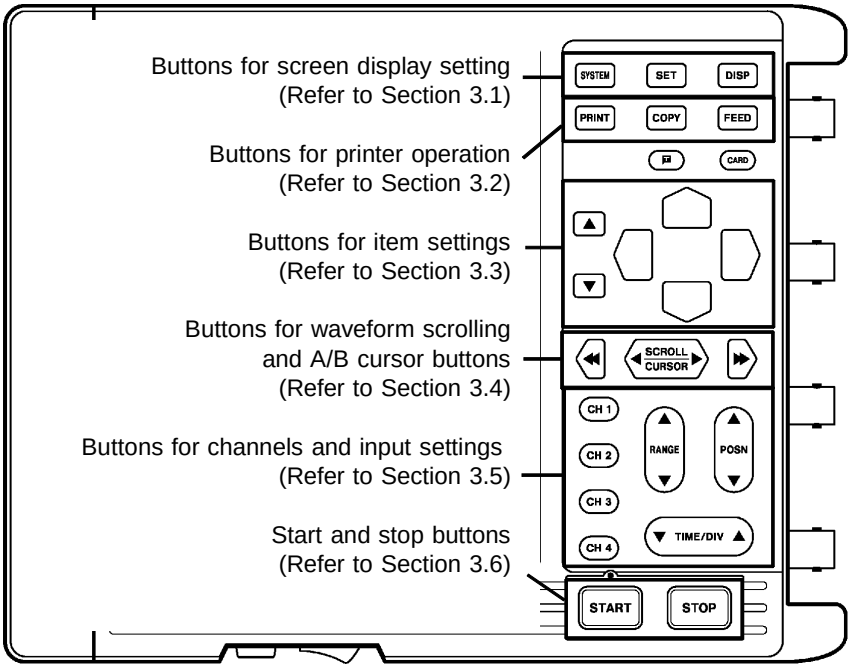
Analog Input Zero Position

The zero position may be offset when the input coupling is DC or GND and the input is open circuit in the high-sensitivity (10 mV) range.

The accuracy specifications apply after 30-minute warm-up following power on. During warm-up, the zero position drifts as indicated below.



Chapter 3
Basic Button Operation



3.1 Screen Display Buttons

These buttons switch between the display screens.

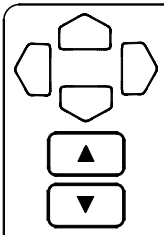
SYSTEM	SYSTEM button	By pressing this button, you can select the Environment, Comment, RS&COPY, Setting, and Initialization Screens.
SET	SET button	By pressing this button, you can select the Status, Channel, Trigger Screens.
DISP	DISP button	Calls up the Waveform Screen. Serves to display and observe waveforms. Pressing this button from the Waveform Screen switches to the DMM Screen.

3.2 Printer Buttons

These buttons are enabled when the 8992 PRINTER UNIT is installed. For details, refer to Chapter 11.

PRINT	PRINT button	Serves to print out the measured data.
COPY	COPY button	Prints a copy of the displayed screen, or to save it as a BMP file. (For output destination, refer to Section 10.3.)
FEED	FEED button	Forwards the paper while the button is held down.

3.3 Item Setting Buttons

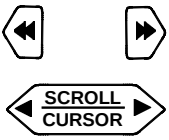


Cursor buttons — Serves to move the flashing cursor. Use to select the Scroll or A/B cursors and Key Lock ON/OFF functions.

▼▲ buttons (Select button) — Serves to set the items.

3.4 Waveform Scrolling Buttons

These buttons move the A/B cursors and scroll the waveforms. For details, refer to Section 9.1 and 9.2.



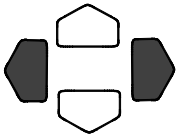
Move the A and B cursors or scroll waveforms by these buttons.
Pressing the ◀◀/▶▶ buttons moves quickly.

(1) Using the A/B cursors

The A/B cursors can be used to read a time difference, frequency, or potential difference on Waveform Screen.

(2) Scrolling the waveform

The waveform on the display can be scrolled horizontally.



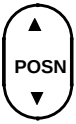
Press both cursor buttons (◁ and ▷) simultaneously to switch the operation for using the A/B cursors or scrolling the waveform.

3.5 Input Operation

Press a channel select button (CH1 to CH4) on the Waveform Screen to display the desired Settings window.

CH1-CH4 buttons Display the Settings window for voltage axis range, magnification, zero position, filtering, trigger conditions and more.

RANGE button Serves to set the voltage axis range for the channel selected.



POSN button Serves to set the zero position for the channel selected.

TIME/DIV button Serves to set the input signal capture speed.

Other settings are made by moving the flashing cursor with the Cursor buttons (◁△▽▷) and pressing the Select (▲/▼) buttons.

3.6 Measurement Start and Stop

The measurement start/stop operation is separately determined by each measurement function.
For details, refer to "Start and Stop Operation," which explains each measurement function.

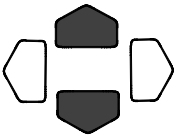
START	START button	Pressing this button starts measurement. The LED on the upper part of the switch lights green during measurement.
STOP	STOP button	Pressing this button stops the measurement.

3.7 Other Buttons Operation

T	T button Manual trigger	When Manual Trigger is enabled (ON) on the Trigger Screen, the trigger is activated by pressing this button during the trigger wait state. Pressing the T button with the flashing cursor aligned with a setting item displays the setting items.
CARD	CARD button	Using PC card: Displays the File Screen. Using Fax/modem card: Displays the Fax&Modem Screen.

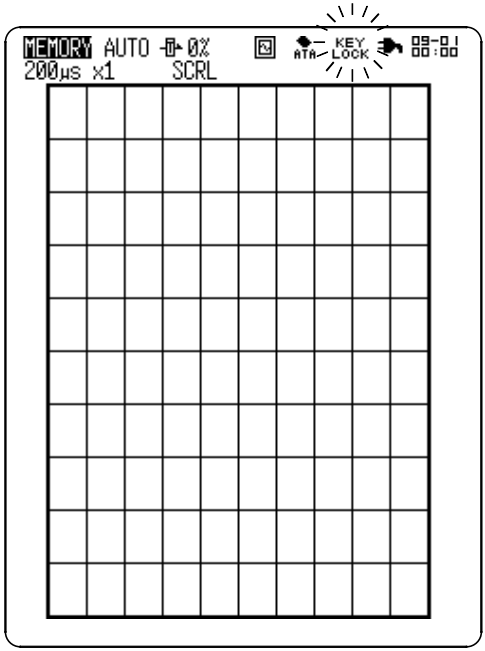
3.8 Key Lock Function

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

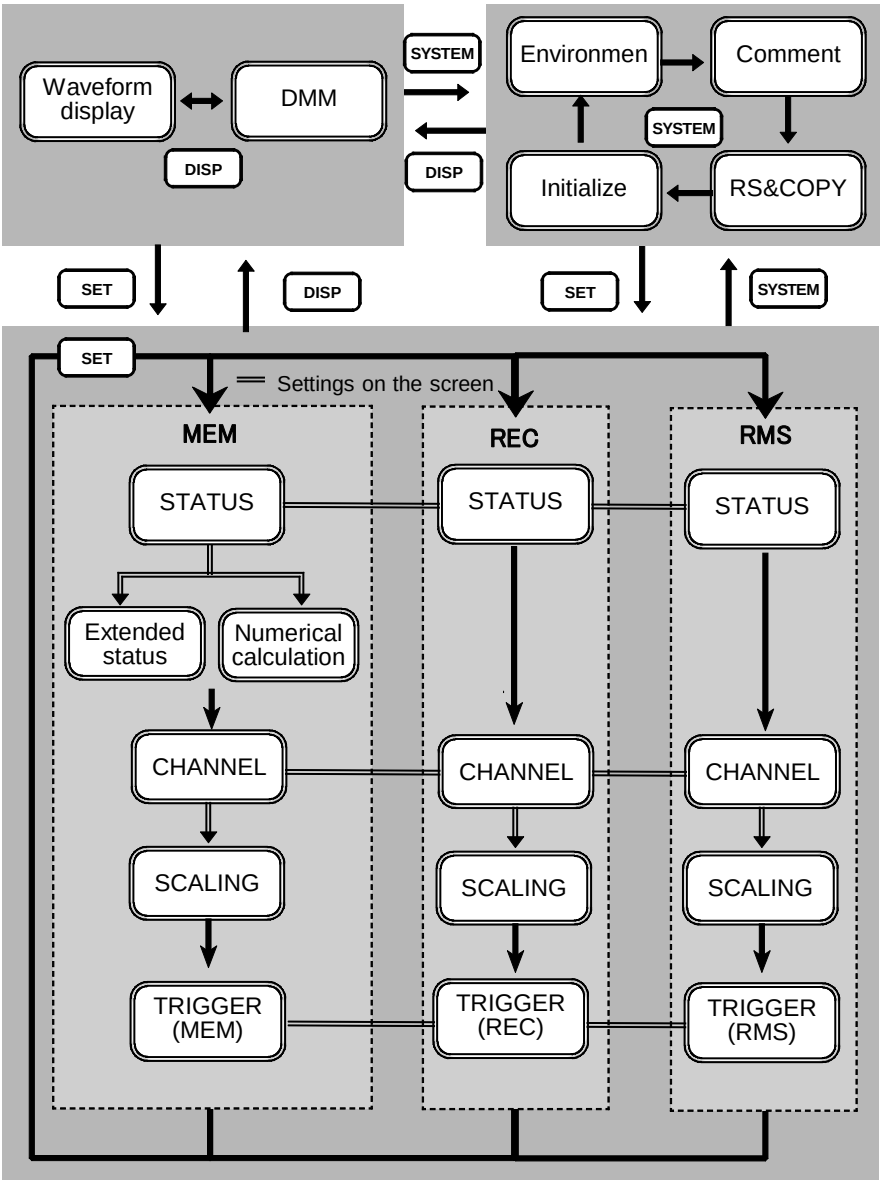


Press both cursor buttons (△▽) simultaneously for 3 seconds to switch the key lock on/off.
The key lock function will not be canceled by turning the power off and on.

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



3.9 Changing the Screen



(MEM): Memory recorder function/ (REC): Recorder function/
(RMS): RMS recorder function

Chapter 4
Memory Recorder Function

4.1 Overview of the Memory Recorder Function

The memory recorder function has the following features.

(1) After being stored in the internal memory, input signal data can be displayed and printed.

(2) All input channel data are recorded on the same time axis. Since data for all channels can be superimposed, the relative relationship between input signals can be observed visually.

(3) Time axis setting
200 µs/DIV to 5 min/DIV

(4) Time axis resolution 80 points/DIV

(5) Storage capacity (DIV)

Model	Number of channels		
	1	2	4
8807-01, 8807-51	3200	1600	---
8808-01, 8808-51	3200	1600	800

(6) Waveform magnification/compression display and print
Time axis direction: x10 to x1/500
Voltage axis direction: x10 to x1/2

(7) Display layout
Time axis waveform: single, dual, quad displays
X-Y waveform: single display (dot, line)

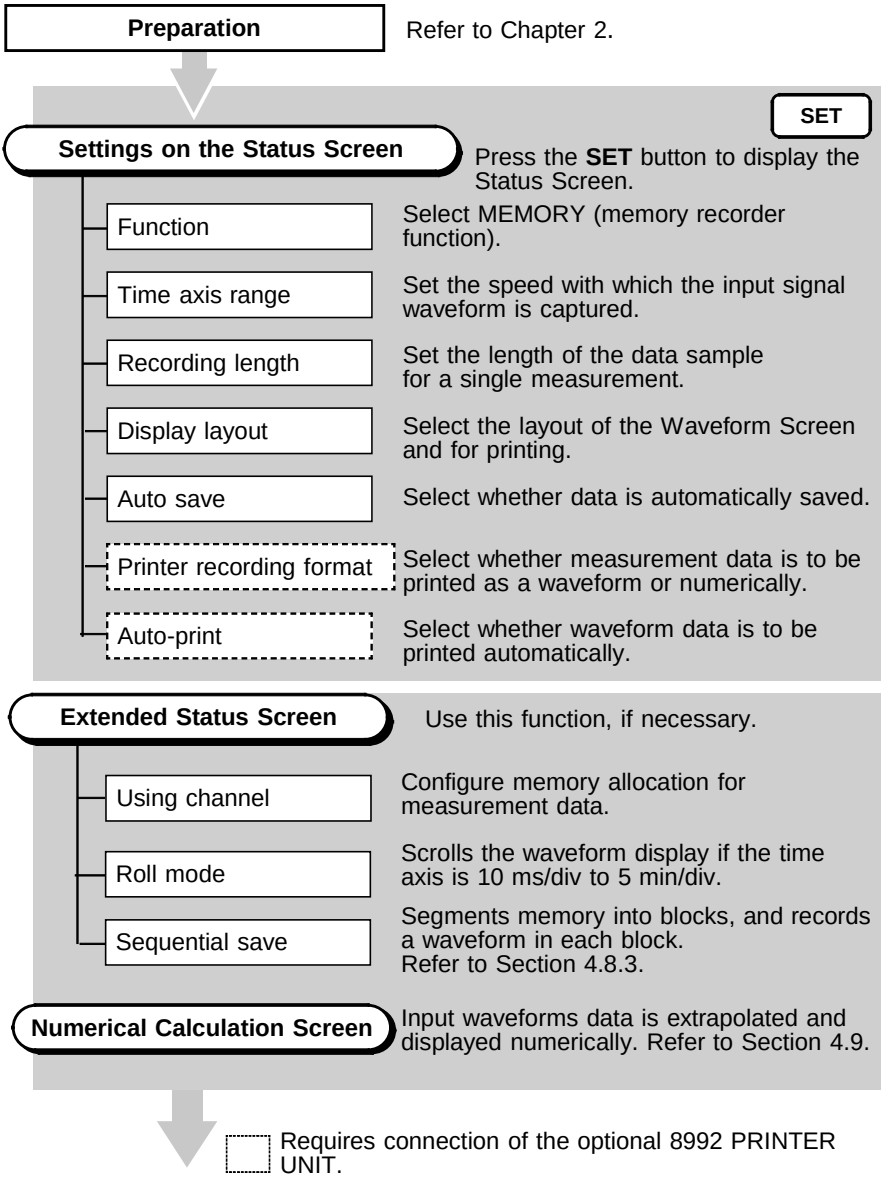
(8) Logging function
Numeric printout of waveform data

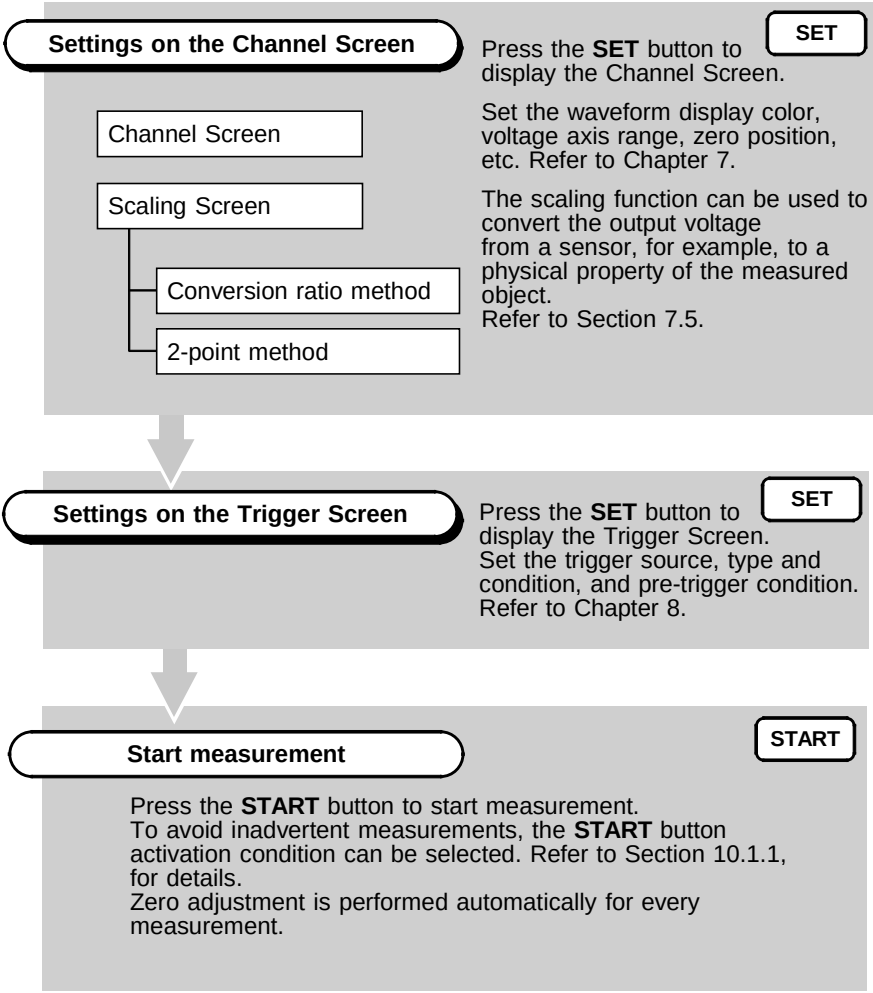
(9) Memory segmentation (Sequential save) function helps to reduce dead time of continuous recording.

(10) Numerical calculation functions
Eleven types of numerical calculation can be performed, such as frequency and RMS measurements.

4.2 Operation Sequence (MEM)

Memory recorder operating procedures are described by the following flowcharts.




Settings on the Channel Screen
SET
Press the SET button to display the Channel Screen.
Channel Screen
Set the waveform display color, voltage axis range, zero position, etc. Refer to Chapter 7.
Scaling Screen
The scaling function can be used to convert the output voltage from a sensor, for example, to a physical property of the measured object.
Refer to Section 7.5.
Conversion ratio method
2-point method
Settings on the Trigger Screen
SET
Press the SET button to display the Trigger Screen.
Set the trigger source, type and condition, and pre-trigger condition.
Refer to Chapter 8.
Start measurement
START
Press the START button to start measurement.
To avoid inadvertent measurements, the START button activation condition can be selected. Refer to Section 10.1.1, for details.
Zero adjustment is performed automatically for every measurement.

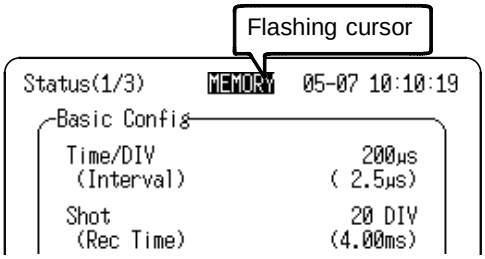
4.3 Setting Items

4.3.1 Setting the Function Mode

The 8807-01, 8808-01 has three function modes. Additionally, the 8807-51, 8808-51 also offers a harmonic wave analysis function. Select the Memory recorder function.

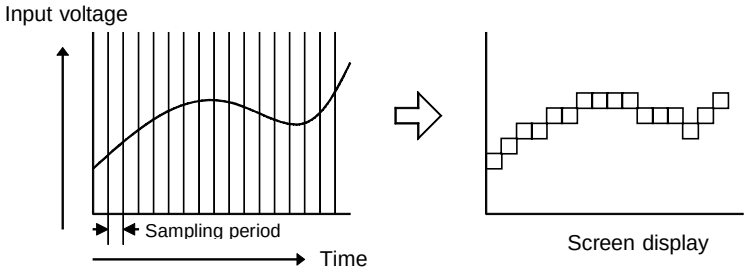
Procedure Status/ Channel/ Trigger Screen

1. Press the **SET** button to display the Status, Channel, or Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and select MEMORY using the ▲▼ buttons.



Memory Recorder Function

Analog input signals are converted by the A/D converter to digital values for display and storage in the internal memory.
X-Y combined plotting of multiple channels is possible.

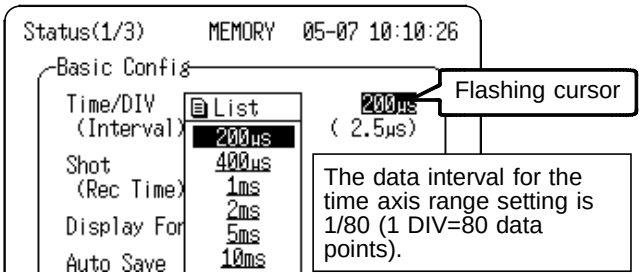


4.3.2 Setting the Time Axis Range

Set the speed for inputting and storing the waveform of the input signal. Time axis range setting expresses the time for 1 division.

Procedure 1 Status Screen

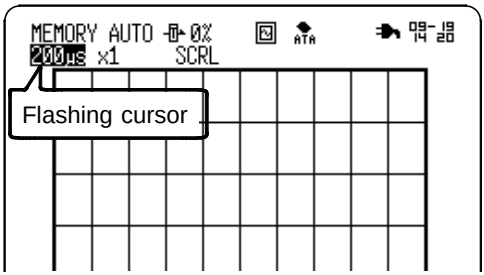
1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Time/DIV and select the time axis range using the ▲▼ buttons.



Pressing the **TIME/DIV** button moves the flashing cursor automatically to the Time Axis position for setting.

Procedure 2 Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to make a setting.



Pressing the **TIME/DIV** button sets the time axis regardless of the flashing cursor position.

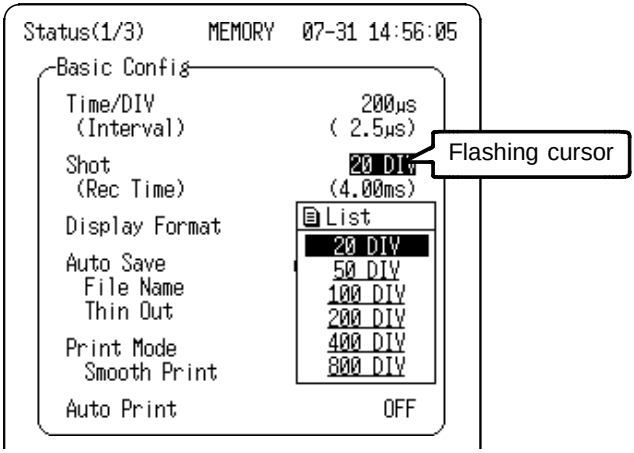
4.3.3 Setting the Recording Length

The length of recording for one measurement operation (number of divisions) can be set.
Constant recording length mode: Select the recording length.
Variable recording length mode: Variable recording length can be selected by the user.

Status Screen

Procedure 1 Constant recording length mode

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Shot and select the recording length using the ▲▼ buttons.

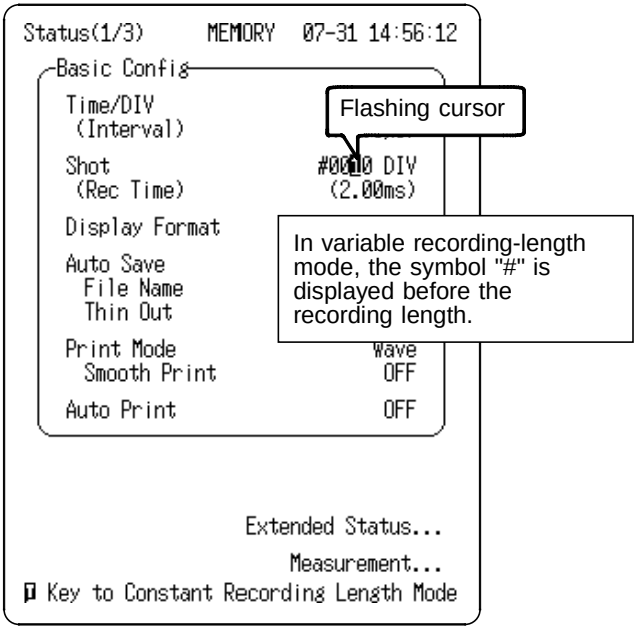


Depending on the number of channels to be used, the recording length is limited. (For setting the number of channels, refer to Section 4.8.1.)

Using channels	Constant recording length [DIV]
1 channel	20, 50, 100, 200, 400, 800, 1600, 3200
1 and 2 channels	20, 50, 100, 200, 400, 800, 1600
1 to 4 channels (8808-01, 8808-51 only)	20, 50, 100, 200, 400, 800

Procedure 2 Variable recording length mode

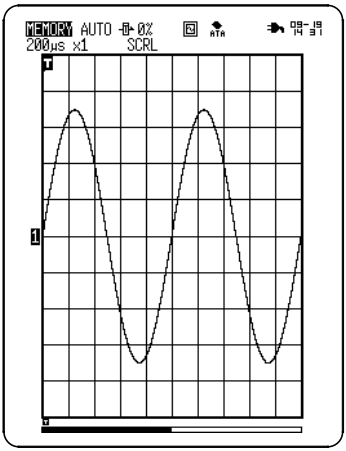
1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Shot.



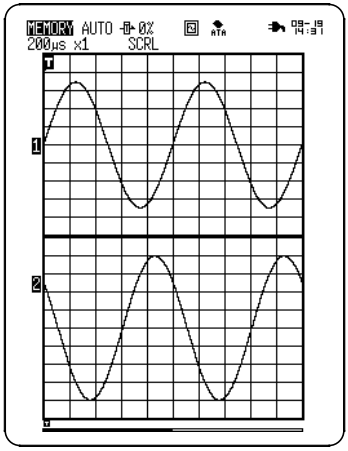
3. Press the T button to set for variable recording length.
4. Using the ◁▷ cursor buttons, move the flashing cursor to the digit to be set and use the ▲▼ buttons to make a setting.
   To return to the constant recording length mode, press the T button again.

4.3.4 Setting the Display Layout

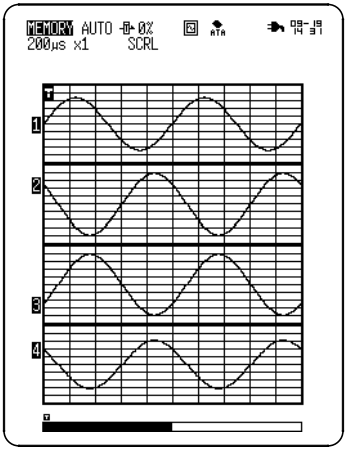
- The display layout of input waveforms can be set for the Waveform Screen and for printing.
- The layouts Single, Dual, Quad, X-Y (Dot/Line) are available.



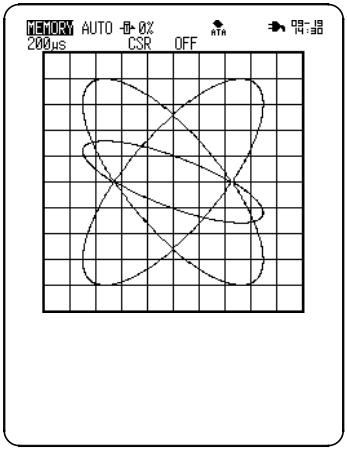
Single Display
Display and record as one graph.



Dual Display
Display and record as two graph.



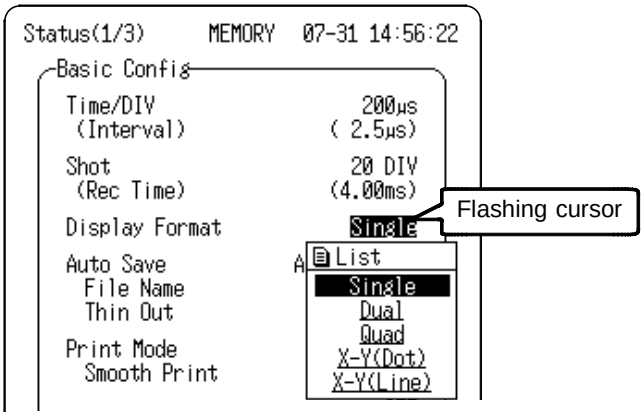
Quad Display
Display and record as four graph.



X-Y Display
(Dot) Linear interpolation (smoothing) is not performed.
(Line) Linear interpolation is performed.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Display Format and select the display format using the ▲▼ buttons.



Single	Display and record as one graph.
Dual	Display and record as two graphs.
Quad	Display and record as four graphs.
X-Y (Dot)	Display and record the waveform as an X-Y (Dot) Screen.
X-Y (Line)	Display and record the waveform as an X-Y (Line) Screen.

When the Dual or Quad display is selected, the channel to be displayed in each screen partition can be set.
For details, refer to Section 7.3.2, and for the settings on the X-Y Screen, refer to Section 4.4.

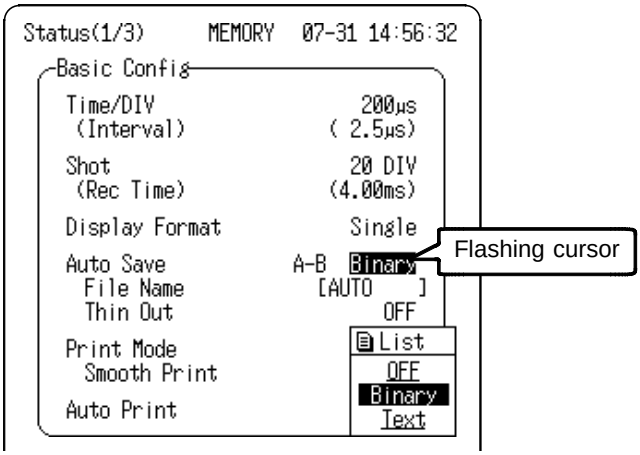
4.3.5 Setting the Auto Save Function

When the function is enabled, measurement data are automatically stored on PC card after they are captured. This function stores a file in the directory currently selected on the File Screen.

Procedure Status Screen

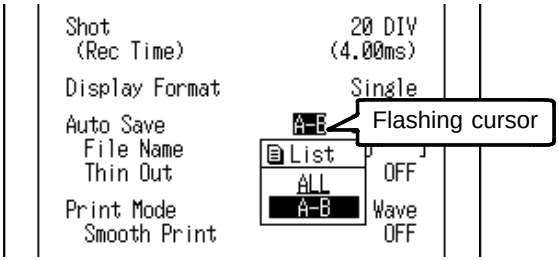
(1) Select the data format for Auto Save.

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Auto Save and select the type of saving using the ▲▼ buttons.



OFF	Auto save is disabled.
Binary	Data are stored as binary data.
Text	Data are stored as text data. Data stored in the text format is not readable by the product.

(2) If using the A/B cursors on the screen, specify the area to save.



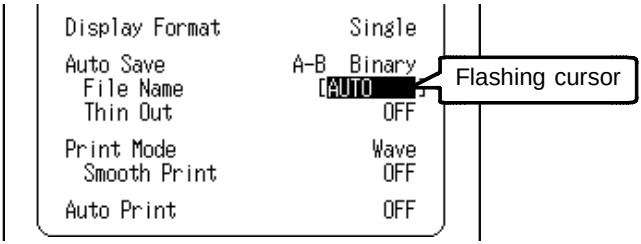
Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.

ALL	Store data for all captured waveforms.
A-B	If A cursor is in use, data is saved from the cursor to the end of input. If both A and B cursors are in use, data between the cursors is saved.

(3) Enter the file name to be used for Auto Save.

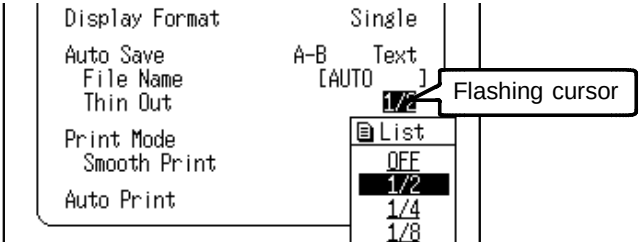
Once the file name has been entered, measurement data is automatically saved as the entered name.
When multiple files are saved in succession, numbers are appended to the file name. If the file name entry is left blank, the file name is automatically set as "AUTO, AUTO0001", etc.

1. Move the flashing cursor to File Name and use the ▲▼ buttons to display the Comment Entry Screen.
2. Move the cursor to the desired character to enter using the ▲▼ buttons. For details, refer to Section 11.3.3.



(4) Enable thinning.

When the text data format is selected, enable thinning. Move the flashing cursor to Thin Out and use the ▲▼ buttons to make a setting.



NOTE

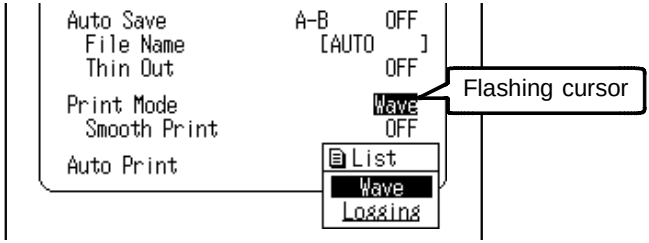
- Data for the channel for which the waveform is displayed is saved.
- During measurement, if remaining PC card capacity runs low enough for a warning message to appear, press the STOP button, then remove the PC card once measurement has been suspended. Data may be lost if the PC card is inserted or removed during measurement.
- Files will be saved in the currently selected directory.

4.3.6 Setting the Print Mode

This mode is available when the 8992 PRINTER UNIT is connected. Select whether to print measurement data as waveform or numeric values.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Print Mode and select Wave or Logging using the ▲▼ buttons.



Wave	Prints measurement data as a waveform. Select Smooth Print to print smoother waveforms, but with slower print speed.
Logging	Print measurement data numerically. Set the print interval.

3. Press the ▲▼ buttons to set Smooth Print to ON or OFF when Wave is selected, or to set the print interval (1 division = 80 points) when Logging is selected.

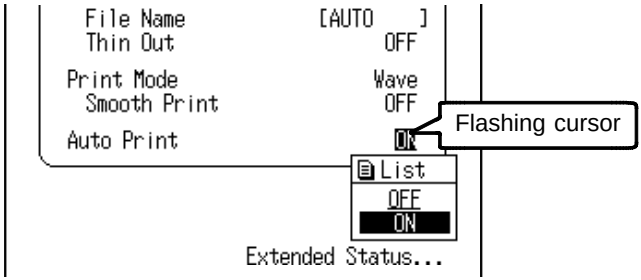
NOTE When "Wave" is selected, Smooth Print can be set only for the Memory Recorder function. Instantaneous waveforms recorded by the RMS Recorder can be smoothed.
When "Logging" is selected, if the print interval is set longer than the record length, only the first point will print.

4.3.7 Setting the Auto Print Function

This function is available when the 8992 PRINTER UNIT is connected. Printout is carried out automatically after a waveform has been captured for the specified recording length.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Auto Print and set to ON or OFF using the ▲▼ buttons.



OFF	Disables the auto print.
ON	Enables the auto print.

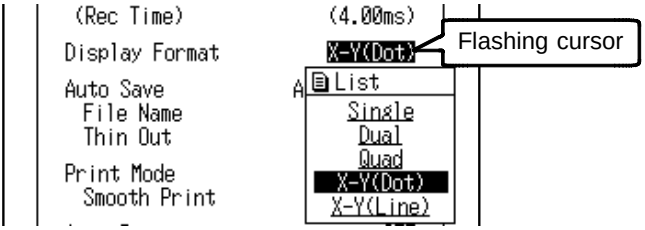
NOTE
- When cursor A and B are enabled, partial printing is executed. For using the A/B cursors, refer to Section 9.1.
- When the roll mode is enabled and the time-axis range is 10 ms/DIV to 5 min/DIV, data is displayed and printed simultaneously.
- The printer cannot be used with alkaline batteries: use either the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) or 9447 BATTERY PACK when using the printer.

4.4 Using the X-Y Waveform Plots (MEM)

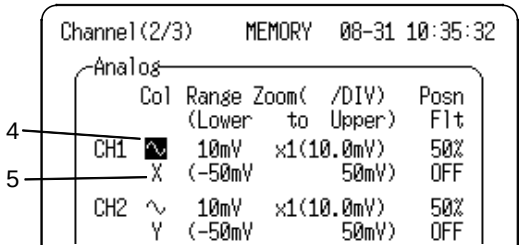
- X-Y combined plotting can be performed when the Display Layout is set to X-Y display on the Status Screen. For the 8808-01, 8808-51 when the X axis is assigned to one analog channel, up to three X-Y combined plots are possible.
- Voltage axis magnification/compression is active also when using X-Y combined plotting.
- Using the A/B cursors, it is possible to specify the data between the cursors for partial plotting.

Procedure Status/ Channel Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Display Format and select format (X-Y Dot or X-Y Line) using the ▲▼ buttons.



3. Press the **SET** button with the Status Screen displayed to display the Channel Screen.

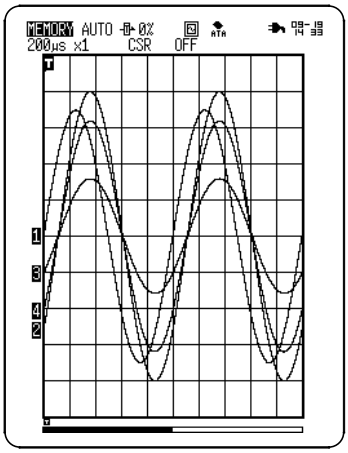


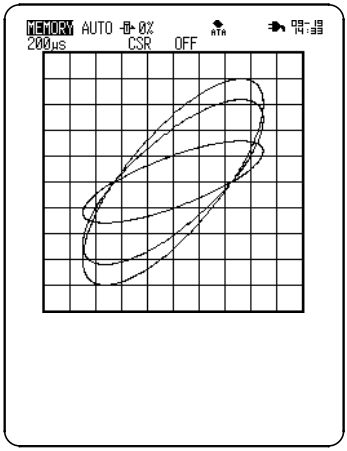
4. Select the display color using the ▲▼ buttons.
5. Move the flashing cursor to the channel to use as the X axis, and select it using the ▲▼ buttons.
   Channels other than the one selected for the X axis are the Y-axis channels.

Partial X-Y plot

Using the A/B cursors, it is possible to specify a range for partial X-Y plotting. Refer to Section 9.1. (Normal X-Y plotting covers all data of the recording length.)

Procedure Status/ Channel/ Waveform Screen





1. Display the input waveforms, except for the X-Y display.
2. Using the A/B cursors, specify the desired portion for plotting.
3. Press the **SET** button to display the Status Screen.
4. Select format (X-Y dot or X-Y line) on the Display Format item.
5. On the Channel Screen, select the channel to use as the x axis, using the ▲▼ buttons.
6. Press the **DISP** button to display the Waveform Screen.

NOTE

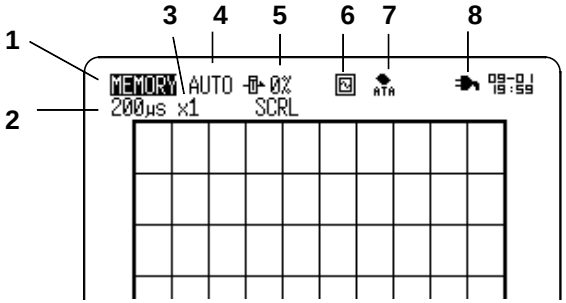
- Partial X-Y plotting is disabled when using the horizontal cursor.
- When using only cursor A, X-Y combined plotting is applied only to the range from cursor A to the end of the measurement.
- When the number of channels to be used is set to one, X-Y combined plotting is not available.Refer to Section 4.8.1.

4.5 Waveform Screen Settings (MEM)

Settings for the Waveform Screen are described below. For details, refer to Section 4.3.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Move the flashing cursor to the item to be set.
3. Use the ▲▼ buttons to make a setting.



1	Function	MEMORY/RECORD/RMS
2	Time axis range	200 µs to 5 min/DIV
3	Magnification/ Compression of the time axis	x10 to x1/500
4	Trigger mode	SING/REP/AUTO
5	Pre-trigger	0 to 100, -95%
6	Waveform display area	Full/partitioned display
7	PC card indicator	Appears when a PC card is installed (SRAM/ ATA/ FAX)
8	Power indicator	Appears the type of power supply of the product or battery low mark.

NOTE Input-related settings are accessible by pressing a channel select button (CH1 to CH4) from the Waveform Screen. For details, refer to Section 7.4.

4.6 Auto Range Function

This function automatically selects the time axis range, voltage axis and zero position (excluding when the setting of input coupling is "CLAMP").
The time axis range is applied to the lowest numbered channel with waveform display enabled, and is automatically set to record 1 to 2.5 cycles on the Waveform Screen.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Press both sides of the **TIME/DIV** button for at least 2 seconds to activate auto-ranging.
3. Press the **START** button to execute, or press the **STOP** button to cancel. To cancel forcibly during auto-range operation, press the **STOP** button. If measurement has started using the auto-range function:

Conditions related to the input channels (all channels)

- Voltage axis range, zero position: Value set automatically
- Magnification/compression ratio along the voltage axis:
  Single display x1
  Other displays x1/2
- Low-pass filter, Input coupling: OFF, DC

Status conditions

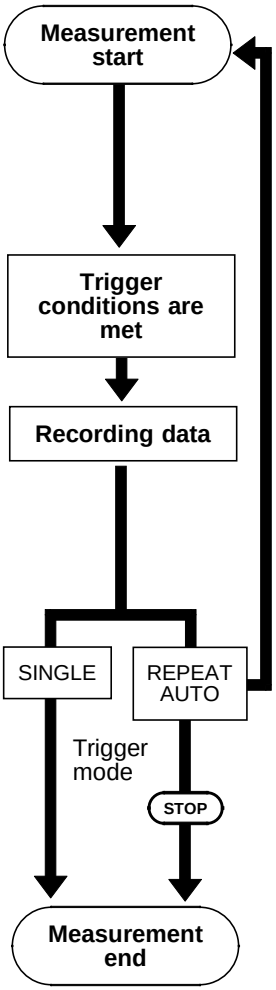
- Time axis range (time/div): Value set automatically (Magnification/compression ratio: x1
- Sequential save: OFF

Trigger conditions (one channel only)

- Trigger mode: AUTO
- AND/OR for internal and external triggers: OR
- Pre-trigger: 20%
- Internal trigger:
  Enables only the waveform display channel with the lowest number. (If the difference between maximum and minimum is 2 divisions or less, the next channel is enabled.)
- Trigger type : Level
  Slope: ⤴ rising
  Trigger level: value set automatically
  Filter: OFF

NOTE When the auto-range function is engaged a trigger output signal is generated. Take suitable precautions when using the auto-range function concurrently with the trigger output connector.

4.7 Start and Stop Operation (MEM)



Press the **START** button to start measurement, and LED lights in green. The **START** button activation condition can be selected. Refer to Section 10.1.1. When pre-trigger is activated, the trigger is not enabled until the specified pre-trigger data has been read.("Pre-trig wait" is displayed.)
"Wait for trig" is displayed until the trigger condition occurs.

Data recording starts when the trigger conditions are met. When trigger mode is AUTO, the product waits for about 1 second for trigger conditions to be met. After this interval, data recording starts, regardless of trigger state.

During recording, "Storing" is displayed.
When the Roll mode is enabled, measurement data is displayed (scrolling) as it is recorded. When automatic printing is also enabled, data prints at the same time it is displayed.
Measurement can be aborted by pressing the **STOP** button twice during measurement.
Then the waveform data until the **STOP** button is pressed is displayed and saved. When the auto saving is enabled, the data until a forced termination is automatically saved. (automatic printing will not execute)

Trigger mode: REP/AUTO
Activates the trigger waiting condition. Input resumes when the trigger conditions are met.

Trigger mode: SING
Measurement can be aborted by pressing the **STOP** button twice (automatic printing will not execute).

Trigger mode: REP/AUTO
During measurement, pressing the **STOP** button once records up to the set recording length (waveform display, printing and auto-save are executed).
Measurement can be aborted by pressing the **STOP** button twice (automatic printing will not execute).

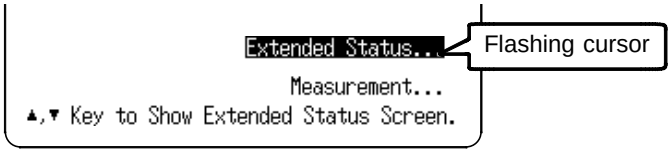
NOTE If measurement is aborted after a trigger event occurs, waveform data up to the abort are retained. However, no data is retained if measurement is aborted before a trigger event. If the trigger mode is Continuous or Auto, and waveforms remain from a previous trigger event, the waveforms are displayed (excluding maximum recording length).

4.8 Extended Status Screen Setup (MEM)

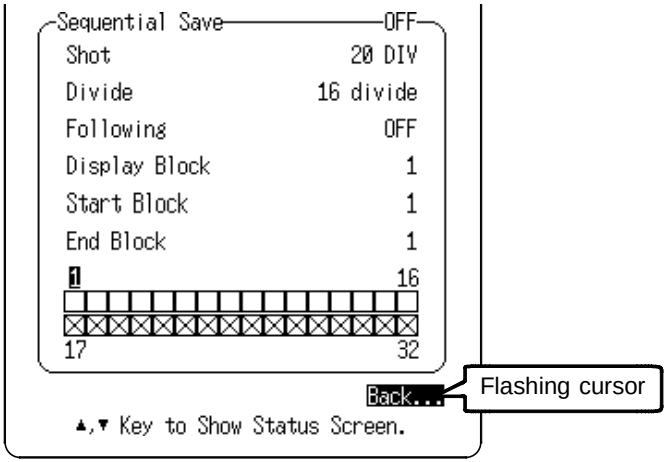
Application settings can be made in Memory recorder function on the Extended Status Screen.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Extended Status... and press the ▲▼ buttons to display the Extended Status Screen.



3. To return to the Status Screen, move the flashing cursor to Back, and press the ▲▼ buttons or **SET** button.

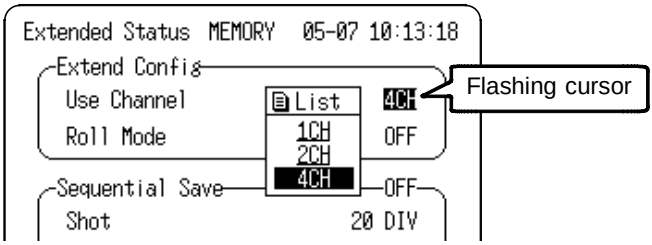


4.8.1 Channel Usage Settings

Set segmenting of measurement data memory.
The record length can be made longer when using fewer channels.

Procedure Extended Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Extended Status and display the Extended Status Screen using the ▲▼ buttons.
3. Move the flashing cursor to Use Channel and select channel using the ▲▼ buttons.



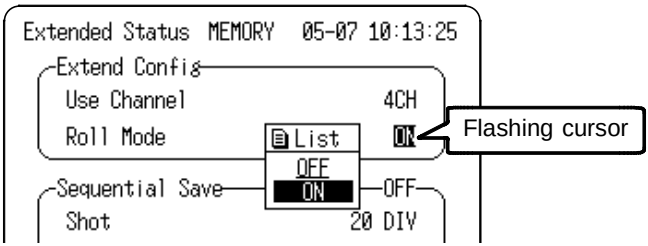
1CH	Internal memory is allocated to channel 1, so measurement data on channels 2 and above cannot be stored to internal memory. Only Channel A can be used for logic.
2CH	Internal memory is allocated to channel 1 and 2, so measurement data on channels 3 and above cannot be stored to internal memory. Channels A and B can be used for logic.
4CH	Internal memory is allocated for the four channels (Model 8808-01, 8808-51). Channels A and B can be used for logic.

4.8.2 Setting the Roll Mode

This mode can be used at a time axis range setting of 10 ms/DIV to 5 min/DIV. When roll mode is set to ON, the waveform is displayed immediately at the start of recording (the screen scrolls).
When the 8992 PRINTER UNIT is connected and the Roll Mode and Auto Print are enabled, printing occurs concurrently with waveform display.

Procedure Extended Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Extended Status and display the Extended Status Screen using the ▲▼ buttons.
3. Move the flashing cursor to Roll Mode and set to ON or OFF using the ▲▼ buttons.



OFF	Disables the roll mode.
ON	Enables the roll mode.

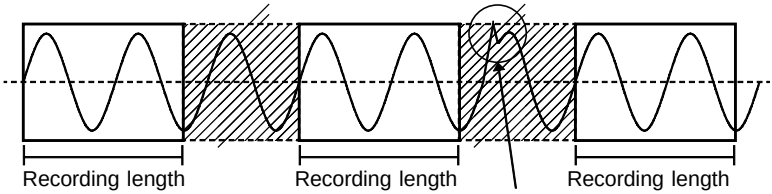
NOTE

- Even if set to ON, the Roll Mode is inoperative when the time axis range is set faster than 10 ms/div.
- When Roll mode is set to ON, the settings for sequential saving is automatically turned OFF.

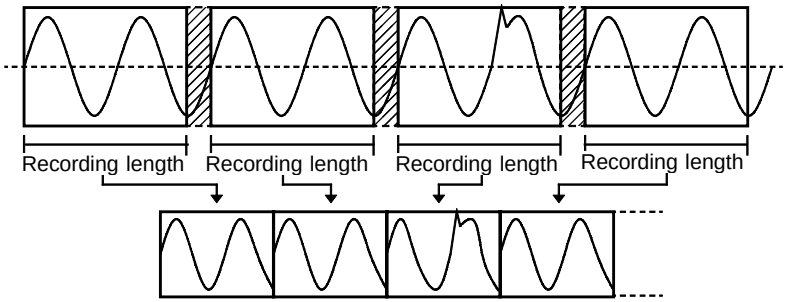
4.8.3 Sequential Save Function

- This function divides the memory into separate blocks, each of which can be used for waveform recording.
- Input signal capture is carried out continuously using the trigger, storing waveform data successively in each block.
- During recording, no display or printout is carried out.
- This reduces dead time (non-sensitivity periods due to display and printing delays).

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



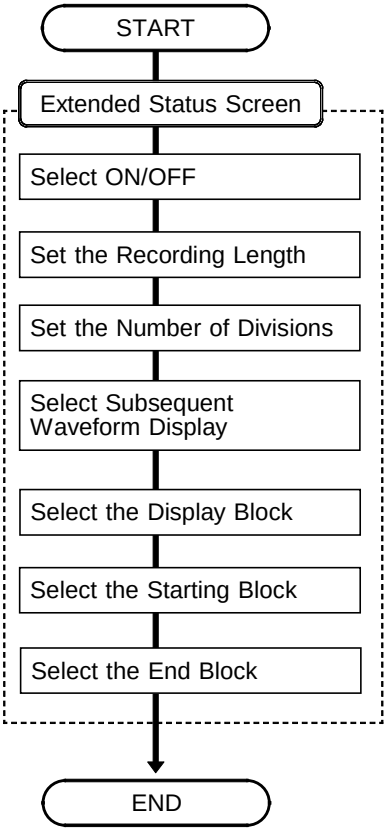
Using sequential save



Data are divided into blocks and recorded in memory.

Dead time: (interval in which no sampling occurs due to display and print processing)

Sequential Save Setting Procedure



Display the Extended Status Screen.

Select whether to enable Sequential Save.

Set the per-block recording length.

Set the number of memory blocks.

Select whether waveforms should be displayed on screen after recording to each block.

Select which blocks to display on screen after measurement.

Select the block at which to start measurement.

Select the block at which to end measurement.

Press the **SET** button to return to the Status Screen.

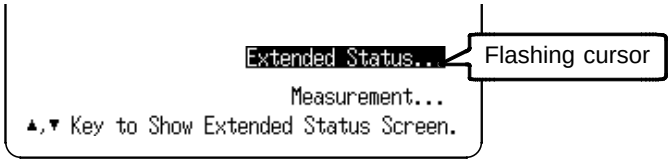
NOTE

- Dead time during which no further data is sampled, in order to permit display and recording after the acquired data is recorded to one block, is about 4 ms.
  Dead time, however, may slightly fluctuate by key operation.
- While the roll mode is being used in memory recorder function (on the Extended Status Screen), the sequential save function is disabled.

Procedure Extended Status Screen (MEM)

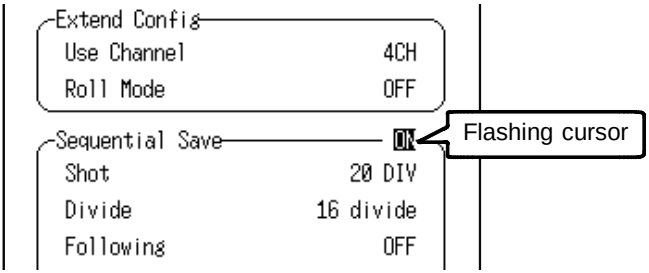
(1) Display the Extended Status Screen.

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Extended Status... and press the ▲▼ buttons to display the Extended Status Screen.



(2) Enable or disable the sequential saving function.

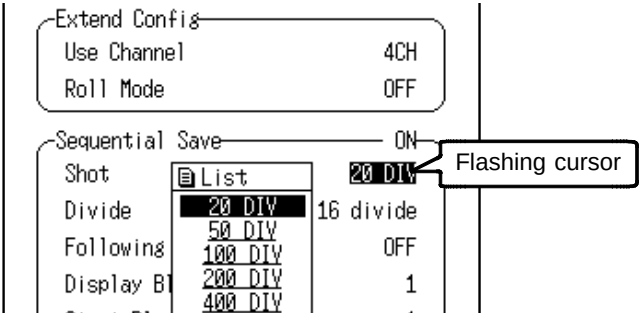
Move the flashing cursor to Sequential Save and set to ON or OFF using the ▲▼ buttons.



OFF	Disables the sequential save function.
ON	Enables the sequential save function.

(3) Set the recording length.

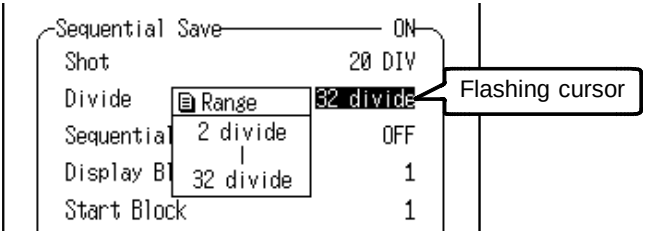
Move the flashing cursor to Shot and set the recording length using the ▲▼ buttons.



When setting the recording length for Sequential Save, the recording length setting (on the Status Screen) is automatically set to the same length.
The variable recording length can be set. Refer to Section 4.3.3.

(4) Set the number of divisions

Move the flashing cursor to Divide and use the ▲▼ buttons to make a setting.



The recording length and maximum number of divisions are automatically determined according to the number of available channels, as shown in the tables below. Refer to Section 4.8.1 for details.

Maximum number of divisions

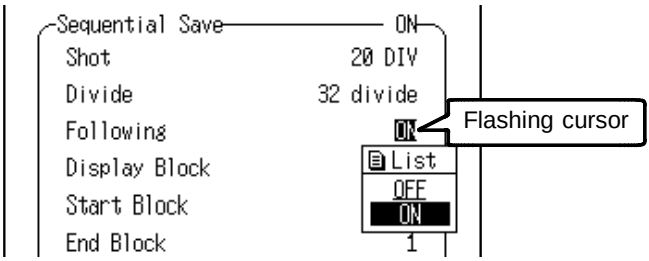
Recording length (DIV) \ Number of channels	1	2	4	Instantaneous waveform recording *
20	32	32	32	16
50	32	32	16	8
100	32	16	8	4
200	16	8	4	2
400	8	4	2	---
800	4	2	---	---
1600	2	---	---	---

*This shows the number of divisions for the instantaneous waveform recording (Memory Recording) of the RMS Recorder function.

(5) Follow-up waveform display

Enabling Subsequent Waveform Display causes the waveforms that were input to each block following a trigger event during Sequential Save to be displayed one by one (resulting in longer dead time).

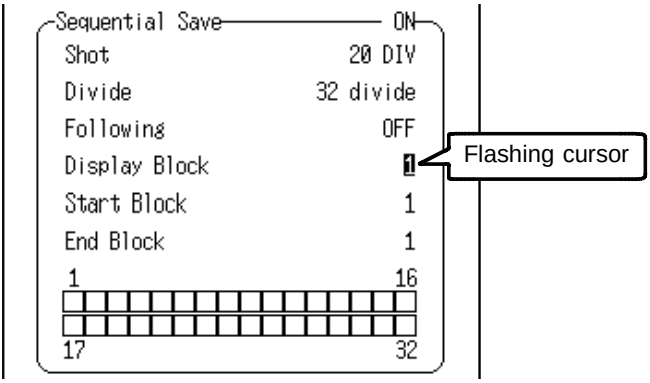
Move the flashing cursor to Following and set to ON or OFF using the ▲▼ buttons.



OFF	After all blocks are recorded, the waveform of the last block only is displayed.
ON	Each block is recorded and displayed.

(6) Set the block to be displayed.

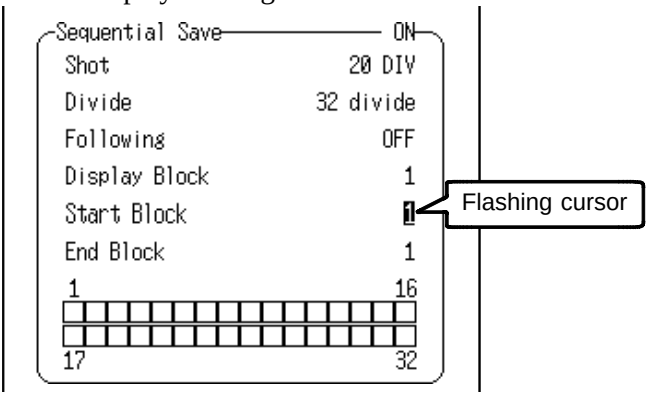
Move the flashing cursor to Display Block and set the block to be displayed using the ▲▼ buttons to make a setting.



After measurement starts, the displayed block is updated by the recorded block. When measurement is completed, the most recently recorded block is displayed.

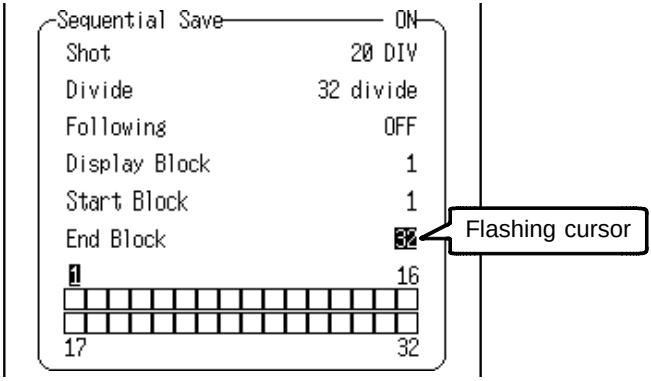
(7) Set the first block

Move the flashing cursor to Start Block and set the first block to be displayed using the ▲▼ buttons.



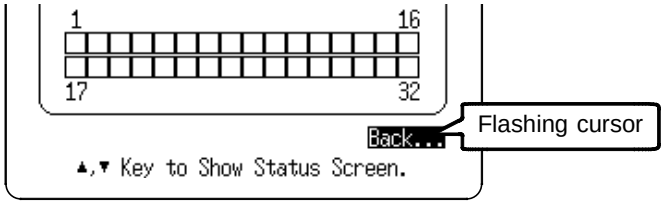
(8) Set the last block

Move the flashing cursor to End Block and set the last block to be displayed using the ▲▼ buttons.



(9) Finishing sequential save setting

When finished setting, move the flashing cursor to Back and press the ▲▼ buttons or **SET** button to return to the Status Screen.

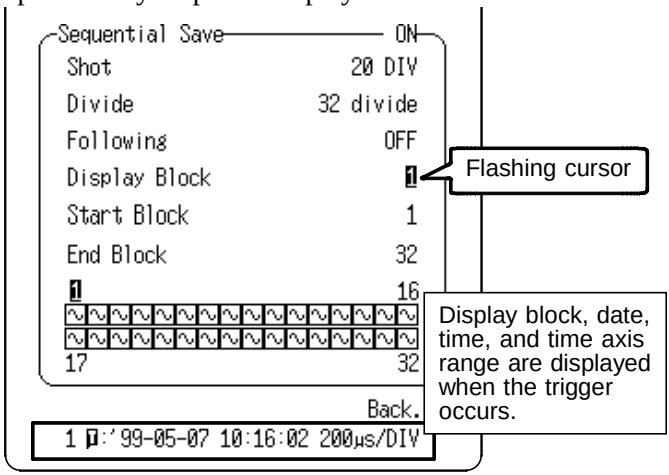


(10) Stored block display procedure

Extended Status Screen

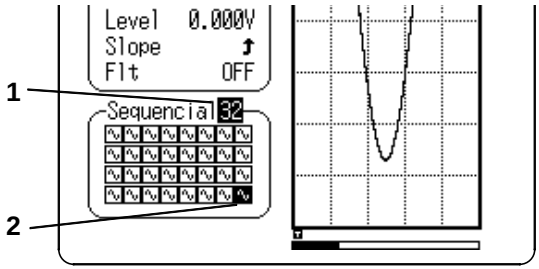
1. Move the flashing cursor to Display Block.
2. Specify the block to be displayed using the ▲▼ buttons. The blocks shown by ∿ indicate that measured data has been saved to the blocks.

3. Press the **DISP** button to display the Waveform Screen. The data specified by step 2 is displayed.

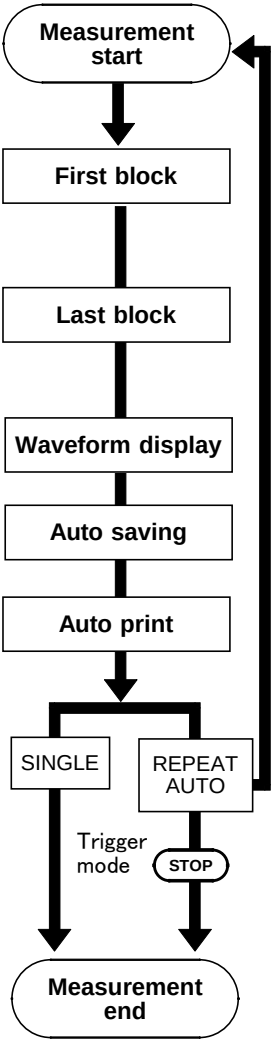


Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Press a Channel Select button (CH1 to CH4) to display the block allocation status.
   The blocks shown by ∿ indicate that measured data has been saved to the blocks.
3. Move the flashing cursor to position 1 and specify the block to be displayed, or use the Cursor buttons to specify the block 2 and press the ▲▼ buttons to display the waveform in the specified block.



Relation between trigger mode and sequential save function



Press the **START** button to start measurement, and LED lights in green. Data recording starts when trigger conditions are met.

First block is stored by trigger setting.
The following waveform display ON: waveform is displayed.
The following waveform display OFF: waveform is not displayed.

Last block is stored by trigger setting.
The following waveform display ON: waveform is displayed.
The following waveform display OFF: waveform is not displayed.

Displays last block waveform.

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

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

Trigger mode: REP/AUTO

Activates the trigger waiting condition. Input resumes when the trigger conditions are met.

Trigger mode: SING

Measurement can be aborted by pressing the **STOP** button twice (automatic printing will not execute).

Trigger mode: REP/AUTO

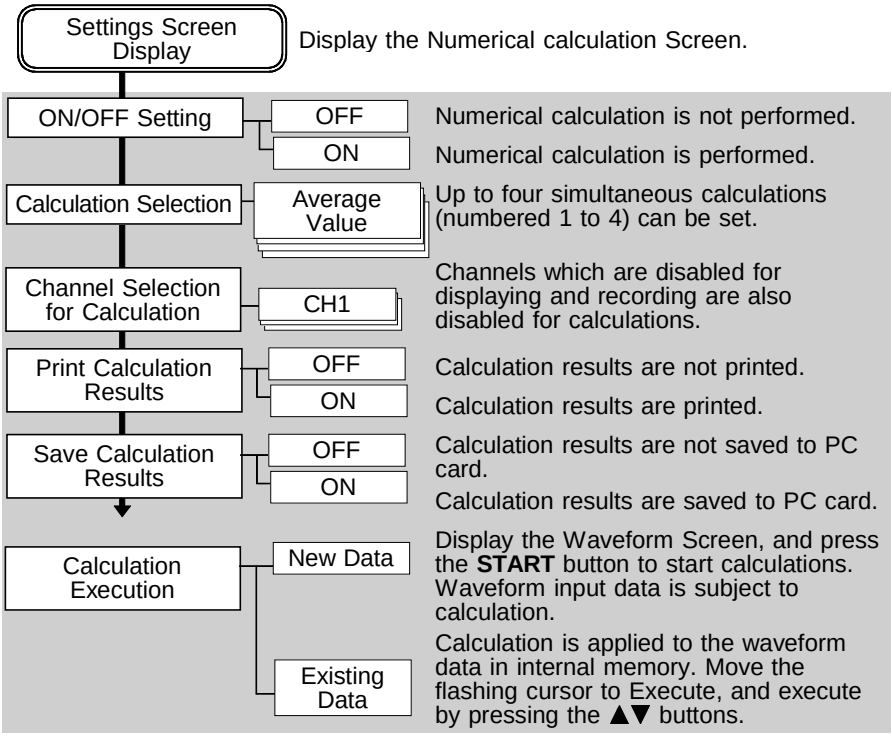
During measurement, pressing the **STOP** button once records up to the end of the block (waveform display, printing and auto-save are executed).
Measurement can be aborted by pressing the **STOP** button twice (automatic printing will not execute).

4.9 Numerical Calculation (Measurement)

Numerical calculations apply to recording by the Memory Recorder and Instantaneous waveform recording in RMS Recorder. Results of calculations are displayed numerically (by printing or saving). Waveforms stored by the Instantaneous waveform recording in RMS Recorder are calculated using the Memory Recorder function. When the A/B cursors are used, calculations are performed on the data between the cursors.

The following eleven types of calculations can be performed.

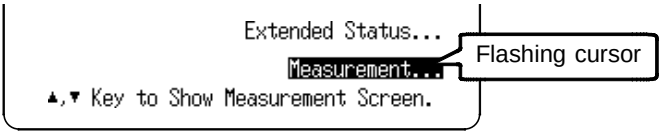
(1) Average value (2) Peak-to-peak value (3) Maximum value
(4) Time to maximum value (5) Minimum value
(6) Time to minimum value (7) Rms value
(8) Period (9) Frequency (10) Area value
(11) XY area value



Procedure Measurement Screen

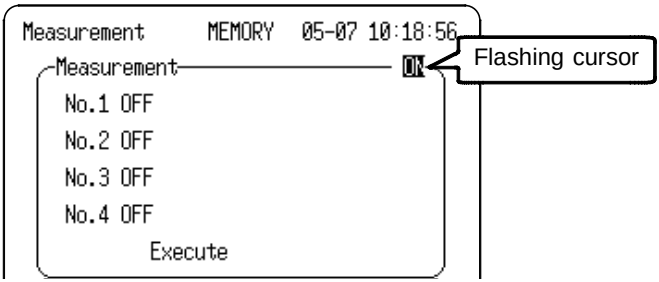
(1) Display the Measurement Screen.

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Measurement and display the Numerical calculation Screen using the ▲▼ buttons.



(2) Set the numerical calculation to on or off.

Move the flashing cursor to Measurement and set to on or off using the ▲▼ buttons.

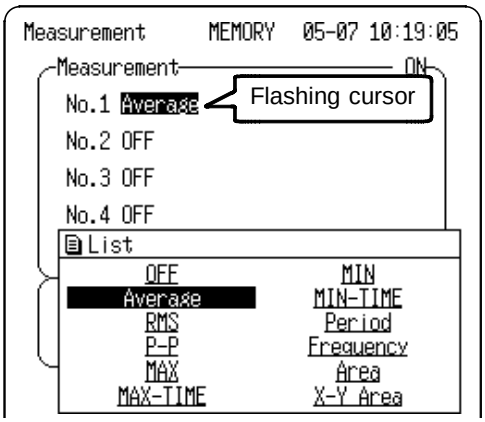


OFF	Disables the numerical calculation.
ON	Enables the numerical calculation.

(3) Select the numerical calculation to perform.

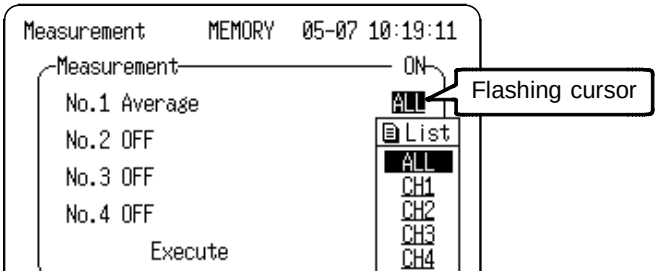
Up to four simultaneous calculations (numbered 1 to 4) can be set.

Move the flashing cursor to the items (No.1 to No.4) to be set and select the item to be calculated using the ▲▼ buttons.



(4) Select the channels for numerical calculation.

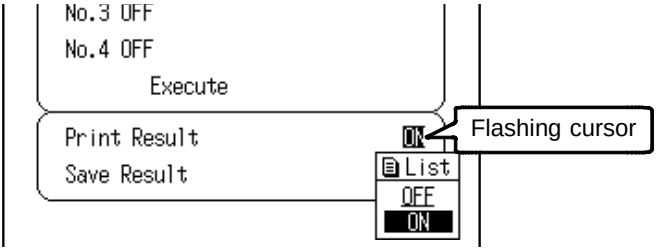
Move the flashing cursor as shown in the figure below and set the channel using the ▲▼ buttons.



ALL	Perform calculations on all channels.
CH1 to CH4	Perform calculations only on the selected channels.

(5) Set whether to print calculation results after display.

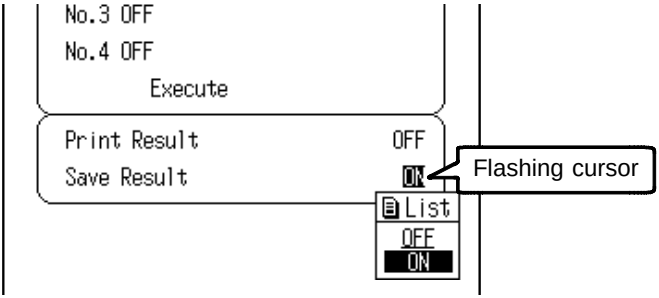
Move the flashing cursor to Print Result and set to on or off using the ▲▼ buttons.



OFF	Calculation results are not printed.
ON	Calculation results are printed.

(6) Set whether to save calculation results to a PC card after display.

Move the flashing cursor to Save Result and set to on or off using the ▲▼ buttons.

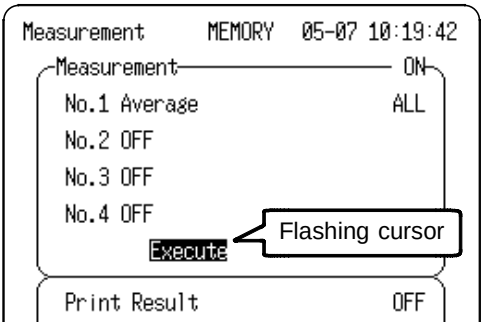


OFF	Calculation results are not saved.
ON	Calculation results are saved to PC card in the text format. Data stored in the text format is not readable by the product.

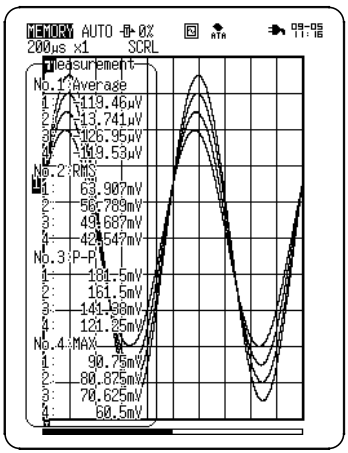
(7) Execute numerical calculation (with existing data)

Calculates the data stored in memory and read from a PC card.

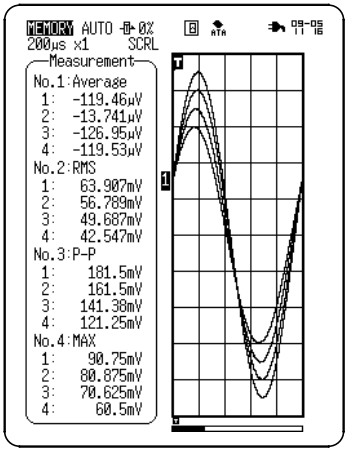
Move the flashing cursor to Execute and use the ▲▼ buttons to make a setting.



Operational Example of Numerical Calculation



Full Screen Display



Partitioning Display

NOTE

- Refer to Section 9.5 for information about waveform display area setting.
- Numerical calculation results cannot be displayed when the Settings window is open on the Waveform Screen: press the Channel select button (CH1 to CH4) to close the Settings window to display calculation results.

Numerical Calculation with New Data

From the Waveform Screen, press the **START** button to begin measurement. Data input begins when trigger conditions are met. After the specified data record amount is input, numerical calculation starts, and when calculation is finished the results are displayed. If printing or saving of calculation results has been enabled, those processes execute.
When starting to input subsequent data, the previous data is cleared.

NOTE

- The calculation area can be specified by the A/B cursors. If only cursor A is used, the calculation area extends from the cursor to the end of the measurement data. The (horizontal) line cursor is not used to specify calculation area.
- When both numerical calculation and sequential save are enabled at the same time, calculation starts after sequential save finishes. All blocks are processed by the calculation, so the calculation result is refreshed and the final calculation result is that of the last block. To view the results of all calculations, enable printing or saving of the calculation results.

Chapter 5
Recorder Function

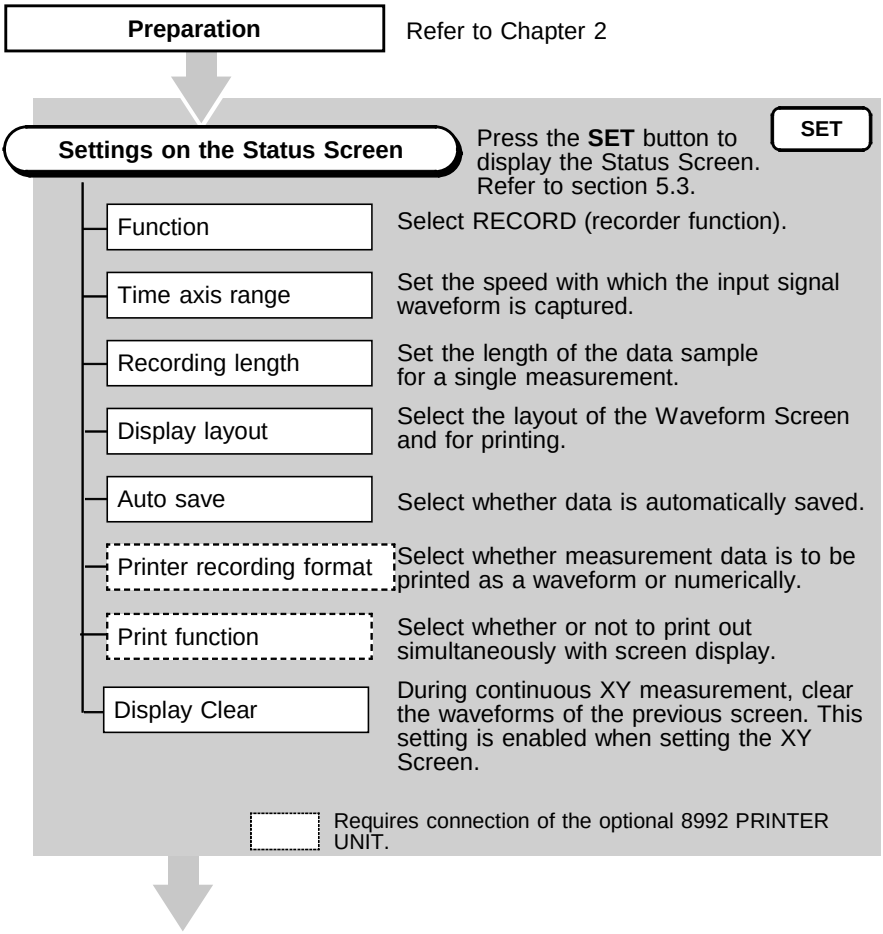
5.1 Overview of the Recorder Function

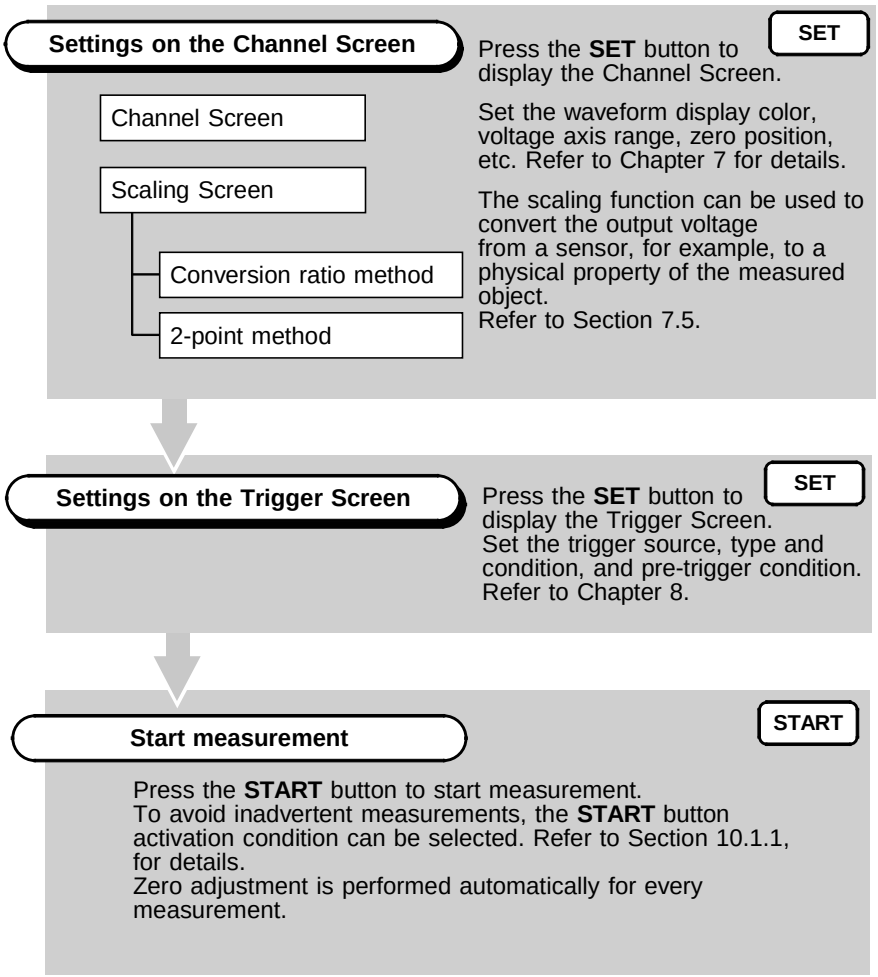
The recorder function has the following features.

(1) Real time display and printing of the input signal
(2) Real time continuous recording of the input signal
(3) All input channel data are recorded on the same time axis.
Since data for all channels can be superimposed, the relative relationship between input signals can be observed visually.
(4) Time axis setting
100 ms/DIV to 1 h/DIV (14 steps)
(5) Time axis resolution 80 points/DIV (printer)
(6) Sampling period 2.5 µs fixed
(7) Waveform magnification/compression display and printout
Time axis direction: x1 to x1/500
Voltage axis direction: x10 to x1/2 (single)
(8) Display layout
Time axis waveform: single, dual, and quad displays
X-Y waveform: single display (dot/line)
(9) Storage capacity
400 divisions of the data are stored in memory.
(10) Logging function
Numeric printout of waveform data
(11) Reprinting capability
The last 400-division quantity of data is stored in memory, and can be printed repeatedly.

5.2 Operation Sequence (REC)

Recorder operating procedures are described by the following flowcharts.




Settings on the Channel Screen
SET
Press the SET button to display the Channel Screen.
Channel Screen
Set the waveform display color, voltage axis range, zero position, etc. Refer to Chapter 7 for details.
Scaling Screen
The scaling function can be used to convert the output voltage from a sensor, for example, to a physical property of the measured object.
Refer to Section 7.5.
Conversion ratio method
2-point method
Settings on the Trigger Screen
SET
Press the SET button to display the Trigger Screen.
Set the trigger source, type and condition, and pre-trigger condition.
Refer to Chapter 8.
Start measurement
START
Press the START button to start measurement.
To avoid inadvertent measurements, the START button activation condition can be selected. Refer to Section 10.1.1, for details.
Zero adjustment is performed automatically for every measurement.

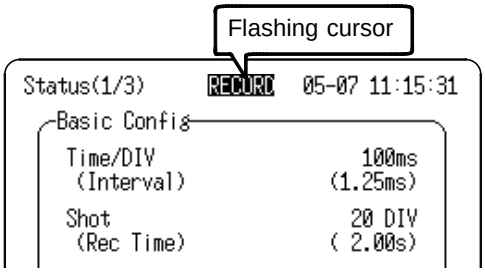
5.3 Setting Items

5.3.1 Setting the Function Mode

The 8807-01, 8808-01 has three function modes. Additionally, the 8807-51, 8808-51 also offers a harmonic wave analysis function. Select the Recorder function.

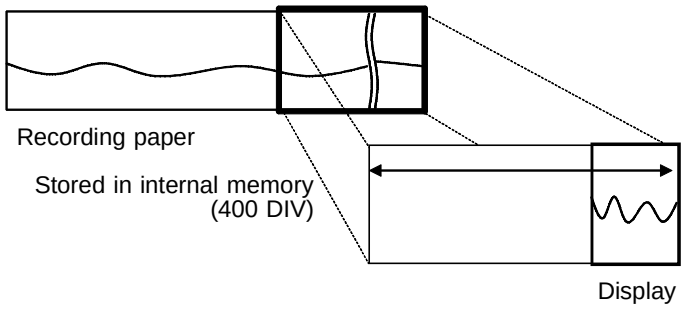
Procedure Status, Channel, Trigger Screen

1. Press the **SET** button to display the Status, Channel, or Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and select RECORD using the ▲▼ buttons.



Recorder Function Description

Input signals converted to digital data are displayed and printed in real time (when the 8992 PRINTER UNIT is connected).
When measurement is finished, the last 400-division quantity is stored in internal memory, so reverse scroll viewing and reprinting are possible.

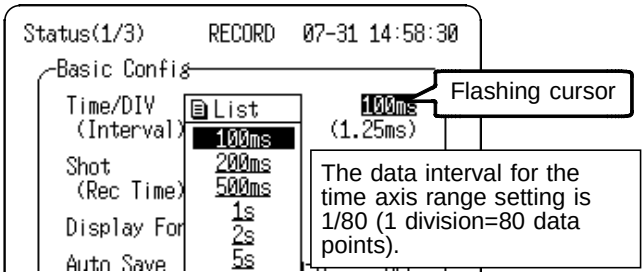


5.3.2 Setting the Time Axis Range

Set the speed for inputting and storing the waveform of the input signal. Time axis range setting expresses the time for 1 division. The sampling period is fixed to 2.5 µs (400 kS/s).

Procedure 1 Status Screen

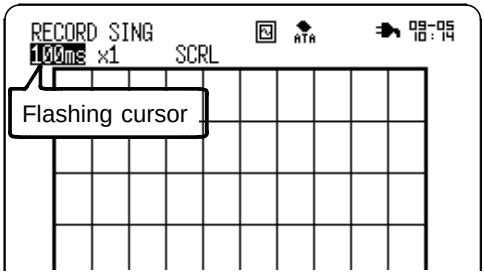
1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Time/DIV and select the time axis range using the ▲▼ buttons.



Pressing the **TIME/DIV** button moves the flashing cursor automatically to the Time Axis position for setting.

Procedure 2 Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to make a setting.



Pressing the **TIME/DIV** button sets the time axis regardless of the flashing cursor position.

5.3.3 Setting the Recording Length

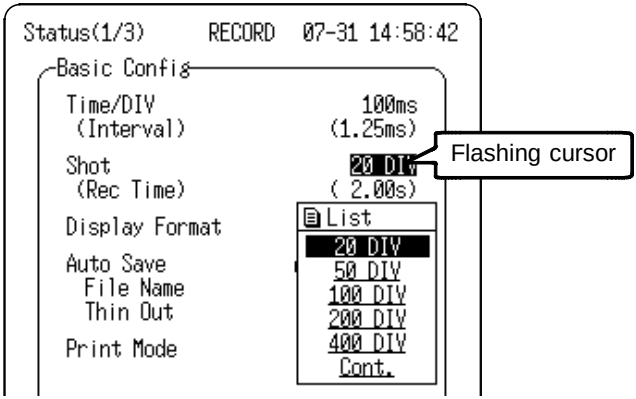
The length of recording for one measurement operation (number of division) can be set.

Constant recording length mode: Select the recording length.
Variable recording length mode: Variable recording length can be selected by the user.

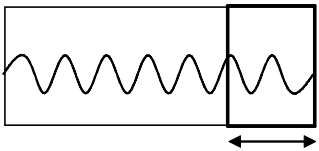
Status Screen

Procedure 1 Constant recording length mode

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Shot and select the recording length using the ▲▼ buttons.



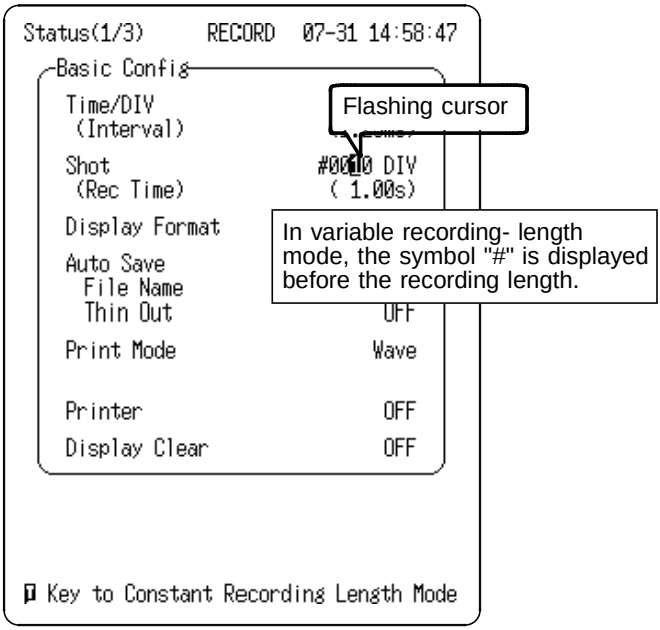
NOTE • When the recording length is set to Cont., the last 400-division quantity is stored in internal memory.



Stored in Internal Memory
(400 DIV)

Procedure 2 Variable recording length mode

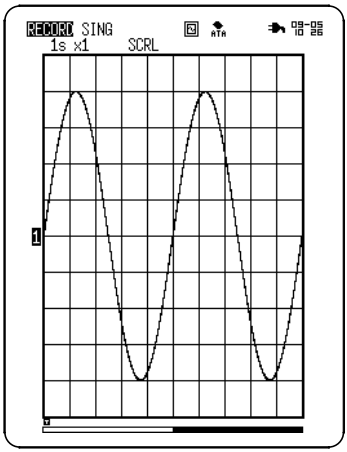
1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Shot.



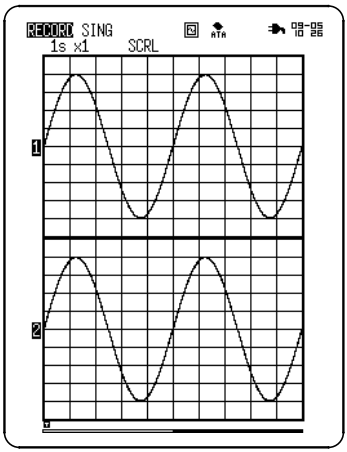
3. Press the T button to make a setting for variable recording length.
4. Using the ◁▷ cursors, move the flashing cursor to the digit to be set and use the ▲▼ buttons to make a setting. To return to the constant recording length mode, press the T button again.

5.3.4 Setting the Display Layout

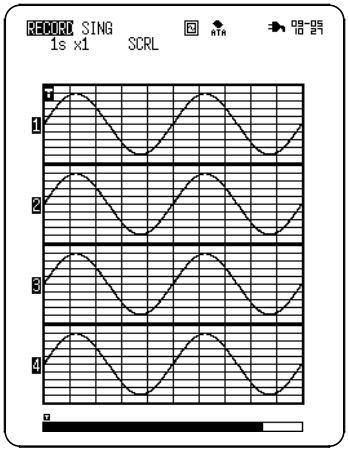
- The display layout of input waveforms can be set for the Waveform Screen and for printing.
- The layouts Single, Dual, Quad, X-Y (Dot/Line) are available.



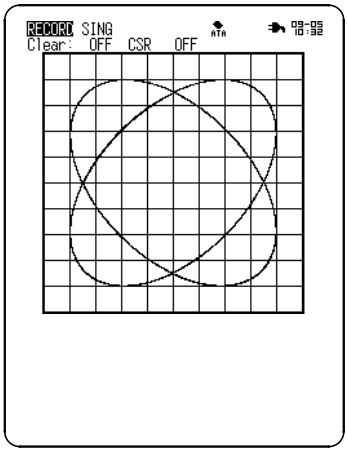
Single Display
Display and record as one graph.



Dual Display
Display and record as two graph.



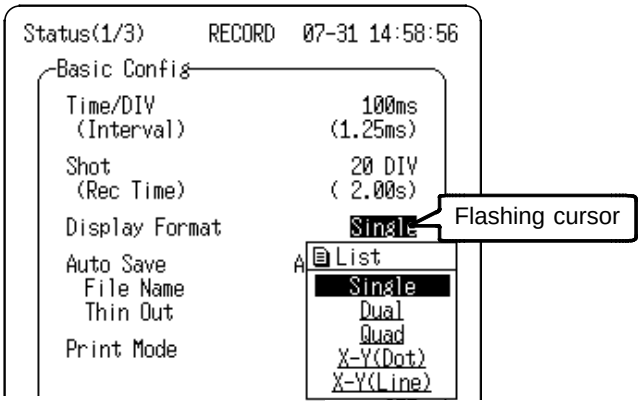
Quad Display
Display and record as four graph.



X-Y Display
(Dot) Linear interpolation (smoothing) is not performed.
(Line) Linear interpolation is performed.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Display Format and select the display format using the ▲▼ buttons.



Single	Display and record as one graph.
Dual	Display and record as two graphs.
Quad	Display and record as four graphs.
X-Y (Dot)	Display and record the waveform as an X-Y (Dot) Screen.
X-Y (Line)	Display and record the waveform as an X-Y (Line) Screen.

When the Dual or Quad display is selected, the channel to be displayed in each display partition can be set.
For details, refer to Section 7.3.2, and for the settings on the X-Y Screen, refer to Section 5.4.

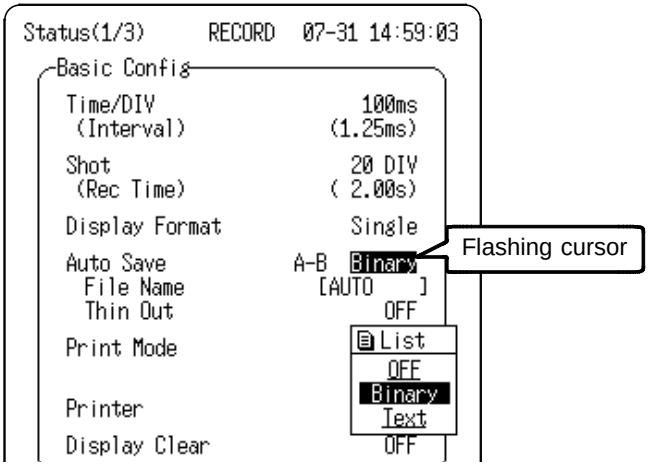
5.3.5 Setting the Auto Save Function

When the function is enabled, measurement data are automatically stored on PC card after they are captured. This function stores a file in the directory currently selected on the File Screen.

Procedure Status Screen

(1) Select the data format for Auto Save.

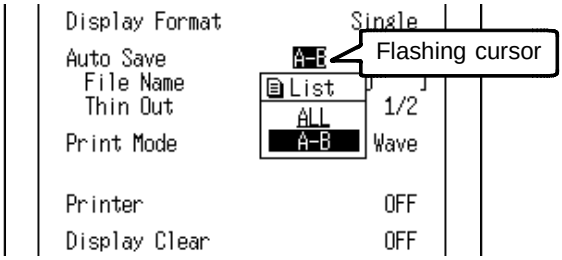
1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Auto Save and select the type of saving using the ▲▼ buttons.



OFF	Auto save is disabled.
Binary	Data are stored as binary data.
Text	Data are stored as text data. Data stored in the text format is not readable by the product.

For Continuous X-Y plot, this item setting is Binary only.

(2) If using the A/B cursors on the screen, specify the area to save.



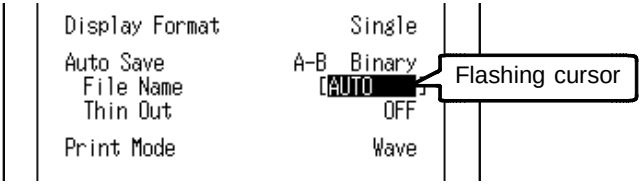
Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.

ALL	Store data for all captured waveforms.
A-B	If A cursor is in use, data is saved from the cursor to the end of input. If both A and B cursors are in use, data between the cursors is saved.

(3) Enter the file name to be used for Auto Save.

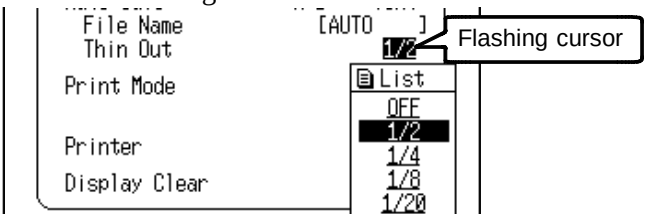
Once the file name has been entered, measurement data is automatically saved as the entered name.
When multiple files are saved in succession, numbers are appended to the file name. If the file name entry is left blank, the file name is automatically set as "AUTO", "AUTO0001", etc.

1. Move the flashing cursor to File Name and use the ▲▼ buttons to display the Comment Entry Screen.
2. Move the cursor to the desired character to enter using the ▲▼ buttons. For details, refer to Section 11.3.3.



(4) Enable thinning.

When the text data format is selected, enable thinning. Move the flashing cursor to Thin Out and use the ▲▼ buttons to make a setting.



NOTE

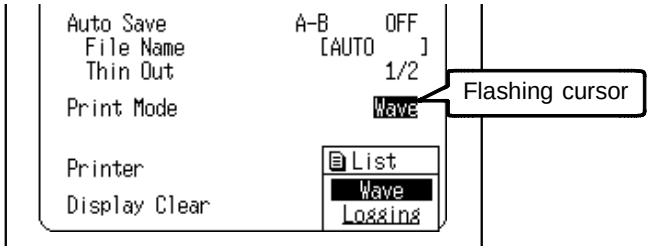
- When recording length is set to "Cont." (continuous), data remaining in internal memory is saved when measurement stops.
- Data for the channel for which the waveform is displayed is saved.
- During measurement, if remaining PC card capacity runs low enough for a warning message to appear, press the STOP button, then remove the PC card once measurement has been suspended. Data may be lost if the PC card is inserted or removed during measurement.
- Files will be saved in the currently selected directory.

5.3.6 Setting the Print Mode

This mode is available when the 8992 PRINTER UNIT is connected. Select whether to print measurement data as waveform or numeric values.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Print Mode and select Wave or Logging using the ▲▼ buttons.



Wave	Prints measurement data as a waveform.
Logging	Print measurement data numerically. Set the spacing of the printed words.

3. Press the ▲▼ buttons to set the print interval (1 division = 80 points) when "Logging" is selected.

NOTE

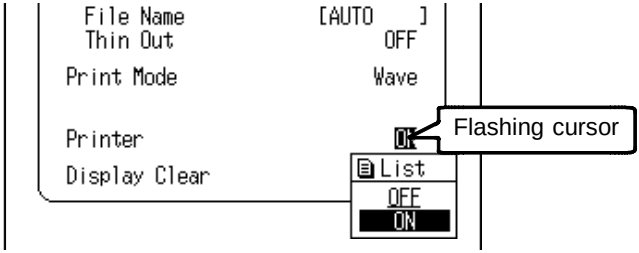
- When "Logging" is selected, if the print interval is set longer than the record length, only the first point will print.
- When "Logging" is selected, the maximum and minimum values are printed. (Refer to Appendix 2.)
- Even if the print interval is set at 1 to 40 points, the print interval used with real time printing is automatically set to 80 points.
- If you want to print with a print interval of 1 to 40 points, press the **PRINT** button after measurement has stopped.

5.3.7 Setting the Printer Function (Real Time Printing)

This function is available when the 8992 PRINTER UNIT is connected. The input waveform is continuously printed in real time.
Print density depends on the time axis range setting.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Printer and set to on or off using the ▲▼ buttons.



OFF	Disables the print.
ON	Enables the print.

NOTE

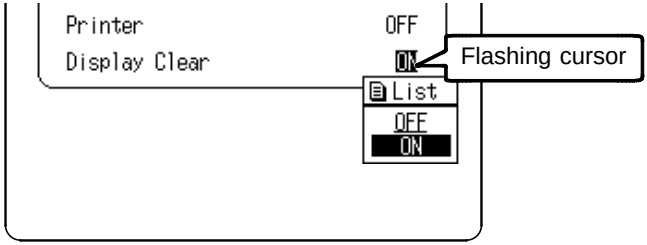
- When operating from the AC adapter, real-time printing requires that the time axis range be no faster than 1 s/DIV.
- When operating from the Battery Pack, real-time printing requires that the time axis range be no faster than 2 s/DIV.
- The printer cannot be used with alkaline batteries: use either the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) or 9447 BATTERY PACK when using the printer.
- While recording, the printer always prints at the measurement magnification ratio, while the screen display may be compressed to the next ratio depending on the time axis range.
  100 ms/DIV x1/10, 200 ms/DIV x1/5, 500 ms/DIV x1/2

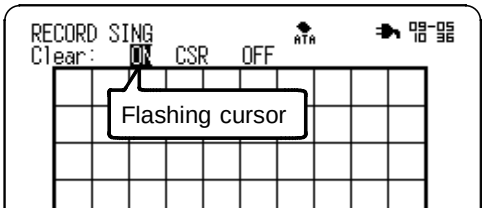
5.3.8 Setting the Display Clear Function (X-Y only)

This setting is possible when the X-Y Screen display format is selected.
This setting determines whether any previous waveforms displayed on the screen will be cleared when the **START** button is pressed to begin a new measurement. If previous waveforms are not cleared, they are overlaid by the new waveform.

Procedure Status, Waveform Screen

1. Display the screen to be displayed.
2. Move the flashing cursor to Display Clear and set to on or off using the ▲▼ buttons.

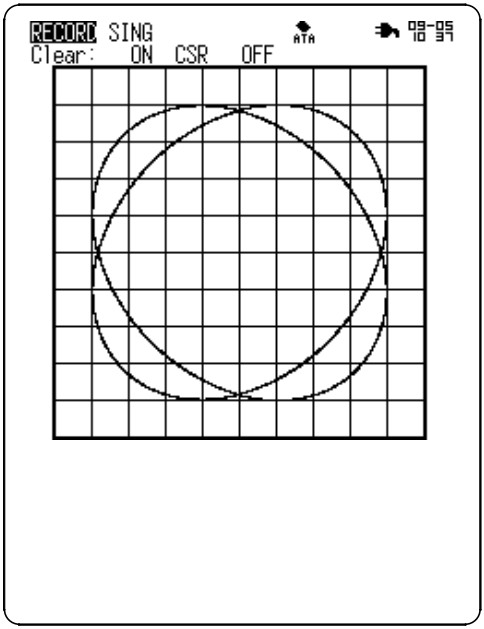




OFF	Overlays new waveforms on the previous waveforms.
ON	Clears the previous waveforms when measurement starts.

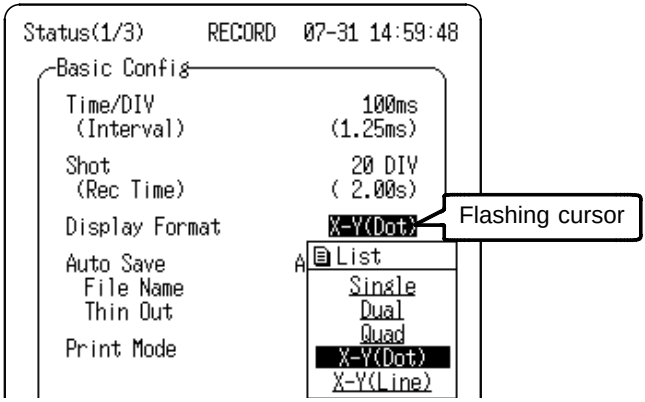
5.4 Using the X-Y CONT Recorder

- The same operation as a normal recorder is available to plot between channels (real time X-Y recording).
- Unlike an X-Y plot produced in the Memory recorder function mode, the time axis information for each channel is not being recorded.
- When an analog channel is assigned to the X axis, the remaining channels are automatically assigned to the Y axis. With the 8808-01, 8808-51, when any analog channel is assigned to the X-axis, a maximum of three X-Y combined plots can be recorded.
- For X-Y (Dot) the sampling period is fixed at 250 µs, while for X-Y (Line) the fastest sampling period is 500 µs (unfixed).
- There is no limit on the length of a recording because basically the operation is the same as that of a conventional recorder.

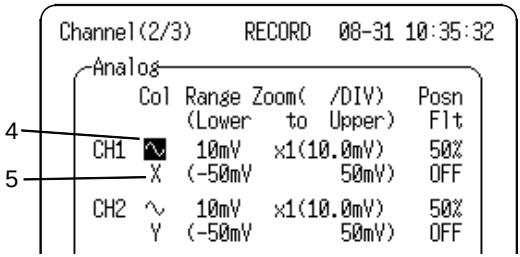


Procedure Status, Channel Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Display Format and select format X-Y (Dot) or X-Y (Line) using the ▲▼ buttons.



3. Press the **SET** button with the Status Screen displayed to display the Channel Screen.



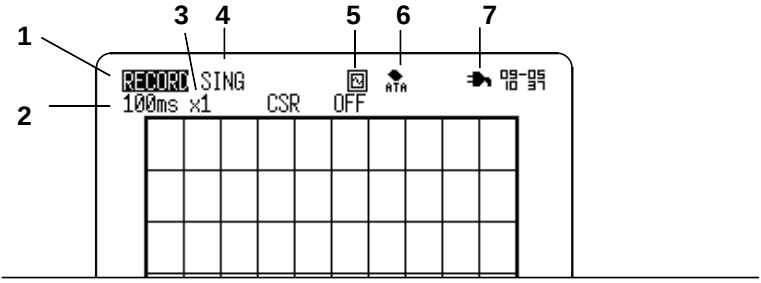
4. Select the display color using the ▲▼ buttons.
5. Move the flashing cursor to the channel to use as the X axis, and select it using the ▲▼ buttons.
   Channels other than the one selected for the X axis are the Y-axis channels.
6. Press the **START** button to start measurement.

5.5 Waveform Screen Settings (REC)

Settings for the Waveform Screen are described below. For details, refer to Section 5.3.

Procedure Waveform Screen

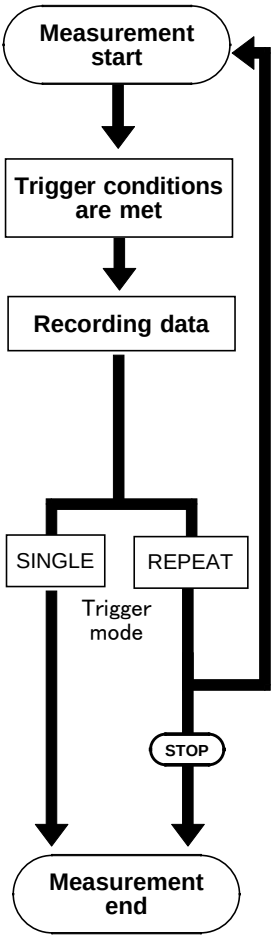
1. Press the **DISP** button to display the Waveform Screen.
2. Move the flashing cursor to the item to be set.
3. Use the ▲▼ buttons to make a setting.



1	Function	MEMORY/RECORD/RMS
2	Time axis range	100 ms to 1 h/DIV
3	Compression of the time axis	x1 to x1/500
4	Trigger mode	SING/REP
5	Waveform display area	Full screen/partitioned display screen
6	PC card indicator	Appears when a PC card is installed (SRAM/ ATA/ FAX)
7	Power indicator	Appears the type of power supply of the product or battery low mark.

NOTE Input-related settings are accessible by pressing a channel select button (CH1 to CH4) from the Waveform Screen. For details, refer to Section 7.4. Trigger timing setting is not accessible from the Waveform Screen. Trigger timing must be set from the Trigger Screen.

5.6 Start and Stop Operation (REC)



Press the **START** button to start measurement, and LED lights in green. The **START** button activation condition can be selected. Refer to Section 10.1.1. "Wait for trig" is displayed until the trigger condition occurs.

Data recording starts when the trigger conditions are met. (Trigger timing: Start, Start&Stop)

During recording, "Storing" is displayed.
If the printer is on, printing initiates simultaneously with display.
When automatic storage is enabled and measurement is interrupted in progress, measurement data taken prior to the interruption point is stored automatically.

Auto saving is executed.

Trigger mode: REP

Trigger timing: Start, Start&Stop
Activates the trigger waiting condition. Input resumes when the trigger conditions are met.

Trigger timing: Stop
Measurement starts.

Trigger mode: SING

Measurement stops.

Trigger mode: REP

Measurement can be aborted by pressing the **STOP** button.

Chapter 6
RMS Recorder Function

6.1 Overview of the RMS Recorder Function

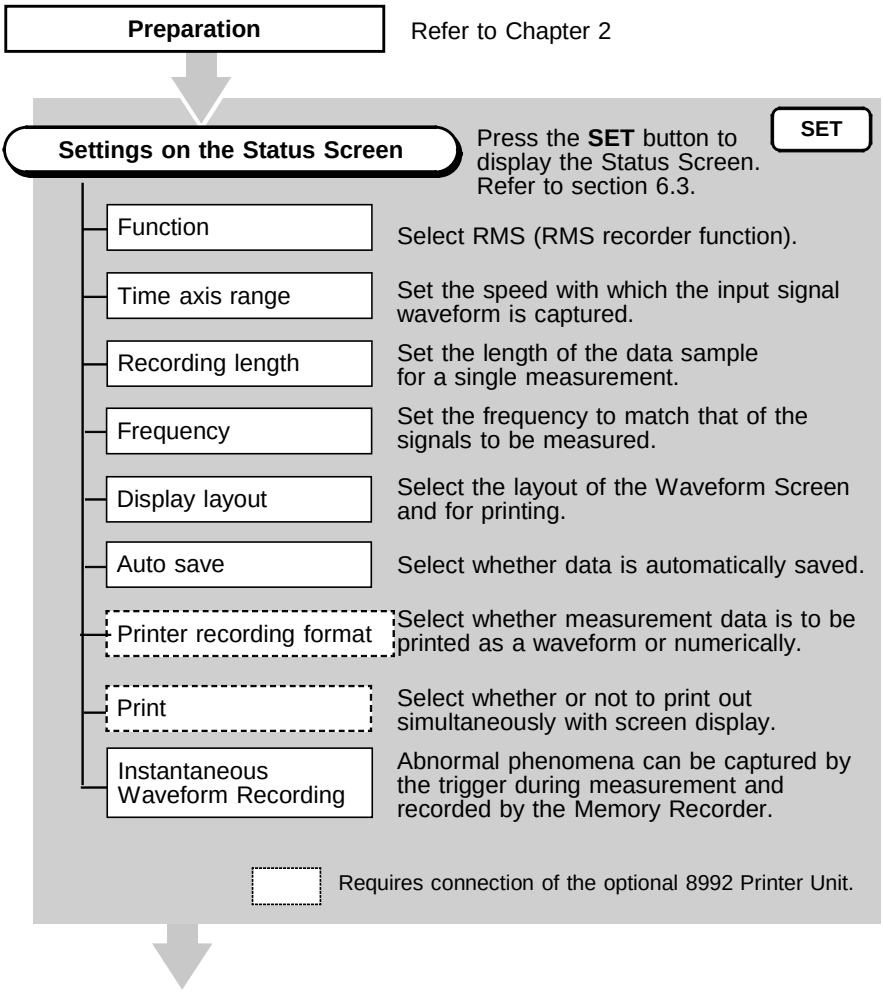
The RMS recorder function has the following features.

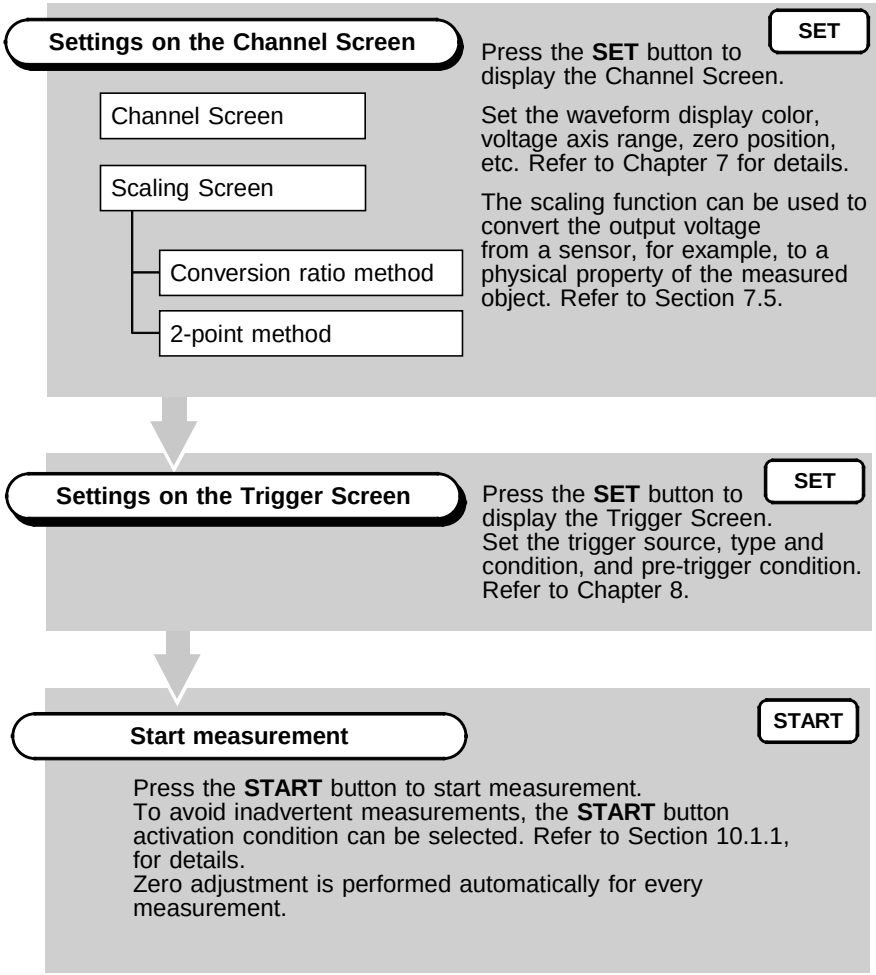
(1) The voltage value for the commercial power supplies and DC signal are displayed and recorded as the rms value.
(2) Real time continuous recording is available.
(3) The product is designed to measure commercial power supplies (50/60 Hz) and DC signal.
(4) During usual recording, sudden phenomena can be observed in detail using Instantaneous Waveform Recording (Memory Recorder).
(5) Time axis setting
100 ms/DIV to 1 h/DIV (RMS recorder)
200 µs/DIV to 20 ms/DIV(Memory recorder)
(6) Storage capacity
RMS recorder waveform 200 DIV
Instantaneous waveform 400 DIV
(7) Time axis resolution: 80 points/DIV (printer)
(8) Sampling speed: 800 rms data/s (250 µs fixed)
(9) Waveform magnification/compression display and printout
- Time axis direction: x1 to x1/500
- Voltage axis direction: x10 to x1/2 (single)

(10) Display layout
Time axis waveform: single, dual, quad displays
(11) Logging function
Numeric printout of waveform data
(12) Reprinting is available. The last 200-DIV data is stored in the memory and it can be printed repeatedly.

6.2 Operation Sequence (RMS)

RMS recorder operating procedures are described by the following flowcharts.




Settings on the Channel Screen
SET
Press the SET button to display the Channel Screen.
Channel Screen
Set the waveform display color, voltage axis range, zero position, etc. Refer to Chapter 7 for details.
Scaling Screen
The scaling function can be used to convert the output voltage from a sensor, for example, to a physical property of the measured object. Refer to Section 7.5.
Conversion ratio method
2-point method
Settings on the Trigger Screen
SET
Press the SET button to display the Trigger Screen.
Set the trigger source, type and condition, and pre-trigger condition.
Refer to Chapter 8.
Start measurement
START
Press the START button to start measurement.
To avoid inadvertent measurements, the START button activation condition can be selected. Refer to Section 10.1.1, for details.
Zero adjustment is performed automatically for every measurement.

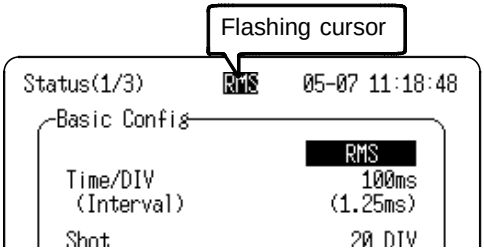
6.3 Setting Items

6.3.1 Setting the Function Mode

The 8807-01, 8808-01 has three function modes. Additionally, the 8807-51, 8808-51 also offers a harmonic wave analysis function. Select the RMS recorder function.

Procedure Status/ Channel/ Trigger Screen

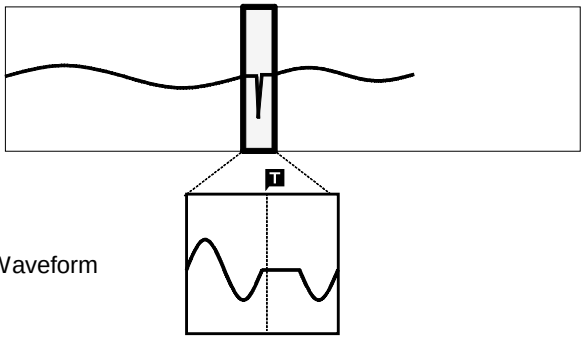
1. Press the **SET** button to display the Status, Channel, or Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and select RMS using the ▲▼ buttons.



RMS Recorder function description

The RMS Recorder calculates the rms value of waveform data by high-speed sampling of the 50/60-Hz power line or DC signal, and records the calculation data on a graph. If an abnormal phenomenon is captured by the trigger, the phenomena can be recorded in parallel by Instantaneous Waveform Recording of the high-speed samples.

Low-speed recording by the RMS Recorder



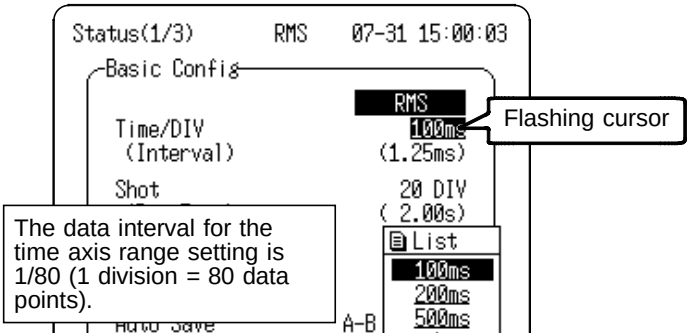
High-speed recording by the Instantaneous Waveform Recording

6.3.2 Setting the Time Axis Range

Set the speed for inputting and storing the waveform of the input signal. Time axis range setting expresses the time for 1 division.

Procedure 1 Status Screen

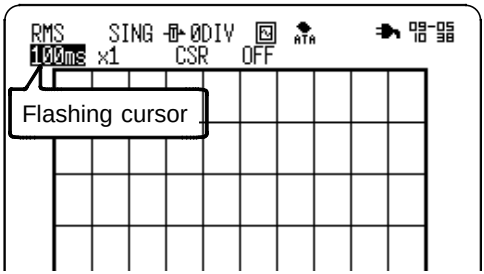
1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Time/DIV and select the time axis range using the ▲▼ buttons.



Pressing the **TIME/DIV** button moves the flashing cursor automatically to the Time Axis position for setting.

Procedure 2 Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to make a setting.



Pressing the **TIME/DIV** button sets the time axis regardless of the flashing cursor position.

6.3.3 Setting the Recording Length

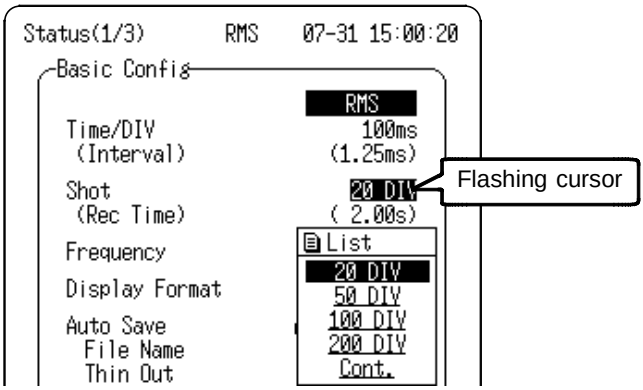
The length of recording for one measurement operation (number of DIV) can be set.

Constant recording length mode: Select the recording length.
Variable recording length mode: Variable recording length can be selected by the user.

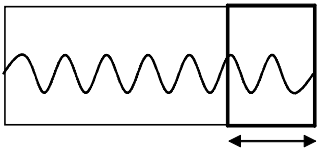
Status Screen

Procedure 1 Constant recording length mode

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Shot and select the recording length using the ▲▼ buttons.



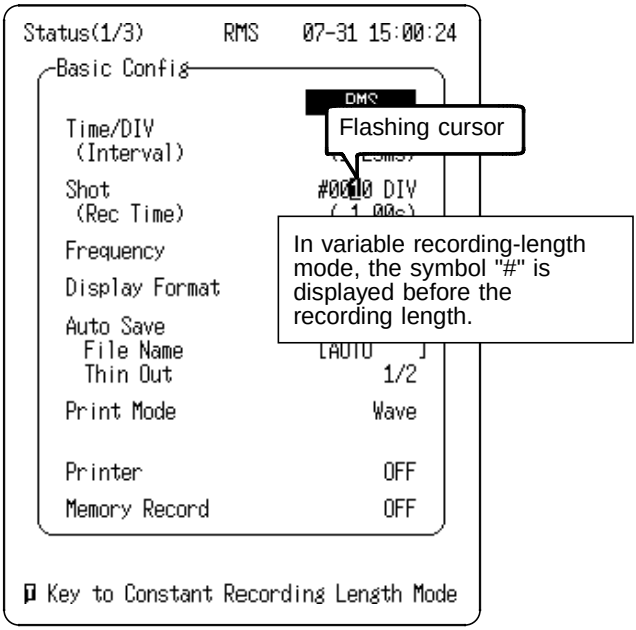
NOTE • When the recording length is set to Cont., the last 200 DIV quantity is stored in internal memory.



Stored in Internal Memory
(200 DIV)

Procedure 2 Variable recording length mode

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to the Shot item.



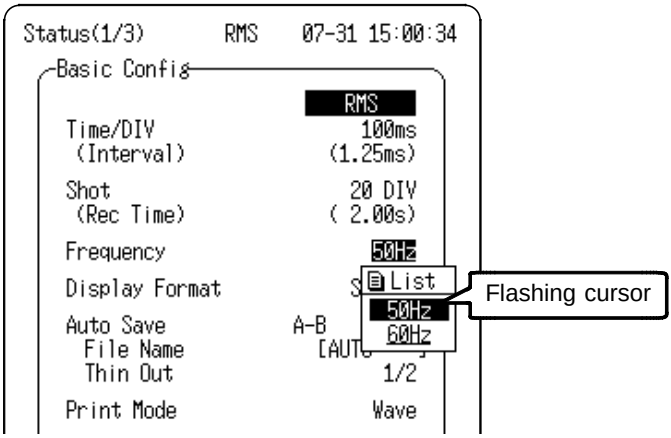
3. Press the **T** button to make a setting for variable recording length.
4. Using the ◁▷ cursor buttons, move the flashing cursor to the digit to be set and use the ▲▼ buttons to make a setting.
   To return to the constant recording length mode, press the **T** button again.

6.3.4 Setting the Frequency

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

Procedure Status Screen

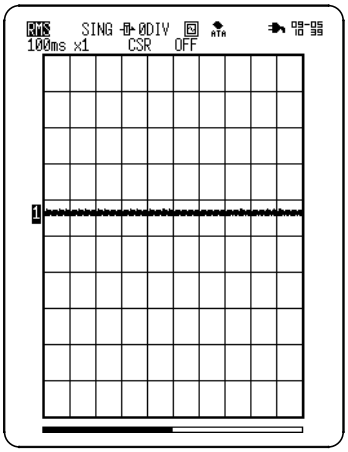
1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to the Frequency and select the frequency using the ▲▼ buttons.



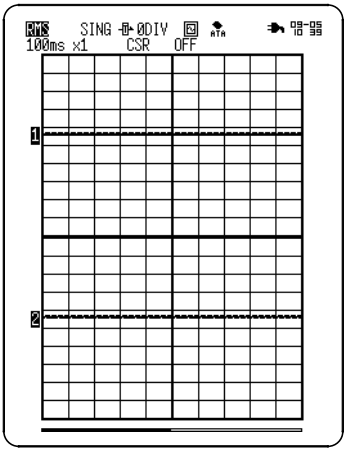
50 Hz	Measure rms value of 50 Hz signal
60 Hz	Measure rms value of 60 Hz signal

6.3.5 Setting the Display Layout

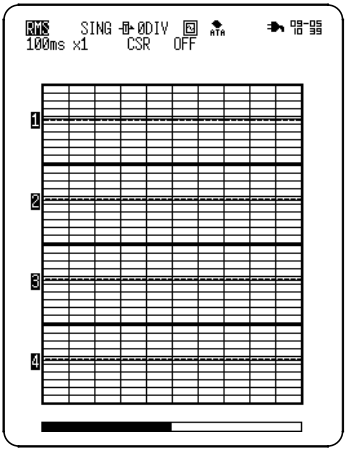
- The display layout of input waveforms can be set for the Waveform Screen and for printing.
- The layouts Single, Dual, and Quad are available.



Single Display
Display and record as one graph.



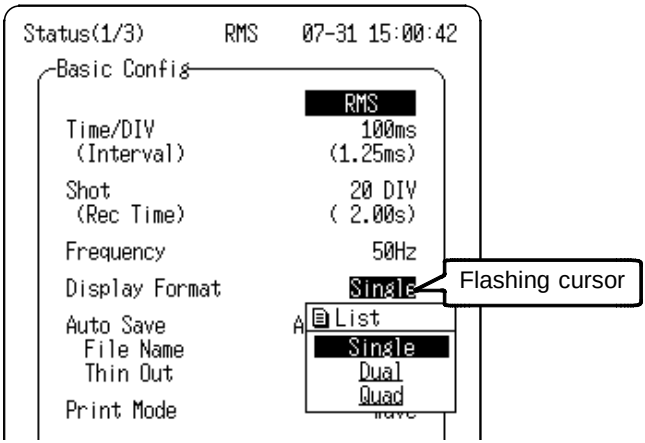
Dual Display
Display and record as two graphs.



Quad Display
Display and record as four graphs.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Display Format and select the display format using the ▲▼ buttons.



Single	Display and record as one graph.
Dual	Display and record as two graphs.
Quad	Display and record as four graphs.

When the Dual or Quad display is selected, the channel to be displayed in each screen partition can be set.
For details, refer to Section 7.3.2.

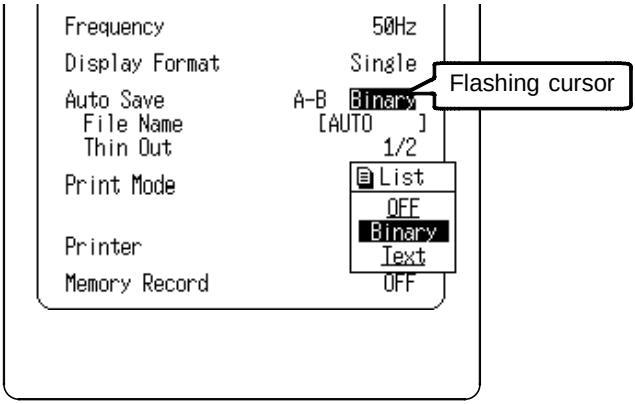
6.3.6 Setting the Auto Save Function

When the function is enabled, measurement data are automatically stored on PC card after they are captured. This function stores a file in the directory currently selected on the File Screen.

Procedure Status Screen

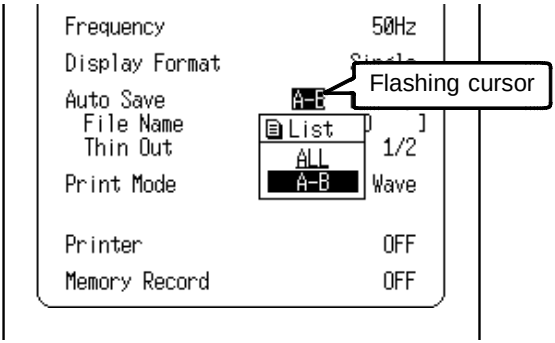
(1) Select the data format for Auto Save.

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Auto Save and select the type of saving using the ▲▼ buttons.



OFF	Auto save is disabled.
Binary	Data are stored as binary data.
Text	Data are stored as text data. Data stored in the text format is not readable by the product.

(2) If using the A/B cursors on the screen, specify the area to save.



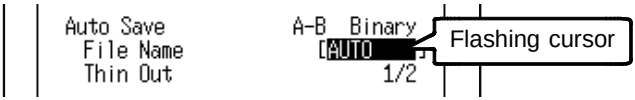
Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.

ALL	Store data for all captured waveforms.
A-B	If A cursor is in use, data is saved from the cursor to the end of input. If both A and B cursors are in use, data between the cursors is saved.

(3) Enter the file name to be used for Auto Save.

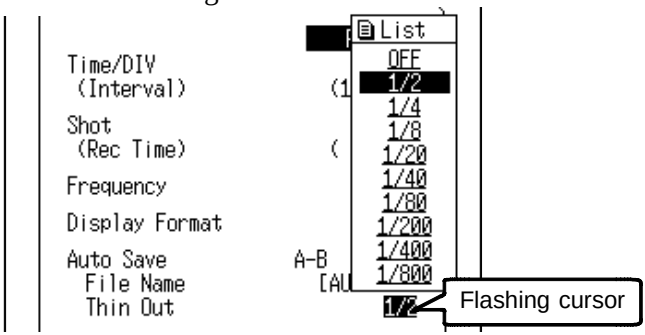
Once the file name has been entered, measurement data is automatically saved as the entered name.
When multiple files are saved in succession, numbers are appended to the file name. If the file name entry is left blank, the file name is automatically set as "AUTO", "AUTO0001", etc.

1. Move the flashing cursor to File Name and use the ▲▼ buttons to display the Comment Entry Screen.
2. Move the cursor to the desired character to enter.
   For details, refer to Section 11.3.3.



(4) Enable thinning.

When the text data format is selected, enable thinning. Move the flashing cursor to Thin Out and use the ▲▼ buttons to make a setting.



NOTE

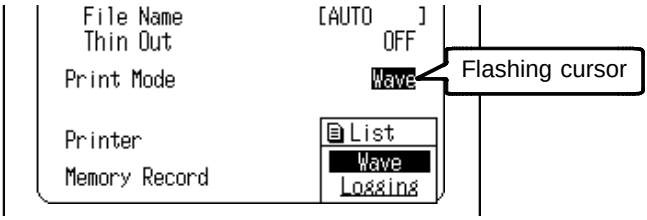
- When recording length is set to "Cont." (continuous), data remaining in internal memory is saved when measurement stops.
- Data for the channel for which the waveform is displayed is saved.
- During measurement, if remaining PC card capacity runs low enough for a warning message to appear, press the STOP button, then remove the PC card once measurement has been suspended. Data may be lost if the PC card is inserted or removed during measurement.
- Files will be saved in the currently selected directory.

6.3.7 Setting the Print Mode

This mode is available when the 8992 PRINTER UNIT is connected. Select whether to print measurement data as waveform or numeric values.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Print Mode and use the ▲▼ buttons to make a selection.



Wave	Prints measurement data as a waveform.
Logging	Print measurement data numerically. Set the spacing of the printed words.

3. Press the ▲▼ buttons to set the print interval (1 division = 80 points) when "Logging" is selected.

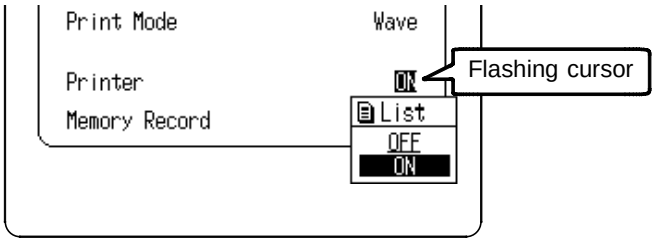
NOTE
- When "Logging" is selected, if the print interval is set longer than the record length, only the first point will print.
- When "Logging" is selected, the maximum and minimum values are printed (excluding 100 ms/DIV). (Refer to Appendix 2.)
- Even if the print interval is set at 1 to 40 points, the print interval used with real time printing is automatically set to 80 points.
- If you want to print with a print interval of 1 to 40 points, press the PRINT button after measurement has stopped.

6.3.8 Setting the Printer Function (Real Time Printing)

This function is available when the 8992 PRINTER UNIT is connected. The input waveform is continuously printed in real time.

Procedure Status Screen

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Printer and set to on or off using the ▲▼ buttons.



OFF	Disables the print.
ON	Enables the print.

NOTE

- When operating from the AC adapter, real-time printing requires that the time axis range be no faster than 1 s/DIV.
- When operating from the Battery Pack, real-time printing requires that the time axis range be no faster than 2 s/DIV.
- The printer cannot be used with alkaline batteries: use either the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) or 9447 BATTERY PACK when using the printer.

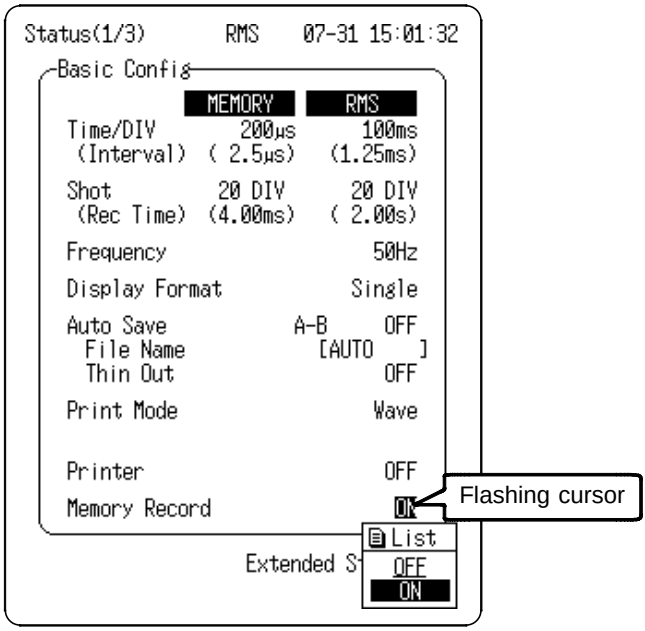
6.3.9 Instantaneous Waveform Recording

When Instantaneous Waveform Recording is enabled, an abnormal phenomena that occurs during measurement is captured by the trigger and recorded in parallel by the Memory Recorder using high-speed sampling.

Procedure Status Screen

(1) Set Instantaneous Waveform Recording on or off.

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to the Memory Record (Instantaneous Waveform Recording) item and set to on or off using the ▲▼ buttons to make a setting.

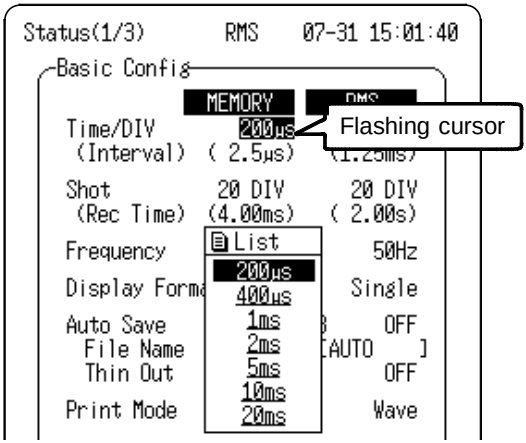


OFF	Disables Instantaneous Waveform Recording (Memory Recording)
ON	Enables Instantaneous Waveform Recording (Memory Recording)

NOTE If the power supply is interrupted during measurement and Instantaneous Waveform Recording is enabled, then the effective value waveform data will not be saved but instantaneous waveform data will be saved.

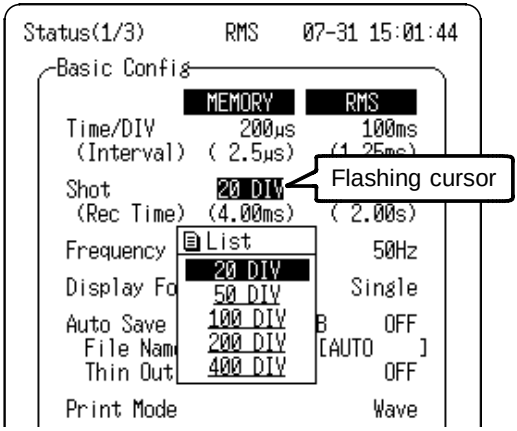
(2) Set the time axis of the Instantaneous Waveform Recording.

When Instantaneous Waveform Recording is turned on, settings for the memory waveform are displayed.
Set the time axis for the memory waveform.
Move the flashing cursor to Time/DIV and use the ▲▼ buttons to make a setting.



(3) Set the recording length the Instantaneous Waveform Recording.

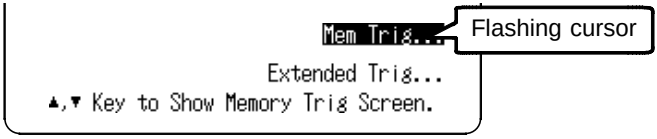
Move the flashing cursor to Shot and use the ▲▼ buttons to make a setting. For details, refer to Section 6.3.3.



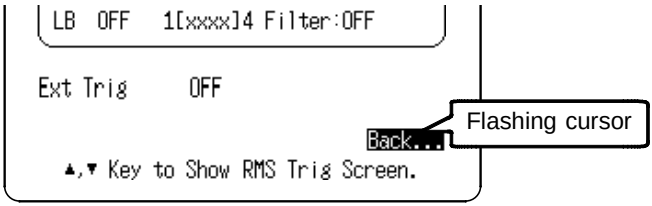
(4) Display the Trigger Screen for the Instantaneous Waveform Recording.

When setting the trigger for memory recording, the RMS Recorder function must be selected and Instantaneous Waveform Recording must be enabled.

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to Mem Trig... (instantaneous waveform trigger setting) and display the Instant (Instantaneous waveform trigger) Screen.



(5) Set the trigger for the Instantaneous Waveform Recording. For details, refer to **Chapter 8.**

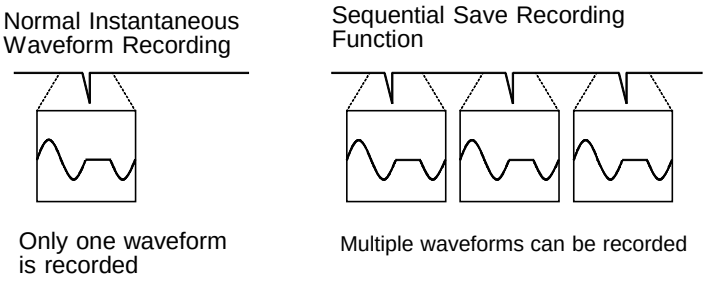


To return to the RMS Trigger Screen, move the flashing cursor to Back, and press the ▲▼ buttons.

NOTE When external trigger (Ext Trig) is set to ON in the instantaneous waveform trigger screen, instantaneous waveform recording starts when a signal is input to the external trigger terminal during measurement with the RMS recorder.
For details on external trigger, refer to Section 8.10.

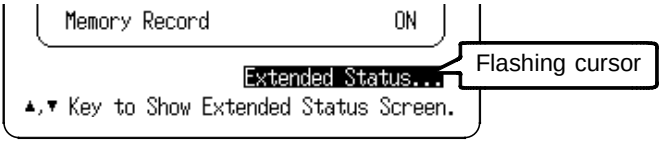
(6) Set Sequential Save on or off.

During normal recording, only one waveform can be recorded, as the recording memory is cleared each time a trigger occurs and input starts.
The Sequential Save function allows multiple waveform recordings to be saved.



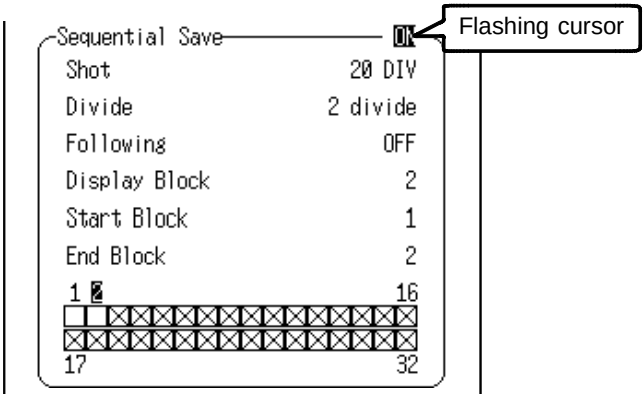
(7) Display the Extended Status Screen.

1. Press the **SET** button to display the Status (RMS) Screen.
2. When Instantaneous Waveform Recording is enabled, the Extended Status is displayed.
3. Move the flashing cursor to Extended Status... and display the Ex Status Screen using the ▲▼ buttons.



(8) Set Sequential Save to ON or OFF.

For details, refer to Section 4.8.3.

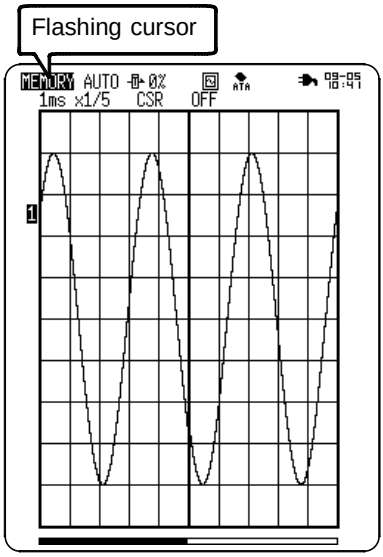


To return to the Status Screen, move the flashing cursor to Back, and press the ▲▼ buttons.

Instantaneous Waveform Recording Display

With normal recording, the instantaneous waveform can be displayed by selecting the Memory function on the Waveform Screen.

Refer to Section 4.8.3 regarding waveforms that were recorded by Sequential Save.

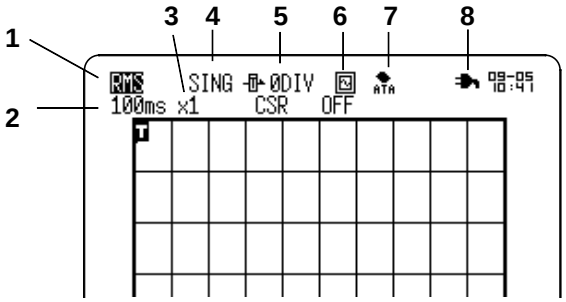


6.4 Waveform Screen Settings (RMS)

Settings for the Waveform Screen are described below. For details, refer to Section 6.3.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Move the flashing cursor to the item to be set.
3. Use the ▲▼ buttons to make a setting.



1 Function	MEMORY/RECORD/RMS
2 Time axis range	100 ms to 1 h/DIV
3 Compression of the time axis	x1 to x1/500
4 Trigger mode	SING/REP
5 Pre-trigger	0, 5, 10 DIV
6 Waveform display area	Full/partitioned display
7 PC card indicator	Appears when a PC card is installed
8 Power indicator	Appears the type of power supply of the product or battery low mark.

NOTE Input-related settings are accessible by pressing a channel select button (CH1 to CH4) from the Waveform Screen. For details, refer to Section 7.4.

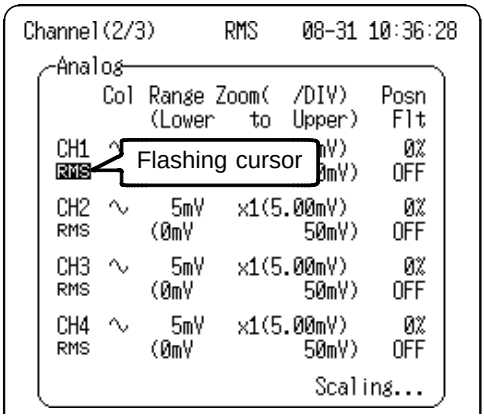
6.5 Settings on the Channel Screen (RMS)

6.5.1 Selecting the Recorder Function or RMS Function

This setting selects either waveform recording or RMS recording. From the RMS Recorder Channel Screen, recording of waveform data for each channel can be set as standard recording or RMS recording.
This setting is valid only if made before the start of measurement. Changing the recording type after measurement has finished results in an invalid waveform.

Procedure Channel Screen

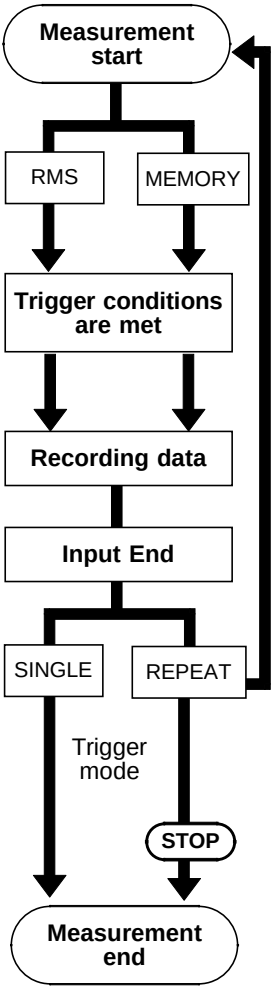
1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the channel to be set and use the ▲▼ buttons to make a setting.



REC	Records waveforms in Recorder function.
RMS	Records waveforms in RMS function.

6.6 Start and Stop Operation (RMS)

This diagram describes the start/stop actions of basic RMS recording. Instantaneous Waveform Recording is presumed to be enabled (ON).



Press the **START** button and LED light in green.

RMS
Data input starts when the trigger conditions of the RMS Recorder are met.
The display shows "Storing" while the RMS Recorder waveform is being stored.
If the printer is enabled, the RMS Recorder waveform prints as it is displayed.

MEM (Instantaneous Waveform Recording)
Data input starts when the trigger conditions of the Memory Recorder are met.
If pre-trigger operation is enabled for the Memory Recorder and if the trigger conditions are met before the timed trigger point, data input starts from the trigger event.
When Auto Save is enabled and measurement is aborted in progress, input up until the stopping point is saved automatically.
Auto saving is executed.

Trigger mode: REP
Restart measurement (previous data is cleared)

Trigger mode: SING
End of measurement

Trigger mode: REP
Pressing the **STOP** button aborts measurement.

NOTE The memory recording trigger is enabled only when the RMS Recorder is recording.

Chapter 7
Input Channel Settings

7.1 Overview

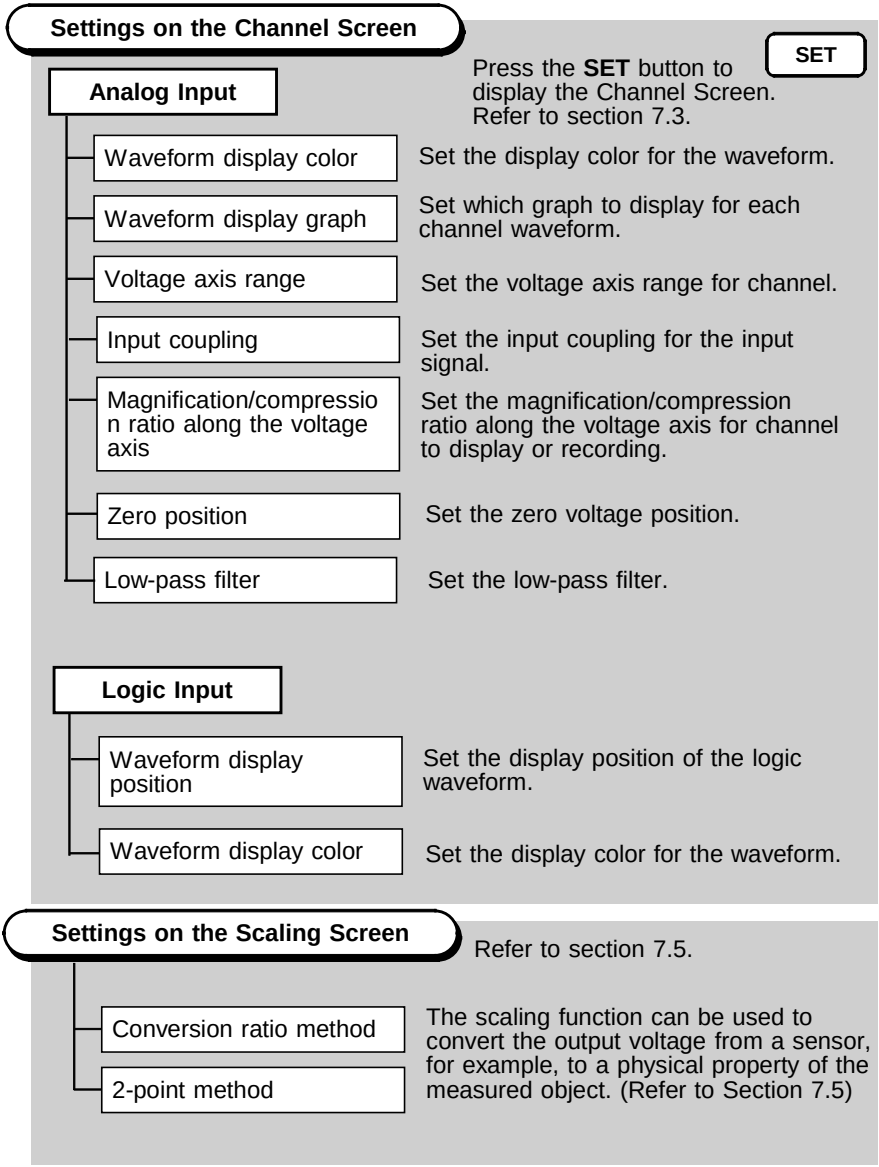
Settings are made separately for one analog channel or four logic channels (1 probe).

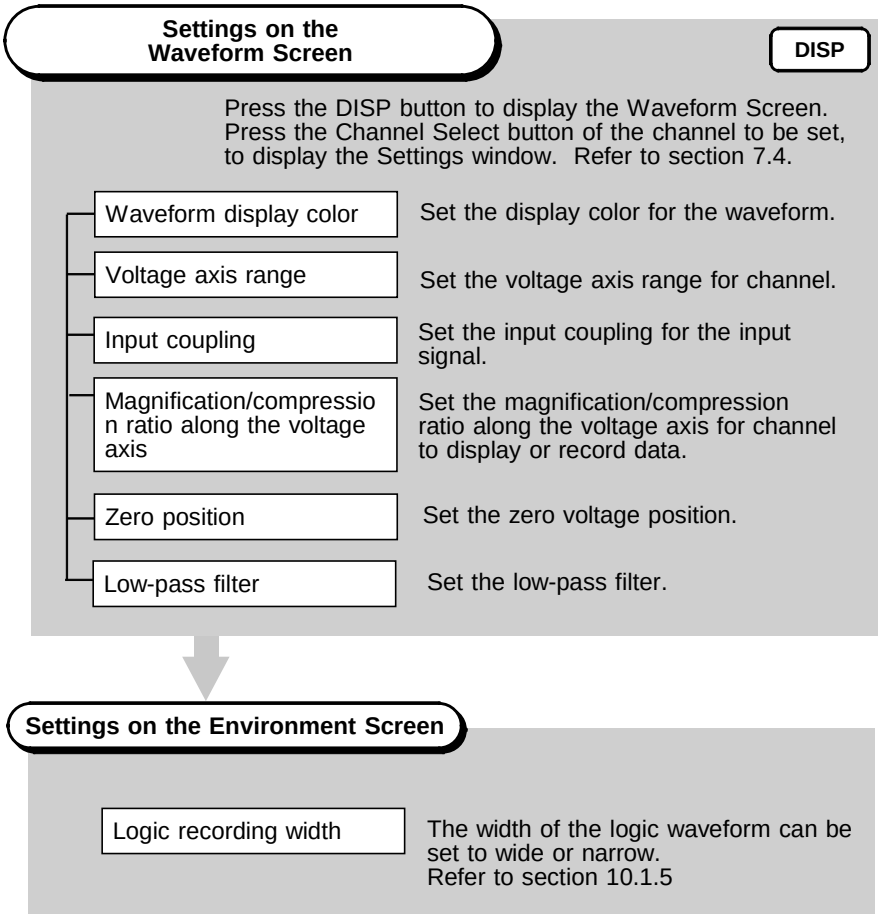
Item \ Screen	Channel	Scaling	Display	System
Waveform display color	●	—	●	—
Waveform display graph	●	—	●	—
Voltage axis (measurement) range	●	—	●	—
Input coupling	●	—	●	—
Magnification/compression ratio along the voltage axis	●	—	●	—
Zero position	●	—	●	—
Low-pass filter	●	—	●	—
Logic display color	●*	—	●*	—
Logic display position	●*	—	●*	—
Logic recording width	—	—	—	●
Functions	●	—	●	—
Scaling function	—	●	—	—

*: when the display layout is Single, Dual, or Quad.

NOTE For details on the input channel settings for the harmonic wave analysis function, refer to the supplement guide "Harmonic Wave Analysis Function."

7.2 Operation Sequence (Input Channel Setting)




Settings on the Waveform Screen
DISP
Press the DISP button to display the Waveform Screen. Press the Channel Select button of the channel to be set, to display the Settings window. Refer to section 7.4.
Waveform display color
Set the display color for the waveform.
Voltage axis range
Set the voltage axis range for channel.
Input coupling
Set the input coupling for the input signal.
Magnification/compression ratio along the voltage axis
Set the magnification/compression ratio along the voltage axis for channel to display or record data.
Zero position
Set the zero voltage position.
Low-pass filter
Set the low-pass filter.
Settings on the Environment Screen
Logic recording width
The width of the logic waveform can be set to wide or narrow.
Refer to section 10.1.5

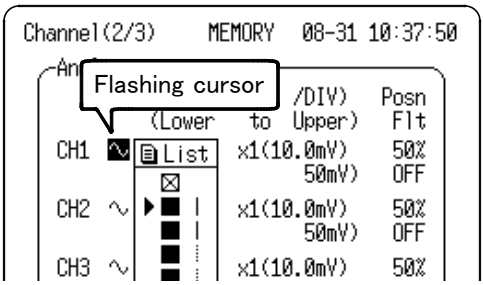
7.3 Setting the Channel Screen

7.3.1 Setting the Waveform Display Color

Set the display color for the waveform.

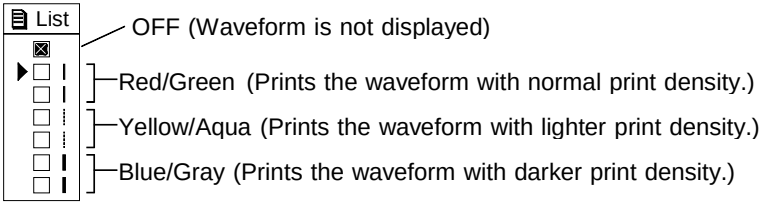
Procedure Channel Screen

1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the desired channel position.
3. Use the ▲▼ buttons to make a setting.



☒	Waveform is not displayed.
■	Waveform is displayed in Red, Green, Yellow, Aqua, Blue, Gray

If the data is to be output on the 8992 PRINTER UNIT, any of three print densities may be set for six waveform display colors. Printing density settings have no effect on real-time printing.

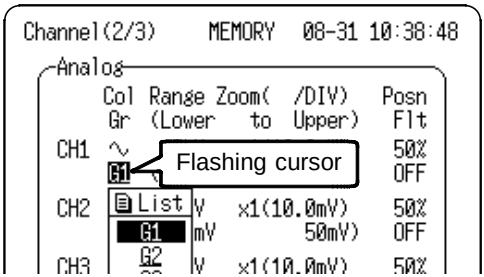


7.3.2 Setting the Waveform Display Graph

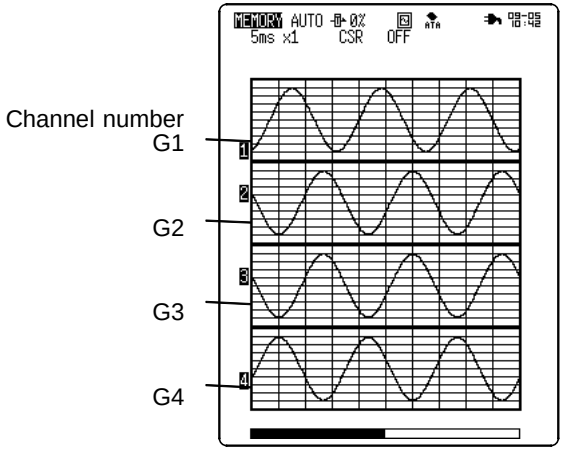
Sets the position at which the waveform is displayed.
This setting is available when the display format selected from each function's Status Screen is set for Dual or Quad.

Procedure Channel Screen

1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the desired channel position.
3. Use the ▲▼ buttons to make a setting.



G1	Displays on graph 1.
G2	Displays on graph 2.
G3 (Quad)	Displays on graph 3.
G4 (Quad)	Displays on graph 4.

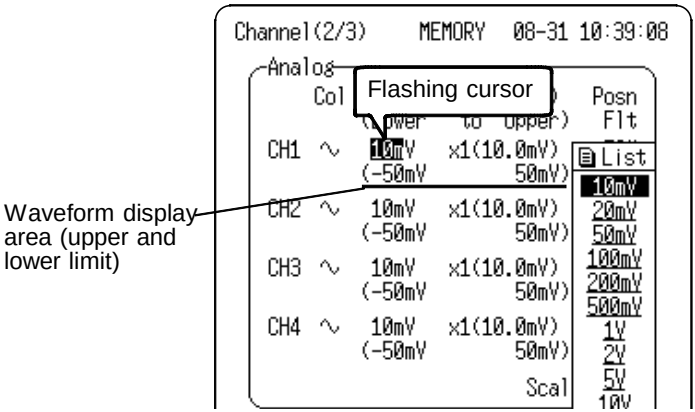


7.3.3 Setting the Voltage Axis Range

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

Procedure Channel Screen

1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the desired channel position.
3. Use the ▲▼ buttons to make a setting.



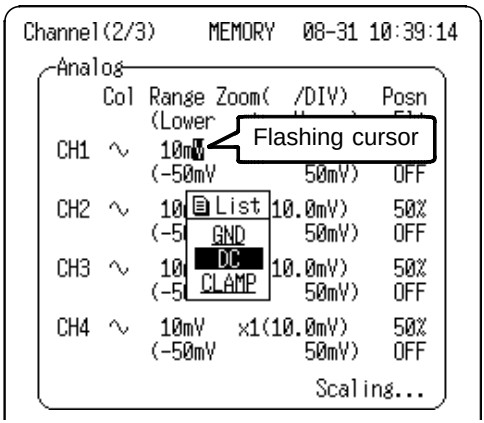
NOTE The full scale of the product's analog input unit is 10 DIV times the voltage-axis range.
On the other hand, the actual range of measurement for the voltage range is about ±1.2 times the full scale of the voltage axis. For example, on the 10 mV range, 10 mV x 10 DIV = ± 100 mV full scale, and 1.2 times that value is the approximate measurable area: ±120 mV.
Measurements that fall outside the measurable range are indicated as approximately ±1.2 times full scale.

7.3.4 Setting the Input Coupling

The input coupling for the input signal is set.

Procedure Channel Screen

1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the desired channel position.
3. Use the ▲▼ buttons to make a setting.



GND	Grounds the input (to check zero position).
DC	DC coupling (DC and AC components of input signal)
CLAMP	Use when a 9018-10, 9132-10 CLAMP ON PROBE is connected.

NOTE

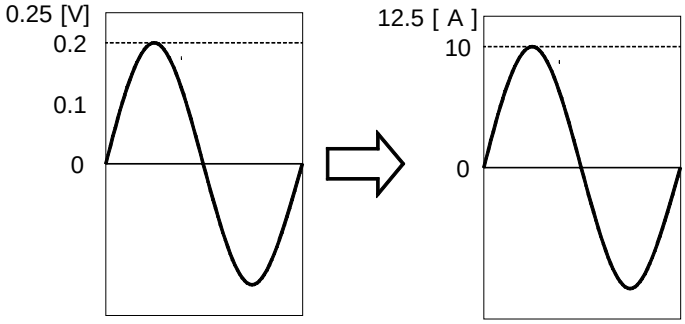
- When measuring current using a HIOKI 9018-10, 9132-10 CLAMP ON PROBE, setting the input coupling to CLAMP automatically selects the A (Amperes current) display. When this occurs, set the current range of the probe and that of the product to the same range.
- The zero position may be offset when the input coupling is DC or GND and the input is open circuit in the high-sensitivity (10 mV) range.

When the 9018-10, 9132-10 is used to measure current waveforms

When the 9018-10, 9132-10 is connected, the input coupling is set to CLAMP and the product and 9018-10, 9132-10 are set to the same measurement range, signals from the sensor are scaled automatically and the current value can be displayed and recorded.
The example shows the 9018 with current range set to 10A. When changing the current range of the probe, change the range of the product to match.

(1) Input coupling is DC and voltage axis is 50 mV/DIV.

(2) Input coupling is set to CLAMP and voltage is set to match the 10 A range of the 9018.



NOTE

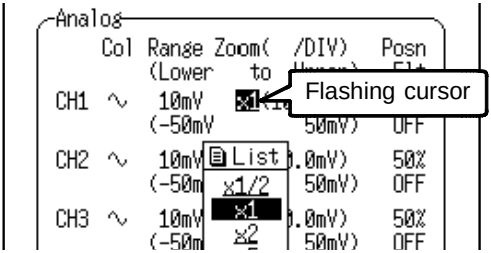
- When measuring current with the input coupling set to CLAMP, if the range of the product and the current range of the clamp do not match, incorrect numeric values are displayed. The same range must be set on both devices for proper measurement.
- The voltage output of a 9018-10, 9132-10 CLAMP ON PROBE is 0.2V AC full scale for the selected range (for the 10A range, 0.2V AC is output with 10A input).
- If a particular scaling value is desired, set the input coupling to DC to enable setting on the Scaling Screen. Refer to Section 7.5 Scaling function for details.
- The clamp measurement scaling settings are enabled when the input coupling is set to CLAMP, but when the coupling is returned to DC the previous scaling settings are recalled.

7.3.5 Setting the Magnification/Compression Ratio Along the Voltage Axis

The voltage axis can be independently magnified or compressed for display and recording of each channel. Magnification and compression are applied relative to the center of the display (50%).

Procedure Channel Screen

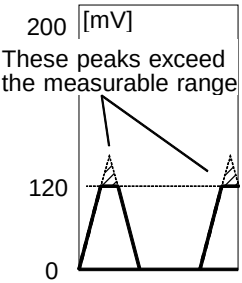
1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the desired channel position.
3. Use the ▲▼ buttons to make a setting.



NOTE

- If the magnification or compression ratio is changed when the zero position is not at 50% for the Memory Recorder and Recorder, or not at 0% for RMS, the zero position of the waveform will be changed.
- The actual measurable range for each voltage range is about ± 1.2 times full scale of the voltage axis. The display area on the Waveform Screen depends on the magnification and compression ratio setting, but the measurable range is not affected. Therefore, even though an area that is outside of the measurable range may be displayed on the screen, those parts of a waveform that are out of range cannot display.

For example, if a compression ratio of x1/2 is set with the zero position to 0% in the 10 mV range, the screen height will show an area that is twice the full scale range, equivalent to 0 to 200 mV, although the measurable range of waveforms that can be input is limited to about ±1.2 times full scale range (-120 to 120 mV).

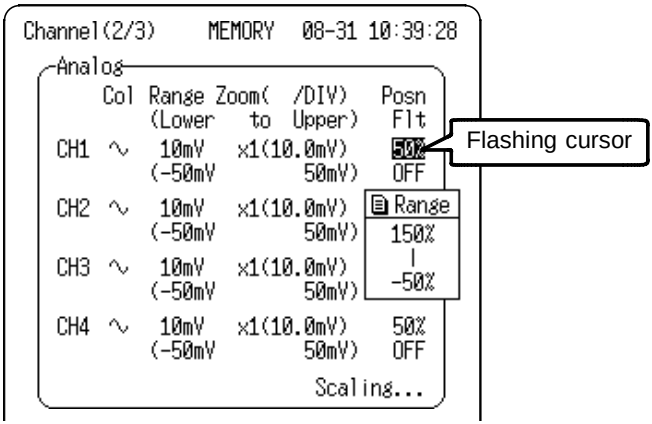


7.3.6 Setting the Zero Position

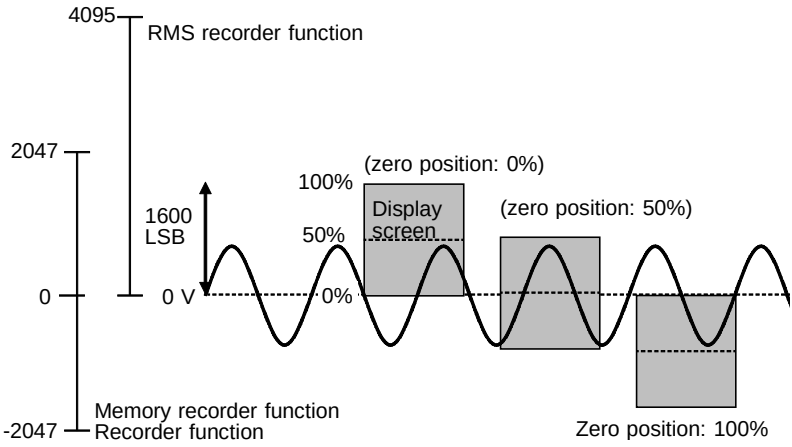
The position of the zero voltage is set.

Procedure Channel Screen

1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the desired channel position.
3. Use the ▲▼ buttons to make a setting.



X1 Magnification



NOTE

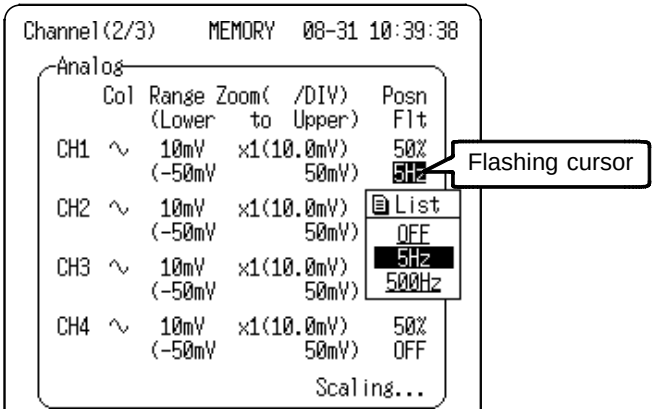
- The measurable range for each voltage range is approximately ±1.2 times the full scale of the voltage-axis range. If a measurement exceeds the measurable range, an over-range is detected.
- The display area for voltage range on the Waveform Screen changes in accordance with the zero position and magnification/compression ratio of the voltage axis, but the measurable range does not.

7.3.7 Setting the Low-Pass Filter

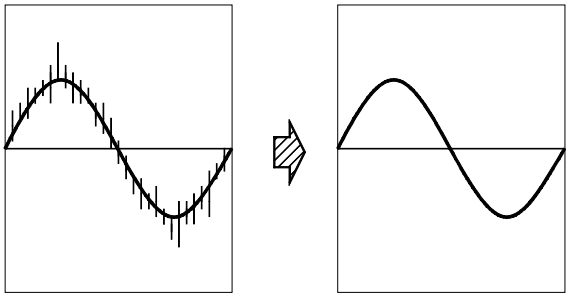
Effective for removing unneeded high-frequency components.

Procedure Channel Screen

1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the desired channel position.
3. Use the ▲▼ buttons to make a setting.



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



Filter: **OFF** Filter: **500 Hz**

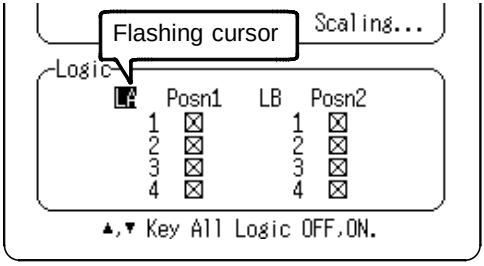
7.3.8 Setting the Logic Inputs

- Select the display color of logic waveform for each channels.
- Select the display position for each probe (4 channels) for logic channels LA and LB.

Procedure Channel Screen

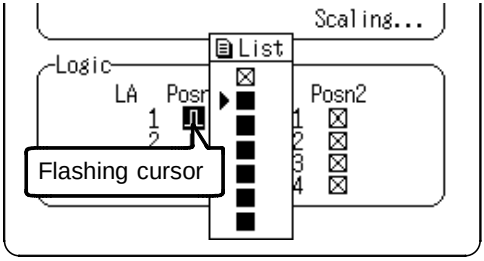
(1) Set the logic waveform to ON or OFF.

1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to the position shown in the figure below and set to ON or OFF using the ▲▼ buttons.



(2) Set the display color.

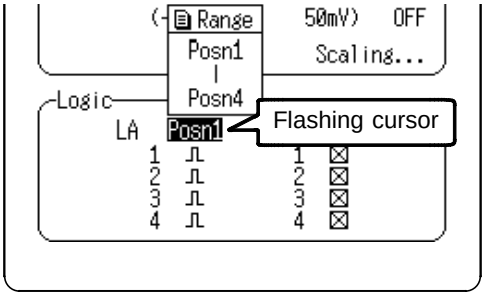
1. Move the flashing cursor to the position shown in the figure below.
2. Select the display color for channels using the ▲▼ buttons.



NOTE For the logic waveforms, the waveform colors have no effect on printing density.

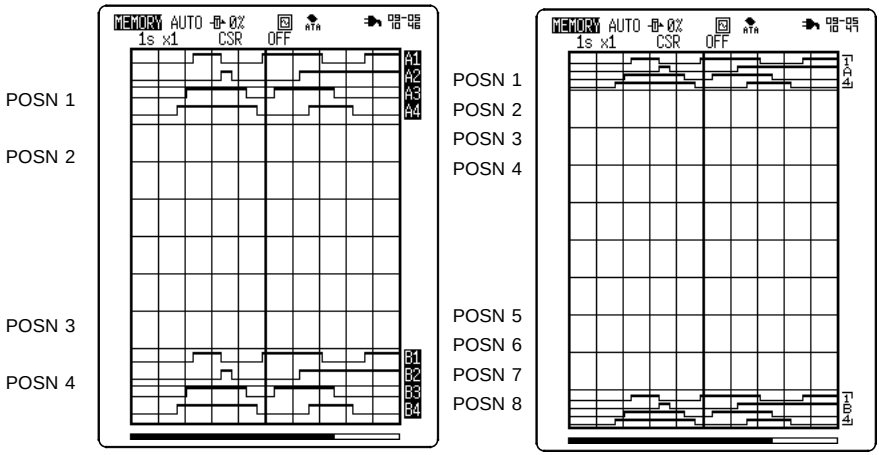
(3) Select the display position for the logic waveform.

Move the flashing cursor to the position shown in the figure below and set the display position using the ▲▼ buttons.



Logic Waveform Display Position

Selection of the display position differs according to the logic recording width setting on the Environment Screen. When Wide is selected choose position 1 to 4, or when Narrow is selected choose position 1 to 8.
For details, refer to Section 10.1.5.



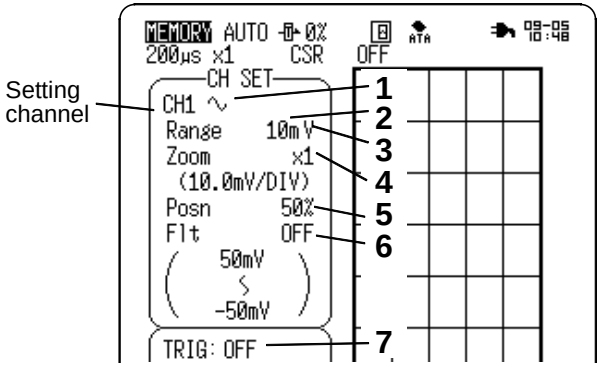
Logic Recording Width

7.4 Waveform Screen Input Settings

Input settings for each channel can be set from the Waveform Screen.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Press the Channel Select button (CH1 to CH4) for the channel to set. The setting window for that channel appears. The setting window can be set to analog channels CH1 to CH4 and logic channels LA and LB using the ▼▲ buttons on the position for setting channel.



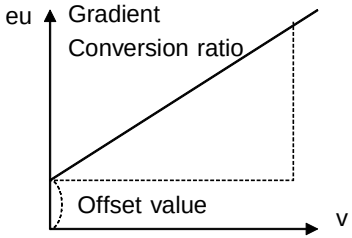
3. Move the flashing cursor to the item to be set and use the ▲▼ buttons to make a setting.
4. To close the setting window, press the Channel Select button again.

1 Waveform display color	Set the display color for the waveform.
2 Voltage axis range	Set the voltage axis range for channel.
3 Input coupling	Set the input coupling for the input
4 Magnification/ compression ratio along the voltage axis	Set the magnification/compression ratio along the voltage axis for channel to display or recording data.
5 Zero position	Set the zero voltage position.
6 Low-pass filter	Set the low-pass filter.
7 Trigger	Set the internal trigger.

7.5 Scaling Function

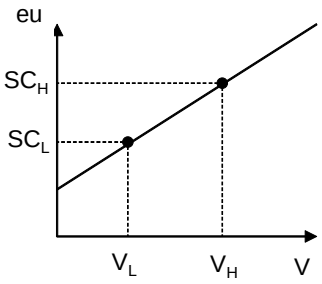
- The scaling function can be used to convert an output voltage from a sensor or similar into a physical quantity.
- The gauge scale (maximum and minimum values of vertical axis) and A/B cursor measurement values are displayed in the scaled units.
- Scaling can be performed for each channel.

Conversion ratio method



Scaling is performed by specifying a physical quantity to correspond to a 1 V input signal (conversion ratio: eu/v), an offset value, and the product (eu: engineering units). This will cause the measurement voltage to be converted into the selected units.

2-point method



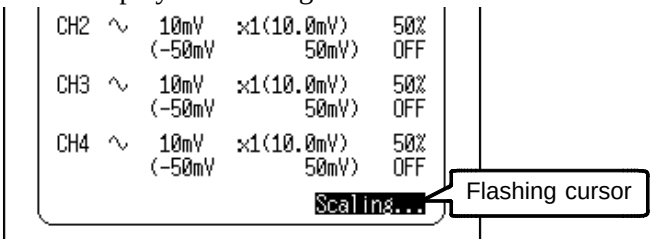
Scaling is performed by specifying two input signal points (voltage values) and the conversion values for these two points in engineering units (eu). This will cause the measurement voltage to be converted into the selected units.

V_H Voltage high point
SC_H Scaling high point
V_L Voltage low point
SC_L Scaling low point

Procedure Scaling Screen

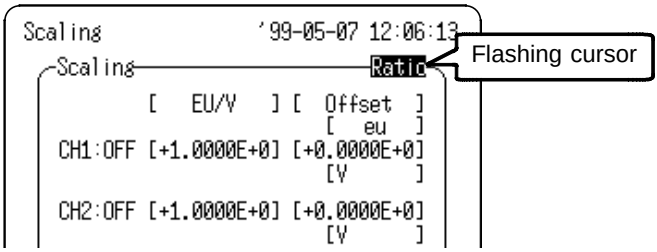
(1) Display the Scaling Screen.

1. Press the **SET** button to display the Channel Screen.
2. Move the flashing cursor to Scaling... and use the ▲▼ buttons to display the Scaling Screen.



(2) Select the scaling method.

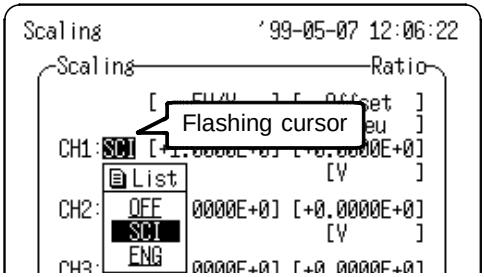
Move the flashing cursor as shown in the figure below and select the scaling method using the ▲▼ buttons to make a setting.



Ratio	Use conversion ratio method
2 Point	Use 2-point method

(3) Set the scaling settings for channels.

Move the flashing cursor as shown in the figure below and use the ▲▼ buttons to make a setting.



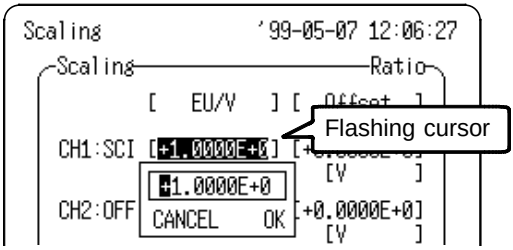
OFF	Scaling not used
SCI	Scaling used (specify exponent as integer)
ENG	Scaling used (specify exponent as multiple of 3)

(4) When specifying by conversion ratio, enter the scaling (numeric value) and offset value.

When specifying by two points, enter two points on the gradient with different values.

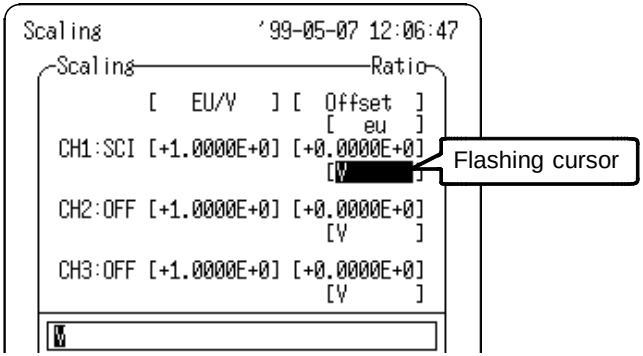
1. Move the flashing cursor to the item to be entered.
2. Press the ▲▼ buttons to display the numeric entry window. Move the cursor to the digit to be set, and press the ▲▼ buttons to make a setting.
3. When finished settings, move the flashing cursor to the OK position and press the ▲▼ buttons or the **START** button to accept the entry.

   To cancel settings, move the flashing cursor to the CANCEL position and press the ▲▼ buttons or the **STOP** button to cancel the entry.



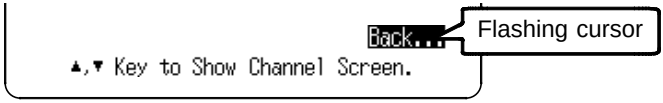
(5) Set the scaling units.

Move the flashing cursor to the channel for which the products are to be set. Enter the products. Refer to Section 11.3.3 Text Entry Procedure for the product entry procedure.

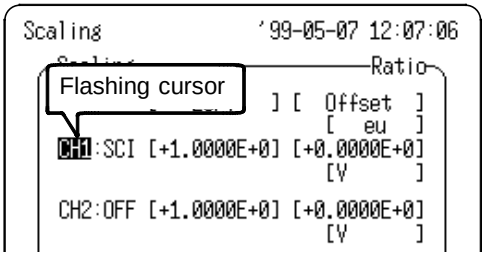


(6) Exit the Scaling Screen.

When finished with scaling settings, move the flashing cursor to the Back position and press the ▲▼ buttons or the **SET** button to return to the Channel Screen.



Copying Scaling Settings

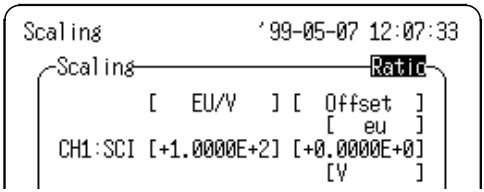


Move the flashing cursor to the position shown in the figure. Pressing the ▲ button then copies the settings from the channel immediately above. Pressing the ▲ button again copies the settings from the channel above that. Similarly, pressing the ▼ button copies the settings from the following channel.

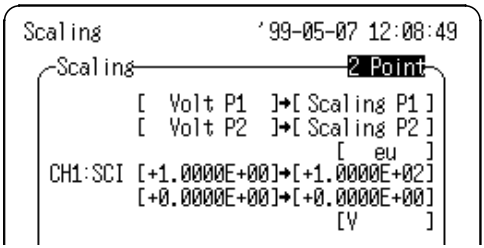
Scaling Examples

(1) To measure the voltage waveform at the secondary of a power transformer with 100:1 winding ratio, the scaling setting allows reading the measurement directly:
Either set a conversion ratio of 100,
or specify 2 points as 1 -> 100 and 0 -> 0.
The units are volts: [V]

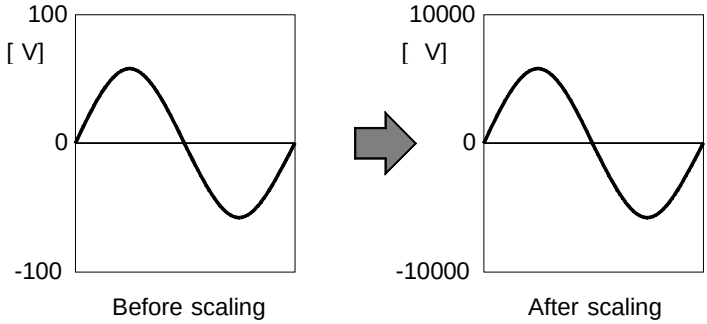
Scaling set by conversion ratio



Scaling set by two points

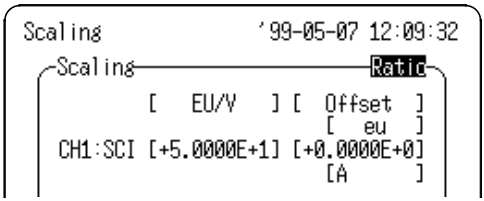


When set as above, scaling is applied as shown below. The voltage axis range is 20 V/DIV.

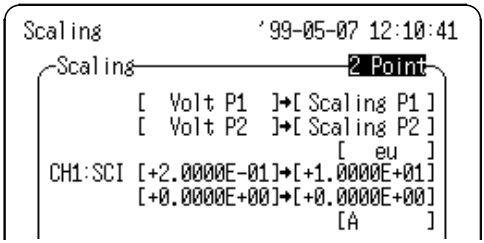


(2) To scale a current waveform for direct reading from a general purpose clamp sensor set to 10A current range that provides 0.2V AC full scale output.
Either set a conversion ratio of 10:0.2 (50:1), or specify two points as 0.2,10 and 0,0. The units are amperes [A].

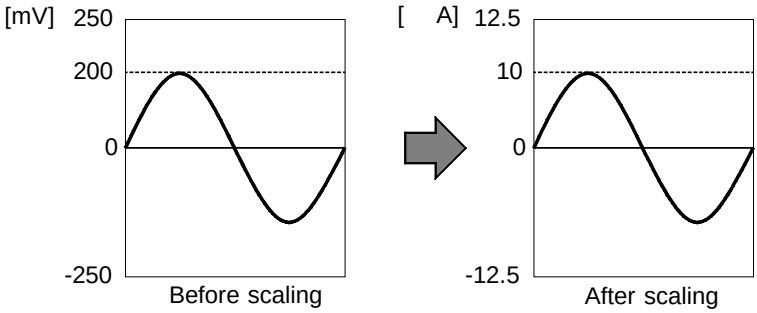
Scaling set by conversion ratio



Scaling set by two points



When set as above, scaling is applied as shown below. The voltage axis range is 50 mV/DIV.

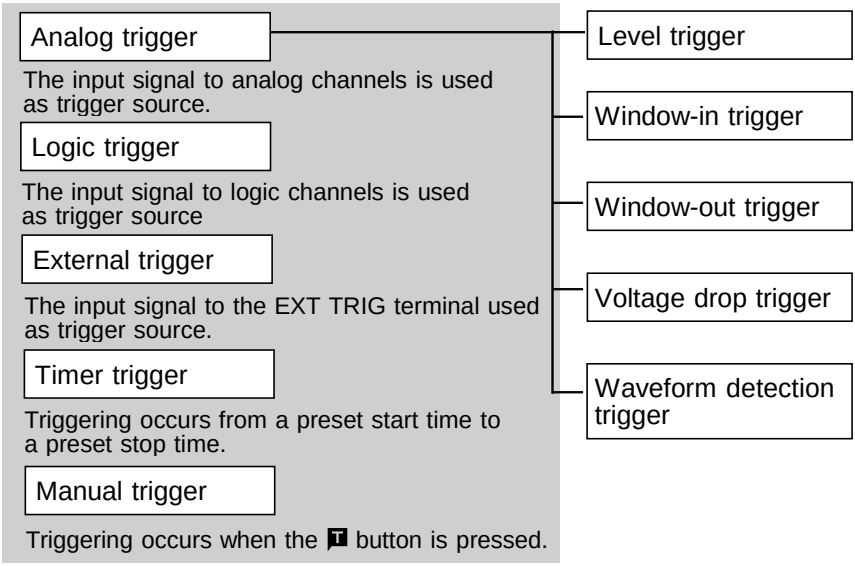


NOTE Refer to Section 7.3.4 to measure current using the HIOKI 9018-10, 9132-10 CLAMP ON PROBEs.

Chapter 8
Trigger Functions

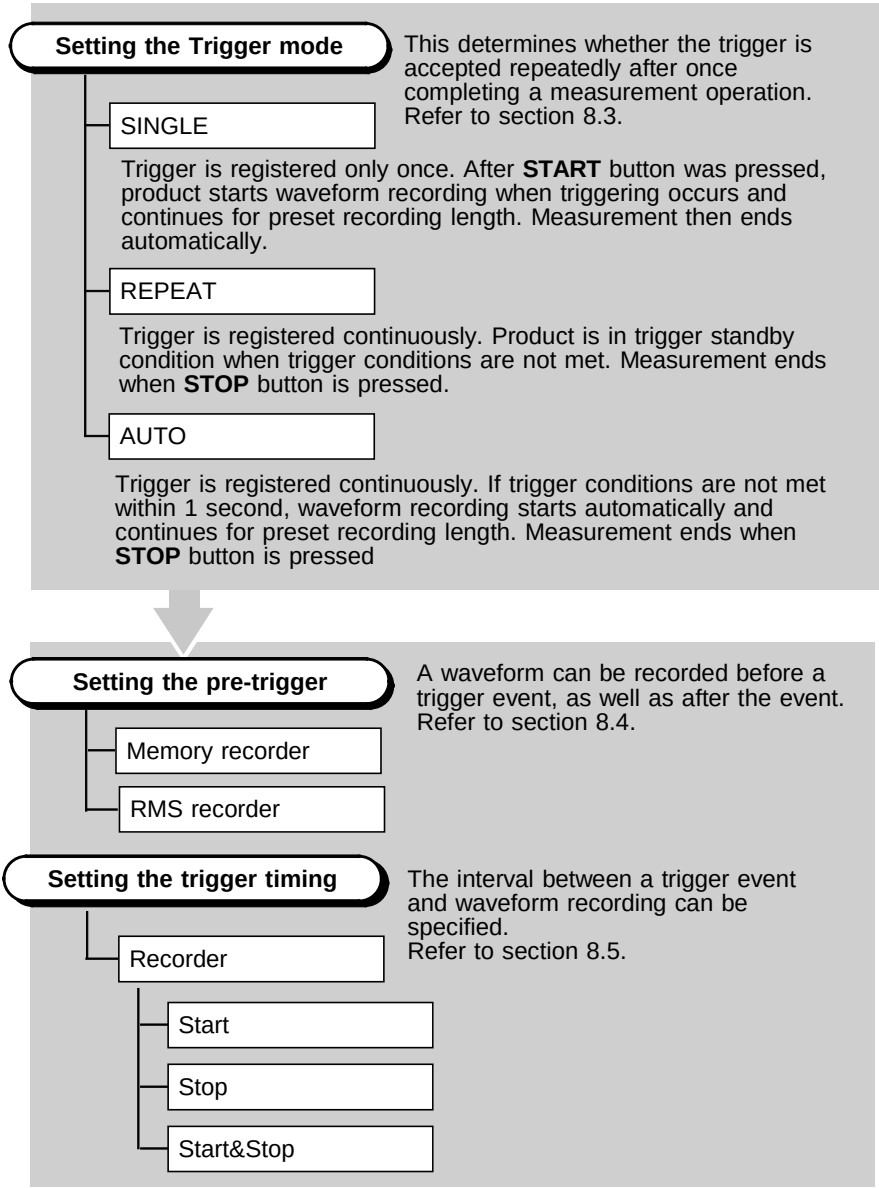
8.1 Overview of the Trigger Function

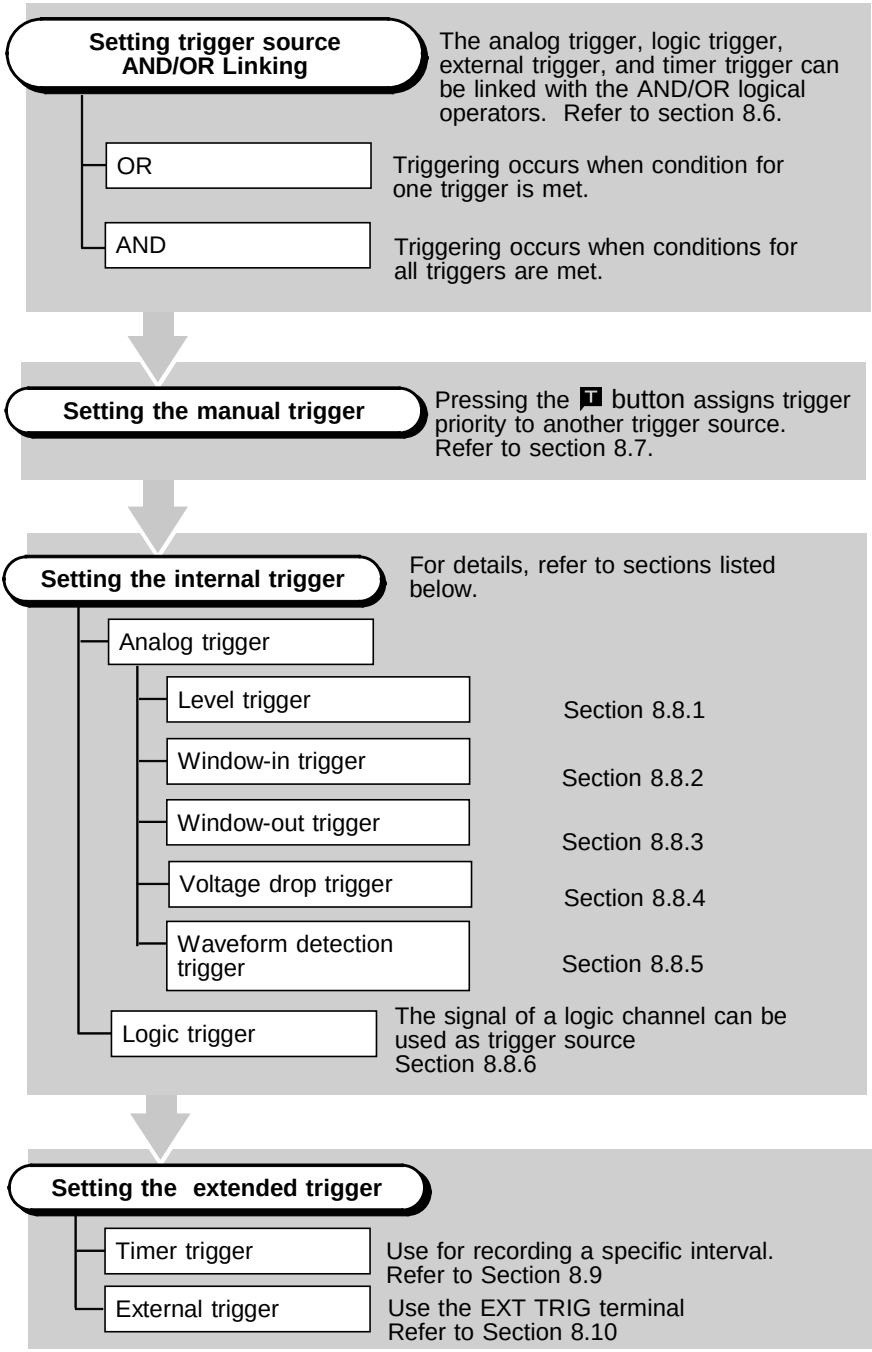
- The term "trigger" refers to a signal which is used to control the timing for recording start or stop.
- The term "triggering has occurred" refers to the state when such a signal has activated recording start or stop.
- Trigger parameters for the various functions are set using the Trigger Screen or the Waveform Screen.



NOTE
- Except for manual triggering, trigger sources can be logically ANDed and ORed. Manu al triggering by the T button can be executed regardless of any other trigger sources.
- For details on the trigger for the harmonic wave analysis function, refer to the supplement guide "Harmonic Wave Analysis Function."

8.2 Operation Sequence (Trigger mode setting)



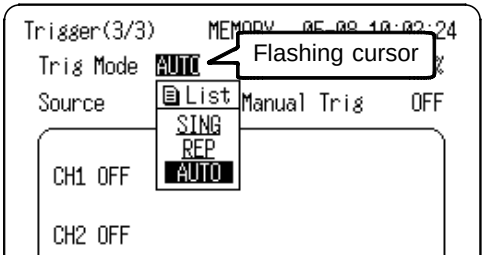

Setting trigger source AND/OR Linking
The analog trigger, logic trigger, external trigger, and timer trigger can be linked with the AND/OR logical operators. Refer to section 8.6.
OR
Triggering occurs when condition for one trigger is met.
AND
Triggering occurs when conditions for all triggers are met.
Setting the manual trigger
Pressing the T button assigns trigger priority to another trigger source. Refer to section 8.7.
Setting the internal trigger
For details, refer to sections listed below.
Analog trigger
Level trigger
Section 8.8.1
Window-in trigger
Section 8.8.2
Window-out trigger
Section 8.8.3
Voltage drop trigger
Section 8.8.4
Waveform detection trigger
Section 8.8.5
Logic trigger
The signal of a logic channel can be used as trigger source
Section 8.8.6
Setting the extended trigger
Timer trigger
Use for recording a specific interval.
Refer to Section 8.9
External trigger
Use the EXT TRIG terminal
Refer to Section 8.10

8.3 Trigger Mode

The trigger mode determines the way triggering is used to control operation of the product. When all trigger sources are set to OFF, a recording operation begins immediately (free-run operation).

Procedure Trigger Screen

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to Trig Mode and use the the ▲▼ buttons to make a setting.



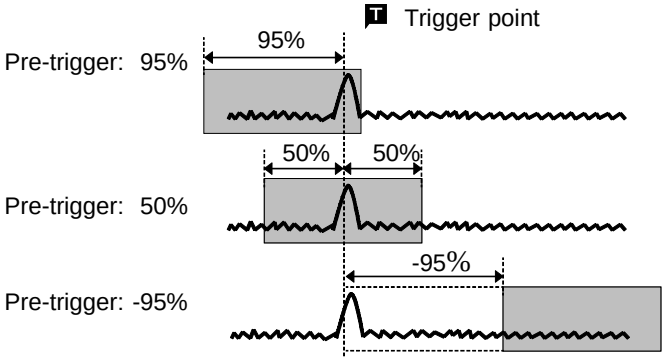
SING (single)	Trigger is registered only once. After START button was pressed, product starts waveform recording when triggering occurs and continues for preset recording length. Measurement then ends automatically.
REP (repeat)	Trigger is registered continuously. Product is in trigger standby condition when trigger conditions are not met. Measurement ends when STOP button is pressed.
AUTO (MEM)	Trigger is registered continuously. If trigger conditions are not met within 1 second, waveform recording starts automatically and continues for preset recording length. Measurement ends when STOP button is pressed (memory recorder function only).

8.4 Pre-trigger

The pre-trigger function serves to record the waveform not only after but also before triggering has occurred.

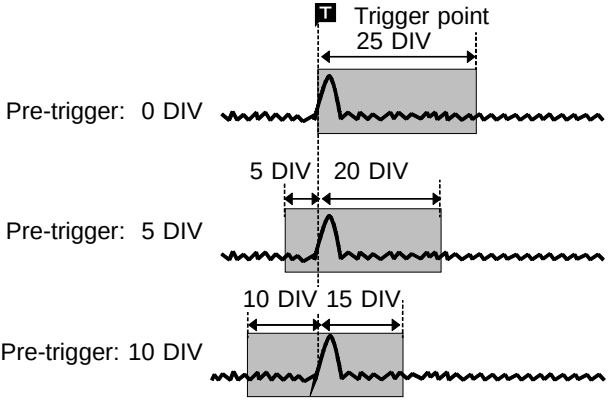
Memory Recorder Function

In the memory recorder function, using the recording start point as 0% and the recording end point as 100%, the trigger point can be specified in percent. When all trigger sources are set to OFF, the pre-trigger setting is invalid.



RMS Recorder Function

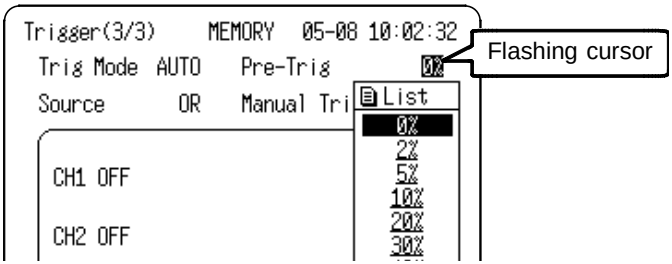
In the RMS recorder function, using the recording start point as 0 DIV, the trigger point can be specified in DIV (0, 5, 10 DIV). When all trigger sources are set to OFF, the pre-trigger setting is invalid.



When the recording length is 25 DIV

Procedure Trigger Screen(MEM, RMS)

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to Pre-Trig and use the ▲▼ buttons to make a setting.



0, 2, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100, -95%	Memory recorder
0, 5, 10 DIV	RMS recorder

NOTE

- In the RMS recorder function, a trigger can be accepted immediately from the start time. In some cases, therefore, the pre-trigger portion of a recording may not be available.
- In Memory recorder function, 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-trig wait is shown on the Waveform Screen.)
- With instantaneous waveform recording using the RMS recorder function, the pre-trigger portion of the waveform may not be recorded even if pre-trigger is selected because triggers are accepted starting at the moment that RMS recorder measurement begins.
- When the trigger can be registered, the indication Wait for trig is shown on the Waveform Screen.

8.5 Trigger Timing (REC only)

- In Recorder function, the moment the trigger occurs, the time related to the waveform being recorded can be set.
- Not only the waveform after the trigger but also the waveform before the trigger can be recorded.

Procedure Trigger Screen (REC)

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to Timing and select the trigger timing using the ▲▼ buttons.

Start	Recording starts at the trigger event and stops after the specified recording length.
Stop	Recording starts when the START button is pressed and stops at the trigger event.
Start&Stop	Recording starts when the first trigger event occurs, and stops when the next trigger event occurs.

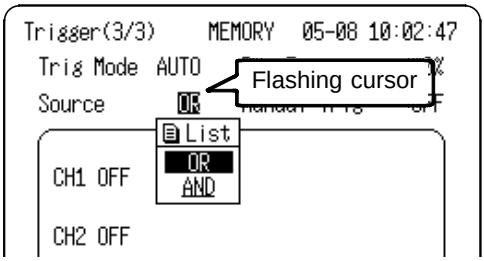
NOTE When the trigger timing is set to Stop or Start & Stop, measured waveform data equivalent to the recording length is recorded if the stop triggering is not generated between the initiation of measurement and the end of the set recording length.
Trigger mode: SINGLE The measurement end
Trigger mode: REPEAT The measurement starts again. (STOP), or waits for trigger. (START&STOP)

8.6 Trigger Source AND/OR Linking

The analog trigger, logic trigger, external trigger, and timer trigger can be linked with the AND/OR logical operators.

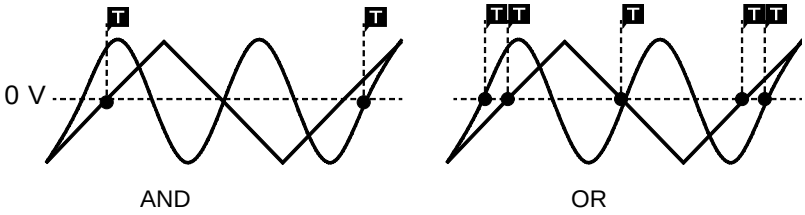
Procedure Trigger Screen

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to Source and select the trigger source using the ▲▼ buttons.



OR	Triggering is activated when any one of the trigger conditions is met.
AND	Triggering is activated when all of the trigger conditions are met.

When the level trigger setting is 0.00 V(⊥) for channels 1 and 2, the following difference between the effect of AND/OR linking is shown.



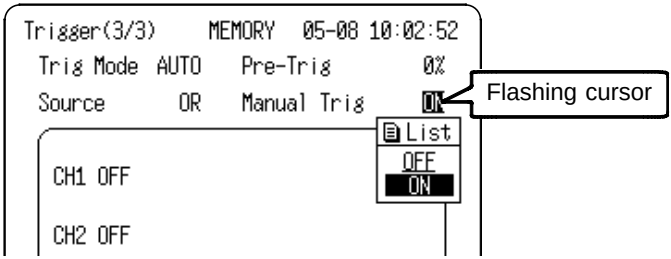
NOTE If the trigger source is set to AND, and the trigger source setting conditions have already been met when the START button is pressed, triggering does not occur. When the conditions are not met once but met subsequently, triggering occurs.

8.7 Manual Trigger

Triggering occurs when the T button is pressed. The manual trigger is always activated when the T button is pressed, regardless of trigger source AND/OR linking setting.

Procedure Trigger Screen

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to Manual Trig and set to on or off using the ▲▼ buttons.



OFF	Manual trigger is disabled.
ON	Manual trigger is enabled.

8.8 Internal Trigger

The type of trigger that can be used for the various functions is limited.

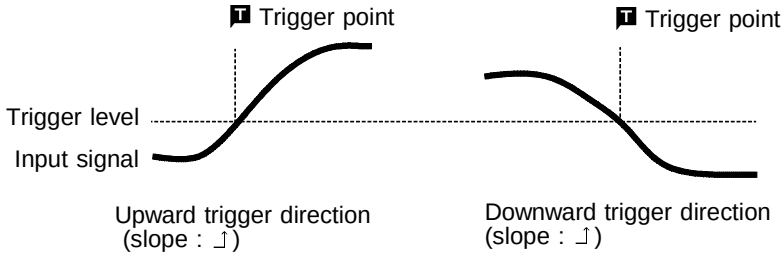
Available trigger types for each function

Function / Trigger	Memory recorder	Recorder	RMS recorder	Instantaneous waveform recording
Level	●	●	●	●
Window in	●	●	●	●
Window out	●	●	●	●
Voltage drop	●	—	—	●
Waveform evaluation	●	—	—	—
Logic	●	●	●	●

●: available / — : not available

8.8.1 Level Trigger

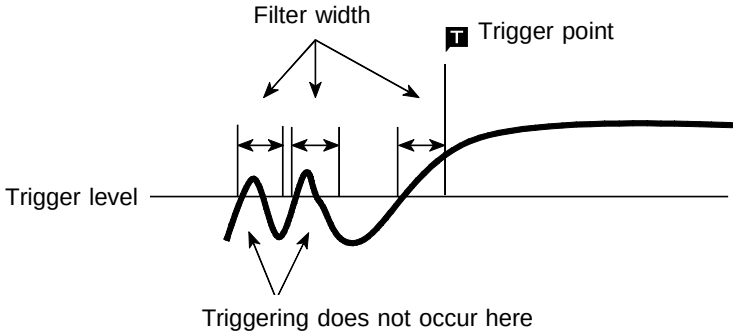
- Triggering occurs when the input signal crosses the preset trigger level (voltage) with the preset trigger slope (⤴, ⤵).
- When a trigger filter is used, triggering occurs only within the filter width. This is useful to exclude noise.



Trigger Filter (MEM, REC)

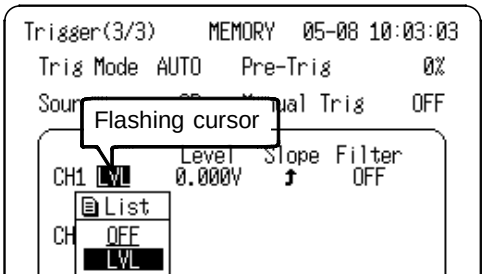
- Triggering occurs when the trigger conditions are met within the filter width. This is useful to prevent spurious triggering by noise.
- The filter width is specified by the number of divisions of the memory recorder function, while it is fixed to 10 ms, which is enabled and disabled using the ▲▼ buttons, for the recorder function.

Rising trigger slope : ⤴

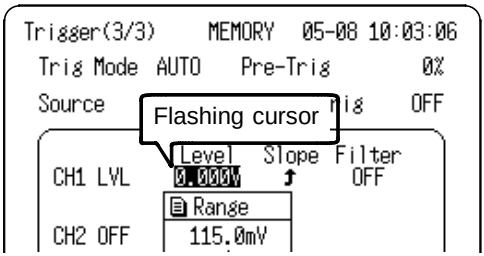


Procedure Trigger Screen

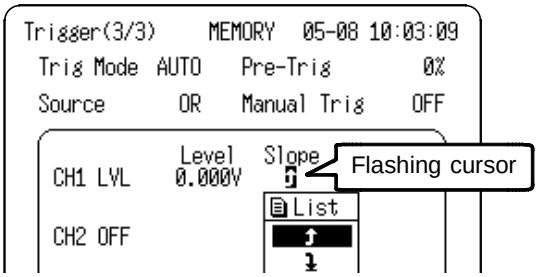
1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and select LVL (level) using the ▲▼ buttons.



3. Move the flashing cursor to the position shown in the figure below, and set the trigger level using the ▲▼ buttons.

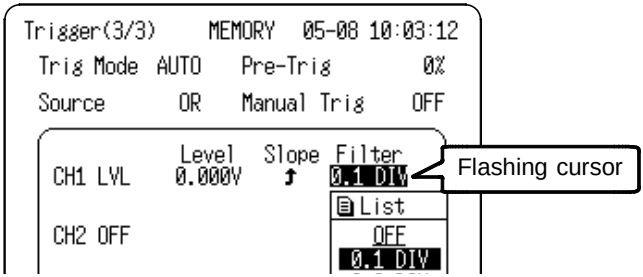


4. Move the flashing cursor to the position shown in the figure below, and set the trigger slope using the ▲▼ buttons.



⌟	Triggering occurs when the rising trigger slope (⌟) crosses the trigger level.
⌝	Triggering occurs when the falling trigger slope (⌝) crosses the trigger level.

5. Move the flashing cursor to the position shown in the figure below, and set the trigger filter width using the ▲▼ buttons. (Filter settings are not available for the RMS Recorder.)

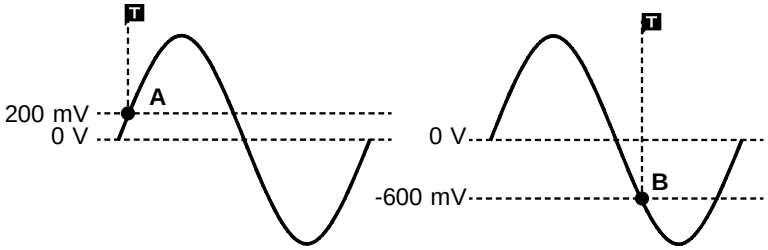


OFF	Trigger filter is disabled.
ON	In Recorder function mode Trigger filter is enabled. Filter width: 10 ms
0.1 to 10	In Memory recorder function Trigger filter is enabled. Filter width (DIV)

To cause triggering at point A or point B with the sine wave shown below, make the following settings.

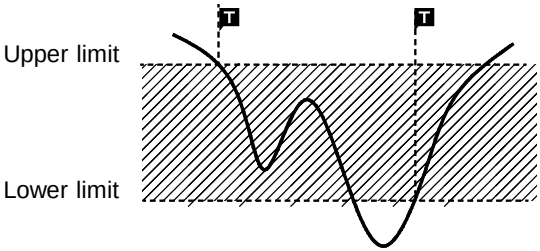
Point A
trigger level: 200 mV,
trigger direction (slope): rising (┘)

Point B
trigger level: -600 mV,
trigger direction (slope): falling (┐)



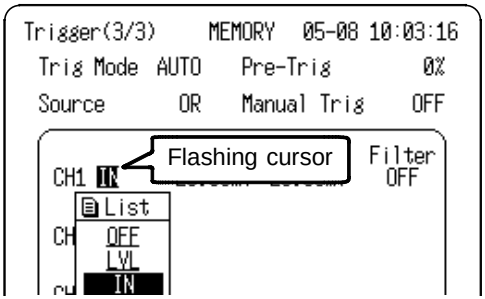
8.8.2 Window-In Trigger

Set upper limit level and lower limit level and activated when the input signal enters the range between these limits.

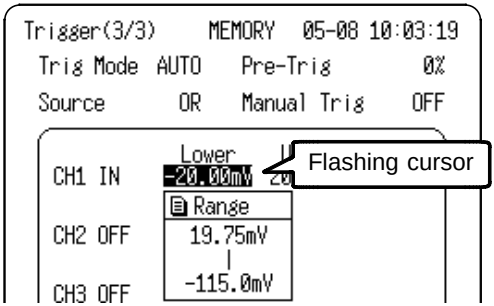


Procedure Trigger Screen

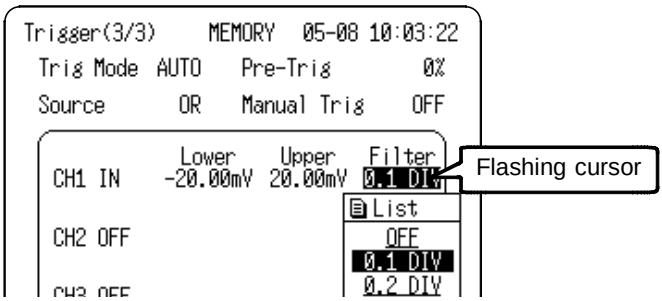
1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and select IN using the ▲▼ buttons.



3. Move the flashing cursor to the position shown in the figure below, and set the lower limit of the trigger level using the ▲▼ buttons.



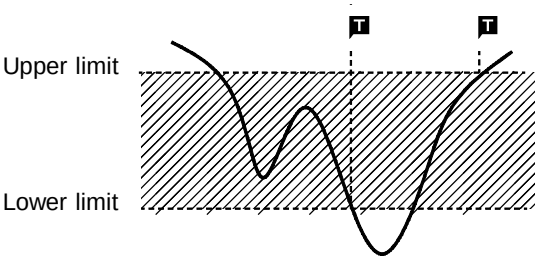
4. Move the flashing cursor to the upper limit, and set the upper limit of the trigger level using the ▲▼ buttons. The upper limits must not be smaller than the lower limits, or the lower limits must not be larger than the upper limits.
5. Move the flashing cursor to the position shown in the figure below, and set the trigger filter width using the ▲▼ buttons. (Filter settings are not available for the RMS Recorder.)



OFF	Trigger filter is disabled.
ON	In Recorder function mode Trigger filter is enabled. Filter width: 10 ms
0.1 to 10	In Memory recorder function Trigger filter is enabled. Filter width (DIV)

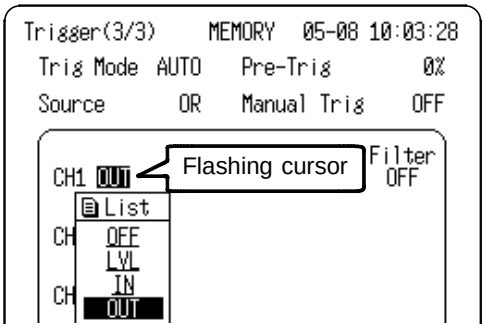
8.8.3 Window-Out Trigger

Set upper limit level and lower limit level and activated when the input signal leaves this range.

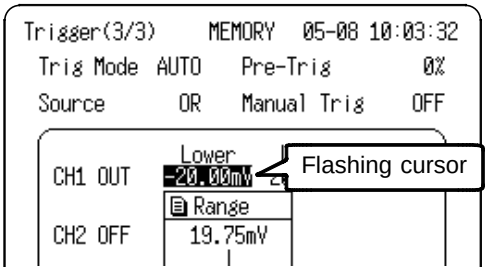


Procedure Trigger Screen

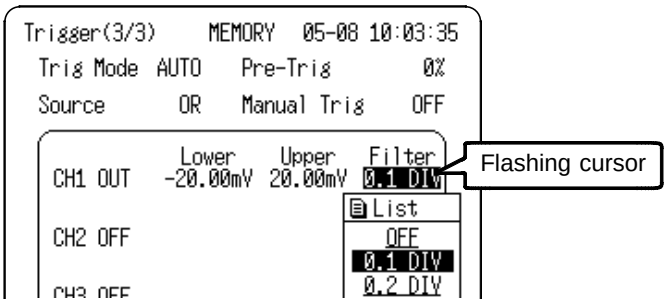
1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and select OUT using the ▲▼ buttons.



3. Move the flashing cursor to the position shown in the figure below, and set the lower limit of the trigger level using the ▲▼ buttons.

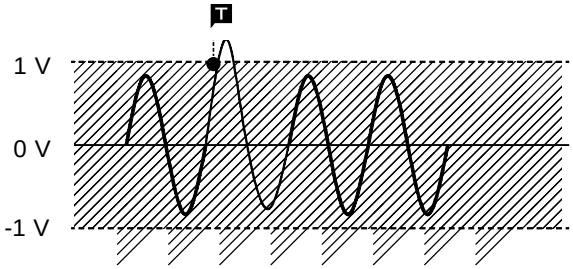


4. Move the flashing cursor to the upper limit, and set the upper limit of the trigger level using the ▲▼ buttons. The upper limits must not be smaller than the lower limits, or the lower limits must not be larger than the upper limits.
5. Move the flashing cursor to the position shown in the figure below, and set the trigger filter width using the ▲▼ buttons. (Filter settings are not available for the RMS Recorder.)



OFF	Trigger filter is disabled.
ON	In Recorder function mode Trigger filter is enabled. Filter width: 10 ms
0.1 to 10	In Memory recorder function Trigger filter is enabled. Filter width (DIV)

In order to cause triggering when the signal as shown in the figure below leaves the hatched area, the following settings are made: upper limit 1 V, lower limit -1 V



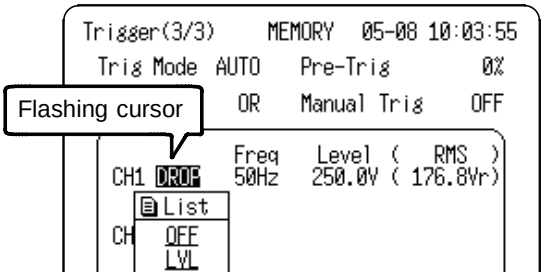
NOTE With the RMS recorder function, if the input signal is already out of range when measurement commences, the trigger is applied from the point where the START button is pressed.

8.8.4 Voltage Drop Trigger

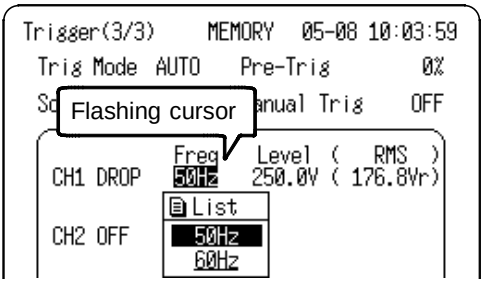
- The time axis ranges that can be used are 200 µs to 50 ms/DIV.
- The product is designed to measure commercial power supplies (50/60 Hz), and detects momentary voltage drops in commercial power supplies.
- Triggering occurs when peak voltage drops below the specified level for more than one-half cycle.

Procedure Trigger Screen

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and select DROP using the ▲▼ buttons.

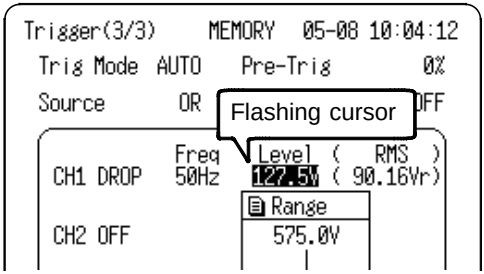


3. Move the flashing cursor to the position shown in the figure below, and set the frequency to be measured using the ▲▼ buttons.

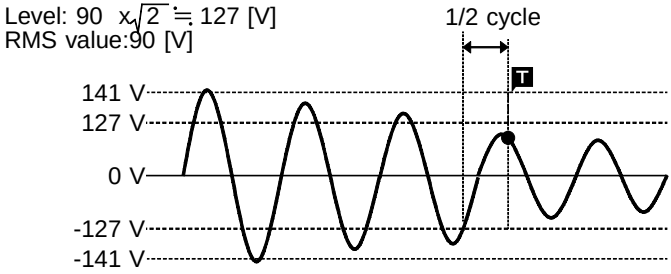


50 Hz	This measurement is made using a 50-Hz commercial power supply.
60 Hz	This measurement is made using a 60-Hz commercial power supply.

4. Move the flashing cursor to the position shown in the figure below, and set the trigger level using the ▲▼ buttons.
   The RMS value is displayed on the right side of the trigger level.



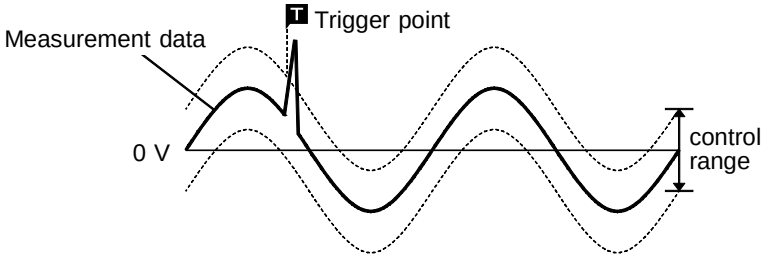
When measuring 100-Vrms (Vmax=141 V) commercial power, if a trigger is set to occur when the voltage drops to 90 Vrms (Vmax=127 V), the trigger event occurs as shown here. In this case, the input voltage axis range should be set to 50 V/DIV.



NOTE The settable trigger area is limited by the voltage axis range setting.

8.8.5 Waveform Detection Trigger (Memory Only)

The waveform detection trigger is intended for use when measuring 50/60-Hz commercial power. The Time axis setting on the Status Screen must be 10 ms or lower.
The waveform detection trigger function compares the measured signal with a pre-defined control waveform range, and triggers if the signal deviates from the control range voltage.
The control range consists of a positive and negative amplitude offset from either a standard sine wave or the previous input cycle.

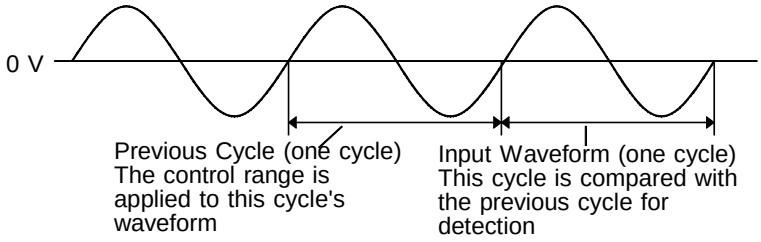


(1) Sine Wave

The control range is based on a sine wave (with RMS value voltage) at the mains frequency.

(2) Previous Cycle

The control range of each cycle is based on the previous cycle of the input waveform. This selection is used when gradual changes should not cause triggering.

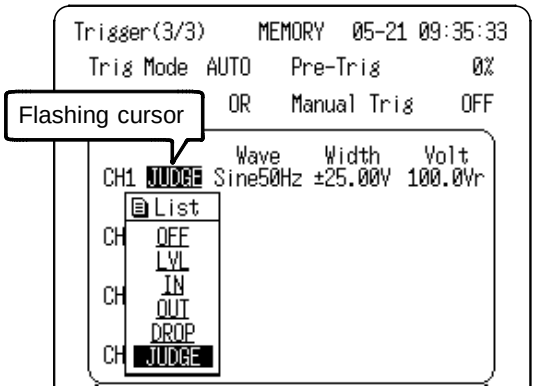


NOTE

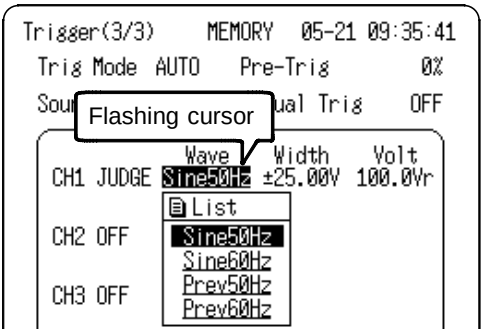
- Specifications of the waveform detection trigger:
  Real-time detection period 125 µs
  Maximum sampling rate 400 kS/s (time axis: 200 µs/DIV)
- When a waveform is printed, the evaluation area for one cycle including the trigger is also printed with the measured waveform superimposed on it.

Procedure Trigger Screen

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and select JUDGE using the ▲▼ buttons. An error results if the measurement starts when the Time axis setting is 20 ms or more.

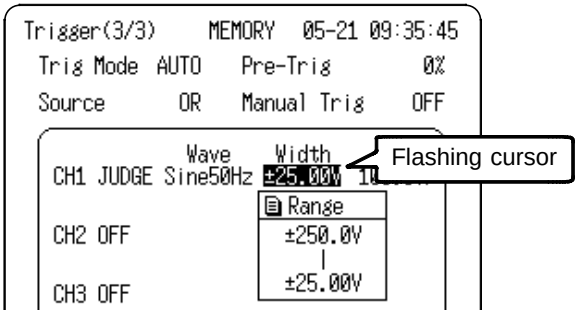


3. Move the flashing cursor to the position shown in the figure below and select the reference waveform using the ▲ ▼ buttons.



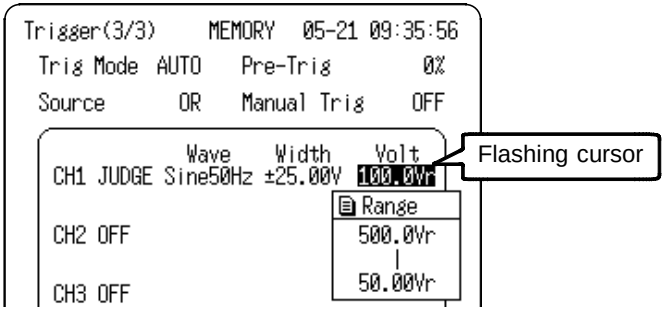
Sine 50 Hz	Compare with 50-Hz sine wave.
Sine 60 Hz	Compare with 60-Hz sine wave.
Prev 50 Hz	Compare with 50-Hz previous cycle.
Prev 60 Hz	Compare with 60-Hz previous cycle.

4. Move the flashing cursor to the position shown in the figure below and set the control range (within±0.5 to±5 divisions of measurement range) using the ▲▼ buttons.



5. When 50- or 60-Hz Sine Wave was selected in step 3, set the Standard Voltage.

   Move the flashing cursor to the position shown in the figure below and set the standard voltage using the ▲▼ buttons.



   When measuring 100-V commercial lines:
   Set the voltage axis range to 20 V/DIV or 50 V/DIV and standard voltage to 100 Vr.
   When measuring 200-V commercial lines:
   Set the voltage axis range to 50 V/DIV or 100 V/DIV and standard voltage to 200 Vr.

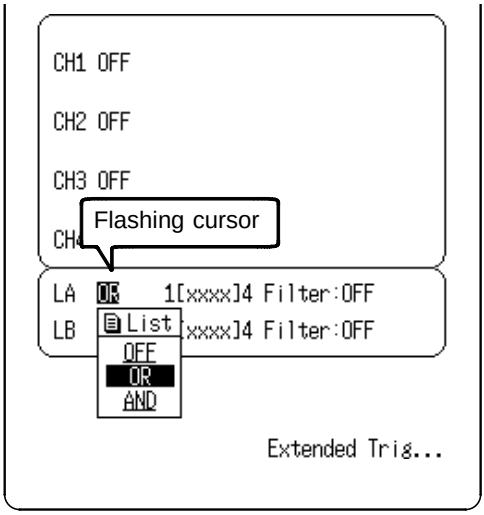
NOTE The settable standard voltage and control range are limited by the voltage range setting.

8.8.6 Logic Trigger

The signal of a logic channel can be used as trigger source. A trigger pattern and logical operator (AND/OR) are specified, and triggering occurs when the trigger conditions are met. A trigger filter can be specified, so that triggering occurs only when the trigger conditions are met within the filter width.

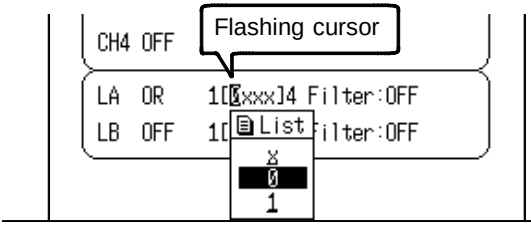
Procedure Trigger Screen

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to make a setting.



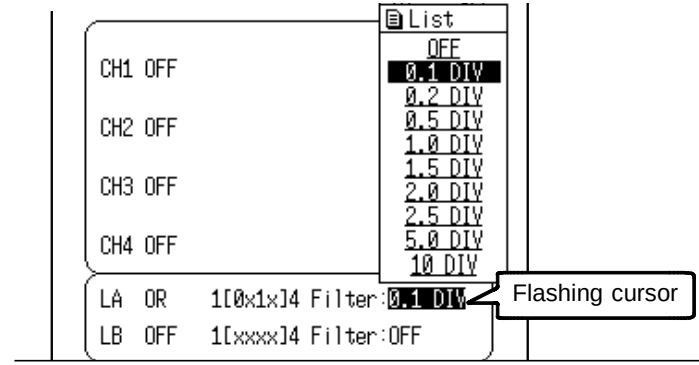
OFF	Logic trigger is not used.
OR	Triggering occurs if any one of the logic input signals conforms to the trigger pattern.
AND	Triggering only occurs if all of the logic input signals conforms to the trigger pattern.

3. Move the flashing cursor to the position shown in the figure below and set the trigger pattern using the ▲▼ buttons.



X	Signal disregarded
0	Low level signal
1	High level signal

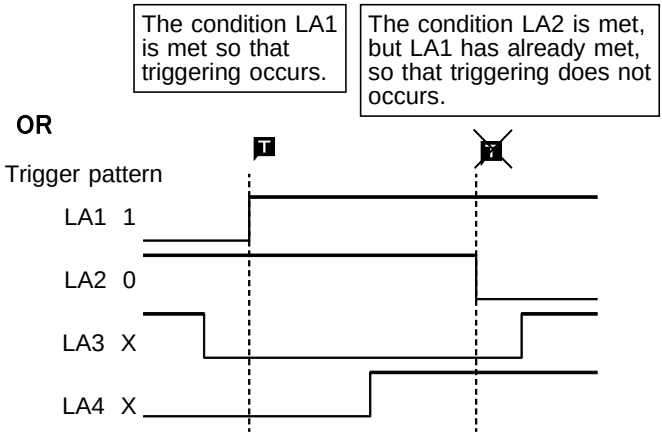
4. Move the flashing cursor to the position shown in the figure below and set the trigger filter width using the ▲▼ buttons.



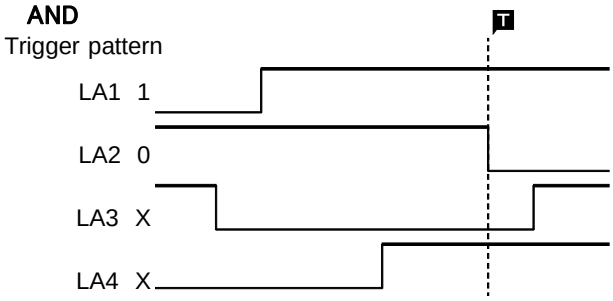
OFF	Trigger filter is disabled.
ON	In Recorder and RMS function mode Trigger filter is enabled. Filter width: 10 ms
0.1 to 10	In Memory recorder function mode Trigger filter is enabled. Filter width (DIV)

Setting example of the Logic Trigger

(1) If the trigger pattern has been set to "10XX" with the operator OR, then triggering occurs as shown in the figure below.



(2) If the trigger pattern has been set to "10XX" with the operator AND, then triggering occurs as shown in the figure below.



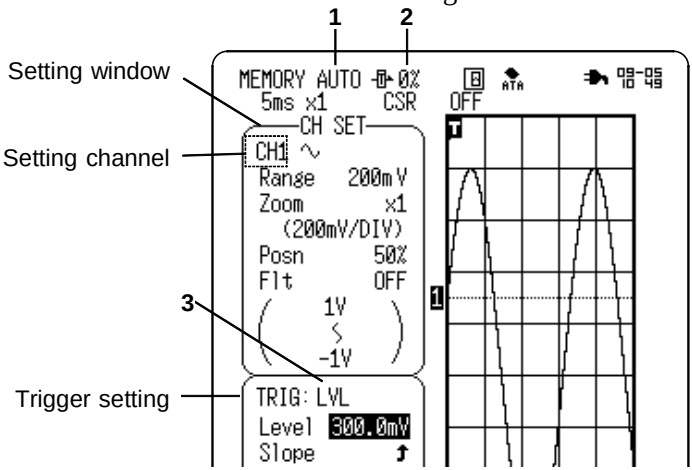
NOTE
- If the conditions are met already when measurement is started (AND: all trigger patterns are met, OR: one trigger pattern is met), triggering does not occur. Triggering only occurs if the conditions are removed and then met again. Refer to the figure (1).
- The trigger source "AND" cannot be set between the logic trigger and analog trigger of rms function.

8.8.7 Trigger Settings from the Waveform Screen

Internal trigger settings for each channel can be made from the Waveform Screen. Available settings differ according to the selected function.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Press the Channel Select button (CH1 to CH4) for the channel to set. The setting window for that channel appears.



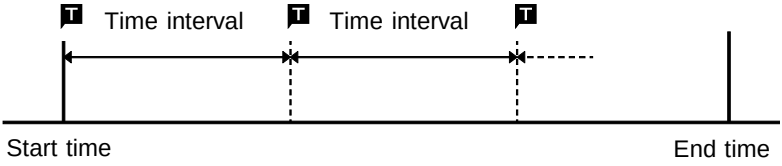
The setting window can be set to analog channels CH1 to CH4 and logic channels LA and LB using the ▼▲ buttons to select the channel to be set.

3. Move the flashing cursor to the trigger setting items (1 to 3) and use the ▲▼ buttons to make a setting.

1 Trigger mode	Set the trigger mode.
2 Pre-trigger	Set the pre-trigger. (In Recorder function, this setting is not displayed.)
3 Internal trigger	Set the internal trigger. Settings depend on the trigger type.

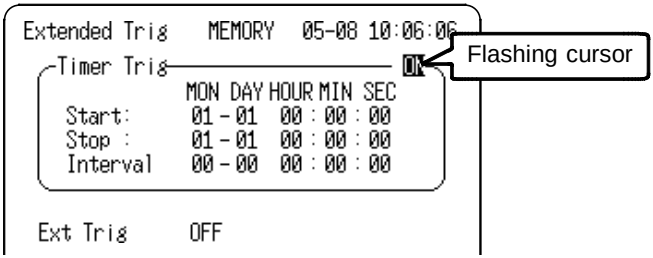
8.9 Timer Trigger Function

This function serves to activate recording at preset times. Triggering can be performed at constant intervals within a preset start time and end time.



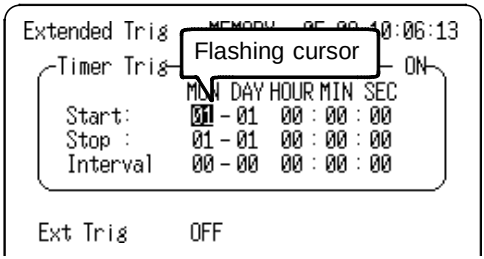
Procedure Extended Trigger Screen

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to Extended Trig... and display the Extended Trigger Screen using the ▲▼ buttons.
3. Move the flashing cursor to Timer Trig and use the ▲▼ buttons to make a setting.



OFF	Timer trigger is disabled.
ON	Timer trigger is enabled.

4. Move the flashing cursor to Start and set the start time using the ▲▼ buttons.
   To set the current time, press the T button.



   Also set the Stop Time and Interval in the same way.

Note on use for the timer trigger

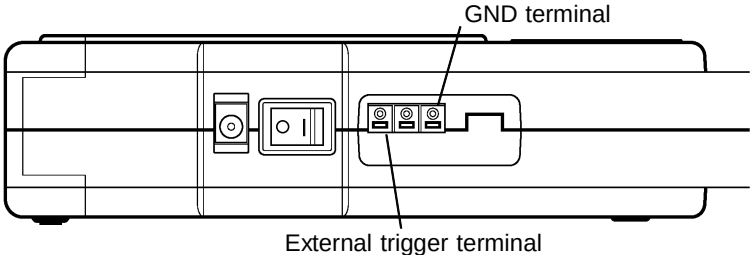
- Set the present time on the System Screen first, then set the timer trigger.
- Set the start time and end time to a point after the pressing of the **START** button.
- When the trigger mode is set to **SINGLE**, only one trigger event is valid for the start time. The settings for time interval and end time are invalid (when timer trigger only is ON).
- To perform recording at regular intervals, establish the following settings.
  Trigger mode: repeat. Other trigger sources: all OFF
  Between end of recording and standby, triggers are invalid while processing is taking place (auto save, auto print, waveform display processing, calculation) and therefore data may not be recorded at regular intervals with some measurement setting.
- When trigger sources are set to OR:
  All trigger sources are valid. If other trigger sources have been set, triggering can also occur before the start time or after the end time.
- When trigger sources are set to AND:
  Measurement is carried out from the start time to the end time. Triggering occurs once at the preset intervals if the conditions for the other trigger sources are also met at these points.
  If the interval has been set to 0 s, triggering occurs at any point between the start and end time, if the conditions for the other trigger sources are met.

8.10 External Trigger Function

DANGER

To avoid damaging the product, do not apply voltage outside of the range -5 to +10 V to the external trigger terminal.

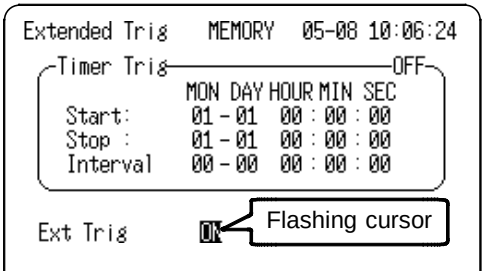
- An external signal can be used as trigger source.
- The external trigger facility can be used to synchronize a number of the products for parallel operation.



Procedure Extended Trigger Screen

1. Press the **SET** button to display the Trigger Screen.
2. Move the flashing cursor to Extended Trig ... and display the Extended Trigger Screen using the ▲▼ buttons.
3. Move the flashing cursor to Ext Trig and use the ▲▼ buttons to make a setting.

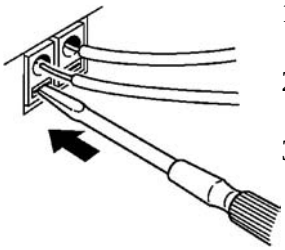
OFF	External trigger is disabled.
ON	External trigger is enabled.



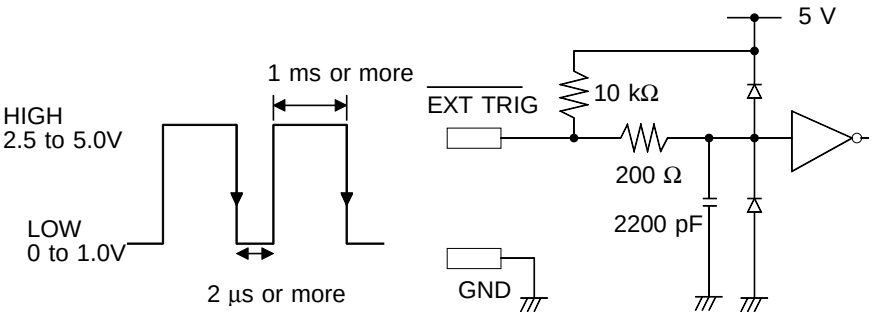
Signal Input

Triggering can be executed by shorting the external trigger terminal to ground, or at the transition from a high logic level (2.5 to 5.0V) to low level (0 to 1.0V).

Voltage range	High level: 2.5 to 5.0 V, Low level: 0 to 1.0 V
Pulse width	High level: Min. 1 ms, Low level: Min. 2 μs
Maximum input voltage	-5 to 10 V
Recommended wire	Single strand: 1.0 mm dia. (AWG #18) Multi-strand: 0.75 mm^2
Usable limits	Single strand: 0.3 to 1.0 mm dia. (AWG #26 to #18) Multi-strand: 0.3 to 0.75 mm^2 (AWG #22 to #20) Strand diameter: minimum 0.18 mm
Standard insulation stripping length	10 mm



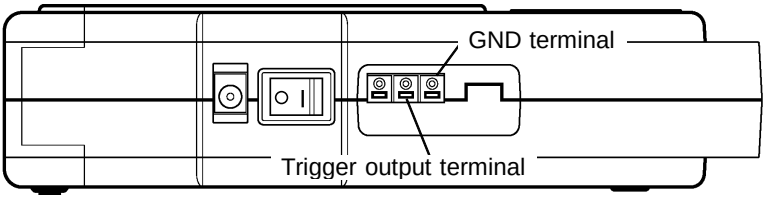
1. Push the tab with a flatblade screwdriver or similar.
2. While keeping the tab depressed, insert a stripped wire into the connector opening.
3. Release the tab to lock the wire.



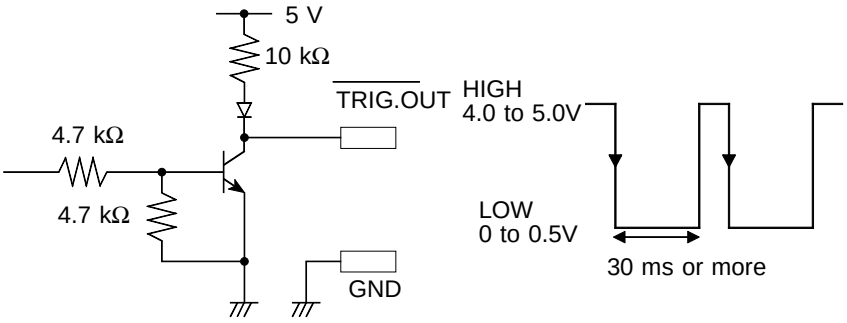
NOTE The external trigger input (EXT TRIG) cannot be used, unless the external trigger is enabled on the Extended Trigger Screen.

8.11 Trigger Output Terminal

When triggering occurs, a signal is output from the TRIG OUT terminal.
This can be used to synchronize several products.

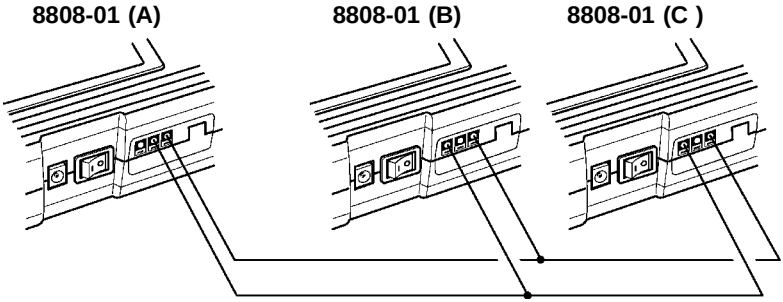


Output voltage	Open-collector signal (with voltage output), active Low
Output voltage range	High level: 4.0 to 5.0 V Low level: 0 to 0.5 V
Pulse width	Low level: Min. 30 ms
Recommended wire	Single strand: 1.0 mm dia. (AWG #18) Multi-strand: 0.75 mm^2
Usable limits	Single strand: 0.3 to 1.0 mm dia. (AWG #26 to #18) Multi-strand: 0.3 to 0.75 mm^2 (AWG #22 to #20) Strand diameter: Min. 0.18 mm dia
Standard insulation stripping length	10 mm
Maximum input voltage	-20 V to +30 V 500 mA max, 200 mW max



Example of synchronous measurement using multiple 8808-01 products

For parallel synchronous measurement, connect 8808-01(A) trigger output to 8808-01(B) and (C) external trigger inputs as shown in the figure. External triggering should be enabled (ON) in the 8808-01(B) and (C) products to receive the external trigger.

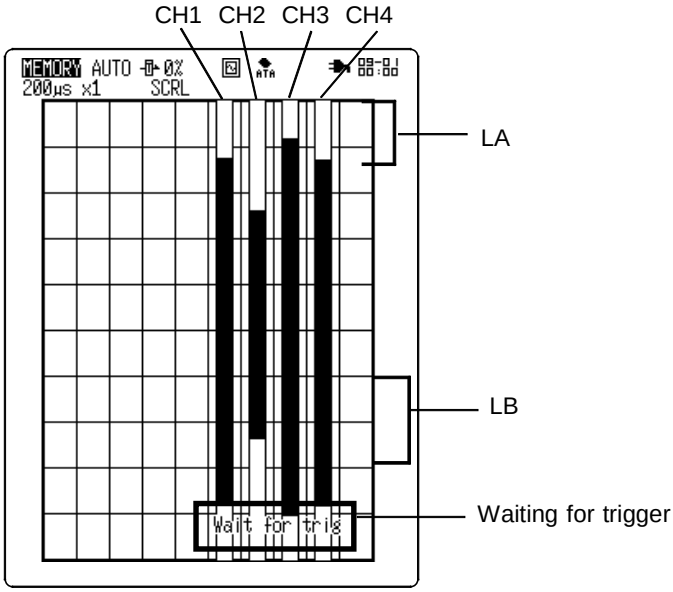


When the trigger condition is set on 8808-01(A) and enabled, trigger pulses are output from the TRIG OUT terminal. The 8808-01(B) and (C) products receive these pulses and apply the trigger to start measurement.

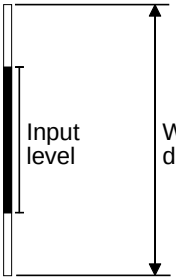
NOTE Using the auto ranging function causes a trigger signal to be output. Care is therefore required when using the auto ranging function when the trigger output terminal is in use. (Only a memory recorder function)
A trigger output signal is also generated when a trigger is applied while "AUTO" is selected as the trigger model.

8.12 Input Level Monitor Function

The input signal is monitored in real time when waiting for the trigger in Memory recorder or Recorder function.
The input settings can be made for a particular channel using the Channel Select buttons (CH1 to CH4) while monitoring on the Waveform Screen.



Analog channels



Logic channels

:The input is stabilized at the HIGH level.

:The input is stabilized at the LOW level.

:The input varies drastically between the HIGH and LOW levels.

:The display is disabled.

When the input level is not displayed on the screen display range

↑ The input level exceeds the upper limit.

↓ The input level exceeds the lower limit.

Chapter 9
Waveform Screen Operation

Indicates the Waveform Screen operation.

Measurement Settings

Input channel and trigger conditions can be set from the Waveform Screen.
For the input channels, refer to Section 7.4, and for the trigger conditions, refer to Section 8.8.7.

Using the A/B Cursors

- Line cursor (vertical)
- Line cursor (horizontal)
- Trace cursor

A/B cursors measurements can be performed on the Waveform Screen.

Scrolling the Waveform

Waveforms can be scrolled on the Waveform Screen. Refer to Section 9.1.

Magnification/compression ratio along the time axis

Time axis magnification and compression can be performed on the Waveform Screen. Refer to Section 9.2.

Screen partitioning

The Waveform Screen can be partitioned into Setting and Waveform Display windows. Refer to Section 9.3.

DMM function

Pressing the **DISP** button on the Waveform Screen causes the DMM Screen to appear. The DMM Screen can display either instantaneous or RMS values. Refer to Section 9.4.

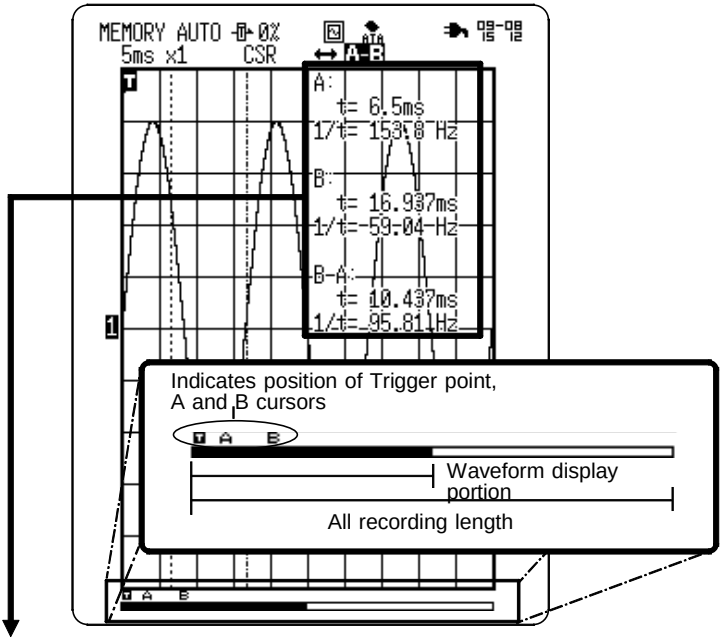
Waveform Display Area

The Waveform Screen can be partitioned into Setting and Waveform Display windows. Refer to Section 9.5.

NOTE For details on the Waveform Screen operation for the harmonic wave analysis function, refer to the supplement guide "Harmonic Wave Analysis Function."

9.1 Using the A/B Cursors

The A/B cursors can be used to read a time difference, frequency, or potential difference on screen. (When scaling is used, the values are displayed in the scaling value. Refer to Section 7.5.)



When using the vertical line cursors as shown in the figure below.

Display		Meaning
A	t = 8.37 ms	Time from the trigger point to A cursor
	1/t = 119.4 Hz	Frequency taking t as the period
B	t = 16.75 s	Time from the trigger point to B cursor
	1/t = 59.7 Hz	Frequency taking t as the period
B-A	t = 8.37 ms	Time interval between the A and B cursors
	1/t = 119.4 Hz	Frequency taking time interval between the A and B cursors as the period

Line Cursor (vertical, horizontal)

The value at cursor A and cursor B, and the value between the two cursors can be determined.

Trace Cursor

- Memory recorder, instantaneous waveform in RMS
  The value at the point where the cursor crosses the waveform can be determined. The trace point moves on the waveform of the specified channel.
- Recorder, RMS recorder
  The intersection between the cursor and the waveform is displayed midway between of the maximum and minimum values.

Cursors values

Cursor	A or B	B - A
Line cursor Vertical (↔)	t Time from the trigger point (*1,*3,*4) Time from recording start (*2) 1/t Frequency taking t as the period	t Time interval between the A and B cursors 1/t Frequency taking t as the period
Line cursor Horizontal (↕)	v Voltage value for channel selected	v Potential difference between the A and B cursors.
Trace cursor (+)	t Time from trigger point (*1,*3,*4) Time from recording start (*2) v Voltage value for channel selected (*1,*3) Maximum and minimum values for channel selected (*2,*5)	t Time difference between the trace points v Potential difference between the trace points

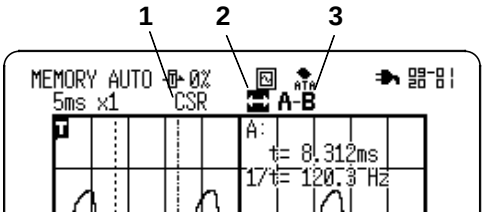
(*1): Memory recorder function
(*2): Recorder function
(*3): Instantaneous waveform in RMS recorder function
(*4): RMS recorder function
(*5): RMS recorder function (excluding time axis setting 100 ms/DIV)

9.1.1 Using the Line Cursors (Vertical)

The line cursor (vertical) displays the time and period starting from the trigger position. On the recorder, the line cursor (vertical) displays the time and period starting from the initiation of recording.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. When position 1 shown in the figure below is selected to SCRL (scroll), use the ▲▼ buttons to set to CSR (cursor). Pressing the ◁ and ▷ buttons simultaneously also changes setting.



3. Move the flashing cursor to position 2 and select ↔ (vertical line cursor).

OFF	Disable A/B cursors
↔	Line cursor (vertical) (t and 1/t are displayed)
↕	Line cursor (horizontal) (v is displayed)
+	Trace cursor (the point where the cursor crosses the waveform)

4. Move the flashing cursor to position 3 and select the cursor to be moved.

A	Use the cursor A only
A-B	Move the cursor A only
A-**B**	Move the cursor B only
A-**B**	Move simultaneously both cursors A and B

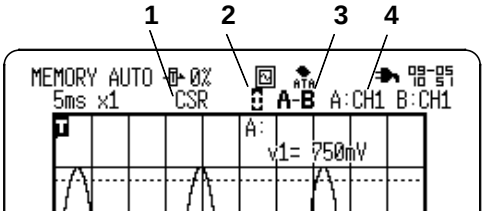
5. Move the A/B cursors using the ◀ ▶ scrolling button to view the display. Pressing the ◀◀ ▶▶ buttons moves the cursors faster.

9.1.2 Using the Line Cursors (Horizontal)

Used to read a voltage value of the specified channel. A/B cursor can be specified a different channel.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. When position 1 shown in the figure below is selected to SCRL (scroll), use the ▲▼ buttons to set to CSR (cursor). Pressing the ◁ and ▷ buttons simultaneously also changes setting.



3. Move the flashing cursor to position 2 and select ↕ (horizontal line cursor).

OFF	Disable A/B cursors
↔	Line cursor (vertical) (t and 1/t are displayed)
↕	Line cursor (horizontal) (v is displayed)
+	Trace cursor (the point where the cursor crosses the waveform)

4. Move the flashing cursor to position 3 and select the cursor to be moved.

A	Use the cursor A only
A-B	Move the cursor A only
A-**B**	Move the cursor B only
A-**B**	Move simultaneously both cursors A and B

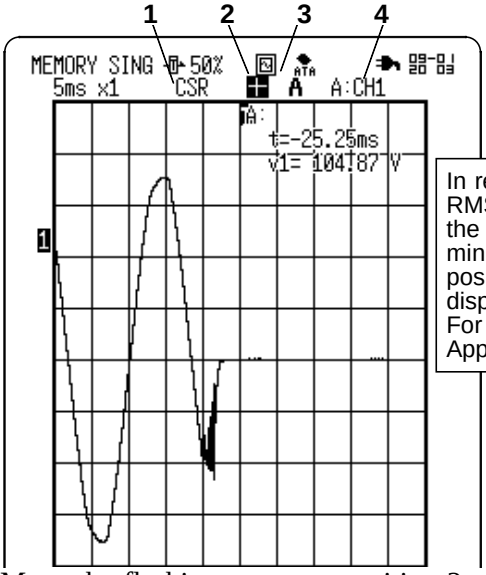
5. Move the flashing cursor to position 4 and select the channel number to be measured by the cursors.
6. Move the A/B cursors using the ◀▶ scrolling button to view the display. Pressing the ◀◀ ▶▶ buttons moves the cursors faster.

9.1.3 Using the Trace Cursors

Used to read the time and voltage values at point where the cursor crosses the waveform of the specified channel. A/B cursor can be specified a different channel.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. When position 1 shown in the figure below is selected to SCRL (scroll), use the ▲▼ buttons to set to CSR (cursor).
   Pressing the ◁ and ▷ buttons simultaneously also changes setting.



In recorder function and RMS recorder function, the maximum and minimum values at the position of cursor are displayed.
For details, refer to Appendix 2.

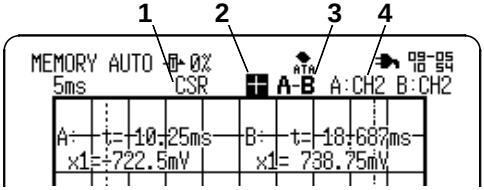
3. Move the flashing cursor to position 2 and select + (trace cursor).
4. Move the flashing cursor to position 3 and select the cursor to be moved.
5. Move the flashing cursor to position 4 and select channel using the ▲▼ buttons.
   When "All" is selected, the time and voltage values at the cross points of cursor and all waveforms are displayed.
   Move the A/B cursors using the ◀▶ scrolling buttons to view the display. Pressing the ◀◀ ▶▶ buttons moves the cursors faster.

9.1.4 Using the Cursors on the X-Y Screen

The cursor can be used on the X-Y Screen. Partial X-Y plotting enables operation of the A/B cursors.

Procedure Waveform Screen(X-Y)

1. Press the **DISP** button to display the Waveform Screen.
2. When position 1 shown in the figure below is selected to SCRL (scroll), use the ▲▼ buttons to set to CSR (cursor). Pressing the ◁ and ▷ buttons simultaneously also changes setting.



3. Move the flashing cursor to position 2 and select the type of cursor.

OFF	Disable A/B cursors
↔	Line cursor (vertical) (t and 1/t are displayed)
↕	Line cursor (horizontal) (v is displayed)
+	Trace cursor (the point where the cursor crosses the waveform)

4. Move the flashing cursor to position 3 and select the cursor to be moved.

A	Use the cursor A only
A-B	Move the cursor A only
A-**B**	Move the cursor B only
A-**B**	Move simultaneously both cursors A and B

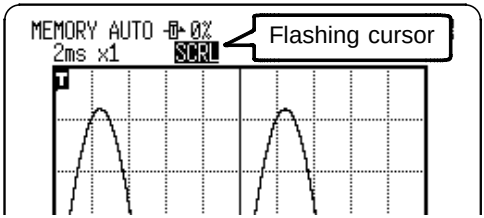
5. Move the flashing cursor to position 4 and select channel using the ▲▼ buttons.
   Move the A/B cursors using the ◀▶ scrolling buttons to view the display. Pressing the ◀◀ ▶▶ buttons moves the cursors faster.

9.2 Scrolling the Waveform

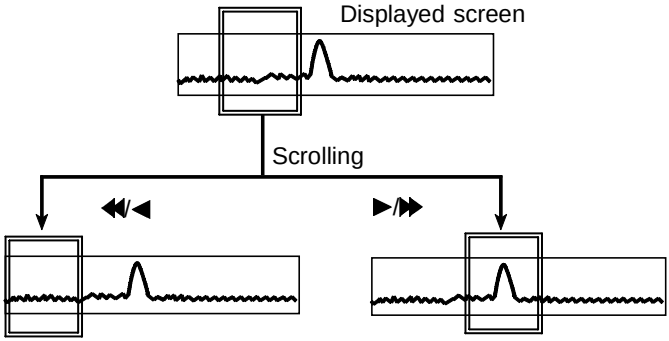
The waveform on the display can be scrolled horizontally.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. When position 1 shown in the figure below is selected to CSR (cursor), use the ▲▼ buttons to set to SCRL (scroll). Pressing the ◁ and ▷ buttons simultaneously also changes setting.



3. Move the cursor using the ◀▶ scrolling button to scroll the display. Pressing the ◀◀ ▶▶ buttons scrolls faster.



Auto-scroll

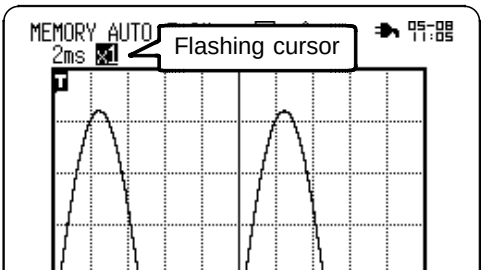
Holding down the Scroll button for 5 seconds causes the waveform to be scrolled automatically ("Auto-scroll" is displayed).
Press the Scroll button again to cancel.

9.3 Magnification/compression Ratio Along the Time Axis

- By magnifying the waveform, detailed observations can be made. By compressing the waveform, an entire change can be promptly apprehended.
- Magnification/compression of the screen uses the left edge as reference, regardless of the status of the A/B cursor.
- The magnification/compression factor can be changed also after measurement is completed.

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform Screen.
2. Move the flashing cursor to the position shown in the figure below and select the magnification or compression ratio using the ▲▼ buttons.



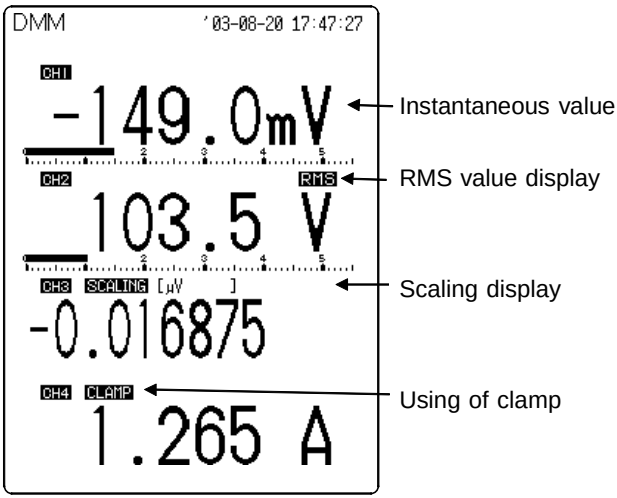
MEM, instantaneous waveform in RMS:
x10, x5, x2, x1, x1/2, x1/5, x1/10, x1/20, x1/50, x1/100, x1/200, x1/500

REC, RMS:
x1, x1/2, x1/5, x1/10, x1/20, x1/50, x1/100, x1/200, x1/500

9.4 DMM Function

Commercial mains and DC signals can be displayed numerically in real time. Digital display of either instantaneous or RMS values can be selected.
Correct values are displayed only when the input voltage is commercial mains (50/60 Hz) or DC.

1. Press the **DISP** button to display the Waveform Screen.
2. From the Waveform Screen, press the **DISP** button to display the DMM Screen. Measurement begins when the DMM Screen appears.



3. Press the **DISP** button from the DMM Screen to return to the Waveform Screen.

Displays

- Instantaneous value display
  Indicates the instantaneous value of commercial mains or DC signals.
- RMS value display
  Indicates the RMS calculation value of the input voltage. (Refer to Section 17.2.6.)
- Scaling display
  Indicates the scaling setting for channel. The converted value and unit are displayed. For details, refer to Section 7.5.
- Display of using Clamp
  Indicates the channel of current measurement using the 9018-10, 9132-10 CLAMP ON PROBE. For details, refer to Section 7.3.4.

Switching displays between instantaneous value and RMS value

▲▼	Switches between instantaneous and RMS values for all channels. For RMS value, "RMS" is displayed.
CH1-CH4	Switches between instantaneous and RMS values for each channel.

Instantaneous and RMS values for channel of scaling display and clamp display ("A" display) can be switched

Display hold

STOP	Holds the current status and "HOLD" is displayed. Press the **START** button to cancel the hold.

DMM Screen

PRINT	Prints the value currently displayed.
COPY	Prints a copy of the screen.

Specifications

Measuring object	Commercial mains (50/60 Hz, auto-selection) and DC signals
Displays	RMS value, instantaneous value (corresponds to scaling value)
Update rate	1s
Sampling rate	4 kS/s
Number of displayed digits	4 (The lowest digit is displayed as 0 for values 0 to 4, and as 5 for values 5 to 9. The actual digit is displayed while setting scaling)
Accuracy	±3% rdg.±5 dgt.

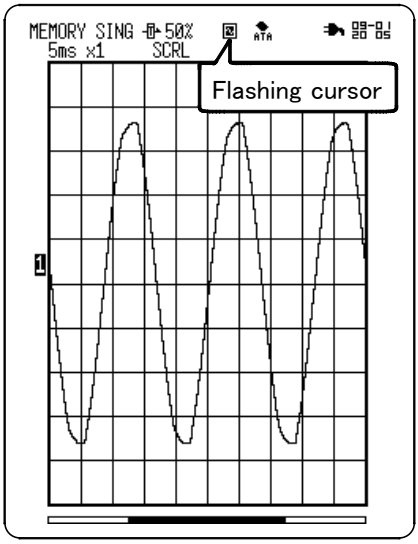
NOTE

The maximum displayable numeric value is 5499. The display changes to the next lower range when the count is less than 500. The minimum digit display is either 0 or 5.
When current measurement, auto-ranging is not available. To change the range, set on the Channel Screen. The setting of current range should be same as clamp range.
The displayed color of the digital values for each channel corresponds to the waveform display color set in 7.3.1.

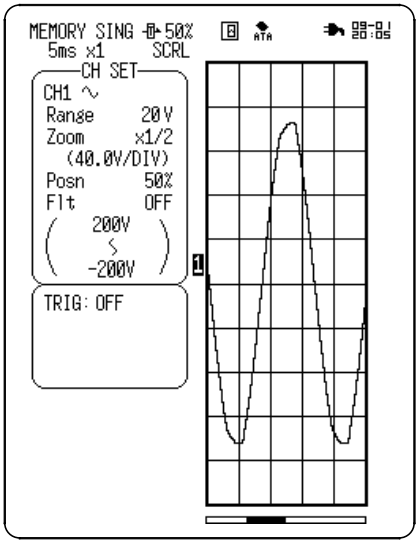
9.5 Setting the Waveform Display Area

The Waveform Screen can be partitioned into Setting and Waveform Display windows. The display cannot be changed during measurement ("Storaging..." is displayed).

1. Press the **DISP** button to display the Waveform Screen.
2. Move the flashing cursor to the position shown in the figure below and make a setting using the ▲▼ buttons.



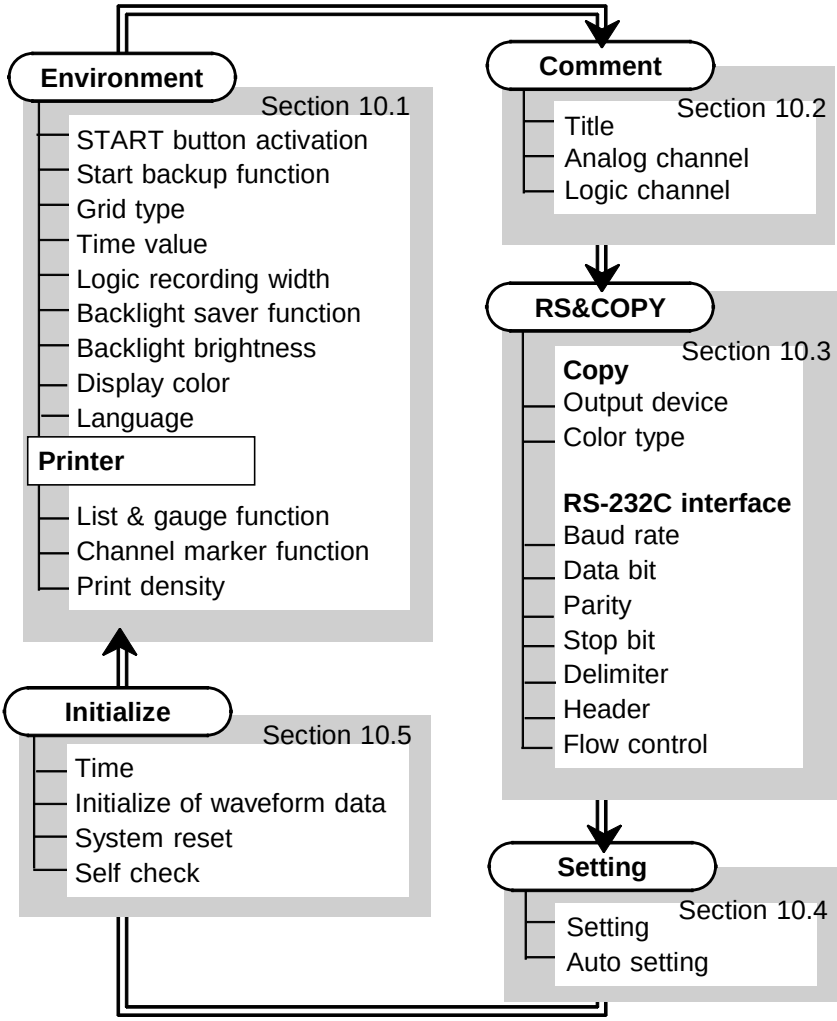
Full Display



Partitioning Display

Chapter 10
System Settings

The following System settings are common to each mode. Press the **SYSTEM** button to select the setting screen.



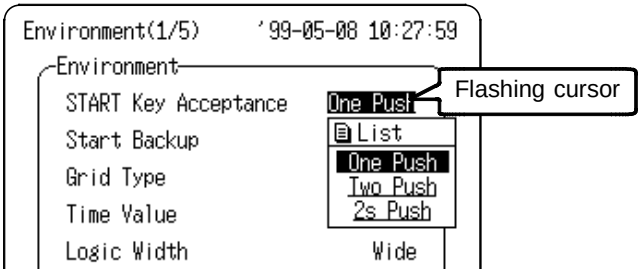
10.1 Environment Screen (SYSTEM)

10.1.1 START Button Activation

The **START** button normally initiates measurement when pressed once, but to avoid erroneous operation, the activation condition of this button can be modified.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to START Key Acceptance and use the ▲▼ buttons to make a setting.



One Push	Press the START button once to start measurement.
Two Push	Press the START button twice to start measurement.
2s Push	Press the START button and hold it for two seconds to start measurement.

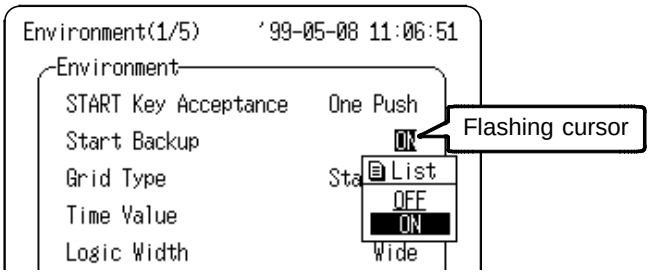
NOTE When the START button activation condition is set to "2s Push", the display shows "Waiting for 2s...." After holding for 2 seconds, the message disappears and measurement starts.

10.1.2 Start Backup

If the power supply is interrupted during recording operation (while the **START** button LED is lit), and then the power supply is restored, the product goes back into the measurement operation mode, and recording is restarted immediately. If the trigger function is used, the product goes into trigger standby mode.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Start Backup and use the ▲▼ buttons to make a setting.



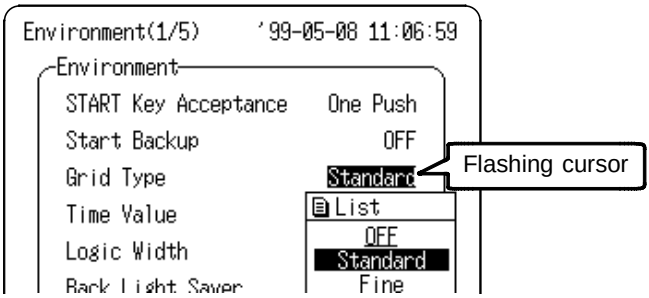
OFF	The Start Backup function is not used.
ON	The Start Backup function is used.

10.1.3 Grid Type

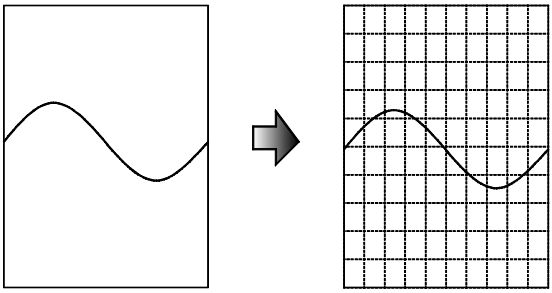
Selects the type of grid shown on the Waveform Screen and drawn on the recording paper.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Grid Type and use the ▲▼ buttons to make a setting.



OFF	No grid is displayed or printed.
ON	Select from Standard, Fine, Std(Dark), Fine(Dark) (There is no difference between Standard and Fine on the Waveform Screen.)



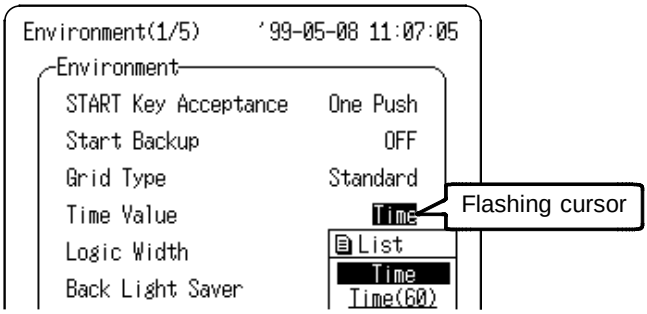
Grid : **OFF** Grid : **ON**

10.1.4 Time Value

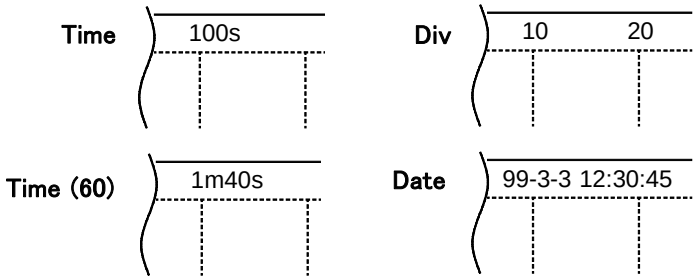
The time from the trigger point and other information can be printed.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Time Value and use the ▲▼ buttons to make a setting.



Time	Displays the time from the trigger point (unit: seconds)
Time (60)	Displays the time from the trigger point (unit: hour, minutes, seconds).
Div	Displays the number of DIV from trigger point.
Date	Displays the date and time when a waveform is captured.

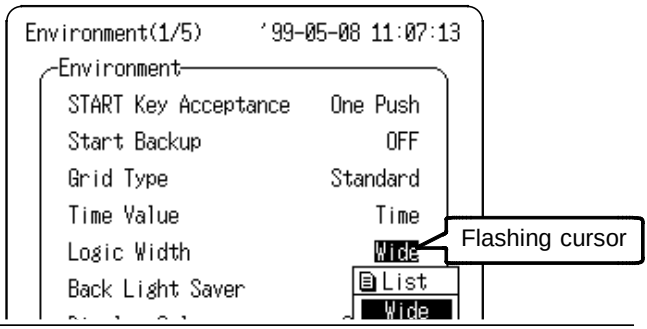


10.1.5 Logic Recording Width

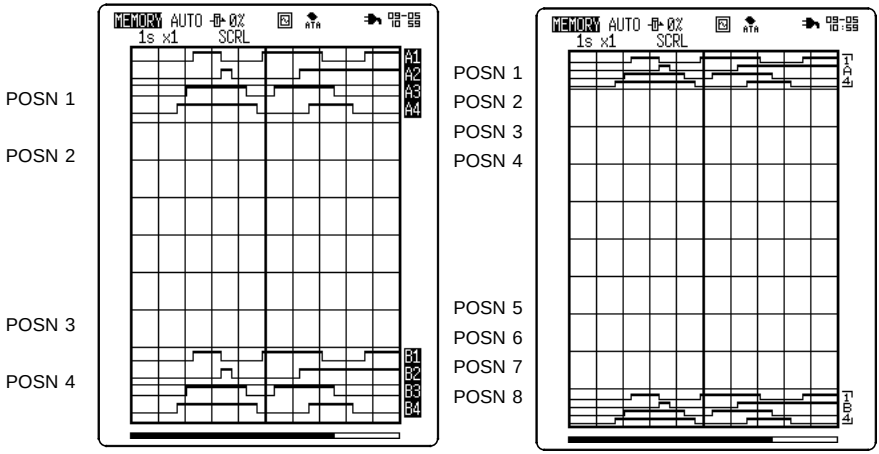
The vertical spacing of logic waveforms can be set.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Logic Width and use the ▲▼ buttons to make a setting.



Wide	Logic recording spacing is set to Wide. The display position type can be selected from 1 to 4.
Narrow	Logic recording spacing is set to Narrow. The display position type can be selected from 1 to 8.

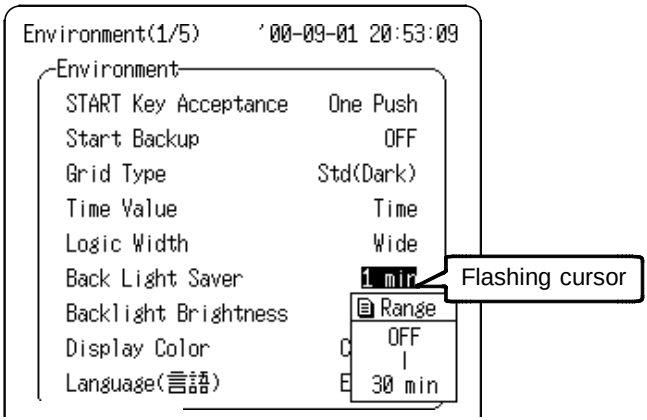


10.1.6 Backlight Saver

- When this function is enabled, LCD back lighting is turned off automatically if no button is pressed for the preset interval.
- Pressing any button will turn the display on again.
- This increases the service life of the back light.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Back Light Saver and use the ▲ ▼ buttons to make a setting.



OFF	The backlight saver is disabled.
1 to 30 min	The backlight time-out in minutes. The light turns off automatically after the set time. When using the alkaline batteries or Battery pack, set to 1 to 5 minutes.

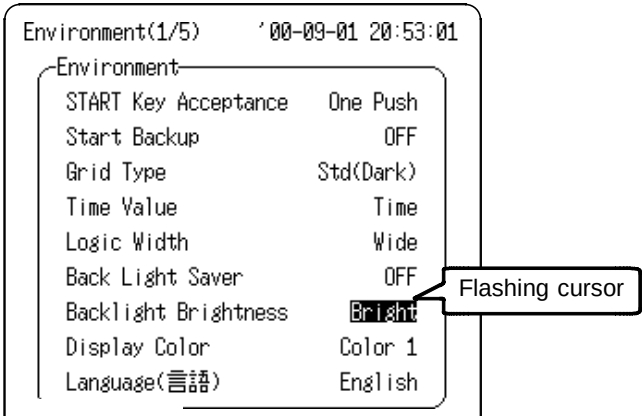
NOTE If the backlight time-out occurs while measuring, the green LED remains lit. If the backlight time-out occurs while setting, the green LED blinks.

10.1.7 Backlight Brightness

The backlight brightness is adjustable. Setting it to Dark extends battery life. Refer to Section 2.2.2, "Installing the Batteries/Battery Pack", for details.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Back Light Brightness and use the ▲▼ buttons to make a setting.



Bright	increases backlight brightness
Dark	reduces backlight brightness

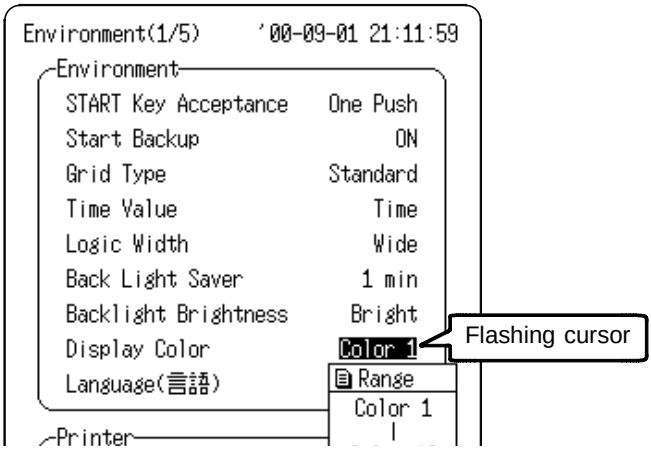
NOTE The backlight is automatically dimmed when the printer is in use.

10.1.8 Display Color

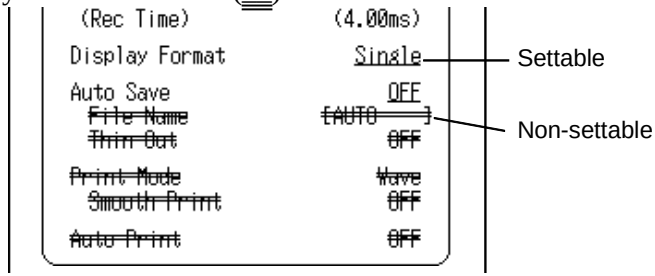
Serves to set the display color.
Screen display color can be selected from colors 1 to 16.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Display Color and select a color using the ▲▼ buttons.



When colors 1 to 6 are selected, the screen displays are shown in colors. The settable items are displayed in yellow, and non-settable items are displayed in gray.
When colors 7 to 16 are selected, the screen displays are shown in single color. As shown in the screen below, settable items are underlined (__) and non-settable items are displayed as double lines(__).

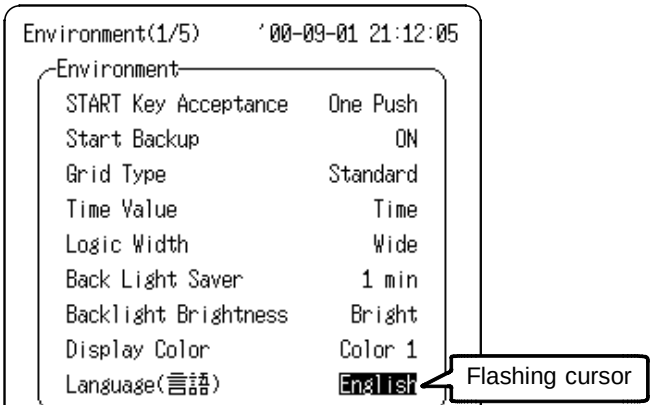


10.1.9 Language

Serves to set the display language.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Language and the ▲▼ buttons to make a setting.



English	Displays in English.
Japanese	Displays in Japanese.

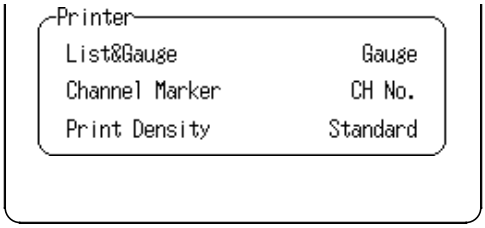
NOTE The Language setting is not changed by a system reset.

10.1.10 Printer

These printer-related settings are valid when the optional 8992 PRINTER UNIT is connected. For details, refer to Chapter 11.

Procedure Environment Screen

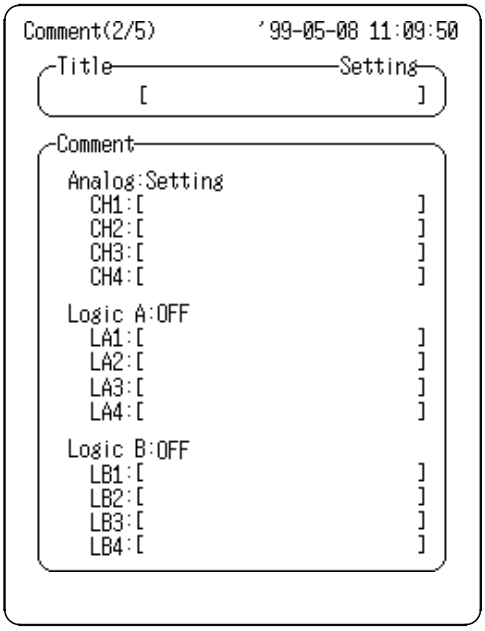
1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to the Printer item to be set.
3. Use the ▲▼ buttons to make a setting.



List&Gauge	OFF	No print both gauges and listing
	List	Print listing only
	Gauge	Print gauges only
	List&gauge	Print both gauges and listing
Channel Marker	OFF	Channel numbers is not be printed.
	CH No.	Print channel numbers
	Comment	Print comments
Print Density	Light/Standard/Dark	

10.2 Comment Screen (SYSTEM)

A title may consist of up to 24 characters for printing on the recording paper.
Select "Set&Com" (Settings and Comments) to print settings (function, time axis range,trigger time) together with comments. For details, refer to Section 11.3.



10.3 RS&COPY Screen (SYSTEM)

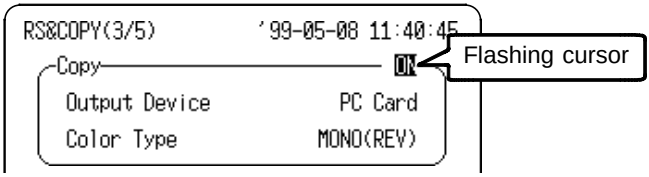
10.3.1 Screen Copy Output Destination

The destination for output of displayed data by the **COPY** button can be specified.

Procedure RS&COPY Screen

(1) Enable screen copy.

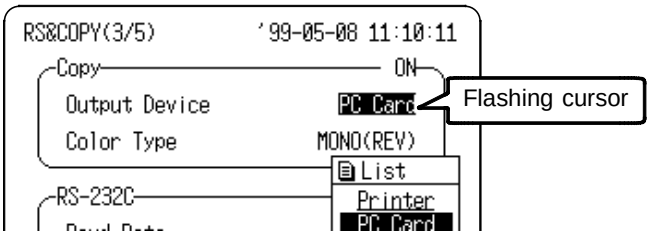
1. Press the **SYSTEM** button to display the RS&COPY Screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to make a setting.



OFF	Screen copy is disabled.
ON	Screen copy is enabled.

(2) Select the output destination.

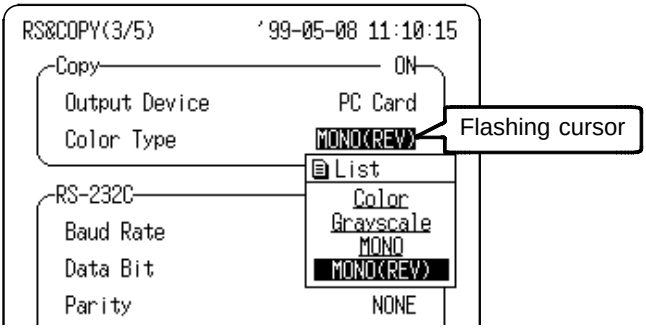
Move the flashing cursor to Output Device and use the ▲▼ buttons to make a setting.



Printer	Prints on the 8992 PRINTER UNIT.
PC Card	Screen data is saved as a BMP file on the PC Card.
RS-232C	Screen data is sent in BMP format to the device connected to the RS-232C interface.

(3) Select output coloring.

Move the flashing cursor to Color Type and use the ▲▼ buttons to make a setting.



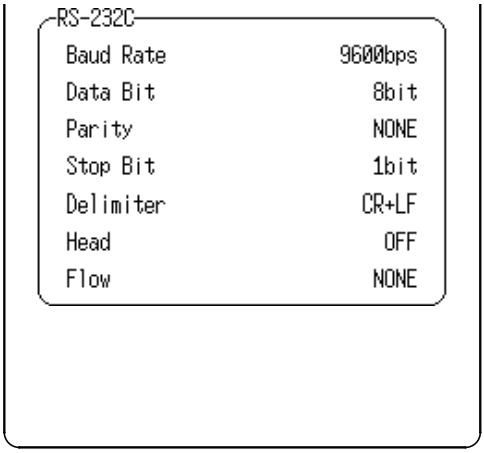
Color	Output in color
Grayscale	Output in gray scale
MONO	Output in black and white (black background)
MONO (REV)	Output in black and white (white background)

10.3.2 RS-232C Settings

For details, refer to Chapter 13.1.

Procedure RS&COPY Screen

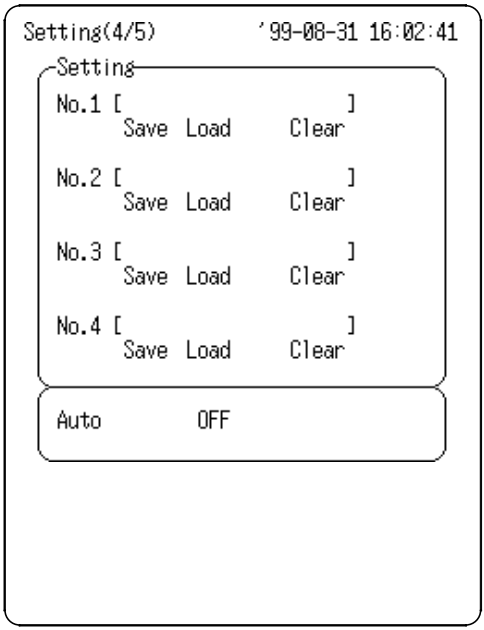
1. Press the **SYSTEM** button to display the RS&COPY Screen.
2. Move the flashing cursor to the RS-232C items to be set.
3. Use the ▲▼ buttons to make a setting.



Baud Rate	1200 bps to 19200 bps
Data Bit	7 bit/ 8 bit
Parity	NONE/ EVEN/ ODD
Stop Bit	1 bit/ 2 bit
Delimiter	LF/ CR+LF
Head	OFF/ ON
Flow	NONE/ Xon/Xoff/ Hardware

10.4 Setting Screen

All settings of the present state are stored in internal memory. Up to four states can be saved for later recall when needed.



(1) Comment entry (enter comment of setting to be saved)

1. Press the **SYSTEM** button to display the Setting Screen.
2. Move the flashing cursor to the Comment entry position for the number of the setting state to be entered.
   Press the ▲▼ button. A Comment Entry Screen appears.
   For details refer to Section 11.3.3.
4. Press the **START** button to accept, or the **STOP** button to cancel.

(2) Storing settings

1. After comment entry, move the flashing cursor to SAVE.
3. Press the ▲▼ button. A confirmation screen appears.
4. Press the **START** button to accept, or the **STOP** button to cancel..

   The settings can be saved to a PC card. For details refer to Section 12.3.2.

(3) Recalling a Saved State (loading previously saved state settings)

1. Press the **SYSTEM** button to display the Setting Screen.
2. Move the flashing cursor to the Load position for the number of the setting state to be loaded.
3. Press the ▲▼ button. A confirmation screen appears.
4. Press the **START** button to accept, or the **STOP** button to cancel.

(4) Deleting a Saved State (deleting saved state settings)

1. Press the **SYSTEM** button to display the Setting Screen.
2. Move the flashing cursor to the Delete position for the number of the setting state to be deleted.
3. Press the ▲▼ button. A confirmation screen appears.
4. Press the **START** button to accept, or the **STOP** button to cancel.

(5) Autosetting (When power is turned on, the specified state number (No. 1 to 4) is loaded automatically).

1. Press the **SYSTEM** button to display the Setting Screen.
2. Move the flashing cursor to the Autosetting position.
3. Press the ▲▼ button to select number to be set automatically.

NOTE If Auto Setup (Refer to Section 12.1) and the Autosetting on this screen are enabled at the same time, Auto Setup has priority.

10.5 Initialize Screen

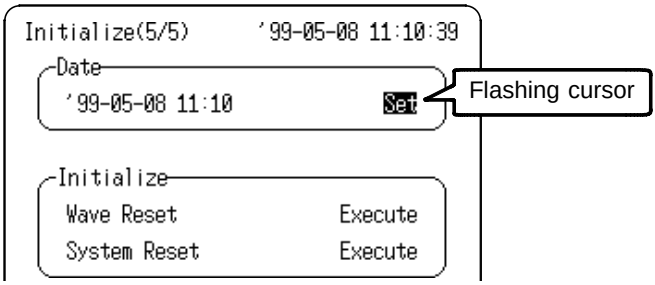
10.5.1 Setting the Clock

This product incorporates a calendar with automatic leap year compensation and 24-hour clock. The clock is used for the following functions:

- Timer trigger function
- Trigger time list printout

Procedure Initialize Screen

1. Press the **SYSTEM** button to display the Initialize Screen.
2. Move the flashing cursor to the Date item to be set and use the ▲▼ buttons to make a setting.



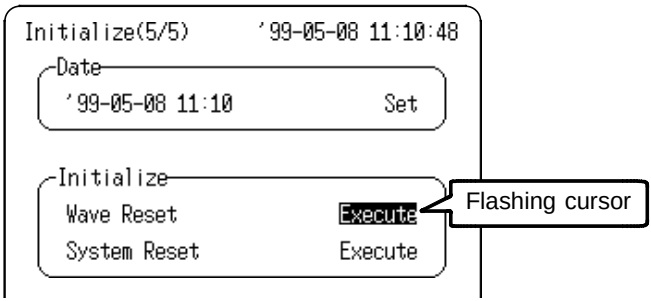
3. Move the flashing cursor to the Set position and press the ▲▼ buttons to confirm the time settings and exit settings.

10.5.2 Clearing the Waveform Data

Clears the waveform data stored in memory and initializes.

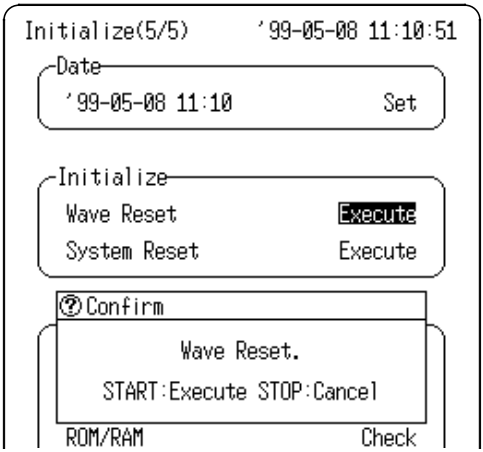
Procedure Initialize Screen

1. Press the **SYSTEM** button to display the Initialize Screen.
2. Move the flashing cursor to Execute of Wave Reset item and press the ▲▼ buttons.



3. A confirmation window appears.

   Press the **START** button to execute clearing, or press the **STOP** button to cancel.

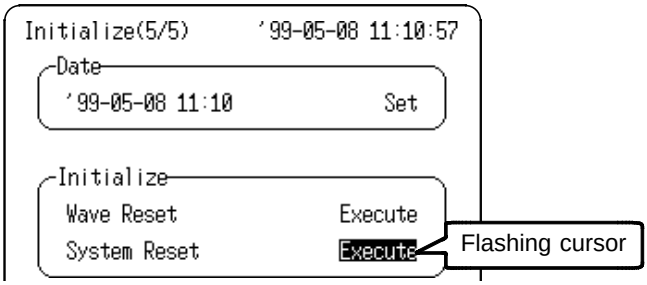


10.5.3 System Reset

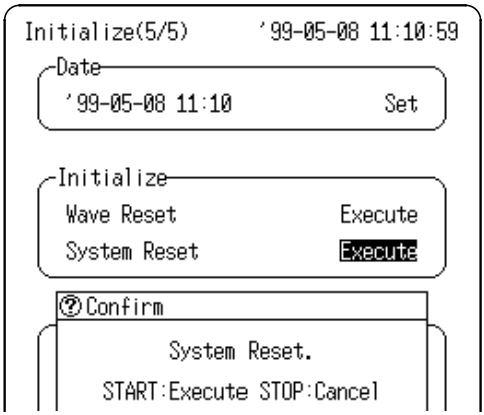
- Resets all settings to the factory default values.
- The same effect can be achieved by turning power to the product on while holding down the **STOP** button.

Procedure Initialize Screen

1. Press the **SYSTEM** button to display the Initialize Screen.
2. Move the flashing cursor to Execute of System Reset item and press the ▲▼ buttons.



3. A confirmation window appears.
   Press the **START** button to execute clearing, or press the **STOP** button to cancel.



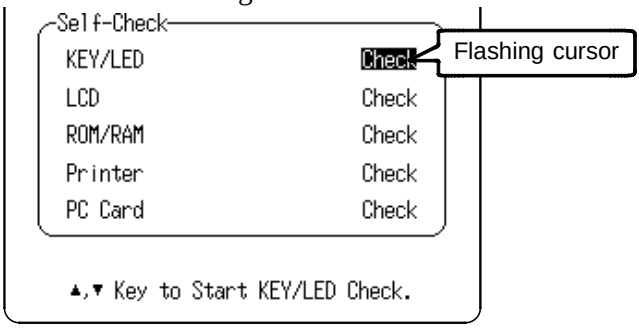
NOTE Improvement in System Reset
The setup conditions and settings on communications (see 10.4, and 10.3.2) stored in the internal memory cannot be reset. To reset these settings in the internal memory as well, turn on the power while simultaneously holding down the **STOP** and **START** keys.

10.5.4 Self-check

If you run a self-check and the message "NG" appears or there seems to be a problem, please have the product serviced.

Procedure Initialize Screen

1. Press the **SYSTEM** button to display the Initialize Screen.
2. Move the flashing cursor to the Self-check item to be checked and execute using the ▲▼ buttons.



KEY/LED Check

The Key check is completed by pressing every buttons. If a malfunction is found, press the **START** and **STOP** buttons at the same time to abort checking.
To check LED operation, confirm that the LED lights green when the **START** button is pressed.

LCD Check

The LCD check tests character display, and solid displays. Press any button to change screen.

ROM/RAM Check

The following items can be checked.

ROM ..... OK/NG
Storage RAM ..... OK/NG
Backup RAM ..... OK/NG
Work RAM ..... OK/NG
Video RAM ..... OK/NG
Address bus ..... OK/NG
Printer Unit Installed Printer Unit /No Printer Unit

Printer Check

This function is available when the 8992 PRINTER UNIT is installed.
The printer check tests solid printing and character printing.
Pressing the **STOP** button aborts.
Pressing the T (Manual Trigger) button causes print head cleaning by solid printing while the button is pressed.

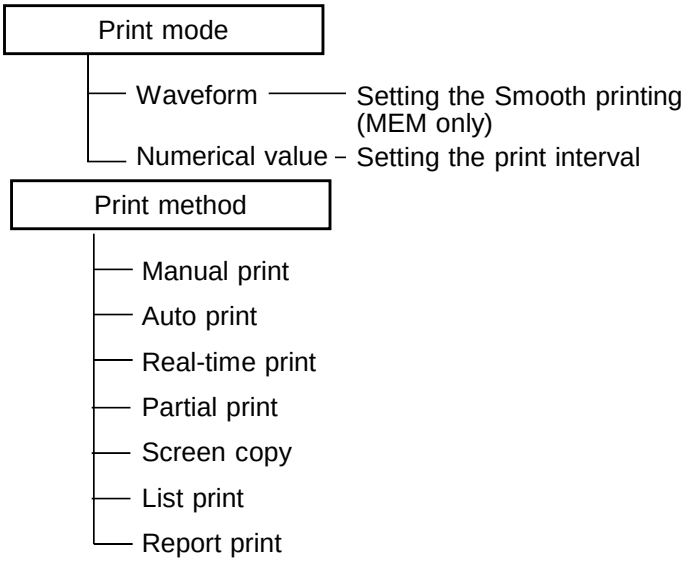
PC card Check

The PC Card check tests the items below. The checking contents are the same as the PC Card self check on the File Config Screen. Refer to Section 12.4.2.

PC Card Type	ATA card/ SRAM card/ MODEM card
RAM Size	Capacity of the using card
Battery Level	OK (normal)
	LOW (The battery should be changed soon)
	NG (The battery change is needed immediately)
Write protect	PROTECT/NONE

Chapter 11
Printout of Measurement Data

Waveform data can be printed out in two formats: waveform or numeric.
Seven different procedures can be used to print out the measured waveforms. On the printer, the print density can be changed in three steps.



NOTE

- The amount of paper remaining is printed at the end of a print job. When new printing paper is installed, the value is reset to indicate the new remaining quantity.
- The printer cannot be used with alkaline batteries: use either the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) or 9447 BATTERY PACK when using the printer.
- For details on the print method for the harmonic wave analysis function, refer to the supplement guide "Harmonic Wave Analysis Function."

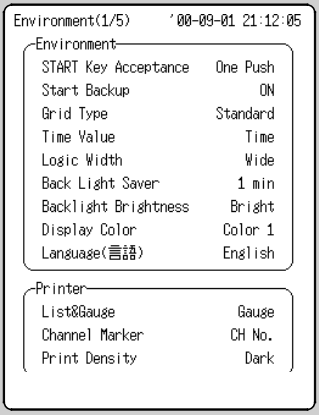
11.1 Printout of Measurement Data Operating Procedure

Printer preparation Refer to Chapter 2

Settings on the Environment Screen

SYSTEM

Press the **SYSTEM** button to display the Environment Screen.

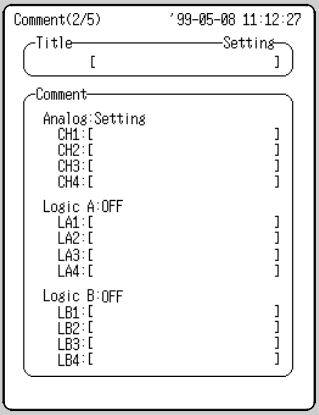


- Grid — Sections 11.2.1
- Time value — 11.2.2
- List&gauge — 11.2.3
- Channel marker — 11.2.4
- Pint density — 11.2.5

Settings on the Comment Screen

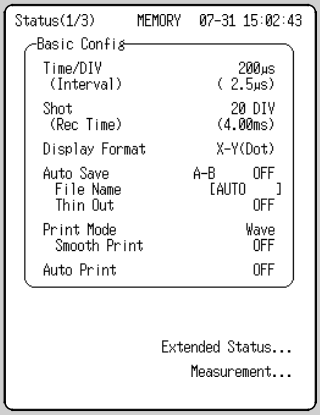
SYSTEM

Press the **SYSTEM** button to display the Comment Screen.



- Title — Sections 11.3.1
- Analog channel — 11.3.2
- Logic channel — 11.3.3

Settings on the Status Screen

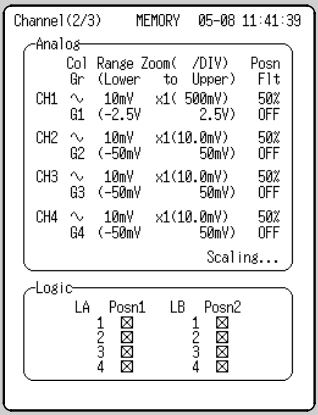


SET

Press the **SET** button to display the Status Screen.

- Display layout — Sections 11.4
- Printer Recording Format — 11.4

Settings on the Channel Screen



SET

Press the **SET** button to display the Channel Screen.

- Print density — Sections 11.5
- Waveform display graph — 11.5

Printing

- Manual print — Sections 11.6.1
- Auto print — 11.6.2
- Real-time print — 11.6.3
- Partial print — Sections 11.6.4
- Screen copy — 11.6.5
- List print — 11.6.6
- Report print — 11.6.7

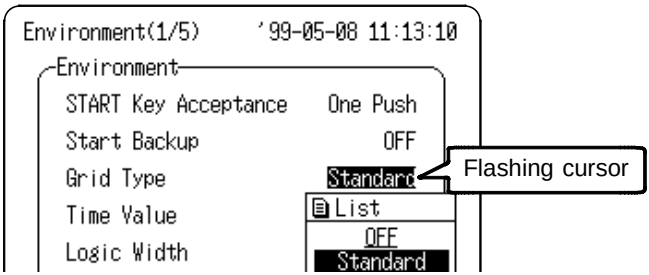
11.2 Environment Screen (Printer)

11.2.1 Grid Type

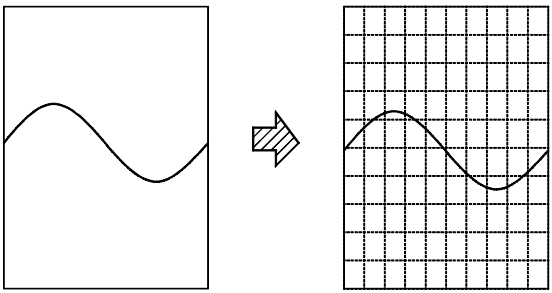
Select the grid to print on the recording paper.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Grid Type and use the ▲▼ buttons to make a setting.



OFF	No grid is displayed or printed.
ON	Select from Standard, Fine, Std(Dark), Fine(Dark) (There is no difference between Standard and Fine on the Waveform Screen.)

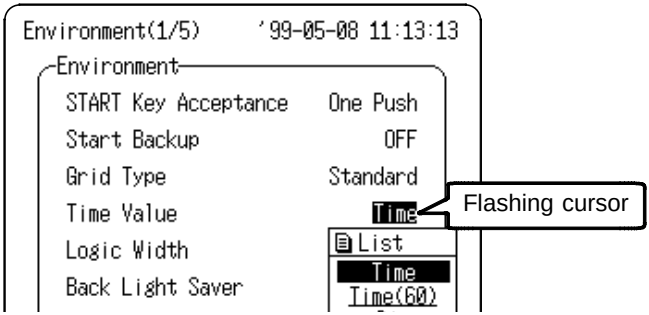


11.2.2 Time Value

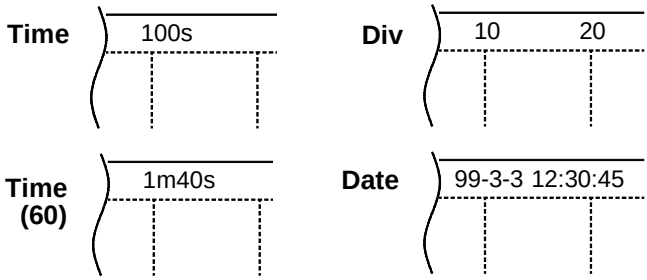
The time from the trigger point and other information can be printed.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Time Value and use the ▲▼ buttons to make a setting.



Time	Displays the time from the trigger point (unit: seconds)
Time (60)	Displays the time from the trigger point (unit: hour, minutes, seconds).
Div	Displays the number of DIV from trigger point.
Date	Displays the date and time when a waveform is captured.

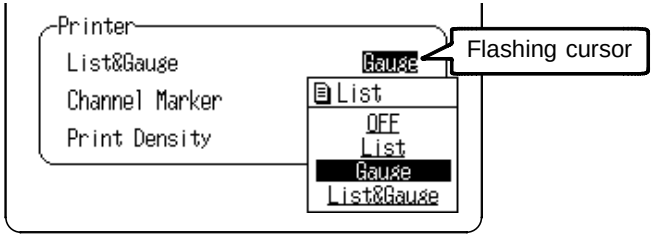


11.2.3 List&Gauge

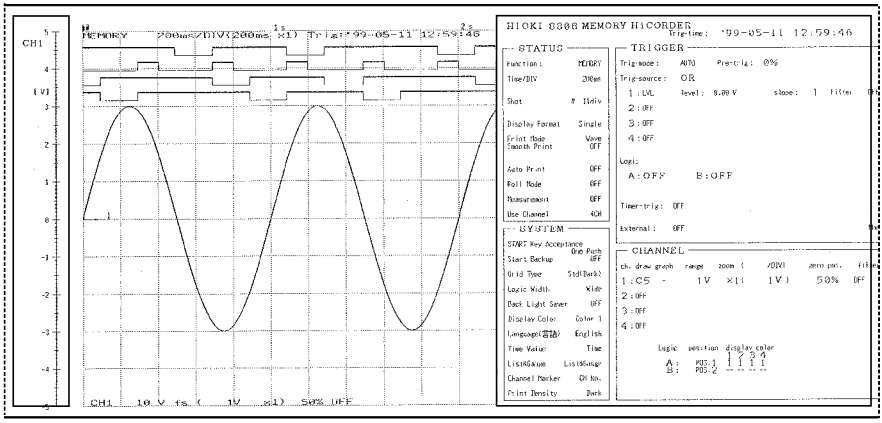
When a waveform is printed out (except for screen copies), the gauge can be printed out at the beginning, and a listing can be printed out at the end.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to List&Gauge and use the ▲▼ buttons to make a setting.



OFF	No gauges or listing
List	Print listing only
Gauge	Print gauges only
List&Gauge	Print both gauges and listing



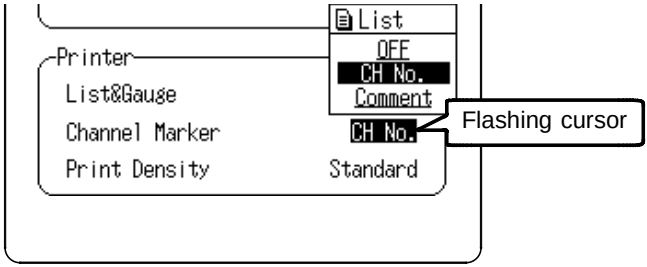
Gauge List

11.2.4 Channel Marker

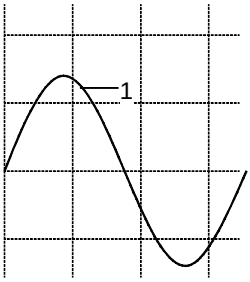
The channel numbers or the comments are printed together with the waveform on the recording paper.

Procedure Environment Screen

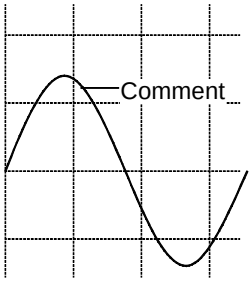
1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Channel Marker and use the ▲▼ buttons to make a setting.



OFF	Channel numbers will not be printed for the waveform on the recording paper.
CH No.	Channel numbers will be printed for the waveform on the recording paper.
Comment	Comments will be printed for the waveform on the recording paper. (Refer to 11.3.2 for entering the comment.)



Channel Number (CH NO.)



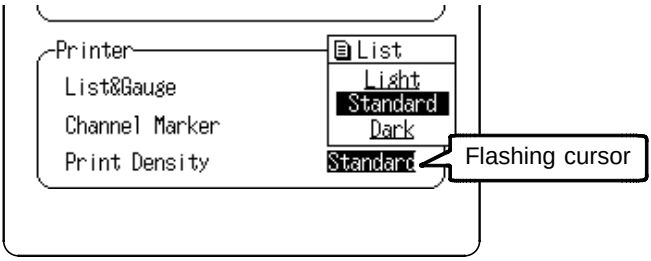
Comment

11.2.5 Printer Density

Serves to set the printer density. Select the setting which yields the most easy to read printout.
Print density can be selected from three types.

Procedure Environment Screen

1. Press the **SYSTEM** button to display the Environment Screen.
2. Move the flashing cursor to Print Density and use the ▲▼ buttons to make a setting.



Light	Print lighter density. Reduces power consumption.
Standard	Print standard density.
Dark	Print darker density.

NOTE The print density of each channel corresponds to the waveform display color. For details, refer to Section 7.3.1.

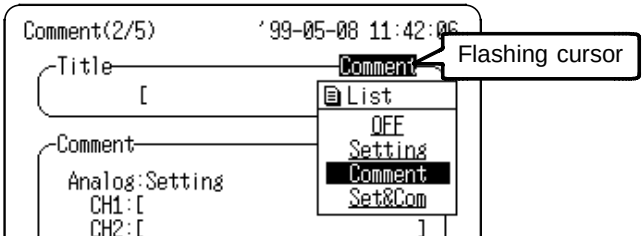
11.3 Comment Screen (Printer)

11.3.1 Title Comment Entry

A title may consist of up to 24 characters for printing on the recording paper.
Select "Set&Com" (Settings and Comments) to print settings (function, time axis range,trigger time) together with comments.

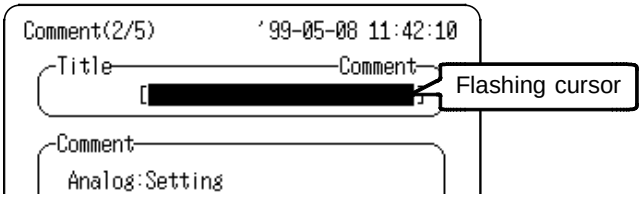
Procedure Comment Screen

1. Press the **SYSTEM** button to display the Comment Screen.
2. Move the flashing cursor to Title and use the ▲▼ buttons to make a setting.



OFF	The setting items of the product and title are not printed.
Setting	The setting items of the product are printed.
Comment	The title is printed.
Set&Com	The setting items of the product and title are printed.

3. Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to display the Comment Entry Screen.



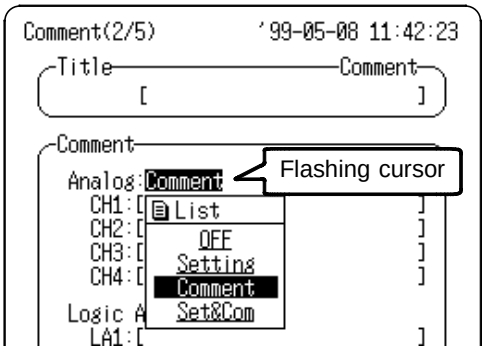
4 Move the cursor to each character to be entered, and enter the comment. Refer to Section 11.3.3 Text Entry Procedure for the entry procedure.

11.3.2 Analog and Logic Comment Entry

A comment consisting of up to 24 characters can be printed on the recording paper for each channel.
Select "Set&Com" (Settings and Comments) to print settings (voltage axis range, magnification/compression ratio along the voltage axis, zero position, low-pass filter, and waveform display range) together with comments.

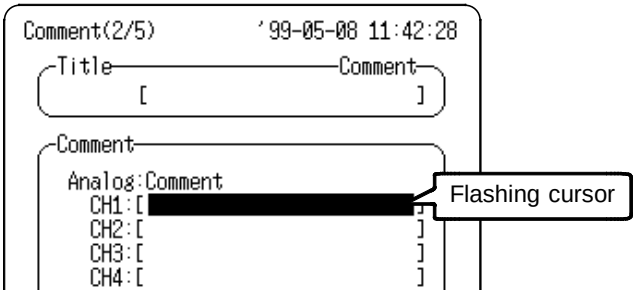
Procedure Comment Screen

1. Press the **SYSTEM** button to display the Comment Screen.
2. Move the flashing cursor to the position as shown in the figure below and use the ▲▼ buttons to make a setting.



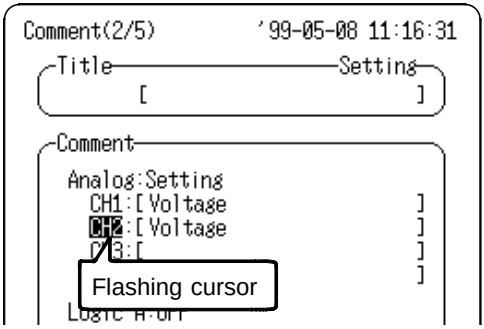
OFF	The setting items of the input channel and comment are not printed.
Setting	The setting items of the input channel are printed.
Comment	The comment of the input channel is printed.
Set&Com	The setting items and comment of the input channel are printed.

3. Move the flashing cursor to the position as shown in the figure below and use the ▲▼ buttons to display the Comment Entry Screen.



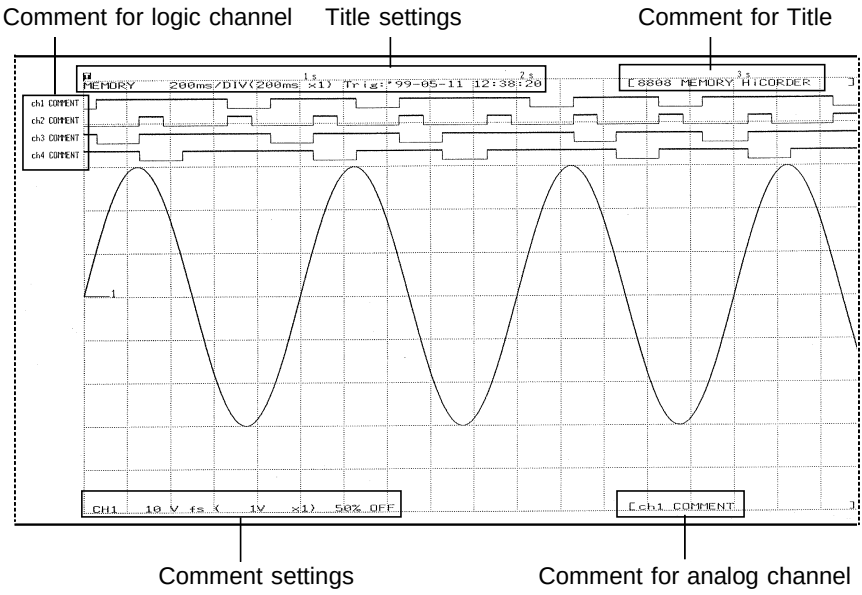
4 Move the cursor to each character to be entered, and enter the comment. Refer to Section 11.3.3 Text Entry Procedure for the entry procedure.
Enter the logic channel comments in the same way.

Copying Comments



Move the flashing cursor to the position shown in the figure. Pressing the ▲ button then copies the comment from the immediately above channel. Pressing the ▲ button again copies the comment from the channel above that. Similarly, pressing the ▼ button copies the comment from the channel below.

Print Example of Title and Comment

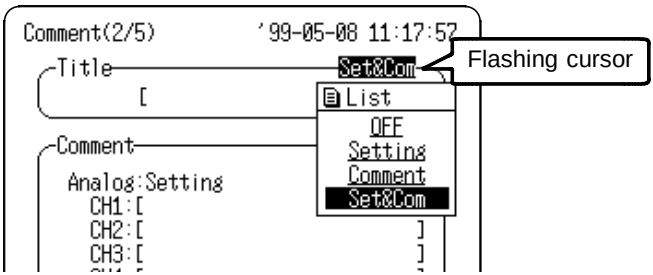


11.3.3 Text Entry Procedure

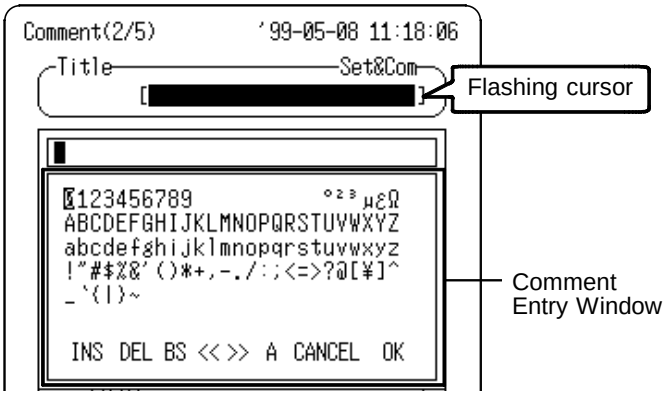
Comments and other text items are entered by the following procedure. Scaling units for the Scaling Screen are entered by the same procedure.

Procedure Comment Screen

1. Press the **SYSTEM** button to display the Comment Screen.
2. Move the flashing cursor to the Title, Analog, or Logic items and select Comment or Set&Com using the ▲▼ buttons.

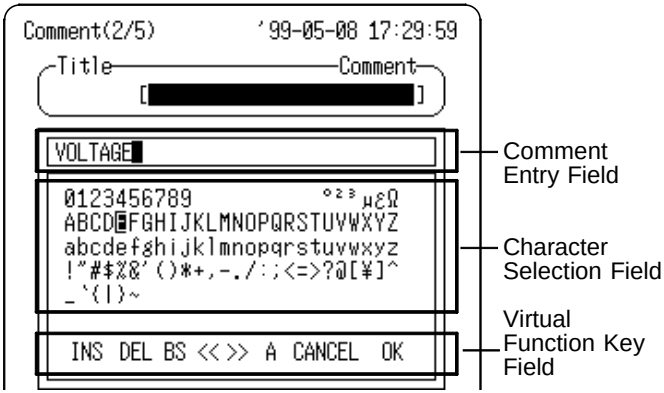


3. Move the flashing cursor to the position as shown in the figure below and use the ▲▼ buttons to display the Comment Entry Screen.



Comment Entry Screen Operations

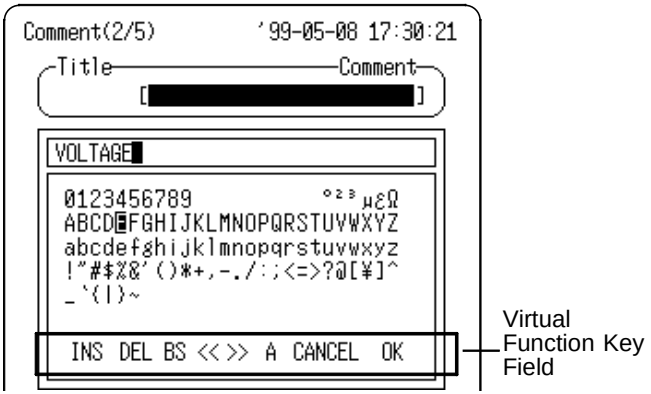
Characters are entered by the following button operations on the Comment Entry Screen.
Enter characters by copying from the Character Selection Field to the Comment Entry Field. When all characters have been entered, press the **START** button to accept the entry.



Comment Entry Field Procedures (on the Comment Entry Screen)	
T	Back space
◀◀	Moves the cursor to the front of the Text Entry Field.
▶▶	Moves the cursor to the end of the Text Entry Field.
◀ SCROLL/ CURSOR ▶	Moves the cursor left or right one character.
Character Selection Field Procedures (on the Comment Entry Screen)	
◁△▽▷	Cursor movement
▲▼	Accepts character entry
START	Accepts comment entry
STOP	Cancels comment entry

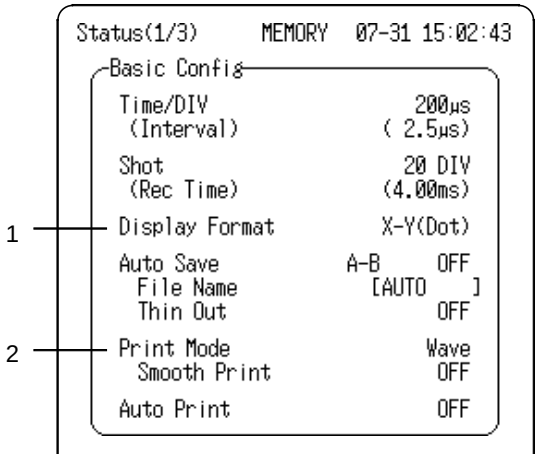
Virtual function keys

The virtual function keys provide shortcuts by duplicating the process of moving the cursor to a particular location and pressing the ▲▼ buttons to accept the selection.



Virtual Function Key Operations	
INS /OVER (Insert/Overwrite)	Switches between Insert and Overwrite modes.
DEL	Deletes the character at the cursor.
BS	Moves back one space.
<< >>	Moves the input position left and right.
A	No function in English display mode.
CANCEL	Exits Comment Entry Screen unchanged.
OK	Accepts Comment Entry.

11.4 Setting the Status Screen (printout)



1. Display layout settings (Display Format) (refer to section for each function)

- The screen display layout can be set for showing input signals on the screen display and recording them on the printer.
- The Single, Dual, Quad, and X-Y(dot/line) displays are available.

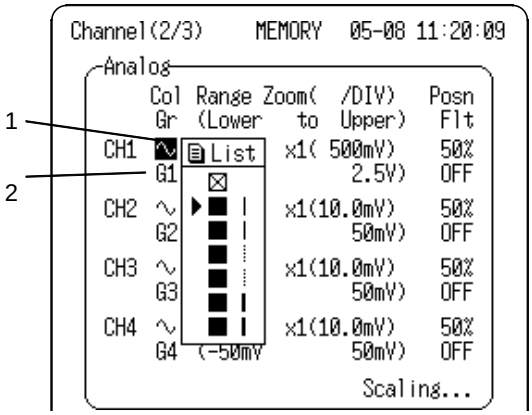
2. Printer recording format settings (Print Mode)

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

NOTE

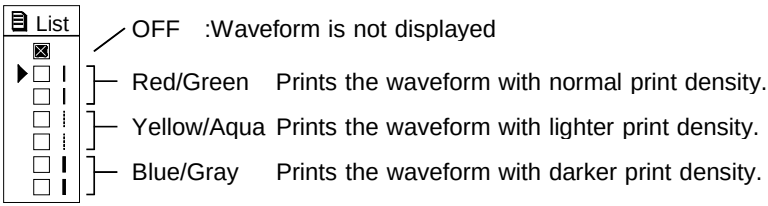
- Smooth printing is only available for the Memory Recorder function. The instantaneous waveform recording measured by the RMS Recorder can be set in Memory Recorder function.
- If the print spacing is set longer than the length of a record, only the first point is printed.
- When the Print Mode is set to "Logging" in Recorder function or RMS recorder function (excluding 100 ms/DIV), the maximum and minimum values are printed.(Refer to Appendix 2.)
- For the example of printing, refer to Section 11.7.

11.5 Setting the Channel Screen (printout)



Setting the Print Density (Section 7.3.1)

If the data is to be output on the 8992 PRINTER UNIT, any of three print densities may be set for six waveform display colors.
Printing density settings have no effect on real-time printing.



Setting the waveform display graph (Refer to Section 7.3.2)

When the display format is set to Dual or Quad on the Status Screen, select the location of the waveform to be printed.

11.6 Printing Procedure

11.6.1 Manual Print

This mode serves to print waveform data from the internal memory.

Memory recorder
Measurement data from one measurement (entire recording length) are printed.

Instantaneous waveform in RMS recorder
The function is switched to Memory Recorder on the Waveform Screen.
Measurement data from one measurement (entire recording length) are printed.

Recorder, RMS recorder
Measurement data stored in memory before the end of measurement are printed

DMM Screen
The numerical voltage values on the DMM Screen are printed.

Procedure

Waveform Screen

After the measurement is completed, press the **PRINT** button.

- 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** button.

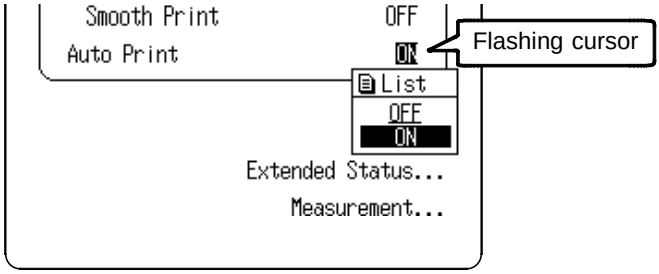
NOTE When cursors A and B are enabled, partial printing is executed.

11.6.2 Auto Print (MEM)

Printout is carried out automatically after a waveform has been captured for the specified recording length.

Procedure Status Screen (MEM)

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Auto Print and use the ▲▼ buttons to make a setting.



OFF	Disables the auto print.
ON	Enables the auto print.

3. When Auto Print is enabled, after recording the specified data length, it is automatically printed.

NOTE

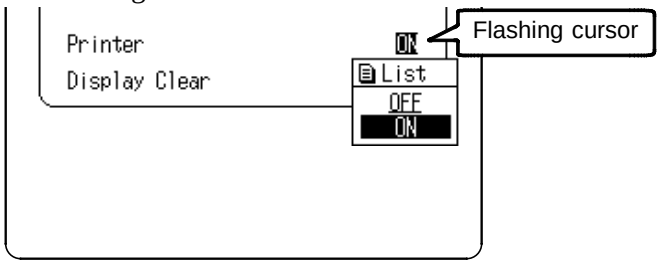
- When cursor A and B are enabled, partial printing is executed.
- When the roll mode is enabled and the time-axis range is 10 ms/DIV to 5 min/DIV, data is displayed and printed simultaneously.
- The printer cannot be used with alkaline batteries: use either the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) or 9447 BATTERY PACK when using the printer.

11.6.3 Real Time Print (REC, RMS)

The input waveform and data are printed out continuously in real time.

Procedure Status Screen (REC, RMS)

1. Press the **SET** button to display the Status Screen.
2. Move the flashing cursor to Printer and use the ▲▼ buttons to make a setting.



3. When measurement starts, waveforms are simultaneously printed as they are displayed.

OFF	Disables the real time print.
ON	Enables the real time print.

NOTE

- When operating from the AC adapter, real-time printing requires that the time axis range be no faster than 1 s/DIV.
- When operating from the Battery Pack, real-time printing requires that the time axis range be no faster than 2 s/DIV.
- The printer cannot be used with alkaline batteries: use either the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) or 9447 BATTERY PACK when using the printer.

11.6.4 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 "Logging". For details regarding the use of the A/B cursors, refer to Section 9.1.

Memory recorder, instantaneous waveform in RMS
Specified range (out of entire data recorded from a measurement) is printed.

Recorder, RMS recorder
The specified area of internal memory immediately before the end of measurement.
Recorder: 400 DIV
RMS recorder: 200 DIV

Procedure Waveform Screen

1. Press the **DISP** button to display the Waveform 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** button.
   The specified range is printed, also if cursor A (or B) is currently off screen.

11.6.5 Screen Copy

Prints a copy of the display screen.
Before printing by the **COPY** button, "Output Device" on the RS&COPY Screen must first be set to "Printer." Refer to Section 10.3 for the setting procedure.

Procedure All Screens

1. Display the desired screen.
2. Press the **COPY** button.

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 copy function is not available during measurement.

11.6.6 List Print

The settings for the various functions made with the Status, Channel, System, Trigger Screens etc. can be printed out in list format.
The contents are the same as the List in the List & Gauge settings. (Refer to Section 11.2.3.)

Procedure All Screens (excluding Waveform)

Press the **PRINT** button on the screen excluding Waveform Screen.

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. If there is no waveform data, the list is not printed.

11.6.7 Report Print

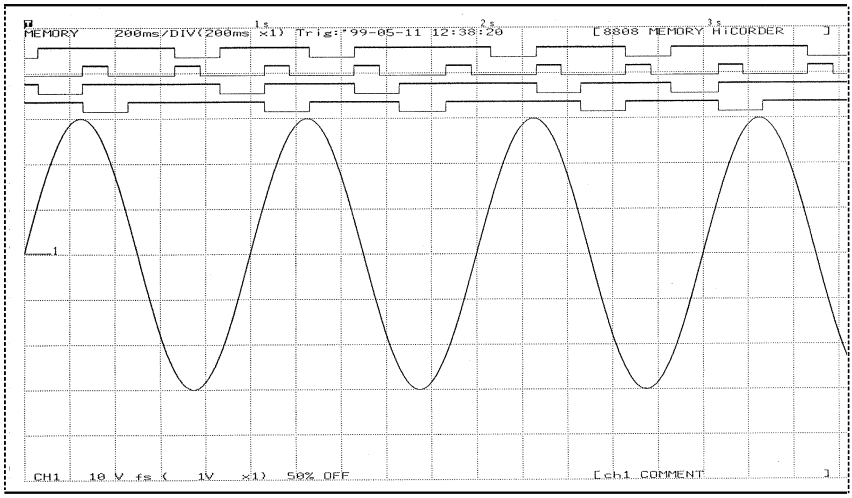
Prints the waveform of the displayed area, the upper limit values for the Waveform Screen and the setting contents of the analog channel.
If the A-B cursors are displayed and comments have been entered for the Waveform Screen, the comments can be printed.

Procedure All Screens

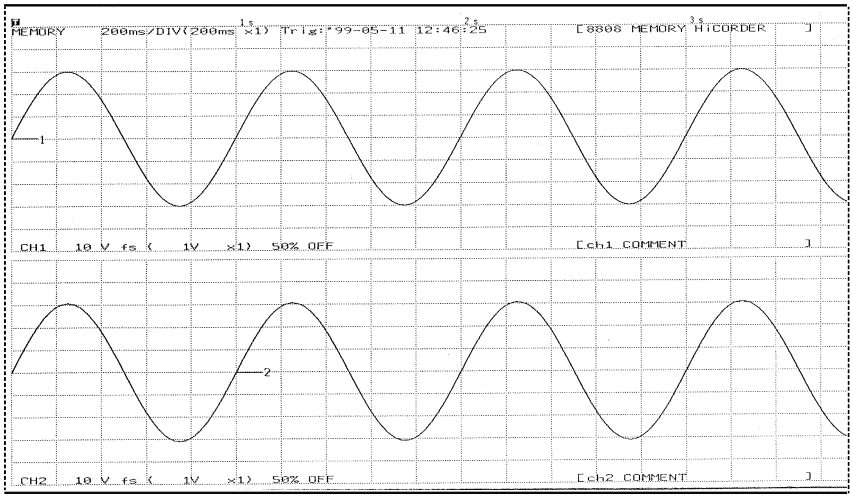
1. Display the desired screen.
2. While holding the **FEED** button, press the **COPY** button.

11.7 Example of Printer Output

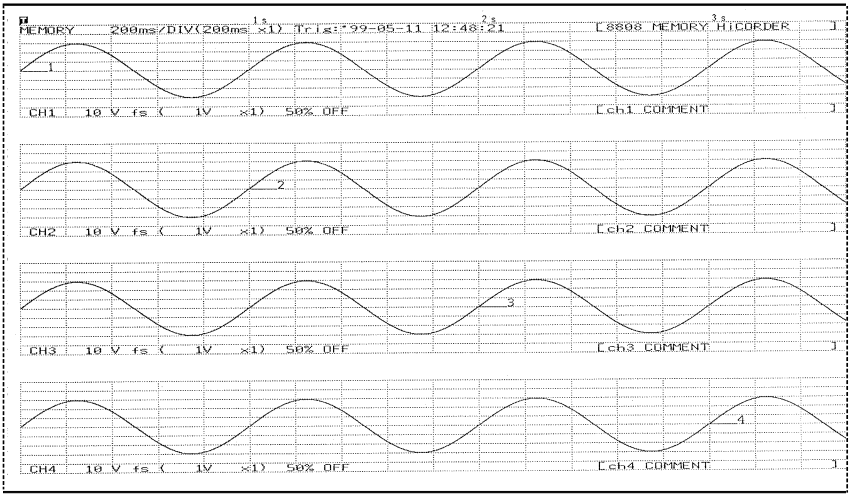
(1) Single Display



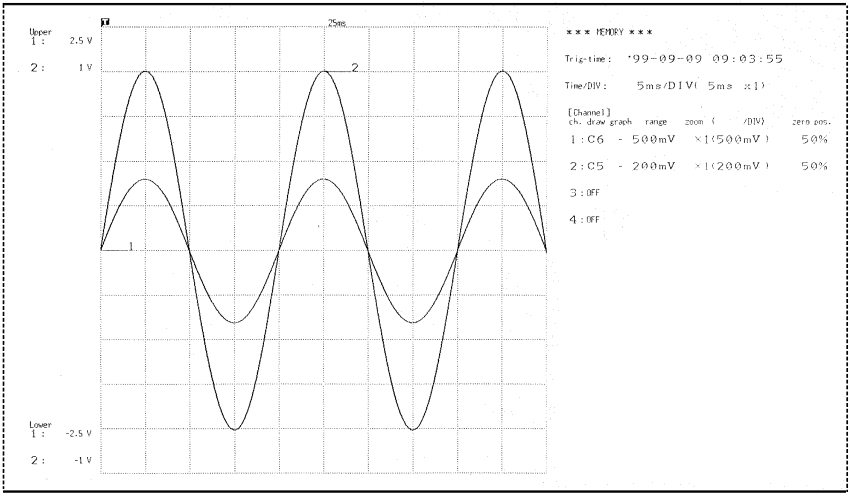
(2) Dual Display



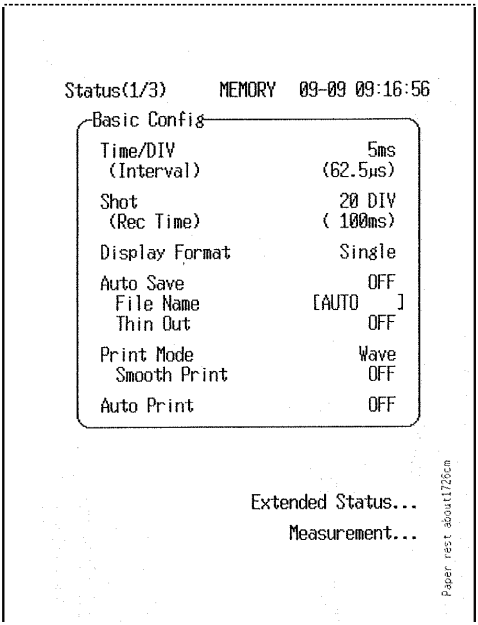
(3) Quad Display



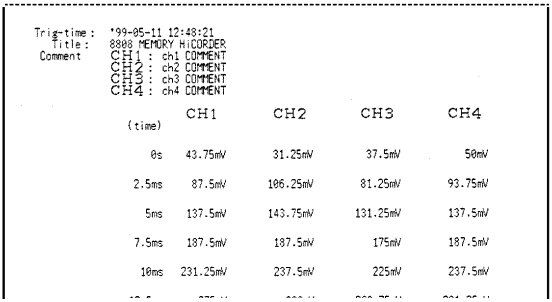
(4) Report print



(5) Screen copy



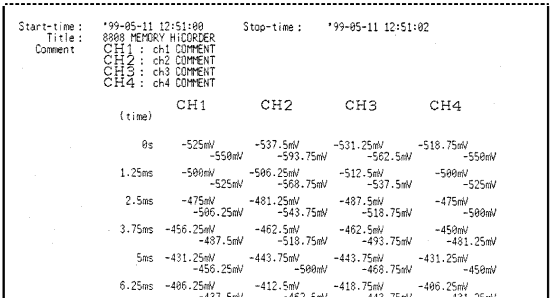
(6) Numerical values (Logging) print (Memory recorder function)



Trig-time : '99-05-11 12:48:21
Title : 8808 MEMORY HiCORDER
Comment CH1 : ch1 COMMENT
CH2 : ch2 COMMENT
CH3 : ch3 COMMENT
CH4 : ch4 COMMENT

(time)	CH1	CH2	CH3	CH4
0s	43.75mV	31.25mV	37.5mV	50mV
2.5ms	87.5mV	106.25mV	81.25mV	93.75mV
5ms	137.5mV	143.75mV	131.25mV	137.5mV
7.5ms	187.5mV	187.5mV	175mV	187.5mV
10ms	231.25mV	237.5mV	225mV	237.5mV

(Recorder and RMS recorder functions (excluding time axis range:100 ms))

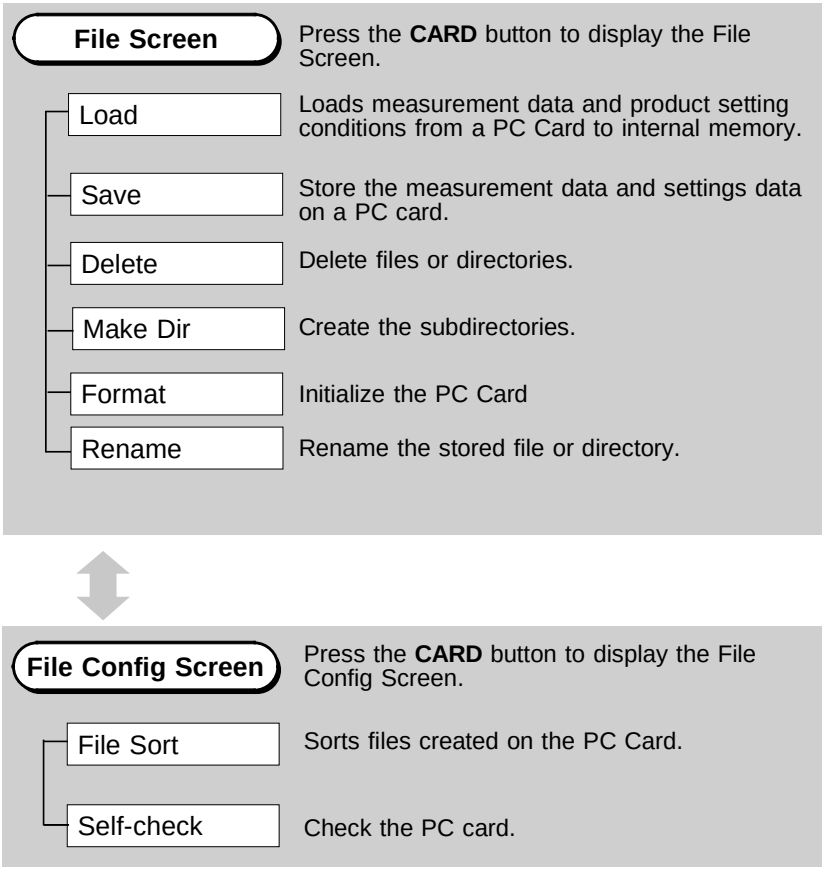


Start-time : '99-05-11 12:51:00 Stop-time : '99-05-11 12:51:02
Title : 8808 MEMORY HiCORDER
Comment CH1 : ch1 COMMENT
CH2 : ch2 COMMENT
CH3 : ch3 COMMENT
CH4 : ch4 COMMENT

(time)	CH1	CH2	CH3	CH4
0s	-525mV	-537.5mV	-531.25mV	-518.75mV
	-550mV	-593.75mV	-562.5mV	-550mV
1.25ms	-500mV	-506.25mV	-512.5mV	-500mV
	-525mV	-568.75mV	-537.5mV	-525mV
2.5ms	-475mV	-481.25mV	-487.5mV	-475mV
	-506.25mV	-543.75mV	-518.75mV	-500mV
3.75ms	-456.25mV	-462.5mV	-462.5mV	-450mV
	-487.5mV	-518.75mV	-493.75mV	-481.25mV
5ms	-431.25mV	-443.75mV	-443.75mV	-431.25mV
	-456.25mV	-500mV	-468.75mV	-450mV
6.25ms	-406.25mV	-412.5mV	-418.75mV	-406.25mV

Chapter 12
Storing the Measurement Data

Measurement data and settings in the product can be saved to and loaded from a PC Card specified by Hioki.
The **CARD** button selects the File and File Config Screens for PC Card settings and operations.



12.1 PC Card

(1) Saving and Loading Measurement Data (binary format)
Measurement data is saved in binary format so that, when needed, it can be loaded back into the product for data analysis and printing.
Harmonic wave analysis data that was saved by the 8807-51, 8808-51 cannot be loaded into the 8807-01, 8808-01.

(2) Saving Measurement Data (text format)
Measurement data can be saved in text (CSV) format. The saved data can be thinned, and can be used directly by many word processing and spreadsheet applications, but the text format cannot be read back into the product.

(3) Automatic Saving of Measurement Data
Measurement input data can be automatically saved to a PC Card.

(4) Partial Saving of Measurement Data (binary and text formats)
Measurement data to be saved to the PC Card can be limited to that between the A and B cursors.

(5) Saving and Loading Setting Data
Settings such as the time axis and voltage axis range are saved and loaded when needed to allow duplicating measurement conditions.

(6) BMP (bitmap) Data Saving
Screen images can be saved in bitmap (BMP) format.

(7) Auto Setup
Settings can be loaded automatically when power is turned on by creating a file named STARTUP.SET in the root directory.

WARNING

- **Use only PC Cards sold by HIOKI.**
  Compatibility and performance are not guaranteed for PC cards made by other manufacturers. You may be unable to read from or save data to such cards. The data on the PC card may be damaged.

CAUTION

- When formatting a PC card on a PC, use the FAT-16 format. Formatting a card in FAT-32 format may result in incompatibility problems.

<HIOKI options> PC cards (includes adapter)
9626 PC CARD 32M
9627 PC CARD 64M
9726 PC CARD 128M
9727 PC CARD 256M
9728 PC CARD 512M
9729 PC CARD 1G

12.2 Using the PC Card Slot

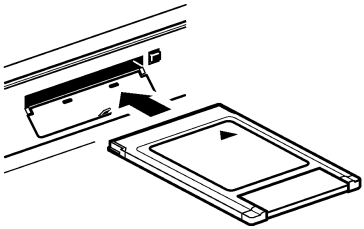
⚠CAUTION

- If a PC card is inserted upside down, backwards, or in the wrong direction, the PC card or the product may suffer damage.
- Do not remove the PC card while the PC card unit is operating.
- Before shipping the product, always remove the PC card and close the cover.

Before using a new PC Card, it must be initialized. For details, refer to Section 12.3.5.

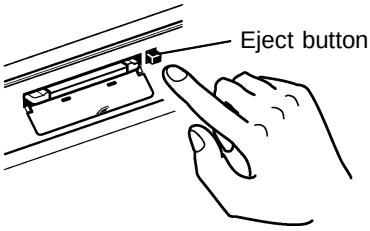
PC Card Insertion and Removal

Inserting a PC Card



Open the cover and insert the PC Card with the arrow facing up and in the direction of the PC card slot, as far as it will go.

Removing a PC Card

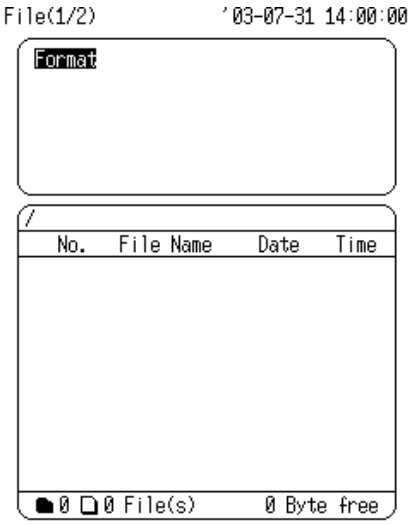


Press the Eject button and pull the PC Card out.

Always close the cover when the PC card is not used.

NOTE

Action to be taken when the message below appears at the bottom of the file screen after a PC card is inserted.



When formatting a PC card on a PC, use the FAT-16 format. Formatting a card in FAT-32 format may result in incompatibility problems.

12.3 Settings on the File Screen

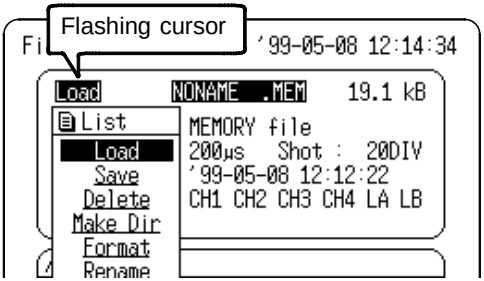
12.3.1 Loading the Data

The product settings or the measurement data are transferred from the media to the memory of the product. When loading measurement data, the channel can be specified.
Data stored in the text format is not readable by the product.
Harmonic wave analysis data that was saved by the 8807-51, 8808-51 cannot be loaded into the 8807-01, 8808-01.

Procedure File Screen

(1) Select the command to load.

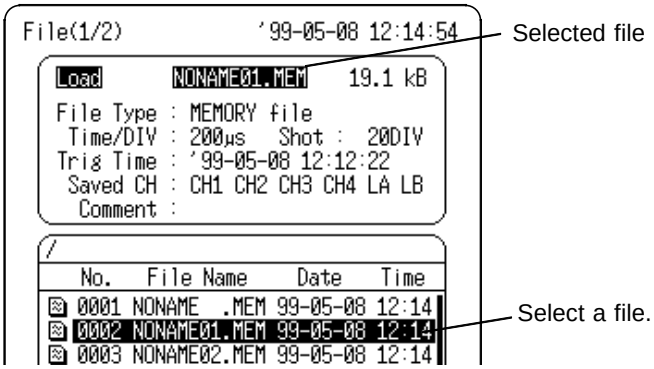
1. Press the **CARD** button to display the File Screen.
2. Move the flashing cursor to the position shown in the figure below and select Load using the ▲▼ buttons.



Load	Load the data from a PC card.
Save	Save the data on a PC card.
Delete	Delete files or directories.
Make Dir	Create directories.
Format	Initialize a PC card.
Rename	Rename a file or directory name.

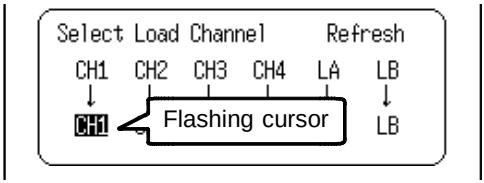
(2) Select the file for loading data.

Using the cursor △▽ buttons, select the file for loading data from the file list. You can select files in multiples of ten using the ◀/▶ button, and multiples of one hundred using the ◀◀/▶▶ button.



(3) Select the channel for loading data

1. Press the **START** button to display the Channel Selection Screen for the loading destination.
2. Move the flashing cursor to the position shown in the figure and specify the channel from which to load the saved data using the ▲▼ buttons.

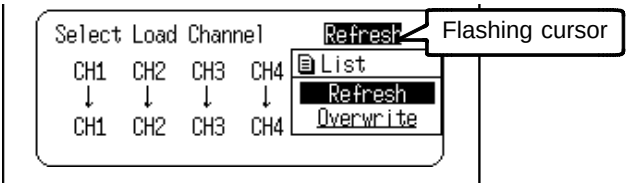


NOTE

- Saved data is loaded in this order: analog channels 1 through 4, and then logic channels A and B.
- When the one channel is specified as the load destination for data from multiple channels, data is read to that channel repeatedly, so that only the last data loaded remains.
- The amount of time needed to load the data is determined by the recording length and the number of channels.
- Channels cannot be selected when loading X-Y combined plotting waveforms and waveform of time-series harmonic analysis are saved with the Recorder function.

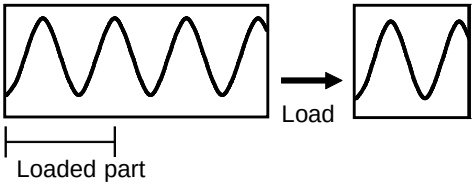
(4) Select New or Overwriting Load (Refresh/Overwrite)

Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to make a setting.

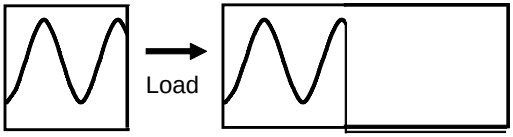


Refresh	Clears the screen and read waveform.
Overwrite	Reads the waveform without first clearing the screen. Overwriting is possible only when both the function and time axis range are the same.

If the recorded length of the saved data is longer than the recording length set in the product, the saved data is loaded for the set recording length, and the remainder of the data is not loaded.



If the recording length set in the product is longer than the saved data, the data from the end of the last saved waveform to the end of the product recording length is invalid.



(5) Execute loading.

Press the **START** button to load, and press the **STOP** button to cancel.

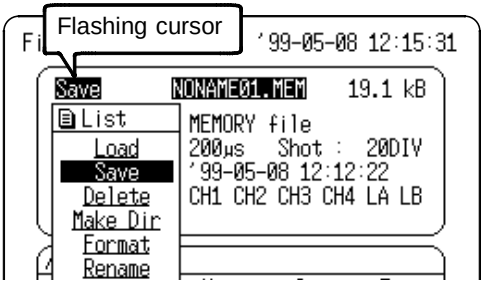
12.3.2 Saving Measurement and Setting Data

Measurement and setting data can be saved to a PC Card. The data to be saved must first be stored in internal memory.
If the A-B cursors are used, settings for partial saving can be made.

Procedure File Screen

(1) Select the command to save.

1. Press the **CARD** button to display the File Screen.
2. Move the flashing cursor to the position shown in the figure below and select Save using the ▲▼ buttons.



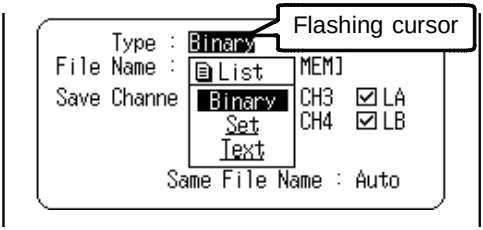
Load	Load the data from a PC card.
Save	Save the data on a PC card.
Delete	Delete files.
Make Dir	Create directories.
Format	Initialize a PC card.
Rename	Rename a file name.

NOTE

- Data stored in the text format is not readable by the product.
- When the display format is set to X-Y for the recorder function, the data cannot be saved in a text format.
- Files will be saved in the currently selected directory.

(2) Select the stored format.

1. Press the **START** button to display the Storing Format Setting Screen.
2. Move the flashing cursor to the position shown in the figure below and select the format using the ▲▼ buttons.



Binary	The waveform data is saved in binary format.
Set	The settings are saved.
Text	The waveform data is saved in text format. Data stored in the text format is not readable by the product. Data of X-Y recorder in Recorder function is not stored in the text format.
Binary (ALL)	Sequential Save data can be saved in a single binary file. An index file is also created.
Text (ALL)	Sequential Save data can be saved in a single text file. An index file is not created.

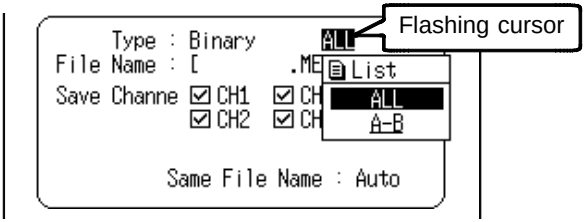
3. Set the thinning when the text format is selected.

NOTE

An index file (with extension SEQ or RMM) is created when measurement data is saved as a single binary file with Sequential Save. Loading the index file loads all measurement data saved by the corresponding Sequential Save.
When sequential save is used with instantaneous waveform recording by the RMS recorder, "Binary ALL" and "Text ALL" can be used for saving files.
If measurement data is saved using "Binary ALL," an index file is created. All saved measurement data can be read at once by reading the index file (the file with the extension SEQ and RMM).

(3) If using the A/B cursors on the screen, specify the area to save. (excluding horizontal cursor)

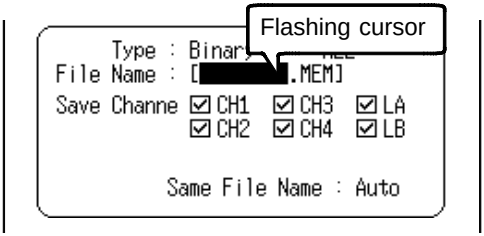
Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to make a setting.



ALL	Store data for all captured waveforms.
A-B (partial saving)	If A cursor is in use, data is saved from the cursor to the end of input. If both A and B cursors are in use, data between the cursors is saved.

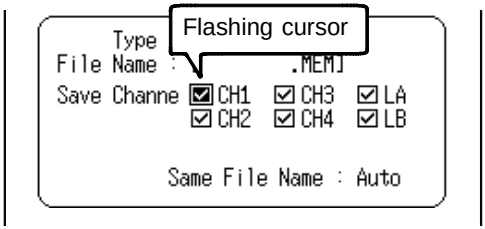
(4) Enter the file name

Move the flashing cursor to the position shown in the figure below and enter the file name. For details, refer to Section 11.3.3.



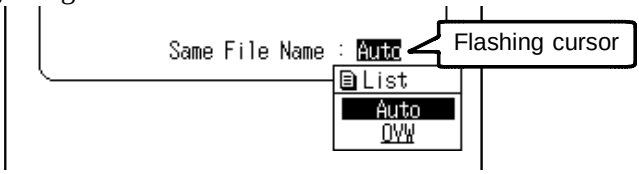
(5) Specify the channel to save. (for measurement data)

Move the flashing cursor to the position shown in the figure below and select channel using the ▲▼ buttons. (The channel that has been check marked is saved.)



(6) Select the Same File Name Handling setting (if same-name saving is desired).

Move the flashing cursor to the position shown in the figure below and select the Same File Name Handling setting using the ▲▼ buttons.



Auto	When saving with the same name, automatically append a number after the file name. If the last file was saved with a number appended, the next save just increments the number. Example: TEST1, TEST2
OVW (Overwrite)	When saving with the same name, overwrite the previous contents of the file.

(7) Execute the Save.

After selecting the channel to save, press the **START** button to execute, or the **STOP** button to abort saving.

NOTE

File name extension

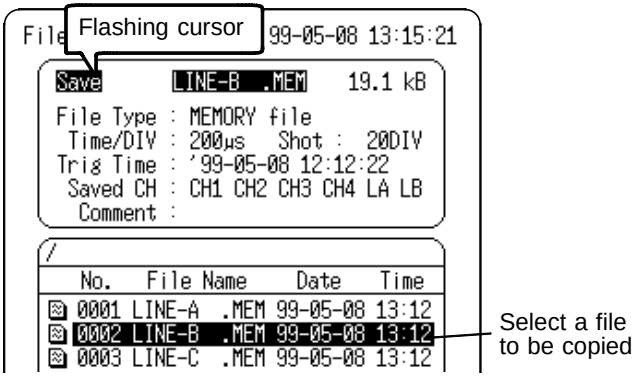
The following extensions are automatically assigned, according to the stored data type.

Mark	Extension	Meaning	
	MEM	Memory recorder binary data file	●
	REC	Recorder binary data file	●
	RMS	RMS recorder binary data file	●
	XYC	X-Y CONT recorder binary data file	●
	SEQ	Sequential save index file	●
	TXT	Text data file	/
	SET	Setting data file	●
	RMM	Memory waveform data of RMS recorder index file	●
	HRI	Binary data files of instantaneous harmonic analysis	●
	HRS	Binary data files of time-series harmonic analysis	●

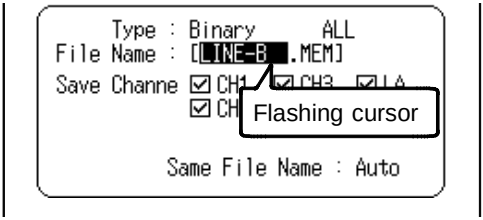
●: Files can be read into the product.
/ : Reading is not possible

Copying File Name

1. Press the **CARD** button to display the File Screen.
2. Select the Save command using the ▲▼ buttons.
3. Select the file with the name to be copied.



4. Press the **START** button to display the setting screen for saving format.



5. Move the flashing cursor to the File name, and press the T button twice. The file name selected in step 3 entries in the File Name entry location.

   A record of file names saved is maintained in memory. When such record is present, you can copy file names saved by moving the flashing cursor to the file name, then holding down the T button. However, when the power is cut, the record is cleared.

Automatic file name assignment

If the file name is entered as a blank [.], it is assigned automatically according to the following principle.

Auto save	Waveform data, screen data	Waveform calculation result
[AUTO] [AUTO0001] [AUTO0002] ↓ [AUTO0100] ↓ [AUTO0100] ↓ [AUTO5000]	[NONAME] [NONAME01] [NONAME02] ↓ [NONAME10] ↓ [NONAM100] ↓ [NONA5000]	[MEASURE1] [MEASURE2] ↓ [MEASUR10] ↓ [MEASU100] ↓ [MEAS5000]

- Waveform File Size (unit: byte)
  File Size = Header Size + Data Size
  Fractional values are ignored.
- In the memory recorder function (Binary data)
  Size of a header = 512 x (4 +number of analog channels +number of logic probes)
  Size of a data = {2 x number of analog channels +(number of logic probes +1)/2} x (recording length [DIV] x 80 +1)
- In the recorder and RMS recorder function (Binary data)
  Size of a header = 512 x (4 +number of analog channels +number of logic probes)
  Size of a data = (4 x number of analog channels +number of logic probes) x (recording length[DIV] x 80 +1)
- In the memory recorder function (Text data) (Intended as a guide only)
  Size of a header = 170+27 x number of analog channels+64 x number of logic probes
  Size of a data = (14+13 x number of analog channels+9 x number of logic probes x (recording length[DIV] x 80 +1)

- In the recorder and RMS recorder function (Text data) (Intended as a guide only)
  Size of a header = 170+64 x number of analog channels +1
  65 x number of logic probes
  Size of a data = (14+26 x number of analog channels + 18 x number of logic probes x (recording length[DIV] x 80 +1)
- In the instantaneous analysis function (Binary data)
  Size of a header = 512 x (7 + number of analog channels)
  Size of a data = 2 x number of analog channels x 10000
- In the time-series analysis function (Binary data)
  Size of a header = 512 x (7 + number of analog channels)
  Size of a data = 4 x number of analysis items x (recording length / time axis x 80 + 1)
- In the instantaneous analysis function (Text data - waveform) (Intended as a guide only)
  Size of a header = 94 + 21 x number of analog channels
  Size of a data = (13 + 12 x number of analog channels) x 10000
- In the instantaneous analysis function (Text data - RMS, content, and phase angle) (Intended as a guide only)
  Size of a header = 97 + 122 x number of analog channels
  Size of a data = 151 + (1476 x number of analog channels)
- In the instantaneous analysis function (Text data - active power, power content, and power phase angle) (Intended as a guide only)
  Size of a header = 97 + 124 x number of power systems
  Size of a data = 151 + (1488 x number of power systems)
- In the time-series analysis function (Text data) (Intended as a guide only)
  Size of a header = 93 + 22 x number of analysis items
  Size of a data = (18 + 12 x number of analysis items) x (recording length x 80 +1)

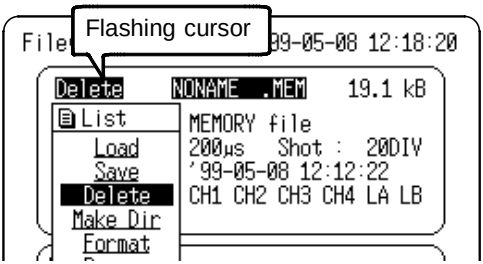
12.3.3 Deleting the Files and Directories

The files and directories can be deleted.

Procedure File Screen

(1) Select the command to delete.

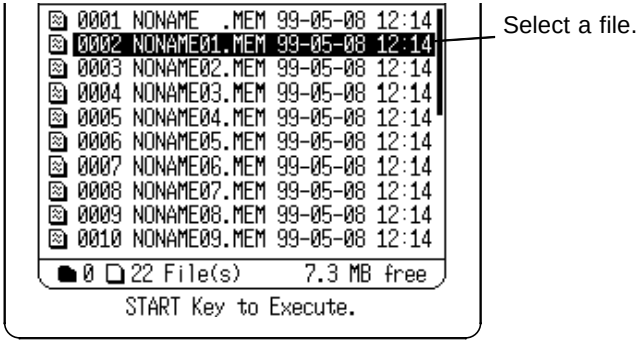
1. Press the **CARD** button to display the File Screen.
2. Move the flashing cursor to the position on the figure below and select Delete using the ▲▼ buttons.



Load	Load the data from a PC card.
Save	Save the data on a PC card.
Delete	Delete files or directories.
Make Dir	Create directories.
Format	Initialize a PC card.
Rename	Rename a file or directory name.

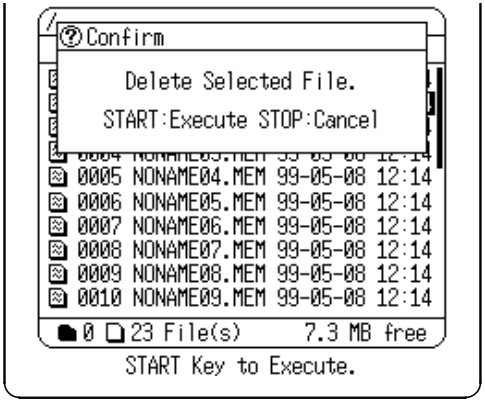
(2) Select the file or directory to be deleted.

Using the △▽ buttons, select a file or directory to be deleted.



(3) Execute deleting.

1. Pressing the **START** button displays a confirmation screen before deleting.
2. Press the **START** button to delete or the **STOP** button to cancel deletion.



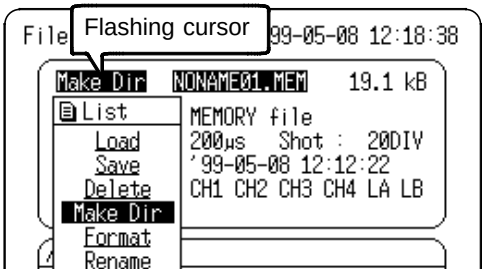
12.3.4 Creating the Directory

Creates a subdirectory on the selected medium.

Procedure File Screen

(1) Select the command to create a directory.

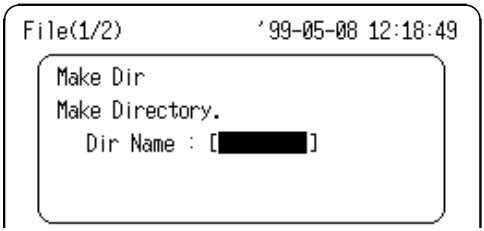
1. Press the **CARD** button to display the File Screen.
2. Move the flashing cursor to the position on the figure below and select Make Dir using the ▲▼ buttons.



Load	Load the data from a PC card.
Save	Save the data on a PC card.
Delete	Delete files or directories.
Make Dir	Create directories.
Format	Initialize a PC card.
Rename	Rename a file or directory name.

(2) Enter the directory name.

1. Press the **START** button to display the Directory Name Entry Screen.
2. Press the ▲▼ buttons to display the Comment Entry Screen.

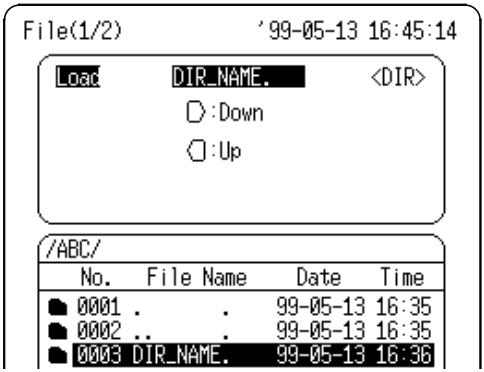


3. Move the cursor to the characters to be entered to enter the directory name (refer to Section 11.3.3 Text Entry Procedure).
4. Press the **START** button to create the directory.

NOTE 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.

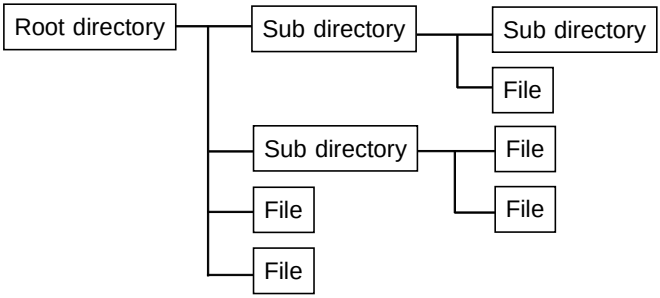
Changing a directory

1. Press the **CARD** button to display the File Screen.
2. Select the desired directory to move using the ⌂▽ cursor buttons.



3. Change the directory using the ◁▷ cursor buttons.
   To move to the upper directory, use ◁.
   To move to the lower directory, use the ▷.

Directory organization



NOTE

- Files will be saved in the currently selected directory.
- Files cannot be moved from one directory to another with the product.
- Up to 512 files and subdirectories can be stored in the root directory of a PC card, and up to 5,000 files can be stored in a subdirectory.
- When saving many files, be sure to save them in subdirectories.

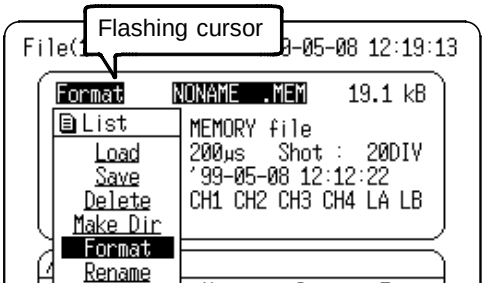
12.3.5 Initializing

Initialization method is described below.

Procedure File Screen

(1) Select the command to initialize a PC card.

1. Press the **CARD** button to display the File Screen.
2. Move the flashing cursor to the position on the figure below and select Format using the ▲▼ buttons.



Load	Load the data from a PC card.
Save	Save the data on a PC card.
Delete	Delete files or directories.
Make Dir	Create directories.
Format	Initialize a PC card.
Rename	Rename a file or directory name.

(2) Execute Initialization.

Press the **START** button to display a confirmation screen, and press it again to proceed with initialization, or press the **STOP** button to abort initialization.

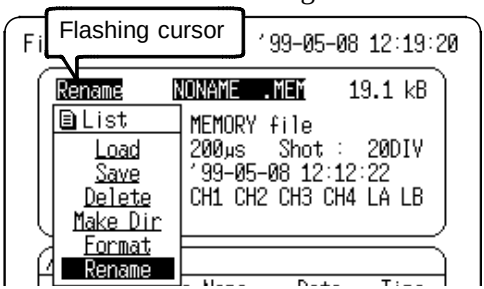
12.3.6 Changing the Names of Files and Directories

Change the name of a saved file, or a directory name.

Procedure File Screen

(1) Select the command to rename.

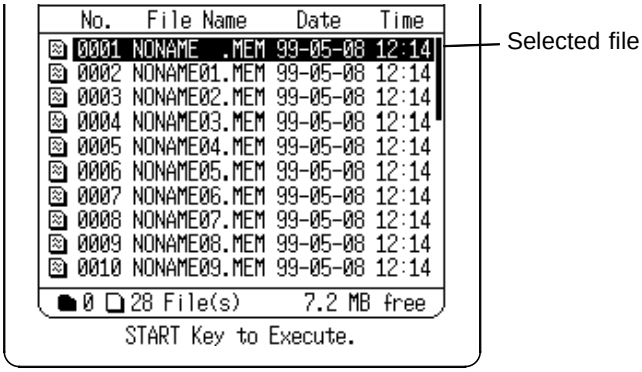
1. Press the **CARD** button to display the File Screen.
2. Move the flashing cursor to the position on the figure below and select Rename using the ▲▼ buttons.



Load	Load the data from a PC card.
Save	Save the data on a PC card.
Delete	Delete files or directories.
Make Dir	Create directories.
Format	Initialize a PC card.
Rename	Rename a file or directory name.

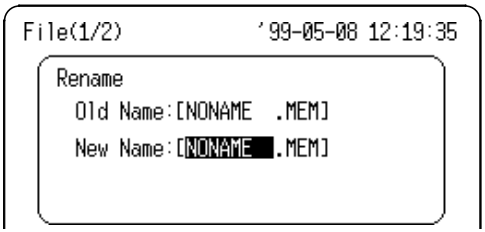
(2) Select the file to be renamed.

Select the file or directory to be renamed using the △▽ cursor.



(3) Rename the file

1. Press the **START** button to display the old and new file name fields.



2. Enter the file name (refer to Section 11.3.3 Text Entry Procedure).
3. When finished with settings, press the **START** button to accept or **STOP** button to cancel renaming.

12.4 Settings on the File Configuration Screen (Application Functions)

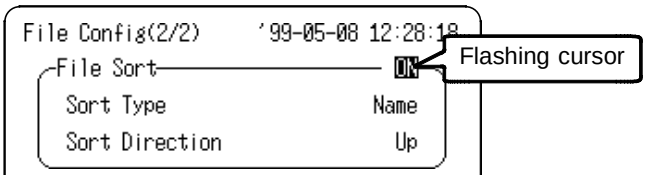
12.4.1 Sorting Files

Sorts files created on the PC Card.

Procedure File Config Screen

(1) Set Sorting to ON.

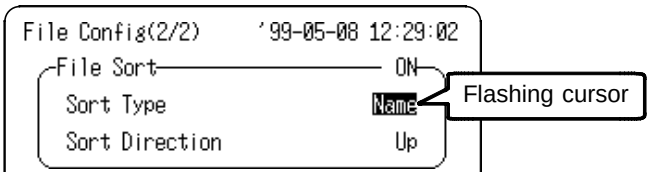
1. Press the **CARD** button to display the File Config Screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to make a setting.



OFF	Sorting is disabled.
ON	Sorting is enabled.

(2) Select the item to sort on.

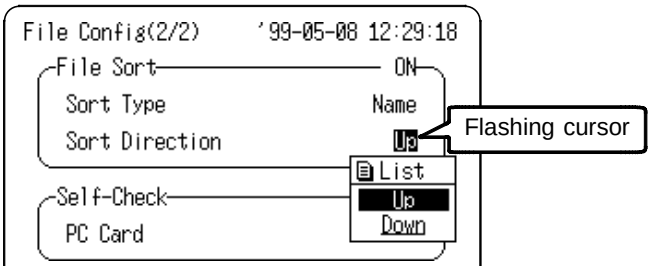
1. Move the flashing cursor to the Sort Type item.
2. Use the ▲▼ buttons to make a setting.



Name	Sorted in file name order
Type	Sorted in file type (extension) order
Date	Sorted in date order
Size	Sorted in file size order

(3) Select the sort order.

1. Move the flashing cursor to the Sort Direction item.
2. Use the ▲▼ buttons to make a setting.



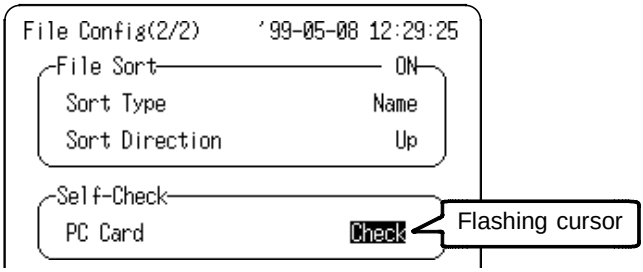
Up	Sort from lower to higher
Down	Sort from higher to lower

12.4.2 Self-check

Checks the PC Card.
The contents are the same as the PC Card Check in the Self Check on the Initialize Screen. Refer to Section 10.5.4.

Procedure File Config Screen

1. Press the **CARD** button to display the File Config Screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲▼ buttons to execute.



PC card Check

The PC Card check tests the items below. The checking contents are the same as the PC Card self test on the Initialize Screen.

PC Card Type	ATA card/ SRAM card/ Modem card
RAM Size	Capacity of the using card
Battery Level	OK (normal)
	LOW (The battery should be changed soon)
	NG (The battery change is needed immediately)
Write protect	PROTECT/NONE

12.5 Text File Internal Format

Text files consist of a header and a data section.
The header consists of the following measurement-related information:

COMMENT	Overall waveform comment
DATE	Measurement month, day and year (in MM-DD-YYYY format)
TIME	Trigger time (in HH:MM:SS format)
NUM_SIGS	Number of data types (including time axis data)
INTERVAL	Sampling rate (= time axis range / 80)
HORZ_UNITS	Time axis units (S = seconds)
VERT_UNITS	Vertical data units (including time axis data)
SIGNAL	Data name
DATA	Indicates the end of the header. Measurement data follows.

(1) When data for 2 analog channels plus 2 logic channels is stored by the Memory Recorder, the Memory Recorder can also store the logic data. The logic data is saved with the Memory Recorder and Recorder functions:

```
"COMMENT",    "8807 MEM DATA"
"DATE",       "01-01-1999"
"TIME",       "15:26:55"
"NUM_SIGS",            11
"INTERVAL",     2.500E-03
"HORZ_UNITS", "S"
"VERT_UNITS", "S", "V      ", "V      ", "Bit", "Bit", "Bit", "Bit",
 "Bit", "Bit", "Bit", "Bit"
"SIGNAL",     "TIME", "ACH1", "ACH2", "LCHA1", "LCHA2", "LCHA3",
"LCHA4", "LCHB1", "LCHB2", "LCHB3", "LCHB4"
"DATA"
0.0000E+00, +1.2500E-01, -7.0000E-01,  1, 1, 1, 1,  1, 1, 1, 1
+2.5000E-03, +2.5000E-02, -7.0000E-01,  1, 1, 1, 1,  1, 1, 1, 1
+5.0000E-03, -2.5000E-02, -6.7500E-01,  1, 1, 1, 1,  1, 1, 1, 1
+7.5000E-03, -1.2500E-01, -6.7500E-01,  1, 1, 1, 1,  1, 1, 1, 1
+1.0000E-02, -2.0000E-01, -6.5000E-01,  1, 1, 1, 1,  1, 1, 1, 1
+1.2500E-02, -2.7500E-01, -6.2500E-01,  1, 1, 1, 1,  1, 1, 1, 1
+1.5000E-02, -3.5000E-01, -6.0000E-01,  1, 1, 1, 1,  1, 1, 1, 1
+1.7500E-02, -4.2500E-01, -5.7500E-01,  1, 1, 1, 1,  1, 1, 1, 1
+2.0000E-02, -5.0000E-01, -5.2500E-01,  1, 1, 1, 1,  1, 1, 1, 1
+2.2500E-02, -5.7500E-01, -5.0000E-01,  1, 1, 1, 1,  1, 1, 1, 1
+2.5000E-02, -6.2500E-01, -4.5000E-01,  1, 1, 1, 1,  1, 1, 1, 1
```

(2) The following example shows data has been saved by the Recorder and RMS Recorder:

```
"COMMENT",    "8807 REC DATA"
"DATE",       "01-01-1999"
"TIME",       "16:52:03"
"NUM_SIGS",             5
"INTERVAL",    2.500E-03
"HORZ_UNITS", "S"
"VERT_UNITS", "S", "V      ", "V      ", "V      ", "V      "
"SIGNAL",     "TIME", "ACH1(Max)", "ACH1(Min)", "ACH2(Max)",
"ACH2(Min)"
"DATA"
0.0000E+00, -7.5000E+00, -8.7500E+00, +9.5000E+00, +8.0000E+00
+2.5000E-03, -6.2500E+00, -7.7500E+00, +8.5000E+00, +6.5000E+00
+5.0000E-03, -5.0000E+00, -6.5000E+00, +7.0000E+00, +5.5000E+00
+7.5000E-03, -3.7500E+00, -5.2500E+00, +6.0000E+00, +4.0000E+00
+1.0000E-02, -2.2500E+00, -4.0000E+00, +4.5000E+00, +2.5000E+00
+1.2500E-02, -5.0000E-01, -2.5000E+00, +3.0000E+00, +1.0000E+00
+1.5000E-02, +1.0000E+00, -1.0000E+00, +1.5000E+00, -1.0000E+00
+1.7500E-02, +2.5000E+00, +7.5000E-01, -5.0000E-01, -2.5000E+00
+2.0000E-02, +4.0000E+00, +2.2500E+00, -2.0000E+00, -4.0000E+00
+2.2500E-02, +5.5000E+00, +3.7500E+00, -3.5000E+00, -5.5000E+00
+2.5000E-02, +6.7500E+00, +5.0000E+00, -5.0000E+00, -6.5000E+00
```

NOTE With the Recorder and RMS Recorder functions, sampling is performed faster than the time axis on the screen (the Recorder function samples at 400 kS/s, and the RMS Recorder samples at 4 kS/s).
Input data is converted to sampling data corresponding to the range to be displayed on the screen.
To save this data in the Recorder and RMS Recorder functions, two values, the maximum and minimum, are stored in memory. However, when data thinning is enabled, only the thinned data is retained.

Chapter 13
Communication Function

RS-232C

The RS-232C interface is a serial interface standard established by the EIA (Electronic Industries Association in the U.S.A.). The standard defines the interface conditions between a DTE (Data Terminal Equipment) and DCE (Data Communications Equipment). The MEMORY HiCORDER can be remote controlled and can transfer data to a personal computer using a portion of this standard (one signal line).

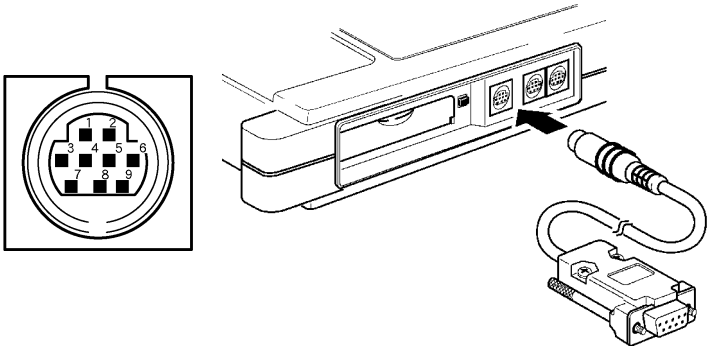
The Communication commands are described in a text file on the supplied floppy disk. Open the 3-Inch Floppy Disk item in the My Computer window. Then open the Command file on the floppy disk.

13.1 Connecting the RS-232C Cable

⚠CAUTION

- The RS-232C interface is not isolated from the product.
- Be aware that the logic input and RS-232C share common ground.
- The 9612 RS-232C CABLE and connectors of the product should be mated carefully. Forcing the connectors together can damage the connector contacts.

Connect the 9612 RS-232C CABLE (cross cable) and the product as shown in the figure below.



9612 RS-232C CABLE (crossed)

Pin No.	Circuit designation	CCITT	Simbol		
			EIA	JIS	Common
2	Receive data	104	BB	RD	RxD
3	Transmitted data	103	BA	SD	TxD
5	Signal ground or common return	102	AB	SG	GND
7	Request to send	105	CA	RS	RTS
8	Clear to send	106	CB	CS	CTS

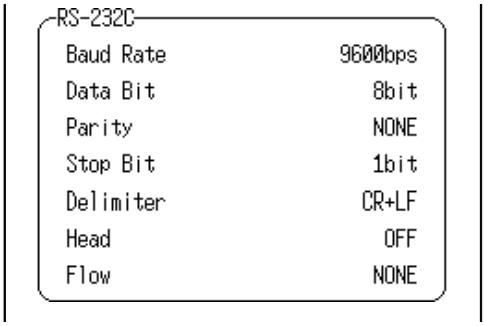
13.2 Setting the RS-232C Interface

Remote control is provided by commands sent from the controller.

NOTE
- The transfer rate is reduced when an overrun or framing error occurs.
- Setting the transfer rate to 19200 bps may cause a communication problem with some incompatible devices.
- Do not attempt to change settings during communications with the product.
- RS-232C communication is not possible with the fax modem card installed. To use RS-232C communications, remove the fax modem card.

Procedure RS&COPY Screen

1. Press the **SYSTEM** button to display the RS&COPY Screen.
2. Move the flashing cursor to the RS-232C items to be set.
3. Use the ▲▼ buttons to make a setting.



Baud rate	1200 bps to 19200 bps
Data Bit	7 bit / 8 bit
Parity	NONE/EVEN/ODD
Stop Bit	1 bit / 2 bit
Delimiter	LF/ CR+LF
Head	OFF/ ON
Flow	NONE/ Xon/Xoff/ hardware

Chapter 14
Specifications

14.1 General Specifications

Basic specifications

Measurement functions	Memory recorder (High-speed data saving) Recorder (Real time recording) RMS recorder (For commercial power supplies) Harmonic wave analysis*[1]
Number of channels (maximum)	8807-01, 8807-51: 2 analog channels + 8 logic channels 8808-01, 8808-51: 4 analog channels + 8 logic channels (The logic channels are standard equipment, common ground with main product)
Memory capacity	8807-01, 8807-51: 256 K words/channel (CH1) 128 K words/channel (CH1, CH2) 8808-01, 8808-51: 256 K words/channel (CH1) 128 K words/channel (CH1, CH2) 64 K words/channel (All)
(Harmonic wave analysis)*[1]	For waveform storage: analog 12 bit X 16 Kwords/ch For analysis results: analysis results 32 bit X 96 Kwords
Maximum sampling rate	400 kS/s (all channels simultaneously)
Time axis accuracy	±0.01% (difference between grid and actual time)
External terminals	External trigger input, trigger output, GND
Time functions	Auto calendar with automatic leap year, 24 hour clock
Backup battery and lifetime	Used for waveform, clock and to preserve waveforms and settings, at least 5 years (reference value at 25°C, 77°F)
Location for use	Max. 2000 m (6562 feet) height, indoors

(*1): 8807-51, 8808-51 only

Operating temperature and humidity	Temperature: 5℃ to 40℃ (41℉ to 104℉) Relative humidity: 35% to 80% RH (with no condensation)
Operating temperature and humidity for guaranteed accuracy	Temperature: 23±5℃ (73℉±9℉) Relative humidity: 35% to 80% RH (with no condensation)
Storage temperature and humidity	Temperature: -10℃ to 50℃ (50℉ to 122℉) Relative humidity: 35% to 80% RH (with no condensation)
Dielectric strength	One minute at 3.7 kV AC (between the main product and input channels, between input channels)
Power supply	• Depending on the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) (powering at 12 V DC ±10%) Rated supply voltage of the AC adapter is 100 to 240 V AC. (Voltage fluctuations of ±10% from the rated supply voltage are taken into account.) Rated supply frequency is 50/60 Hz. • Six LR6* alkaline batteries are used. • 9447 BATTERY PACK* can be used. • 12 V car battery (tolerance: 12 V DC±10%) *: The AC adapter is prior to batteries when using together.
Maximum rated power	15 VA
Continuous Operating Time	Approx. 3 hours (when using with 9447 BATTERY PACK) (Waiting for trigger, 23℃ reference value)
Charging function	The 9447 BATTERY PACK can be charged with the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) when the product is turned off. Approx. 2 hours necessary to charge (23℃ reference value)
Dimensions	Approx. 203W x 170H x 52D mm (7.99"W x 6.69"H x 2.05"D) (excluding projections) Approx. 280W x 170H x 52D mm (11.02"W x 6.69"H x 2.05"D) (with using the printer, excluding projections)

Mass (excluding batteries)	8807-01, 8807-51	Approx. 1.1 kg (38.8 oz.) Approx. 1.5 kg (52.9 oz.) (with using the printer)	
	8808-01, 8808-51	Approx. 1.2 kg (42.3 oz.) Approx. 1.6 kg (56.4 oz.) (with using the printer)	
Standards Applying		Safety	EN 61010 Pollution Degree 2, Measurement Category II (anticipated transient overvoltage 4000 V)
		EMC	EN 61326 Class A EN 61000-3-2 EN 61000-3-3

Display

Display language	Japanese/English (selective)
Screen	5.7- inch STN color LCD display (320 x 240 dots)
Display resolution	Waveform: 10 DIVf.s. x 10 DIV f.s. (1 DIV = 20 (horizontally) x 28 (vertically) dots)
Dots spacing	0.36 (horizontally) x 0.36 (vertically) mm
Backlight lifetime	Approx. 25,000 hours (23℃ reference value)
Backlight saver	Available

TFT color LCDs characteristically have a few defective pixels that do not always light, or that remain lit. We do not consider the presence of three or fewer such defects to indicate a damaged or faulty display. Please be aware of this in advance.

External storage (PC card)

Slot	Complies with PC card standard specification 68-pin (1 slot) (TYPE I, II)
Card types	SRAM card, flash ATA card
Card capacity	32 MB max (SRAM), 1 GB max (flash ATA card)
Data format	MS-DOS format (MS-DOS is the registered trademark of Microsoft Corporation in USA.)
Data stored	Settings, measurement data (binary or text), screen data, calculation results (measurement data can be saved between cursors A and B.)

External interface

RS-232C Electrical Specifications	Complies with EIA RS-232C (9-Pin Round Connector) Remote control by 9-pin D connector and 9612 RS-232C CABLE Communication mode: Full duplex Synchronization: Start-Stop Baud rate: 1200, 2400, 4800, 9600, 19200 (bps) Start Bit: 1 bit Stop Bit: 1 bit / 2 bit Data Bit: 7 bit / 8 bit Parity: NONE/EVEN/ODD Delimiter: LF/ CR+LF Flow: NONE/ Xon/Xoff/ hardware
Printer	Compatible printer: 8992 PRINTER UNIT Total recording width: 104 mm (832 dots) Waveform area: 100 mm f.s. (1 DIV=10 mm 10 DIV f.s.) Recording speed: Max 1 s/cm (using with AC adapter)
PC card	Fax modem

14.2 Trigger

Trigger Method	Digital comparison
Trigger modes	Memory recorder Single, repeat, auto Recorder, Single, repeat RMS recorder Single, repeat
Trigger source	Analog input, logic input, external trigger, timer trigger Sources can be set on or off. When all sources are off, the product is in the free-run state. Trigger settings can be made independently for each channel. External trigger (With an external trigger, the triggering occurs on a falling edge of 2.5 V, or when the terminals are shorted together.)
Manual trigger	Provided
Trigger conditions	Logical AND or OR of any trigger sources
Trigger types (analog)	Level trigger, voltage drop trigger*[1], window trigger, RMS level trigger*[2], waveform detection trigger*[3]
Trigger type (logic)	Pattern trigger specified by 1, 0, and x (x means that either 1 or 0 is fine.)
Trigger filter	Memory recorder: OFF, 0.1, 0.2, 0.5, 1.0, 1.5, 2.0, 2.5, 5.0, 10.0 DIV, Recorder: ON, OFF (10 ms fixed)
Trigger level resolution	0.25%f.s., waveform detection trigger only: 0.1%f.s. (f.s.=10 DIV)
Pre-trigger	Memory recorder: 0, 2, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100, -95%, RMS recorder: 0, 5, 10 DIV
Trigger timing	Start, Stop, Start&Stop (Recorder)
Trigger output	Open collector output (with 5 V output voltage, active low) Pulse width 30 ms minimum
Trigger input/ output terminal	Terminal block

(*1): For use when measuring commercial power.
(*2): RMS recorder function only, for use when measuring DC or commercial power.
(*3): Memory recorder function only, real-time detection period: 125 µs, maximum sampling rate: 400 kS/s (time axis: 200 µs/DIV)

14.2.1 Harmonic Wave Trigger

Harmonic wave trigger mode	Single, repeat
Harmonic wave trigger source	Up to four different harmonic wave triggers can be selected; trigger conditions can be set separately for each trigger type. Free run operation if all triggers are off.
Trigger conditions	Harmonic wave triggers can be ORed. Harmonic wave trigger sources and external or timer sources can be ANDed.
Harmonic wave triggers	Effective value trigger for any harmonic wave Component ratio trigger for any harmonic wave Active power value trigger for any harmonic wave Power component ratio trigger for any harmonic wave Power phase angle trigger for any harmonic wave Total effective value trigger Total distortion trigger*
Trigger level resolution	One digit of the analysis display value One degree (phase angle trigger)
Pre-trigger	0, 5, 10 DIV (time series analysis function)
Trigger timing	Start only

*: Total distortion-F, total distortion-R

14.3 Memory Recorder Function

Time axis	200, 400 μs/DIV 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1, 2, 5 min/DIV
Time axis resolution	80 points/DIV (*with the printer)
Data interval	1/80 of the time axis
Recording length	20, 50, 100, 200, 400, 800 DIV (4ch), 1600 DIV (2ch), 3200 DIV (1ch)
Display/print layout	Single, dual, quad, X-Y (dot/line)
Waveform magnification/ compression	Time axis x10, x5, x2, x1, x1/2, x1/5, x1/10, x1/20, x1/50, x1/100, x1/200, x1/500 Voltage axis x10, x5, x2, x1, x1/2
Waveform scrolling	Available in the left/right directions
Auto-print *	Automatically prints the memorized waveform
Manual print *	Available
Partial print *	Prints between the A and the B cursors
Print smoothing function *	When set, a smoothed waveform is printed, with twice the density in the time axis direction.
Logging function *	Records measured data as digital values
X-Y plot	Provided

*: when the 8992 PRINTER UNIT is connected

14.4 Recorder Function

T-Y waveform

Time axis	100*[1], 200*[1], 500*[1] ms/DIV, 1*[1,3], 2, 5, 10, 30 s/DIV, 1, 2, 5, 10, 30 min/DIV, 1 h/DIV
Time axis resolution	80 points/DIV (with the printer) *[2]
Sampling period	2.5 µs fixed
Recording length	20, 50, 100, 200, 400 DIV, CONT
Display/print layout	Single, dual, quad, X-Y single
Waveform magnification/ compression	Time axis: x1, x1/2, x1/5, x1/10, x1/20, x1/50, x1/100, x1/200, x1/500 Voltage axis: x10, x5, x2, x1, x1/2
Storage capacity	Last 400 divisions of data saved in memory Can be checked by reverse scrolling and reprinted*[2]
Auto-print*[2]	ON/OFF, real-time print (prints simultaneously as display)
Logging function*[2]	Records measured data as digital values
Interpolation	Line only

X-Y waveform

X channel	Any channel 1 or 2 (8807-01), 1 to 4 (8808-01)
Y channel	Any channel other than the X channel
Available recording area	100 mm x 100 mm (3.94" x 3.94") (10 DIV x 10 DIV)
X-Y axis resolution	20 dots/DIV (with the display) 80 dots/DIV (horizontally x vertically) (with the printer*[2])
X-Y Sampling period	Dot display: 250 µs fixed, Line display: 500 µs max
Recording length	CONT only
Interpolation	Line/Dot only

(*1): screen display only /(*2): when the 8992 is connected.
(*3): when the 8992 is connected.(can be printed only when using the AC adapter)

14.5 RMS Recorder Function

Time axis	RMS	100*[1], 200*[1], 500*[1] ms/DIV 1*[3], 2, 5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV
	Instantaneous waveform	200, 400 µs/DIV 1, 2, 5, 10, 20 ms/DIV
Time axis resolution	RMS	80 points/DIV (with the printer) *[2]
	Instantaneous waveform	80 points/DIV
Sampling period	RMS	250 µs fixed (800 rms data/s)
	Instantaneous waveform	1/80 of time axis
RMS accuracy	±3% f.s.	
Measuring object	Commercial power supplies (50/60 Hz), DC	
Recording length	RMS	20, 50, 100, 200 DIV, CONT
	Instantaneous waveform	OFF *[4], 20, 50, 100, 200, 400 DIV
Display/print layout	Single, dual, quad	
Waveform magnification/ compression	Time axis	x1, x1/2, x1/5, x1/10, x1/20, x1/50 x1/100, x1/200, x1/500
	Voltage axis	x10, x5, x2, x1, x1/2
Storage capacity	RMS	max. 200 divisions of data (all channels)
	Instantaneous waveform	max. 400 divisions of data
	Can be checked by reverse scrolling and reprinted*[2]	
Auto-print*[2]	ON/OFF, real-time print (prints simultaneously as display)	
Logging function*[2]	Records measured data as digital values	

(*1): screen display only
(*2): when the 8992 is connected.
(*3): when the 8992 is connected. (can be printed only when using the AC adapter)
(*4): functions as RMS Recorder when OFF (default)

14.6 Harmonic Wave Analysis Function

14.6.1 General Specifications

Object of measurement	Select from among independent between channels (UNIQUE), one-phase two-wire (2 systems), one-phase three-wire, or three-phase three-wire.
Input settings	
UNIQUE	Select from among "voltage," "9018," "9132," "3283," "3284," "3285," and "9322."
Other settings	It is possible to set odd channels to voltage and even channels to current. (When measuring power, it is necessary either to select input type "9018" or "9132," or else to select input type "voltage" and then use a clamp-on probe with good phase precision and apply current scaling.)
Measurement range	1. Voltage : 5, 10, 20, 50, 100, 200, 500 mVr/DIV 1, 2, 5, 10, 20, 50 Vr/DIV 2. 9018 : 10, 20, 50, 100, 200, 500 Ar 3. 9132 : 20, 50, 100, 200, 500, 1000 Ar 4. 3283 : 10 m, 100 m, 1, 10, 200 Ar 5. 3284 : 20, 200 Ar 6. 3285 : 200, 2000 Ar 7. 9322 : 50, 100 Vr
Base frequency range	45 to 65 Hz Automatic setting or manual setting (0.1 Hz resolution)
Analysis degree	Base wave to 40th degree
Measurement precision (on the x1 display) (Base wave to 20th degree) (21st degree to 40th degree)	 ±(1.5%rdg. + 15 dgt.) ±(3%rdg. + 15 dgt.)
Phase precision ("a" is the component ratio of the harmonic wave across the full span.) (Base wave to 20th degree) (21st degree to 40th degree)	 ±(3.00 + 2.89a + 1/50a)° ±(6.74 + 7.80a + 1/75a)°
Sampling speed	400 ks/s
Number of FFT operations	512 points (sample extraction for one cycle of the base wave)

14.6.2 Instantaneous Analysis Functions

Update cycle: 1s

Types of analyses	When voltage (current) input is set (1) Harmonic effective value (Bar graph, numerical value) (2) Harmonic percentage content (Bar graph, numerical value) (3) Harmonic phase (Bar graph, numerical value) (4) Synthesis effective value (Numerical value) (5) Synthesis distortion rate - F (Numerical value) (6) Synthesis distortion rate - R (Numerical value) When single-phase two-wire, single-phase three-wire, or three-phase three-wire is set (not available when using the 3283 to 3285) (7) Harmonic active power (Bar graph, numerical value) (8) Harmonic power percentage content (Bar graph, numerical value) (9) Harmonic power phase (Vector graph, numerical value) (10) Active power (Numerical value) (11) Reactive power (Numerical value) (12) Apparent power (Numerical value) (13) Power factor (Numerical value)
Waveform enlargement/compression factor	x100, x50, x20, x10, x5, x2, x1, x1/2, LOG*[1]
Print type	Waveform, graph, list
Auto print	ON/OFF
Manual print	Available
Scaling function	Available (1) When using a Hioki clamp, the unit of measurement is automatically set to "A" once the model name has been selected. (2) PT/CT ratio can be set. (3) When using a clamp from another manufacturer, the unit of measurement is automatically set to "A" once the voltage/current conversion ratio has been input.

(*1): Excluding for vector graph.

14.6.3 Time Series Analysis Functions

Update cycle: 3.75s

Types of analyses	When voltage (current) input is set (1) Harmonic effective value (2) Harmonic percentage content (3) Harmonic phase (4) Synthesis effective value (5) Synthesis distortion rate - F (6) Synthesis distortion rate - R When single-phase two-wire, single-phase three-wire, or three-phase three-wire is set (not available when using the 3283 to 3285) (7) Harmonic active power (8) Harmonic power percentage content (9) Harmonic power phase (10) Active power (Numerical value) (11) Reactive power (Numerical value) (12) Apparent power (Numerical value) (13) Power factor (Numerical value)
Number of simultaneous analyses	20 types Different types of analyses may be combined as desired. Only a maximum of four analyses may be printed or displayed simultaneously.
Time axis	5, 10, 30 min/DIV 1, 3, 6, 12 h/DIV (1DIV = 80 samples)
Recording time	Depend on the time axis and recording length.

Analysis items \ Time axis	5 min	10 min	30 min	1 h	3 h	6 h	12 h
20	30 min	1 h	3 h	6 h	12 h	1 days	3 days
20	1 h	3 h	6 h	12 h	1 days	3 days	7 days
20	3 h	6 h	12 h	1 days	3 days	7 days	14 days
20	5 h	10 h	1 days	2 days	7 days	14 days	30 days
10	10 h	20 h	2 days	4 days	14 days	30 days	60 days
4	1 days	2 days	6 days	12 days	37 days	75 days	150 days
20	CONT*1 (5 h)	CONT*1 (10 h)	CONT*1 (30 h)	CONT*1 (2.5 days)	CONT*1 (7.5 days)	CONT*1 (15 days)	CONT*1 (30 days)

(*1): The final 60 divisions of analysis data are stored in memory in the main unit.

Averaging function	ON/OFF (Obtains the simple average of all data loaded within a period equal to 1/80 of the time axis)
Waveform enlargement/compression factor	
(Time axis) (Voltage axis)	x4, x2, x1, x1/2, x1/4, x1/6, x1/12, x1/24, x1/48 x100, x50, x20, x10, x5, x2, x1, x1/2, LOG
Print type	Dotted line graph of each analysis value, numerical data*[1]
Print interval (Numerical data)	1, 8, 16, 40, 80, 160, 400, 800 samples
Auto print	ON/OFF; prints simultaneously with the display on the screen in real time.
Manual print	Available
Partial print	Prints out the portion of a graph between cursors A and B.
Scaling function	Available (1) When using a Hioki clamp, the unit of measurement is automatically set to "A" once the model name has been selected. (2) PT/CT ratio can be set. (3) When using a clamp from another manufacturer, the unit of measurement is automatically set to "A" once the voltage/current conversion ratio has been input.
Scroll function	Scrolls analysis value graphs in any direction.
Tabulated results output	Outputs a list of the maximum and average values for each analysis result over the entire recording period.

(*1): Time display printing

14.6.4 Additional Functions

Level check function	Level can be checked through a level meter
Connection check function	Calculates the active power value, and deems the connection to be reversed if a negative value is obtained. Determines the phase sequence when using a three-phase three-wire connection.
Over range function	Automatically lowers the range sensitivity if the input range is exceeded while taking measurements.

14.7 Communication Function

Applicable to all Communications

Communication Types	RS-232C (built-in)
Screen Image Transmission	RS-232C (Screen Copy [BMP file format])
Measurement Data Transmission	with RS-232C
Setting Data Receiving	with RS-232C (Power on/off switching not possible)

14.8 Others

Numerical calculation function	Average value, peak-to-peak value, maximum value, time to maximum value, minimum value, time to minimum value, rms value, period, frequency, area value, XY area value Up to four calculations can be performed simultaneously.
Comment printing *1	Function, channel, input range, zero position, trigger time, division and other information can be printed.
Comment input function	Provided
Cursor measurement function	Time difference, voltage difference or frequency between cursors A and B, voltage at each cursor, time from trigger can be measured.
Scaling function	Specifiable for each channel
Display copy function*1	Provided
List/gauge functions *1	ON, OFF
List print *1	Settings are printed after waveform is printed (can be disabled), or by pressing the PRINT key beside the Waveform screen.
Backup function *2	Provided, waveform data and settings are saved even if the power switch is turned off.
Start backup function	Provided
Auto setup function	Settings can be read from a PC Card automatically at power on.
Auto save function	Provided
Auto-range function	Provided (time and voltage axes are automatically selected to suit input waveforms)
LCD back lighting	ON, OFF (with the auto OFF function)

DMM function	Displays input voltage numerically. Update rate: 1second Displays rms value, instantaneous value Measuring object: DC, 50/60 Hz (auto-selection) Sampling rate: 4 kS/s Number of displayed digits: 4 (The lowest digit is displayed as 0 for values 0 to 4, and as 5 for values 5 to 9.) (The actual digit is displayed while setting scaling) Accuracy: ±3% rdg.±5 dgt.

(*1): when the 8992 PRINTER UNIT is connected.

(*2): If the power supply is interrupted during measurement and Instantaneous Waveform Recording is enabled in the effective value Recorder Function, then the effective value waveform data will not be backed up.

Chapter 15
Logic and Analog Inputs

15.1 Logic Inputs

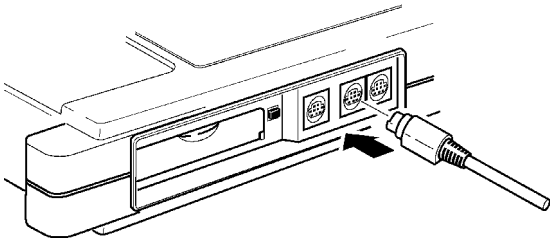
WARNING

- **Two probes can be connected to the Logic Input section, but the probes are not isolated from each other or from the frame ground of the product (common ground). Therefore, applying voltages with different ground levels can result in a short circuit, depending on the probe type.**
- **Logic probes other than those supplied by HIOKI should not be connected to the logic inputs.**

Logic Probe Connection

- The logic input is located on the upper side of the product. Up to two probes can be connected.
- One logic probe can record up to four channels, so up to eight logic waveforms can be recorded with two probes.

NOTE Connect the 9323 CONVERSION CABLE to the product to use with the 9320, 9321 LOGIC PROBE.

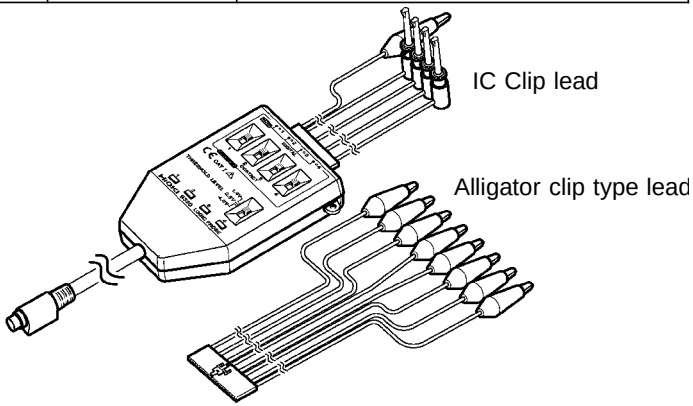


9320-01 LOGIC PROBE

The logic probes are used to test for circuit voltage and to measure relay timing.

- Measuring digital signals
  Set the input selector to DIGITAL. Use an IC clip lead, connect the alligator clip to the circuit ground, and adjust the threshold value selector.
- Measuring contact signals
  Set the input selector to CONTACT. Use the alligator clip leads. When an input terminal is connected to ground, a high (H) level appears at the logic input.

Range	Digital input (Threshold value)	Contact input (Detecting resistance value)
1.4 V	1.4 V±0.3 V	Open = more than 1.5 kΩ (Output L) Short = less than 500 Ω (Output H)
2.5 V	2.5 V±0.4 V	Open = more than 3.5 kΩ (Output L) Short = less than 1.5 kΩ (Output H)
4.0 V	4.0 V±0.5 V	Open = more than 25 kΩ (Output L) Short = less than 8 kΩ (Output H)



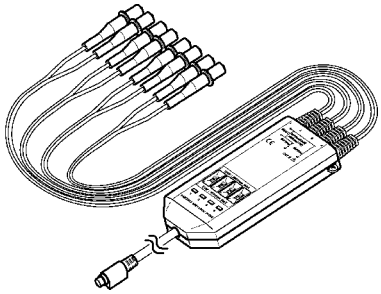
NOTE Refer to the manual supplied with the 9320-01 LOGIC PROBE for details.

9321-01 LOGIC PROBE

Use to determine whether power to a circuit is on or off.

- Set the input selector according to the measured voltage.
  LOW range: 100 V AC or 24 V DC
  HIGH range: 200 V AC
- The inputs are bipolar, so polarity may be disregarded.
- As the inputs are isolated, each channel can be connected to points with different potential.

The number of channels	4 (insulated between product and channels)	
Input voltage range	LOW	HIGH
Input resistance	30 kΩ min	100 kΩ min
Sensitivity (Output: L)	0 to 10 V AC ±(0 to 15) V DC	0 to 30 V AC ±(0 to 43) V DC
Sensitivity (Output: H)	60 to 150 V AC ±(20 to 150) V DC	170 to 250 V AC ±(70 to 250) V DC
Response time (⌟) (⌝)	Less than 1 ms Less than 3 ms with 100 V DC	Less than 1 ms Less than 3 ms with 200 V DC
Maximum input voltage	150 V rms	250 V rms
Maximum rated voltage to earth	250 V rms	
Dielectric strength	2.3 kV AC /1 min (between product and channels)	
Insulation resistance	More than 100 MΩ / 500 V DC (between product and channels)	



This product detects absolute values so that negative DC voltages can be applied. The above values for AC voltages are those obtained with sine wave signals of 50/60 Hz.

NOTE Refer to the manual supplied with the 9321-01 LOGIC PROBE for details.

15.2 Analog Inputs

Accuracy at 23℃±5℃ , after 30-minutes warmnig-up time
Accuracy guaranteed for 1 year

Measurement ranges	5*[1], 10, 20, 50, 100, 200, 500 mV/DIV, 1, 2, 5, 10, 20, 50, 100*[2] V/DIV (f.s.=10 DIV)
Accuracy	±0.5%f.s.
Temperature characteristic	Gain: ±0.1%f.s./℃, Zero position: ±0.1%f.s./℃
Frequency characteristic	DC to 50 kHz ±3 dB
Common mode rejection ratio	90 dB min. (at 50/60 Hz and with signal source resistance 100 Ω max)
Low-pass filter	OFF, 5, 500±50%(Hz) -3 dB
Anti-aliasing filter*[3] (automatically ON during harmonic wave analysis)	4th degree active-type low-pass filter Cutoff frequency: 4.83 kHz ± 200 Hz-3 dB Attenuation characteristics: -24 dB/OCT
Noise	2 mVp-p (typ), 4 mVp-p (max) (with 10 mV input shorted)
Input type	Unbalanced (input isolated from output)
Input resistance and capacitance	1 MΩ±1%, 7 pF±3 pF (at 100 kHz)
A/D resolution	12 bits Voltage axis resolution: 160 data/DIV (when displaying at a magnification of x1)
Maximum sampling rate	400 kS/s
Input coupling	DC/GND
Input terminals	Insulated BNC terminal
Maximum input voltage	450 V rms/DC max (CAT II)
Maximum rated voltage to earth	450 V AC/DC (between each input channel HIGH/LOW and main product, and between input channels)

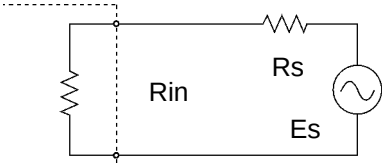
(*1): RMS recorder and Harmonic wave analysis
(*2): Memory recorder and Recorder
(*3): 8807-51, 8808-51

Measurement Errors Caused by Signal Source Internal Resistance

- If the signal source impedance is higher than the input impedance of the analog input, a measurement error will occur.
- The input impedance is 1 MΩ. If the signal source impedance is 1 kΩ, an error of about 1% will occur.

$$\text{Measurement error} = Es \left[1 - \frac{Rin}{Rs + Rin} \right] \quad [V]$$

Es: Signal voltage
Rs: Signal source resistance
Rin: Input resistance



Chapter 16
Maintenance and Service

- If damage is suspected, check the "16.5 Troubleshooting" section before contacting your dealer or Hioki representative.
- Pack the product carefully so that it will not be damaged during shipment, and include a detailed written description of the problem. Hioki cannot be responsible for damage that occurs during shipment.

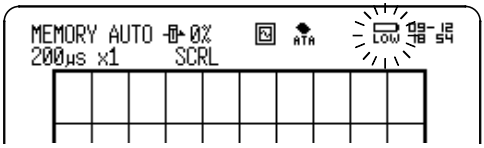
16.1 Changing the Battery

- **To avoid electric shock, turn off the power switch and disconnect the connection cords before replacing the batteries.**
- **After replacing the batteries, replace the cover and screws before using the product.**
- **To avoid the possibility of explosion, do not short circuit, disassemble or incinerate battery pack. Handle and dispose of batteries in accordance with local regulations.**
- **Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.**
- **Use LR6 alkaline batteries or the specified 9447 BATTERY PACK.**
- **Keep batteries away from children to prevent accidental swallowing.**
- **Handle and dispose of batteries in accordance with local regulations.**

NOTE

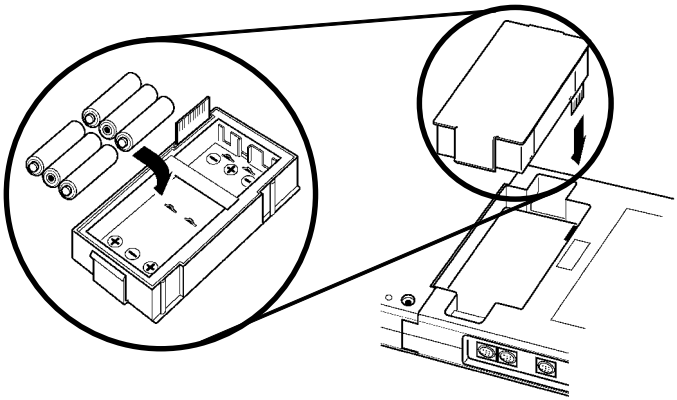
- To avoid problems with battery operation, remove the batteries from the product if it is to be stored for a long time.
- If the product shuts down because the batteries are exhausted, it still continues to consume a very small amount of power. After the shutdown, be sure to turn the power switch off.

When using the alkaline batteries and then the following warning message appears, replace the batteries.
"WARNING 620: Battery low."
A low battery warning appears on the Waveform Screen when the battery charge is low. When this indicator appears, replace the batteries or recharge the battery pack as soon as possible.



Replacing the Batteries

1. Turn the power OFF.
2. Take off the cover of the battery compartment.
3. Remove the old batteries and replace them with six new LR6 alkaline batteries with the correct polarity.
4. Replace the battery cover.

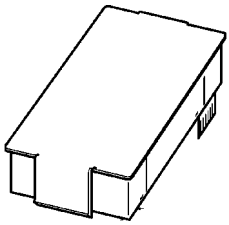


16.2 9447 BATTERY PACK

⚠CAUTION

- Keep batteries away from children to prevent accidental swallowing.
- To avoid the possibility of explosion, do not short circuit, disassemble or incinerate battery pack. Handle and dispose of batteries in accordance with local regulations.

- The 9447 BATTERY PACK is a Ni-MH battery which can be recharged while in the product.
- Refer to Section 16.1, "Changing the Battery", on replacing the 9447 batteries.



9447 BATTERY PACK

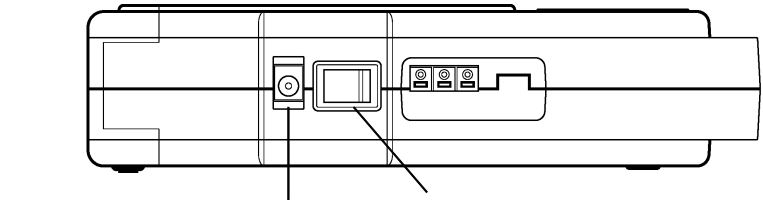
NOTE

- The battery pack is subject to self-discharge. Be sure to charge the battery before initial use. If the battery capacity remains very low after correct recharging, the useful battery life is at an end.
- Before storing the product, remove the battery pack from the product.
- The 9447 BATTERY PACK has a tendency to self-discharge. When the battery pack is in long-term storage, recharge about once every two months. If stored long-term in the discharged state, the battery pack characteristics will be impaired.
- When not in use for a long time, remove the battery packs from the product before storage.

16.2.1 Battery Charging with the MEMORY HiCORDER

- When using the 9447 BATTERY PACK and the following warning message is displayed, recharge them.
  "WARNING 620: Battery low"
- If not using the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) the recharging of the 9447 is not possible.

1. Connect the AC ADAPTER.
2. When the power switch is OFF, the LED above the **START** button will light in red to start the charging.
3. About 2 hours, the charging is completed and the LED automatically goes off to end.



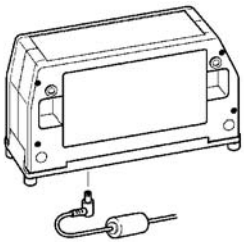
NOTE

- When the power switch is ON, the battery charging is not performed.
- Always carry out battery charging at an ambient temperature between 10℃ and 40℃. Outside this range, not only is the charging capacity reduced, but also there is a possibility of reduced performance, electrolyte leakage, degraded compounds within the battery, or shortening battery life.
- Only use the specified 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) for charging.

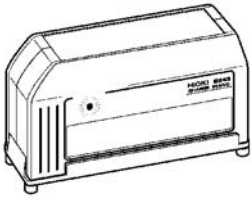
16.2.2 Battery Charging with the 9643 CHARGE STAND

The Hioki 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) is required to charge the Model 9447 BATTERY PACK with the Charging Stand.

Charging Procedure



1. Install the battery pack in the charging stand.
2. Connect the AC adapter to the charging stand. The LED blinks red and then stays on as rapid charging begins.



3. After about two hours, rapid charging finishes and the LED turns green as supplemental charging begins.

16.3 Removing the Battery Before Discarding the Product

WARNING

- **To avoid the risk of electric shock, be sure that all cables and the power cord are disconnected before removing the battery.**
- **Keep batteries away from children to prevent accidental swallowing.**
- **To avoid the possibility of explosion, do not short circuit, disassemble or incinerate battery pack. Handle and dispose of batteries in accordance with local regulations.**

- The product incorporates a lithium battery for memory backup.
- Before final disposal of the product, remove the lithium battery as described below.

Removing the battery

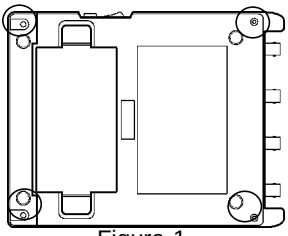


Figure 1

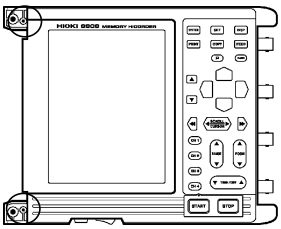


Figure 2

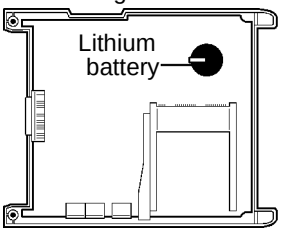


Figure 3

1. Check that the product is powered OFF.
2. Remove the four screws which is holding on the rear panel with a Phillips screwdriver (see Figure 1).
3. Remove the case of printer connecting portion.
4. Remove the two hidden screws in the cover using a Phillips screwdriver (see Figure 2).
5. Remove the upper case (front).
6. Wrench up the battery, and cut the positive (+) connection with nippers (see Figure 3).
7. Wrench the battery up further.
8. Cut the negative (-) connection, which was underneath the battery.

CALIFORNIA, USA ONLY

This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply.
See
www.dtsc.ca.gov/hazardouswaste/perchlorate

16.4 Cleaning the Printer Head

The maintenance of the 8992 PRINTER UNIT (option) is not especially required. However, depending upon the conditions of use, and especially if the printer has been used over a long period of time, it is possible for dirt or paper dust to adhere to the printer thermal head, causing the printing to be faint or otherwise indistinct. If this occurs, use one of the following procedures to clean the printer head.

Method 1

1. Press the **SYSTEM** button to call up the Initialize Screen.
2. Move the flashing cursor to the "Printer" item.
3. Press the **T** button to clean the print head by printing a solid pattern.
4. If this method does not alleviate the problem, perform the steps of cleaning method 2 as described below.

Method 2

1. Moisten printer paper on the rear with alcohol and set the paper in the printer. (If the front side of the paper is moistened, discoloring will occur.)
2. Lower the head up/down lever and move the printer paper back and forth to clean the head.

NOTE

- Do not use organic solvents such as thinner or benzene, which could discolor or deform the product.
- After using alcohol, be sure that the printer is completely dry before operating it.
- After extended use, paper residue (visible as a white powder-like substance) may accumulate on the roller. While a small amount of residue has no adverse effect, the roller can be cleaned using a air-blow brush (such as sold as a camera accessory).
- Always use the paper cutter integrated in the printer cover to cut printer paper. If the paper is cut near the thermal head, a large amount of paper residue may accumulate on the roller.

16.5 Troubleshooting

If the product does not seem to operate normally, check the following points before requesting service.

The screen and indicators do not light when powered on.	• Is the AC Adapter correctly connected? • Are the batteries correctly inserted? • Are the batteries near the end of their useful life? • When the battery capacity is reduced, the power is automatically turned off. Before turning on the power again, turn the power off first and leave the product for about 30 seconds. • Is the contrast too dark?
The normal screen is not displayed when turning the power on.	Are the batteries near the end of their useful life?
No waveform appears on the screen when the **START** button is pressed.	• Is the "Pre-Trig wait." message displayed? When recording before the trigger, until the corresponding item interval has elapsed, a trigger is not accepted. • Has the "Wait for trigger" message appeared? Check the trigger settings. • Are all of the waveform display colors for each channels switched off? • Has the timer trigger been set?
There is absolutely no variation in the recorded waveform.	• Is the measurement range setting appropriate? • Is the input cord correctly connected? • Has a low pass filter been set?
The printed recording is very faint or non-existent.	• Is the recording paper back to front? • Are you using the correct recording paper? • Is there enough power left in the battery pack? • Is the 8992 printer unit connected correctly?
The display language has changed	Turn the power on while holding the SYSTEM and SET keys down at the same time.

During memory recorder operation, the apparent frequency of the recording is much lower than the expected frequency.	• This is likely to be an aliasing error. • Make the "time" setting (time axis range) faster. For more details see the background information on aliasing distortion in Appendix "Aliasing".
Recording lines are dense or blurred.	Input signal contains ripple components. Make suitable filter settings.
The screen does not appear and the green LED stays on or blinks.	The backlight has been switched off by the backlight saver function. Press any button to switch on the backlight.

If none of the above conditions apply, and the cause of the problem is not understood, try performing a system reset. All the settings will revert to the factory settings.
Also refer to Appendices (Error messages) and Index for more information.

System reset

To perform a system reset, power ON the product while holding down the **STOP** button. The settings are initialized, and revert to the factory settings.

16.6 Cleaning of the Product

- To clean the product, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
- Wipe the LCD gently with a soft, dry cloth.

Appendix

Appendix 1 Messages

Error messages

Error messages are displayed until the cause of the error is remedied or the **STOP** button is pressed.

1	Paper End.	Printer paper has run out. Reload.
2	Set printer lever.	Lower the head up/down lever.
12	Printer is not connected.	The 8992 PRINTER UNIT is not connected.
14	Printer Error.	Check the built-in printer.
21	Battery low (Printer)	Battery voltage is low

Warning messages

When an error occurs, the accompanying warning message is displayed only once (and disappears after a few seconds). Warning messages can be cleared by pressing any button.

50	Error	The PC card format is incorrect. Please use a PC to reformat it to FAT-16 format.
71	Cannot load.(not 8807,8808 data)	Data cannot be loaded, because it is not a set of data created by the product.
72	Illegal format.	The media is not a correctly formatted MS-DOS.
73	Write Protected.	The media is write-protected. Release it.
75	File is read only.	File cannot be written or deleted, because it is read- only.
76	General failure.	Access to disk is not possible because of some error, such as in formatting or file saving.
80	Insert PC card.	No card is present in the PC card slot. Insert one.
90	File already exists.	Rename a file.
91	Directory full.	Since only a limited number of files (including directory) can be created in the root directory.

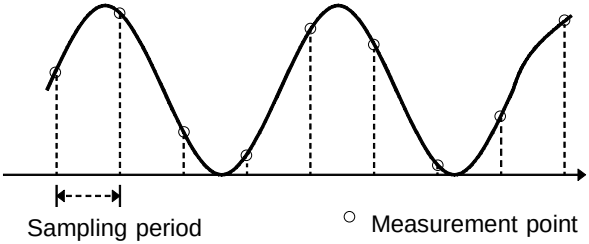
93	Disk full.	Little capacity is available. Delete files or use new media.
94	Path name error.	Up to 127 characters can be used for a path name.
95	Empty directory name.	Name the directory.
96	Directory already exists.	Another directory of the same name exists. Saving cannot be performed.
99	Conditions for OVERWRITE are not satisfied.	Match the product condition and file data condition (function and time-axis).
201	Set printer paper.	Printer paper has run out. Reload.
202	Set printer lever	The head up/down lever has been left in the up position.
203	Cannot start.	Start measurement after printing is completed.
205	Invalid (START)	The button pressed is not valid, because measurement operation is in progress.
207	AUTO RANGE failure.	The auto ranging function has failed. Check the input signal.
300	Cannot START. (SYSTEM)	Cannot start measurement from screen displayed by pressing the SYSTEM button.
345	Cannot set. (AND logic trigger)	The trigger source "AND" cannot be set between the logic trigger and analog trigger of rms function.
346	Cannot set. (AND analog trigger)	The trigger source "AND" cannot be set between the logic trigger and analog trigger of rms function.
347	Invalid. (Pre Trigger)	If the trigger is not set, the pre-trigger is disabled (0%).
348	Invalid. (V-drop Trigger)	When the time axis range is other than 200 µs to 5 ms/DIV, the voltage drop trigger is disabled.
349	Invalid.(Real Trigger)	When the time axis range is other than 10 ms/DIV, the waveform evaluation trigger is disabled.
382	No waveform data.	There is no waveform data to display on the Waveform Screen. Data must be input before processing can start.
397	Out of range. (scaling)	Input the appropriate value.
398	A/B cursor positions invalid.	Move the cursors to the appropriate position.
503	Communication settings is incorrect.	Make the communication settings correctly.
504	Communication error	The communications line was disconnected repeatedly. Turn off the power and turn it on again.

620 Battery low.	Recharge or change the batteries.
621 Battery low (Printer)	Battery voltage is low.
631 Range changed.(Out of range)	The range was changed with the Auto Range function during measurement.
632 Input too large.	The input value exceeded the measurement range.
633 Set CH1=Volt,CH2=Current.	Measurement may not be possible under some measurement conditions. (For 8807-51, 8808-51 only.) For details, see page 20 of the Harmonic Wave Analysis Functions manual supplied with the 8807-51 and 8808-51.
634 Set CH1,3=Volt,CH2,4=Current.	
635 3283,3284,3285 can't analyze power.	
636 Don't analyze power.	

Appendix 2 Reference

Sampling

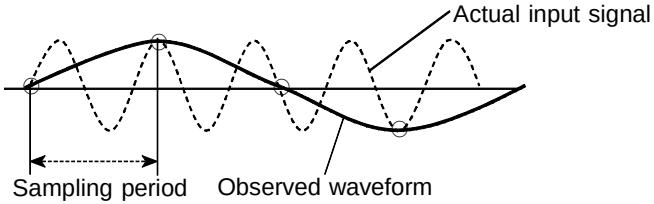
- The product converts the input signal to a digital value, then carries out all internal processing digitally. This process of converting an analog signal to digital values is termed sampling.
- Sampling measures the magnitude of the signal at fixed time intervals (sampling periods).



- 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).

Aliasing

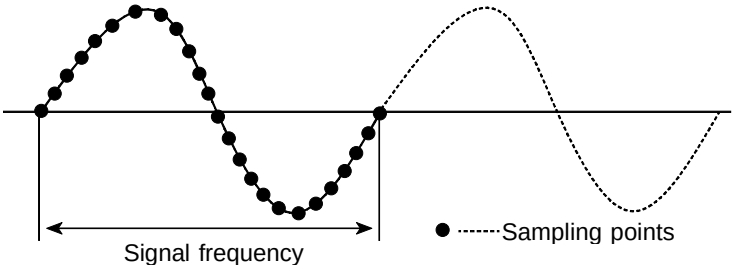
If the frequency of the signal being measured is significantly higher than the sampling rate, it is possible for sampling to produce an apparent signal which is actually nonexistent. This phenomenon is termed aliasing.



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

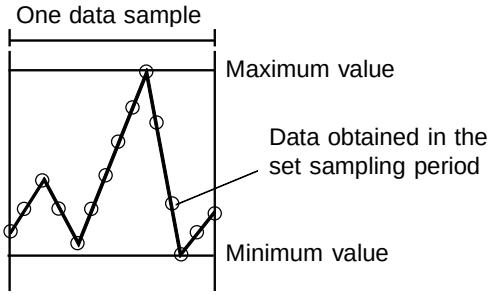
Measurement Limit Frequency

- 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.



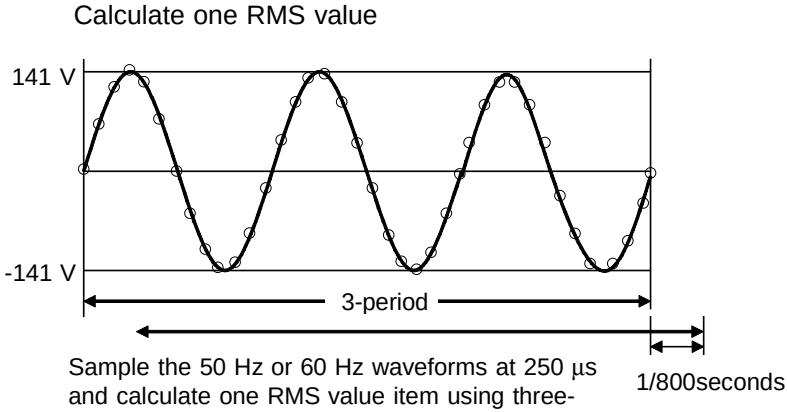
Recorder Function

- One division is equal to 80 samples.
- For recording purposes, one data sample consists of the maximum and minimum values of the acquired voltage during the set sampling period. That is, each data sample has a width defined by a pair of voltage values.



RMS Recorder Function.

- Input data sampled at a fixed 250 µs rate is subjected to 800 RMS calculations per second.
- One division is equal to 80 samples.



Sample the 50 Hz or 60 Hz waveforms at 250 µs and calculate one RMS value item using three-period data.
Afterwards, the RMS data is calculated in 1/800 second intervals.

(1) Time axis: 100 ms/division

Since the sampling period is fixed to 800 RMS-value data items per second, 100 ms/division provides 80 RMS-value data items per division. This value is in agreement with 80 samples per division and, therefore, the voltage value does not have a width (upper and lower limits).

(2) Time axis: other than 100 ms/division

The maximum and minimum values are specified based on the RMS-value data (by multiplying 600 RMS-value data items per second by the time-axis range [s/division]/80), and the data containing these maximum and minimum values are defined as one item of sample data. When the time-axis range is set to 1 min/division, the maximum and minimum values are specified in the RMS-value data (800X60 [s/division] /80 = 600), and the data containing these maximum and minimum values are defined as one item of sample data.

Numerical Calculation Details

(1) Average value

Calculates the average value (V) of the waveform data.

$$AVE = \sum_{i=1}^{n} di/n$$

AVE: average value
n: number of data samples
di: i-th data of the source channel

(2) Peak-to-peak value

Calculates the peak-to-peak (maximum-minimum) value of the waveform data.

(3) Maximum value

Calculates the maximum value of the waveform.

(4) 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.

(5) Minimum value

Calculates the minimum value of the waveform.

(6) 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.

(7) RMS value

Calculates the RMS (effective) value of the waveform data. When scaling is used, the value is calculated after scaling.

$$RMS = \sqrt{\left(\sum_{i=1}^{n} di^2/n\right)}$$

RMS: effective value
n: number of data samples
di: i-th data of the source channel

(8) Period

(9) Frequency

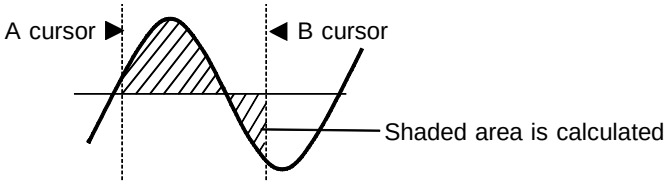
- Displays the period (s) and frequency (Hz) of the signal waveform.
- The calculation is performed by determining the middle point of the signal amplitude and then measuring the interval from the point when that level is crossed (in rising or falling direction) to the point when it is next crossed.

(10) 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.

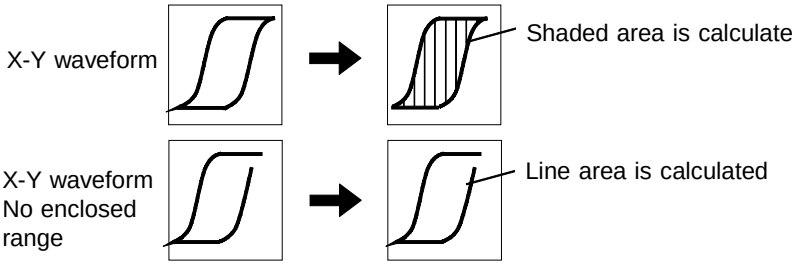
$$S = \sum_{i=1}^{n} |di| \cdot h$$

S: Area value
n: number of data samples
di: i-th data of the source channel
h = Δt sampling period



(11) 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 display, the A/B cursors (vertical, trace) can be used to specify the range for X-Y plotting and area calculation.
- On the X-Y Screen of the memory recorder function, it is not possible to specify the range with the A/B cursors.



Appendix 3 WaveViewer (Wv)

The waveform viewer provides a simplified view of data transferred to a PC by remote control or data acquisition. The viewer has a CSV conversion function. Converted files may be read by a spreadsheet program.

System requirements

For a PC running Windows 95, 98, Me, Windows NT4.0 SP3 or later, Windows 2000, or Windows XP

Installation

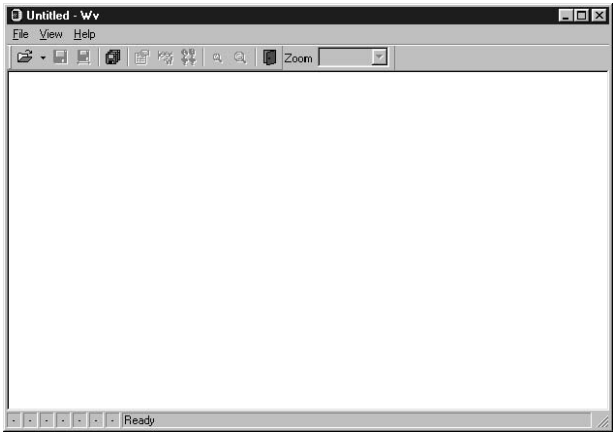
Install by the following procedure:

1. When you insert the Application Disk (CD) into the CD-ROM drive, the opening page should appear automatically. If it does not appear, open the "index.htm" file with your Web browser.
2. Select the language to display (click the **English** icon).
3. Click the [**Wave viewer (Wv)**] icon to view Wv specifications and revision history.
4. Click the [**Install**] icon at the top right of the page to open the [**File Download**] dialog.
5. Click [**Open**] to display the confirmation dialog to proceed with installation.
6. Click [**Next**] to open the installation destination selection window.
   Click the [**Browse**] button to change the installation folder.
7. Click [**Next**] to start installation.
   The program is now installed.

Appendix 3.1 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

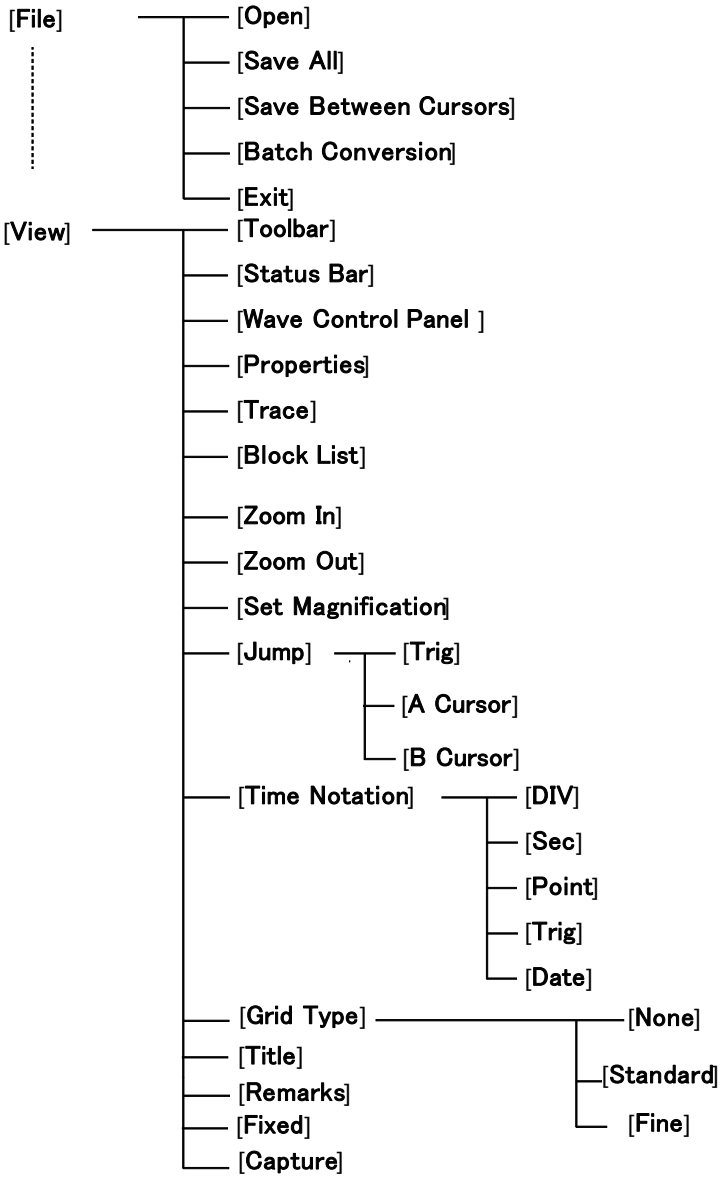
The status bar shows, from the left, the model name, function, recording length, time axis, trigger time, pre-trigger, and judgement result.

Version information

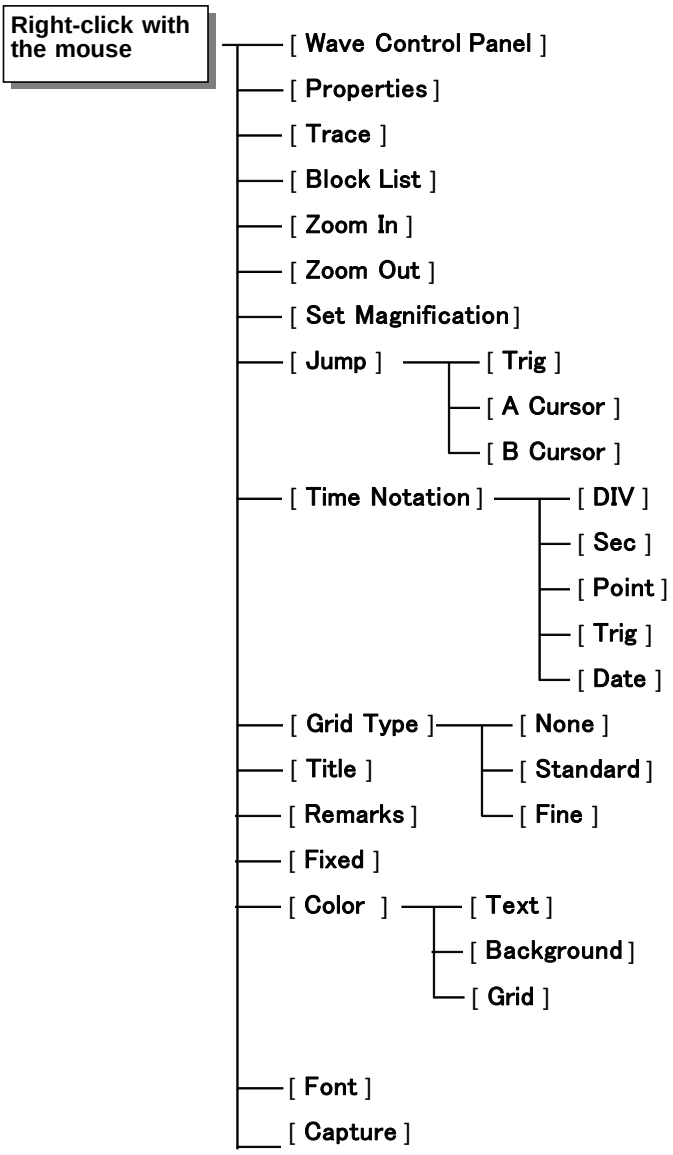
When making inquiries, the version number will be required.
To check the software version number, in the [**Help**] menu select [**About Wv**].

Appendix 3.2 Waveform Viewer Menus

The following is the complete menu tree of the waveform viewer application.



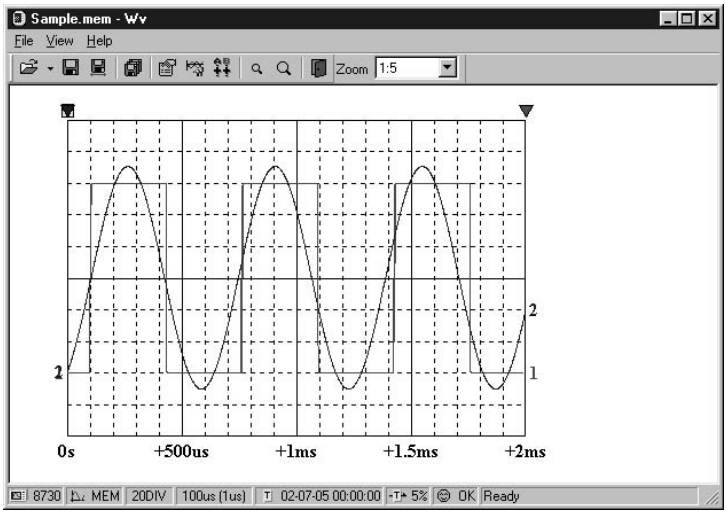
Right-click with the mouse in the waveform display screen for the following functions.



Appendix 3.3 Using the Waveform Viewer

Waveform display

To display a waveform it is first necessary to select the file to be displayed.
In the [**File**] menu, select [**Open**], to display the file selection dialog box.
Select a waveform file, and click Open to read in the file, and display the waveform.

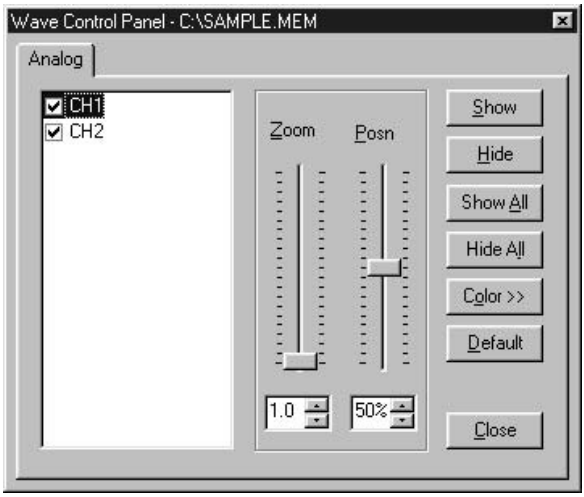


Changing the time axis scale (zoom function)

You can change the time axis scale in the display using the menus or toolbar.
In the toolbar, click the [**Set Magnification**] box, to display the possible zoom factors: you can then select any desired value.

Changing waveform scale and position (Waveform Control Panel)

You can adjust the display for each channel separately. In the [**View**] menu, select [**Wave Control Panel**] to display a dialog box.



CH	This indicate the list of channel. When a check mark is present the corresponding channel is displayed.
Zoom	Set the magnification on the voltage axis for the specified channel.
Posn	Set the position of the specified channel.
Show	Display the specified channel(s).
Hide	Do not display the specified channel(s).
Show All	Display all channels.
Hide All	Do not display all channels.
Color	Change the color of the specified channel(s).
Default	Set all values of the specified channel(s) to their default values.
Close	Close the Waveform Control Panel.

Checking the waveform measurement conditions (Properties)

Select [**View**] - [**Properties**] on the menu to display the measurement settings on the MEMORY HiCORDER.

Checking voltage values (Trace)

Select [**View**] - [**Trace**] on 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**] - [**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**] - [**Jump**] on the menu to jump to the trigger position or the positions of the A or B cursors.

Time Notation

Select [**View**] - [**Time Notation**] on the menu to select the time notation on the waveform display screen.

Setting Grid Type

Select [**View**] - [**Grid Type**] on the menu to set the type of grid (none, standard, or detail).

Display of Title Comment

Select [**View**] - [**Title**] on the menu to display a title comment at the top of the waveform screen.

Waveform legend view

Select [**View**] - [**Remarks**] on the menu to view the unit type of each channel, measurement mode, measurement range, filters, comments, scaling, display position, and magnification on the portion below the waveform screen.

Fixing waveform view conditions

Select [**View**] - [**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**] - [**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.

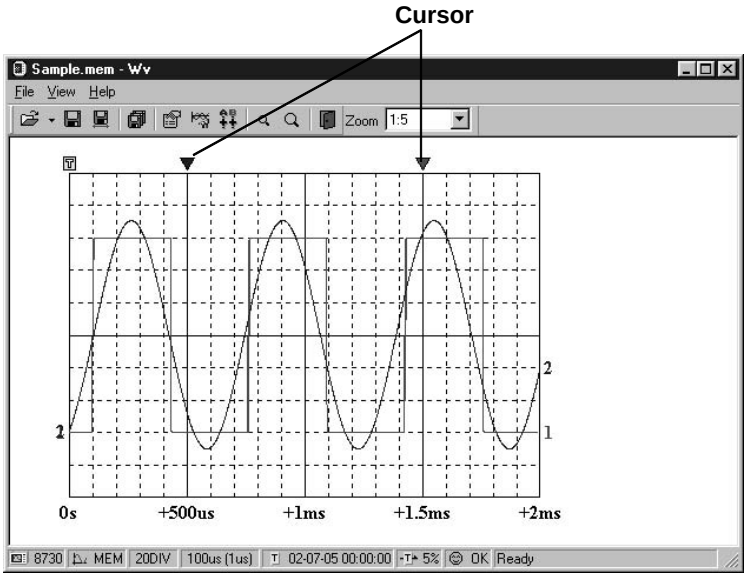
Waveform display snaps (capture)

Select [**View**] - [**Capture**] on the menu to capture waveform display and copy to clipboard as a bit image. You can paste it into other applications.

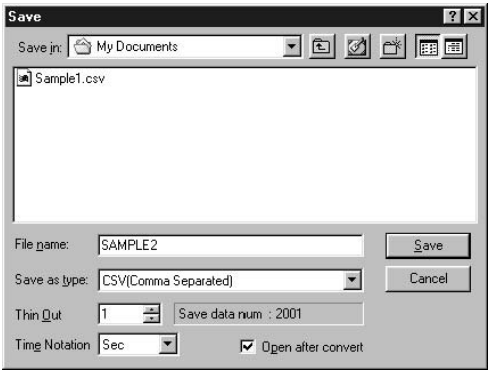
Appendix 3.4 Conversion to CSV Format

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.

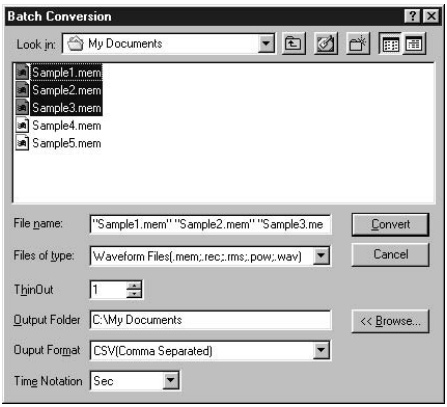


To save in text formats other than CSV (space delimited or tab delimited), select the desired format from the [**Save as type**] list.
In the [**Thin Out**] box, enter the number of original samples corresponding to one converted value.
Use this when data over a large range (long time interval) is required, 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 3.5 Converting Multiple Waveform Files into CSV Files

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.

Index

- G -

- I -

- K -

- L -

- M -

- N -

- O -

- P -

- R -

- S -

- T -

- V -

- W -

- X -

- Z -

HIOKI

DECLARATION OF CONFORMITY

Manufacturer's Name:	HIOKI E.E. CORPORATION
Manufacturer's Address:	81 Koizumi, Ueda, Nagano 386-1192, Japan
Product Name:	MEMORY HiCORDER
Model Number:	8807-01, 8808-01, 8807-51, 8808-51
Options:	9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) 8992 PRINTER UNIT 9217 CONNECTION CORD 9612 RS-232C CABLE 9320-01 LOGIC PROBE 9321-01 LOGIC PROBE 9197 CONNECTION CORD 9198 CONNECTION CORD 9199 CONVERSION ADAPTOR 9447 BATTERY PACK

The above mentioned products conform to the following product specifications:

Safety:	EN61010-1:2001 EN61010-031:2002
EMC:	EN61326-1:2006 Class A equipment Basic immunity test requirement EN61326-2-2:2006 Class A equipment Portable test, measuring and monitoring equipment used in low-voltage distribution systems EN61000-3-2:2006 EN61000-3-3:1995+A1:2001+A2:2005

Supplementary Information:

The products herewith comply with the requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC.

HIOKI E.E. CORPORATION

19 December 2008

Atsushi Mizuno

Director of Quality Assurance

8807A999-09

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